Transnet Port Terminals
an Operating Division **TRANSNET SOC LTD**
[Registration Number 1990/000900/30]

REQUEST FOR PROPOSAL (RFP)

FOR THE: COMPLETE ENGINEERING, INSTALLATION AND COMMISSIONING OF TIPPLER, TRAIN POSITIONER, FEEDERS, DUST HANDLING PLANT AT PORT OF SALDANHA BAY, FOR TRANSNET SOC LTD (REG. NO. 1990/000900/30) OPERATING AS TRANSNET PORT TERMINALS, (HEREINAFTER REFERRED TO AS "TPT").

RFP NUMBER	**: TPT/2024/04/0002/62053/RFP**
ISSUE DATE	**: 08 April 2024**
CLOSING DATE	**: 23 April 2024**
CLOSING TIME	**: 10h00am**
TENDER VALIDITY PERIOD	**: 12 weeks from closing date**

Contents

T1.1 TENDER NOTICE AND INVITATION TO TENDER

SECTION 1: NOTICE TO TENDERERS

1. INVITATION TO TENDER

Responses to this Tender [hereinafter referred to as a **Tender**] are requested from persons, companies, close corporations or enterprises [hereinafter referred to as a Tenderer].

DESCRIPTION	**Complete Engineering, Installation and Commissioning of Tippler, Train Positioner, Feeders, Dust Handling plant at Port of Saldanha Bay, for Transnet SOC Ltd (Reg. No. 1990/000900/30) Operating as Transnet Port Terminals, (Hereinafter Referred to as "TPT").**
TENDER DOWNLOADING	**This Tender may be downloaded directly from the National Treasury eTender Publication Portal at www.etenders.gov.za and the Transnet website at https://transnetetenders.azurewebsites.net (please use Google Chrome to access Transnet link) FREE OF CHARGE.**

CLOSING DATE	**10:00am on** (2024/04/23) Tenderers must ensure that tenders are uploaded timeously onto the system. **If a tender is late, it will not be accepted for consideration**.

2. TENDER SUBMISSION

Transnet has implemented a new electronic tender submission system, the e-Tender Submission Portal, in line with the overall Transnet digitalization strategy where suppliers can view advertised tenders, register their information, log their intent to respond to bids and upload their bid proposals/responses on to the system.

a) The Transnet e-Tender Submission Portal can be accessed as follows:

Log on to the Transnet eTenders management platform website (https://transnetetenders.azurewebsites.net);

- Click on "ADVERTISED TENDERS" to view advertised tenders;
- Click on "SIGN IN/REGISTER – for bidder to register their information (must fill in all mandatory information);
- Click on "SIGN IN/REGISTER" - to sign in if already registered;

- Toggle (click to switch) the "Log an Intent" button to submit a bid;
- Submit bid documents by uploading them into the system against each tender selected.
- **Tenderers are required to ensure that electronic bid submissions are done at least a day before the closing date to prevent issues which they may encounter due to their internet speed, bandwidth or the size of the number of uploads they are submitting. Transnet will not be held liable for any challenges experienced by bidders as a result of the technical challenges. Please do not wait for the last hour to submit. A Tenderer can upload 30mb per upload and multiple uploads are permitted.**

b) The tender offers to this tender will be opened as soon as possible after the closing date and time. Transnet shall not, at the opening of tenders, disclose to any other company any confidential details pertaining to the Tender Offers / information received, i.e. pricing, delivery, etc. The names and locations of the Tenderers will be divulged to other Tenderers upon request.

c) Submissions must not contain documents relating to any Tender other than that shown on the submission.

3. CONFIDENTIALITY

All information related to this RFP is to be treated with strict confidentiality. In this regard Tenderers are required to certify that they have acquainted themselves with the Non-Disclosure Agreement. All information related to a subsequent contract, both during and after completion thereof, will be treated with strict confidence. Should the need however arise to divulge any information gleaned from provision of the Works, which is either directly or indirectly related to Transnet's business, written approval to divulge such information must be obtained from Transnet.

4. DISCLAIMERS

Tenderers are hereby advised that Transnet is not committed to any course of action as a result of its issuance of this Tender and/or its receipt of a tender offer. In particular, please note that Transnet reserves the right to:

4.1. Award the business to the highest scoring Tenderer/s unless objective criteria justify the award to another tenderer.

4.2. Not necessarily accept the lowest priced tender or an alternative Tender;

4.3. Go to the open market if the quoted rates (for award of work) are deemed unreasonable;

4.4. Should the Tenderers be awarded business on strength of information furnished by the Tenderer, which after conclusion of the contract is proved to have been incorrect, Transnet reserves the right to terminate the contract;

4.5. Request audited financial statements or other documentation for the purposes of a due diligence exercise;

4.6. Not accept any changes or purported changes by the Tenderer to the tender rates after the closing date;

4.7. Verify any information supplied by a Tenderer by submitting a tender, the Tenderer/s hereby irrevocably grant the necessary consent to the Transnet to do so;

4.8. Conduct the evaluation process in parallel. The evaluation of Tenderers at any given stage must therefore not be interpreted to mean that Tenderers have necessarily passed any previous stage(s);

4.9. Unless otherwise expressly stated, each tender lodged in response to the invitation to tender shall be deemed to be an offer by the Tenderer. The Employer has the right in its sole and unfettered discretion not to accept any offer.

4.10. Not be held liable if tenderers do not provide the correct contact details during the clarification session and do not receive the latest information regarding this RFP with the possible consequence of being disadvantaged or disqualified as a result thereof.

4.11. Transnet reserves the right to exclude any Tenderers from the tender process who has been convicted of a serious breach of law during the preceding 5 [five] years including but not limited to breaches of the Competition Act 89 of 1998, as amended. Tenderers are required to indicate in tender returnable on T2.2-17], [**Breach of Law**] whether or not they have been found guilty of a serious breach of law during the past 5 [five] years.

4.12. Transnet reserves the right to perform a risk analysis on the preferred tenderer to ascertain if any of the following might present an unacceptable commercial risk to the employer*:*

- *unduly high or unduly low tendered rates or amounts in the tender offer;*
- *contract data of contract provided by the tenderer; or*
- *the contents of the tender returnables which are to be included in the contract.*

5. Transnet will not reimburse any Tenderer for any preparatory costs or other work performed in connection with this Tender, whether or not the Tenderer is awarded a contract.

6. NATIONAL TREASURY'S CENTRAL SUPPLIER DATABASE

Tenderer are required to self-register on National Treasury's Central Supplier Database (CSD) which has been established to centrally administer supplier information for all organs of state and facilitate the verification of certain key supplier information. The CSD can be accessed at https://secure.csd.gov.za/. Tenderer are required to provide the following to Transnet in order to enable it to verify information on the CSD:

Supplier Number……………………………… and Unique registration reference number……………………………(Tender Data)

Transnet urges its clients, suppliers and the general public

to report any fraud or corruption to

TIP-OFFS ANONYMOUS: 0800 003 056 OR Transnet@tip-offs.com

T1.2 TENDER DATA

The conditions of tender are the Standard Conditions of Tender as contained in Annex C of the CIDB Standard for Uniformity in Engineering and Construction Works Contracts. The Standard for Uniformity in Construction Procurement was first published in Board Notice 62 of 2004 in Government Gazette No 26427 of 9 June 2004. It was subsequently amended in Board Notice 67 of 2005 in Government Gazette No 28127 of 14 October 2005, Board Notice 93 of 2006 in Government Gazette No 29138 of 18 August 2006, Board Notice No 9 of 2008 in Government Gazette No 31823 of 30 January 2009, Board Notice 86 of 2010 in Government Gazette No 33239 of 28 May 2010, Board Notice 136 of 2015 in Government Gazette 38960 of 10 July 2015 and Board Notice 423 of 2019 in Government Gazette No 42622 of 8 August 2019.

This edition incorporates the amendments made in Board Notice 423 of 2019 in Government Gazette 42622 of 8 August 2019. (see www.cidb.org.za).

The Standard Conditions of Tender make several references to Tender data for detail that apply specifically to this tender. The Tender Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the Standard Conditions of Tender.

Each item of data given below is cross-referenced in the left-hand column to the clause in the Standard Conditions of Tender to which it mainly applies.

Clause		**Data**
C.1.1	The *Employer* is	**Transnet SOC Ltd** **(Reg No. 1990/000900/30)**
C.1.2	The tender documents issued by the *Employer* comprise:	
	Part T: The Tender	
	Part T1: Tendering procedures	T1.1 Tender notice and invitation to tender T1.2 Tender data
	Part T2 : Returnable documents	T2.1 List of returnable documents T2.2 Returnable schedules
	Part C: The contract	
	Part C1: Agreements and contract data	C1.1 Form of offer and acceptance C1.2 Contract data (Part 1 & 2) C1.3 Form of Securities

	Part C2: Pricing data	C2.1 Pricing instructions C2.2 Activity Schedule
	Part C3: Scope of work	C3.1 Works Information
	Part C4: Site information	C4.1 Site information
C.1.4	The Employer's agent is:	Sourcing Specialist Bulk
	Name:	Thabile Zuma
	Address:	202 Anton Lembede Street, Durban, 4000
	Tel No.	031 361 7850
	E – mail	Thabile.Zuma@transnet.net

C.2.1 Only those tenderers who satisfy the following eligibility criteria are eligible to submit tenders:

1. **Stage One - Eligibility with regards to attendance at the compulsory clarification meeting:**

   An authorised representative of the tendering entity or a representative of a tendering entity that intends to form a **Joint Venture (JV)** must attend the compulsory clarification meeting in terms C2.7

2. **Stage Two - Eligibility in terms of the Construction Industry Development Board:**

a) Only those tenderers who are registered with the CIDB, or are capable of being so prior to the evaluation of submissions, in a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations, designation of **8ME (PE) or 9ME** class of construction work, are eligible to have their tenders evaluated.

b) Joint Venture (JV)

   Joint ventures are eligible to submit tenders subject to the following:

   1. every member of the joint venture is registered with the CIDB;
   2. the lead partner has a contractor grading designation of not lower than one level below the required class of construction works under consideration and possesses the required recognition status; and

3. the combined Contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than a Contractor grading designation determined in accordance with the sum tendered for a 8ME or higher class of construction work or a value determined in accordance with Regulation 25(1B) or 25(7A) of the Construction Industry Development Regulations
   The tenderer shall provide a certified copy of its signed joint venture agreement

Any tenderer that fails to meet the stipulated eligibility criteria will be regarded as an unacceptable tender.

3. Stage Three – Eligibility:

Professional Registration Engineering Council of South Africa (ECSA)

4. Stage Four - Functionality:

Only those tenderers who obtain the minimum qualifying score for functionality will be evaluated further in terms of price and the applicable preference point system. The minimum qualifying for score for functionality is 70 points.

The evaluation criteria for measuring functionality and the points for each criteria and, if any, each sub-criterion are as stated in C.3.11 below.

Any tenderer that fails to meet the stipulated pre-qualifying criteria will be regarded as an unacceptable tender.

C.2.7 The arrangements for a compulsory clarification meeting are as stated in the Tender Notice and Invitation to Tender. **Tenderers must complete and sign the attendance register.** Addenda will be issued to and tenders will only be received from those tendering entities including those entities that intends forming a joint venture appearing on the attendance register.

Tenderers are also **required to bring their RFP document to the briefing session and have their returnable document T2.2-01 certificate of attendance** signed off by the Employer's authorised representative.

C.2.12 No alternative tender offers will be considered.

C.2.13.3 Each tender offer shall be in the **English Language.**

C.2.13.5
C2.15.1 The *Employer*'s details and identification details that are to be shown on each tender offer are as follows:

Identification details: The tender documents must be uploaded with:

- Name of Tenderer:
- Contact person and details:
- The Tender Number: iCLM HQ 788/TPT
- The Tender Description: Complete Engineering, Installation and Commissioning of Tippler, Train Positioner, Feeders, Dust Handling plant at Port of Saldanha Bay, for Transnet SOC Ltd (Reg. No. 1990/000900/30) Operating as Transnet Port Terminals, (Hereinafter Referred to as "TPT").

Documents must be marked for the attention of: ***Employer*'s Agent: Thabile Zuma**

C.2.13.9 Telephonic, telegraphic, facsimile or e-mailed tender offers will not be accepted.

C.2.15 The closing time for submission of tender offers is:
Time: **10:00am** on the 23 April 2024
Location: The Transnet e-Tender Submission Portal:
(https://transnetetenders.azurewebsites.net);

<u>NO LATE TENDERS WILL BE ACCEPTED</u>

C.2.16 The tender offer validity period is **12 weeks** after the closing date. Tenderers are to note that they may be requested to extend the validity period of their tender, on the same terms and conditions, if Transnet's internal evaluation and governance approval processes has not been finalised within the validity period.

C.2.23 The tenderer is required to submit with his tender:

1. A valid Tax Clearance Certificate issued by the South African Revenue Services. **<u>Tenderers also to provide Transnet with a TCS PIN to verify Tenderers compliance status</u>**.

2. A **valid B-BBEE Certificate** from a Verification Agency accredited by the South African Accreditation System [**SANAS**], or a **sworn affidavit** confirming annual turnover and level of black ownership in case of all EMEs and QSEs with 51% black ownership or more

together with the tender;

3. A valid CIDB certificate in the correct designated grading;
4. Proof of registration on the Central Supplier Database;
5. Letter of Good Standing with the Workmen's compensation fund by the tendering entity or separate Letters of Good Standing from all members of a newly constituted JV.

Note: Refer to Section T2.1 for List of Returnable Documents

C3.11 The minimum number of evaluation points for functionality is: **70**

The procedure for the evaluation of responsive tenders is Functionality, Price and Preference:

Only those tenderers who attain the minimum number of evaluation points for Functionality will be eligible for further evaluation, failure to meet the minimum threshold will result in the tender being disqualified and removed from any further consideration.

Functionality Criteria

The functionality criteria and maximum score in respect of each of the criteria are as follows:

<table>
<tr><th colspan="7">TECHNICAL EVALUATION</th></tr>
<tr><th colspan="7">DESCRIPTION OF THE WORKS: Complete Engineering, Installation and Commissioning of Tippler, Train Positioner, Feeders, Dust Handling plant at Port of Saldanha Bay, for Transnet SOC Ltd (Reg. No. 1990/000900/30) Operating as Transnet Port Terminals, (Hereinafter Referred to as "TPT").</th></tr>
<tr><th>Evaluation Criteria</th><th>Description</th><th colspan="2">Scoring Principal</th><th>Returnable Schedule</th><th>Criteria</th><th>Weighting</th></tr>
<tr><td rowspan="5">Eligibility</td><td>CIDB Mechanical Engineering (ME)</td><td colspan="2">Contractors to be registered with the Construction Industry Development Board (CIDB) as a Mechanical Contractor and be able to handle contracts that are grade 8 ME (PE) or 9ME.</td><td>T2.2-02</td><td>Yes/No</td><td>N/A</td></tr>
<tr><td rowspan="4">Professional Registration</td><td rowspan="4">The tenderer to submit all active professional registration certificates for all key engineering personnel with Engineering Council of South Africa (ECSA). Curriculum Vitae to be submitted to demonstrate relvant experience in line with professional registration.</td><td>Mechanical Engineer (Train Wagon Tippler Design)</td><td>T2.2-03</td><td>Yes/No</td><td>N/A</td></tr>
<tr><td>Mechanical Engineer (Bulk Material Handling)</td><td>T2.2-03</td><td>Yes/No</td><td>N/A</td></tr>
<tr><td>Electrical Engineer (MV, LV, Substations)</td><td>T2.2-03</td><td>Yes/No</td><td>N/A</td></tr>
<tr><td>Electronics Engineer (Control/Software - PLC/SCADA)</td><td>T2.2-03</td><td>Yes/No</td><td>N/A</td></tr>
</table>

				Civil Engineer (Structural)	T2.2-03	Yes/No	N/A
Management & CV's of Key Personnel = 40 Points	General experience, Knowledge Pertinent to Project (=20 points)	Site Management = 15%	Project Manager = 35%	**(score 0)** - The Tenderer has submitted no information to determine a score. **(score 20)** - Key staff do not have relevant levels of experience and knowledge pertinent to the project. **(score 40)** - Key staff has limited levels of relevant experience and knowledge pertinent to the project. **(score 60)** - Key staff has the required minimum levels of experience and knowledge pertinent to the project.. **(score 80**) - Key staff has extensive levels of relevant experience and knowledge pertinent to the project. **(score 100)** - Key staff has outstanding levels of relevant experience and knowledge pertinent to the project.	T2.2-04	3%	1.05
			Project Planner = 20%			2%	0.6
			Document Controller = 10%			1%	0.3
			Quantity Surveyor = 35%			3%	1.05
		Engineers = 80%	Mechanical Engineer (Train Wagon Tippler and Positioner) = 20%			8%	3.2
			Mechanical Engineer (BMH) = 15%			6%	2.4
			Electrical Engineer = 20%			8%	3.2
			Hydraulic Engineer = 15%			6%	2.4
			Electronics Engineer = 15%			6%	2.4
			Civil Engineer (Structural) = 15%			6%	2.4
		Safety and Environment = 5%	Health and Safety Officer = 100%			3%	1

	Education, training and skills (=20 points)	Site Management = 15%	Project Manager = 35%	**(Score 0)** - The Tenderer has submitted no information to determine a score. **(Score 20) -** Key staff does not have project specific education, skills and training. (**Score 40) -** Key staff has limited levels of project specific education, skills and training. **(Score 60) -** Key staff has the required minimum levels of project specific education, skills and training. **(Score 80) -** Key staff has extensive levels of project specific education, skills and training. **(Score 100) -** Key staff has outstanding levels of project specific education, skills and training		3%	1.05
			Project Planner =20%			2%	0.6
			Document Controller = 10%			1%	0.3
			Quantity Surveyor = 35%			3%	1.05
		Engineers = 80%	Mechanical Engineer (Train Wagon Tippler and Positioner) = 20%			8%	3.2
			Mechanical Engineer (BMH) = 15%			6%	2.4
			Electrical Engineer = 20%			8%	3.2
			Elctronics Engineer = 15%			6%	2.4
			Hydraulic Engineer = 15%			6%	2.4
			Civil Engineer (Structural) = 15%			6%	2.4
		Safety Management = 5%	Health and Safety Officer = 100%			3%	1
Method Statement = 30 Points	Contractor site establishment (=1,5 points)	Contractor site establishment to be completed by the tenderer taking into consideration all items in the scope of works, office facilities, safety and environmental requirements, connection of services and de-establishment when the project is complete.		**Score 0** - The tenderer has submitted no information to determine a score. **Score 20** - The methodology/approa	T2.2-05	5%	1.5

	Design, Site Installation and Commissioning (=22,5 points)	The tenderer to issue a Method Statement on the required engineering, component procurement, component fabrication, installation and commissioning stages for the total scope of works which will include; 1. Dual Wagon Tippler 2. Train Positioner 3. Apron Feeders / Knife Gates 4. Dust Handling Plant 5. Electrical Works 6. PLC/SCADA Works	ch and work alignment to project schedule is poorly presented and not tailored to address the specific project objectives and methodology. **Score 40** - The methodology/approach is not tailored to address the specific project objectives and methodology. The methodology approach does not deal with the critical characteristics of the project. **Score 60** - Satisfactory response/solution to the particular aspect of the requirement and evidence given that the stated employer's requirements will be met. **Score 80** - The methodology/approach is specifically tailored to address the specific project objectives and methodology and is sufficiently flexible to accommodate changes that may		75%	22.5
	Project handover (=6 points)	Handover of the project needs to include all training requirements, manual and data packs			20%	6

			occur during execution. The methodology/approach to manage activities is specifically tailored to the critical characteristics of the project. **Score 100** - Besides meeting the "80" rating, the important issues are approached in an innovative and efficient way, indicating that the tenderer has outstanding knowledge of state-of-the-art approaches. The methodology approach details ways to improve the project outcomes and the quality of the outputs.			

Previous Experience = 20 Points	Previous Experience (=14 points)	**0** - The Tenderer failed to address the question / issue. Has not submitted any information. **20%** - The Tenderer's previous experience presented has no relevance to the scope of this project and did not address any of the required categories. **40%** - The Tenderer's previous experience presented has some relevance to the project but lacks detail i.e. Description of previous projects, value and references. **60%** - The Tenderer's previous experience presented demonstrates knowledge and experience to successfully execute this project scope. **80%** - The Tenderer's previous experience presented demonstrates a real understanding and substantial evidence of the ability meet the stated project requirements. The tenderer has extensive previous experience in relation to the works **100%** -The Tenderer's previous experience presented demonstrates real confidence extensive understanding in all of the categories as required.	T2.2-06	70%	14
	References: Specific to the Design, Manufacture, Installation and Commissioning of Train Wagon Tippler (= 6 points)	**0** - The Tenderer failed to address the question / issue. Has not submitted any information. **20%** - One (1) reference letters from companies where the Respondent has provided a similar service with details of SOW **40%** - Two (2) reference letters from companies where the Respondent has provided a similar service with details of SoW **60%**- Three (3) reference letters from companies where the Respondent has provided a similar service with details of SoW **80%** - Four (4) reference letters from companies where the Respondent has provided a similar service with deatails of SoW **100%** - Five (5) reference letters from companies where the Respondent has provided a similar service with deatails of SoW		30%	6

Programme = 10 Points	Meet the required timeframes (= 4 points)	Ability to provide the services in terms of the Employer's requirements; demonstrating timeframes to meet the works as stated in the Scope of Works by indicating, in a logical sequence, the order, the timing, and the duration of the works that will take place in order to Provide the Works.	**Score 0** -The tenderer has submitted no information or inadequate information to determine a score. **Score 20** - The tenderer has not addressed date requirements and submission is missing activities and dates. **Score 40** -The tenderer has not addressed all date requirements and submission is missing critical activities and dates which renders it unrealistic / unachievable **Score 60** - The tenderer has addressed some but not all date requirements and submission is missing some activities and dates which renders it at risk of being unrealistic / unachievable. **Score 80** -The tenderer has addressed most date requirements correctly and submission contains	T2.2-07	40%	4

			logic and sequencing which is accurate, and renders the submission realistic and achievable **Score 100** - The tenderer has addressed all date requirements correctly and submission contains logic and sequencing which is accurate, and renders the submission realistic and achievable.			

	Programme information (= 2 points)	The Contractor clearly indicates in the schedule all milestones, activities & information related to the following – 1. Float, 2. Time Risk Allowances, 3. Health and safety requirements, 4. Procedures set out in this contract, 5. Work by the Employer and Others, 6. Access to a part of the site if later than its access date, 7. Acceptances, 8. Plant & Materials and other things to be provided by the employer, 9. Information by Others, 10. Starting date, access dates, Key Dates and Completion Date 11. Planned Completion for each Key Date for each option and the complete works 12. Shows how each activity on the Activity Schedule relates to the operations on each programme	**Score 0** - The tenderer has submitted no information or inadequate information to determine a score. **Score 20** - The tenderer has addressed some but not all date requirements as listed in this returnable (4 or less of 12 addressed) **Score 40** - The tenderer has addressed some but not all date requirements as listed in this returnable (5 or 6 of 12)addessed **Score 60** - The tenderer has addressed most but not all date requirements as listed in this returnable (7 or 8 of 12 addressed) **Score 80** - The tenderer has addressed most but not all date requirements as listed in this	T2.2-07	20%	2

			returnable (9 or 10 of 12 addressed) **Score 100** - The tenderer has addressed all date requirements as listed in this returnable (11 or 12 of 12 addressed)			

	Resourcing & Equipment (= 4 points)	The Contractor indicates for each operation, how the Contractor plans to do the work identifying the principal Equipment and other resources which he plans to use. Resources & equipment are loaded against activities with their associated rates to the programme for evaluation.	**Score 0** - The tenderer has submitted no information or inadequate information to determine a score. **Score 20 -** The tenderer has addressed some but not all resource requirements and the submission is missing critical both resources & equipment which renders it unrealistic / unachievable. **Score 40** - The tenderer has addressed some but not all resource requirements and the submission is missing either critical resources or equipment which renders it unrealistic / unachievable. **Score 60** - The tenderer has addressed some but not all resource requirements and the submission is missing some resources & equipment, but not critical providing the works, which renders	T2.2-07	40%	4

			it at risk of being unrealistic / unachievable. **Score 80** - The tenderer has addressed all resource requirements correctly and the submission contains resources & equipment, which is accurate, and renders the submission realistic and achievable. **Score 100** - The tenderer has addressed all resource requirements correctly and the submission contains resources & equipment, which is accurate, and renders the submission realistic and achievable and is fully aligned to the method statements			
TOTAL RATING						100

Technical Qualification Threshold = 70%

Functionality shall be scored independently by not less than 3 (three) evaluators and averaged in accordance with the following schedules:

- T2.2-02 CIDB Certificate Grading 8 ME (PE) or 9ME
- T2.2-03 All key engineering personnel with (ECSA)
- T2.2-04 Management & CV's of Key Personnel
- T2.2-05 Method Statement
- T2.2-06 Previous Experience
- T2.2-07 Programme

Each evaluation criteria will be assessed in terms of scores of 0, 20, 40, 60, 80 or 100 The scores of each of the evaluators will be averaged, weighted and then totalled to obtain the final score for functionality, unless scored collectively. (See CIDB Inform Practice Note #9).

Note: Any tender not complying with the above mentioned requirements, will be regarded as non-responsive and will therefore not be considered for further evaluation. This note must be read in conjunction with Clause C.2.1.

C.3.11. Only tenders that achieve the minimum qualifying score for functionality will be evaluated further in accordance with the 90/10 preference points systems as described in Preferential Procurement Regulations.

Up to 100 minus W_1 tender evaluation points will be awarded to tenderers who complete the preferencing schedule and who are found to be eligible for the preference claimed. **Should the BBBEE rating not be provided, tenderers with no verification will score zero points for preferencing.**

Note: Transnet reserves the right to carry out an independent audit of the tenderers scorecard components at any stage from the date of close of the tenders until completion of the contract.

C.3.13 Tender offers will only be accepted if:

1. The tenderer or any of its directors/shareholders is not listed on the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business with the public sector;

2. the tenderer does not appear on Transnet’s list for restricted tenderers and National Treasury’s list of Tender Defaulters;

3. the tenderer has fully and properly completed the Compulsory Enterprise Questionnaire and there are no conflicts of interest which may impact on the tenderer’s ability to perform the contract in the best interests of the Employer or potentially compromise the tender process and persons in the employ of the state.

4. Transnet reserves the right to award the tender to the tenderer who scores the highest number of points overall, unless there are **objective criteria** which will justify the award of the tender to another tenderer. Objective criteria include but are not limited to the outcome of a due diligence exercise to be conducted. The due diligence exercise may take the following factors into account inter alia;

   the tenderer:

a) is not under restrictions, or has principals who are under restrictions, preventing participating in the employer's procurement,

b) can, as necessary and in relation to the proposed contract, demonstrate that he or she possesses the professional and technical qualifications, professional and technical competence, financial resources, equipment and other physical facilities, managerial capability, reliability, experience and reputation, expertise and the personnel, to perform the contract,

c) has the legal capacity to enter into the contract,

d) is not insolvent, in receivership, under Business Rescue as provided for in chapter 6 of the Companies Act, 2008, bankrupt or being wound up, has his affairs administered by a court or a judicial officer, has suspended his business activities, or is subject to legal proceedings in respect of any of the foregoing,

e) complies with the legal requirements, if any, stated in the tender data and

f) is able, in the option of the employer to perform the contract free of conflicts of interest.

Table 1: Transnet Preferential Procurement Policy (Specific Goals)

Preference Point System 90/10		
Specific Goal	**Number of Points**	**Price**
B-BBEE Level 1&2	5	
Subcontracting 30% of the value of the contract to Black Owned EME's and QSE's 51%	5	
Total	**10**	**90**

C.3.17 The number of paper copies of the signed contract to be provided by the Employer is 1 (one).

T2.1 List of Returnable Documents

2.1.1 These schedules are required for pre-qualification and eligibility purposes:

T2.2-01	Stage One as per CIDB: Eligibility Criteria Schedule - CIDB Registration Certificate
T2.2-02	Stage Two**:** All key engineering personnel with (ECSA)

2.1.2 Stage Three as per CIDB: these schedules will be utilised for evaluation purposes:

T2.2-03	**Evaluation Schedule:** Management & CV's of Key Personnel
T2.2-04	**Evaluation Schedule:** Method Statement
T2.2-05	**Evaluation Schedule:** Previous experience
T2.2-06	**Evaluation Schedule:** Programme

2.1.3 Returnable Schedules:

General:

T2.2-07	Authority to submit tender
T2.2-08	Record of addenda to tender documents
T2.2-09	Letter of Good Standing
T2.2-10	Risk Elements
T2.2-11	Availability of equipment and other resources
T2.2-12	Schedule of proposed Subcontractors
T2.2-13	Site Establishment requirements

Agreement and Commitment by Tenderer:

T2.2-14	CIDB SFU ANNEX G Compulsory Enterprise Questionnaire
T2.2-15	Non-Disclosure Agreement
T2.2-16	RFP Declaration Form
T2.2-17	RFP – Breach of Law
T2.2-18	Certificate of Acquaintance with Tender Document
T2.2-19	Service Provider Integrity Pact
T2.2-20	Supplier Code of Conduct

1.3.2 Bonds/Guarantees/Financial/Insurance:

T2.2-21	Insurance provided by the Contractor

T2.2-22 Form of Intent to provide a Defects Correction Guarantee
T2.2-23 Forecast Rate of Invoicing
T2.2-24 Three (3) years audited financial statements
T2.2-25 Agreement in terms of Protection of Personal Information Act (POPIA)

1.3.3 Transnet Vendor Registration Form:

T2.2-26 Transnet Vendor Registration Form

2.2 C1.1 Offer portion of Form of Offer & Acceptance

2.3 C1.2 Contract Data

2.4 C1.3 Forms of Securities

2.5 C2.1 Pricing Instructions (Activity Schedule)

2.6 C2.2 Activity Schedule

2.7 C3. Scope of Works

Mandatory Returnable

T2.2-01: Eligibility Criteria Schedule:

Note to tenderers:

Tenderers are to indicate their CIDB Grading by filling in the table below. **Attach a copy of the CIDB Grading Designation or evidence of being capable of being so registered.**

CRS Number	Status	Grading	Expiry Date
-----------------------	-----------------------	------------------------	------------------------

1. Only those tenderers who are registered with the CIDB, or are capable of being so prior to the evaluation of submissions, in a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations, for a **8ME (PE) or 9ME** class of construction work, are eligible to have their tenders evaluated.

2. Joint Venture (JV)

Joint ventures are eligible to submit tenders subject to the following:

a) Every member of the joint venture is registered with the CIDB;

b) The lead partner has a contractor grading designation of not lower than one level one level below the required grading designation in the class of construction works under consideration and possesses the required recognition status; and

c) The combined Contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than a Contractor grading designation determined in accordance with the sum tendered for a **8ME (PE) or 9ME** class of construction work or a value determined in accordance with Regulation 25(1B) or 25(7A) of the Construction Industry Development Regulations

d) The Contractor shall provide the employer with a certified copy of its signed joint venture agreement;

e) And in the event that the joint venture is an 'Incorporated Joint Venture' the Memorandum of Incorporation to be provided within 4 (four) weeks of the Contract Date.

Reference to attached submissions to this schedule:

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The undersigned, who warrants that he/she is duly authorized to do so on behalf of the Tenderer, confirms that the contents and referenced submissions of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Signed	…………………………	Date	…………………………
Name	…………………………	Position	…………………………
Tenderer	…………………………		

Mandatory Returnable

T2.2-02: Eligibility Criteria Schedule:

Professional Registration

The tender must be able to demonstrate that the project personnel have professional registration. The professional registration must be registered with the Engineering Council of South Africa (ECSA). Curriculum Vitae to be submitted to demonstrate relevant experience. The tenderer to submit the following professional registration with the tender:

Profession	Name and Surname	Professional Registration	Certification Attached (Yes/No)
Mechanical Engineer (Train Wagon Tippler and Positioner)		ECSA - Pr Eng / Pr Tech Eng	
Mechanical Engineer (BMH)		ECSA - Pr Eng / Pr Tech Eng	
Electrical Engineer (MV,LV)		ECSA - Pr Eng / Pr Tech Eng	
Electronic Engineer (PLC/SCADA)		ECSA - Pr Eng / Pr Tech Eng	
Civil Engineer (Structural)		ECSA - Pr Eng / Pr Tech Eng	

Reference to attached submissions to this schedule:

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....

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the Tenderer, confirms that the contents and referenced submissions of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Signed	....	Date	....
Name	....	Position	....
Tenderer	....		

T2.2-03: Evaluation Schedule - Management & CV's of Key Personnel

The tender must be able to demonstrate that the project personnel have sufficient knowledge, experience and qualifications to provide the required services and submit the following documents as a minimum with the tender:

1. The experience of assigned key persons in relation to the scope of work will be evaluated from three different points of view, namely:
    i. The education, training and skills of the assigned staff in the specific sector, field, subject, etc. which is directly linked to the Scope of Works. Proof of education and training must be attached to the C.V.
2. Comprehensive CV's should be attached to this schedule:

    As a minimum each CV should address the following, but not limited to;

    i. Personal particulars
        a. Name
        b. Place (s) of tertiary education and dates associated
    ii. Qualifications (degrees, diplomas, grades of membership of professional societies and professional registrations)
    iii. Name of current employer and position in enterprise
    iv. Overview of post graduate experience (year, organization and position)
    v. Outline of recent assignments / experience that has a bearing on the Scope of Works

The following table is to be populated by the tenderer identifying the resources for the key roles on the project.

Profession	Name and Surname	Professional Registration	CV attached (Yes/No)
Project Manager		PMP Registration	
Mechanical Engineer (Train Wagon Tippler Design)		ECSA - Pr Eng / Pr Tech Eng	
Mechanical Engineer (BMH)		ECSA - Pr Eng / Pr Tech Eng	
Electrical Engineer (MV, LV, Substation)		ECSA - Pr Eng / Pr Tech Eng	
Quantity Surveyor		Professional Registration SACQSP	
Electronics Engineer PLC/SCADA		ECSA - Pr Eng / Pr Tech Eng	
Civil Engineer (Structural)		ECSA - Pr Eng / Pr Tech Eng	
Hydraulics Engineer		NQF Level 5 Mechanical	
Health and Safety Officer		NQF Level 5	

3. CV's for people proposed for all identified posts including, amongst others:

Site Management

- **Project Manager**
  The Project Manager should have a qualification of a minimum Diploma in Mechanical/Electrical Engineering. Registration as a professional project manager with SACPCMP or PMP registration experience in Mechanical construction projects specifically focused in the Bulk Materials Handling industry is preferred. The Project Manager should further provide evidence in working with the NEC suit of contracts.

- **Quantity Surveyor**

  The Quantity Surveyor should have a minimum qualification of a Diploma in Quantity Surveying and registered with SACQSP.

- **Document Controller**

  Document controller should have experience working in Bulk Materials handling field and construction. Experience working with the NEC3 Engineering and Construction Contract Option A chosen for this contract is required.

- **Project Planner**

  Project Planner should have experience working in bulk materials handling field as Planner and experience working with the NEC3 ECC and Primavera Software Suite.

  The Planner is employed and shall be on-site for progress measurements and in attendance at progress meetings to present programme and tracking sheet updates to the *Project Manager* for the duration of the contract.

Engineering Team

- **Mechanical Engineer (Train Wagon Tippler)**

  The Mechanical Engineer must have a qualification of a, B.Tech or BSc.Eng in Mechanical Engineering with experience in design and construction of train wagon tipplers and its associated infrastructure and equipment.

  The Mechanical Engineer must be professionally registered (Pr Tech Eng or Pr Eng) with ECSA, for final sign off and provision of relevant compliance certifications.

- **Mechanical Engineer (Bulk Materials Handling)**

  The Mechanical Engineer must have a qualification of a, B.Tech or BSc.Eng in Mechanical Engineering with experience in bulk material handling design and construction of its associated infrastructure and equipment.

  The Mechanical Engineer must be professionally registered (Pr Tech Eng or Pr Eng) with ECSA, for final sign off and provision of relevant compliance certifications.

  The Mechanical Engineer must also have experience in Conveyor and Chute construction and modelling and exhibit structural construction experience associated with the any infrastructure and equipment related to the Bulk Materials handling field.

- **Electrical Engineer**

  The Electrical Engineer must have a qualification of a Diploma, B.Tech or BSc.Eng in Electrical Engineering with experience in design and construction of BMH Equipment and its associated infrastructure and equipment.

  The Electrical Engineer must be professionally registered (Pr Tech Eng or Pr Eng) with ECSA, for final sign off and provision of relevant compliance certifications.

- **Civil Engineer**

  The Civil Engineer must have a minimum qualification of a Diploma, B.Tech or BSc.Eng (or equivalent) in Civil Engineering with experience in design and construction of civil structures.

  The Civil Engineer must be ECSA Professional Registered (Pr. Eng./ Pr.Tech. Eng.).

- **Electronics Engineer (PLC/SCADA)**

  The Electronics Engineer must have a minimum qualification of a Diploma, B.Tech or BSc.Eng (or equivalent) in Electronic Engineering with experience in control systems of Bulk Material Handling Equipment – interface with I/O's and the general plant.

  Experience with PLC systems and SCADA management systems.

  The Electronics Engineer must be ECSA Professional Registered (Pr. Eng./ Pr.Tech. Eng.).

- **Hydraulics Engineer**

  Experienced Hydraulics Engineer – must demonstrate Design, Installation and Commissioning of Hydraulic Systems as integrated in BHM Equipment.

  The Hydrauics Engineer must expand on this experience and exposure to demonstrate competency. NQF level 5 Mechanical qualification.

<u>Safety</u>

- **Health and Safety Officer**

  NQF Level 5 Health and Safety Management Course as a minimum qualification. Relevant qualification and experience in Structural or Mechanical projects.

The scoring of the Management & CV's of Key Persons will be as follows: **40 POINTS**

General experience, Knowledge Pertinent to Project:		**Education, training and skills Adequacy:**	
	Weight		Weight
Site Management	**15%**	**Site Management**	**15%**
Project Manager	35%	Project Manager	35%
Project Planner	20%	Project Planner	20%
Document Controller	10%	Document Controller	10%
Quantity Surveyor	35%	Quantity Surveyor	35%
Engineers	**80%**	**Engineers**	**80%**
Mechanical Engineer (Tippler)	20%	Mechanical Engineer (Tippler)	20%
Mechanical Engineer (BMH)	15%	Mechanical Engineer (BMH)	15%

Electrical Engineer	20%	Electrical Engineer	20%
Electronic Engineer	15%	Electronic Engineer	15%
Hydraulic Engineer	15%	Hydraulic Engineer	15%
Civil Engineer	15%	Civil Engineer	15%
Safety and Construction	**5%**	**Safety and Construction**	**5%**
Health and Safety Officer	100%	Health and Safety Officer	100%
	20 - POINTS		**20 - POINTS**

(Score 0)	The Tenderer has submitted no information to determine a score.	
(Score 20)	**Key staff do not have relevant levels of experience.** Site Management: ≤2 years Engineers (post professional registration experience): ≤2 years Safety and Construction: ≤2 years	**Key staff does not have project specific education, skills and training.** • Very poor response – Education, training and skills are totally insufficient to satisfy the minimum requirements. • Does not have necessary registrations or education.
(Score 40)	**Key staff has limited levels of relevant experience.** Site Management: >2 ≤ 5 years Engineers (post professional registration experience): >2 ≤ 5 years Safety and Construction: >2 ≤ 5 years	**Key staff has limited levels of project specific education, skills and training.** • Below minimum response – Education, Training and skills lacks convincing evidence to satisfy the minimum requirements. Does not have all of the required registrations required.
(Score 60)	**Key staff has the required minimum levels of experience.** Site Management: > 5 ≤ 7 years Engineers (post professional registration experience): > 5 ≤ 7 years Safety and Construction: > 5 ≤ 7 years	**Key staff has the required minimum levels of project specific education, skills and training.** • Satisfactory response – Education, training and skills meet certain aspects of the minimum requirements. The key staff have the respective registrations required.
(Score 80)	**Key staff has extensive levels of relevant experience.** Site Management: > 7 ≤ 9 years Engineers (post professional registration experience): > 7 ≤ 9 years Safety and Construction: > 7 ≤ 9 years	**Key staff has extensive levels of project specific education, skills and training.** • Good response – Education, training and skills meet the minimum requirements. Key staff have the required qualifications and registrations as well as one additional qualifications or training relating to the project needs.

(Score 100)	**Key staff has outstanding levels of relevant experience.** Site Management: ≥10 years Engineers (post professional registration experience): ≥10 years Safety and Construction: ≥10 years	**Key staff has outstanding levels of project specific education, skills and training.** Excellent response – All specified education, training and skills minimum requirements are met and exceeded. Key staff have the required qualifications and registrations as well more than one additional qualification, training or skill relating to the project needs.

Reference to attached submissions to this schedule:

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The undersigned, who warrants that he / she is duly authorised to do so on behalf of the Tenderer, confirms that the contents and referenced submissions of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Signed ……………………………… Date ………………………………

Name ……………………………… Position ………………………………

Tenderer ………………………………………………………………

T2.2-04: Evaluation Schedule: Method Statement = 30 Points

Note to tenderers:

Method statement - The tenderers must sufficiently demonstrate the approach/methodology that will be employed to cover the scope of the project linked to the submitted project programme.

The method statement should include as a minimum the following, the contractor must refer to the works information for the full description of the scope of works.

1. **Contractor site establishment -** Contractor site establishment to be completed by the tenderer taking into consideration all items in the scope of works, office facilities, safety and environmental requirements, connection of services and de establishment when the project is complete.
2. **Design, Site Installation and Commissioning -**
   The tenderer to demonstrate the required engineering, component procurement, component fabrication, installation and commissioning stages for the total scope of works which will include;
   1. Dual Wagon Tippler
   2. Train Positioner
   3. Apron Feeders / Knife Gates
   4. Dust Handling Plant
   5. Electrical Works
   6.PLC/SCADA Works
3. **Project Management and Handover -** Handover of the project needs to include all training requirements, manual and data packs

The items above (1,2 and 3) will include as the minimum the following information.

a) Outline of method statement
b) Narrative to demonstrate alignment to the programme submission & basis of schedule.
c) Detailed method statement, technical approach and sequencing of work
d) Demonstrate and understanding on how the project objectives will be achieved
e) Demonstrate how risks and constraints will be addressed and managed.
f) Detailed method statement for document control and review
g) Narrative related to project close out, as-builts, training, operator's manual, data packs etc

Please note: Tenderers are required to provide detailed method statements for the categories as listed above. Each sub-category as listed will be scored based on the linear scale below and will be averaged and weighed to provide a final score.

The table below will be used as guidelines for scoring / evaluating the method statement submitted by the Tenderer:

No information submitted = 0	Contractor site establishment	Design Site installation and Commissioning	Project handover
	1.5 points	22.5 points	6 points
Score 0	The tenderer has submitted no information to determine a score.		
Score 20%	The methodology/approach and work alignment to project schedule is poorly presented and not tailored to address the specific project objectives and methodology.		
Score 40%	The methodology/approach is not tailored to address the specific project objectives and methodology. The methodology approach does not deal with the critical characteristics of the project.		
Score 60%	Satisfactory response/solution to the particular aspect of the requirement and evidence given that the stated employer's requirements will be met.		
Score 80%	The methodology/approach is specifically tailored to address the specific project objectives and methodology and is sufficiently flexible to accommodate changes that may occur during execution. The methodology/approach to manage activities is specifically tailored to the critical characteristics of the project.		
Score 100%	Besides meeting the "80" rating, the important issues are approached in an innovative and efficient way, indicating that the tenderer has outstanding knowledge an innovative approach. The methodology approach details ways to improve the project outcomes and the quality of the outputs.		

Reference to attached submissions to this schedule:

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………………………………………………………………………………………………………

The undersigned, who warrants that he I she is duly authorised to do so on behalf of the Tenderer, confirms that the contents and referenced submissions of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Signed ………………………… Date …………………………

Name ………………………… Position …………………………

Tenderer …………………………

T2.2-05: Evaluation Schedule: Previous Experience

Note to tenderers:

Tenderers are required to demonstrate performance in comparable projects of similar size and nature by supplying the following:

1. **Design, Manufacture/Fabrication, Installation and Commissioning of similar works as detailed in the Works Information with reference to:**
   - **Mechanical/Structural/Civil/Electrical/ Control Systems C&I (SCADA) works.**
   - **Specific to Tippler/Train Positioner/Feeders/Dust Handling Plant**

   Note: Detail description of the projects executed must include; Scope of works, Complexity, Challenges, Execution Strategy/Methodology.

2. **Five (5) reference letters from companies where the Respondent has provided a similar service with details of scope of works completed.**

Index of documentation attached to this schedule.

Reference letters from companies where the Respondent has provided a similar service				
No	Project Name and Description	Client	Contactable reference details i.e., Name, Cell-phone, and email address	Specific Details of Scope of Works
1				
2				
3				
4				
5				

Score	**Previous Experience** (Design, Manufacture/Fabrication, Installation and Commissioning (Train Tippler, Positioner and Dust Handling Plant) **(14 Points)**	**References** (Design, Manufacture/Fabrication, Installation, and Commissioning (Train Tippler, Positioner and Dust Handling Plant) **(6 Points)**
0%	The Tenderer failed to address the question / issue. Has not submitted any information.	The Tenderer failed to address the question / issue. Has not submitted any information.
20%	The Tenderer's previous experience presented has no relevance to the scope of this project and did not address any of the required categories.	One (1) reference letter from companies where the Respondent has provided a similar service with details of Scope of Work performed
40%	The Tenderer's previous experience presented has some relevance to the project but lacks detail i.e. Description of previous projects, value and references.	Two (2) reference letter from companies where the Respondent has provided a similar service with details of Scope of Work performed
60%	The Tenderer's previous experience presented demonstrates knowledge and experience to successfully execute this project scope.	Three (3) reference letters from companies where the Respondent has provided a similar service with details of Scope of Work performed
80%	The Tenderer's previous experience presented demonstrates a real understanding and substantial evidence of the ability meet the stated project requirements. The tenderer has extensive previous experience in relation to the *works*.	Four (4) reference letters from companies where the Respondent has provided a similar service with details of Scope of Work performed
100%	The Tenderer's previous experience presented demonstrates real confidence extensive understanding in all of the categories as required.	Five (5) reference letters from companies where the Respondent has provided a similar service with details of Scope of Work performed

Reference to attached submissions to this schedule:

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The undersigned, who warrants that he/she is duly authorised to do so on behalf of the Tenderer, confirms that the contents and referenced submissions of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Signed	………………………	Date	………………………
Name	………………………	Position	………………………
Tenderer	………………………		

T2.2-06: Evaluation Schedule: Programme = 10 Points

Note to tenderers:

The Tenderer provides a hard copy proposed programme and/or refers to his proposed programme and attaches it to this returnable schedule.

The Programme should indicate the following columns as a bare minimum:

Task ID	Task description	Start date	Finish date	Successor	Resources & Equipment	Time risk allowances (TRA)

The tenderer shall provide the proposed programme detailed to minimum of level 3 showing as a minimum the following: -

1. **Timeframes to be Established in line with the Works:**
   Ability to provide the services in terms of the *Employer*'s requirements; demonstrating timeframes to meet the works as stated in the Scope of Works by indicating, in a logical sequence, the order, the timing, and the duration of the works that will take place in order to Provide the Works.

   The contractor to indicate at minimum the following four (4) milestones for each of the four components:

   List of components
   1. Dual Wagon Tippler
   2. Train Positioner
   3. Apron Feeder and Knife Gates
   4. Dust Handling Plant

   List of Completion Milestones (For each of the above listed components)
   1. Design and Engineering
   2. Fabrication, Procurement and Supply
   3. Installation including Electrical, Mechanical and PLC/SCADA
   4. Commissioning

2. **Programme Information:**
   The *Contractor* clearly indicates in the schedule all milestones, activities & information related to the following –
   1. Float,
   2. Time Risk Allowances,
   3. Health and safety requirements,
   4. Procedures set out in this contract,
   5. Work by the *Employer* and Others,
   6. Access to a part of the site if later than its *access date,*
   7. Acceptances,
   8. Plant & Materials and other things to be provided by the employer,
   9. Information by Others,

10. *starting date, access dates*, Key Dates and Completion Date
11. planned Completion for each Key Date for each option and the complete works
12. Shows how each activity on the Activity Schedule relates to the operations on each programme

3. Resourcing & Equipment:

The *Contractor* indicates for each operation, how the *Contractor* plans to do the work identifying the principal Equipment and other resources which he plans to use. Resources & equipment are loaded against activities with their associated rates to the programme for evaluation.

The scoring of the programme will be as follows:

	Establish Timeframes (4)	**Programme Information (2)**	**Resourcing & Equipment (4)**
Score 0	The tenderer has submitted no information or inadequate information to determine a score.	The tenderer has submitted no information or inadequate information to determine a score.	The tenderer has submitted no information or inadequate information to determine a score.
Score 20	The tenderer has not addressed any date requirements and submission is missing activities and dates, which renders this incomplete.	The tenderer has addressed some but not all date requirements as listed in this returnable (4 or less of 12 addressed)	The tenderer has addressed some but not all resource requirements and the submission is missing critical both resources & equipment which renders it unrealistic / unachievable.
Score 40	The tenderer has not addressed all date requirements and submission is missing activities and dates which renders it incomplete and impacts on the Critical Path Calculation	The tenderer has addressed some but not all date requirements as listed in this returnable (5 or 6 of 12 addressed)	The tenderer has addressed some but not all resource requirements and the submission is missing either critical resources or equipment which renders it unrealistic / unachievable.
Score 60	The tenderer has addressed some but not all date requirements and submission is missing some activities and dates which renders it incomplete and does not impact on the Critical Path Calculation	The tenderer has addressed most but not all date requirements as listed in this returnable (7 or 8 of 12 addressed)	The tenderer has addressed some but not all resource requirements and the submission is missing some resources & equipment, but not critical providing the works, which renders it at risk of being unrealistic / unachievable.
Score 80	The tenderer has addressed all date requirements correctly and submission contains logic and sequencing which is accurate, and renders the	The tenderer has addressed most but not all date requirements as listed in this returnable (9 or 10 of 12 addressed)	The tenderer has addressed all resource requirements correctly and the submission contains resources & equipment, which is accurate, and renders the

	submission is complete but is not fully aligned to the method statements		submission realistic and achievable.
Score 100	The tenderer has addressed all date requirements correctly and submission contains logic and sequencing which is accurate, and renders the submission complete and is fully aligned to the method statements	The tenderer has addressed all date requirements as listed in this returnable (11 or 12 of 12 addressed)	The tenderer has addressed all resource requirements correctly and the submission contains resources & equipment, which is accurate, and renders the submission realistic and achievable and is fully aligned to the method statements

Reference to attached submissions to this schedule:

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……………………

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the Tenderer, confirms that the contents and referenced submissions of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Signed ……………………………… Date ………………………………

Name ……………………………… Position ………………………………

Tenderer ………………………………………………………………

T2.2-07: Authority to submit a Tender

Indicate the status of the tenderer by ticking the appropriate box hereunder. The tenderer must complete the certificate set out below for his category of organisation or alternatively attach a certified copy of a company / organisation document which provides the same information for the relevant category as requested here.

A - COMPANY	B - PARTNERSHIP	C - JOINT VENTURE	D - SOLE PROPRIETOR

A. Certificate for Company

I, ___________________________________ chairperson of the board of directors ______ ____, hereby confirm that by resolution of the board taken on _________________ (date), Mr/Ms ______________________________, acting in the capacity of ___________________________________, was authorised to sign all documents in connection with this tender offer and any contract resulting from it on behalf of the company.

Signed		Date	
Name		Position	Chairman of the Board of Directors

B. Certificate for Partnership

We, the undersigned, being the **key partners** in the business trading as ____________ __________________________ hereby authorise Mr/Ms ______________________________ acting in the capacity of _____________________________________, to sign all documents in connection with the tender offer for Contract _______________________________ and any contract resulting from it on our behalf.

Name	**Address**	**Signature**	**Date**

NOTE: This certificate is to be completed and signed by the full number of Partners necessary to commit the Partnership. Attach additional pages if more space is required.

C. Certificate for Joint Venture

We, the undersigned, are submitting this tender offer in Joint Venture and hereby authorise Mr/Ms ________________________________, an authorised signatory of the company ____, acting in the capacity of lead partner, to sign all documents in connection with the tender offer for Contract _________ ________________________________ and any contract resulting from it on our behalf.

This authorisation is evidenced by the attached power of attorney signed by legally authorised signatories of all the partners to the Joint Venture.

Furthermore we attach to this Schedule a copy of the joint venture agreement which incorporates a statement that all partners are liable jointly and severally for the execution of the contract and that the lead partner is authorised to incur liabilities, receive instructions and payments and be responsible for the entire execution of the contract for and on behalf of any and all the partners.

Name of firm	Address	Authorising signature, name (in caps) and capacity

D. Certificate for Sole Proprietor

I, ___________________________________, hereby confirm that I am the sole owner of the business trading as ____.

Signed		Date	
Name		Position	Sole Proprietor

T2.2-08: Record of Addenda to Tender Documents

This schedule as submitted confirms that the following communications received from the *Employer* before the submission of this tender offer, amending the tender documents, have been taken into account in this specific tender offer:

	Date	**Title or Details**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

Attach additional pages if more space is required.

T2.2-9 Letter/s of Good Standing with the Workmen's Compensation Fund

Attached to this schedule is the Letter/s of Good Standing.

1.

2.

3.

4.

Name of Company/Members of Joint Venture:

……
……
……
……
……
……
……
……
……
……

T2.2-10: Risk Elements

Tenderers to identify and evaluate the potential risk elements associated with the Works and possible mitigation thereof. The risk elements and the mitigation as identified thereof by the Tenderer are to be submitted.

If No Risks are identified "No Risks" must be stated on this schedule.

Tenderers are also to evaluate any risk/s stated by the *Employer* in Contract Data Part C1, and provide possible mitigation thereof.

Tenders to note: Notwithstanding this information, all costs related to risk elements which are at the Contractor's risk are deemed to be included in the tenderer's offered total of the Prices.

T2.2-11: Availability of Equipment and Other Resources

The Tenderer to submit a list of all Equipment and other resources that will be used to execute the *works* as described in the Works Information.

Equipment Type and Availability – Description	**Hourly Rate**	**Number of Equipment**	**Details of Ownership**

T2.2-12: Schedule of Proposed Subcontractors

The tenderer is required to provide details of all the sub-contractors that will be utilised in the execution of the *works.*

Note to tenderers:

- In terms of PPPFA Regulation 6 (5), A tenderer may not be awarded points for B-BBEE status level of contributor if the tender documents indicate that the tenderer intends subcontracting more than 25% of the value of the contract to any other person not qualifying for at least the points that the tenderer qualifies for, unless the intended subcontractor is an EME that has the capability to execute the subcontract.

- In terms of PPPFA Regulation 12 (3), A person awarded a contract may not subcontract more than 25% of the value of the contract to any other enterprise that does not have an equal or higher B-BBBEE status level of contributor that the person concerned, unless the contract is subcontracted to an EME that has the capability and ability to execute the contract.

Tenderer to note that after award, any deviations from this list of proposed sub-contractors will be subject to acceptance by the *Project Manager* in terms of the Conditions of Contract.

Provide information of the Sub-contractors below:

Name of Proposed Subcontractor	Address	Nature of work	Amount of Worked	Percentage of work

% Black Owned	EME	QSE	Youth	Women	Disabilities	Rural/ Underdeveloped areas/ Townships	Military Veterans
	☐	☐	☐	☐	☐	☐	☐

Name of Proposed Subcontractor	Address	Nature of work	Amount of Worked	Percentage of work

% Black Owned	EME	QSE	Youth	Women	Disabilities	Rural/ Underdeveloped areas/ Townships	Military Veterans
	☐	☐	☐	☐	☐	☐	☐

Name of Proposed Subcontractor	Address	Nature of work	Amount of Worked	Percentage of work

% Black Owned	**EME**	**QSE**	**Youth**	**Women**	**Disabilities**	**Rural/ Underdeveloped areas/ Townships**	**Military Veterans**
	☐	☐	☐	☐	☐	☐	☐

Name of Proposed Subcontractor	**Address**	**Nature of work**	**Amount of Worked**	**Percentage of work**

% Black Owned	**EME**	**QSE**	**Youth**	**Women**	**Disabilities**	**Rural/ Underdeveloped areas/ Townships**	**Military Veterans**
	☐	☐	☐	☐	☐	☐	☐

T2.2-13: Site Establishment Requirements

Tenderers to indicate their Site establishment area requirements:

T2.2-14: ANNEX G Compulsory Enterprise Questionnaire

The following particulars hereunder must be furnished.

In the case of a Joint Venture, separate enterprise questionnaires in respect of each partner/member must be completed and submitted.

Section 1: Name of enterprise: ______________________________

Section 2: VAT registration number, if any: ______________________________

Section 3: CIDB registration number, if any: ______________________________

Section 4: CSD number: ______________________________

Section 5: Particulars of sole proprietors and partners in partnerships

Name	**Identity number**	**Personal income tax number**

* Complete only if sole proprietor or partnership and attach separate page if more than 3 partners

Section 6: Particulars of companies and close corporations

Company registration number ______________________________

Close corporation number ______________________________

Tax reference number: ______________________________

Section 7: The attached SBD4 must be completed for each tender and be attached as a tender requirement.
Section 8: The attached SBD 6 must be completed for each tender and be attached as a requirement.

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise:

i) authorizes the Employer to obtain a tax clearance certificate from the South African Revenue Services that my / our tax matters are in order;

ii) confirms that the neither the name of the enterprise or the name of any partner, manager, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears on the Register of Tender Defaulters established in terms of the Prevention and Combating of Corrupt Activities Act of 2004;

iii) confirms that no partner, member, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears, has within the last five years been convicted of fraud or corruption;

iv) confirms that I / we are not associated, linked or involved with any other tendering entities submitting tender offers and have no other relationship with any of the tenderers or those responsible for compiling the scope of work that could cause or be interpreted as a conflict of interest; and

v) confirms that the contents of this questionnaire are within my personal knowledge and are to the best of my belief both true and correct.

Signed		Date	
Name		Position	
Enterprise name			

SBD 6.1

PREFERENCE POINTS CLAIM FORM

This preference form must form part of all bids invited. It contains general information and serves as a claim for preference points for Broad-Based Black Economic Empowerment [**B-BBEE**] Status Level of Contribution.

Transnet will award preference points to companies who provide valid proof of their B-BBEE status using either the latest version of the generic Codes of Good Practice or Sector Specific Codes (if applicable).

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1. GENERAL CONDITIONS

1.1 The following preference point systems are applicable to all bids:

- the 80/20 system for requirements with a Rand value of up to R50 000 000 (all applicable taxes included); and
- the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).

1.2 The value of this bid is estimated to exceed R50 000 000 (all applicable taxes included) and therefore the 90/10 preference point system shall be applicable. Despite the stipulated preference point system, Transnet shall use the lowest acceptable bid to determine the applicable preference point system in a situation where all received acceptable bids are received outside the stated preference point system.

1.3 Preference points for this bid shall be awarded for:

(a) Price; and

(b) B-BBEE Status Level of Contribution. (5 points)

(c) Sub-contracting at least 30% of the value of the contract to Black Owned EME's and QSE's 51% (5 points)

1.4 The maximum points for this bid are allocated as follows:

	POINTS
PRICE	**90**
B-BBEE STATUS LEVEL OF CONTRIBUTION AND Subcontracting 30% of the value of the contract to Black Owned EME's and QSE's 51%	**10**
Total points for Price and B-BBEE must not exceed	**100**

1.5 Failure on the part of a bidder to submit proof of B-BBEE status level of contributor together with the bid will be interpreted to mean that preference points for B-BBEE status level of contribution are not claimed.

1.6 The purchaser reserves the right to require of a bidder, either before a bid is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the purchaser.

2. DEFINITIONS

(a) **"all applicable taxes"** includes value-added tax, pay as you earn, income tax, unemployment insurance fund contributions and skills development levies;

(b) **"B-BBEE"** means broad-based black economic empowerment as defined in section 1 of the Broad-Based Black Economic Empowerment Act;

(c) "**B-BBEE status level of contributor"** means the B-BBEE status received by a measured entity based on its overall performance using the relevant scorecard contained in the Codes of Good Practice on Black Economic Empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act;

(d) **"bid"** means a written offer in a prescribed or stipulated form in response to an invitation by an organ of state for the supply/provision of services, works or goods, through price quotations, advertised competitive bidding processes or proposals;

(e) **"Broad-Based Black Economic Empowerment Act"** means the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(f) **"EME"** means an Exempted Micro Enterprise as defines by Codes of Good Practice under section 9 (1) of the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(g) **"functionality"** means the ability of a bidder to provide goods or services in accordance with specification as set out in the bid documents

(h) **"Price"** includes all applicable taxes less all unconditional discounts.

(i) **"Proof of B-BBEE Status Level of Contributor"**

i) the B-BBBEE status level certificate issued by an authorised body or person;

ii) a sworn affidavit as prescribed by the B-BBEE Codes of Good Practice; or

iii) any other requirement prescribed in terms of the B-BBEE Act.

(j) **"QSE"** means a Qualifying Small EEnterprise as defines by Codes of Good Practice under section 9 (1) of the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(k) **"rand value"** means the total estimated value of a contract in South African currency, calculated at the time of bid invitations, and includes all applicable taxes and excise duties.

3. POINTS AWARDED FOR PRICE

3.1 THE 90/10 PREFERENCE POINT SYSTEMS

A maximum of 90 points is allocated for price on the following basis:

90/10

$$Ps = 90\left(1 - \frac{Pt - P\min}{P\min}\right)$$

Where

Ps = Points scored for comparative price of bid under consideration

Pt = Comparative price of bid under consideration

Pmin = Comparative price of lowest acceptable bid

4. POINTS AWARDED FOR B-BBEE STATUS LEVEL OF CONTRIBUTION

4.1 preference points must be awarded to a bidder for attaining the B-BBEE status level of contribution in accordance with the table below:

B-BBEE Status Level of Contributor	Number of points (90/10 system)
1&2	5
Non-compliant contributor	0

4.2 The table below indicates the required proof of B-BBEE status depending on the category of enterprises:

Enterprise	B-BBEE Certificate & Sworn Affidavit
Large	Certificate issued by SANAS accredited verification agency
QSE	Certificate issued by SANAS accredited verification agency Sworn Affidavit signed by the authorised QSE representative and attested by a Commissioner of Oaths confirming annual turnover and black ownership (only black-owned QSEs - 51% to 100% Black owned) [Sworn affidavits must substantially comply with the format that can be obtained on the DTI's website at www.dti.gov.za/economic_empowerment/bee_codes.jsp.]
EME[1]	Sworn Affidavit signed by the authorised EME representative and attested by a Commissioner of Oaths confirming annual turnover and black ownership

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[1] In terms of the Implementation Guide: Preferential Procurement Regulations, 2017, Version 2, paragraph 11.11 provides that in the Transport Sector, EMEs can provide a letter from accounting officer or get verified and be issued with a B-BBEE certificate by SANAS accredited professional or agency as the Transport Sector Code has not been aligned to the generic Codes. EMEs in the Transport Sector are not allowed to provide a sworn affidavit as the generic codes are not applicable to them.

	Certificate issued by CIPC (formerly CIPRO) confirming annual turnover and black ownership Certificate issued by SANAS accredited verification agency only if the EME is being measured on the QSE scorecard

4.3 A trust, consortium or joint venture (including unincorporated consortia and joint ventures) must submit a consolidated B-BBEE Status Level verification certificate for every separate bid.

4.4 Tertiary Institutions and Public Entities will be required to submit their B-BBEE status level certificates in terms of the specialized scorecard contained in the B-BBEE Codes of Good Practice.

4.5 A person will not be awarded points for B-BBEE status level if it is indicated in the bid documents that such a bidder intends sub-contracting more than 25% of the value of the contract to any other enterprise that does not qualify for at least the points that such a bidder qualifies for, unless the intended sub-contractor is an EME that has the capability and ability to execute the sub-contract.

4.6 A person awarded a contract may not sub-contract more than 25% of the value of the contract to any other enterprise that does not have an equal or higher B-BBEE status level than the person concerned, unless the contract is sub-contracted to an EME that has the capability and ability to execute the sub-contract.

4.7 Bidders are to note that the rules pertaining to B-BBEE verification and other B-BBEE requirements may be changed from time to time by regulatory bodies such as National Treasury or the DTI. It is the Bidder's responsibility to ensure that his/her bid complies fully with all B-BBEE requirements at the time of the submission of the bid.

5. BID DECLARATION

5.1 Bidders who claim points in respect of B-BBEE Status Level of Contribution must complete the following:

6. B-BBEE STATUS LEVEL OF CONTRIBUTION CLAIMED IN TERMS OF PARAGRAPHS 1.4 AND 6.1

6.1 B-BBEE Status Level of Contribution: 1-2 . = (maximum of 5 points)

(Points claimed in respect of paragraph 6.1 must be in accordance with the table reflected in paragraph 4.1 and must be substantiated by relevant proof of B-BBEE status level of contributor.

7. SUB-CONTRACTING

7.1 Will any portion of the contract be sub-contracted?

(***Tick applicable box***)

YES		NO	

7.1.1 If yes, indicate:

i) What percentage of the contract will be subcontracted..%
ii) The name of the sub-contractor..
iii) The B-BBEE status level of the sub-contractor...
iv) Whether the sub-contractor is an EME or QSE.
(Tick applicable box)

YES	☐	NO	☐

8. DECLARATION WITH REGARD TO COMPANY/FIRM

8.1 Name of company/firm:..

8.2 VAT registration number:..

8.3 Company registration number:...

8.4 TYPE OF COMPANY/ FIRM

☐ Partnership/Joint Venture / Consortium
☐ One person business/sole propriety
☐ Close corporation
☐ Company
☐ (Pty) Limited

[TICK APPLICABLE BOX]

8.5 DESCRIBE PRINCIPAL BUSINESS ACTIVITIES

....
....
....

8.6 COMPANY CLASSIFICATION

☐ Manufacturer
☐ Supplier

☐ Professional Service provider
☐ Other Service providers, e.g. transporter, etc.
[*TICK APPLICABLE BOX*]

8.7 Total number of years the company/firm has been in business:……………………………

8.8 I/we, the undersigned, who is / are duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the B-BBE status level of contribution indicated in paragraphs 1.4 and 6.1 of the foregoing certificate, qualifies the company/ firm for the preference(s) shown and I / we acknowledge that:

i) The information furnished is true and correct;

ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form;

iii) In the event of a contract being awarded as a result of points claimed as shown in paragraph 1.4 and 6.1, the contractor may be required to furnish documentary proof to the satisfaction of the purchaser that the claims are correct;

iv) If a bidder submitted false information regarding its B-BBEE status level of contributor,, which will affect or has affected the evaluation of a bid, or where a bidder has failed to declare any subcontracting arrangements or any of the conditions of contract have not been fulfilled, the purchaser may, in addition to any other remedy it may have

(a) disqualify the person from the bidding process;

(b) recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;

(c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;

(d) if the successful bidder subcontracted a portion of the bid to another person without disclosing it, Transnet reserves the right to penalise the bidder up to 10 percent of the value of the contract;

(e) recommend that the bidder or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted by the National Treasury from obtaining business from any organ of state for a period not exceeding 10 years, after the audi alteram partem (hear the other side) rule has been applied; and

(f) forward the matter for criminal prosecution.

WITNESSES
1. ……………………………………..
2. ……………………………………..

……………………………………….
SIGNATURE(S) OF BIDDERS(S)
DATE: …………………………………..

BIDDER'S DISCLOSURE

1. PURPOSE OF THE FORM

Any person (natural or juristic) may make an offer or offers in terms of this invitation to bid. In line with the principles of transparency, accountability, impartiality, and ethics as enshrined in the Constitution of the Republic of South Africa and further expressed in various pieces of legislation, it is required for the bidder to make this declaration in respect of the details required hereunder.

Where a person/s are listed in the Register for Tender Defaulters and / or the List of Restricted Suppliers, that person will automatically be disqualified from the bid process.

2. Bidder's declaration

2.1 Is the bidder, or any of its directors / trustees / shareholders / members / partners or any person having a controlling interest2 in the enterprise, employed by the state? **YES/NO**

2.1.1 If so, furnish particulars of the names, individual identity numbers, and, if applicable, state employee numbers of sole proprietor/ directors / trustees / shareholders / members/ partners or any person having a controlling interest in the enterprise, in table below.

Full Name	**Identity Number**	**Name of State institution**

2.2 Do you, or any person connected with the bidder, have a relationship with any person who is employed by the procuring institution? **YES/NO**

2.2.1 If so, furnish particulars:

………………………………………………………………………………………
………………………………………………………………………………………

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[2] the power, by one person or a group of persons holding the majority of the equity of an enterprise, alternatively, the person/s having the deciding vote or power to influence or to direct the course and decisions of the enterprise.

2.3 Does the bidder or any of its directors / trustees / shareholders / members / partners or any person having a controlling interest in the enterprise have any interest in any other related enterprise whether or not they are bidding for this contract? **YES/NO**

2.3.1 If so, furnish particulars:
………………………………………………………………………………….
………………………………………………………………………………….

3 DECLARATION

I, the undersigned, (name)……………………………………………………………………. in submitting the accompanying bid, do hereby make the following statements that I certify to be true and complete in every respect:

3.1 I have read and I understand the contents of this disclosure;

3.2 I understand that the accompanying bid will be disqualified if this disclosure is found not to be true and complete in every respect;

3.3 The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However, communication between partners in a joint venture or consortium3 will not be construed as collusive bidding.

3.4 In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications, prices, including methods, factors or formulas used to calculate prices, market allocation, the intention or decision to submit or not to submit the bid, bidding with the intention not to win the bid and conditions or delivery particulars of the products or services to which this bid invitation relates.

3.4 The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.

3.5 There have been no consultations, communications, agreements or arrangements made by the bidder with any official of the procuring institution in relation to this procurement process prior to and during the bidding process except to provide clarification on the bid submitted where so required by the institution; and the bidder was not involved in the drafting of the specifications or terms of reference for this bid.

3.6 I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the

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[3] Joint venture or Consortium means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract.

Competition Act No 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

I CERTIFY THAT THE INFORMATION FURNISHED IN PARAGRAPHS 1, 2 and 3 ABOVE IS CORRECT.
I ACCEPT THAT THE STATE MAY REJECT THE BID OR ACT AGAINST ME IN TERMS OF PARAGRAPH 6 OF PFMA SCM INSTRUCTION 03 OF 2021/22 ON PREVENTING AND COMBATING ABUSE IN THE SUPPLY CHAIN MANAGEMENT SYSTEM SHOULD THIS DECLARATION PROVE TO BE FALSE.

……………………………… Signature	..…………………………………………… Date
……………………………… Position	……………………………………………… Name of bidder

T2.2-15 NON-DISCLOSURE AGREEMENT

[................. 2020]

Note to tenderers: This Non-Disclosure Agreement is to be completed and signed by an authorised signatory:

THIS AGREEMENT is made effective as of .... day of .... 20...... by and between:

TRANSNET SOC LTD

(Registration No. 1990/000900/30), a company incorporated and existing under the laws of South Africa, having its principal place of business at Transnet Corporate Centre 138 Eloff Street , Braamfontein , Johannesburg 2000

and

....

(Registration No. ....),a private company incorporated and existing under the laws of South Africa having its principal place of business at

....

....

WHEREAS

Transnet and the Company wish to exchange Information [as defined below] and it is envisaged that each party may from time to time receive Information relating to the other in respect thereof. In consideration of each party making available to the other such Information, the parties jointly agree that any dealings between them shall be subject to the terms and conditions of this Agreement which themselves will be subject to the parameters of the Tender Document.

IT IS HEREBY AGREED

1. INTERPRETATION

In this Agreement:

1.1 **Agents** mean directors, officers, employees, agents, professional advisers, contractors or sub-contractors, or any Group member;

1.2 **Bid** or **Bid Document** (hereinafter Tender) means Transnet's Request for Information [**RFI**] Request for Proposal [**RFP**] or Request for Quotation [**RFQ**], as the case may be;

1.3 **Confidential Information** means any information or other data relating to one party [the **Disclosing Party**] and/or the business carried on or proposed or intended to be carried on by that party and which is made available for the purposes of the Bid to the other party [the **Receiving Party**] or its Agents by the Disclosing Party or its Agents or recorded in agreed minutes following oral disclosure and any other information otherwise made available by the Disclosing Party or its Agents to the Receiving Party or its Agents, whether before, on or after the date of this Agreement, and whether in writing or otherwise, including any information, analysis or specifications derived from, containing or reflecting such information but excluding information which:

1.3.1 is publicly available at the time of its disclosure or becomes publicly available [other than as a result of disclosure by the Receiving Party or any of its Agents contrary to the terms of this Agreement]; or

1.3.2 was lawfully in the possession of the Receiving Party or its Agents [as can be demonstrated by its written records or other reasonable evidence] free of any restriction as to its use or disclosure prior to its being so disclosed; or

1.3.3 following such disclosure, becomes available to the Receiving Party or its Agents [as can be demonstrated by its written records or other reasonable evidence] from a source other than the Disclosing Party or its Agents, which source is not bound by any duty of confidentiality owed, directly or indirectly, to the Disclosing Party in relation to such information;

1.4 **Group** means any subsidiary, any holding company and any subsidiary of any holding company of either party; and

1.5 **Information** means all information in whatever form including, without limitation, any information relating to systems, operations, plans, intentions, market opportunities, know-how, trade secrets and business affairs whether in writing, conveyed orally or by machine-readable medium.

2. CONFIDENTIAL INFORMATION

2.1 All Confidential Information given by one party to this Agreement [the **Disclosing Party**] to the other party [the **Receiving Party**] will be treated by the Receiving Party as secret and confidential and will not, without the Disclosing Party's written consent, directly or indirectly communicate or disclose [whether in writing or orally or in any other manner] Confidential Information to any other person other than in accordance with the terms of this Agreement.

2.2 The Receiving Party will only use the Confidential Information for the sole purpose of technical and commercial discussions between the parties in relation to the Tender or for the subsequent performance of any contract between the parties in relation to the Tender.

2.3 Notwithstanding clause 2.1 above, the Receiving Party may disclose Confidential Information:

2.3.1 to those of its Agents who strictly need to know the Confidential Information for the sole purpose set out in clause 2.2 above, provided that the Receiving Party shall ensure that such Agents are made aware prior to the disclosure of any part of the Confidential Information that the same is confidential and that they owe a duty of confidence to the Disclosing Party. The Receiving Party shall at all times remain liable for any actions of such Agents that would constitute a breach of this Agreement; or

2.3.2 to the extent required by law or the rules of any applicable regulatory authority, subject to clause 2.4 below.

2.4 In the event that the Receiving Party is required to disclose any Confidential Information in accordance with clause 2.3.2 above, it shall promptly notify the Disclosing Party and cooperate with the Disclosing Party regarding the form, nature, content and purpose of such disclosure or any action which the Disclosing Party may reasonably take to challenge the validity of such requirement.

2.5 In the event that any Confidential Information shall be copied, disclosed or used otherwise than as permitted under this Agreement then, upon becoming aware of the same, without prejudice to any rights or remedies of the Disclosing Party, the Receiving Party shall as soon as practicable notify the Disclosing Party of such event and if requested take such steps [including the institution of legal proceedings] as shall be necessary to remedy [if capable of remedy] the default and/or to prevent further unauthorised copying, disclosure or use.

2.6 All Confidential Information shall remain the property of the Disclosing Party and its disclosure shall not confer on the Receiving Party any rights, including intellectual property rights over the Confidential Information whatsoever, beyond those contained in this Agreement.

3. RECORDS AND RETURN OF INFORMATION

3.1 The Receiving Party agrees to ensure proper and secure storage of all Information and any copies thereof.

3.2 The Receiving Party shall keep a written record, to be supplied to the Disclosing Party upon request, of the Confidential Information provided and any copies made thereof and, so far as is reasonably practicable, of the location of such Confidential Information and any copies thereof.

3.3 The Company shall, within 7 [seven] days of receipt of a written demand from Transnet:

3.3.1 return all written Confidential Information [including all copies]; and

3.3.2 expunge or destroy any Confidential Information from any computer, word processor or other device whatsoever into which it was copied, read or programmed by the Company or on its behalf.

3.4 The Company shall on request supply a certificate signed by a director as to its full compliance with the requirements of clause 3.3.2 above.

4. ANNOUNCEMENTS

4.1 Neither party will make or permit to be made any announcement or disclosure of its prospective interest in the Tender without the prior written consent of the other party.

4.2 Neither party shall make use of the other party's name or any information acquired through its dealings with the other party for publicity or marketing purposes without the prior written consent of the other party.

5. DURATION

The obligations of each party and its Agents under this Agreement shall survive the termination of any discussions or negotiations between the parties regarding the Tender and continue thereafter for a period of 5 [five] years.

6. PRINCIPAL

Each party confirms that it is acting as principal and not as nominee, agent or broker for any other person and that it will be responsible for any costs incurred by it or its advisers in considering or pursuing the Tender and in complying with the terms of this Agreement.

7. ADEQUACY OF DAMAGES

Nothing contained in this Agreement shall be construed as prohibiting the Disclosing Party from pursuing any other remedies available to it, either at law or in equity, for any such threatened or actual breach of this Agreement, including specific performance, recovery of damages or otherwise.

8. PRIVACY AND DATA PROTECTION

8.1 The Receiving Party undertakes to comply with South Africa's general privacy protection in terms Section 14 of the Bill of Rights in connection with this Tender and shall procure that its personnel shall observe the provisions of such Act [as applicable] or any amendments and re-enactments thereof and any regulations made pursuant thereto.

8.2 The Receiving Party warrants that it and its Agents have the appropriate technical and organisational measures in place against unauthorised or unlawful processing of data relating to the Tender and against accidental loss or destruction of, or damage to such data held or processed by them.

9. GENERAL

9.1 Neither party may assign the benefit of this Agreement, or any interest hereunder, except with the prior written consent of the other, save that Transnet may assign this Agreement at any time to any member of the Transnet Group.

9.2 No failure or delay in exercising any right, power or privilege under this Agreement will operate as a waiver of it, nor will any single or partial exercise of it preclude any further exercise or the exercise of any right, power or privilege under this Agreement or otherwise.

9.3 The provisions of this Agreement shall be severable in the event that any of its provisions are held by a court of competent jurisdiction or other applicable authority to be invalid, void or otherwise unenforceable, and the remaining provisions shall remain enforceable to the fullest extent permitted by law.

9.4 This Agreement may only be modified by a written agreement duly signed by persons authorised on behalf of each party.

9.5 Nothing in this Agreement shall constitute the creation of a partnership, joint venture or agency between the parties.

9.6 This Agreement will be governed by and construed in accordance with South African law and the parties irrevocably submit to the exclusive jurisdiction of the South African courts.

Signed ……………………………… Date ………………………………

Name ……………………………… Position ………………………………

Tenderer ………………………………………………………………

T2.2-16: RFP DECLARATION FORM

NAME OF COMPANY: ____

We ____ do hereby certify that:

1. Transnet has supplied and we have received appropriate tender offers to any/all questions (as applicable) which were submitted by ourselves for tender clarification purposes;
2. we have received all information we deemed necessary for the completion of this Tender;
3. at no stage have we received additional information relating to the subject matter of this tender from Transnet sources, other than information formally received from the designated Transnet contact(s) as nominated in the tender documents;
4. we are satisfied, insofar as our company is concerned, that the processes and procedures adopted by Transnet in issuing this tender and the requirements requested from tenderers in responding to this tender have been conducted in a fair and transparent manner; and
5. furthermore, we acknowledge that a direct relationship exists between a family member and/or an owner / member / director / partner / shareholder (unlisted companies) of our company and an employee or board member of the Transnet Group as indicated below: *[Respondent to indicate if this section is not applicable]*

FULL NAME OF OWNER/MEMBER/DIRECTOR/
PARTNER/SHAREHOLDER: ADDRESS:

____

____

____

Indicate nature of relationship with Transnet:

____

____

____

____

[Failure to furnish complete and accurate information in this regard may lead to the disqualification of your response and may preclude a Respondent from doing future business with Transnet]

We declare, to the extent that we are aware or become aware of any relationship between ourselves and Transnet (other than any existing and appropriate business relationship with Transnet) which could unfairly advantage our company in the forthcoming adjudication process, we shall notify Transnet immediately in writing of such circumstances.

6. We accept that any dispute pertaining to this tender will be resolved through the Ombudsman process and will be subject to the Terms of Reference of the Ombudsman. The Ombudsman process must first be exhausted before judicial review of a decision is sought. (Refer "Important Notice to respondents" below).

7. We further accept that Transnet reserves the right to reverse a tender award or decision based on the recommendations of the Ombudsman without having to follow a formal court process to have such award or decision set aside.

8. We have acquainted ourselves and agree with the content of T2.2-20 "Service Provider Integrity Pact".

For and on behalf of …………………………………………………………………………………………………… duly authorised thereto
Name:
Signature:
Date:

IMPORTANT NOTICE TO TENDERERS

- Transnet has appointed a Procurement Ombudsman to investigate any <u>material complaint</u> in respect of tenders exceeding R5,000,000.00 (five million S.A. Rand) in value. Should a Tenderer have any material concern regarding an tender process which meets this value threshold, a complaint may be lodged with Transnet's Procurement Ombudsman for further investigation.

- It is incumbent on the Tenderer to familiarise himself/herself with the Terms of Reference for the Transnet Procurement Ombudsman, details of which are available for review at Transnet's website www.transnet.net.

- An official complaint form may be downloaded from this website and submitted, together with any supporting documentation, within the prescribed period, to procurement.ombud@transnet.net
- For transactions below the R5,000,000.00 (five million S.A. Rand) threshold, a complaint may be lodged with the Chief Procurement Officer of the relevant Transnet Operating Division.
- All Tenderers should note that a complaint must be made in good faith. If a complaint is made in bad faith, Transnet reserves the right to place such a tenderer on its List of Excluded Bidders.

T2.2-17: REQUEST FOR PROPOSAL – BREACH OF LAW

NAME OF COMPANY: ____

I / We ____ do hereby certify that ***I/we have/have not been*** found guilty during the preceding 5 (five) years of a serious breach of law, including but not limited to a breach of the Competition Act, 89 of 1998, by a court of law, tribunal or other administrative body. The type of breach that the Tenderer is required to disclose excludes relatively minor offences or misdemeanours, e.g. traffic offences.

Where found guilty of such a serious breach, please disclose:

NATURE OF BREACH:

____

____

____

DATE OF BREACH:

____

Furthermore, I/we acknowledge that Transnet SOC Ltd reserves the right to exclude any Tenderer from the tendering process, should that person or company have been found guilty of a serious breach of law, tribunal or regulatory obligation.

Signed on this _____ day of __________________ 20____

____

SIGNATURE OF TENDER

T2.2-18 Certificate of Acquaintance with Tender Documents

NAME OF TENDERING ENTITY:

____

1. By signing this certificate I/we acknowledge that I/we have made myself/ourselves thoroughly familiar with, and agree with all the conditions governing this RFP. This includes those terms and conditions of the Contract, the Supplier Integrity Pact, Non-Disclosure Agreement etc. contained in any printed form stated to form part of the documents thereof, but not limited to those listed in this clause.
2. I/we furthermore agree that Transnet SOC Ltd shall recognise no claim from me/us for relief based on an allegation that I/we overlooked any tender/contract condition or failed to take it into account for the purpose of calculating my/our offered prices or otherwise.
3. I/we understand that the accompanying Tender will be disqualified if this Certificate is found not to be true and complete in every respect.
4. For the purposes of this Certificate and the accompanying Tender, I/we understand that the word "competitor" shall include any individual or organisation, other than the Tenderer, whether or not affiliated with the Tenderer, who:
    a) has been requested to submit a Tender in response to this Tender invitation;
    b) could potentially submit a Tender in response to this Tender invitation, based on their qualifications, abilities or experience; and
    c) provides the same Services as the Tenderer and/or is in the same line of business as the Tenderer
5. The Tenderer has arrived at the accompanying Tender independently from, and without consultation, communication, agreement or arrangement with any competitor. However communication between partners in a joint venture or consortium will not be construed as collusive Tendering.
6. In particular, without limiting the generality of paragraph 5 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:
    a) prices;

b) geographical area where Services will be rendered [market allocation]

c) methods, factors or formulas used to calculate prices;

d) the intention or decision to submit or not to submit, a Tender;

e) the submission of a tender which does not meet the specifications and conditions of the tender; or

f) Tendering with the intention not winning the tender.

7. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the Services to which this tender relates.

8. The terms of the accompanying tender have not been, and will not be, disclosed by the Tenderer, directly or indirectly, to any competitor, prior to the date and time of the official tender opening or of the awarding of the contract.

9. I/We am/are aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to tenders and contracts, tenders that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and/or may be reported to the National Prosecuting Authority [NPA] for criminal investigation. In addition, Tenderers that submit suspicious tenders may be restricted from conducting business with the public sector for a period not exceeding 10 [ten] years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

Signed on this _____ day of ___________________20___

____

SIGNATURE OF TENDERER

T2.2-19 Service Provider Integrity Pact

Important Note: All potential tenderers must read this document and certify in the RFP Declaration Form that that have acquainted themselves with, and agree with the content.

The contract with the successful tenderer will automatically incorporate this Integrity Pact and shall be deemed as part of the final concluded contract.

INTEGRITY PACT

Between

TRANSNET SOC LTD

Registration Number: 1990/000900/30

("Transnet")

and

The Contractor (hereinafter referred to as the "Tenderer/Service Providers/Contractor")

PREAMBLE

Transnet values full compliance with all relevant laws and regulations, ethical standards and the principles of economical use of resources, fairness and transparency in its relations with its Tenderers/Service Providers/Contractors.

In order to achieve these goals, Transnet and the Tenderer/Service Provider/Contractor hereby enter into this agreement hereinafter referred to as the "Integrity Pact" which will form part of the Tenderer's/Service Provider's/Contractor's application for registration with Transnet as a vendor.

The general purpose of this Integrity Pact is to agree on avoiding all forms of dishonesty, fraud and corruption by following a system that is fair, transparent and free from any undue influence prior to, during and subsequent to the currency of any procurement and/or reverse logistics event and any further contract to be entered into between the Parties, relating to such event.

All Tenderers/Service Providers/Contractor's will be required to sign and comply with undertakings contained in this Integrity Pact, should they want to be registered as a Transnet vendor.

1 OBJECTIVES

1.1 Transnet and the Tenderer/Service Provider/Contractor agree to enter into this Integrity Pact, to avoid all forms of dishonesty, fraud and corruption including practices that are anti-competitive in nature, negotiations made in bad faith and under-pricing by following a system that is fair, transparent and free from any influence/unprejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to:

a) Enable Transnet to obtain the desired contract at a reasonable and competitive price in conformity to the defined specifications of the works, goods and services; and

b) Enable Tenderers/Service Providers/Contractors to abstain from bribing or participating in any corrupt practice in order to secure the contract.

2 COMMITMENTS OF TRANSNET

Transnet commits to take all measures necessary to prevent dishonesty, fraud and corruption and to observe the following principles:

2.1 Transnet hereby undertakes that no employee of Transnet connected directly or indirectly with the sourcing event and ensuing contract, will demand, take a promise for or accept directly or through intermediaries any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the Tenderer, either for themselves or for any person, organisation or third party related to the contract in exchange for an advantage in the tendering process, Tender evaluation, contracting or implementation process related to any contract.

2.2 Transnet will, during the registration and tendering process treat all Tenderers/ Service Providers/Contractor with equity, transparency and fairness. Transnet will in particular, before and during the registration process, provide to all Tenderers/ Service Providers/Contractors the same information and will not provide to any Tenderers/Service Providers/Contractors confidential/additional information through which the Tenderers/Service Providers/Contractors could obtain an advantage in relation to any tendering process.

2.3 Transnet further confirms that its employees will not favour any prospective Tenderers/Service Providers/Contractors in any form that could afford an undue advantage to a particular Tenderer during the tendering stage, and will further treat all Tenderers/Service Providers/Contractors participating in the tendering process in a fair manner.

2.4 Transnet will exclude from the tender process such employees who have any personal interest in the Tenderers/Service Providers/Contractors participating in the tendering process.

3 OBLIGATIONS OF THE TENDERER / SERVICE PROVIDER

3.1 Transnet has a '**Zero Gifts'** Policy. No employee is allowed to accept gifts, favours or benefits.

a) Transnet officials and employees **shall not** solicit, give or accept, or from agreeing to solicit, give, accept or receive directly or indirectly, any gift, gratuity, favour, entertainment, loan, or anything of monetary value, from any person or juridical entities in the course of official duties or in connection with any operation being managed by, or any transaction which may be affected by the functions of their office.

b) Transnet officials and employees **shall not** solicit or accept gifts of any kind, from vendors, suppliers, customers, potential employees, potential vendors, and suppliers, or any other individual or organisation irrespective of the value.

c) Under **no circumstances** should gifts, business courtesies or hospitality packages be accepted from or given to prospective suppliers participating in a tender process at the respective employee's Operating Division, regardless of retail value.

d) Gratuities, bribes or kickbacks of any kind must never be solicited, accepted or offered, either directly or indirectly. This includes money, loans, equity, special privileges, personal favours, benefit or services. Such favours will be considered to constitute corruption.

3.2 The Tenderer/Service Provider/Contractor commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its Tender or during any ensuing contract stage in order to secure the contract or in furtherance to secure it and in particular the Tenderer/Service Provider/Contractor commits to the following:

a) The Tenderer/Service Provider/Contractor will not, directly or through any other person or firm, offer, promise or give to Transnet or to any of Transnet's employees involved in the tendering process or to any third person any material or other benefit or payment, in order to obtain in exchange an advantage during the tendering process; and

b) The Tenderer/Service Provider/Contractor will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any employee of Transnet, connected directly or indirectly with the tendering process, or to any person, organisation or third party related to the contract in exchange for any advantage in the tendering, evaluation, contracting and implementation of the contract.

3.3 The Tenderer/Service Provider/Contractor will not collude with other parties interested in the contract to preclude a competitive Tender price, impair the transparency, fairness and progress of the tendering process, Tender evaluation, contracting and implementation of the contract. The Tenderer / Service Provider further commits itself to delivering against all agreed upon conditions as stipulated within the contract.

3.4 The Tenderer/Service Provider/Contractor will not enter into any illegal or dishonest agreement or understanding, whether formal or informal with other Tenderers/Service Providers/Contractors. This applies in particular to certifications, submissions or non-submission of documents or actions that are restrictive or to introduce cartels into the tendering process.

3.5 The Tenderer/Service Provider/Contractor will not commit any criminal offence under the relevant anti-corruption laws of South Africa or any other country. Furthermore, the Tenderer/Service Provider/Contractor will not use for illegitimate purposes or for restrictive purposes or personal gain, or pass on to others, any information provided by Transnet as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

3.6 A Tenderer/Service Provider/Contractor of foreign origin shall disclose the name and address of its agents or representatives in South Africa, if any, involved directly or indirectly in the registration or tendering process. Similarly, the Tenderer / Service Provider / Contractor of South African nationality shall furnish the name and address of the foreign principals, if any, involved directly or indirectly in the registration or tendering process.

3.7 The Tenderer/Service Provider/Contractor will not misrepresent facts or furnish false or forged documents or information in order to influence the tendering process to the advantage of the Tenderer/Service Provider/Contractor or detriment of Transnet or other competitors.

3.8 Transnet may require the Tenderer/Service Provider/Contractor to furnish Transnet with a copy of its code of conduct. Such code of conduct must address the compliance programme for the implementation of the code of conduct and reject the use of bribes and other dishonest and unethical conduct.

3.9 The Tenderer/Service Provider/Contractor will not instigate third persons to commit offences outlined above or be an accessory to such offences.

3.10 The Tenderer/Service Provider/Contractor confirms that they will uphold the ten principles of the United Nations Global Compact (UNGC) in the fields of Human Rights, Labour, Anti-Corruption and the Environment when undertaking business with Transnet as follows:

a) Human Rights

- Principle 1: Businesses should support and respect the protection of internationally proclaimed human rights; and
- Principle 2: make sure that they are not complicit in human rights abuses.

b) Labour

- Principle 3: Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;
- Principle 4: the elimination of all forms of forced and compulsory labour;
- Principle 5: the effective abolition of child labour; and
- Principle 6: the elimination of discrimination in respect of employment and occupation.

c) Environment

- Principle 7: Businesses should support a precautionary approach to environmental challenges;

- Principle 8: undertake initiatives to promote greater environmental responsibility; and

- Principle 9: encourage the development and diffusion of environmentally friendly technologies.

d) Anti-Corruption

- Principle 10: Businesses should work against corruption in all its forms, including extortion and bribery.

4 INDEPENDENT TENDERING

4.1 For the purposes of that Certificate in relation to any submitted Tender, the Tenderer declares to fully understand that the word "competitor" shall include any individual or organisation, other than the Tenderer, whether or not affiliated with the Tenderer, who:

a) has been requested to submit a Tender in response to this Tender invitation;
b) could potentially submit a Tender in response to this Tender invitation, based on their qualifications, abilities or experience; and
c) provides the same Goods and Services as the Tenderer and/or is in the same line of business as the Tenderer.

4.2 The Tenderer has arrived at his submitted Tender independently from, and without consultation, communication, agreement or arrangement with any competitor. However communication between partners in a joint venture or consortium will not be construed as collusive tendering.

4.3 In particular, without limiting the generality of paragraph 5 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:

a) prices;
b) geographical area where Goods or Services will be rendered [market allocation];
c) methods, factors or formulas used to calculate prices;
d) the intention or decision to submit or not to submit, a Tender;
e) the submission of a Tender which does not meet the specifications and conditions of the RFP; or
f) tendering with the intention of not winning the Tender.

4.4 In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the Goods or Services to which his/her tender relates.

4.5 The terms of the Tender as submitted have not been, and will not be, disclosed by the Tenderer, directly or indirectly, to any competitor, prior to the date and time of the official Tender opening or of the awarding of the contract.

4.6 Tenderers are aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to Tenders and contracts, Tenders that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and/or may be reported to the National Prosecuting Authority [**NPA**] for criminal investigation and/or may be restricted from conducting business with the public sector for a period not exceeding 10 [ten] years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

4.7 Should the Tenderer find any terms or conditions stipulated in any of the relevant documents quoted in the Tender unacceptable, it should indicate which conditions are unacceptable and offer alternatives by written submission on its company letterhead, attached to its submitted Tender. Any such submission shall be subject to review by Transnet's Legal Counsel who shall determine whether the proposed alternative(s) are acceptable or otherwise, as the case may be.

5 DISQUALIFICATION FROM TENDERING PROCESS

5.1 If the Tenderer/Service Provider/Contractor has committed a transgression through a violation of section 3 of this Integrity Pact or in any other form such as to put its reliability or credibility as a Tenderer/Service Provider/Contractor into question, Transnet may reject the Tenderer's / Service Provider's / Contractor's application from the registration or tendering process and remove the Tenderer/Service Provider/Contractor from its database, if already registered.

5.2 If the Tenderer/Service Provider/Contractor has committed a transgression through a violation of section 3, or any material violation, such as to put its reliability or credibility into question. Transnet may after following due procedures and at its own discretion also exclude the Tenderer/Service Provider /Contractor from future tendering processes. The imposition and duration of the exclusion will be determined by the severity of the transgression. The severity will be determined by the circumstances of the case, which will include amongst others the number of transgressions, the position of the transgressors within the company hierarchy of the Tenderer/Service Provider/Contractor and the amount of the damage. The exclusion will be imposed for up to a maximum of 10 (ten) years. However, Transnet reserves the right to impose a longer period of exclusion, depending on the gravity of the misconduct.

5.3 If the Tenderer/Service Provider/Contractor can prove that it has restored the damage caused by it and has installed a suitable corruption prevention system, or taken other remedial measures as the circumstances of the case may require, Transnet may at its own discretion revoke the exclusion or suspend the imposed penalty.

6 TRANSNET'S LIST OF EXCLUDED TENDERERS (BLACKLIST)

6.1 The process of restriction is used to exclude a company/person from conducting future business with Transnet and other organs of state for a specified period. No Tender shall be awarded to a Tenderer whose name (or any of its members, directors, partners or trustees) appear on the Register of Tender Defaulters kept by National Treasury, or who have been placed on National Treasury's List of Restricted Suppliers. Transnet reserves the right to withdraw an award, or cancel a contract concluded with a Tenderer should it be established, at any time, that a tenderer has been restricted with National Treasury by another government institution.

6.2 All the stipulations on Transnet's restriction process as laid down in Transnet's Supply Chain Policy and Procurement Procedures Manual (CPM included) are included herein by way of reference. Below follows a condensed summary of this restriction procedure.

6.3 On completion of the restriction procedure, Transnet will submit the restricted entity's details (including the identity number of the individuals and registration number of the entity) to National Treasury for placement on National Treasury's Database of Restricted Suppliers for the specified period of exclusion. National Treasury will make the final decision on whether to restrict an entity from doing business with any organ of state for a period not exceeding 10 years and place the entity concerned on the Database of Restricted Suppliers published on its official website.

6.4 The decision to restrict is based on one of the grounds for restriction. The standard of proof to commence the restriction process is whether a "*prima facie*" (i.e. on the face of it) case has been established.

6.5 Depending on the seriousness of the misconduct and the strategic importance of the Goods/Services, in addition to restricting a company/person from future business, Transnet may decide to terminate some or all existing contracts with the company/person as well.

6.6 A Service Provider or Contractor to Transnet may not subcontract any portion of the contract to a blacklisted company.

6.7 Grounds for blacklisting include: If any person/Enterprise which has submitted a Tender, concluded a contract, or, in the capacity of agent or subcontractor, has been associated with such Tender or contract:

a) Has, in bad faith, withdrawn such Tender after the advertised closing date and time for the receipt of Tenders;

b) has, after being notified of the acceptance of his Tender, failed or refused to sign a contract when called upon to do so in terms of any condition forming part of the Tender documents;

c) has carried out any contract resulting from such Tender in an unsatisfactory manner or has breached any condition of the contract;

d) has offered, promised or given a bribe in relation to the obtaining or execution of the contract;

e) has acted in a fraudulent or improper manner or in bad faith towards Transnet or any Government Department or towards any public body, Enterprise or person;

f) has made any incorrect statement in a certificate or other communication with regard to the Local Content of his Goods or his B-BBEE status and is unable to prove to the satisfaction of Transnet that:

   (i) he made the statement in good faith honestly believing it to be correct; and

   (ii) before making such statement he took all reasonable steps to satisfy himself of its correctness;

g) caused Transnet damage, or to incur costs in order to meet the contractor's requirements and which could not be recovered from the contractor;

h) has litigated against Transnet in bad faith.

6.8 Grounds for blacklisting include a company/person recorded as being a company or person prohibited from doing business with the public sector on National

Treasury's database of Restricted Service Providers or Register of Tender Defaulters.

6.9 Companies associated with the person/s guilty of misconduct (i.e. entities owned, controlled or managed by such persons), any companies subsequently formed by the person(s) guilty of the misconduct and/or an existing company where such person(s) acquires a controlling stake may be considered for blacklisting. The decision to extend the blacklist to associated companies will be at the sole discretion of Transnet.

7 PREVIOUS TRANSGRESSIONS

7.1 The Tenderer/Service Provider/Contractor hereby declares that no previous transgressions resulting in a serious breach of any law, including but not limited to, corruption, fraud, theft, extortion and contraventions of the Competition Act 89 of 1998, which occurred in the last 5 (five) years with any other public sector undertaking, government department or private sector company that could justify its exclusion from its registration on the Tenderer's/Service Provider's/Contractor's database or any tendering process.

7.2 If it is found to be that the Tenderer/Service Provider/Contractor made an incorrect statement on this subject, the Tenderer/Service Provider/Contractor can be rejected from the registration process or removed from the Tenderer/ Service Provider/Contractor database, if already registered, for such reason (refer to the Breach of Law Returnable Form contained in the document.)

8 SANCTIONS FOR VIOLATIONS

8.1 Transnet shall also take all or any one of the following actions, wherever required to:

a) Immediately exclude the Tenderer/Service Provider/Contractor from the tendering process or call off the pre-contract negotiations without giving any compensation the Tenderer/Service Provider/Contractor. However, the proceedings with the other Tenderer/ Service Provider/Contractor may continue;
b) Immediately cancel the contract, if already awarded or signed, without giving any compensation to the Tenderer/Service Provider/Contractor;
c) Recover all sums already paid by Transnet;
d) Encash the advance bank guarantee and performance bond or warranty bond, if furnished by the Tenderer/Service Provider/Contractor, in order to recover the payments, already made by Transnet, along with interest;
e) Cancel all or any other contracts with the Tenderer/Service Provider/Contractor; and

f) Exclude the Tenderer/ Service Provider/Contractor from entering into any Tender with Transnet in future.

9 CONFLICTS OF INTEREST

9.1 A conflict of interest includes, inter alia, a situation in which:

a) A Transnet employee has a personal financial interest in a tendering / supplying entity; and

b) A Transnet employee has private interests or personal considerations or has an affiliation or a relationship which affects, or may affect, or may be perceived to affect his / her judgment in action in the best interest of Transnet, or could affect the employee's motivations for acting in a particular manner, or which could result in, or be perceived as favouritism or nepotism.

9.2 A Transnet employee uses his / her position, or privileges or information obtained while acting in the capacity as an employee for:

a) Private gain or advancement; or

b) The expectation of private gain, or advancement, or any other advantage accruing to the employee must be declared in a prescribed form.

Thus, conflicts of interest of any Tender committee member or any person involved in the sourcing process must be declared in a prescribed form.

9.3 If a Tenderer/Service Provider/Contractor has or becomes aware of a conflict of interest i.e. a family, business and / or social relationship between its owner(s)/ member(s)/director(s)/partner(s)/shareholder(s) and a Transnet employee/ member of Transnet's Board of Directors in respect of a Tender which will be considered for the Tender process, the Tenderer/Service Provider/ Contractor:

a) must disclose the interest and its general nature, in the Request for Proposal ("RFX") declaration form; or

b) must notify Transnet immediately in writing once the circumstances has arisen.

9.4 The Tenderer/Service Provider/Contractor shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any committee member or any person involved in the sourcing process, where this is done, Transnet shall be entitled forthwith to rescind the contract and all other contracts with the Tenderer/Service Provider/Contractor.

10 DISPUTE RESOLUTION

10.1 Transnet recognises that trust and good faith are pivotal to its relationship with its Tenderer / Service Provider / Contractor. When a dispute arises between Transnet and its Tenderer / Service Provider / Contractor, the parties should use their best endeavours to resolve the dispute in an amicable manner, whenever possible. Litigation in bad faith negates the principles of trust and good faith on which commercial relationships are based. Accordingly, following a blacklisting process as mentioned in paragraph 6 above, Transnet will not do business with a company that litigates against it in bad faith or is involved in any action that reflects bad faith on its part. Litigation in bad faith includes, but is not limited to the following instances:

a) **Vexatious proceedings**: these are frivolous proceedings which have been instituted without proper grounds;
b) **Perjury:** where a Tenderer / Service Provider / Contractor make a false statement either in giving evidence or on an affidavit;
c) **Scurrilous allegations:** where a Tenderer / Service Provider / Contractor makes allegations regarding a senior Transnet employee which are without proper foundation, scandalous, abusive or defamatory; and
d) **Abuse of court process:** when a Tenderer / Service Provider / Contractor abuses the court process in order to gain a competitive advantage during a Tender process.

11 GENERAL

11.1 This Integrity Pact is governed by and interpreted in accordance with the laws of the Republic of South Africa.

11.2 The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the law relating to any civil or criminal proceedings.

11.3 The validity of this Integrity Pact shall cover all the tendering processes and will be valid for an indefinite period unless cancelled by either Party.

11.4 Should one or several provisions of this Integrity Pact turn out to be invalid the remainder of this Integrity Pact remains valid.

11.5 Should a Tenderer/Service Provider/Contractor be confronted with dishonest, fraudulent or corruptive behaviour of one or more Transnet employees, Transnet expects its Tenderer/Service Provider/Contractor to report this behaviour directly to a senior Transnet official/employee or alternatively by using Transnet's "Tip-Off Anonymous" hotline number 0800 003 056, whereby your confidentiality is guaranteed.

The Parties hereby declare that each of them has read and understood the clauses of this Integrity Pact and shall abide by it. To the best of the Parties' knowledge and belief, the information provided in this Integrity Pact is true and correct.

I ………………………………………….. duly authorised by the tendering entity, hereby certify that the tendering entity are **fully acquainted** with the contents of the Integrity Pact and further **agree to abide by it** in full.

Signature …………………………………

Date ………………………………………..

T2.2-20 : Supplier Code of Conduct

Transnet SOC Limited aims to achieve the best value for money when buying or selling goods and obtaining services. This however must be done in an open and fair manner that supports and drives a competitive economy. Underpinning our process are several acts and policies that any supplier dealing with Transnet must understand and support. These are:

- The Transnet Procurement Policy – A guide for Tenderers.
- Section 217 of the Constitution - the five pillars of Public PSCM (Procurement and Supply Chain Management): fair, equitable, transparent, competitive and cost effective;
- The Public Finance Management Act (PFMA);
- The Broad Based Black Economic Empowerment Act (BBBEE)
- The Prevention and Combating of Corrupt Activities Act (PRECCA); and
- The Construction Industry Development Board Act (CIDB Act).

This code of conduct has been included in this contract to formally appraise Transnet Suppliers of Transnet's expectations regarding behaviour and conduct of its Suppliers.

Prohibition of Bribes, Kickbacks, Unlawful Payments, and Other Corrupt Practices

Transnet is in the process of transforming itself into a self-sustaining State Owned Enterprise, actively competing in the logistics industry. Our aim is to become a world class, profitable, logistics organisation. As such, our transformation is focused on adopting a performance culture and to adopt behaviours that will enable this transformation.

1. Transnet SOC Limited will not participate in corrupt practices. Therefore, it expects its suppliers to act in a similar manner.

- Transnet and its employees will follow the laws of this country and keep accurate business records that reflect actual transactions with, and payments to, our suppliers.
- Employees must not accept or request money or anything of value, directly or indirectly, from suppliers.
- Employees may not receive anything that is calculated to:
  - Illegally influence their judgement or conduct or to ensure the desired outcome of a sourcing activity;

  - Win or retain business or to influence any act or decision of any person involved in sourcing decisions; or
  - Gain an improper advantage.

- There may be times when a supplier is confronted with fraudulent or corrupt behaviour of Transnet employees. We expect our Suppliers to use our "Tip-offs Anonymous" Hot line to report these acts. (0800 003 056).

2. *Transnet SOC Limited is firmly committed to the ideas of free and competitive enterprise.*

- Suppliers are expected to comply with all applicable laws and regulations regarding fair competition and antitrust practices.
- Transnet does not engage with non-value adding agents or representatives solely for the purpose of increasing BBBEE spend (fronting).

3. Transnet's relationship with suppliers requires us to clearly define requirements, to exchange information and share mutual benefits.

- Generally, suppliers have their own business standards and regulations. Although Transnet cannot control the actions of our suppliers, we will not tolerate any illegal activities. These include, but are not limited to:
  - Misrepresentation of their product (origin of manufacture, specifications, intellectual property rights, etc);
  - Collusion;
  - Failure to disclose accurate information required during the sourcing activity (ownership, financial situation, BBBEE status, etc.);
  - Corrupt activities listed above; and
  - Harassment, intimidation or other aggressive actions towards Transnet employees.
- Suppliers must be evaluated and approved before any materials, components, products or services are purchased from them. Rigorous due diligence is conducted and the supplier is expected to participate in an honest and straight forward manner.
- Suppliers must record and report facts accurately, honestly and objectively. Financial records must be accurate in all material respects.

Conflicts of Interest

A conflict of interest arises when personal interests or activities influence (or appear to influence) the ability to act in the best interests of Transnet SOC Limited.

- Doing business with family members.
- Having a financial interest in another company in our industry

Where possible, contracts will be negotiated to include the above in the terms of such contracts. To the extent such terms are not included in contractual obligations and any of the above code is breached, then Transnet reserves its right to review doing business with these suppliers.

I, ______________________________ of ______________________________

(insert name of Director or as per Authority Resolution from Board of Directors) *(insert name of Company)*

hereby acknowledge having read, understood and agree to the terms and conditions set out in the "Transnet Supplier Code of Conduct."

Signed this on day __________________________ at ______________________________

____

Signature

T2.2-21: Insurance provided by the *Contractor*

Clause 84.1 in NEC3 Engineering & Construction Contract (June 2005)(amended June 2006 and April 2013) requires that the *Contractor* provides the insurance stated in the insurance table except any insurance which the *Employer* is to provide as stated in the Contract Data.

Please provide the following details for insurance which the *Contractor* is still to provide. Notwithstanding this information all costs related to insurance are deemed included in the tenderer's rates and prices.

Insurance against **(See clause 84.2 of the ECC)**	**Name of Insurance Company**	**Cover**	**Premium**
Liability for death of or bodily injury to employees of the *Contractor* arising out of and in the course of their employment in connection with this contract			
Motor Vehicle Liability Insurance comprising (as a minimum) "Balance of Third Party" Risks including Passenger and Unauthorised Passenger Liability indemnity with a minimum indemnity limit of R5 000 000.			
Insurance in respect of loss of or damage to own property and equipment.			
(Other)			

T2.2-22: Form of Intent to Provide a Defects Correction Guarantee

It is hereby agreed by the Tenderer that a Defects Correction Guarantee drafted **exactly** as provided in the tender documents will be provided by the Guarantor named below, which is a **bank or insurer registered in South Africa**:

Name of Guarantor (Bank/Insurer) ....

Address ....

The Defects Correction Guarantee shall be provided within **2** (**Two**) weeks after the Contract Date defined in the contract unless otherwise agreed to by the parties.

Signed ....

Name ....

Capacity ....

On behalf of (name of tenderer) ....

....

Date ....

Confirmed by Guarantor's Authorised Representative

Signature(s) ....

Name (print) ....

Capacity ....

On behalf of Guarantor (Bank/insurer) ....

Date ....

T2.2-23: Forecast Rate of Invoicing

Tenderer to submit the forecast rate of invoicing (cash-flow) based on the Tender Price and Tender Programme.

Index of documentation attached to this schedule:

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………

T2.2-24: Three (3) years audited financial statements

Attached to this schedule is the last three (3) years audited financial statements of the single tenderer/members of the Joint Venture.

NAME OF COMPANY/IES and INDEX OF ATTACHMENTS:

……
……
……
………

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T2.2-25 Agreement in terms of Protection of Personal Information Act, 4 of 2013 ("POPIA")

1. PREAMBLE AND INTRODUCTION

1.1. The rights and obligation of the Parties in terms of the Protection of Personal Information Act, 4 of 2013 ("POPIA") are included as forming part of the terms and conditions of this contract.

2. PROTECTION OF PERSONAL INFORMATION

2.1. The following terms shall bear the same meaning as contemplated in Section 1 of the Protection of Person information act, No. of 2013 "(POPIA"):

consent; data subject; electronic communication; information officer; operator; person; personal information; processing; record; Regulator; responsible party; special information; as well as any terms derived from these terms.

2.2. The Operator will process all information by the Transnet in terms of the requirements contemplated in Section 4(1) of the POPIA:

Accountability; Processing limitation; Purpose specification; Further processing limitation; Information quality; Openness; Security safeguards and Data subject participation.

2.3. The Parties acknowledge and agree that, in relation to personal information of Transnet and the information of a third party that will be processed pursuant to this Agreement , the Operator is (……………………………………………………………………) hereinafter Operator and the Data subject is "Transnet". Operator will process personal information only with the knowledge and authorisation of Transnet and will treat personal information and the information of a third party which comes to its knowledge as confidential and will not disclose it, unless so required by law or subject to the exceptions contained in the POPIA.

2.4. Transnet reserves all the rights afforded to it by the POPIA in the processing of any of its information as contained in this Agreement and the Operator is required to comply with all prescripts as detailed in the POPIA relating to all information concerning Transnet.

2.5. In terms of this Agreement, the Operator acknowledges that it will obtain and have access to personal information of Transnet and the information of a third party and agrees that it shall only process the information disclosed by Transnet in terms of this Agreement and only for the purposes as detailed in this Agreement and in accordance with any applicable law.

2.6. Should there be a need for the Operator to process the personal information and the information of a third party in a way that is not agreed to in this Agreement, the Operator must request consent from Transnet to the processing of its personal information or and the information of a third party in a manner other than that it was collected for, which consent cannot be unreasonably withheld.

2.7. Furthermore, the Operator will not otherwise modify, amend or alter any personal information and the information of a third party submitted by Transnet or disclose or permit the disclosure of any personal information and the information of a third party to any third party without prior written consent from Transnet.

2.8. The Operator shall, at all times, ensure compliance with any applicable laws put in place and maintain sufficient measures, policies and systems to manage and secure against all forms of risks to any information that may be shared or accessed pursuant to the services offered to Transnet in terms of this Agreement (physically, through a computer or any other form of electronic communication).

2.9. The Operator shall notify Transnet in writing of any unauthorised access to personal information and the information of a third party , cybercrimes or suspected cybercrimes, in its knowledge and report such crimes or suspected crimes to the relevant authorities in accordance with applicable laws, after becoming aware of such crimes or suspected crime. The Operator must inform Transnet of the breach as soon as it has occurred to allow Transnet to take all necessary remedial steps to mitigate the extent of the loss or compromise of personal information and the information of a third party and to restore the integrity of the affected personal information as quickly as is possible.

2.10. Transnet may, in writing, request the Operator to confirm and/or make available any personal information and the information of a third party in its possession in relation to Transnet and if such personal information has been accessed by third parties and the identity thereof in terms of the POPIA.

2.11. Transnet may further request that the Operator correct, delete, destroy, withdraw consent or object to the processing of any personal information and the information of a third party relating to the Transnet or a third party in the Operator's s possession in terms of the provision of the POPIA and utilizing Form 2 of the POPIA Regulations .

2.12. In signing this addendum that is in terms of the POPIA, the Operator hereby agrees that it has adequate measures in place to provide protection of the personal information and the information of a third party given to it by Transnet in line with the 8 conditions of the POPIA and that it will provide to Transnet satisfactory evidence of these measures whenever called upon to do so by Transnet.

The Operator is required to provide confirmation that all measures in terms of the POPIA are in place when processing personal information and the information of a third party received from Transnet:

YES			**NO**	

2.13. Further, the Operator acknowledges that it will be held liable by Transnet should it fail to process personal information in line with the requirements of the POPIA. The Operator will be subject to any civil or criminal action, administrative fines or other penalty or loss that may arise as a result of the processing of any personal information that Transnet submitted to it.

2.14. Should a Tenderer have any complaints or objections to processing of its personal information, by Transnet, the Tenderer can submit a complaint to the Information Regulator on https://www.justice.gov.za/inforeg/, click on contact us, click on complaints.IR@justice.gov.za

3. SOLE AGREEMENT

3.1. The Agreement, constitute the sole agreement between the parties relating to the subject matter referred to in paragraph 1.1 of this and no amendment/variation/change shall be of any force and effect unless reduced to writing and signed by or on behalf of both parties.

Signed at ______________________ on this ______day of _______________________ 2021

Name: ___________________________

Title: ___________________________

Signature: ________________________

.... (Pty) Ltd

(Operator)

Authorised signatory for and on behalf of .... (Pty) Ltd who warrants that he/she is duly authorised to sign this Agreement.

AS WITNESSES:

1. Name: __________________________ Signature: _________________________

2. Name: __________________________ Signature: _________________________

T2.2-26 VENDOR REGISTRATION FORM

Transnet Vendor Management has received a request to load / change your company details onto the Transnet vendor master database. Please return the completed Supplier Declaration Form (SDF) together with the required supporting documents as per Appendix A to the Transnet Official who is intending to procure your company's services / products, to enable us to process this request. Please only submit the documentation relevant to your request.

Please Note: all organisations, institutions and individuals who wish to provide goods and/or services to organs of the State must be registered on the National Treasury's Central Supplier Database (CSD). This needs to be done via their portal at https://secure.csd.gov.za/ **before applying to Transnet**.

General Terms and Conditions:

Please Note: Failure to submit the relevant documentation will delay the vendor creation / change process.

Where applicable, the respective Transnet Operating Division processing your application may request further or additional information from your company.

The Service Provider warrants that the details of its bank account ("the nominated account") provided herein, are correct and acknowledges that payments due to the Supplier will be made into the nominated account. If details of the nominated account should change, the Service Provider must notify Transnet in writing of such change, failing which any payments made by Transnet into the nominated account will constitute a full discharge of the indebtedness of Transnet to the Supplier in respect of the payment so made. Transnet will incur no liability for any payments made to the incorrect account or any costs associated therewith. In such an event, the Service Provider indemnifies and holds Transnet harmless in respect of any payments made to an incorrect bank account and will, on demand, pay Transnet any costs associated herewith.

Transnet expects its suppliers to timeously renew their Tax Clearance and B-BBEE certificates (Large Enterprises and QSEs less than 51% black owned) as well as sworn affidavits in the case of EMEs and QSEs with more than 51% black ownership as per Appendices C and D.

In addition, please note of the following very important information:

1. **If your annual turnover is R10 million or less,** then in terms of the DTI Generic Codes of Good Practice, you are classified as an Exempted Micro Enterprise (EME). If your company is classified as an EME, please include in your submission a sworn affidavit confirming your company's most recent annual turnover is less than R10 million and percentage of black ownership and black female ownership in the company (Appendix C) OR B-BBEE certificate issued by a verification agency accredited by SANAS in terms of the EME scorecard should you feel you will be able to attain a better B-BBEE score. It is only in this context that an EME may submit a B-BBEE verification certificate.

2. **If your annual turnover is between R10 million and R50 million,** then in terms of the DTI codes, you are classified as a Qualifying Small Enterprise (QSE). A QSE which is at least 51% black owned, is required to submit a sworn affidavit confirming their annual total revenue of between R10 million and R50 million and level of black ownership (Appendix D). QSE 'that does not qualify for 51% of black ownership, are required to submit a B-BBEE verification certificate issued by a verification agency accredited by SANAS their QSEs are required to submit a B-BBEE verification certificate issued by a verification agency accredited by SANAS.

Please Note: B-BBEE certificate and detailed scorecard should be obtained from an accredited rating agency (e.g. SANAS Member).

3. **If your annual turnover exceeds R50 million,** then in terms of the DTI codes, you are classified as a Large Enterprise. Large Enterprises are required to submit a B-BBEE level verification certificate issued by a verification agency accredited by SANAS.

Please Note: B-BBEE certificate and detailed scorecard should be obtained from an accredited rating agency (e.g. SANAS Member).

4. **The supplier to furnish proof to the procurement department as required in the Fourth Schedule of the Income Tax Act. 58 of 1962** whether a supplier of service is to be classified as an "employee", "personal service provider" or "labour broker". Failure to do so will result in the supplier being subject to employee's tax.

5. **No payments can be made to a vendor until the** vendor has been registered / updated, and no vendor can be registered / updated until the vendor application form, together with its supporting documentation, has been received and processed**.** No payments can be made to a vendor until the vendor has met / comply with the procurement requirements.

6. It is in line with PPPFA Regulations, only valid B-BBBEE status level certificate issued by an unauthorised body or person OR a sworn affidavit as prescribed by the B-BBEE Codes of Good Practice, OR any other requirement prescribed in terms of the Broad- Based Black Economic Empowerment Act.

7. As per the communique dated 04 March 2016 addressed to the **Members of the IRBA**, as of **30 September 2016**, the IRBA will no longer be the 'Approved Regulatory Body' as per Code Series 000, Statement 005 of the Codes of Good Practice. Any entity that seeks to apply for B-BBEE Accreditation to issue B-BBEE Verification Certificates post 30 September 2016 or wishes to participate in the B-BBEE Verification Industry must thus follow the Code Series 000, Statement 005, Section 5 of the Codes of Good Practice application process to the Accreditation Body (SANAS).'

APPENDIX A

Supplier Declaration Form

Important Notice: all organisations, institutions and individuals who wish to provide goods and/or services to organs of the State must be registered on the National Treasury Central Supplier Database (CSD). This needs to be done via their portal at https://secure.csd.gov.za/ **before applying to Transnet**.

CSD Number (MAAA xxxxxxx):	

Company Trading Name						
Company Registered Name						
Company Registration No Or ID No If a Sole Proprietor						
Company Income Tax Number						
Form of Entity	CC	Trust	Pty Ltd	Limited	Partnership	Sole Proprietor
	Non-profit (NPO's or NPC)	Personal Liability Co	State Owned Co	National Govt	Provincial Govt	Local Govt
	Educational Institution	Specialised Profession	Financial Institution	Joint Venture	Foreign International	Foreign Branch Office

Did your company previously operate under another name?	Yes		No	
If **YES** state the previous details below:				

Trading Name						
Registered Name						
Company Registration No Or ID No If a Sole Proprietor						
Form of Entity	CC	Trust	Pty Ltd	Limited	Partnership	Sole Proprietor
	Non-profit (NPO's or NPC)	Personal Liability Co	State Owned Co	National Govt	Provincial Govt	Local Govt
	Educational Institution	Specialised Profession	Financial Institution	Joint Venture	Foreign International	Foreign Branch Office

Your Current Company's VAT Registration Status	
VAT Registration Number	
If **Exempted from VAT registration,** state reason and submit proof from SARS in confirming the exemption status	
If your business entity is not VAT Registered, please submit a current original sworn affidavit (see example in Appendix I). Your Non VAT Registration must be confirmed annually.	

Company Banking Details		Bank Name	
Universal Branch Code		Bank Account Number	

Company Physical Address			
		Code	
Company Postal Address			
		Code	
Company Telephone number			
Company Fax Number			
Company E-Mail Address			
Company Website Address			

Company Contact Person Name	
Designation	
Telephone	
Email	

Is your company a Labour Broker?	Yes		No	
Main Product / Service Supplied e.g. Stationery / Consulting / Labour etc.				
How many personnel does the business employ?	Full Time		Part Time	
Please Note: Should your business employ more than 2 full time employees who are not connected persons as defined in the Income Tax Act, please submit a sworn affidavit, as per Appendix II.				

Most recent Financial Year's Annual Turnover	<R10Million		>R10Million <R50Million		>R50Million	

Does your company have a valid B-BBEE certificate?	Yes		No					

Please indicate your Broad Based BEE status (Level 1 to 9)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Majority Race of Ownership									

% Black Ownership		% Black Women Ownership		% Black Disabled person(s) Ownership		% Black Youth Ownership	
% White Ownership		% Indian Ownership		% Coloured Ownership			

Please Note: Please provide proof of B-BBEE status as per Appendix C. If you qualify as an EME or QSE then provide an affidavit following the templates provided in **Appendix C and D** respectively. If you have indicated Black Disabled person(s) ownership, then provide a **certified** letter signed by a physician, on the physician's letterhead, confirming the disability. A certified South African Identification Document will be required for all Black Youth Ownership.

Supplier Development Information Required	
EMPOWERING SUPPLIER	YES ○ NO ○
FIRST TIME SUPPLIER	YES ○ NO ○
SUPPLIER DEVELOPMENT PLAN	YES ○ NO ○
DEVELOPMENT PLAN DOCUMENT	* If Yes- Attach supporting documents
ENTERPRISE DEVELOPMENT BENEFICIARY	YES ○ NO ○
SUPPLIER DEVELOPMENT BENEFICIARY	YES ○ NO ○
GRADUATION FROM ED TO SD BENEFICIARY	YES ○ NO ○
ENTERPRISE DEVELOPMENT RECIPIENT	YES ○ NO ○

By signing below, I hereby verify that I am duly authorised to sign for and on behalf of firm / organisation and that all information contained herein and attached herewith are true and correct

Name and Surname		Designation	
Signature		Date	

APPENDIX B

Affidavit or Solemn Declaration as to VAT registration status

Affidavit or Solemn Declaration

I, ____ solemnly swear/declare that ____ is not a registered VAT vendor and is not required to register as a VAT vendor because the combined value of taxable supplies made by the provider in any 12 month period has not exceeded or is not expected to exceed R1million threshold, as required in terms of the Value Added Tax Act.

Signature: --

Designation: --

Date: --

Commissioner of Oaths

Thus signed and sworn to before me at ______________________ on this the ________

day of ____________________ 20__________,

the Deponent having knowledge that he/she knows and understands the contents of this Affidavit, and that he/she has no objection to taking the prescribed oath, which he/she regards binding on his/her conscience and that the allegations herein contained are all true and correct.

____
Commissioner of Oaths

APPENDIX C

SWORN AFFIDAVIT – B-BBEE EXEMPTED MICRO ENTERPRISE

I, the undersigned, ____

Full name & Surname	
Identity number	

Hereby declare under oath as follows:

1. The contents of this statement are to the best of my knowledge a true reflection of the facts.
2. I am a Member / Director / Owner of the following enterprise and am duly authorised to act on its behalf:

Enterprise Name:	
Trading Name (If Applicable):	
Registration Number:	
Enterprise Physical Address:	
Type of Entity (CC, (Pty) Ltd, Sole Prop etc.):	
Nature of Business:	
Definition of "Black People"	As per the Broad-Based Black Economic Empowerment Act 53 of 2003 as Amended by Act No 46 of 2013 "Black People" is a generic term which means Africans, Coloureds and Indians – (a) who are citizens of the Republic of South Africa by birth or descent; or (b) who became citizens of the Republic of South Africa by naturalisations - i. before 27 April 1994; or ii. on or after 27 April 1994 and who would have been entitled to acquire citizenship by naturalization prior to that date;"
Definition of "Black Designated Groups"	"Black Designated Groups means: a) unemployed black people not attending and not required by law to attend an educational institution and not awaiting admission to an educational institution; b) Black people who are youth as defined in the National Youth Commission Act of 1996;

	c) Black people who are persons with disabilities as defined in the Code of Good Practice on employment of people with disabilities issued under the Employment Equity Act; d) Black people living in rural and under developed areas; e) Black military veterans who qualifies to be called a military veteran in terms of the Military Veterans Act 18 of 2011;"

3. I hereby declare under Oath that:

- The Enterprise is _______________% Black Owned as per Amended Code Series 100 of the Amended Codes of Good Practice issued under section 9 (1) of B-BBEE Act No 53 of 2003 as Amended by Act No 46 of 2013,
- The Enterprise is _______________% Black Female Owned as per Amended Code Series 100 of the Amended Codes of Good Practice issued under section 9 (1) of B-BBEE Act No 53 of 2003 as Amended by Act No 46 of 2013,
- The Enterprise is _______________% Black Designated Group Owned as per Amended Code Series 100 of the Amended Codes of Good Practice issued under section 9 (1) of B-BBEE Act No 53 of 2003 as Amended by Act No 46 of 2013,
- Black Designated Group Owned % Breakdown as per the definition stated above:
  - Black Youth % = _______________%
  - Black Disabled % =_______________%
  - Black Unemployed % =_______________%
  - Black People living in Rural areas % = _______________%
  - Black Military Veterans % =_______________%
- Based on the Financial Statements/Management Accounts and other information available on the latest financial year-end of ______________, the annual Total Revenue was R10,000,000.00 (Ten Million Rands) or less
- Please Confirm on the below table the B-BBEE Level Contributor, **by ticking the applicable box.**

100% Black Owned	**Level One** (135% B-BBEE procurement recognition level)	
At least 51% Black Owned	**Level Two** (125% B-BBEE procurement recognition level)	
Less than 51% Black Owned	**Level Four** (100% B-BBEE procurement recognition level)	

4. I know and understand the contents of this affidavit and I have no objection to take the prescribed oath and consider the oath binding on my conscience and on the Owners of the Enterprise which I represent in this matter.
5. The sworn affidavit will be valid for a period of 12 months from the date signed by commissioner.

Deponent Signature ....

Date ....

____
Commissioner of Oaths
Signature & stamp

APPENDIX D

SWORN AFFIDAVIT – QUALIFYING SMALL ENTERPRISE – GENERAL

I, the undersigned, ____

Full name & Surname	
Identity number	

Hereby declare under oath as follows:

1. The contents of this statement are to the best of my knowledge a true reflection of the facts.
2. I am a Member / Director / Owner of the following enterprise and am duly authorised to act on its behalf:

Enterprise Name:	
Trading Name (If Applicable):	
Registration Number:	
Enterprise Physical Address:	
Type of Entity (CC, (Pty) Ltd, Sole Prop etc.):	
Nature of Business:	
Definition of "Black People"	As per the Broad-Based Black Economic Empowerment Act 53 of 2003 as Amended by Act No 46 of 2013 "Black People" is a generic term which means Africans, Coloureds and Indians – a) who are citizens of the Republic of South Africa by birth or descent; or b) who became citizens of the Republic of South Africa by naturalisation. i. before 27 April 1994; or ii. on or after 27 April 1994 and who would have been entitled to acquire citizenship by naturalization prior to that date;"
Definition of "Black Designated Groups"	"Black Designated Groups means: a) unemployed black people not attending and not required by law to attend an educational institution and not awaiting admission to an educational institution; b) Black people who are youth as defined in the National Youth Commission Act of 1996; c) Black people who are persons with disabilities as defined in the Code of Good Practice on employment of people with disabilities issued under the Employment Equity Act; d) Black people living in rural and under developed areas; e) (e) Black military veterans who qualifies to be called a military f) veteran in terms of the Military Veterans Act 18 of 2011;"

3. I hereby declare under Oath that:

- The Enterprise is _______________% Black Owned as per Amended Code Series 100 of the Amended Codes of Good Practice issued under section 9 (1) of B-BBEE Act No 53 of 2003 as Amended by Act No 46 of 2013,
- The Enterprise is _______________% Black Female Owned as per Amended Code Series 100 of the Amended Codes of Good Practice issued under section 9 (1) of B-BBEE Act No 53 of 2003 as Amended by Act No 46 of 2013,
- The Enterprise is _______________% Black Designated Group Owned as per Amended Code Series 100 of the Amended Codes of Good Practice issued under section 9 (1) of B-BBEE Act No 53 of 2003 as Amended by Act No 46 of 2013,
- Black Designated Group Owned % Breakdown as per the definition stated above:

    - Black Youth % = _______________%
    - Black Disabled % =_______________%
    - Black Unemployed % =_______________%
    - Black People living in Rural areas % = _______________%
    - Black Military Veterans % =_______________%

- Based on the Financial Statements/Management Accounts and other information available on the latest financial year-end of __________________, the annual Total Revenue was between R10,000,000.00 (Ten Million Rands) and R50,000,000.00 (Fifty Million Rands),

- Please confirm on the table below the B-BBEE level contributor, **by ticking the applicable box.**

100% Black Owned	**Level One** (135% B-BBEE procurement recognition level)	
At Least 51% black owned	**Level Two** (125% B-BBEE procurement recognition level)	

4. I know and understand the contents of this affidavit and I have no objection to take the prescribed oath and consider the oath binding on my conscience and on the owners of the enterprise which I represent in this matter.
5. The sworn affidavit will be valid for a period of 12 months from the date signed by commissioner.

Deponent Signature ....

Date ....

____
Commissioner of Oaths
Signature & stamp

VENDOR REGISTRATION DOCUMENTS CHECKLIST

Please note that you will have to provide the first two documents on the list and the rest will be provided by the supplier:

	Yes	No
1. Complete the "Supplier Declaration Form" (SDF) (commissioned). See attachment.		
2. Complete the "Supplier Code of Conduct" (SCC). See attachment.		
3. Copy of cancelled cheque OR letter from the bank verifying banking details (with **bank stamp not older than 3 Months & sign by Bank Teller**).		
4. Certified (**Not Older than 3 Months**) copy of Identity document of Shareholders/Directors/Members (where applicable).		
5. Certified copy of certificate of incorporation, CM29 / CM9 (name change).		
6. Certified copy of share Certificates of Shareholders, CK1 / CK2 (if CC).		
7. A letter with the company's letterhead confirming both **Physical** and **Postal** address.		
8. Original or certified copy of SARS Tax Clearance certificate and Vat registration certificate.		
9. BBBEE certificate and detailed scorecard from a **SANAS** Accredited Verification Agency and/or Sworn Certified Affidavit.		
10. Central Supplier Database (CSD) Summary Registration Report.		

C1.1: Form of Offer & Acceptance

Offer

The Employer, identified in the Acceptance signature block, has solicited offers to enter into a contract for the procurement of:

Title of the Contract

The tenderer, identified in the Offer signature block, has

either	examined the documents listed in the Tender Data and addenda thereto as listed in the Returnable Schedules, and by submitting this Offer has accepted the Conditions of Tender.
or	examined the draft contract as listed in the Acceptance section and agreed to provide this Offer.

By the representative of the tenderer, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance the tenderer offers to perform all of the obligations and liabilities of the *Contractor* under the contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the *conditions of contract* identified in the Contract Data.

The offered total of the Prices exclusive of VAT is	**R**
Value Added Tax @ 15% is	**R**
The offered total of the Prices inclusive of VAT is	**R**
(in words)	

This Offer may be accepted by the Employer by signing the Acceptance part of this Form of Offer and Acceptance and returning one copy of this document including the Schedule of Deviations (if any) to the tenderer before the end of the period of validity stated in the Tender Data, or other period as agreed, whereupon the tenderer becomes the party named as the *Contractor* in the *conditions of contract* identified in the Contract Data.

Signature(s)

Name(s)

Capacity

For the tenderer:

(Insert name and address of organisation)

Name & signature of witness

Date

Tenderer's CIDB registration number:

Acceptance

By signing this part of this Form of Offer and Acceptance, the *Employer* identified below accepts the tenderer's Offer. In consideration thereof, the *Employer* shall pay the *Contractor* the amount due in accordance with the *conditions of contract* identified in the Contract Data. Acceptance of the tenderer's Offer shall form an agreement between the *Employer* and the tenderer upon the terms and conditions contained in this agreement and in the contract that is the subject of this agreement.

The terms of the contract, are contained in:

Part C1	Agreements and Contract Data, (which includes this Form of Offer and Acceptance)
Part C2	Pricing Data
Part C3	Scope of Work: Works Information
Part C4	Site Information

and drawings and documents (or parts thereof), which may be incorporated by reference into the above listed Parts.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Returnable Schedules as well as any changes to the terms of the Offer agreed by the tenderer and the Employer during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and forming part of this Form of Offer and Acceptance. No amendments to or deviations from said documents are valid unless contained in this Schedule.

The tenderer shall within two weeks of receiving a completed copy of this agreement, including the Schedule of Deviations (if any), contact the Employer's agent (whose details are given in the Contract Data) to arrange the delivery of any securities, bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the *conditions of contract* identified in the Contract Data at, or just after, the date this agreement comes into effect. Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this agreement.

Notwithstanding anything contained herein, this agreement comes into effect on the date when the tenderer receives one fully completed original copy of this document, including the Schedule of Deviations (if any).

Unless the tenderer (now *Contractor*) within five working days of the date of such receipt notifies the Employer in writing of any reason why he cannot accept the contents of this agreement, this agreement shall constitute a binding contract between the Parties.

Signature(s)			
Name(s)			
Capacity			
for the Employer	Transnet SOC Ltd *(Insert name and address of organisation)*		
Name & signature of witness		Date	

Schedule of Deviations

Note:

1. To be completed by the Employer prior to award of contract. This part of the Offer & Acceptance would not be required if the contract has been developed by negotiation between the Parties and is not the result of a process of competitive tendering.
2. The extent of deviations from the tender documents issued by the Employer prior to the tender closing date is limited to those permitted in terms of the Conditions of Tender.
3. A tenderer's covering letter must not be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid be the subject of agreement reached during the process of Offer and Acceptance, the outcome of such agreement shall be recorded here and the final draft of the contract documents shall be revised to incorporate the effect of it.

No.	Subject	Details
1		
2		
3		

By the duly authorised representatives signing this Schedule of Deviations below, the Employer and the tenderer agree to and accept this Schedule of Deviations as the only deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules, as well as any confirmation, clarification or changes to the terms of the Offer agreed by the tenderer and the Employer during this process of Offer and Acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the tenderer of a completed signed copy of this Form shall have any meaning or effect in the contract between the parties arising from this Agreement.

	For the tenderer:	**For the Employer**
Signature		
Name		
Capacity		
On behalf of	*(Insert name and address of organisation)*	Transnet SOC Ltd
Name & signature of witness		
Date		

C1.2 Contract Data

Part one - Data provided by the *Employer*

Clause	Statement	Data	
1	**General**		
	The *conditions of contract* are the core clauses and the clauses for main Option		
		A:	**Priced contract with activity schedule**
	dispute resolution Option	**W1:**	**Dispute resolution procedure**
	and secondary Options		
		X2	**Changes in the law**
		X7:	**Delay damages**
		X13:	**Defects Correction Bond**
		X18:	**Limitation of liability**
		Z:	***Additional conditions of contract***
	of the NEC3 Engineering and Construction Contract June 2005 (amended June 2006 and April 2013)		
10.1	The *Employer* is:	**Transnet SOC Ltd** **(Registration No. 1990/000900/30)**	

	Address	Registered address: **Transnet Corporate Centre** **138 Eloff Street** **Braamfontein** **Johannesburg** **2000**
	Having elected its Contractual Address for the purposes of this contract as:	**Transnet Port Terminals** *Address of the applicable office* **Transnet Port Terminals (HQ)** **202 Anton Lembede Street** **Durban** **4000**
10.1	The *Project Manager* is: (Name)	**TBC (To Be Communicated)**
	Address	**TBC**
	Tel	**TBC**
	e-mail	**TBC**
10.1	The *Supervisor* is: (Name)	**TBC**
	Address	**TBC**
	Tel No.	**TBC**
	e-mail	**TBC**
11.2(13)	The *works* are	**Complete Engineering, Installation and Commissioning of Tippler, Tain Positioner, Feeders, Dust Handling plant at Port of Saldanha Bay, for Transnet SOC Ltd (Reg. No. 1990/000900/30) Operating as Transnet Port Terminals, (Hereinafter Referred to as "TPT").**
11.2(14)	The following matters will be included in the Risk Register	**No further information**
11.2(15)	The *boundaries of the site* are	**As stated in Part C3."Description of the Site and it surroundings"**
11.2(16)	The Site Information is in	**Part C3**
11.2(19)	The Works Information is in	**Part C3**

12.2	The *law of the contract* is the law of	**the Republic of South Africa subject to the jurisdiction of the Courts of South Africa.**
13.1	The *language of this contract* is	**English**
13.3	The *period for reply* is	**2 weeks**
2	**The *Contractor's* main responsibilities**	**No additional data is required for this section of the *conditions of contract*.**
3	**Time**	
11.2(3)	The *completion date* for the whole of the *works* is	**TBC**
11.2(9)	The *key dates* and the *conditions* to be met are:	***Condition* to be met** — ***key date*** **As per SoW deliverables** — **TBC**
30.1	The *access dates* are	**Part of the Site** — **Date** **As per C4 Site information** — **TBC**
31.1	The *Contractor* is to submit a first programme for acceptance within	**2 weeks of the Contract Date.**
31.2	The *starting date* is	**TBC**
32.2	The *Contractor* submits revised programmes at intervals no longer than	**2 weeks.**
35.1	The *Employer* is not willing to take over the *works* before the Completion Date.	
4	**Testing and Defects**	
42.2	The *defects date* is	**52 (fifty-two) weeks after Completion of the whole of the *works*.**
43.2	The *defect correction period* is	**2 weeks**
5	**Payment**	
50.1	The *assessment interval* is monthly on the	**25th (twenty fifth) day of each successive month.**

51.1	The *currency of this contract* is the	**South African Rand.**
51.2	The period within which payments are made is	**Payment will be effected on or before the last day of the month following the month during which a valid Tax Invoice and Statement were received.**
51.4	The *interest rate* is	**the prime lending rate of Standard Bank of South Africa.**
6	**Compensation events**	
60.1(13)	The *weather measurements* to be recorded for each calendar month are,	**the cumulative rainfall (mm)**
		the number of days with rainfall more than 10 mm
		the number of days with minimum air temperature less than 0 degrees Celsius
		the number of days with snow lying at 08:00 hours South African Time
		and these measurements: 10mm
	The place where weather is to be recorded (on the Site) is:	**Saldanha Iron Ore Terminal**
	The *weather data* are the records of past *weather measurements* for each calendar month which were recorded at:	**Saldanha Iron Ore Terminal**
	and which are available from:	**South African Weather Service 012 367 6023 or info3@weathersa.co.za.**
7	**Title**	**No additional data is required for this section of the *conditions of contract*.**
8	**Risks and insurance**	
80.1	These are additional *Employer*'s risks	**No further information**

84.1	The *Employer* provides these insurances from the Insurance Table		
	1	Insurance against:	**Loss of or damage to the *works*, Plant and Materials is as stated in the Insurance policy for Contract Works/ Public Liability.**
		Cover / indemnity:	**to the extent as stated in the insurance policy for Contract Works / Public Liability**
		The deductibles are:	**as stated in the insurance policy for Contract Works / Public Liability**
	2	Insurance against:	**Loss of or damage to property (except the *works*, Plant and Materials & Equipment) and liability for bodily injury to or death of a person (not an employee of the *Contractor)* arising out of or in connection with the performance of the Contract as stated in the insurance policy for Contract Works / Public Liability**
		Cover / indemnity	**Is to the extent as stated in the insurance policy for Contract Works / Public Liability**
		The deductibles are	**as stated in the insurance policy for Contract Works / Public Liability**
	3	Insurance against:	**Loss of or damage to Equipment (Temporary Works only) as stated in the insurance policy for contract Works and Public Liability**
		Cover / indemnity	**Is to the extent as stated in the insurance policy for Contract Works / Public Liability**
		The deductibles are:	**As stated in the insurance policy for Contract Works / Public Liability**
	4	Insurance against:	**Contract Works SASRIA insurance subject to the terms, exceptions and conditions of the SASRIA coupon**
		Cover / indemnity	**Cover / indemnity is to the extent provided by the SASRIA coupon**

	The deductibles are	**The deductibles are, in respect of each and every theft claim, 0,1% of the contract value subject to a minimum of R2,500 and a maximum of R25,000.**
	Note:	**The deductibles for the insurance as stated above are listed in the document titled "Certificate of Insurance: Transnet (SOC) Limited Principal Controlled Insurance."**
84.1	The minimum limit of indemnity for insurance in respect of death of or bodily injury to employees of the *Contractor* arising out of and in the course of their employment in connection with this contract for any one event is	**The *Contractor* must comply at a minimum with the provisions of the Compensation for Occupational Injuries and Diseases Act No. 130 of 1993 as amended.**
	The *Contractor* provides these additional Insurances	**1 Where the contract requires that the design of any part of the *works* shall be provided by the *Contractor* the *Contractor* shall satisfy the *Employer* that professional indemnity insurance cover in connection therewith has been affected** **2 Where the contract involves manufacture, and/or fabrication of Plant & Materials, components or other goods to be incorporated into the *works* at premises other than the site, the *Contractor* shall satisfy the *Employer* that such plant & materials, components or other goods for incorporation in the *works* are adequately insured during manufacture and/or fabrication and transportation to the site.** **3 Should the *Employer* have an insurable interest in such items during manufacture, and/or fabrication, such interest shall be noted by endorsement to the *Contractor's* policies of insurance as well as those of any sub-contractor**

		4 Motor Vehicle Liability Insurance comprising (as a minimum) "Balance of Third Party" Risks including Passenger and Unauthorised Passenger Liability indemnity with a minimum indemnity limit of R 5 000 000. **5 The insurance coverage referred to in 1, 2, 3 and 4 above shall be obtained from an insurer(s) in terms of an insurance policy approved by the *Employer*. The *Contractor* shall arrange with the insurer to submit to the *Project Manager* the original and the duplicate original of the policy or policies of insurance and the receipts for payment of current premiums, together with a certificate from the insurer or insurance broker concerned, confirming that the policy or policies provide the full coverage as required. The original policy will be returned to the *Contractor.***
84.2	The minimum limit of indemnity for insurance in respect of loss of or damage to property (except the works, Plant, Materials and Equipment) and liability for bodily injury to or death of a person (not an employee of the *Contractor*) caused by activity in connection with this contract for any one event is	**Whatever the *Contractor* requires in addition to the amount of insurance taken out by the *Employer* for the same risk.**
84.2	The insurance against loss of or damage to the works, Plant and Materials as stated in the insurance policy for contract works and public liability selected from:	**Principal Controlled Insurance policy for Contract OR Project Specific Insurance for the contract**
9	**Termination**	**There is no additional Contract Data required for this section of the *conditions of contract*.**

10	**Data for main Option clause**	
A	**Priced contract with Activity Schedule**	**No additional data is required for this Option.**
11	**Data for Option W1**	
W1.1	The *Adjudicator* is	**Both parties will agree as and when a dispute arises. If the parties cannot reach an agreement on the *Adjudicator*, the Chairman of the Association of Arbitrators will appoint an *Adjudicator.***
W1.2(3)	The *Adjudicator nominating body* is:	**The Chairman of the Association of Arbitrators (Southern Africa)**
	If no *Adjudicator nominating body* is entered, it is:	**the Association of Arbitrators (Southern Africa)**
W1.4(2)	The *tribunal* is:	**Arbitration**
W1.4(5)	The *arbitration procedure* is	**The Rules for the Conduct of Arbitrations of the Association of Arbitrators (Southern Africa)**
	The place where arbitration is to be held is	**Durban, South Africa**
	The person or organisation who will choose an arbitrator - if the Parties cannot agree a choice or - if the arbitration procedure does not state who selects an arbitrator, is	**The Chairman of the Association of Arbitrators (Southern Africa)**
12	**Data for secondary Option clauses**	
X2	**Changes in the law**	**No additional data is required for this Option**
X7	**Delay damages**	
X7.1	Delay damages for Completion of the whole of the *works* are	**To be equated to the actual monetary loss of Transnet per day**
X13	**Defects Correction bond**	

X13.1	The amount of the defects correction bond is	**10% of the total of the Prices**
X16	**Retention**	
X16.1	The retention free amount is	**Nil**
	The retention percentage is	**10% on all payments certified provided the defects correction bond isn't received by the time payment is due.**
X18	**Limitation of liability**	
X18.1	The *Contractor*'s liability to the *Employer* for indirect or consequential loss is limited to:	**Nil (this is the default position depending on a risk assessment, therefore this can go up to Total of the Prices)**
X18.2	For any one event, the *Contractor's* liability to the *Employer* for loss of or damage to the *Employer's* property is limited to:	**The deductible of the relevant insurance policy**
X18.3	The *Contractor's* liability for Defects due to his design which are not listed on the Defects Certificate is limited to:	**The cost of correcting the Defect**
X18.4	The *Contractor's* total liability to the *Employer* for all matters arising under or in connection with this contract, other than excluded matters, is limited to:	**The Total of the Prices**
X18.5	The *end of liability date* is	**5 years after Completion of the whole of the *works***

Z	***Additional conditions of contract* are*:***	
Z1	**Job Creation**	
Z1.1		**It will be a material term of this contract that the *Contractor* must contribute to the *Employer's* job-creation objectives as set out in Returnable Schedule T2.2-22**
Z1.2		**The *Contractor's* undertaking as to the number of new jobs created due to the award of this contract as set out in Returnable Schedule T.2.2-22 will constitute a binding agreement throughout the duration of the contract until Completion, if not, it will be deemed that the *Contractor* has failed in full to meet this specific material term of the contract, which may constitute a reason for termination..**
Z1.3		**The *Contractor* shall provide to the *Employer*, on a monthly basis or upon receiving an instruction to do so by the *Project Manager*, any documentation and/or evidence required by the *Employer*, which in the *Employer*'s opinion would be necessary to verify whether the *Contractor* has maintained the job-creation undertaking as stipulated in Returnable Schedule T.2.2-22 The *Contractor* shall provide the said documentation and/or evidence within the period stated or as instructed. The provision of the documentation and/or evidence shall not constitute a compensation event.**

Z2	**Additional clause relating to Defects Correction Bonds and/or Guarantees**	
Z2.1		**The Defects Correction Guarantee under X13 above shall be an irrevocable, on-demand defects correction guarantee, to be issued exactly in the form of the Pro Forma documents provided for this purpose under C1.3 (Forms of Securities), in favour of the *Employer* by a financial institution reasonably acceptable to the *Employer.***

Z3 Additional clauses relating to Joint Venture

Z3.1 **Insert the additional core clause 27.5**

27.5. In the instance that the *Contractor* is a joint venture, the *Contractor* shall provide the *Employer* with a certified copy of its signed joint venture agreement, and in the instance that the joint venture is an 'Incorporated Joint Venture,' the Memorandum of Incorporation, within 4 (four) weeks of the Contract Date.
The Joint Venture agreement shall contain but not be limited to the following:

- **A brief description of the Contract and the Deliverables;**
- **The name, physical address, communications addresses and domicilium citandi et executandi of each of the constituents and of the Joint Venture;**
- **The constituent's interests;**
- **A schedule of the insurance policies, sureties, indemnities and guarantees which must be taken out by the Joint Venture and by the individual constituents;**
- **Details of an internal dispute resolution procedure;**
- **Written confirmation by all of the constituents:**
    - **i. of their joint and several liabilities to the *Employer* to Provide the Works;**
    - **ii. identification of the lead partner in the joint venture confirming the authority of the lead partner to bind the joint venture through the *Contractor's* representative;**

		iii. Identification of the roles and responsibilities of the constituents to provide the Works. • **Financial requirements for the Joint Venture:** **iv. the working capital requirements for the Joint Venture and the extent to which and manner whereby this will be provided and/or guaranteed by the constituents from time to time;** **v. the names of the auditors and others, if any, who will provide auditing and accounting services to the Joint Venture.**
Z3.2		**Insert additional core clause 27.6** **27.6. The *Contractor* shall not alter its composition or legal status of the Joint Venture without the prior approval of the *Employer.***
Z4	**Additional obligations in respect of Termination**	
Z4.1		**The following will be included under core clause 91.1:** **In the second main bullet, after the word 'partnership' add 'joint venture whether incorporate or otherwise (including any constituent of the joint venture)' and** **Under the second main bullet, insert the following additional bullets after the last sub-bullet:** • **commenced business rescue proceedings (R22)** • **repudiated this Contract (R23)**

Z4.2	**Termination Table**	**The following will be included under core clause 90.2 Termination Table as follows:** **Amend "A reason other than R1 – R21" to "A reason other than R1 – R23"**
Z4.3		**Amend "R1 – R15 or R18" to "R1 – R15, R18, R22 or R23."**
Z5	**Right Reserved by the *Employer* to Conduct Vetting through SSA**	
Z5.1		**The *Employer* reserves the right to conduct vetting through State Security Agency (SSA) for security clearances of any *Contractor* who has access to National Key Points for the following without limitations:** **1. Confidential – this clearance is based on any information which may be used by malicious, opposing or hostile elements to harm the objectives and functions of an organ of state.** **2. Secret – clearance is based on any information which may be used by malicious, opposing or hostile elements to disrupt the objectives and functions of an organ of state.** **3. Top Secret – this clearance is based on information which may be used by malicious, opposing or hostile elements to neutralise the objectives and functions of an organ of state.**

Z6	**Additional Clause Relating to Collusion in the Construction Industry**	
Z6.1		**The contract award is made without prejudice to any rights the *Employer* may have to take appropriate action later with regard to any declared tender rigging including blacklisting.**
Z7	**Protection of Personal Information Act**	
Z7.1		**The *Employer* and the *Contractor* are required to process information obtained for the duration of the Agreement in a manner that is aligned to the Protection of Personal Information Act.**

Z8 Anti-corruption

Z8.1

The contractor hereby undertakes and warrants that, at the date of the entering into force of the Contract, itself, its directors, officers or employees have not offered, promised, given, authorized, solicited or accepted any undue pecuniary or other advantage or gift of any kind (or implied that they will or might do any such thing at any time in the future) in any way connected with the Contract (hereinafter referred to as any "Corrupt Act") and that it has taken all reasonable measures to prevent its subcontractors, agents or any other third parties, subject to its control or determining influence, from doing so.

In the event that the contractor has committed any corrupt act or is found by any competent court or judicial body to have committed any corrupt act in relation to this Contract or in relation to another contract that has a material impact on this Contract, or in the event that:

i. Improper payments are being or have been made or offered to Transnet officials or any other person by the contractor or those acting on behalf of the contractor with respect to the Services; or

ii. The contractor or those acting on behalf of the contractor has accepted any payment or benefit, regardless of value, as an improper inducement to award, obtain or retain business or otherwise gain or grant an improper business advantage from or to any other person or entity; then:

(a) In addition to the remedies available in law to Transnet, Transnet reserves the right to instruct the contractor to

	(i) dismiss the employee(s) involved, and/or **(ii) to terminate its contracts with the relevant supplier/subcontractor, as the case may be, and should the contractor fail to do so, or if the breach is incapable of being remedied, Transnet may terminate the Contract; and** **(b) Transnet will be entitled to recover the direct damages suffered by Transnet as a result of the termination of the Contract and no further payments will be made to the contractor, save for those sums which have already been committed. The contractor shall deliver to Transnet all works already completed in terms of the contract which Transnet has paid for.**

Z9 TPT Indemnity

Z9.1

The contractor irrevocably and unconditionally undertakes to indemnify and does hereby keep TPT indemnified and hold TPT harmless against, and, in respect of, all and any loss or damage incurred by itself or any other third- Party as a result of, arising out of or connected with any failure, act or omission or breach of this Agreement by the contractor or any of its employees, security officers, servants, agents , assigns, contractors or sub-contractors, or occurring during or as a result of the provision by the Contractor of the Security Service. Such absolute obligation of the Contractor to indemnify TPT on a full indemnity basis against all claims shall including, but not be limited to:

a) liability in respect of any loss or damage to property, whether movable or immovable, belonging to third parties; or other

b) liability in respect of lost property belonging to third parties;

c) liability arising out of any unlawful act committed by the contractor or its employees, security officers, servants, agents, contractors and sub-contractors during the process of rendering a Security Service; or at any other time when a claim has been and could be made against the TPT arising out of the acts of or omissions of one or more of such persons;

d) liability in respect of the death, unlawful arrest, injury, illness or disease of any person, or entity should the damage, loss, unlawful arrest, death, injury, illness or disease referred to above be attributable to or arise out of the Security Services that are being or

have been rendered by the contractor, its agents, service providers, sub-contractors in terms of this Agreement.

The contractor shall at its own expense and with effect from the date of signature hereof, take reasonable precautions for the protection of life and or property that is in any way connected with in whole or any part of this agreement and shall hold TPT harmless against all claims for any loss, demands, proceedings, damages, costs, charges, expenses whatsoever, arising out of this agreement.

The contractor agrees that it shall intervene in any claim arising and to indemnify and hold TPT harmless from any claim, damage, loss, cost, expense, legal expenses, arising from or attributable to the contractor provision of services, its acts, or omissions or those of its agents, employees, sub-contractors, representative/s or other for whom TPT may be / may not be deemed responsible for in terms of the agreement.

C1.2 Contract Data

Part two - Data provided by the *Contractor*

The tendering *Contractor* is advised to read both the NEC3 Engineering and Construction Contract - June 2005 (with amendments June 2006 and April 2013) and the relevant parts of its Guidance Notes (ECC3-GN) in order to understand the implications of this Data which the tenderer is required to complete. An example of the completed Data is provided on pages 156 to 158 of the ECC3 Guidance Notes.

Completion of the data in full, according to Options chosen, is essential to create a complete contract.

Clause	Statement	Data
10.1	The *Contractor* is (Name):	
	Address	
	Tel No.	
	Fax No.	
11.2(8)	The *direct fee percentage* is	**%**
	The *subcontracted fee percentage* is	**%**
11.2(18)	The *working areas* are the Site and	
24.1	The *Contractor's* key persons are:	
	1 Name:	
	Job:	
	Responsibilities:	
	Qualifications:	
	Experience:	
	2 Name:	
	Job	
	Responsibilities:	
	Qualifications:	
	Experience:	

		CV's (and further key persons data including CVs) are appended to Tender Schedule entitled .		
11.2(14)	The following matters will be included in the Risk Register			
31.1	The programme identified in the Contract Data is			
A	**Priced contract with activity schedule**			
11.2(20)	The *activity schedule* is in			
11.2(30)	The tendered total of the Prices is	**(in figures)** **(in words), excluding VAT**		
11.2(31)	The tendered total of the Prices is	(in figures) (in words), excluding VAT		
	Data for Schedules of Cost Components	*Note "SCC" means Schedule of Cost Components starting on page 60 of ECC, and "SSCC" means Shorter Schedule of Cost Components starting on page 63 of ECC.*		
A	**Priced contract with activity schedule**	**Data for the Shorter Schedule of Cost Components**		
41 in SSCC	The percentage for people overheads is:	**%**		
21 in SSCC	The published list of Equipment is the last edition of the list published by			
	The percentage for adjustment for Equipment in the published list is	**%** (state plus or minus)		
22 in SSCC	The rates of other Equipment are:	**Equipment**	**Size or capacity**	**Rate**

61 in SSCC	The hourly rates for Defined Cost of design outside the Working Areas are	**Category of employee**	**Hourly rate**
62 in SSCC	The percentage for design overheads is	**%**	
63 in SSCC	The categories of design employees whose travelling expenses to and from the Working Areas are included in Defined Cost are:		

C1.3 Forms of Securities

Pro forma Defects Correction Guarantee

For use with the NEC3 Engineering & Construction Contract - June 2005 (with amendments June 2006 and April 2013)

The *conditions of contract* stated in the Contract Data Part 1 include the following Secondary Option:

Option X13: Defects Correction bond

The pro forma document for this Guarantee is provided here for convenience but is to be treated as part of the *Works Information*.

The organisation providing the Guarantee does so by copying the pro forma document onto its letterhead without any change to the text or format and completing the required details. The completed document is then given to the *Employer* within the time stated in the contract.

The Defects Correction Bond needs to be issued by an institution that are reasonably acceptable to the *Employer*.

Transnet may choose to not to accept an Issuer. Should the issuer not being accepted, the Defects Correction bond needs to be replaced by an issuer that are acceptable to Transnet. Issuers need to be verified for acceptance by Transnet before a Defects Correction bond is issued.

Pro-forma Defects Correction Bond (for use with Option X13)

(to be reproduced exactly as shown below on the letterhead of the Surety)

Transnet SOC Ltd
C/o Transnet Port Terminals
Transnet Corporate Centre
138 Eloff Street
Braamfontein
Johannesburg
2000

Date:

To whom it may concern,

Defects Correction Bond for Contract No. iCLM HQ 788/TPT

With reference to the above numbered contract made or to be made between

Transnet SOC Limited, Registration No. 1990/000900/30	(the *Employer*) and
{Insert registered name and address of the *Contractor*}	(the *Contractor*), for
{Insert details of the *works* from the Contract Data}	(the *works*).

I/We the undersigned ……………………………………

on behalf of the Guarantor ……………………………………

of physical address ……………………………………

……………………………………

and duly authorised thereto do hereby bind ourselves as Guarantor and co-principal debtors in solidum for the due and faithful Defects Correction of all the terms and conditions of the Contract by the *Contractor* and for all losses, damages and expenses that may be suffered or incurred by the *Employer* as a result of non-Defects Correction of the Contract by the *Contractor*, subject to the following conditions:

1. The terms *Employer*, *Contractor*, *Project Manager*, *works* and Completion Certificate have the meaning as assigned to them by the *conditions of contract* stated in the Contract Data for the aforesaid Contract.

2. We renounce all benefits from the legal exceptions "Benefit of Excussion and Division", "No value received" and all other exceptions which might or could be pleaded against the validity of this bond, with the meaning and effect of which exceptions we declare ourselves to be fully acquainted.

3. The *Employer* has the absolute right to arrange his affairs with the *Contractor* in any manner which the *Employer* deems fit and without being advised thereof the Guarantor shall not have the right to claim his release on account of any conduct alleged to be prejudicial to the Guarantor. Without derogating from the foregoing compromise, extension of the construction period, indulgence, release or variation of the *Contractor's* obligation shall not affect the validity of this Defects Correction bond.

4. This bond will lapse on the earlier of

   - the date that the Guarantor receives a notice from the *Project Manager* stating that the Completion Certificate for the whole of the *works* has been issued, that all amounts due from the *Contractor* as certified in terms of the contract have been received by the *Employer* and that the *Contractor* has fulfilled all his obligations under the Contract, or

   - the date that the Surety issues a replacement Defects Correction Bond for such lesser or higher amount as may be required by the *Project Manager*.

5. Always provided that this bond will not lapse in the event the Guarantor is notified by the *Project Manager*, (before the dates above), of the *Employer's* intention to institute claims and the particulars thereof, in which event this bond shall remain in force until all such claims are paid and settled.

6. The amount of the bond shall be payable to the *Employer* upon the *Employer's* demand and no later than 7 days following the submission to the Guarantor of a certificate signed by the *Project Manager* stating the amount of the *Employer's* losses, damages and expenses incurred as a result of the non-Defects Correction aforesaid. The signed certificate shall be deemed to be conclusive proof of the extent of the *Employer's* loss, damage and expense.

7. Our total liability hereunder shall not exceed the sum of:

   (say) ____

   R ____

8. This Defects Correction Bond is neither negotiable nor transferable and is governed by the laws of the Republic of South Africa, subject to the jurisdiction of the courts of the Republic of South Africa

Signed at ____________________ on this ____________________ day of ____________________ 201_

Signature(s)		
Name(s) (printed)		
Position in Guarantor company		
Signature of Witness(s)		
Name(s) (printed)		

PART C2: PRICING DATA

Document reference	**Title**	**No of pages**
C2.1	Pricing instructions: Option A	2
C2.2	Activity Schedule	30
C2.2	C2.2 Staff Rates	1

C2.1 Pricing instructions: Option A

1 The conditions of contract

1.1 How the contract prices work and assesses it for progress payments

Clause 11 in NEC3 Engineering Construction Contract (ECC), June 2005 (with amendments June 2006 and April 2013) **Option A** states:

Identified and defined terms	11 11.2	(20) The Activity Schedule is the *activity schedule* unless later changed in accordance with this contract. (22) Defined Cost is the cost of the components in the Shorter Schedule of Cost Components whether work is subcontracted or not excluding the cost of preparing quotations for compensation events (27) The Price for Services Provided to Date is the total of the Prices for the activities which have been completed. A completed activity is one which is without Defects which would delay immediately following work. (30) The Prices are the lump sums for each of the activities on the Activity Schedule unless later changed in accordance with this contract.

1.2 Measurement and Payment

The activity schedule provides the basis of all valuations of the Price for Services Provided to Date, payments in multiple currencies and general progress monitoring.

1.2.1 The amount due at each assessment date is based on **completed activities and/or milestones** as indicated on the activity schedule.

1.2.2 The activity schedule work breakdown structure provided by the *Contractor* is based on the activity schedule provided by the *Employer*. The activities listed by the *Employer* are the minimum activities acceptable and identify the specific activities which are required to achieve Completion. The activity schedule work breakdown structure is compiled to the satisfaction of the *Employer* with any additions and/or amendments deemed necessary.

1.2.3 The *Contractor's* detailed activity schedule summates back to the activity schedule provided by the *Employer* and is in sufficient detail to monitor completion of activities related to the Accepted Programme in order that payment of completed activities may be assessed.

1.2.4 The Prices are obtained from the activity schedule. The Prices includes for all direct and indirect costs, overheads, profits, oncosts, risks, liabilities, obligations, etc. relative to the contract.

1.3 C2.2 Activity Schedule

The details given below serve as guidelines only and the *Contractor* may split or combine the activities to suit his particular methods.

*** This activity schedule is based on the initial scope of works as agreed on. Scope and timelines for deliverables may be modified due to changes in circumstances, with written consent required from both parties.**

Activity No.	Activity	Unit	Price of each activity
A	**Preliminaries - Fixed**	**Sum**	
A.1	**Establishment of the site**		
A1.1	Offices, stores, ablution facilities, other amenities		
A1.2	Connections of temporary power, water, telephone		
A1.3	Security, access, fences		
A.2	**Mobile and lifting Equipment - Establishment**		
A2.1	Telehandler/Forklift		
A2.3	Heavy Duty Transport		
A2.4	Diesel Generator (LV) duration of project		
A2.5	Diesel Generator (Capacity to turn Tippler Cage and Power-up Positioner and Dust Handling Plant) 2 weeks		
A2.6	Diesel Welding Machine		
A2.7	Transport Staff and Management		
A2.8	Craneage		
A2.9	Other		
A2.10			
A.3	**Contractual Items**		
A3.1	Insurances, permits, fees		
A3.2	Inspections, tests, notices		
A3.3	Sureties and Contractual Items		
A.4	**Final clean & handover**		
A4.1	Final clean – labour, bins, cleaner, disposal		
A4.2	Documentation, manuals, tests, guarantees, warranties		
A4.3	Site de-establishment and clear		
	Sub-total Fixed Preliminaries		
B	**Preliminaries - Time Related**	**Duration**	
B.1	**Insurance's**		
B1.1	Workmen's Compensation Insurance		
B1.2	Insurance of Contractor's Equipment		
B1.3	Insurance of Goods in Transit/Public liability		
B1.4	Insurance Excesses		
B1.5	Other		
B.2	**Site Offices, Stores and Facilities**		
B2.1	Temporary offices, sheds, etc.		
B2.2	Containers		
B2.3	Chemical Toilets, Sanitary facilities, etc		
B2.4	Telephone facilities		
B2.5	Office consumables		
B2.6	Other		
B.3	**Employee Transport**		
B3.1	Bus		
B3.2	LDV		
B3.3	Other		
B.4	**Mobile and lifting equipment**		
B4.1	Telehandler/Forklift		
B4.2	Heavy Duty Transport		
B4.3	Diesel Generator (LV) duration of project		
B4.4	Diesel Generator (Capacity to turn Tippler Cage and Power-up Positioner) 2 weeks		
B4.5	Diesel Welding Machine		
B4.6	Transport Staff and Management		
B4.7	Craneage		
B4.8	Other		
B.5	**Management, Supervision and Accommodation**		
B5.1	On Site Management and Supervision		
B5.2	Off Site Management		
B5.3	Head Office Overhead Costs		
B5.4	Accommodation and messing		

B.6	**Sundry Items**		
B6.1	Programme, project planning and control		
B6.2	Project Finance		
B6.3	Sub-Contractors		
B6.4	Other		
	Sub-total Time Related Preliminaries		
C	**Engineering, Detail Design & Draughting**	**Sum**	
C1	**Tippler Cage**		
C1.1	3D Scan of Tippler Cage		
C1.2	FEA Model of Tippler Cage		
C1.3	Stress Analysis of Tippler Cage (Simulation – Components and Superstructure)		
C1.4	Design of Load Bearing supports to jack Tippler		
C1.5	Design on Trestle to Jack and Support Tippler Cage		
C2	**Train Holding Devices**		
C2.1	Repositioning of the Gripper HPUs from inside the concrete pits to ground level		
C3	**Tippler Dust Cowl**		
C3.1	Carry out a dimensional survey of the Dust Cowl components		
C3.2	Engineer any modifications as well as update the detail drawing compiled by Takraf		
C4	**Hopper**		
C4.1	Carry out a 3D scan of the Hopper and immediate areas to facilitate necessary design work for the fixing of the ceramic lined plates		
C4.2	Engineer the fixing details of the liners which need to be installed in the tippler hopper		
C5	**Upper Deflector Wall**		
C5.1	**Tip Side**		
C5.1.1	Make use of the current design and make the necessary structural design modifications to the Impact Wall		
C5.2	**Non-Tip Side**		
C5.2.1	Improve the clearance between the underside of the clamp ballast and the top of the non-tip side deflector wall		
C6	**Support Roller Dust Shrouds**		
C6.1	Redesign the Dust Shrouds in order to ensure effectiveness of the dust extraction and containment		
C7	**Apron Feeder Support Steelwork**		
C7.1	Carry out an engineering strength review of the apron feeder support structure to check that the design is fit for purpose		
C7.2	Incorporated into the existing drawings changes due to design weaknesses		
C8	**Isolation Knife Gates**		
C8.1	Engineering, Detail design of Knife Gates		
C8	**Tippler Substation**		
C8.1	Review the current support structure of electrical panels and improve on the rigidity of the floor structure		
C9	**Civil Works**		
C9.1	Update any civil foundation drawings pertaining to the tippler		
C10	**Main Rail Tracks**		
C10.1	Provide detail drawings of the track support beams, along with the fixing method of the support beams to the concrete troughs		
C11	**Dust Extraction**		
C11.1	Carry-out ducting modification to suit error in floor slab		
C12	**Maintenance Equipment**		
C12.1	Design and detail 20ton crawl beam for apron feeder lifting		
C13	**Electrical**		
C13.1	400V Bus Bar design location and design.		
C13.2	TAG Numbering revision		
C13.3	Cable Routing		
C13.4	LCS & JB Positioning (Local Control Station/ Junction Box)		
C13.5	Instrument brackets		
C14	**SCADA System**		
C14.1	Development of software		
C14.2	MIS/MES Additional Equipment Inclusion		
C14.3	SCADA/Overview Modifications		
C14.5	PLC Addition and Tag Addition		
C14.6	TCS Equipment Modifications		

C14.8	PLC Configuration and Development		
C14.9	Network Configuration		
	Sub-total Engineering, Detail Design & Draughting		
D	**Procurement & Supply**	**Sum**	
D1	Procure all grease lubrication piping and distribution blocks.		
D2	Procure all hydraulic pipes and missing fittings.		
D3	Procure of Busbar System from 11kV/400V Transformer to MCC panel		
D4	Procure all power and control cables.		
D5	Procure, all power and control cables termination kits.		
D6	Procure missing cable trays.		
D7	Procure missing field devices and instruments.		
D12	Procure holding down bolts and anchorages		
D13	Procure positioner track rail clips		
D14	Procure main track rail clips		
D15	Procure foundation bolts for locating Thrust Brackets		
D16	Procure Motorized Trolley Chain Hoist Come Along rated for 20-ton lifting capacity		
D17	**Medium Voltage Cable**		
D17.1	3 core XLPE insulated, copper tape screened, PVC bedded, galvanised steel wire armoured, and PVC sheathed		
D18	**Medium Voltage Cable Joints**		
D18.1	3-core, XLPE insulated, copper tape screened, PVC bedded, galvanised steel wire armoured, and PVC sheathed		
D19	**Medium Voltage Cable termination**		
D19.1	Termination for 3-core, XLPE insulated, copper tape screened, and PVC sheathed		
D20	**Low Voltage cable**		
D20.1	4-core, ECC, PVC insulated, galvanised steel wire armoured and PVC sheathed cable		
D21	**Low Voltage Cable termination**		
D21.1	Termination for 4-core, ECC, PVC insulated, galvanised steel wire armoured and PVC sheathed cable		
D22	**Cable Clamps**		
D22.1	Supply and installation of cable Clamps 316 stainless steel for 3-core, XLPE insulated, copper tape screened, PVC bedded, galvanised steel wire armoured and PVC sheath		
D22.2	Supply and installation of cable Clamps 316 stainless steel for 4-core ECC, PVC insulated, galvanised steel wire armoured and PVC sheated cable		
D23	**Cable Racking**		
D23.1	Heavy Duty Cable Ladder System, 800mm 316 Stainless Steel Including Fittings and Accessories (4-Way Piece, 90º Internal Bend, Staggered Cantilever, 90º External Bend and Tee Piece, Etc.)		
D24	**SCADA**		
D24.1	SCADA Industrial PC		
D24.2	Multi-touch built-in Control Panel		
D24.3	SCADA software package		
D24.4	CAT.6A cable from the industrial PC to the Control Panel		
D25	**Miscellaneous Substation Items/Equipment**		
D25.1	Tool Rack (wall mounted)		
D25.2	Steel Substation Desk (to Transnet Specifications)		
D25.3	VCB trolley		
D25.4	Substation Key Rack (wooden key rack to accommodate 10 keys with glass window)		
D25.5	Stainless steel plate to cover ducts around the switchgear panels, stainless steel 6mm thick non- corrosive with lifting holes at intervals of 1000mm		
D25.6	Wiring for LV/MV inter-tripping		
D25.7	General signage in substation (To Transnet Port Terminals specifications)		
D26	**Instruments**		
D26.1	**Tippler, Positioner & Loco Signalling**		
D26.1.1	Encoders		
D26.1.2	Brake Release Switches		
D26.1.3	Torque Limit Switches		
D26.1.4	Overtravel Limit Switches		
D26.1.5	Forward & Reverse Limit Switches		
D26.1.6	Sensors (HP, LP, Oil Flow, Oil Pressure, Blocked)		
D26.1.7	Lasers		
D26.2	**Hopper**		
D26.2.1	Level Detectors		

D26.2.2	Full Tilt Switches		
D26.2.3	Gate Open Switch/s		
D26.2.4	Gate Closed Switch/s		
D26.2.5	Transfer Chute Block Chute		
D26.3	**Apron Feeder**		
D26.3.1	Pull Cord Switch (PCS)		
D26.3.2	Speed Switches		
D27	**Control & Instrumentation Cables, Cable Terminations & Cable Racking**		
D27.1	**Cables**		
D27.1.1	Tippler cage		
D27.1.2	Positioner (on-board)		
D27.1.3	Knife Gates		
D27.1.4	Apron Feeders		
D27.1.5	Dust Extraction Plant		
D27.2	**Cable Terminations**		
D27.2.1	Tippler cage		
D27.2.2	Festoon Cables		
D27.2.3	Knife Gates		
D27.2.4	Apron Feeders		
D27.2.5	Dust Extraction Plant (Control)		
D27.3	**Cable Racking**		
D27.3.1	Tippler Cage		
D27.3.2	Positioner		
D27.3.3	Hoppers		
D27.3.4	Train Holding devices		
D27.3.5	Dust Extraction Plant		
D27.3.6	Tippler Vault		
D27.3.7	Tippler E-House		
D27.3.8	Tippler Control Room		
D27.4	**Gland Plates**		
D27.4.1	Tippler Cage		
D27.4.2	Positioner		
D27.4.3	Train Holding devices		
D27.4.4	Hoppers		
D27.4.5	Dust Extraction Plant		
	Sub-total Procurement & Supply		
E	**Manufacturing & Installation**	**Sum**	
E.1	Manufacturing and corrosion protection in-go and out-go rail support beam		
E.2	Manufacture, and corrosion protection of four-cage links		
E.3	Installation of 5x hopper knife gates		
E.4	Manufacture and corrosion protection of instrument brackets		
E.5	Manufacture of trim plates		
E.6	Manufacture and corrosion protection of ducting modification to suit error in floor slab		
E.7	Manufacture and corrosion protection of Coupler Alignment Tool		
E.8	Manufacture and corrosion protection of Encoder Guards		
E.9	Manufacture and corrosion protection of trackside handrailing to reach Towing Arm		
E.10	Machine chamfer thrust pads installed		
E.11	Machine rack lubrication roller		
E.12	Manufacture and corrosion protection of train holding devices concrete pit ladder cleats		
E.13	Manufacture and corrosion protection of access support angles and rail location plates for ground mounted thrust pads.		
E.14	Manufacture and corrosion protection of Access Support Frame and all Floor Panels for ground mounted thrust pads.		
E.15	Manufacture and corrosion protection of Tie Rod/Pin Spacers for hopper maintenance doors		
E.16	Manufacture and corrosion protection of 20ton crawl beam for apron feeder lifting		
E.17	Manufacture and corrosion protection of Apron Feeder drive Torque Reaction Arm anchor bracket		
E.18	Manufacture and corrosion protection of removable platforms support steelwork		
E.29	Manufacture and corrosion protection of new strengthening members for the Deflector wall		

E.20	Manufacture and corrosion protection of Support Roller Dust Shrouds		
	Sub-total Manufacturing & Machining		
F	**Transportation**	**Sum**	
F.1	Transport to site all components in storage – Saldanha		
	Sub-total Transportation		
G	**Stripping, inspecting and re-assemble**	**Sum**	
G.1	**Tippler support rollers**		
G1.1	Remove one set of support roller bogies on the in-go and out-go side strip, and the bearings cleaned and inspected for corrosion pitting as well as brinelling		
G1.2	If the inspection reveals that the bearings are still in a good condition, then the Contractor will repack the bearings with grease and re-assemble the bogies		
G1.3	If the inspection reveals that the bearings are showing signs of corrosion pitting and/or brinelling, then all the bogie wheels will be removed, and the bearings replaced.		
G1.4	Once the bogies have been re-installed the Contractor will then re-check that the support rollers are installed in accordance with procedure and tolerances as specified in the Ashton Bulk Site Installation drawings		
G1.5	When satisfied with the alignment, the Contractor will re-check the holding down bolts. Re-check the beam height and the roller alignment.		
G.2	**Tippler Structure**		
G2.1	**End Rings & Tippler Cage**		
G2.1.1	Design load bearing beams to Jack Tippler Cage – to accommodate change out of shrink discs		
G2.1.2	Design trestles to support beam once in the position to work		
G2.1.3	Jack cage and allow for alignment od end rings		
	Sub-total Stripping, inspecting and re-assemble		
H	**Stripping, replacing and re-assemble**	**Sum**	
H.1	**End Rings & Tippler Cage**		
H1.1	Replace the four-cage links		
H1.2	Replace star shaped end plates		
	Sub-total Stripping, replacing and re-assemble		
J	**Stripping, surface rust removal and re-assemble**	**Sum**	
J.1	**End Rings & Tippler Cage**		
J1.1	Remove all the surface rust from the end ring racks coat the rack teeth with a thin layer of graphite grease and re-assemble		
J1.2	Side beam and ballast beams: replace the four Incorrect Shrink Discs		
J1.3	Pivot Shafts inside the Side Beam and Ballast Beam		
J1.4	Platform pivot shaft: replace the incorrect Shrink Discs		
J1.5	Torque brackets - Correct exit Non-Tip Side		
J.2	**Tippler Clamp Gear**		
J2.1	Remove all surface rust of pivot pins and coat the surface of the pivot pins and pivot pin bores with Molyslip Copaslip anti seize compound grease		
J2.2	Repair of all the clamp gear articulation pins if necessary		
J.3	**Positioner track**		
J3.1	Remove all the surface rust from the positioner racks coat the rack teeth with a thin layer of graphite grease and re-assemble		
J.4	**Positioner Drives**		
J4.1	Remove the eight drive shafts complete with the respective pinions and remove all the surface rust and coat the pinions with graphite grease		
J.5	**Positioner Main Arm**		
J5.1	Remove all the articulation pins remove all surface rust and coat the pinions with graphite grease		
J.6	**Last Wagon Arm**		
J6.1	Remove the pivot shaft and remove all surface rust and coat with Molyslip Copaslip anti seize compound grease		
J6.2	Remove latch assembly and remove surface rust and coat with Molyslip Copaslip anti seize compound grease		
J6.3	Remove LWA Pivot Pin, carry out the removal of surface rust, particularly the splined end and coat with Molyslip Copaslip anti seize compound grease		
J.7	**Positioner Guide Rollers**		
J7.1	Remove Guide Rollers complete, dismantle roller assembly and re-assemble with new bearings and seals		
J.8	**Sprung support rollers**		
J8.1	Remove Sprung Support Roller complete, dismantle roller assembly and re-assemble with new bearings and seals		
J.9	**Entry & Exit Grippers**		

J9.1	Remove gripper articulation pivot pins and remove the surface rust and coat with Molyslip Copaslip anti seize compound grease		
J.10	**Fixed Support Roller**		
J10.1	Remove Fixed Support Roller complete, dismantle roller assembly and re-assemble with new bearings and seals		
	Sub-total Stripping, surface rust removal and re-assemble		
K	**Weld repairs (Including paint repairs as per Transnet Corrosion Specification)**	**Sum**	
K.1	**End Rings & Tippler Cage**		
K1.1	internal box sections of the end rings		
K1.2	external welds of the end rings		
K1.3	repair of external welds on the tippler platform		
K1.4	side beam: repair entry end and exit end underside fillet welds		
K1.5	ballast beam: repair entry end and exit end underside fillet welds		
K.2	**Positioner**		
K2.1	**Positioner Main Frame**		
K2.1.1	Weld located between mainframe trackside web and bottom flange		
K2.1.2	The weld located at the main frame front fixed support roller wheel		
K2.2	**Positioner Main Arm**		
K2.2.1	Front Pedestal front plate to bottom flange weld		
	Sub-total Weld repairs (Including paint repairs as per Transnet Corrosion Specification)		
L	**Erection & corrosion protection (Structural, Mechanical, Hydraulics & Grease Lubrication**	**Sum**	
L.1	**Tippler Cage**		
L1.1	**Tippler Structure**		
L1.1.1	Lower the cage structure onto the support rollers		
L1.1.2	Install machined thrust pads in-go and out-go		
L1.1.3	Install Oleo Buffers on the in-go and out-go end rings		
L1.1.4	Modify tippler access flooring to suit installation of Support Frame and Braces and re-install access flooring after modification		
L1.2	**Tippler Ballast Box**		
L1.2.1	Procure, Transport, and install concrete ballast into ballast box compartments		
L1.2.2	Procure, Transport and install trim plates		
L1.3	**Tippler Thrust Pads**		
L1.3.1	Install foundation bolts for locating Thrust Brackets		
L1.3.2	Install the thrust pads as detailed on the Ashton Bulk drawings		
L1.3.3	Install Access Support Angles and Rail Location Plates as detailed on the Ashton Bulk drawings		
L1.3.4	Install Access Support Frame and all Floor Panels as detailed on the Ashton Bulk drawings		
L1.3.5	Install Rail Clips		
L1.4	**Tippler Lubrication System**		
L1.4.1	Install fully automated Stand-alone, electrically driven pump type, progressive, grease lubrication system		
L1.4.2	Install fully automated Stand-alone, electrically driven pump type spray lubricant system		
L1.4.3	Install Grouped Manual: (GM)Total loss greasing of individual components		
L1.5	**Tippler Drive Gear**		
L1.5.1	Install Tippler Drive Unit Base Plate onto grout packers as detailed on Ashton Bulk's drawings		
L1.5.2	Survey the alignment and position of the drive base plate and record all dimensions shown on Ashton Bulk's drawings.		
L1.5.3	Grout Drive base plate using full strength grout		
L1.5.4	Position and align each individual drive unit until correct mesh is obtained between the drive pinion and rack		
L.2	**Positioner system**		
L2.1	Install the Liner Trays		
L2.2	Procure and fit positioner track rail clips at all module joints that are missing		
L2.3	Install, level and align in-go and out-go rail support beam		
L2.4	Fit and adjust the sprung support roller as per Ashton Bulk drawing		
L2.5	Adjust the twin guide rollers on opposite side of rack to achieve a clearance between the rollers and the spine bar as per the Ashton Bulk drawing		
L2.6	Adjust the single guide rollers to achieve a clearance as per Ashton Bulk drawing between the rollers and the spine bar		
L2.7	Adjust resolver unit as per Ashton Bulk drawing to obtain correct backlash with racks		

L2.8	Install positioner drives		
L2.9	Fill main arm ballast box with concrete		
L2.10	Install Coupler Alignment Tool		
L2.11	Fit trackside handrailing to reach Towing Arm and to be turned in at Drive Cartridge end		
L2.12	Fit access flooring		
L2.13	**Positioner Hydraulic System (Including piping & fittings)**		
L2.13.1	Install the Positioner hydraulics in accordance with the hydraulic OEM installation method statement		
L2.14	**Positioner Grease Lubrication System (Including piping & fittings)**		
L2.14.1	Install fully automated Stand-alone, electrically driven pump type, progressive, grease lubrication system		
L2.14.2	Install fully automated Stand-alone, electrically driven pump type spray lubricant system		
L.3	**Train holding devices**		
L3.1	Assemble the gripper mechanisms once the pivot pins and bores are cleaned		
L3.2	Check the alignment with the main rail and when positioned correctly on the grout packers		
L3.3	Grout under the foundation frames using full strength grout		
L3.4	**Entry & exit grippers hydraulic powerpacks (Including piping & fittings)**		
L3.4.1	Flush the powerpacks to remove all contamination from the pipe runs/hoses etc in accordance with the hydraulic OEM installation commissioning schedule		
L3.4.2	Place the hydraulic powerpacks at floor level alongside the respective gripper concrete pits		
L3.4.3	Install a removable barrier to safeguard the hydraulic powerpacks		
L3.4.4	Install the powerpacks with the isolation valves on all units		
L3.4.5	Install, the pipes to the gripper Clamp cylinders		
L3.5	**Entry & exit grippers grease lubrication (Including piping & fittings)**		
L3.5.1	Install fully automated Stand-alone, electrically driven pump type, progressive, grease lubrication system		
L.4	**Hoppers & Apron Feeders & Isolation Knife Gates**		
L4.1	Install the hopper chutes and hopper outlet liner panels		
L4.2	remove all the removable panels of the apron feeder chutes as well as the temporary spacer chute		
L4.3	Install the isolation gate frame assemblies		
L4.4	Install the five apron feeder assemblies		
L4.5	Install the five apron feeder drive assemblies in positions		
L4.6	Install all the hopper liners in line with the installation drawing compiled by Tenova Takraf		
L4.7	Install 20ton crawl beam for apron feeder lifting		
L4.8	Install Apron Feeder Safety Guards		
L4.9	Install Apron Feeder drive Torque Reaction Arm anchor bracket		
L4.10	Install 5 off Knife Gates		
L4.11	Install Knife Gate HPU		
L4.12	Manufacture in-situ and install cut-outs in non-tip side steel hopper wall to accommodate Wagon Clamp Counterweights		
L4.13	**Apron Feeder grease lubrication (Including piping & fittings)**		
L4.13.1	Install 5 fully automated Stand-alone, electrically driven pump type, progressive, grease lubrication systems		
L.5	**Dust Extraction & Collection System**		
L5.1	**Structural (Dust Extraction Plant)**		
L5.1.1	Install columns T1 to T9		
L5.1.2	Install ducting pipes 002/D11 to 002/D31		
L5.1.3	Install compensator		
L5.1.4	Install Bearing access platform		
L5.1.5	Install dust monitor access platform		
L5.1.6	Install extraction fan support structure		
L5.1.7	Install dust extraction fan ducting		
L5.1.8	Install columns T10 to T12		
L5.1.9	Install ducting pipe 002/D32 followed by ducting pipes 004/D53 to 004/D59		
L5.1.10	Once all the dust cowl connecting piping has been installed the Contractor will proceed to install the vertical piping in the pipe shafts down to the apron feeder extraction level		
L5.1.11	Install ducting pipes 011/D34 to 011/D38 followed by 003/D39		
L5.1.12	Install ducting pipes 002/D47 to 022/D52 followed by 003/D46 and 003/D44		

L5.1.13	Install ducting pipes 002/D41 to 003/D43 followed by 002/D43 and 003/D44.		
L5.1.14	**Mechanicals (Dust Extraction Plant)**		
L5.1.14.1	Install bag filter units (Bag filter A & B)		
L5.1.14.2	Install dust extraction fan		
L5.1.14.3	Install dust extraction blower fan		
L5.1.14.4	Install dust extraction blower valve		
L5.1.14.5	Install dust storage isolation valve		
L5.1.14.6	Install dust storage rotary valve		
L5.1.14.7	Install dust storage diverter chute		
L5.1.14.8	Install dust storage pug mill		
L5.1.14.9	Install Dust Storage Ventilation Valve (Pressure Relief)		
L5.1.14.10	Install Dust storage Control Air Valve		
L5.1.14.11	Install Dust Extraction Compressor 1		
L5.1.14.12	Install Dust Extraction Compressor 1 - Non-Return Valve		
L5.1.14.13	Install Dust Extraction Air Receiver 1		
L5.1.14.14	Install Dust Extraction Air Receiver 1- Various Valves		
L5.1.14.15	Install Dust Extraction Desiccant Dryer 1 Primary Filter 1		
L5.1.14.16	Install Dust Extraction Desiccant Dryer 1 Secondary Filter 2		
L5.1.14.17	Install Dust Extraction Desiccant Dryer 1		
L5.1.14.18	Install Dust Extraction Desiccant Dryer 1 - Various Bypass Valves		
L5.1.14.19	Install Dust Extraction Desiccant Dryer 1 - Various Pressure Relief Valves		
L5.1.14.20	Install Dust Extraction Desiccant Dryer 1 - Various Air Blow Off Valves		
L5.1.14.21	Install Dust Extraction Desiccant Dryer 2 - Tertiary Filter 3		
L5.1.14.22	Install Dust Extraction Dust Collector 1		
L5.1.14.23	Install Dust Collector 1 Screw Conveyor		
L5.1.14.24	Install Dust Collector 1 Screw Conveyor - Motor		
L5.1.14.25	Install Dust Extraction Screw Conveyor 1 - Field Isolator		
L5.1.14.26	Install Dust Collector 1 Various Valves		
L5.1.14.27	Install Dust Extraction Compressor 2		
L5.1.14.28	Install Dust Extraction Compressor 2 - Non-Return Valve		
L5.1.14.29	Install Dust Extraction Air Receiver 2		
L5.1.14.30	Install Dust Extraction Air Receiver 2 - Various Valves		
L5.1.14.31	Install Dust Extraction Desiccant Dryer 2 - Primary Filter 1		
L5.1.14.32	Install Dust Extraction Desiccant Dryer 2 - Secondary Filter 2		
L5.1.14.33	Install Dust Extraction Desiccant Dryer 2 - Secondary Filter 2		
L5.1.14.34	Install Dust Extraction Desiccant Dryer 2 - Various Bypass Valves		
L5.1.14.35	Install Dust Extraction Desiccant Dryer 2 - Various Pressure Relief Valves		
L5.1.14.36	Install Dust Extraction Desiccant Dryer 2 - Various Air Blow Off Valve		
L5.1.14.37	Install Dust Extraction Desiccant Dryer 2 - Tertiary Filter 3		
L5.1.14.38	Install Dust Extraction Dust Collector 2		
L5.1.14.39	Install Dust Collector 2 Screw Conveyor		
L5.1.14.40	Install Dust Collector 2 Screw Conveyor - Motor		
L5.1.14.41	Install Dust Extraction Screw Conveyor 2 - Field Isolator		
L5.1.14.42	Install Dust Collector 2 - Various Valves		
L5.1.14.43	Install Dust Collector 2 Rotary Vane Feeder - Motor		
L5.1.14.44	Install Dust Extraction Rotary Vane Feeder 2 - Field Isolator		
L.6	**DUST COWL & DEFLECTOR WALL/BARRIER**		
L6.1	Re-install dust cowl and correct manufacturing errors		
L6.2	Modification to North-East floor hatch to provide clearance for Tippler Rotational Switches		
L6.3	Cutting and welding of seal ring at the dust cowl to achieve a consistent gap with Tippler End Rings		
L6.4	Install replacement Support Roller Dust Shrouds.		
	Sub-Total Erection & corrosion protection (Structural, Mechanical, Hydraulics & Grease Lubrication)		
M	**Electrical installation & corrosion protection electrical installation**	**Sum**	
M.1	**Instruments**		
M1.1	**Tippler, Positioner & Loco-Signalling (Includes any brackets and fixtures)**		
M1.1.1	Install Encoders		
M1.1.2	Install Brake Release Switches		
M1.1.3	Install Torque Limit Switches		

M1.1.4	Install Overtravel Limit Switches		
M1.1.5	Install Forward & Reverse Limit Switches		
M1.1.6	Install Sensors (HP, LP, Oil Flow, Oil Pressure, Blocked)		
M1.1.7	Install Reflectors		
M1.1.8	Install Lasers		
M1.2	**Hopper**		
M1.2.1	Install Level Detectors		
M1.2.2	Install Full Tilt Switches		
M1.2.3	Install Knife Gate Open Switch/s		
M1.2.4	Install Knife Gate Closed Switch/s		
M1.2.5	Transfer Chute Block Chute		
M1.3	**Apron Feeder**		
M1.3.1	Install Pull Cord Switch (PCS)		
M1.3.2	Install Speed Switches		
M1.4	**Dust Extraction Plant**		
M1.4.1	Install instruments for valves, field isolators, pressure indicators, filters		
M.2	**Positioner and Positioner Building (*All brackets, frames and fixtures required for LCS's, LOS's and JB's to be provided by contractor*)**		
M2.1	Install, align, and level Tippler Lock Out Station to support frame		
M2.2	Install, align, and level Tippler Lock in Station to support frame		
M2.3	Install, align, and level Positioner Land LCS to support frame		
M2.4	Install, align, and level Positioner Onboard LCS to support frame		
M2.5	Install, align, and level Festoon JB's (Power) to support frame		
M2.6	Install, align, and level Lube System 1 (Positioner) Junction Box to support frame		
M2.7	Install, align, and level Lube System 2 (Positioner) Junction Box to support frame		
M.3	**Train Holding Devices (All brackets, frames and fixtures required for LCS's, LOS's and JB's to be provided by contractor)**		
M3.1	Install, align, and level Entry Wheel Grippers LCS to support frame		
M3.2	Install, align, and level Exit Wheel Grippers LCS to support frame		
M3.3	Install, align, and level Lube System 3 (Entry Gripper) Junction Box to support frame		
M3.4	Install, align, and level Lube System 4 (Exit Gripper) Junction Box to support frame		
M.4	**Tippler Cage (All brackets, frames and fixtures required for LCS's, LOS's and JB's to be provided by contractor)**		
M4.1	Install, align, and level Tippler Entry LCS to support frame		
M4.2	Install, align, and level Lube System 5 (Tippler) Junction Box to support frame		
M4.3	Install, align, and level Tippler Exit LCS to support frame		
M4.4	Install, align, and level Lube System 5 (Tippler) Junction Box to support frame		
M.5	**Tippler Hopper (All brackets, frames and fixtures required for LCS's, LOS's and JB's to be provided by contractor)**		
M5.1	Install, align, and level Hopper LCS to support frame		
M5.2	Install, align, and level Hopper Bin #1 LCS to support frame		
M5.3	Install, align, and level Hopper Bin #2 LCS to support frame		
M5.4	Install, align, and level Hopper Bin #3 LCS to support frame		
M5.5	Install, align, and level Hopper Bin #4 LCS to support frame		
M5.6	Install, align, and level Hopper Bin #5 LCS to support frame		
M.6	**Apron Feeders (All brackets, frames and fixtures required for LCS's, LOS's and JB's to be provided by contractor)**		
M6.1	Install, align, and level Apron Feeder #1 LCS to support frame		
M6.2	Install, align, and level Apron Feeder #2 LCS to support frame		
M6.3	Install, align, and level Apron Feeder #3 LCS to support frame		
M6.4	Install, align, and level Apron Feeder #4 LCS to support frame		
M6.5	Install, align, and level Apron Feeder #5 LCS to support frame		
M.7	**Dust Extraction Plant**		
M7.1	Install, align, and level extraction fan LCS to support frame		
M7.2	Install, align, and level extraction blower fan LCS to support frame		
M7.3	Install, align, and level air compressor #1 LCS to support frame		
M7.4	Install, align, and level Air Receiver #1 LCS to support frame		
M7.5	Install, align, and level Dust Extraction Desiccant Dryer #1 LCS to support frame		
M7.6	Install, align, and level screw conveyor #1 LCS to support frame		

M7.7	Install, align, and level air compressor #2 LCS to support frame		
M7.8	Install, align and level Air Receiver #2 LCS to support frame		
M7.9	Install, align, and level Dust Extraction Desiccant Dryer #2 LCS to support frame		
M7.10	Install, align, and level screw conveyor #2 LCS to support frame		
M.8	**Cable Racking (*Contractor is responsible to provide all fixtures and brackets to fix cable racking to structures*)**		
M8.1	Install and fix cable racking to Tippler Building concrete cable vault for Positioner Power & Control Cables		
M8.2	Install and fix cable racking to Tippler Building concrete cable vault for Entry gripper hydraulic system Power & Control Cables		
M8.3	Install and fix cable racking to Tippler Building concrete cable vault for Entry gripper Control Cables		
M8.4	Install and fix cable racking to Tippler Building concrete cable vault for Exit gripper hydraulic system Power & Control Cables		
M8.5	Install and fix cable racking to Tippler Building concrete cable vault for Entry gripper Control Cables		
M8.6	Install and fix cable racking to Tippler Building concrete cable vault for Lube System 3 (Entry Gripper) Junction Box for Power & Control Cables		
M8.7	Install and fix cable racking to Tippler Building concrete cable vault for Lube System 4 (Exit Gripper) Junction Box for Power & Control Cables		
M8.8	Install and fix cable racking to Tippler Building concrete cable vault for Positioner Land mounted JB Power & Control Cables		
M8.9	Install and fix cable racking to Tippler Building concrete cable vault for tippler drive LCS Power & Control Cables		
M8.10	Install and fix cable racking to Tippler Building concrete cable vault for dust extraction fan/s and screw conveyor/s LCS Power & Control Cables		
M8.11	Install and fix cable racking to Tippler Building concrete cable vault for hopper LCS Power & Control Cables		
M8.12	Install and fix cable racking to Tippler Building concrete cable vault for Hopper Bin #1 LCS Power & Control Cables		
M8.13	Install and fix cable racking to Tippler Building concrete cable vault for Hopper Bin #2 LCS Power & Control Cables		
M8.14	Install and fix cable racking to Tippler Building concrete cable vault for tippler vault Power & Control Cables		
M8.15	Install and fix cable racking to apron feeder support structure for apron feeder LCS Power & Control Cables		
M8.16	Install and fix cable racking to conveyor stringers for conveyor drive LCS Power & Control Cables		
M8.17	Install and fix cable racking to conveyor stringers and moving head structure for moving head drive LCS Power & Control Cables		
M8.18	Install and fix cable racking to Tippler Building concrete cable vault for tippler workshops power cables		
M8.19	Install and fix cable racking to Tippler shed columns for overhead crane JB Power Cable		
M9	**Operators Control desk**		
M9.1	Complete installation of operators control desk including operators' controls, industrial PC, Multi-touch built-in Control Panel and CCTV monitor		
M9.2	Install and terminate power & control cables from LV & PLC panels to control desk		
M9.3	Polish operators control desk before handing over to client		
	Sub-Total Electrical installation & corrosion protection electrical installation		
N	**Cable Installation (*This includes pulling cables, installing cables and strapping to cable racks*)**	**Sum**	
N.1	**Medium Voltage**		
N1.1	From substation____ 3.3kV Switchgear to dust extraction fan MCC		
N.2	**Low Voltage - 400V**		
N2.1	Busbar system from tippler #3 substation main 11kV/400Vtransformer to tippler 400V MCC		
N2.2	400V MCC to Lighting & Small Power Distribution Panel		
N2.3	400V MCC to PLC panel and Auxiliary panel		
N2.4	400V MCC to UPS/s		
N2.5	400V MCC to Control TX1		
N2.6	400V MCC to Control TX2		
N2.7	**Entry Grippers**		
N2.7.1	400V MCC to wheel gripper #1 (entry) hydraulic system		
N2.7.2	400V MCC to wheel gripper #2 (entry) hydraulic system		
N2.7.3	400V MCC to wheel gripper #3 (entry) hydraulic system		
N2.7.4	400V MCC to wheel grippers (entry) lub system		
N2.8	**Exit Grippers**		
N2.8.1	400V MCC to wheel grippers (exit) hydraulic system		

N2.8.2	400V MCC to wheel grippers (exit) lub system		
N2.9	**Positioner**		
N2.9.1	400 V MCC Busbar to positioner VVVF panel Busbar		
N2.9.2	From positioner VVVF #1 panel to positioner land mounted JB		
N2.9.3	From positioner VVVF #2 panel to positioner land mounted JB		
N2.9.4	From positioner VVVF #3panel to positioner land mounted JB		
N2.9.5	From positioner VVVF #4 panel to positioner land mounted JB		
N2.9.6	From positioner VVVF #5 panel to positioner land mounted JB		
N2.9.7	From positioner VVVF #6 panel to positioner land mounted JB		
N2.9.8	From positioner VVVF #7 panel to positioner land mounted JB		
N2.9.9	From positioner VVVF #8 panel to positioner land mounted JB		
N2.9.10	400V MCC to Positioner land mounted JB (Hydraulic System)		
N2.9.11	400V MCC to Positioner land mounted JB (lub system #1)		
N2.9.12	400V MCC to Positioner land mounted JB (lub system #2)		
N2.10	**Tippler Cage**		
N2.10.1	400V MCC to tippler cage #1 VVVF panel		
N2.10.2	From tippler cage VVVF panel to tippler cage drive motor #1		
N2.10.3	400V MCC to tippler cage #2 VVVF panel		
N2.10.4	From tippler cage VVVF panel to tippler cage drive motor #2		
N2.10.5	400V MCC to Tippler cage drive brake #1		
N2.10.6	400V MCC to Tippler cage drive brake #2		
N2.10.7	400V MCC to tippler cage lub system #1		
N2.10.8	400V MCC to tippler cage lub system #2		
N2.11	**Hopper Knife Gates**		
N2.11.1	400V MCC to hopper knife gate #1		
N2.11.2	400V MCC to hopper knife gate #2		
N2.11.3	400V MCC to hopper knife gate #3		
N2.11.4	400V MCC to hopper knife gate #4		
N2.11.5	400V MCC to hopper knife gate #5		
N2.12	**Apron Feeders**		
N2.12.1	400V MCC Busbar to Apron Feeders VVVF panel Busbar		
N2.12.2	400V MCC to apron feeder #1 VVVF panel		
N2.12.3	400V MCC to apron feeder #2 VVVF panel		
N2.12.4	400V MCC to apron feeder #3 VVVF panel		
N2.12.5	400V MCC to apron feeder #4 VVVF panel		
N2.12.6	400V MCC to apron feeder #5 VVVF panel		
N2.12.7	From apron feeder VVVF panel #1 to apron feeder drive motor #1		
N2.12.8	From apron feeder VVVF panel #1 to apron feeder drive motor #2		
N2.12.9	From apron feeder VVVF panel #1 to apron feeder drive motor #3		
N2.12.10	From apron feeder VVVF panel #1 to apron feeder drive motor #4		
N2.12.11	From apron feeder VVVF panel #1 to apron feeder drive motor #5		
N2.13	**Dust Extraction Plant**		
N2.13.1	400V MCC to extraction fan		
N2.13.2	400V MCC to extraction blower fan		
N2.13.3	400V MCC to air compressor #1		
N2.13.4	400V MCC to Air Receiver #1		
N2.13.5	400V MCC to Dust Extraction Desiccant Dryer #1		
N2.13.6	400V MCC to screw conveyor #1		
N2.13.7	400V MCC to air compressor #2		
N2.13.8	400V MCC to Air Receiver #2		
N2.13.9	400V MCC to Dust Extraction Desiccant Dryer #2		
N2.13.10	400V MCC to screw conveyor #2		
N2.13.11	Auxiliary panel to Railway signal supplies		
N2.13.12	Auxiliary panel to PLC panel lighting		
N2.13.13	Auxiliary panel to CCTV cameras & monitor		
N2.13.14	Auxiliary panel to Battery Charger/s		
N2.13.15	Auxiliary panel to air-conditioning motor starters (MV, LV & Control Rooms)		
N2.13.16	Auxiliary panel to overhead crane JB		
N2.13.17	Overhead crane JB to crane hot rails		
N2.13.18	Auxiliary panel to tippler cage drive motor anti-condensation heater		
N2.13.19	Auxiliary panel to Positioner land mounted JB (positioner drive motors anti-condensation heaters)		
N2.13.20	Auxiliary panel to LCS & I/O station heaters		

N2.13.21	Auxiliary panel to panels in MV, LV & Control room anti-condensation heater		
N2.13.22	Auxiliary panel to hydraulic pump motors anti-condensation heater		
N.3	**Low Voltage Cables- 230V**		
N3.1	230V to UPS		
N3.2	UPS to PLC Rack		
N3.3	UPS to socket outlet for laptop		
N3.4	UPS to operators control room SCADA PC		
N3.5	UPS to Positioner land mounted JB (positioner encoder module)		
N3.6	UPS to tippler cage encoder module #1		
N3.7	UPS to tippler cage encoder module #2		
N.4	**Control Cables - 110V**		
N4.1	110V from PLC to operators control room fibre optic module		
N4.2	110V to PLC panel for warning relay supply		
N4.3	110V to Positioner Land LCS		
N4.4	110V to Tippler entry LCS		
N4.5	110V to Tippler exit LCS		
N4.6	110V to hopper LCS		
N4.7	110V to Entry Wheel grippers #1 LCS		
N4.8	110V to Entry Wheel grippers #2 LCS		
N4.9	110V to Entry Wheel grippers #3 LCS		
N4.10	110V to Exit Wheel grippers LCS		
N4.11	110V to Positioner Land LCS		
N4.12	110V to Positioner Land Distributed I/O panel		
N4.13	110V to Tippler entry Distributed I/O panel		
N4.14	110V to Tippler exit Distributed I/O panel		
N4.15	110V to hopper LCS Distributed I/O panel		
N4.16	110V to Entry Wheel grippers #1 Distributed I/O panel		
N4.17	110V to Entry Wheel grippers #2 Distributed I/O panel		
N4.18	110V to Entry Wheel grippers #3 Distributed I/O panel		
N4.19	110V to Exit Wheel grippers Distributed I/O panel		
N4.20	110V to positioner over-travel circuit		
N4.21	110V to tippler cage over-travel circuit		
N4.22	110 V to hopper LCS for the following signals: i. Hopper full; ii. Block chute; iii. Tilt switch/bindicator iv. Control units		
N4.23	110V to entry gripper #1 solenoids		
N4.24	110V to entry gripper #2 solenoids		
N4.25	110V to entry gripper #3 solenoids		
N4.26	110V to exit gripper solenoids		
N4.27	110V to positioner main arm solenoids (on-board)		
N4.28	110V to positioner Last Car Arm solenoids (on-board)		
N4.29	110V to positioner drive #1 brake solenoids (on-board)		
N4.30	110V to positioner drive #2 brake solenoids (on-board)		
N4.31	110V to positioner drive #3 brake solenoids (on-board)		
N4.32	110V to positioner drive #4 brake solenoids (on-board)		
N4.33	110V to positioner drive #5 brake solenoids (on-board)		
N4.34	110V to positioner drive #6 brake solenoids (on-board)		
N4.35	110V to positioner drive #7 brake solenoids (on-board)		
N4.36	110V to positioner drive #8 brake solenoids (on-board)		
N4.37	110V to tippler warning siren		
N.5	**Control Cables - 24V**		
N5.1	24V to laser		
N5.2	24V to operators control room fibre optic module		
N5.3	24V for fibre optic modules		
N.6	**Positioner Festoon (*Contractor will install festoon cables from land mounted JB over the festoon carriers to the positioner motors, including termination*)**		
N6.1	**Festoon Cables (Power)**		
N6.1.1	400V positioner motor #1 supply & earth		
N6.1.2	400V positioner motor #2 supply & earth		
N6.1.3	400V positioner motor #3 supply & earth		

N6.1.4	400V positioner motor #4 supply & earth		
N6.1.5	400V positioner motor #5 supply & earth		
N6.1.6	400V positioner motor #6 supply & earth		
N6.1.7	400V positioner motor #7 supply & earth		
N6.1.8	400V positioner motor #8 supply & earth		
N6.1.9	400V hydraulic pump supply		
N6.1.10	400V lube system #1 supply		
N6.1.11	400V lube system #2 supply		
N6.1.12	400V hydraulic fill/filter pump supply		
N6.2	**Festoon Cables (Control)**		
N6.2.1	110V motor heaters		
N6.2.2	110V hydraulic motor heater/s		
N6.2.3	110V on-board pos. hydraulic solenoid supply		
N6.2.4	110V on-board positioner brake solenoid supply		
N6.2.5	110V AC on-board LCS		
N6.2.6	110V warning beacon/horn supply		
N6.2.7	110V hardwiring		
N6.2.8	110V positioner motors encoder & temp		
N6.2.9	24V photocells supply		
N.7	**Cable Glanding**		
N.7.1	Supply and installation of appropriate glands for Multicore cables wired direct to electrical equipment		
N.8	**Gland Plates**		
N8.1	Supply and installation of Gaskets/sealant to be used to ensure watertight joints between surfaces of all gland plates		
N.9	**Core Identification**		
N9.1	Supply and installation of cable ferrule idents at both ends adjacent to terminations		
	Sub-Total Cable Installation (This includes pulling cables, installing cables and strapping to cable racks)		
P	**Cable Terminations (*Contractor is responsible to provide all termination kits, splicing kits and any other consumables required to terminate*)**	**Sum**	
P.1	**Medium Voltage Cables**		
P1.1	Terminate at substation____ dust extraction fan 3.3kV Switchgear and VVVF panel		
P1.2	Terminate at dust extraction fan VVVF panel and dust extraction fan		
P.2	**Low Voltage Cables- 400V**		
P2.1	Terminate tippler #3 substation main 11kV/400Vtransformer and tippler 400V MCC		
P2.2	Terminate at 400V MCC and Lighting & Small Power Distribution Panel		
P2.3	Terminate at 400V MCC to PLC panel and Auxiliary panel		
P2.4	Terminate at 400V MCC and UPS/s		
P2.5	Terminate at 400V MCC and Control TX1		
P2.6	Terminate at 400V MCC and Control TX2		
P2.7	Terminate at 400V MCC Busbar and positioner VVVF panel Busbar		
P2.8	Terminate at positioner VVVF #1 panel and positioner land mounted JB		
P2.9	Terminate at positioner VVVF #2 panel and positioner land mounted JB		
P2.10	Terminate at positioner VVVF #3panel and positioner land mounted JB		
P2.11	Terminate at positioner VVVF #4 panel and positioner land mounted JB		
P2.12	Terminate at positioner VVVF #5 panel and positioner land mounted JB		
P2.13	Terminate at positioner VVVF #6 panel and positioner land mounted JB		
P2.14	Terminate at positioner VVVF #7 panel and positioner land mounted JB		
P2.15	Terminate at positioner VVVF #8 panel and positioner land mounted JB		
P2.16	Terminate at 400V MCC and wheel grippers (entry) hydraulic system #1		
P2.17	Terminate at 400V MCC and wheel grippers (entry) hydraulic system #2		
P2.18	Terminate at 400V MCC and wheel grippers (entry) hydraulic system #3		
P2.19	Terminate at 400V MCC and wheel grippers (exit) hydraulic system		
P2.20	Terminate at 400V MCC and Positioner Hydraulic System		
P2.21	Terminate at 400V MCC busbar and tippler cage VVVF panel busbar		
P2.22	Terminate at tippler cage VVVF panel #1 and tippler cage drive motor #1		
P2.23	Terminate at tippler cage VVVF panel #1 and tippler cage drive motor #2		
P2.24	Terminate at 400V MCC and Tippler cage drive brake #1		
P2.25	Terminate at 400V MCC and Tippler cage drive brake #2		

P2.26	Terminate at 400V MCC and tippler lub system in-go		
P2.27	Terminate at 400V MCC and tippler lub system out-go		
P2.28	Terminate at 400V MCC and Positioner land mounted JB (Hydraulic System)		
P2.29	Terminate at 400V MCC and Positioner land mounted JB (lub system #1)		
P2.30	Terminate at 400V MCC and Positioner land mounted JB (lub system #2)		
P2.31	Terminate at Positioner Hydraulic System (on-board)		
P2.32	Terminate at Positioner lub system #1 (on-board)		
P2.33	Terminate at Positioner lub system #2 (on-board)		
P2.34	Terminate at 400V MCC and apron feeder VVVF panel		
P2.35	Terminate at apron feeder VVVF panel and apron feeder drive motor		
P2.36	Terminate at 400V MCC Busbar and apron feeders VVVF panel Busbar		
P2.37	Terminate at apron feeder VVVF panel #1 and apron feeder drive motor #1		
P2.38	Terminate at apron feeder VVVF panel #1 and apron feeder drive motor #2		
P2.39	Terminate at apron feeder VVVF panel #1 and apron feeder drive motor #3		
P2.40	Terminate at apron feeder VVVF panel #1 and apron feeder drive motor #4		
P2.41	Terminate at apron feeder VVVF panel #1 and apron feeder drive motor #5		
P2.42	Terminate at 400V MCC and knife gate #1		
P2.43	Terminate at 400V MCC and knife gate #2		
P2.44	Terminate at 400V MCC and knife gate #3		
P2.45	Terminate at 400V MCC and knife gate #4		
P2.46	Terminate at 400V MCC and knife gate #5		
P2.47	Terminate at 400V MCC and extraction fan		
P2.48	Terminate at 400V MCC and extraction blower fan		
P2.49	Terminate at 400V MCC and air compressor #1		
P2.50	Terminate at 400V MCC and Air Receiver #1		
P2.51	Terminate at 400V MCC and Dust Extraction Desiccant Dryer #1		
P2.52	Terminate at 400V MCC and screw conveyor #1		
P2.53	Terminate at 400V MCC and air compressor #2		
P2.54	Terminate at 400V MCC and Air Receiver #2		
P2.55	Terminate at 400V MCC and Dust Extraction Desiccant Dryer #2		
P2.56	Terminate at 400V MCC and screw conveyor #2		
P2.57	Terminate at Auxiliary panel and Railway signal supplies		
P2.58	Terminate at Auxiliary panel and PLC panel lighting		
P2.59	Terminate at Auxiliary panel and CCTV cameras & monitor		
P2.60	Terminate at Auxiliary panel and Battery Charger/s		
P2.61	Terminate at Auxiliary panel and overhead crane JB		
P2.62	Terminate at Auxiliary panel and tippler cage drive motor anti-condensation heater		
P2.63	Terminate at Auxiliary panel and positioner drive motors anti-condensation heaters		
P2.64	Terminate at Auxiliary panel and LCS & I/O station heaters		
P2.65	Terminate at Auxiliary panel and panels in MV, LV & Control room anti-condensation heaters		
P2.66	Terminate at Auxiliary panel and hydraulic pump motors anti-condensation heater		
P.3	**Low Voltage Cables- 230V**		
P3.1	Terminate at 230V at 400V MCC panel and UPS		
P3.2	Terminate at UPS and PLC Rack		
P3.3	Terminate at UPS and socket outlet for laptop		
P3.4	Terminate at UPS and operators control room SCADA PC		
P3.5	Terminate at UPS and positioner encoder module		
P3.6	Terminate at UPS and tippler cage encoder modules #1 & #2		
P.4	**Control Cables - 110V**		
P4.1	Terminate 110V at PLC and operators control room fibre optic module		
P4.2	Terminate 110V at PLC panel and warning relay supply		
P4.3	Terminate 110V at marshalling panel and Positioner Land LCS		
P4.4	Terminate 110V at marshalling panel and Tippler entry LCS		
P4.5	Terminate at 110V marshalling panel and hopper LCS		
P4.6	Terminate 110V at marshalling panel and Entry Wheel grippers LCS		
P4.7	Terminate 110V at marshalling panel and Exit Wheel grippers LCS		
P4.8	Terminate 110V at marshalling panel and Positioner Land LCS		
P4.9	Terminate 110V at marshalling panel and Positioner Land Distributed I/O panel		
P4.10	Terminate 110V at marshalling panel and Tippler entry Distributed I/O panel		
P4.11	Terminate 110V at marshalling panel and hopper LCS Distributed I/O panel		

P4.12	Terminate 110V at marshalling panel and Entry Wheel grippers Distributed I/O panel		
P4.13	Terminate 110V at marshalling panel and Exit Wheel grippers Distributed I/O panel		
P4.14	Terminate 110V at marshalling panel and positioner over-travel circuit		
P4.15	Terminate 110V at marshalling panel and tippler cage over-travel circuit		
P4.16	Terminate 110V at marshalling panel and hopper LCS for the following signals: i. Hopper full; ii. Block chute; iii. Tilt switch/bindicator iv. Control units		
P4.17	Terminate 110V at marshalling panel and entry gripper #1 solenoids		
P4.18	Terminate 110V at marshalling panel and entry gripper #2 solenoids		
P4.19	Terminate 110V at marshalling panel and entry gripper #3 solenoids		
P4.20	Terminate 110V at marshalling panel and exit gripper solenoids		
P4.21	Terminate 110V at marshalling panel and positioner main arm solenoids		
P4.22	Terminate 110V at marshalling panel and positioner last car arm solenoids		
P4.23	Terminate 110V at marshalling panel and positioner drive #1 brake solenoids		
P4.24	Terminate 110V at marshalling panel and positioner drive #2 brake solenoids		
P4.25	Terminate 110V at marshalling panel and positioner drive #3 brake solenoids		
P4.26	Terminate 110V at marshalling panel and positioner drive #4 brake solenoids		
P4.27	Terminate 110V at marshalling panel and positioner drive #5 brake solenoids		
P4.28	Terminate 110V at marshalling panel and positioner drive #6 brake solenoids		
P4.29	Terminate 110V at marshalling panel and positioner drive #7 brake solenoids		
P4.30	Terminate 110V at marshalling panel and positioner drive #8 brake solenoids		
P4.31	Terminate 110V at marshalling panel and tippler warning siren		
P.5	**Control Cables - 24V**		
P5.1	24V to laser		
P5.2	24V to operators control room fibre optic module		
P5.3	24V for fibre optic modules		
	Sub-Total Cable Terminations (Contractor is responsible to provide all termination kits, splicing kits and any other consumables required to terminate)		
Q	**Works Punch Listing & Inspection – Mechanical**	**Sum**	
Q.1	**Wagon tippler cage**		
Q1.1	**Tippler Punch Listing**		
Q1.1.1	The Contractor will create Punch Lists		
Q1.2	**Final Inspection**		
Q1.2.1	The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state		
Q1.3	**Final Document Check**		
Q1.3.1	Final document check to verify that all specified operations have been completed with satisfactory results		
Q.2	**Positioner system**		
Q2.1	**Positioner Punch Listing**		
Q2.1.1	The Contractor will create Punch Lists		
Q2.2	**Final Inspection**		
Q2.2.1	The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state		
Q2.3	**Final Document Check**		
Q2.3.1	Final document check to verify that all specified operations have been completed with satisfactory results		
Q.3	**Train holding devices**		
Q3.1	**Grippers Punch Listing**		
Q3.1.1	The Contractor will create Punch Lists		
Q3.2	**Final Inspection**		
Q3.2.1	The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state		
Q3.3	**Final Document Check**		
Q3.3.1	Final document check to verify that all specified operations have been completed with satisfactory results		
Q.4	**Hoppers & apron feeders**		
Q4.1	**Punch Listing**		
Q4.1.1	The Contractor will create Punch Lists		

Q4.2	**Final Inspection**		
Q4.2.1	The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state		
Q4.3	**Final Document Check**		
Q4.3.1	Final document check to verify that all specified operations have been completed with satisfactory results		
Q.5	**Dust Extraction & Collection System**		
Q5.1	**Punch Listing**		
Q5.1.1	The Contractor will create Punch Lists		
Q5.2	**Final Inspection**		
Q5.2.1	The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state		
Q5.3	**Final Document Check**		
Q5.3.1	Final document check to verify that all specified operations have been completed with satisfactory results		
Q.6	**Dust Cowl**		
Q6.1	**Punch Listing**		
Q6.1.1	The Contractor will create Punch Lists		
Q6.2	**Final Inspection**		
Q6.2.1	The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state		
Q6.3	**Final Document Check**		
Q6.3.1	Final document check to verify that all specified operations have been completed with satisfactory results		
	Sub-Total Works Punch Listing & Inspection – Mechanical		
R	**Works Punch Listing & Inspection – Electrical**	**Sum**	
R0.10	**Cables**		
R1.10	**Continuity & Insulation**		
R1.1.1	*Continuity Tests*		
R1.1.2	*Insulation Tests*		
R1.1.3	*Main Earth Bonding Checks*		
R1.20	**Punch Listing**		
R1.2.1	The Contractor will create Punch Lists		
R1.30	**Final Inspection**		
R1.3.1	The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state		
R1.40	**Final Document Check**		
R1.4.1	Final document check to verify that all specified operations have been completed with satisfactory results		
R0.20	**Electrics House and Control Room**		
R2.10	**Conduct checks applicable to the following equipment: -**		
R2.1.1	*400V MCC*		
R2.1.2	*Positioner VVVF Drive Panel*		
R2.1.3	*Tippler VVVF Drive Panel*		
R2.1.4	*Apron Feeders VVVF Drive Panel*		
R2.1.5	*PLC Panel.*		
R2.1.6	*Operators Control desk*		
R2.20	**Punch Listing**		
R2.2.1	The Contractor will create Punch Lists		
R2.30	**Final Inspection**		
R2.3.1	The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state		
R2.40	**Final Document Check**		
R2.4.1	Final document check to verify that all specified operations have been completed with satisfactory results		
R0.30	**Junction Boxes (JB) and Marshalling Boxes (MB)**		
R3.10	**Punch Listing**		
R3.1.1	The Contractor will create Punch Lists		
R3.20	**Final Inspection**		
R3.2.1	The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state		
R3.40	**Final Document Check**		
R3.4.1	Final document check to verify that all specified operations have been completed with satisfactory results		
R0.40	**Local Control Stations**		
R4.10	**Punch Listing**		

R4.1.1	The Contractor will create Punch Lists		
R4.20	**Final Inspection**		
R4.2.1	The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state		
R4.30	**Final Document Check**		
R4.3.1	Final document check to verify that all specified operations have been completed with satisfactory results		
R0.50	**Entry Wheel Grippers & Exit Wheel Grippers**		
R5.10	**Conduct checks applicable to the following equipment: -**		
R5.1.1	*Entry Wheel Grippers Limit Switches.*		
R5.1.2	*Entry Wheel Grippers Hydraulic Unit.*		
R5.1.3	*Exit Wheel Grippers Limit Switches.*		
R5.1.4	*Exit Wheel Grippers Hydraulic Unit.*		
R5.20	**Punch Listing**		
R5.2.1	The Contractor will create Punch Lists		
R5.30	**Final Inspection**		
R5.3.1	The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state		
R5.40	**Final Document Check**		
R5.4.1	Final document check to verify that all specified operations have been completed with satisfactory results		
R0.60	**Positioner**		
R6.10	**Conduct checks applicable to the following equipment: -**		
R6.1.1	*Positioner Drive Motors, Cooling Fans & Encoders.*		
R6.1.2	*Positioner Arm Motor & Encoder.*		
R6.1.3	*Positioner Drive Gearbox Sensors.*		
R6.1.4	*Positioner Arm & Last Car Lasers.*		
R6.1.5	*Positioner Lubrication Systems.*		
R6.1.6	*Positioner Brake Systems.*		
R6.1.7	*Positioner Limit Switches.*		
R6.1.8	*Festoon System.*		
R6.1.9	*Audible Alarm.*		
R6.1.10	*Warning Beacon.*		
R6.20	**Punch Listing**		
R6.2.1	The Contractor will create Punch Lists		
R6.30	**Final Inspection**		
R6.3.1	The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state		
R6.40	**Final Document Check**		
R6.4.1	Final document check to verify that all specified operations have been completed with satisfactory results		
R0.70	**Tippler**		
R7.10	**Conduct checks applicable to the following equipment: -**		
R7.1.1	*Motors, Cooling Fans & Encoders*		
R7.1.2	*Lubrication Systems*		
R7.1.3	*Roller Bearing Temperature Sensors*		
R7.1.4	*Brake Systems*		
R7.1.5	*Limit Switches*		
R7.1.6	*Entry & Exit Clear Photocells*		
R7.1.7	*Cables*		
R7.1.8	*Audible Alarms*		
R7.1.9	*Warning Beacons.*		
R7.20	**Punch Listing**		
R7.2.1	The Contractor will create Punch Lists		
R7.30	**Final Inspection**		
R7.3.1	The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state		
R7.40	**Final Document Check**		
R7.4.1	Final document check to verify that all specified operations have been completed with satisfactory results		
R0.80	**Land Cables and Cable Trays**		
R8.10	**Conduct checks of all interconnecting cables**		
R8.1.1	*Check that all cables have been properly secured along their length*		
R8.1.2	*Check that the gland at each end of all cables has been fitted correctly*		
R8.1.3	*Check that the cable trays have been fitted correctly and have earth bonding straps fitted*		

R8.20	**Punch Listing**		
R8.2.1	The Contractor will create Punch Lists		
R8.30	**Final Inspection**		
R8.3.1	The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state		
R8.40	**Final Document Check**		
R8.4.1	Final document check to verify that all specified operations have been completed with satisfactory results		
	Sub-Total Works Punch Listing & Inspection – Electrical		
S	**Testing (De-Energised): Electrical Land Equipment**	**Sum**	
S.1	**Conduct point to point tests applicable to the following equipment: -**		
S1.1	*400V MCC*		
S1.2	*Positioner Drive Inverter Panels*		
S1.3	*Tippler Drive Inverter Panels*		
S1.4	*Land Junction Boxes and Marshalling Boxes*		
S1.5	*Land Local Control Stations*		
S1.6	*Entry Wheel Grippers Limit Switches*		
S1.7	*Entry Wheel Grippers Hydraulic Unit*		
S1.8	*Exit Wheel Grippers Limit Switches*		
S1.9	*Exit Wheel Grippers Hydraulic Unit*		
S1.10	*Positioner Festoon Track Limit Switches*		
S1.11	*Tippler Motors, Cooling Fans & Encoders*		
S1.12	*Tippler Entry & Exit Lasers*		
S1.13	*Tippler Lubrication Systems*		
S1.14	*Tippler Roller Bearing Temperature Sensors*		
S1.15	*Tippler Brake Systems*		
S1.16	*Tippler Limit Switches*		
S1.17	*Tippler Cable Loops*		
S1.18	*Land Audible Alarms*		
S1.19	*Land Warning Beacons*		
S1.20	*Land Interconnecting Cables.*		
S.2	**Continuity Tests**		
S.3	**Insulation Resistance (IR) Tests**		
S.4	**Earth Fault Continuity Tests**		
	Sub-Total Testing (De-Energised): Electrical Land Equipment		
T	**TESTING (DE-ENERGISED): Positioner**	**Sum**	
T.1	**Positioner Festoon cables** (tests should be completed on the Positioner festoon cables before their connection either end)		
T1.1	*Continuity Tests*		
T1.2	*Insulation Resistance Tests on Power Cables*		
T1.3	*Insulation Resistance Tests on Control Cables*		
T1.4	**Cables To Positioner Machine**		
T1.4.1	***Perform tests after the festoon cables have been connected both ends and before connection to any incoming power supplies***		
T1.5	*Termination Checks*		
T1.6	*Earth Continuity Checks*		
T1.7	*Earth Bonding Checks*		
	Sub-Total TESTING (DE-ENERGISED): Positioner		
U	**Electrical Site Testing**	**Sum**	
U.1	**Energising: MCC & PLC (Carry out the following checks:)**		
U1.1	**Protection Settings**		
U1.2	**MCC Panel Incoming Supply Voltage**		
U1.3	**MCC Panel Distribution Voltages**		
U1.4	**Energising PLC**		
U1.4.7	**Check the Following**		
U1.4.7.1	*Positioner Encoder*		
U1.4.7.2	*Tippler Encoder.*		
U1.4.8	*Check that these encoders are operating correctly in accordance with their operating manuals and are correctly addressed and communicating via the Profibus network*		
U.2	**Energising Intouch SCADA**		

U2.1	Check, that the Intouch SCADA system hardware is operating correctly in accordance with its operating manual.		
U2.2	Check that the Intouch SCADA application program is loaded correctly and running.		
U2.3	Check that Intouch SCADA is communicating with the PLC Ethernet Communication Card and PLC I/O Database.		
U2.4	Toggle the "Cycle Start Pushbutton" on the relevant Intouch SCADA Screen and Check that the PLC receives the correct Signal.		
U2.5	Toggle the status of a known PLC Input or Output and check that the Intouch SCADA shows the correct status.		
U.3	**110V AC Relay and Contactor Circuitry**		
U3.1	Check out the correct operation of all the 110V AC relay and contactor circuitry against the schematic drawings and rectify any errors found		
U.4	**Emergency Stop & Overtravel Circuitry**		
U4.1	Check out the correct operation of all the emergency stop & overtravel circuitry in schematic drawing and rectify any errors found		
U.5	**Energising MCC Motor Starter Modules**		
U5.1	***Tests apply respectively to all the motor starter modules***		
U5.1.1	*Entry Wheel Grippers & THA Hyd. Pump Motor #1*		
U5.1.2	*Entry Wheel Grippers & THA Hyd. Pump Motor #2*		
U5.1.3	*Entry Wheel Grippers & THA Hyd. Pump Motor #3*		
U5.1.4	*Entry Wheel Grippers & THA Fill Filter Pump #1*		
U5.1.5	*Entry Wheel Grippers & THA Fill Filter Pump #2*		
U5.1.6	*Entry Wheel Grippers & THA Fill Filter Pump #3*		
U5.1.7	*Exit Wheel Grippers & THA Hyd. Pump Motor #1*		
U5.1.8	*Exit Wheel Grippers & THA Fill Filter Pump*		
U5.1.9	*Positioner Hyd. Pump Motor #1*		
U5.1.10	*Positioner Hyd. Pump Motor #2*		
U5.1.11	*Positioner Fill Filter Pump.*		
U.6	**Commission the brake systems**		
U6.1	**Positioner Brake Systems**		
U6.1.1	***Commission the Positioner Brake Systems for operation in accordance with their Manufacturer Instruction Manuals. This should include but not be limited to:*** *– Ensuring all safety devices are fully functional* *– Checking correct operation all associated PLC inputs and outputs for these systems.*		
U6.1.2	Check correct operation of all brakes and feedback signals to the PLC		
U6.2	**Commission the Tippler Brake System**		
U6.2.1	Commission the Tippler Brake System for operation in accordance with the Manufacturer Instruction Manuals. This should include but not be limited to: *– Tippler Entry & Exit Normal Brake* *–Tippler Entry & Exit Emergency Brake* *–Ensuring all safety devices are fully functional* *–Checking correct operation all associated PLC inputs and outputs for these systems.*		
U6.2.2	Check correct operation of all the tippler brake systems and their feedback signals to the PLC		
U.7	**ENERGISING: AC VVVF DRIVE CUBICLES & EQUIPMENT TESTING**		
U7.1	**Test AC drives and their VVVF drive motors**		
U7.1.1	*Positioner Drive Motor #1*		
U7.1.2	*Positioner Drive Motor #2*		
U7.1.3	*Positioner Drive Motor #3*		
U7.1.4	*Positioner Drive Motor #4*		
U7.1.5	*Positioner Drive Motor #5*		
U7.1.6	*Positioner Drive Motor #6*		
U7.1.7	*Positioner Drive Motor #7*		
U7.1.8	*Positioner Drive Motor #8*		
U7.1.9	*Tippler Entry Drive Motor*		
U7.1.10	*Tippler Exit Drive Motor*		
U7.1.11	*Apron Feeder Drive Motor #1*		
U7.1.12	*Apron Feeder Drive Motor #2*		
U7.1.13	*Apron Feeder Drive Motor #3*		
U7.1.14	*Apron Feeder Drive Motor #4*		
U7.1.15	*Apron Feeder Drive Motor #5.*		
U7.2	**Protection Settings**		
U7.3	**110V AC DC Control Supply Voltages**		

U7.4	**240V AC Motor Heater Supplies**		
U7.5	**Software Configuration of AC drives**		
U7.6	**AC Drive Cubicle Ancillary Circuits**		
U7.6.1	**Perform checks and tests on the following associated circuits before the AC drives are powered up:**		
U7.6.1.1	*Drive motor thermistor circuit*		
U7.6.1.2	*Drive motor tacho speed encoder*		
U7.6.1.3	*Profibus data communication circuitry*		
U7.6.1.4	*Emergency stop circuitry*		
U7.6.1.5	*Start Contactor circuitry*		
U7.6.1.6	*Positioner Encoder circuitry*		
U7.6.1.7	*Tippler Encoder circuitry*		
	Sub-Total Electrical Site Testing		
V	**Commissioning No-Load Operation:**	**Sum**	
V.1.1	**Positioner Drive Motors**		
V1.1.1	*Positioner Drive Motor #1*		
V1.1.2	*Positioner Drive Motor #2*		
V1.1.3	*Positioner Drive Motor #3*		
V1.1.4	*Positioner Drive Motor #4*		
V1.1.5	*Positioner Drive Motor #5*		
V1.1.6	*Positioner Drive Motor #6*		
V1.1.7	*Positioner Drive Motor #7*		
V1.1.8	*Positioner Drive Motor #8.*		
V1.1.10	**Energising the Positioner Motors on No-Load**		
V1.1.10.1	**Ensure the following AC drive Profibus signals are communicating and are calibrated correctly:**		
V1.1.10.1.1	*Speed reference*		
V1.1.10.1.2	*Speed feedback*		
V1.1.10.1.3	*Torque feedback (if required)*		
V1.1.10.8	After the individual Positioner AC drives have been set-up and operated successfully, operate the complete Positioner AC drive 'system' under no load conditions at all speeds, recording the values of voltage, current and frequency		
V.1.2	**Tippler Drive Motors**		
V1.2.1	*Tippler Entry Drive Motor*		
V1.2.2	*Tippler Exit Drive Motor.*		
V1.2.3	**Energising Each Tippler Motor on No-Load**		
V1.2.3.1	Operate each Tippler AC drive and its associated drive motor. Perform functional tests to confirm that each drive 'system' is operating satisfactorily, including the motor's tacho speed encoder, thermistor, and anti-condensation heater circuit.		
V1.2.4	**Ensure the following AC drive Profibus signals are communicating and are calibrated correctly:**		
V1.2.4.1	*Speed reference*		
V1.2.4.2	*Speed feedback*		
V1.2.4.3	*Torque feedback (if required)*		
V1.2.5	**Operating Tippler on No-Load**		
V1.2.5.1	Operate both Tippler AC drives as a 'system' under no load conditions at all the speeds specified in the Results Table, recording the values of voltage, current and frequency.		
V1.2.5.2	Set the maximum 'Maintenance Mode' speed of each Tippler cell to 6.0 degrees/second.		
V1.2.5.3	Isolate the MCC motor starters for the Tippler Brake Motors and remove any temporary PLC changes made		
	Sub-Total Commissioning No-Load Operation:		
W	**Operational Tests in Maintenance Mode**	**Sum**	
W1.2	**Commission the Entry Wheel Grippers Hydraulic Systems**		
	Commission the Entry Wheel Grippers Hydraulic Power Pack and hydraulic system in accordance with the Manufacturers Instruction Manual. This should include but not be limited to:		
W1.2.1	*Checking for correct rotation of all Motors & Pumps*		
W1.2.2	*Flushing the system for at least two hours using temporary filters*		
W1.2.3	*Fitting new filters after flushing*		
W1.2.4	*Inspecting all pipework for leaks and rectify any found*		
W1.2.5	*Ensuring correct pressures are attained*		
W1.2.6	*Ensuring all safety devices are fully functional*		
W1.2.7	*Checking correct operation all PLC inputs and outputs at the hydraulic power pack.*		
W1.3	**Operating the Entry Wheel Grippers #1, #2, #3**		

W1.3.1	Operate the Wheel Grippers to check for correct operation of all the limit / Pressure switches and their signals back to the PLC.		
W1.3.2	Operate the Wheel Grippers to measure and record the pressures, operating times, pressure and settings, record results and present the results to the Transnet Project Manager for review and approval in principle.		
	Sub-Total Operational Tests in Maintenance Mode		
X	**Operational Tests IN 'LOCAL' MODE**	**Sum**	
X.1	**EXIT WHEEL GRIPPERS (NO WAGONS)**		
X1.1	**Commission the Entry Wheel Grippers Hydraulic Systems**		
	Commission the Exit Wheel Grippers Hydraulic Power Pack and hydraulic system in accordance with the Manufacturers Instruction Manual. This should include but not be limited to:		
X1.1.1	*Checking for correct rotation of all Motors & Pumps*		
X1.1.2	*Flushing the system for at least two hours using temporary filters*		
X1.1.3	*Fitting new filters after flushing*		
X1.1.4	*Inspecting all pipework for leaks and rectify any found*		
X1.1.5	*Ensuring correct pressures are attained*		
X1.1.6	*Ensuring all safety devices are fully functional*		
X1.1.7	*Checking correct operation all PLC inputs and outputs at the hydraulic power pack.*		
X1.2	**Operating the Exit Wheel Grippers**		
X1.2.1	Operate the Wheel Grippers to check for correct operation of all the limit / Pressure switches and their signals back to the PLC.		
X1.2.2	Operate the Wheel Grippers to measure and record the pressures, operating times, pressure and settings, record results and present the results to the Transnet Project Manager for review and approval in principle.		
	Sub-Total Operational Tests IN 'LOCAL' MODE		
Y	**Operational Tests IN 'LOCAL' MODE**	**Sum**	
Y.1	**Positioner (No Wagons)**		
Y1.1	Commission the Positioner Lock-off Stop Pushbuttons		
Y1.2	Commission the Tippler Warning Devices		
Y1.3	Commission the Positioner Lubrication Systems		
Y1.4	Commission the Positioner Lubrication Systems for operation in accordance with their OEM's Instruction Manuals. This should include but not be limited to:		
Y1.4.1	*Filling with lubricant(s)*		
Y1.4.2	*Checking for correct rotation of the pump motor and air compressor*		
Y1.4.3	*Flushing the systems using temporary filters*		
Y1.4.4	*Fitting new filters after flushing*		
Y1.4.5	*Inspecting all pipework for leaks and rectify any found*		
Y1.4.6	*Ensuring correct pressures are attained*		
Y1.4.7	*Ensuring all safety devices are fully functional*		
Y1.5	Checking correct operation all associated PLC inputs and outputs for these systems		
Y1.6	Force respective PLC outputs as required to check correct delivery of lubricant at each delivery point and feedback signals to the PLC		
Y1.7	**Commission the Positioner Limit Switches**		
	Set up the following Positioner travel limit switches in accordance with the relevant drawing:		
Y1.7.1	*Positioner Forward Overtravel Limit*		
Y1.7.2	*Positioner Forward Limit*		
Y1.7.3	*Positioner Reverse Limit*		
Y1.7.4	*Positioner Reverse Overtravel Limit*		
	Set up the following Positioner Arm limit switches in accordance with the relevant drawing:		
Y1.7.5	*Positioner Arm Lowered*		
Y1.7.6	*Positioner Arm Lowered Slowdown Limit*		
Y1.7.7	*Positioner Arm Raised*		
Y1.7.8	*Positioner Arm Raised Slowdown Limit*		
Y1.7.9	*Commission the Last Car laser.*		
Y1.8	**Commission the Positioner travel motion over normal travel range**		
Y1.9	**Commission the Positioner travel motion overtravel recovery**		
Y1.10	**Commission the Positioner Arm**		
Y1.11	**Commission the Positioner Encoder**		
Y1.12	**Commission the Positioner Arm Gap Laser**		
Y1.13	**Check Operation of Positioner temperature and vibration sensors**		

	Sub-Total Operational Tests IN 'LOCAL' MODE		
Z	**Operational Tests In 'Maintenance' Mode – Tippler (No Wagons)**	**Sum**	
Z.1	**Tippler**		
Z1.1	**Commission the Tippler Lubrication Systems**		
Z1.1.1	**Commission the Tippler Lubrication Systems for operation in accordance with their Manufacturers Instruction Manuals. This should include but not be limited to:**		
Z1.1.1.1	*Filling with lubricant(s)*		
Z1.1.1.2	*Checking for correct rotation of the pump motor*		
Z1.1.1.3	*Flushing the systems using temporary filters*		
Z1.1.1.4	*Fitting new filters after flushing*		
Z1.1.1.5	*Inspecting all pipework for leaks and rectify any found*		
Z1.1.1.6	*Ensuring correct pressures are attained*		
Z1.1.1.7	*Ensuring all safety devices are fully functional*		
Z1.1.1.8	*Checking correct operation all associated PLC inputs and outputs for these systems.*		
Z1.1.2	Force respective PLC outputs as required to check correct delivery of lubricant at each delivery point and feedback signals to the PLC		
Z1.2	**Commission the Tippler Limit Switches**		
Z1.2.1	**Set up the following Tippler limit switches in accordance with the relevant Drawings**		
Z1.2.1.1	*Overtravel Return Limit*		
Z1.2.1.2	*At Rail Level Limit*		
Z1.2.1.3	*Not Over tipped Limit*		
Z1.2.1.4	*Overtravel Tip Limit.*		
Z1.2.2	Operate each of the limit switches to ensure correct operation and feedback signals to the PLC		
Z1.3	**Commission the Tippler Local Control Stations**		
Z1.4	**Commission the Tippler Entry Clear lasers**		
Z1.5	**Commission the Tippler Exit Clear lasers**		
Z1.6	**Check Operation of Tippler Temperature Sensors**		
Z1.8	**Commission the Tippler Drive Motion Over Normal Travel Range**		
Z1.9	**Commission the Tippler Overtravel Recovery**		
Z1.10	**Conduct Tippler Motion No-Load Tests**		
Z1.11	**Conduct over tipping the Empty Tippler in Maintenance Mode**		
	Operational Tests In 'Maintenance' Mode – Tippler (No Wagons)		
AA	**Operational Tests in Semi-Auto Mode (No Wagons)**	**Sum**	
AA.1	**Positioner**		
AA1.2	**Initialising System for 'Semi-Auto' Mode**		
AA1.2.3	**Ensure in Maintenance Mode that:**		
AA1.2.3.1	*Positioner is fully back*		
AA1.2.3.2	*Positioner Arm is fully raised*		
AA1.2.3.3	*Train Holding Arm is fully Raised*		
AA1.2.3.4	*Tippler is at rail level*		
AA1.2.3.5	*Entry Wheel Grippers are fully released*		
AA1.2.3.6	*Exit Wheel Grippers are fully released*		
AA1.2.3.7	*The beam of the Last Car laser pair broken (block with a temporary cover).*		
	Operational Tests in Semi-Auto Mode (No Wagons)		
BB	**Operating Complete Car Tippler System In 'Semi-Auto' Mode (Individual Movements Through 'Next Step' Button)**	**Sum**	
BB.2	**Carry out the following:**		
BB2.1	*Entry Wheel Grippers will engage.*		
BB2.2	*Tippler to the normal tip position.*		
BB2.3	*Tippler travel back to rail level*		
BB2.4	*Positioner travel to the arm engage position.*		
BB2.5	*Positioner Arm swing up and down*		
BB2.6	*Entry Wheel Grippers release.*		
BB2.7	*Positioner travel to Train Holding Arm Engage position.*		
BB2.8	*Exit Wheel Grippers and train holding arm engage.*		

BB2.9	*Tippler move to the normal tip position.*		
BB2.10	*Tippler return back to rail level.*		
BB2.11	*Positioner arm retract to the fully retracted position. The positioner will then travel back to the arm engage position. The Entry wheel grippers will engage at the pre-determined position.*		
BB2.12	*Positioner arm will engage, entry & exit grippers will retract and Train Holding Arm will swing*		
	Sub-Total Operating Complete Car Tippler System In 'Semi-Auto' Mode (Individual Movements Through 'Next Step' Button)		
CC	**Operational Tests In 'Auto' Mode (No Wagons)**	**Sum**	
CC.1	**Operating Complete Car Tippler System in 'Auto Mode'**		
CC1.1	**Confirm the following events occur in sequence:**		
CC1.1.1	*The Entry Wheel Grippers release*		
CC1.1.2	*The Positioner moves to the fully forward position*		
CC1.1.3	*The Entry Wheel Grippers engage*		
CC1.1.4	*The Exit Wheel Grippers engage*		
CC.2	**TIP CYCLE**		
CC2.1	**Confirm the following events occur in sequence:**		
CC2.1.1	*The Exit Wheel Grippers release.*		
CC2.1.2	*The Entry Wheel Grippers engage at a pre-determined positioner position.*		
CC2.1.3	*The Positioner moves to the arm engage position.*		
CC2.1.4	*The Positioner Arm engages.*		
CC2.1.5	*The positioner moves to the fully forward position (THD Engage Position)*		
CC2.1.6	*The Exit Wheel Grippers engage.*		
CC.3	**Stopping the 'Auto' Mode by Removal of 'Tippler Permissive' Signal**		
CC4	**Locomotive and wagon clearances through tippler system**		
CC4.1	**Testing Locomotive and Wagon Clearances**		
CC4.1.1	Arrange for the train to be driven very slowly through the Entry Wheel Grippers, past the Positioner, through Tippler Cells and through the Exit Wheel Grippers		
CC4.2	**Setting Up Train Position Control Points**		
CC4.2.1	**Set-up or confirm the settings for correct operation of the following items:**		
CC4.2.1.1	*Last Car arm lasers*		
CC4.2.1.2	*Tippler Entry Clear lasers*		
CC4.2.1.3	*Tippler Exit Car lasers*		
CC4.2.1.4	*Positioner Forward Slowdown limit*		
CC4.2.1.5	*Positioner Reverse Slowdown limit*		
CC4.2.1.6	*Positioner Forward Limit*		
CC4.2.1.7	*Positioner reverse Limit*		
CC4.2.1.8	*Positioner Encoder settings*		
CC4.2.1.9	*Positioner Drive systems*		
CC4.2.1.10	*Rectify any problems found.*		
	Sub-Total Operational Tests In 'Auto' Mode (No Wagons)		
DD	**Full Operational Test In 'Auto' Mode (Complete Train of full Wagons)**	**Sum**	
DD.1	**Operating Complete Car Tippler System in 'Auto' Mode**		
DD1.1	***On Intouch SCADA, select 'Start Cycle' then confirm the following events occur in sequence:***		
DD1.1.1	*The Positioner arm engages.*		
DD1.1.2	*The Entry Wheel Grippers release.*		
DD1.1.3	*The Positioner moves to the fully forward position.*		
DD1.1.4	*The Exit Wheel Grippers engage.*		
DD1.1.5	*The Entry Wheel Grippers engage as the positioner returns to the back limit*		
DD.2	**TIP CYCLE**		
DD2.1	**Confirm the following events occur in sequence:**		
DD2.1.1	*The Tippler moves to normal tip position before returning to rail level and at the same time the Positioner Arm raises, and the Positioner returns to the fully back position*		
DD2.2.2	*The Positioner Travel VVVF drives are de-energised, and the brakes are applied*		
DD2.2	**Confirm the following events occur in sequence:**		
DD2.2.1	*The Exit Wheel Grippers release*		
DD2.2.2	*The Entry Wheel Grippers release*		
	Sub-Total Full Operational Test In 'Auto' Mode (Complete Train of full Wagons)		

EE	Mechanical Site Commissioning for The Wagon Unloading Station	Sum	
EE.1	**Hoppers And Apron Feeders**		
EE1.1	Check that the hoppers and feeders have been installed as per the relevant drawings. Particular attention should be given to the clearances around the feeder.		
EE1.2	Check the lubrication systems have been installed as described in the relevant drawings and lubrication schedule of the grease lubrication OEM. Pipes must be adequately supported and protected from damage from mechanical movement		
EE1.3	Check the Hopper liners have been installed and are secured		
EE1.4	Check the operation of the Knife Gate Assembly ensure that all the knife gates are able to extend and retract		
EE1.5	Check operation of all Apron Feeders and clearances between adjacent chutes and skirts		
EE.2	**Train Holding Devices**		
EE2.1	Check that the Gripper units have been assembled as described in the Contractor's drawings. Particular attention shall be given to each Gripper unit's relationship to the main rails		
EE2.2	Check the security of all bolted components and foundation bolts, particularly the rail clip fasteners		
EE2.3	Set each Gripper bar gap to the dimensions as shown on Contractor's drawings and check that the offset of this gap in relation to the main rail is correct.		
EE2.4	Check that the lubrication system has been installed to the requirements the grease lubrication OEM. Check that all pipe runs are secure, primed with grease and all discharge valves are set.		
EE2.5	Operate lubrication pump to ensure that all points requiring grease have been lubricated.		
EE2.6	Check that the hydraulic system has been installed to the requirements shown on the Contractors drawings and the hydraulic OEM requirements. Check that all pipe runs, and hoses are secure, and all connections are adequately tightened and free from leaks when the system is pressurised. Work thru OEM Pre-commissioning document.		
EE2.7	Ensure that grippers engage and retract fully.		
EE2.8	During operation, check that there is no binding of the pins and bushes.		
EE2.9	Check that limit switches are adjusted to trip when the grippers are in the retracted position.		
EE.3	**POSITIONER**		
EE3.1	Check that the positioner and track have been assembled and installed as per the Contractors drawings. Particular attention shall be given to the installation and alignment of positioner track and racks and their relationship to the main track as shown on the Contractors drawings.		
EE3.2	Check the security of all bolted components and foundation bolts.		
EE3.3	Check gearboxes are filled with oil to manufacturers requirements.		
EE3.4	Check that the lubrication systems have been installed to the grease lubrication OEM requirements. Check that all pipe runs are secure, purged and primed with grease.		
EE3.5	Check that the drive brake system has been installed to the suppliers' requirements.		
EE3.6	Release and lock off all positioner drive brakes		
EE3.7	Check that the rack is adequately coated with lubricant.		
EE3.8	Check positioner pinion mesh and guide roller clearances as required in Contractor's drawings		
EE3.9	Reset brakes		
EE3.10	Operate the positioner main arm for several cycles ensuring that there is free movement of all links, pins, and rollers.		
EE3.11	Check that the head is capable of lowering to the 908 mm dimension stated on Contractor's drawings from main rail level to underside of head and record below		
EE3.12	Operate positioner last wagon arm for several cycles ensuring that there is free movement of the rotary actuator. Check that the head is capable of lowering to the 840 dimension as per the Contractors drawings from main rail level to centre line of head. Also check that the arm will swing completely to the rest position		
EE3.13	Operate positioner last wagon arm coupler mechanism for several cycles ensuring that there is free movement of the coupler pin linkage and hydraulic cylinder. Check that the coupler is set for both the engaged and release positions		
EE3.14	Run Positioner along the entire length of track in "inch" mode in both directions with no wagon present. Stop the positioner at regular intervals and check that guide roller and track clearances correspond to those specified in the Contractors drawings. Re-adjust guide rollers if necessary		
EE3.15	Check guide roller setting as per Contractor's drawings and adjust if necessary		
EE3.16	Run positioner at slow speed to end stops at both ends of travel and check that the hydraulic buffers contact the end stops at the same time. Weld on suitable packing plate to stop face if necessary		
EE3.17	At the same time, check the stroke and freedom of movement of the positioner festoon system		

EE.4	**TIPPLER**		
EE4.1	Check that the tippler cage has been assembled and installed as described in the Contractors drawings. Particular attention should be given to support roller settings and main cage assembly tolerances		
EE4.2	Check the security of all bolted components and foundation bolts.		
EE4.3	Ensure gearboxes are filled with oil to manufacturers requirements.		
EE4.4	Check that the lubrication system has been installed to the grease lubrication OEM requirements		
EE4.5	Check that all pipe runs are secure, primed with grease and all discharge valves are set. If necessary, operate lubrication pumps to ensure that all points requiring grease have been purged, pressurised, and lubricated.		
EE4.6	Check that tippler racks have been adequately coated with lubricant.		
EE4.7	Check that the platform rails are aligned with the main rails to within ±3mm both laterally and vertically		
EE4.8	"Inch" rotate the cell through one complete cycle (to 180° and return) to check for correct mesh between the rack and pinion		
EE4.9	Inspect surface of racks for evidence of any hard contact with pinion, indicated by bright polished areas on the tooth face		
EE4.10	**During inch rotation test to 180° also check the following: -**		
EE4.10.1	*Rack and pinion engagement is satisfactory.*		
EE4.10.2	*Working clearances between rotating cage and foundations are satisfactory. Also, between the rotating cage and the dust cowl.*		
EE4.10.3	*Clamp gear operation is satisfactory and contacts their fully tipped stops without any interference.*		
EE4.11	During inch rotation test check operation of clamp gear assemblies through their full range of. Ensure there is no binding of links, pins or bushes. Check for lubrication pipework snags over full movement of clamps. In particular check that the tip side clamps are clear of any obstruction from the side pad.		
EE4.12	Rotate empty tippler cage through one complete tip and return cycle to 150° at slow speed and repeat checks.		
EE4.13	Rotate empty tippler cage through one complete tip and return cycle to 150° at full speed and check for smooth operation.		
EE4.14	Back rotate the tippler to confirm that the operation of the overtravel limit switch at -2.5 degrees and that buffers contact the stops at the same time. Weld on suitable packing plate to the stop face if necessary.		
EE4.15	Forward rotate the tippler to confirm the operation of the overtravel limit switch at 181° degrees and that buffers contact the stops at the same time. Weld on suitable packing to the stop face if necessary		
EE.5	**Dust extraction system**		
EE5.1	**DRIVE CHECKS**		
EE5.1.1	Dust extraction fan		
EE5.1.2	Dust extraction blower fan		
EE5.1.3	Dust storage pug mill		
EE5.1.4	Compressor 1		
EE5.1.5	Desiccant Dryer 1		
EE5.1.6	Dust Collector 1 Screw Conveyor		
EE5.1.7	Dust Collector 1 Rotary Vane Feeder		
EE5.1.8	Compressor 2		
EE5.1.9	Desiccant Dryer 2		
EE5.1.10	Dust Collector 2 Screw Conveyor		
EE5.1.11	Dust Collector 2 Rotary Vane Feeder		
EE5.2	**PULSE SYSTEMS**		
EE5.2.1	Pulse system across the cartridges		
EE5.3	**TESTS**		
EE5.3.1	Pulse System 1		
EE5.3.2	Pulse System 2		
EE5.3.3	Pulse System 3		
EE5.3.4	Pulse System 4		
EE5.3.5	Duct Pressure Sensor 1		
EE5.3.6	Duct Pressure Sensor 2		
EE5.4	**AIR VOLUME**		
EE5.4.1	Using a pilot tube and magnehelic gauge or manometer, check air volume at stack test points		
	Sub-Total Mechanical Site Commissioning for The Wagon Unloading Station		
FF	**System No Load Test (Individual Loaded Test)**	**Sum**	
FF.1	**TRAIN HOLDING DEVICES**		
FF1.1	Check clearances of the wagon in the tippler as the rake is pushed through		

FF1.2	Ensure the gripper bars are contacting the wagon wheel rims and that the wheels are central in the gripper units		
FF1.4	Check that the 4 wagon wheels are aligned with the exit wheel gripper units and engage wheel grippers. Ensure the gripper bars are contacting the wagon wheel rims and that the wheels are central in the gripper units		
FF.2	**POSITIONER**		
	To ensure that full functional test of the plant equipment can be carried out, a minimum of 14 empty wagons are required. Prior to loco marshalling into the Wagon Unloading system the following conditions must be satisfied: -		
FF2.1	*Positioner located at its datum position*		
FF2.2	*Positioner main arm raised*		
FF2.3	*Positioner last car arm swung out of the way*		
FF2.4	*Tippler aligned and stationary at rail level*		
FF2.5	*Tippler clamps fully raised. Note - clamp counterweight arms to be in contact with stop faces*		
FF2.6	*Tippler drive brakes on*		
FF2.7	*Entry track clear*		
FF2.8	*All wheel grippers retracted.*		
FF2.9	**Bringing in a new train**		
	Check relative clearance between the locomotive and the following components during this operation: -		
FF2.9.1	*End Rings and 'U' Frame Structures & Guide Blocks*		
FF2.9.2	*Clamps*		
FF2.9.3	*Side Pad & Tip Side Guide Blocks*		
FF2.9.4	*Cross Beam Guide Blocks*		
FF2.9.5	*End Ring Spill Plates and Covers.*		
FF2.10	**Complete Positioner Maintenance Set-Up Operation**		
FF2.11	**Complete Positioner Semi-Automatic Operation**		
FF2.12	**Complete Positioner Automatic Operation**		
FF.3	**TIPPLER**		
FF3.1	**At 90° carry out the following checks: -**		
FF3.1.1	*That there is full contact between the side pad and the wagon body.*		
FF3.1.2	*That there is a positive clamping action and full contact between all clamps and sill faces of wagons.*		
FF3.1.3	*That there is a positive clamping action and full contact between wagon wheels and platform rails.*		
FF3.1.4	*There is clearance between the clamp arm and the rear face of the side pad.*		
FF3.1.5	*That all clamp counterweight arms are not engaged with the stop pads.*		
FF3.2	**Return the tippler to rail level at slow speed and check the following: -**		
FF3.2.1	*That clamp gear assemblies return to the normal retracted position*		
FF3.2.2	*The stopping angles for normal return and over return conditions have not varied*		
FF3.2.3	*The platform rail and main rails are aligned to within ±3mm both laterally and vertically in the normal return position.*		
FF3.3	**Rotate the tippler at slow speed to normal tip position (actual tip angle to be recorded) and observe the following: -**		
FF3.3.1	*That there is full contact between the side pad and the wagon body.*		
FF3.3.2	*That there is a positive clamping action and full contact between all clamp beams and sill faces of wagon.*		
FF3.3.3	*That there is a positive clamping action and full contact between wagon wheels and platform rails.*		
FF3.3.4	*The stopping angle at the normal tip condition has not varied.*		
FF3.3.5	*The spillage of material around the end ring spill plates.*		
FF3.4	**Return the tippler to rail level at slow speed and observe the following:**		
FF3.4.1	*That the clamp gear assemblies return to the normal raised position, (counterweight arms in contact with stop pads).*		
FF3.4.2	*The stopping angle at normal return condition has not varied.*		
FF3.4.3	*The platform rails and main rails are aligned to within ±3mm both laterally and vertically in the normal return position.*		
	Sub-Total System No Load Test (Individual Loaded Test)		
GG	**SYSTEM LOADED TEST (TOTAL SEQUENTIAL OPERATION)**	**Sum**	
GG.1	**LOAD COMMISSIONING**		

	Chart recordings shall be made of the following parameters: -Recordings are required for no-wagon, empty wagon and maximum CR5, CR13 & CR14 wagon loads at normal operating speed and slow (maintenance) speed.		
GG1.1	*Position (rotation or linear as appropriate)*		
GG1.2	*Volts*		
GG1.3	*Amps*		
GG1.4	*Frequency*		
GG1.5	*Kilowatts*		
GG1.6	*Brake application sequence*		
GG1.7	*Positioner Main Arm operating time and pressures*		
GG1.8	*Positioner Last Wagon operating time and pressures*		
GG1.9	*Gripper's application times and pressures*		
GG1.10	*Reducer bearing and support roller bearing temperatures*		
GG1.11	*Noise emission levels at agreed locations.*		
GG.2	**Performance Testing**		
GG2.1	The performance test shall operate for a minimum of 5 rakes of 110 CR5 ore wagons and 5 rakes of 110 CR13 or CR14 wagons. During the performance testing, no further adjustments shall be performed.		
GG2.2	The performance test of the tippler, positioner, wheel grippers, feeders, and conveyor 308 shall achieve the required cycle times and feed rates for each component and the entire system.		
GG2.3	Feeder operation, including trimming to minimise feeder stoppages due to hoppers emptying below low level between tip cycles and prevent delays to subsequent cycles as a result of the hoppers overfilling		
GG2.4	Operation of Dust Extraction Equipment		
	Sub-Total SYSTEM LOADED TEST (TOTAL SEQUENTIAL OPERATION)		
FF	**Submittals**	**Sum**	
	The Contractor shall submit to the Project Manager documentation and drawings, including all revisions thereof, required for the project management, design, furnishing of equipment, fabrication, erection, installation, maintenance, and operation of the Machine		
FF.1	**Submittals shall include the following**		
FF1.1	Design Brief		
FF1.2	Project Management Procedures		
FF1.3	Equipment Specifications		
FF1.4	Control System Level 1,2 & 3		
FF1.5	Control System Quality Plan		
FF1.6	Operators Control Room & SCADA Specification		
FF1.7	PLC I/O Schedule		
FF1.8	Device Schedule		
FF1.9	Level 2 PLC Control Sequence Descriptions		
FF1.10	Drawings		
FF1.11	Calculations		
FF1.12	Erection Procedures		
FF1.13	Commissioning Procedures		
FF1.14	Installation, Operation, and Maintenance Manuals		
FF1.15	Quality Assurance Manual		
FF1.16	Contract Quality Plan		
FF1.17	Programs.		
FF.2	**Drawings**		
	The Contractor shall submit certified drawings for all of the detailed items supplied under the agreement and related equipment provided by others		
FF2.1	**Layout drawings**		
FF2.1.1	The Contractor shall submit certified drawings of all machine layouts or general arrangement drawings including, but not limited to motion extreme positions and limits. The arrangements shall indicate the location of major equipment components with requirements for installation, removal, and maintenance clearances		
FF2.2	**Structural drawings**		
FF2.2.1	The Contractor shall submit general arrangement and detail drawings showing the Machine steel structure and the loads for which it is designed.		
FF2.3	**Mechanical drawings**		
	The Contractor shall submit general arrangement and detail drawings showing all mechanical components and equipment assemblies, sub-assemblies and details including proprietary equipment. The drawings shall include but not be limited to:		

FF2.3.1	Overall arrangements showing leading dimensions of the Machine		
FF2.3.2	General arrangement and details of each component		
FF2.3.4	Arrangements, diagrams, and details of all hydraulic, pneumatic, lubrication, and dust suppression systems		
FF2.3.5	Manufacturer's certified arrangement and detail drawings of all equipment and components purchased by the Contractor		
FF2.4	**Electrical drawings**		
	The Contractor shall submit certified drawings of all electrical power and control system equipment including, but not limited to:		
FF2.4.1	Electrical Equipment Single Line Diagram		
FF2.4.2	General Arrangement drawings showing locations of all major items of electrical equipment, control equipment and lighting fixtures		
FF2.4.3	Control, instrumentation and alarm system block and wiring diagrams		
FF2.4.4	Main cable/conduit routing drawings and schedules		
FF2.4.5	Equipment lists indicating equipment voltages, rating, manufacturer, type and where applicable, fault current ratings		
FF2.4.6	Operator Panel Arrangements to scale		
FF2.5	**Erection drawings**		
	The Contractor shall provide erection drawings required for the Machine to be fully assembled and erected on site. Erection drawings shall include, but not be limited to the following:		
FF2.5.1	Sequence field assembly, installation and erection layouts identifying all components and clearance requirements		
FF2.5.2	Crane position and loading diagrams		
FF2.5.3	Weights and centres of gravity of major assemblies		
FF2.5.4	Connection details for major assemblies showing welding and bolting requirements at all connections		
FF2.5.5	Field run conduit and cable drawings, schedules and wiring diagrams		
FF2.6	**As-built drawings**		
	The Contractor shall provide the Project Manager with complete sets of certified A3 size As-Built Drawings plus electronic copies in AutoCAD format. The As-Built Drawings shall show all details of the Plant as actually built or constructed. The As-Built Drawings shall include the following, but not limited:		
FF2.6.1	*Family Tree*		
FF2.6.2	*All general arrangement drawings*		
FF2.6.3	*Detail drawings*		
FF2.6.4	*All mechanical component drawings including fully dimensional detail drawings and material specifications for all internal and external components*		
FF2.6.6	*Electrical drawings*		
FF2.6.8	*As-Built Bill of Quantities of the Plant in Excel format*		
FF.3	**Calculations**		
	The Contractor shall submit for review by the Transnet Project Manager, copies of design calculations and all explanatory notes including, but not limited to the following:		
FF3.1	*Scan 3D Tippler Cage*		
FF3.2	*FEA Model Tippler Cage*		
FF3.3	*Stress analyses plots*		
FF3.4	*Power and load calculations*		
FF3.5	*Other design calculations where requested by the Project Manager*		
FF.4	**Erection procedures**		
FF4.1	The Contractor shall submit a detailed erection procedure for the balance of plant		
FF.5	**Commissioning procedures**		
FF5.1	The Contractor shall submit written commissioning procedures		
FF.6	**Installation, operation and maintenance manuals**		
FF6.1	The Contractor shall submit to the Project Manager for review two (2) draft copies of Installation, Operation, Maintenance and Training Manuals for all of the equipment covered by Machine Specifications		
FF6.2	The final issue of the manuals shall be six (6) sets of hard copies bound in A4 size, three-ring binders and two (2) sets of electronic files in MS Word and PDF format on compact disks		
FF.7	**PLC and HMI programs**		
FF7.1	The Contractor will provide the Programmable Logic Control (PLC) and Human Machine Interface (HMI) licensed software shall be provided on the original manufacturer's discs. The customised programs shall be provided in the electronic format on CDs and in hardcopy printout		
FF.8	**Spare parts**		
	The Contractor shall submit detailed lists of all recommended spare parts for:		
FF8.1	*Commissioning and start-up;*		

FF8.2	*Twelve (12) months of operation;*		
	Sub-Totals Submittals		
HH	**Environmental Constraints and Management**	**Sum**	
	The Contractor must supply the following, namely: -		
HH.1	*Environmental Management plan*		
HH.2	*Environmental file*		
HH.3	*Environmental method statements for all construction operations at the Site and/or Working Area*		
	Sub-Totals Environmental Constraints and Management		
JJ	**Project Execution**	**Sum**	
	The Contractor must supply a Project Execution plan, which will cover as a minimum the following: -		
JJ.1	*Project Definition and Set-up phase*		
JJ.2	*Design phase*		
JJ.3	*Procurement and fabrication phase*		
JJ.4	*Construction phase*		
JJ.5	*Commissioning, handover, and close-out phase.*		
	Sub-Total Project Execution		
KK	**Safety Management**	**Sum**	
KK.1	Full-time, site-based Health and Safety Officer		
KK.3	Site-based staff entry medical examinations		
	Sub-Total Project Execution		
LL	**Project Controls**	**Sum**	
LL.1	**Document management**		
LL1.1	Contractor document controller		
LL.2	**Project reporting**		
LL2.1	Contractor Project Planner		
LL.3	**Cost Reporting**		
LL3.1	Contractor Cost Controller		
	Sub-Total Project Controls		
MM	**Project Quality Assurance**	**Sum**	
	The Contractor shall submit the following: -		
MM.1	Project Quality Management plan		
MM.2	Contractor Quality Lead		
	Sub-Total Project Quality Assurance		
NN	**Training**	**Sum**	
	The Contractor shall be responsible for the following: -		
NN.1	Operational Training Manual		
NN.2	Maintenance Training Manual		
NN.3	Training Officer for a period of 3 months		
	Sub-Total Training		

GRAND TOTAL TIPPLER 3		

C2.2 Staff *Rates*

This section can be used when the *staff rates* are considerable in number and more conveniently located here than in the Contract Data. Entries in the Contract Data should refer to this section of Part 2.

1.4 The staff and equipment rates are:

No.	Designation (or category) or name of staff member	Rate per {hour, day, month} excluding VAT
1	Mechanical Engineer (Tippler Design)	
2	Mechanical Engineer (BMH)	
3	Electrical Engineer	
4	Electronics Engineer	
5	Hydraulic Engineer	
6	Civil Engineer	
7	Quantity Surveyor	
8	Fitter	
9	Welder	
10	Boilermaker	
11	Electrician	
12	PLC Engineer	
13	Drives Integrator	
14	Hydraulic technician	
15	Grease Lubrication technician	
16	Semi-Skilled labourer	
17	Helper	
18	Sandblast Operator	
19	Spray Painter	
20	Sandblast Pot and painting equipment	
21	Container c/w with tools and rigging equipment to support above resources	
22	Generator/Welding machine	
23	Air Compressor	
24	Cranes - Specify	
25	Telehandler	
26	Cherry Picker	
27	Truck	
28	LDV	
29		
30		
31		

SCOPE OF WORK Rev 1

TIPPLER CAGE /TRAIN POSITIONER / APRON FEEDERS / DUST HANDLING PLANT / CONTROL SYSTEM (PLC/SCADA)

Document Reference	**Title**	**No of page**
	This cover page	1
C3.1	*Employer's* Works Information	
	Total number of pages	**130**

Table of Contents

Tables

Figures

1 Definitions/Abbreviations

Table 1: Definitions and abbreviations

Acronym / Abbreviation	Description
BMH	Bulk Materials Handling
BoQ	Bill of Quantity
EPC	Engineering, Procurement and Construction
HAZOP	Hazard & Operability Analysis
HSEQ	Health, Safety, Environmental and Quality
HSSMP	Health, Safety and Security Management Plan
ITP's	Inspection and Test Plans
Km	Kilometre
MPI	Magnetic Particle Inspection
Mtpa	Million tonnes per annum
NDT	Non-Destructive Testing
P & ID's	Piping and Instrumentation Diagrams
PFD's	Process Flow Diagrams
TFR	Transnet Freight Rail
TIMS	Transnet Integrated Management Systems
TPT	Transnet Port Terminals
WBS	Work Breakdown Structure

2 Standards

Standards shall be prioritized as stated below, the standard stated at the top having the highest priority should there be conflict.

2.1 Project Standards

The documentation listed in the tables below is used as a reference and/or guideline, with the purpose to enhance the interpretation of this document.

Table 2: Transnet specifications

Standard no.	Document Title
EEAM-Q-008	Corrosion Protection
EEAM-Q-009	Quality Management

2.2 National Standards

Table 3: National standards

Standard no.	Document title
SANS 094	The use of high strength friction grip bolts
SANS 10142-1	The Wiring of Premises – Part 1: Low-Voltage Installations
SANS 10142-2	The Wiring of Premises – Part 2: Medium-voltage Installations Above 1 Kv AC Not Exceeding 22 kV AC and Up to and Including 3000 Kw Installed Capacity
SANS 10198	The Selection, Handling of Installation of Electric Power Cables of Rating Not Exceeding 33 kV: Parts 1 to 14
SANS 135	ISO metric bolts, screws and nuts (hexagon and square)
SANS 136	ISO metric precision hexagon head bolts and screws, and hexagon nuts
SANS 1411	Materials of Insulated Electric Cables and Flexible Cords: Parts 1 to 7
SANS 1431	Weldable Structural Steel
SANS 1507	Electric Cables with Extruded Solid Dielectric Insulation for Fixed Installations (300/500 V To 1900/3300 V): Parts 1 to 6
SANS 1520	Flexible Electric Trailing Cables for Use in Mines – Part 1: Low-voltage (640/1100 V And 1900/3300 V) Cables: Parts 1 to 3
SANS 15708	Non-destructive testing - Radiation methods: Parts 1 and 2
SANS 1574	Electric Flexible Cables with Solid Extruded Dielectric Insulation: Parts 1 to 5
SANS 1804	Induction Motors: Parts 1 to 4
SANS 23279	Non-destructive testing of welds - Ultrasonic testing
SANS 3452	Non-destructive testing - Penetrant testing: Parts 1:to 4
SANS 763	Hot dip (galvanized) zinc coatings (other than on continuously zinc coated sheet and wire)
SANS 780	Distribution Transformers
SANS 9934	Non-destructive testing - Magnetic particle testing
SANS 62305-1:2011	Protection against lightning Part 1: General principles

Standard no.	Document title
SANS 62305-2:2011	Protection against lightning Part 2: Risk management
SANS 62305-3:2011	Protection against lightning Part 3: Physical damage to structures and life hazard
SANS 62305-4:2011	Protection against lightning Part 4: Electrical and electronic systems within structures
SANS 10313:2012	Protection against lightning - Physical damage to structures and life hazard
SANS 10161-1:2019	Basis of Structural Design and Actions for Buildings and Industrial Structures Part1: Basis of Structural Design
SANS 10199:2010	The design and installation of earth electrodes
SANS 1063:2011	Earth rods, couplers and connections
SANS 10200:1985	Neutral earthing in medium voltage industrial power systems
SANS 10292:2013	Earthing of low-voltage (LV) distribution systems
SANS 10142-1:2012	The wiring of premises Part 1: Low-voltage installations
SANS 10142-2:2009	The wiring of premises Part 2: Medium-voltage installations above 1 kV A.C. not exceeding 22 kV A.C. and up to and including 3 000 kW installed capacity
SANS 104 00: 2011	National Building Regulations

2.3 International Standards

Table 4: International standards

Standard no.	Document title
AFBMA	Anti-friction bearing manufacturers association (as applicable)
AGMA	American gear manufacturers association (as applicable)
ASME	American Society of Mechanical Engineers (As Applicable)
ASME B16.3	Flanges and Bolting for Pipes, Valves and Fittings.
ASTM	American Society of Testing and Materials (As Applicable)
AWS D1.1/D1.1M	Structural welding code – steel
BS 2634	Surface roughness comparison specimens
BS2573 part 1 1983	Rules for the design of cranes (structures).
BS2573 part 2 1980	Rules for the design of cranes (mechanisms);
BS 3790	Endless wedge belt and v-belt drives
BS 4235	Specification for Metric Keys and Keyways
BS 5228	Occupational noise management
BS 5499	Safety Signs for The Occupational Environment
BS 7608	Code of Practice for Fatigue Design and Assessment of Steel Structures
DIN 22101:2011-12	Continuous Conveyors- Belt conveyors for loose bulk materials
EN 10025	Hot-rolled steel flat products
EN 10025	Carbon steels & carbon manganese steels – hot rolled bars & semi-finished. Products

Standard no.	**Document title**
EN 10025	Structural Steel – Hot-Rolled Plates, Floor Plates and Slabs
EN 10083	Carbon Steels and Carbon Manganese Steels – Cold Finished Bars
EN 10088	Wrought Alloy Steels – Stainless Steel Bars and Semi-Finished Products
EN 10220	Steel Tubes for Mechanical Purposes
EN 12882	Conveyor Belting of Elastomeric and Steel Cord Construction
EN 13414	Wire-Rope Slings
EN 14399	High Strength Steel Bolts with Associated Nuts and Washers for Structural Engineering
EN 15877	PVC Pipes and Fittings for Pressure Applications
EN 20286	ISO System of Limits and Fits
EN 2560	Covered Electrodes for Welding
EN 583	Non-Destructive Testing – Ultrasonic Testing of Carbon and Low Alloy Steel Plate – Test Methods and Quality Classifications
EN 60204	Electrical Installations – Surface Mines and Associated Processing Plant
EN 60439	Low-Voltage Switchgear and Control Gear Assemblies – Type-Tested and Partially Type-Tested Assemblies
EN 61386	Electrical Installations – Selection of Cables
EN ISO 3743	Acoustics – Determination of Sound Power Levels of Noise Sources
EN ISO 4783	Metric Screws Threads for Fasteners
EN10219	Structural Steel Hollow Sections
FEM Section II 2.131/2.132	Rules for the design of mobile equipment for continuous handling of bulk materials
FM Global	FM Global Fire Protection Approval Standards (As Applicable)
GB/T 1591	High Strength Low Alloy Structural Steel
GB/T 5782	Hexagon Head Bolts
GB/T 5783	Hexagon Head Bolts – Full Thread
IEC 60204	Safety of Machinery
IEC 61508	Functional Safety of Electrical/Electronic/Programmable Equipment
ISO 10816	Mechanical Vibration – Evaluation of Machine Vibrations by Measurements on Non-Rotating Parts
ISO 128	Technical Drawing
ISO 12944	Guide to The Protection of Structural Steel Against Atmospheric Corrosion by The Use Of Protective Coatings
ISO 14520	Gaseous fire-extinguishing systems - Physical properties and system design
ISO 1461	Hot Dip Galvanised Coating of Fabricated Iron and Steel Articles. Specification And Test Methods
ISO 2408	Steel Wire Ropes

Standard no.	**Document title**
ISO 2631	Evaluation of Human Exposure to Whole-Body Vibration
ISO 281	Rolling Bearings – Dynamic Load Ratings and Rating Life
ISO 4014	ISO Metric Hexagon Bolts and Screws – Product Grade A and B
ISO 4016	ISO Metric Hexagon Bolts and Screws – Product Grade C
ISO 4032	ISO Metric Hexagon Nuts Including Thin Nuts, Slotted Nuts and Castle Nuts.
ISO 4413	Hydraulic Fluid Power – General Requirements for Systems
ISO 4759	Tolerances for ISO Metric Bolts, Screws, Studs and Nuts—Product Grades A, B And C
ISO 5048:1989	Continuous Mechanical Handling Equipment – Belt Conveyors Calculation of Operating Power and Tensile Forces
ISO 5049-1:1994	Mobile Equipment for continuous handling of bulk materials – Part 1: Rules for the design of steel structures
ISO 717	Acoustics – Methods for The Determination of Noise Rating Numbers
ISO 898	Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel
ISO 9001:2015	Quality management systems - Requirements

3 Preamble

3.1 Project Background

In 2018 Transnet embarked on the build of a third tippler at Saldanha Iron Ore Terminal.

The contract was awarded to Tenova Takraf, who sub-contracted the design of the wagon tippler to a UK company by the name of Ashton Bulk Ltd (AB). AB Ltd was established in 2010 because of the closure of the Metso MBH in Bristol.

AB Ltd scope of works was to design and detail the wagon unloading plant except for the apron feeders, tippler conveyor and dust extraction plant. The apron feeders and dust extraction plant were left to Tenova Takraf to size and supply, whilst the incline conveyor was designed by CKIT.

Based on differences, the contract with Tenova Takraf was terminated in the 3rd quarter of 2020. This termination left the installation of the tippler plant partially complete.

For this reason, in the 1st quarter of 2022, Transnet issued the designer (AB) of the wagon tippler an inquiry requesting the designer to establish state of equipment installed and BOQ and condition of uninstalled equipment.

The above will be referred to as Phase 1.

Phase 1: **Due diligence** including a **condition assessment** of all works done to date and a full description of the **'scope to go'** to be completed in phase 2.

Phase 2: Design (Engineering) Installation, Commissioning & Hand-over of Tippler 3.

3.2 Project Location

The project is located in the Iron Ore Terminal of Saldanha in the province of the Western Cape.

Figure 1: Aerial View of Tippler 3

4 Scope

Transnet will appoint a Contractor on the basis of Engineering, Procurement and Construction and Management (EPCM) who will be responsible to provide the following Works, namely:

Complete outstanding work as set out in this scope in the final delivery of a functional dual wagon tippler, train positioner and dust handling plant including hoppers and apron feeders; the work is currently in a partial completed state. The works to include engineering, procurement, transportation, installation and commissioning of a dual wagon tippler, train positioner and a dust handling plant and implement the Tippler Control System - Progammable Logic Control (PLC) and Supervisory Control and Data Acquisition (SCADA) system.
Include (Structural/Mechanical/Electrical/C&I – SME and C&I)

- **Tippler and Feeders** (Includes Cage, Positioner, Perways, Train Holding Equipment)
- **Dust Handling Plant**
- **Control System (PLC and SCADA – Tippler; Positioner; Knife Gates; Apron Feeders; Dust Handling Plant)**

Notwithstanding any detail of specific activities provided in these Works Information and Employer's Requirements, it is the responsibility of the Contractor to provide the Works compliant to the specifications contained herein with same being fit for the purpose for which they are intended.

These Employer's Requirements are accordingly not to be construed as constituting instructions to the Contractor on how to execute the Works, but are indicative only, and if any specific activity is not specified or included in the Employer's Requirements same shall not be deemed to be an exclusion of such activity and the Contractor shall undertake whatever activities are necessary to meet his contractual requirements.

4.1 Deliverables

4.1.1. "Functional" and "Compliant" with referenced specifications, control philosophies and assessment reports as listed in Section 27 include:
  4.1.1.1. Functional and Compliant Dual Wagon Tippler
  4.1.1.2. Functional and Compliant Train Positioner
  4.1.1.3. Functional and Compliant Dust Extraction and Handling Plant
  4.1.1.4. Functional and Compliant Apron Feeders and Knife Gate
  4.1.1.5. PLC/SCADA
  4.1.1.6. Auxiliary equipment – Rail Perways, Electrical and Hydraulic Installation

4.1.2. The Contractor is required to review and complete design, fabrication, corrosion protection, lubrication, installation, commissioning on all mechanical, structural, and electrical equipment including all communications and SCADA equipment associated with the equipment within the Contractor's battery limits as defined in the following sub-section.

4.1.3. Battery Limits for the Contractor's Scope:
  4.1.3.1. Mechanical:
    4.1.3.1.1. To include Dual Wagon Tippler
    4.1.3.1.2. To include Train Positioner
    4.1.3.1.3. To include Wheel Grippers
    4.1.3.1.4. To include 5 off Apron Feeders
    4.1.3.1.5. To include Dust Collection Plant
    4.1.3.1.6. To include all Hoppers and Chutes
  4.1.3.2. Rail:
    4.1.3.2.1. Rail entry point at outer edge of Ingo slab and exit at outer edge of Outgo slab, underside of rail on the Tippler rail level slab.
    4.1.3.2.2. Underside of positioner support rail
  4.1.3.3. Electrical and Communications:
    4.1.3.3.1. Main new LV distribution board inside the switch-room, including busbars from the transformer secondary side.
    4.1.3.3.2. Complete sub-DB boards and control equipment plus electrical cables and cable management systems, related to the tippler facility under this scope of works.

4.1.3.3.3. All main tippler building monitoring/control, automation, instrumentation and associated communication systems, plus associated cabling, and cable management systems at all required positions inside the building.

4.1.3.3.4. All related software, and licenses, for the monitoring/control, automation, instrumentation, and associated communication systems

4.1.3.3.5. Seamless interfacing, where required, between electrical and communications infrastructure/systems.

4.1.3.3.6. Standardised electrical and electronic equipment, plus software throughout The Contractor shall liaise and obtain all appropriate information from all relevant parties, to ensure successful execution and interfacing of the defined required facilities with others.

4.1.3.4. SCADA and PLC

4.1.3.4.1. PLCs, Server(s), Network Switch and all Software (including tippler control room SCADA)

4.1.3.4.2. PLC systems, to be 100% compatible with current systems in use in the plant (current OEM for PLC systems is SIEMENS)

4.1.3.4.3. Panel to include associated I/O as required by the process and external communications to the communications panel. All PLC hardware, including I/O subsystems, shall be designed to include stand-alone operation and adhere to the specified standards.

4.1.3.4.4. Software configuration programming. PLC Software shall be designed to include stand-alone operation.

4.1.3.4.5. Programming functional specification covering the operation of the equipment, which shall be approved by the Employer before any software programming commences.

4.1.3.4.6. Identification and labelling of all equipment supplied by the Contractor, in accordance with the project standards and mandatory regulatory requirements.

4.1.3.4.7. Provision of detailed single line - schematic - layout and termination diagrams (including any other that may be required)

4.1.3.4.8. Software licenses for all programmable equipment. Software passwords to be supplied by Contractor to Employer

4.1.3.4.9. Contractor's support for the electrical installation both off-Site and on-Site, including remote and off-Site connection to the PLC.

4.1.3.4.10. Interface with Site SCADA (Port Operations)

4.1.3.4.11. Fully programmed and tested SCADA PC. The SCADA to be the same as existing SCADA in use. SCADA programme shall be to be 100% compatible with current Port SCADA systems (Current systems installed is WONDERWARE)

4.1.3.4.12. Contractor to supply and install a standalone SCADA system including software for commissioning the Dual Wagon Tippler Facility. The standalone SCADA application to be integrated into the Site SCADA application (by others in consultation with Contractor) and Employer. SCADA pages and database will be made available at detail design stage.

4.1.3.5. Requirements of the Contractor's Design

4.1.3.5.1. The Contractor's design shall comply with the requirements as set out in:

4.1.3.5.2. 'Technical Specification: PLC - SCADA' Annexure B

4.1.3.5.3. 'Technical Specification: Dual Wagon Tipplers, Feed Hoppers, Apron Feeders and Dust House for the Port of Saldanha' (1924701-2-211-M-SP-0003) - Annexure I

4.1.3.5.4. 'Dual Wagon Tippler Data Sheet' (1924701-2-211-M-DS-0003) - Annexure J

4.1.3.5.5. 'Technical Specification: Apron Feeder' (No 1924701-2-213-M-SP-0003) - Annexure K

4.1.3.5.6. 'Apron Feeder Data Sheet' (1924701-2-213-M-DS-0001) - Annexure L
4.1.3.5.7. 'Technical Specification: Dust Collection' (1924701-2-214-M-SP-0003) - Annexure M
4.1.3.5.8. 'Dust Collection (Bag House) Data Sheet' (1924701-2-214-M-DS-0003) - Annexure N

4.2 Works

4.2.1. The works are to include all as referred to in this scope but with reference to the Appendices; most particularly Annexure A – Ashston Bulk Scoping Inspection Report together with the relevant Appendices of this report with reference to:
  4.2.1.1. Appendix B - Site Scope Work
  4.2.1.2. Appendix G – Enabling Works
  4.2.1.3. Appendix H – Summary Scoping Site Inspection Reports

4.2.2. Survey of tippler, dust extraction plant and in-go & out-go perways.

4.2.3. Design, fabricate, transport to site, off load and install in-go and out-go rail support beam.

4.2.4. Complete installation and commissioning of Train Positioner structural, mechanical, electrical control and instrumentation (SME and C&I).

4.2.5. Complete installation and commissioning of Tippler Cage (SME and C&I)

4.2.6. Complete installation of Train Holding Devices (SME and C&I)

4.2.7. Complete installation and commissioning of Apron Feeders and Knife Gates (SME and C&I)

4.2.8. Complete installation and commissioning of Dust Handling Plant (SME and C&I)

4.2.9. Complete installation of all Field Devices as aligned with Control Philosophy

4.2.10. Complete software development in alignment with the Control Philosophy – to include PLC and SCADA interface.

4.2.11. 3D-Scanned Image of Tippler Cage – to develop model for Finite Element Analysis

4.2.12. Finite Element Analysis (FEA) of Tippler Cage to determine stress patterns to assist in engineering decisions in the alignment correction of all misaligned components (Cage End Rings, Clamp Gear, Cage Links)

4.2.13. Design and manufacture of jacking spreader-beams to jack the tippler cage to enable remedial work – alignment of the end-rings and the installation of locking discs. These beams are to be corrosion protected in compliance with the relevant standards for safe keeping.

4.2.14. Design manufacture of trestles to support tippler cage to enable remedial work – alignment of the end-rings and the installation of locking discs. These trestles to be corrosion protected in compliance with the relevant standards for safe keeping.

4.2.15. Jacking of tippler cage for remedial work – alignment of end rings and the installation of locking discs

4.2.16. Change bearings on tipper cage support wheels.

4.2.17. Removal of Tippler Cage dust cowl and re-instating after completion of all remedial work

4.2.18. Servicing of Drives (Reducer and Motor) and Hydraulic Actuators

  4.2.18.1. 2 off Tippler Cage Drives
  4.2.18.2. 8 off Positioner Drives
  4.2.18.3. 1 off Positioner Main Arm Actuator
  4.2.18.4. 1 off Main Arm Latch Actuator
  4.2.18.5. 1 off Coupler Release Actuator
  4.2.18.6. 1 off Last Wagon Arm Latch Actuator
  4.2.18.7. 1 off Last Wagon Arm Rotary Actuator
  4.2.18.8. 16 off Wheel Gripper Actuators

4.2.19. Erection and Installation of hydraulic power packs of train holding devices next to the respective train holding devices pits. (Change in design – position of hydraulic power packs)

4.2.20. Installation of the complete grease lubrication system for the train holding devices.

4.2.21. Complete assembly; positioning and erection of tippler cage after end ring alignment on to the tippler support rollers.

4.2.22. Installation of the complete grease lubrication system for the tippler cage drives racks.

4.2.23. Installation of hopper liners and hopper outlet liner panels.

4.2.24. Delivery to site of 5 off Apron Feeders

4.2.25. Installation of 5 off Apron Feeders with Drives

4.2.26. Installation of the complete grease lubrication system for the 5 off Apron feeder Drives and sprockets.

4.2.27. Design review, detail draughting, manufacturing, transporting and fabrication and installation of 5 off Hopper Knife Gates.

4.2.28. Erection completion of hopper outlet liner plates.

4.2.29. Erection completion of dust extraction plant structural, mechanical, electrical control and instrumentation.

4.2.30. Procuring all hydraulic pipes and delivery to site.

4.2.31. Procuring, delivery to site, installing and terminating all power and control cables.

4.2.32. Procuring, delivery to site, installing all power and control cables termination kits.

4.2.33. Procuring, delivery to site, installing missing cable trays.

4.2.34. Erection and placing of the tippler electrical substation electrical panels, junction boxes and local control stations.

4.2.35. PLC Hardware, Software and Programming

4.2.36. SCADA interface of all field devices in line with Control Philosophy

4.2.37. Design, fabricate and installation of field devices brackets.

4.2.38. Inspect all external paintwork ensuring that all repair painting has been carried out in accordance with the Transnet Port Terminals Saldanha Corrosion Protection specification.

4.2.39. Inspect all main structural bolted joints and areas where structure has been drilled for auxiliary equipment. (Cabling, hydraulics, etc). Seal any gaps with an appropriate grade of mastic or similar to ensure water/moisture cannot enter box sections.

4.2.40. Ensure that all erection checks have been completed in accordance with Site installation Method Statement compiled by the Contractor, and that all temporary supports/chocks etc. have been removed where not required.

4.2.41. Inspect all external paintwork ensuring that all repair painting has been carried out in accordance with the Transnet Port Terminals Saldanha Corrosion Protection specification.

4.2.42. Inspect all main structural bolted joints and areas where structure has been drilled for auxiliary equipment. (Cabling, hydraulics, etc). Seal any gaps with an appropriate grade of mastic or similar to ensure water/moisture cannot enter box sections.

4.2.43. Ensure that all erection checks have been completed in accordance with Site installation Method Statement compiled by the Contractor, and that all temporary supports/chocks etc. have been removed where not required.

4.2.44. Check that all lubrication systems have been installed correctly to the Method Statement compiled by the Contractor.

4.2.45. Verify that the installed electrical equipment follows the Installation Method Statement compiled by the Contractor and that the equipment is not visibly damaged.

4.2.46. Final inspection to confirm that the equipment is in accordance with all specifications, fully painted as required and that all extraneous material, tools etc have been removed before cold commissioning starts.

4.2.47. Check to ensure Continuity and Insulation Resistance (IR) Tests as described in the Installation Schedule follows the Installation Method Statement compiled by the Contractor for the new substation M, mini substations, new tippler e-house and all field mounted electrical equipment, has been completed satisfactorily.

4.2.48. Conduct Earth Fault Loop Impedance Tests and record (LV Circuits for new tippler electrical house and field mounted equipment).

4.2.49. Conduct Earth Continuity Return Path Tests and record for the various circuits of the tippler cage, positioner, apron feeder, tippler conveyor CV 308 and dust extraction plant.

4.2.50. Ensure all pre-power checks have been completed in accordance with the Drive Supplier Operating Instructions (Positioner, tippler cage and apron feeder). These checks to be carried out by an approved Drives Commissioning Engineer, which the Contractor will be responsible to appoint and remunerate.

4.2.51. Train Holding devices and positioner arm Hydraulic Systems. Ensure all pre-power checks have been completed in accordance with the Operating Instructions. These checks to be carried out by an approved Hydraulics Commissioning Engineer, which the Contractor will be responsible to appoint and remunerate.

4.2.52. Cold commissioning will take place without wagons and product. Test the overall plant by simulating wagon positioning, wagon tipping, wagon removal, apron feeder operation, conveyor CV 308 and dust extraction plant operations in order to prove the correct interaction between all of the machines' systems and verify performance prior to handling material.

4.2.53. Plant Testing. Conduct the different machine tests according to Contractor's Cold commissioning method statement.

4.2.54. Hot commissioning. Perform live tests and carry out final checking and adjustments in order to prove that the plant can meet the operational requirements and reliability for wagon positioning, wagon tipping, wagon removal, CV 308 product conveying and dust plant extraction and filtration.

4.2.55. Complete Performance Testing as per contract requirements.

4.2.56. Final inspections to confirm that the equipment, including paintwork, is in a good state and that all extraneous materials, tools etc. have been removed from the plant, must be carried out at the end of the performance testing period before the plant is taken over by Transnet Port Terminals Saldanha. Contractor will also be required to clear the erection site of all materials used during the erection of the plant.

4.2.57. As-Built Drawings. A full set of as-built red line drawings incorporating all changes including those of original equipment suppliers must be handed over to Transnet before the Plant is taken over by Transnet Port Terminals Saldanha, final As-Built drawings shall be supplied eight (8) weeks after hand-over.

4.2.58. Take-over Certificate will only be issued by Transnet if Transnet is satisfied that the Contractor has contractually delivered.

4.3 Work included in the Construction and Installation Scope

4.3.1. The Contractor shall provide a Construction and Installation Proposal for all Work associated with the completion of the balance plan for Tippler 3 at the Iron Ore Terminal in Saldanha. Installation shall include, but not necessarily be limited to, all labour, tools, and equipment. The Contractor must include for all the requirements and details contained in this Works Information and the Activity Schedules that are relevant to the Plant. The SOW shall cover the following, but not necessarily be limited to as per below.

4.3.2. Fencing of Contractors erection area, provision of mobile offices for the Contractors staff stores and 24- hour security services for contractor's erection area and mobile offices.

4.3.3. Provision of a diesel generator with sufficient capacity to provide power to the dual wagon tippler, train positioner and dust handling plant for no load commissioning. Sizing of the diesel generator will be done by the Contractor considering the loads for the running of the dual wagon tippler, train positioner and dust handling plant during no load commissioning of the tippler plant. Required for a period of 2 weeks.

4.3.4. The Contractor will have to provide his own Information Systems/Information Technology services for the duration of the works on site.

4.3.5. Transnet Port Terminals will provide the Contractor with potable water at the Contractor's mobile offices. This water is for human consumption purposes only. Due to the size of the site, the Contractor is required to provide mobile ablution facilities next to the erection site, in order to minimize standing time. The ablution facilities shall be serviced on a daily basis by an appointed contractor, which will be contracted by the Contractor.

4.3.6. Welding of structures on-site, including welding consumables, alignment blocks, stillage's, protective canopies over welding for inclement weather and all Non-Destructive testing.

4.3.7. Sandblast of welded sections where welds are not in accordance with AWS D1.1 requirements.

4.3.8. Repairs of welds which are not in accordance with AWS D1.1 requirements.

4.3.9. Non-Destructive testing of weld repairs, allow for MPI.

4.3.10. Sandblast and Painting of welded sections according to Transnet Port Terminals Saldanha Corrosion Protection Specification EEAM-Q-008 included in Section 5 [Drawings and Standard Specifications] of the Contract.

4.3.11. Restoration of paint for all damaged paint caused by transportation, handling, and erection in accordance with Transnet Corrosion Protection Specification EEAM-Q-008.

4.3.12. Provision of all craneage for the manipulation of structures, lifting of structures as well as lifting of all mechanical, hydraulic, and electrical equipment.

4.3.13. Mechanical, structural, electrical installation of the balance of plant.

4.3.14. Provision of specialist services for alignment of couplings or any other equipment requiring precise alignment/setting.

4.3.15. Provision of first fill oils and lubricating greases for the both the automatic and manual grease lubrication systems.

4.3.16. Lubrication, servicing, and maintenance of the Plant and maintaining service records of Work carried out, up to the issue of the Certificate of Take-Over.

4.3.17. Grouting of structures and equipment.

4.3.18. Procuring, supplying, and transporting of all electrical and control cables required for the complete wagon unloading plant.

4.3.19. Procuring, supplying, and transporting of outstanding cable racking.

4.3.20. Pulling of all electrical and control cables.

4.3.21. Supply of cable termination kits for all the power and instrumentation cables.

4.3.22. Termination of all power and termination cables.

4.3.23. Labour, tools, and equipment to support pre-commissioning and cold commissioning.

4.3.24. Labour, tools, and equipment to support hot commissioning and performance testing.

4.3.25. Overall Project Schedule.

5 General Requirements and Conditions

5.1 Site Conditions

The equipment must be able to operate in a marine foreshore environment subject to the following conditions:

Table 5: Site Conditions

Condition	Description
Altitude:	Sea Level
Ambient Temperature:	0°C to 45°C with solar irradiation in direct sunlight up to 1000 watt/m² which can result in temperatures of 70° and over on metal
Relative Humidity:	Up to 100%
Air Pollution	Heavily saline, corrosive dust laden and industrial fumes
Wind and Rain:	Heavy rain windblown to near horizontal
In-service wind speed	80 km/hr (max)
Out of service wind speed (storm)	130 km/hr (max) up to 20m

5.2 Commodity Properties

The wagon tippler is required to handle multiple commodities defined in Table 7 below.

Table 6: Commodity Properties

Lump Ore	Density	2.6 t/m^3
	Moisture	0.7% average
	Particle Size	-25 +8mm
	Angle of Repose	Between 33 and 35°
Fine Ore	Density	3.0 t/m^3
	Moisture	2.2% average, 2.5% max.
	Particle Size	-5 +0.20mm
	Angle of Repose	Between 35 and 38°
DRS Ore	Density	2.45 t/m^3
	Moisture	0.7% average, max. 1.0%
	Particle Size	-27 +13mm
	Angle of Repose	Between 33 and 35°
C/Sinter	Density	2.3 t/m^3
	Moisture	1.3% average, max. 1.5%
	Particle Size	-8 +5mm
	Angle of Repose	Between 33 and 35°
*** Compressive Strength**	Between 600 and 1000 MPa	

6 Engineering Requirements

In light of the engineering gaps identified as per AB report, the Contractor will carry out the following engineering, to ensure that the tippler will operate as per the original Transnet Scope of Works.

6.1 Tippler Cage and Positioner – 3D Scan and Finite Element Analysis (FEA)

To ensure the dimensional accuracy, operational suitability and fit for purpose of the Tippler and Positioner assembly the contractor should verify the following:

6.1.1. 3-Dimensional structural scanning, and CAD model generation of the Tippler and Positioner to verify the following:

- Manufacturing tolerances to ensure all structural components are dimensionally accurate and accurately aligned.
- Verify structural deformations in the as installed condition, to be compared with the calculated deformations.
- Verify installation and alignment tolerances.

6.1.2. Detailed Finite Element Analysis of Tippler and Positioner structures.

- The contractor is to complete a detailed structural analysis (FEA) substantiated by load and stress calculations based on first principles of the complete Dual Wagon Tippler and Train Positioner Arms to ensure the designs are fit for purpose.
- The Dual Wagon Tippler must be simulated as a complete unit to ensure accurate reaction force verifications, deformations and structural stresses, making use of proven Finite Element analysis and verification techniques that align with International Standards for the design of bulk material equipment.
- Where detailed structural drawings of the Dual Wagon Tippler and Train Positioner structures are not available, the 3D cad models as generated from the scan data must be referenced to ensure the accuracy of the simulations. All inspection hatches must be opened to determine internal stiffeners/gussets position, design and material thickness.
-

On completion of the process as set out the contractor should be able to confirm the suitability of the Tippler and Positioner designs and recommend any modifications that may be required to ensure the Tippler and Positioners would meet performance requirements after commissioning.

6.2 Train Holding Devices

Repositioning of the Gripper HPUs from inside the concrete pits to ground level where they will be easier to monitor, maintain and replace should the need arise. Due to the position of the HPU's, damage by traffic is unavoidable, the Contractor will provide a removable crash barrier around each unit.

6.3 Tippler Dust Cowl

The Contractor will carry out a dimensional survey of the Dust Cowl components. Depending on the outcomes of the survey any modifications required, the Contractor will complete an engineering design of any modifications and update the detail drawing.

6.4 Hopper

6.4.1. The Contractor will complete an engineering design of the fixing details of the liners which need to be installed in the tippler hopper. To date the final engineering to fix the ceramic lined plates to the concrete hopper walls has not been finalized along with the detail of the ceramic liner plates.

6.4.2. The Contractor will carry out a 3D scan of the Hopper and immediate areas to facilitate necessary design work for the fixing of the ceramic lined plates.

6.5 Upper Deflector Wall & Support Roller Dust Shrouds

6.5.1 Deflector Walls

6.5.1.1. Tip Side

Above the concrete hopper is a steel construction Impact Wall consisting of outer face plates and a mounting structure constructed of I beams. When calculating the trajectory of iron ore from the wagons the original contractor neglected to account for the effect of the Tippler Side Beam directing material flow outside of the Tippler profile. Such flow would direct material onto the Impact Wall and necessitate the Wall being designed for high impact rather than cursory deflection and designed for the fixing of necessary ceramic liners. This modification will require additional steelwork and modification to existing steel structure. The contractor is to determine and demonstrate the material flow using Discrete Element Modelling techniques.

6.5.1.2. Non-Tip Side

It was noted that the Non-Tip Side Deflector Wall has insufficient clearance with the Tippler Wagon Clamp Ballast Weights. The Current clearance is unacceptable due to potential clashes. The Contractor is required to increase the clearance between the underside of the clamp ballast and the top of the non-tip side deflector wall to an acceptable operational clearance. This will be inclusive of redesign and remedial structural works.

6.5.2 Support Roller Dust Shrouds

6.5.2.1. The Dust Shrouds at the Hopper ends are too small and short to provide any shrouding effect for the Support Rollers and will be entirely ineffective.

6.5.2.2. The Contractor is required to redesign the Dust Shrouds in order to ensure effectiveness of the dust extraction and containment.

6.6 Apron Feeder Support Steelwork

6.6.1. The apron feeder support structures were designed by the original contractor, the load calculations to verify structural integrity are not available. The Contractor will produce load computations to ensure the structure is in accordance with SANS 10160-1.

6.6.2. The design will be in accordance with the requirements as prescribed in SANS 10160-

6.7 Isolation Knife Gates

6.7.1. The Knife Gate design to be reviewed – the contractor must determine most practical orientation of the current design and develop proposals and design for isolation.

6.7.2. Hydraulic Actuation and HPU of Gates must be designed.

6.8 Electrical and Control Equipment

6.8.1. Tippler MCC

Based on inspections conducted, it was discovered that in certain places the support structures on which the electrical panels are fixed to, appear to be under-designed, to prevent any unforeseen collapse of the floor structure, the Contractor will assess the integrity of the support structure, and implement design improvements.

6.9 Civils & Main Track

6.9.1. Civil Works

The Contractor will be required to update any civil foundation drawings pertaining to the tippler, this is to ensure that the foundations drawings reflect what the final as-built condition is.

6.9.2. Main Rail Tracks

6.9.2.1. The rail tracks have not been installed in the tippler building. Troughs have been cast in the concrete floor slab to allow for the tracks, so that the Top of Main Line Rail (TOR) is nominally at a common elevation with the Tippler building Top of Concrete (TOC).

6.9.2.2. The Contractor is required to provide detail design of the track support beams, to include the fixing method of the support beams to the concrete troughs.

6.10 Engineering Documents

6.10.1. The package of drawings and documents provided to Transnet by the original contractor for the Dust Handling Plant, are of a poor quality and deficient in content. Most of the drawings are not accompanied by bills of material, there is no structured index, and no drawings or documents are provided in soft copy.

6.10.2. The Contractor is therefore required to improve the standard of engineering drawings of the Dust Handling Plant to that of the Dual Wagon Tippler and Train Positioner by way of a harmonisation exercise.

6.11 Programmable Logic Controller / Supervisory Control and Data Acquisition (PLC/SCADA)

6.11.1. The design and development of the PLC program and SCADA control for the plant is outstanding. The Contractor will be required to comply with the following requirements as set out in the Control Philosophy Specification for the PLC design software.

6.11.2. The specification applies to all PLC software developed for the Siemens S7-1500 range of equipment. The specification is generic and where differences in functionality occur due to the variety of machines, these are detailed in the attached appendices.

6.11.3. This scope includes for the design, compilation, testing and commissioning of software modules, blocks, routines, sub-routines and data structures, which are to be loaded into the memory of a programmable logic controller.

6.11.4. The software design for the PLC/SCADA system must have a Failure Modes and Effects Analysis (FMEA) philosophy – Refer specifically to the Technical Specification PLC-SCADA on the software design for fault management Section 4.10 (PLC/SCADA Software Design).

6.11.5. This scope further requires a merge with SCADA Software Design to ensure that the PLC/SCADA interface is compatible.

7 Dual Wagon Tippler (Mechanical and Structural)

7.1 Tippler Support Rollers

Reference Drawings:
Annexure A
Appendix A Drawing List

7.1.1. The Contractor is required to remove the tippler support rollers and replace the bearings and oil seals on all sets of roller pairs (8 off - Ingo and Outgo).
7.1.2. Ensure alignment of all sets of roller assemblies.

7.2 Tippler Structure

Reference Drawings:
Annexure A
Appendix A Drawing List

7.2.1. End Rings & Tippler Cage

7.2.1.1. During the initial Phase1 investigation, after a 3-D site survey it was discovered that the parallelism of the in-go and out-go end rings is not in accordance with the tolerances as specified in the AB assembly drawings.

7.2.1.2. The Contractor will price for the removal of the already installed dust cowl in its entirety. Once the dust cowl has been removed the Contractor will then jack-up the cage and align the end rings for parallelism. The Contractor will design spreader beams to jack the tipper cage. The contractor will supply hydraulic jacks to jack the tipper cage to a practical working height to allow for the alignment of the tippler cage end-rings and the installation of the end ring shrink disks (4 off). All the costs associated with the jacking of the cage and alignment of the end rings will be for the Contractors account, this includes any scaffolding that might be required to gain access to areas which require working at heights.

7.2.1.3. Before the Contractor starts with the adjustment of the end ring parallelism, the Contractor will carry out the following repair works as a minimum, namely:

i. replace the four-cage links. The Contractor will be responsible for the manufacture, delivery to site and installation of the four-cage links. Final welding of the cage links will be carried out once the alignment of the end ring has been carried out.

ii. where practically possible access to the internal box sections of the end rings must be obtained to improve on some of the poor internal welds. Accessibility to be determined by mutually by the contractor and Transnet representative. Any improvements must be followed by the appropriate NDT which as a minimum will include MPI. Once any weld repair has been accepted, the Contractor will then carry out the necessary paint repairs all in accordance with the Transnet Corrosion Specification

iii. repair of welds is not only applicable to inside box sections of the end rings but any other external welds which are deemed not acceptable. Again, the same procedure will be followed as the internal welds.

iv. repair of welds on Buffer Brackets. Any improvements must be followed by the appropriate NDT which as a minimum will include MPI. Once any weld repair has been accepted, the Contractor will then carry out the necessary paint repairs all in accordance with the Transnet Corrosion Specification.

v. tippler platform: repair of external welds on the tippler platform, any improvements mut be followed by the appropriate NDT which as a minimum will include MPI. Once any weld repair has been accepted, the Contractor will then carry out the necessary paint repairs all in accordance with the Transnet Corrosion Specification.

vi. side beam: repair entry end and exit end underside fillet welds, any improvements must be followed by the appropriate NDT which as a minimum will include MPI. Once any weld repair has been accepted, the Contractor will then carry out the necessary paint repairs all in accordance with the Transnet Corrosion Specification.

vii. ballast beam: repair entry end and exit end underside fillet welds, any improvements mut be followed by the appropriate NDT which as a minimum will include MPI. Once any weld repair has been accepted, the Contractor will then carry out the necessary paint repairs all in accordance with the Transnet Corrosion Specification. The Contractor must also establish that the material thickness of the ballast side beam is in accordance with original designer's drawings

viii. side beam and ballast beams: the Contractor will replace the four Incorrect Shrink Discs with the correct shrink discs in all four locations.

- Replace star shaped end plates with the correct end cap as per original design
- As far as practically possible inspect the inner end of the Pivot Shafts inside the Side Beam and Ballast Beam
- Check and re-adjust, if necessary, torque of fasteners on inner end Shrink Disc.

ix. Torque Reaction Brackets

- The four (4) torque reaction brackets are used to restrain the side and ballast beams that are connected to the End Rings via axial pins in rotary bearings. These brackets are in turn pin jointed to eyes on the rail platform.
- The non-tip side bracket is misaligned with the connecting eyes on the rail platform.
- Effects of the misaligned bracket must be assessed on the developed FEA model.
- Correct (Remedial design) the exit non-tip side torque bracket which is mis-aligned with its rail platform mounted bracket
- Verify plate thickness and conduct dimensional checks of Torque Brackets.

x. Platform pivot shaft: the Contractor will replace the incorrect Shrink Discs with the correct shrink discs as per AB's drawings.

  - Check and re-adjust, if necessary, torque the fasteners on inner end Shrink Disc.

xi. Check all the End Ring joint connection bolts (In-Go & Out-Go), to ensure that they are torqued to the correct specification.

xii. Working from the centre of the rail (In-Go & Out-Go), check the rail bolts to ensure that they are torqued to the correct specification.

xiii. Check that the two rail butt joints (In-Go & Out-Go) are smooth and firmly butted together.

xiv. Check that there are no gaps (In-Go & Out-Go) between the rails and the end ring mating surfaces.

xv. Check Torque of clip bolts (In-Go & Out-Go) on rail sections.

xvi. Carry out full survey of the Tippler end rings and record the survey readings (To be included in Quality Control Plan as hold point).

7.2.1.4. After the end ring alignment has been approved in principle by the Transnet Project Manager, before the cage is lowered onto the tippler support rollers the Contractor will carry out the following:

7.2.1.5. The Contractor is required to remove all the surface rust from the end ring racks. Once the rust has been removed the Contractor will coat the rack teeth with a thin layer of graphite grease to ensure the surface rust does not manifest itself again.

7.2.1.6. The Contractor is required to fit the Oleo Buffers on the in-go and out-go end rings.

7.2.2. Wagon Clamp Gear

7.2.2.1. The wagon clamps are of the "plain" type bearing and hence not subjected to localised fretting as in roller bearings. Hence these clamps will not be further inspected.

7.2.3. Tippler Ballast Box

7.2.3.1. The Contractor is advised to record the mass of ballast box without the concrete ballast. Once the box has been weighed, the Contractor will install concrete ballast into ballast box compartments.

7.2.3.2. The Contractor will record the mass of concrete ballast placed in each compartment, and before finalizing the final ballast the Contractor will ascertain the cube strength of the concrete to ensure that the correct number of trim plates are installed. The following information must be provided to the Transnet Project Manager for review and acceptance in principle.

Ballast Box	**Ballast Box Mass (tonnes)**
Ballast Box Structure	
Concrete Ballast	
Combined Mass	

7.2.3.3. The Contractor will also be required to provide the following information pertaining to the ballast box trim plates to the Transnet Project Manager for review and approval in principle.

Ballast Required	**Mass (tonnes)**
Number of trim plates installed	
Total mass of trim plates installed	
Total calculated ballast concrete & trim plates	

7.2.3.4. Once the ballasting is complete the Contractor is required to seal the ballast box compartments by bolting on cover plates. The Contractor must ensure cover plates have been sealed with mastic prior to fitting.

7.2.4. Assembly of Tippler Thrust Pads

7.2.4.1. The Contactor will need to remove the Thrust Pads that are installed, and machine required chamfer and re-fit as per the AB design drawings.

7.2.4.2. The Contractor is required to manufacture and fit Access Support Angles and Rail Location Plates as detailed on the AB's drawings.

7.2.4.3. The Cast in foundation bolts locating Thrust Brackets are too short and do not protrude the dimension specified on Tippler & Plant Foundation drawing. The Contractor will remove and replace bolts with new foundation bolts.

7.2.4.4. The Contractor is required to procure and install Rail Clips.

7.2.4.5. The Contractor will check the distance over the land-mounted thrust pads and the gaps at the entry and exit ends and will record these gaps and will ensure that this information is included in the As-built drawings of the tippler.

7.2.5. Assembly of Tippler Limit Switches

7.2.5.1. The Contractor will manufacture and provide tippler limit switch mounting brackets, the Contractor will then align, drill and fit tippler limit switch mounting brackets and strikers as per AB Drawing

7.2.6. Assembly of Tippler Lubrication System

7.2.6.1. The tippler drives are fitted with two types of automatic grease lubrication systems, namely:

7.2.6.1.1. Fully automated stand-alone, electrically driven pump type, progressive, grease lubrication systems with cycle feedback to the PLC and satisfying the lubrication needs of groups of bearings. This system supplies grease to all the pinion bearings, side guide roller bearings, sprung supported roller bearings, main arm pivots and Last Wagon Arm pivot pins.

7.2.6.1.2. Fully automated stand-alone, electrically driven pump type spraying lubricant automatically onto the gear teeth with cycle feedback to the PLC and satisfying the lubrication needs of the rack and pinions.

7.2.6.2. The Contractor will fit both these fully automated stand-alone progressive, grease lubrication systems on the tippler drive frames in an area that will not restrict the servicing of the systems and surrounding equipment.

7.2.6.3. The rack lubrication roller is missing, the Contractor is required to provide a new rack lubrication roller and install the roller in the position as indicted by the AB drawing.

7.2.6.4. The Contractor will then provide and fit all the stainless-steel piping and fittings to respective bearings and open rack and pinions.

7.2.6.5. Once all the piping is complete, the Contractor will run the respective pumps and check that grease is reaching all points that require lubrication (when power is available in conjunction with the electrical site installation method statement).

7.2.6.6. The tippler clamp gear is fitted with a Grouped Manual: (GM)Total loss greasing of individual components by means of nipples grouped together to service a quantity of items. The grouped manual manifolds must be place in an area where maintenance will have access to the manifold block.

7.2.6.7. The Contractor must provide and fit all the stainless-steel piping and fittings to respective clamp gear pivot pins.

7.2.6.8. Once the Grouped Manual: (GM)Total loss greasing system has been installed the Contractor will purge the lines and then attach the pipes to the relevant fittings on the clamp gear pivot pins.

7.2.7. Tippler Drives

7.2.7.1. The 2 off Tippler Drives consist of an electric motor, gear reducer, brake, pinion shaft, drive pinion, shaft bearings all mounted on a sub-frame.

7.2.7.2. The drives have not been aligned, secured or grouted to the foundations.

7.2.7.3. The Contractor is required to remove the tippler drive gear (In-Go & Out-Go) and have the drive gear OEM on site for stripping and inspection, if required a change of bearings and seals must be done at a local workshop (Saldanha).

7.2.7.4. As it is not possible to determine what remedial work will be required, the Contractor must price for a complete refurb listed above (bearings and seals).

7.2.7.5. On completion of the remedial work, Contractor will then undertake the following Works:

7.2.7.4.1. Install Tippler Drive Unit Base Plate onto grout packers as detailed on AB's drawings.

7.2.7.4.2. Grout Drive base plate using full strength grout.

7.2.7.6. Once the tippler drive installation is complete, the Contractor will carry out the following:

7.2.7.5.1. The Tippler Cage is to be driven and checked for rotation clearances, gear mesh and clamp operation in conjunction with the Siemens engineer (drives).

7.2.7.5.2. Check and record drive unit high speed and low speed coupling alignment.

7.2.7.5.3. Position and align each individual drive unit until correct mesh is obtained between the drive pinion and rack.
7.2.7.5.4. Lock drive unit jacking screws, tighten anchor bolts to drive unit base frame as shown on AB's drawings to maintain position.

7.2.7.5.5. Fully tighten anchor bolts and weld enlarged washers to drive unit base frame as shown on AB drawings to maintain position.

7.2.7.7. Tippler Punch Listing

10.2.7.6.1. The Contractor will create Punch Lists on all outstanding works detailing uncompleted items including painting of bolt heads, nuts and sealing of packers. The Contractor will then carry out remedial work to damaged painting in accordance with the Transnet Corrosion Protection specification.

Note:

Edges of ALL packers to be sealed with mastic and painted.

10.2.7.6.2. The Contractor will rectify all the items of the punch list. Once the Contractor is finished with his punch list and he is satisfied that the Transnet QC inspector is allowed to conduct his own punch list, the Contractor will then notify the Transnet Project Manager of all the items punched and corrected and will hand-over the completed punch list for the Transnet QC inspector to review and go through the punch list.

7.2.7.8. Final Inspection

The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state and that all extraneous materials, tools etc. have been removed.

7.2.7.9. Final Document Check

Final document check to verify that all specified operations have been completed with satisfactory results, all supporting records are available and all reported non-conformities have been satisfactorily resolved. The Contractor will then present the final documents checks to the Transnet Project Manager for approval in principle.

8 Positioner System

8.1 Reference Drawings:

Annexure A
Appendix A Drawing List

8.2 Train Positioner Track

8.2.1. Positioner Track is installed and fully grouted in position.

8.2.2. Rail clamps on each of the five modules are missing and must be replaced.

8.2.3. Some racks are loose – All racks must be tightened to the correct torque values and the bolts as per drawing are to be HSFG bolts.

8.2.4. The Contractor is required to remove all the surface rust from the positioner racks. Once the rust has been removed the Contractor will coat the rack teeth with a thin layer of graphite grease to ensure the surface rust does not manifest itself again.

8.2.5. The Contractor is required to correct the minor misalignment of the Positioner Track relative to the main track datums.

8.2.6. The Contractor will conduct an inventory check of the positioner track rail clips and will procure and fit track rail clips at all module joints that are missing.

8.2.7. The Contractor will remove a set of the spine bar HSFG bolts and nuts one at a time which are excessively corroded and replace with new HSFG bolts. The contractor will torque the HSFG bolts in accordance with the torque value for the installed bolts.

8.2.8. It was established that Zinc plated washers have been installed instead of HSFG washers at all Module Frame connections. The Contractor will procure and install HSFG washers.

8.2.9. The Contractor is required to verify the torque of all rack to spine bar bolts, and where necessary torque the bolts to the correct torque settings.

8.2.10. The support stool beams for the main line rails (In-Go & Out-Go) have not been manufactured. The Contractor will fabricate, supply, install, level and align the support stool beams. Once the support stool beams are aligned and fitted, the Contractor will cast the support stool beams with concrete, making sure that enough clearance or pockets are allowed to fit the and tighten the rail clip nuts.

8.2.11. Once the concrete is dry the Contractor will fit the mainline rails which will be provided by Transnet Freight Rail. The rail clips will be procured and fitted by the Contractor as well.

8.2.12. Once the main line rails (In-Go & Out-Go) have been fitted, the Contractor will check that the distance between positioner track and main track is set to the clearance as per original designer's drawing.

8.2.13. Although the spine bars and racks are fitted, the Contractor is still required to check the straightness of spine bar. The tolerance will have to be within maximum deviation over total length as required by the AB drawings.

8.3 Positioner Drives

8.3.1. The Contractor will remove all eight (8) positioner drives and will deliver the drives to the drive OEM for stripping and inspection.

8.3.2. The Contractor will notify the Transnet Project Manager once the drive gearboxes has been stripped so that a joint decision with the drive OEM on the remedial actions required to ensure that the positioner drives is fit for purpose.

8.3.3. The Contractor will arrange for the torque limiting clutches/couplings to be bench tested to ensure that the de-clutching torque setting is as per AB's positioner drives calculations. Records of these settings will be recorded and must be included in the positioner maintenance manual for future reference.

8.3.4. Once the positioner drives have been refurbished the Contractor will have the drives transported to site and re-installed on the positioner.

8.3.5. The Contractor will provide and position pad jacks and suitable packers to support the positioner above the track so that the drive pinions are just clear of the rack. Using lifting lugs and suitable lifting beam, the Contractor will lift positioner and lower on to pad jacks.

8.3.6. The Contractor will remove rack sections as required to allow the guide roller to be lowered to the spine bar.

8.3.7. Whilst the positioner drives are being refurbished, the Contractor will remove the eight drive shafts complete with the respective pinions and will remove all the surface rust on the positioner drive pinions. Once the pinions have been cleaned, the Contractor will then fit the pinion-shaft arrangement and will coat the pinions with graphite grease to prevent surface rust manifesting itself again.

8.3.8. The Contractor will rotate drive pinions by hand so that the pinion teeth will mesh with the rack teeth.

8.3.9. The Contractor will lower the positioner onto the track ensuring correct rack and pinion mesh as per original designers AB drawings.

8.3.10. Without the positioner drives, pull the Positioner along track away from removed rack segment positions.

8.3.11. Replace rack segments to the track assembly.

8.3.12. The Contractor will remove Guide Rollers complete, dismantle roller assembly and re-assemble with new bearings and seals.

8.3.13. The Contractor will supply and install packing to correct the elevation of the Guide Rollers.

8.3.14. The Contractor will remove Fixed Support Roller complete, dismantle roller assembly and re-assemble with new bearings and seals.

8.3.15. The Contractor will Remove Sprung Support Roller complete, dismantle roller assembly and re-assemble with new bearings and seals

8.3.16. The Contractor will fit and adjust the sprung support roller as per original designer drawing.

8.3.17. The Contractor will then pull the positioner laterally across the track such that all pinions bottom in the rack teeth. Adjust the twin guide rollers on opposite side of rack to achieve a clearance between the rollers and the spine bar as per the original designer drawing.

8.3.18. The Contractor will then pull the Positioner laterally across the track in the opposite direction, which will withdraw pinions, until the twin guide rollers previously adjusted contact the spine bar.

8.3.19. Adjust the single guide rollers to achieve a clearance as per original designer drawing between the rollers and the spine bar. The Contractor will record the guide roller clearances.

8.3.20. The Contractor will adjust resolver unit as per original designer drawing to obtain correct backlash with racks.

8.3.21. Once the rack, guide rollers and resolver unit clearances have been set the Contractor will proceed to install the eight positioner drives.

8.4 Positioner Main Arm

8.4.1. Whilst the positioner main arm is fitted the Contractor will be required to check the clearance of the main arm and the thrust pads. The Clearance has to be in accordance with the original designer drawings.

8.4.2. The Contractor will be required to remove all the articulation pins, to ensure that the main arm does not collapse the Contractor will only remove one pin at a time. The Contractor will remove all surface rust with an emery cloth grit designation P180. Whilst these pins are out the Contractor will also repeat the same work on the pivot pin bores. Once the pivot pin and bore are cleaned the Contractor will coat the surface of the pivot pin and pivot pin bore with Copper-slip anti seize compound grease.

8.4.3. The Contractor will grind out and re-weld Front Pedestal front plate to bottom flange weld. Any improvements done to the welds mentioned above must be followed by the appropriate NDT which as a minimum will include MPI. Once any weld repair has been accepted, the Contractor will then carry out the necessary paint repairs all in accordance with the Transnet Corrosion Specification.

8.4.4. The Contractor will complete a 20% sample torque tightness bolt check for each critical bolt group.
8.4.5. The Contractor will send 1 bolt per critical connection for mechanical and chemical analysis.

8.4.6. It's not clear if the main arm ballast box has been filled with Concrete. The Contractor will remove the two inspection covers and verify that the ballast box has been filled concrete. If the ballast box has not been filled with concrete, then the Contractor will price for filling the ballast box with concrete.

8.4.7. Once all the articulation pins have been reinstated and the ballast inside the ballast box has been confirmed, the Contractor will then lift the main arm up and down through its operating range and record the operating dimensions for including in the maintenance manual.

8.5 Last Wagon Arm (LWA)

8.5.1. Similar to the main arm, the last wagon arm was also installed by the OEM and shipped with the positioner to site. Due to the amount of time that the equipment has not been rotated the Contractor will be required to support the last wagon arm and will remove the pivot pin.

8.5.2. The Contractor will remove all surface rust with an emery cloth grit designation P180. Whilst this pivot shaft is out the Contractor will also repeat the same work on the pivot shaft bore. Once the pivot shaft and bore are cleaned the Contractor will coat the surface of the pivot shaft and pivot shaft bore with Copper-slip anti seize compound grease. The Contractor will then re-assemble the pivot shaft.

8.5.3. The Contractor will then proceed to strip the latch assembly and will carry out the removal of surface rust as well as coat of machine surface with copper-slip anti seize compound grease.

8.5.4. The Contractor will remove LWA Pivot Pin, carry out the removal of surface rust, particularly the splined end and coat of machined surfaces with copper-slip anti seize compound grease.

8.5.5. The Contractor will remove Arm Head assembly, dismantle head assembly carry out the removal of surface rust as well as coat of machine surface with Copper-slip anti seize compound grease.

8.5.6. The Contractor will check alignment of LWA latch pin hole with Latch Pin and rectify accordingly.

8.5.7. The Contractor will fabricate, transport to site, and erect Coupler Alignment Tool.

8.5.8. The Contractor will alter Limit Switch Bracket to achieve correct fit.

8.5.9. Shim LWA Latch Pin Bracket to achieve alignment of Pin with LWA.

8.5.10. The Contractor will Remove Arm Head assembly from LWA, dismantle, lubricate, and re-assemble.

8.5.11. The Contractor will complete a 20% sample torque tightness bolt check for each critical bolt group.

8.5.12. The Contractor will Send 1 bolt per critical connection for mechanical and chemical analysis.

8.6 Assembly of Positioner Hydraulic System

8.6.1. The Contractor will provide and install the Positioner hydraulics in accordance with the hydraulic OEM installation method statement. The Installation will include the following:
    8.6.1.1. Connect pipework to the last wagon arm pivot shaft actuator.
    8.6.1.2. Connect pipework to the last wagon arm coupler actuator.
    8.6.1.3. Connect pipework to the last wagon arm latch actuator.
    8.6.1.4. Connect pipework to the arm raise cylinder.

8.7 Assembly of Positioner Grease Lubrication System

8.7.1. The Positioner is to be fitted with two types of automatic grease lubrication systems, namely:
    8.7.1.1. Fully automated Stand-alone, electrically driven pump type, progressive, grease lubrication systems with cycle feedback to the PLC and satisfying the lubrication needs of groups of bearings. This system supplies grease to all the pinion bearings, side guide roller bearings, sprung supported roller bearings, main arm pivots and Last Wagon Arm pivot pins.
    8.7.1.2. Fully automated Stand-alone, electrically driven pump type spraying lubricant automatically onto the gear teeth with cycle feedback to the PLC and satisfying the lubrication needs open rack and pinions.

8.7.2. The Contractor will fit both if these Fully automated Stand-alone progressive, grease lubrication systems on-board the positioner in an area that will not restrict the servicing of the systems and surrounding equipment.

8.7.3. The Contractor will then provide and fit all the stainless-steel piping and fittings to respective bearings and open rack and pinions.

8.7.4. Once all the piping is complete, the Contractor will run the respective pumps and check that grease is reaching all points that require lubrication (when power is available in conjunction with the electrical site installation method statement).

8.8 Assembly of Festoon & Travel limit Switches

8.8.1. Although the festoon rails and support structure have already been installed, the Contractor is still required to survey the festoon rail columns and check that the festoon rail columns are at the correct elevation and are vertically aligned. The survey results will be recorded and presented to the Transnet Project Manager for review and approval in principle.

8.8.2. As far as the festoon cable carriers are concerned the majority of the carriers are already in place including the fixed carrier, however the Contractor will inspect that the assembly of the carriers is in accordance with the OEM of the festoon carriers. Any adjustment that are necessary will be carried out by the Contractor. Should the Contractor discover that not all the carriers are in place, then the Contractor will install the missing carriers.

8.8.3. The Contractor will supply and Install festoon, and travel limit switches.

8.8.4. The Contractor will supply and install the positioner and festoon cables in accordance with the festoon cable schedule.

8.9 Assembly of Tippler & Positioner Lasers & Locomotive System

8.9.1. The Contractor will supply and install all the necessary brackets for the position lasers, limit switches and proximity switches required for the accurate position of the rake wagons.

8.9.2. The Contractor will then also supply and install all the necessary lasers, switches, and proximity switches. These in accordance with the standard Transnet Port Terminal specifications.

8.10 Positioner Main Frame

8.10.1. Whilst the condition of the positioner main frame was found to be acceptable and in accordance to the original designer drawings, during the phase 1 condition assessment it was discovered that some major structural welds were not acceptable in line with the load and stresses that the main frame will see during its operating life, therefore the Contractor will carry out weld repairs to the weld located between mainframe trackside web and bottom flange as well as the weld located at the main frame front fixed support roller wheel.

8.10.2. Any improvements done to the welds mentioned above must be followed by the appropriate NDT which as a minimum will include MPI. Once any weld repair has been accepted, the Contractor will then carry out the necessary paint repairs all in accordance with the Transnet Corrosion Specification.

8.10.3. It appears that the lifting plates welded to the positioner main frame for lifting and handling were not removed. The Contractor will remove these plates and grind the parent material free of all welding. Once the weld material has been completely removed then the Contractor will carry out the appropriate NDT which as a minimum will include MPI to the area where the lifting lugs was welded.

8.10.4. The Contractor will fit all missing components, as listed on sub-assembly SIP's.

8.10.5. The Contractor will complete a 20% sample torque tightness bolt check for each critical bolt group.

8.10.6. The Contractor will fit the OLEO buffers.

8.10.7. The Contractor will manufacture and fit new Encoder Guards.

8.10.8. Re-manufacture and fit trackside handrailing to reach Towing Arm and to be turned in at Drive Cartridge end.

8.11 Positioner Punch Listing

8.11.1. The Contractor will create Punch Lists on all outstanding works detailing uncompleted items including painting of bolt heads, nuts and sealing of packers. The Contractor will then carry out remedial work to damaged painting in accordance with the Transnet Corrosion Protection specification.

Note: Edges of ALL packers to be sealed with mastic and painted.

8.11.2. The Contractor will rectify all the items of the punch list. Once the Contractor is finished with his punch list and he is satisfied that the Transnet QC inspector is allowed to conduct his own punch list, the Contractor will then notify the Transnet Project Manager of all the items punched and corrected and will hand-over the completed punch list for the Transnet QC inspector to review and go through the punch list.

8.12 Final Inspection

8.12.1. The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state and that all extraneous materials, tools etc. have been removed.

8.13 Final Document Check

8.13.1. Final document check to verify that all specified operations have been completed with satisfactory results, all supporting records are available and all reported non-conformities have been satisfactorily resolved.

9 Assembly of Train Holding Devices

9.1 Foundations

9.1.1. The Contractor is required to survey the foundations for the Entry and Exit Wheel Gripper Pits. In order to do this the Contractor will be required to lift the gripper stools.

9.1.2. The survey results will be recorded and presented to the Transnet Project Manager for review and approval in principle.

9.1.3. The Contractor is required to manufacture and install ladder cleats for the small cat ladders in the four pits.

9.2 Assembly of Entry & Exit Grippers

9.2.1. The Gripper Clamp Assemblies were fully shop assembled, however because of the duration that the grippers have not been used, the gripper mechanism pivot pins are showing considerable amount of surface rust.

9.2.2. The Contractor will dismantle the gripper articulation pivot pins and will remove the surface rust with an emery cloth grit designation P180. Whilst these pivot pins are out the Contractor will also repeat the same work on the pivot pin bores. Once the pivot pins and bores are cleaned the Contractor will coat the surface of the pivot pins and pivot pins bores with Copper-slip anti seize compound grease. The Contractor will then re-assemble the gripper mechanisms.

9.2.3. The Contractor will check the alignment with the main rail and when positioned correctly on the grout packers, the Contractor will then secure the gripper unit and stools using the foundation bolts supplied – to snug tight condition. Record all dimensions and presented to the Transnet Project Manager for review and approval.

9.2.4. Once the grippers have been levelled and aligned the Contractor will then grout under the foundation frames using full strength grout and allow to cure. Fully tighten foundation and HSFG bolts.

9.2.5. The Contractor will need to price for the supply and replacement of all shims ≤3mm in stainless steel 304L. The shims currently installed are the incorrect shim material for the size mentioned above.

9.3 Entry & Exit Grippers Hydraulic Powerpacks

9.3.1. Whilst the original intention was to mount the individual hydraulic power packs in the respective gripper pits, it was decided that due to the potential of water flooding the powerpacks, the powerpacks will be moved to the outside of the gripper pits. The Contractor will place the hydraulic powerpacks at floor level alongside the respective grippers as long as the powerpacks are clear of any obstruction, i.e. sides of the ore wagons.

9.3.2. To safeguard the powerpacks from being damaged, the Contractor will install an Armco barrier, that will serve as protection from damage.

9.3.3. The Contractor will install the powerpacks with the isolation valves on all units facing away from the centre of the track.

9.3.4. Before the hydraulic powerpacks are installed, the Contractor will flush the powerpacks to remove all contamination from the pipe runs/hoses etc in accordance with the hydraulic OEM installation commissioning schedule.

9.3.5. Once the powerpacks have been flushed, the Contractor will proceed to install, the pipes to the gripper Clamp cylinders.

9.3.6. At this point the Contractor will stroke the cylinders to its full length to ensure free operation, (when power is available in conjunction with the electrical site installation method statement).

9.4 Entry & Exit Grippers Grease Lubrication

9.4.1. The Contractor will install the Gripper fully automated Stand-alone, electrically driven pump type, progressive, grease lubrication systems with cycle feedback to the PLC and satisfying the lubrication needs of groups of articulation pins.

9.4.2. The Contractor will supply and install all grease lubrication piping along with all the correct grease fittings.

9.4.3. Once all the piping is complete, the Contractor will run the respective pumps and check that grease is reaching all points that require lubrication (when power is available in conjunction with the electrical site installation method statement).

9.5 Train Holding Devices Punch Listing

9.5.1. The Contractor will create Punch Lists on all outstanding works detailing uncompleted items including painting of bolt heads, nuts and sealing of packers. The Contractor will then carry out remedial work to damaged painting in accordance with the Transnet Corrosion Protection specification.

Note: Edges of ALL packers to be sealed with mastic and painted.

9.5.2. The Contractor will rectify all the items of the punch list. Once the Contractor is finished with his punch list and he is satisfied that the Transnet QC inspector is allowed to conduct his own punch list, the Contractor will then notify the Transnet Project Manager of all the items punched and corrected and will hand-over the completed punch list for the Transnet QC inspector to review and go through the punch list.

9.6 Final Inspection

The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state and that all extraneous materials, tools etc. have been removed.

9.7 Final Document Check

The Contractor will conduct a final document check to verify that all specified operations have been completed with satisfactory results, all supporting records are available and all reported non-conformities have been satisfactorily resolved. The Final documents will be issued to the Transnet Project Manager for review and acceptance in principle.

10 Hoppers & Apron Feeders

Reference Documents:

Annexure J: Apron Feeders Specification

10.1. As conveyor 308 is already in place, the Contractor will check that the centre line of the Feeder Chutes is in line with the centreline of conveyor 308. If alignment not centred then contractor to ensure alignment is corrected.

10.2. The Contractor will before be proceeding with installation of the apron feeders, carry out a dimensional check of the apron feeder chutes, to ensure that the apron feeder chutes are correctly manufactured and installed.

10.3. It appears that all the fixing bolts of the apron feeder chutes, and support structures have all been torqued, to ensure that the correct bolts have been used, the Contractor will remove 5 bolts from around the structure for mechanical and chemical analysis. Once it's established the correct grade of bolts was used the Contractor will then carry out a random 20% torque tightness checks. If bolts are incorrect then new bolts as per design requirements will be installed. The bolts that are found not be tightened according to the torque requirements of the bolt will be tightened to the correct torque requirements.

10.4. None of the five hopper chutes and hopper outlets have been fitted with the liner panels. The Contractor will install the hopper chutes and hopper outlet liner panels.

10.5. In order to install the isolation gate frame assembly, the Contractor will be required to remove all the removable panels of the apron feeder chutes as well as the temporary spacer chute.

10.6. Once all the removable panels of the apron feeder chute have been removed the Contractor will then proceed to install the isolation gate frame assemblies.

10.7. The Contractor will manufacture and install five Apron Feeder drive Torque Reaction Arm anchor brackets.

10.8. The Contractor will clean end of Head and Tail Drive Shafts before installing Apron Feeder Drives.

10.9. The Contractor will install the five apron feeder assemblies. The Contractor will ensure that the centre lines of the feeders are in line with the centre line of conveyor 308.

10.10. Once the five-apron feeder have been installed, the Contractor will install the five apron feeder drive assemblies in position. The Contractor will ensure that the output coupling half on the feeder drive shaft is correctly positioned, and the locking element fully tightened before fitting the drive unit.

10.11. The Contractor will complete the Bolting of the Apron Feeder Chutes and Underpans to the supporting steelwork which was not completed by original installer.

10.12. The Contractor will procure, supply, transport to site and install shim packs and missing bolts.

10.13. The Contractor will then fit the Tilt Switch Assembly into position in the Feeder Chute, as well as the Material Level Sensors.
10.14. The Contractor will install all the Apron Feeder Safety Guards before the start of cold commissioning.

10.1 Hopper & Hopper Liners

10.1.1. During the phase 1 inspection it was observed that the structural integrity of the impact wall seems to be a very lightweight construction, probably not strong enough to withstand the loads expected from falling material.

10.1.2. In view of the above visual findings, the Contractor is required to review the design, re-design the required strengthening members, manufacture new strengthening members and install suitable strengthening members to the Deflector wall.

10.1.3. The Contractor will procure, supply, and install all the hopper liners in line with the installation drawing compiled by original contractor.

10.1.4. Due to the magnetic arrangement of the liner panels, to ensure that the panels stay fixed and do not slide due to weight of the panels and the material sliding over the panels, its recommended that the Contractor consider welding flat bar for the full length of the hopper walls to serve as a retaining plate for each row of liner panels. If the recommendation is not practical the contractor will provide an acceptable engineering solution and implement the solution.

10.1.5. It was observed during the phase 1 inspection that the counterweights of the wagon clamps will clash with the hopper edge beam on the non-tip side of the hopper. The Contractor is required to review the current design and make the necessary modifications to the hopper edge beam. The structural modifications will be painted in accordance with the EEAM-Q-008 Corrosion Protection specification.

10.2 Hopper Instruments

The Contractor will procure, supply, and install Material Level Sensors as per the Transnet standard.

10.3 Apron Feeder Grease Lubrication systems

10.3.1. The Contractor must take note that there are 5 fully automated Stand-alone, electrically driven pump type, progressive, grease lubrication systems with cycle feedback to the PLC and satisfying the lubrication needs of groups of bearings. This system supplies grease to all the sprocket shaft bearings of the apron feeders.

10.3.2. The Contractor will fit all five of these Fully automated Stand-alone progressive, grease lubrication systems alongside the respective apron feeder in an area that will not restrict the servicing of the systems and surrounding equipment.

10.3.3. The Contractor will then provide and fit all the stainless-steel piping and fittings to respective sprocket shaft bearings.

10.3.4. Once all the piping is complete, the Contractor will run the respective pumps and check that grease is reaching all points that require lubrication (when power is available in conjunction with the electrical site installation method statement).

10.4 Maintenance Equipment (20t Crawl Beam and Hoist)

10.1.6. The Contractor will design, fabricate, deliver to site and install 20ton crawl beam system complete with a Motorized Trolley Chain Hoist Come Along rated for 20-ton lifting capacity. Detailed drawings and design calculations to be submitted by the contractor. All structural material to be corrosion protected as per specification EEAM-Q-008 Corrosion Protection.

10.5 Hoppers & Apron Feeder Punch Listing

10.5.1. The Contractor will create Punch Lists on all outstanding works detailing uncompleted items including painting of bolt heads, nuts and sealing of packers. The Contractor will then carry out remedial work to damaged painting in accordance with the Transnet Corrosion Protection specification.

10.5.2. The Contractor will rectify all the items of the punch list. Once the Contractor is finished with his punch list and he is satisfied that the Transnet QC inspector is allowed to conduct his own punch list, the Contractor will then notify the Transnet Project Manager of all the items punched and corrected and will hand-over the completed punch list for the Transnet QC inspector to review and go through the punch list.

10.6 Knife Gates

10.6.1. The contractor will remove the 5 off spacers currently installed.
10.6.2. The contractor will install the reviewed designed 5 off Knife Gates.
10.6.3. The Knife Gates to be installed with the dedicated HPU.

10.7 Final Inspection

10.7.1. The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state and that all extraneous materials, tools etc. have been removed.

10.8 Final Document Check

10.8.1. The Contractor will conduct a final document check to verify that all specified operations have been completed with satisfactory results, all supporting records are available and all reported non-conformities have been satisfactorily resolved. The Final documents will be issued to the Transnet Project Manager for review and acceptance in principle.

11 Dust Extraction & Collection System

Reference Documents:
Annexure C: Technical Specification
Dust Extraction/ Handling Plant

1. Although most of the dust extraction plant structures are in place, the Contractor will survey the dust extraction plant foundations. Due to the state of the plant the elevations will be to the top of base plate of the support structures. The Contractor will record the survey results and will provide the Transnet Project Manager the survey results for review and approval in principle.

2. The Contractor will Design, fabricate, supply, and install ducting modification to suit error in floor slab.

3. The Contractor will arrange for all the big extraction ducting to be collected from the various places around the site and lay the ducting down in close vicinity to where the dust plant is located.

4. Scattered all over the plant is support trestles, which also need to be retrieved and laid down in close proximity to the dust plant. The Contractor will also arrange for the collection of all the dust plant structural steel.

5. As the dust cowl was removed for the lifting of the tippler cage, the installation of the ducting connecting the duct cowl extraction points will only be installed once the dust cowl is re-installed. To ensure that there is continuity of work the Contractor will proceed with the installation of all the outstanding structures and equipment on the dust extraction plant, until such time the dust cowl is re-assembled back into position. Therefore, the contractor will proceed as follows:

6. Structural
    - Install all structural columns.
    - Install all pipe ducting.
    - Install compensator.
    - Install dust monitor access platform.
    - Install extraction fan support structure.
    - Install dust extraction fan ducting.
    - Install ducting pipe 002/D32 followed by ducting pipes 004/D53 to 004/D59.
7. Mechanicals
    - Install bag filter units (Bag filter A & B)
    - Install dust extraction fan, blower fan, blower valve, isolation valve, rotary valve
    - Install dust storage diverter chute.
    - Install dust storage pug mill.
    - Install Dust Storage Ventilation Valve (Pressure Relief)
    - Install Dust Extraction Compressor 1 and Auxiliary components.
    - Install Dust Extraction Air Receiver 1 and Auxiliary valves.
    - Install Dust Extraction Desiccant Dryer 1 - and Auxiliary valves.
    - Install Dust Extraction Dust Collector 1 and Auxiliary components.
    - Install Dust Collector 1 and Auxiliary components.
    - Install Dust Extraction Air Receiver 2 – and Auxiliary valves.
    - Install Dust Extraction Desiccant Dryer 2 - and Auxiliary valves.
    - Install Dust Extraction Desiccant Dryer 2 - Secondary Filter 2
    - Install Dust Extraction Dust Collector 2
    - Install Dust Collector 2 and Auxiliary components.

11.1 Dust Cowl

11.1.1. The dust cowl to be re-installed once all the rotational checks of the tippler cage have been completed, this is to ensure that the cage is able to rotate through the complete angle of normal and maintenance operations.

11.1.2. Once the Contractor is satisfied that the tippler cage is rotating according to design requirements, the Contractor will proceed with the installation of the dust cowl, ensuring accurate fit up of all panels and components.

11.1.3. Once the dust cowl ring beams and panels have been installed the Contractor will then proceed to install the dust cowl access.

11.1.4. During the phase 1 inspection it was discovered that the seal ring at the dust cowl ends did not have the correct clearances, in view of this the Contractor will make the necessary adjustments possibly by cutting and welding, to achieve a consistent gap with Tippler End Rings.

11.1.5. The Contractor is required to engineer, procure, and install a rubber lip seal between Dust Cowl and End Rings on the in-go and out-go sides of the tippler cage.

11.1.6. The Contractor is required to design, manufacture, and install replacement Support Roller Dust Shrouds.

11.2 Dust Extraction Plant Punch List

11.2.1. The Contractor will create Punch Lists on all outstanding works detailing uncompleted items including painting of bolt heads, nuts and sealing of packers. The Contractor will then carry out remedial work to damaged painting in accordance with the Transnet Corrosion Protection specification.

Note: Edges of ALL packers to be sealed with mastic and painted.

11.2.2. The Contractor will rectify all the items of the punch list. Once the Contractor is finished with his punch list and he is satisfied that the Transnet QC inspector is allowed to conduct his own punch list, the Contractor will then notify the Transnet Project Manager of all the items punched and corrected and will hand-over the completed punch list for the Transnet QC inspector to review and go through the punch list.

11.3 Final Inspection

11.3.1. The Contractor will conduct a final inspection to confirm that the equipment, including paintwork, is in a good state and that all extraneous materials, tools etc. have been removed.

11.4 Final Document Check

11.4.1. The Contractor will conduct a final document check to verify that all specified operations have been completed with satisfactory results, all supporting records are available and all reported non-conformities have been satisfactorily resolved. The Final documents will be issued to the Transnet Project Manager for review and acceptance in principle.

12 Electrical Site Testing

12.1. The Contractor will be fully responsible to carry out and supply any consumables required for the electrical site commissioning. The Contractor will ensure that all necessary equipment and resources will be available on site before the start of the electrical site commissioning.

12.2. The Contractor is also fully responsible for the respective OEM's technical staff to be present on site for the full duration of Cold and Hot commissioning. The Costs associated with appointing this technical staff will be for the Contractors account.

12.3 Introduction

This section covers the electrical site testing and commissioning of electrical equipment provided for the Wagon Unloading Station.

12.3.1 Objectives

To verify the installed electrical equipment is in compliance with Contract Specification for the Dual Wagon Unloading Station.

To verify the electrical equipment is not visibly damaged so as to impair safety.

To carry out tests prior to connecting electrical power to the system to establish correctness and suitability of the system for energising.

To carry out live tests on individual items of plant to establish correct operation.

To carry out live tests on the total system to establish correct sequential operation.

12.3.2 General Safety Requirements

Prior to commencing any operation detailed in this schedule the following requirements must be satisfied:

12.3.2.1. All necessary 'Permit to Work' clearances must be obtained from the Transnet Project Manager. Woking at heights and associated equipment costs to be allowed for.

12.3.2.2. The TIMS Health and Safety specifications are to apply to all work on the project. Furthermore, the SHEQ risk assessment will determine all risks and associated SHEQ controls to be applied during the various phases of the project

12.3.2.3. All necessary warning notices must be posted.

12.3.2.4. All necessary safety barriers must be in place as to avoid any possibility of accidental contact with live or moving plant.

12.3.3 Test Conditions

Each section of the electrical site testing and commissioning must be completed before proceeding with tests in the subsequent section.

12.3.4 Results Sheets

12.3.4.1. Results sheets for the tests described in this literature must be produced by the Contractor and presented to the Transnet Project Manager for review and approval in principle. The Contractor will allow the Transnet Project Manager at least 8 hours to review and approve the results test sheet. The Contractor is at liberty to proceed with the testing and commissioning, if however, the Transnet Project Manager rejects a test sheet, the Contractor will action the immediate correction of such non-compliances and present the correct results to the Transnet Project Manager

12.3.4.2. Each result sheet must be completed as the tests proceed.

12.4 Energising: MCC & PLC

The tests described in this section apply respectively to the circuits within the MCC panel and PLC panel.

12.4.1 Pre-Requisites

12.4.1.1.All checks and tests in previous sections of this schedule have been satisfactorily completed.

12.4.1.2. All necessary 'Permit to Work' clearances must be obtained.

12.4.1.3. Ensure warning labels are fitted to all items where access may be gained to live or potentially dangerous equipment.

12.4.1.4. All necessary safety barriers must be in place so as to avoid any possibility of accidental contact with the respective live or moving plant.

12.4.1.5. Ensure all personnel are competent as to the use of this electrical equipment, are aware of any dangers which may exist and know what action to take in the event of such a situation occurring.

12.4.1.6. As far as is practicable, ensure there will be no load on the equipment when it is energised.

12.4.1.7. At the MCC Panel ensure the supply isolator and all outgoing circuit isolators are open and locked in the OFF position.

12.4.1.8. Ensure all remaining isolation points to sub-circuits, including all remote equipment and devices, are in the OFF position (preferably locked) at all panels.

12.4.1.9. With reference to the Panel Manufacturer Instruction Manual for the MCC Panel ensure any 'Final Check List Before Energising' is complied with.

12.4.1.10. Ensure all equipment will be energised in sequence, starting at the source end of the system, and working towards the load end.

12.4.2 Protection Settings

The Contractor will check that all fuse, overload, and protection settings in the MCC Panel are in accordance with the Single Line Diagrams and relevant schematic drawings. The Contractor will record any deviations and presented it to the Transnet Project Manager.

12.4.3 MCC Panel Incoming Supply Voltage

12.4.3.1. At Electrics House close the 400V supply circuit breaker to MCC Panel. At MCC check that the level of incoming voltage is within 400V ± 5%. Record the results and present to the Transnet Project Manager.

12.4.3.2. Check bus bar voltmeter and selector switch for correct operation.

12.4.4 MCC Panel Distribution Voltages

12.4.4.1. Close the 240V supply circuit breaker. Check that the level of incoming voltage is within 240V ± 5%. Record the results and present to the Transnet Project Manager.

12.4.4.2. Close all the MCB's to 110V AC Check the level of voltage on is within 110V ± 5%. Record the results of this section and present to the Transnet Project Manager.

12.4.4.3. Close all the MCB's to the 240V AC programming outlets. Check the voltage on the outlets is 240V ± 5% and of correct polarity.

12.4.5 Energising PLC

The Contractor will Ensure the PLC is Switched to the Program Stop Position, and carry out the following checks:

12.4.5.1. Close the 240V AC supply MCB on to the PLC.

12.4.5.2. Load the PLC program into PLC. Check that the PLC program is loaded correctly.

12.4.5.3. Check the Profibus Communication network is operating correctly.

12.4.5.4. Ensure all personnel are in safe positions, switch the PLC to the run position: Check that the CPU is operating correctly in accordance with the PLC operating manuals.

12.4.5.5. Close the 110V AC MCB's to the PLC inputs, ensuring that the circuitry is operating correctly before proceeding to the next MCB.

12.4.5.6. Close the 110V AC MCB's to the PLC outputs, ensuring that the circuitry is operating correctly before proceeding to the next MCB.

12.4.5.7. Rectify the problems that cause any MCB's to trip.

12.4.5.8. Using the LED's on the PLC, check out all digital input contacts (switches, push buttons, relay and contactor contacts, etc) against the I/O Schedule to ensure they operate correctly and are of the correct polarity. Rectify any errors found.

12.4.5.9. Mark-up a copy of the I/O Schedule and append to Results Sheets to confirm these digital input checks have been performed and to record any required amendments.

12.4.5.10. Check out all digital outputs against the I/O Schedule to ensure they operate their loads (relays, solenoids, lamps, warning devices, etc) correctly and with correct polarity. Rectify any errors found.

Note 1
The Contractor will Ensure all 415V mains power supplies to final circuits are still isolated before commencing this step.

Note 2
The Contractor will use the respective schematic drawings to determine which contacts need to be temporarily linked out to simulate closed contacts in order to prove the PLC output signals and wiring. Remove all temporary links afterwards.

12.4.5.11. The Contractor will Mark-up a copy of the I/O Schedule and append to Results Sheets to confirm these digital output checks have been performed and to record any required amendments.

12.4.5.12. The Contractor will Check the Following:

- Positioner Encoder
- Tippler Encoder.

The Contractor will Check, as far as is possible at this stage, that all these encoders are operating correctly in accordance with their operating manuals and are correctly addressed and communicating via the Profibus network.

12.5 Energising Intouch SCADA

The following steps will be carried out by the Contractor, namely:

12.5.1. Close the 240V AC supply MCB to the Intouch SCADA Tippler Operators Control Screen.

12.5.2. Check, as far as is possible at this stage that the Intouch SCADA system hardware is operating correctly in accordance with its operating manual.
12.5.3. Check that the Intouch SCADA application program is loaded correctly and running.

12.5.4. Check that Intouch SCADA is communicating with the PLC Ethernet Communication Card and PLC I/O Database.

12.5.5. Toggle the "Cycle Start Pushbutton" on the relevant Intouch SCADA Screen and Check that the PLC receives the correct Signal.

12.5.6. Toggle the status of a known PLC Input or Output and check that the Intouch SCADA shows the correct status.

12.5.7 110V AC Relay and Contactor Circuitry

The Contractor will Check out the correct operation of all the 110V AC relay and contactor circuitry against the schematic drawings. Rectify any errors found.

Note 1

The Contractor will Ensure all 415V mains power supplies to final circuits are still isolated before commencing this step.

Note 2

The Contractor will Use the respective schematic drawings to determine which contacts need to be temporarily linked out to simulate closed contacts in order to prove the operation and wiring. Remove all temporary links afterwards.

12.6 Emergency Stop & Overtravel Circuitry

The Contractor will check out the correct operation of all the emergency stop & overtravel circuitry in schematic drawing. Rectify any errors found.

Note 1

The Contractor will Ensure all 415V mains power supplies to final circuits are still isolated before commencing this step.

Note 2

The Contractor will Use the respective schematic drawings to determine which contacts need to be temporarily linked out to simulate closed contacts in order to prove the operation and wiring. Remove all temporary links afterwards.

12.7 Energising MCC Motor Starter Modules

12.7.1. The tests described in this section apply respectively to all the motor starter modules, which should be fully tested one at a time in the most convenient order by the Contractor:

- Entry Wheel Grippers & Hyd. Pump Motor #1
- Entry Wheel Grippers & Hyd. Pump Motor #2
- Entry Wheel Grippers & Hyd. Pump Motor #3
- Entry Wheel Grippers & Fill Filter Pump #1
- Entry Wheel Grippers & Fill Filter Pump #2
- Entry Wheel Grippers & Fill Filter Pump #3
- Exit Wheel Grippers & Hyd. Pump Motor #1
- Exit Wheel Grippers & Fill Filter Pump
- Positioner Hyd. Pump Motor #1
- Positioner Hyd. Pump Motor #2
- Positioner Fill Filter Pump.

12.7.2. At the MCC terminals, the Contractor will temporarily disconnect and insulate the power supply cable to the motor of the module being tested.

12.7.3. Check the overload is reset.

12.7.4. Close the 110V AC control supply MCB to the respective MCC module.

12.7.5. De-isolate and close the 415V power supply circuit breaker to the respective module.

12.7.6. From all the drive schematic drawings, ensure the respective LOS trip contacts are closed and energise the Safety Relay within the respective modules.

12.7.7. Momentarily force the PLC output signal for its Start Relay inside the respective module to check the following signal is being received correctly at the PLC: -

- "Module" Contactor Closed.

12.7.8. Rectify any problems found.

12.7.9. Record the final status of each module and present to Transnet Project Manager for review and approval in principle.

12.8 Commission the Brake Systems

12.8.1 Positioner Brake Systems

12.8.1.1. Commission the Positioner Brake Systems for operation in accordance with their Manufacturer Instruction Manuals. This should include but not be limited to:

- Ensuring all safety devices are fully functional.
- Checking correct operation all associated PLC inputs and outputs for these systems.

12.8.1.2. Force respective PLC outputs as required to check correct operation of all brakes and feedback signals to the PLC.

12.8.2 Commission the Tippler Brake System

12.8.2.1. The Contractor will commission the Tippler Brake System for operation in accordance with the Manufacturer Instruction Manuals. This should include but not be limited to:

- Tippler Entry & Exit Normal Brake
- Tippler Entry & Exit Emergency Brake
- Ensuring all safety devices are fully functional.
- Checking correct operation all associated PLC inputs and outputs for these systems.

12.8.2.2. Force respective PLC outputs as required to check correct operation of all the tippler brake systems and their feedback signals to the PLC.

12.9 Energising: AC VVVF Drive Cubicles

The tests described in this section apply respectively to the following AC drives and their VVVF drive motors which should be fully tested one at a time in the most convenient order by the Contractor:

- Positioner Drive Motor #1
- Positioner Drive Motor #2
- Positioner Drive Motor #3
- Positioner Drive Motor #4

- Positioner Drive Motor #5
- Positioner Drive Motor #6
- Positioner Drive Motor #7
- Positioner Drive Motor #8
- Tippler Entry Drive Motor
- Tippler Exit Drive Motor
- Apron Feeder Drive Motor #1
- Apron Feeder Drive Motor #2
- Apron Feeder Drive Motor #3
- Apron Feeder Drive Motor #4
- Apron Feeder Drive Motor #5.

12.9.1 Pre-Requisites

12.9.1.1. The Contractor will ensure that the Drives Commissioning Engineer shall be involved with all the checking, setting up and testing of the AC drive cubicles described in this section.

12.9.1.2. With reference to the Siemens AC Drive Instruction Manual ensure any 'Final Check List Before Energising' is complied with.

12.9.1.3. All checks and tests in previous sections of this schedule have been satisfactorily completed.

12.9.1.4. All necessary 'Permit to Work' clearances must be obtained.

12.9.1.5. Ensure warning labels are fitted to all items where access may be gained to live or potentially dangerous equipment.

12.9.1.6. All necessary safety barriers must be in place so as to avoid any possibility of accidental contact with the respective live or moving plant.

12.9.1.7. Ensure all personnel are competent as to the use of this electrical equipment, are aware of any dangers which may exist and know what action to take in the event of such a situation occurring.

12.9.1.8. The Tippler and Positioner areas shall be free of wagons.
12.9.1.9. At MCC ensure all the respective main AC drive supply isolators are open and locked in the OFF position.

12.9.1.10. Ensure all respective 110V AC control supply circuit breakers are open.

12.9.1.11. Ensure all respective isolators and circuit breakers are open in the respective AC drive cubicles.

12.9.1.12. Ensure all equipment will be energised starting at the source end of the system and working towards the load end.

12.9.2 Protection Settings

12.9.2.1. The Contractor will check that all fuse, overload, and protection settings in the MCC are in accordance with the relevant schematic drawings.

12.9.3 110V AC DC Control Supply Voltages

The Contractor will carry out the following:

12.9.3.1. At the MCC close the respective 110V AC control supply circuit breakers to all AC drive cubicles.

12.9.3.2. Check the level of incoming control voltages into the AC drive cubicles are within ± 5% of their nominal values. Record the measured results of this section and present to the Transnet Project Manager for review and approval in principle.

12.9.4 240V AC Motor Heater Supplies

The Contractor will carry out the following:

12.9.4.1. Close the Positioner drive motor anti-condensation heater supply circuit breakers within the respective AC drive cubicles.

12.9.4.2. Check for correct operation of the circuitry to each drive motor anti-condensation heater. Rectify any problems found.

12.9.4.3. Check the level of voltage and current at each drive motor anti-condensation heater. Record the measured results.

12.9.5 Software Configuration of AC drives

The Contractor will carry out the following:

12.9.5.1. Check that the software has been correctly installed into all AC drive units by Drives Commissioning Engineer.

12.9.5.2. Perform the procedure as recommended by Drives Commissioning Engineer to confirm that the AC drive software is functioning correctly and is ready for controlling power to the respective VVVF drive motors.

12.9.5.3. Check that the Profibus connections is installed into all AC drive units and the drives are communicating with the PLC CPU.

12.9.6 AC Drive Cubicle Ancillary Circuits

12.9.6.1. The Contractor will perform any additional checks and tests that may be required on the following associated circuits before the AC drives are powered up:

- Drive motor thermistor circuit
- Drive motor tacho speed encoder
- Profibus data communication circuitry
- Emergency stop circuitry.
- Start Contactor circuitry.
- Positioner Encoder circuitry

- Tippler Encoder circuitry.

12.9.6.2. Check for correct operation and direction of rotation of the following items by momentarily forcing the PLC output signal for their Start Relay inside the respective module. Rectify any problems found.

12.10 Commissioning No-Load Operation:

12.10.1 Positioner Drive Motors

12.10.1.1. The procedures described in this section apply to operation of the following motors and their associated control circuitry:

- Positioner Drive Motor #1
- Positioner Drive Motor #2
- Positioner Drive Motor #3
- Positioner Drive Motor #4
- Positioner Drive Motor #5
- Positioner Drive Motor #6
- Positioner Drive Motor #7
- Positioner Drive Motor #8.

12.10.1.2. Pre-Requisites

12.10.1.2.1. The Drives Commissioning Engineer shall be involved with all the checking, setting up and testing of the AC drive cubicles described in this section.

12.10.1.2.2. All checks and tests in previous sections of this schedule have been satisfactorily completed.

12.10.1.2.3. All 'Permit to Work' clearances on the Positioner have been cleared and their associated warning and safety barriers have been removed.

12.10.1.2.4. Special barriers shall be placed around the potentially dangerous areas of the Positioner motor drive pinions going to be rotated during this procedure.

12.10.1.2.5. Ensure all personnel are informed that the Positioner motors could be operating without warning, that they are aware of the potential dangers which will then exist and know what actions to take in the event of such situations occurring.

12.10.1.2.6. The Positioner area shall be free of wagons.

12.10.1.2.7. PLC and Intouch SCADA are fully operational.

12.10.2 Energising the Positioner Motors on No-Load

The Contractor will carry out the following:

12.10.2.1. The Contractor will ensure sufficient sections of rack are removed to allow no-load operation of the individual Positioner drive motors.

12.10.2.2. At the MCC ensure that all the respective Positioner main AC drive supply 400V isolators and 110V AC control supply circuit breakers are closed.

12.10.2.3. At the Positioner AC drive cubicles ensure all respective isolators and circuit breakers are closed.

12.10.2.4. Carry out any remaining AC drive parameter set-up, start-up and tuning procedures as detailed in the Siemens AC Drive Instruction Manual Commissioning Instructions.

12.10.2.5. Carry out tests to confirm the emergency stop circuitry for the Positioner motors is operating correctly.

12.10.2.6. In conjunction with the Siemens Engineer and the PLC Commissioning Engineer ensure that when all VVVF drive brake release signals are energised, that the brakes release and the relevant signals are received at the drives.

12.10.2.7. Operate each Positioner AC drive and its associated drive. Perform functional tests to confirm that each drive 'system' is operating satisfactorily, including brake control, Correct Direction of the motor, the motor's tacho speed encoder, thermistor and anti-condensation heater circuit.

12.10.2.8. Operate the drive at all required speeds and ramps. Operate the drive fast stop circuit and confirm that the drive stops the motor under a fast ramp, without going into current limit or overload.

12.10.2.9. Ensure the following AC drive Profibus signals are communicating and are calibrated correctly:

- Speed reference
- Speed feedback
- Torque feedback (if required).

Note: It will be necessary to have the Positioner brakes available. In conjunction with the PLC Commissioning Engineer, make the relevant temporary changes to allow all the brakes to be released on command of the AC Drive being tested.

12.10.2.10. After the individual Positioner AC drives have been set-up and operated successfully, operate the complete Positioner AC drive 'system' under no load conditions at all speeds, recording the values of voltage, current and frequency.

12.10.2.11. When the Positioner AC Drive no-load have been satisfactorily completed, switch off the Positioner AC drives. Replace the Positioner rack sections.

12.10.2.12. Transnet Port Terminals Saldanha will make available sufficient rail wagons and commodity for the commissioning and testing activities to take place.

13 Commissioning

13.1 Responsibilities

13.1.1 Contractor's Responsibilities

13.1.1.1. The Contractor shall undertake pre-commissioning and no-load commissioning of the Machine.

13.1.1.2. The Contractor under the supervision of the Supervisor shall perform Load Commissioning and Performance Testing.

13.1.1.3. Commissioning of the Machine shall include checking the function and operation of each component of the equipment, pre-commissioning, no-load commissioning, load commissioning and performance testing.

13.1.1.4. The Contractor shall ensure that sufficient spare parts are available on site prior to the commencement of commissioning.

13.1.1.5. The Contractor shall submit to the Project Manager for approval a commissioning manual detailing the sequence, timing and operation of all commissioning and testing work and procedures necessary to complete the Works.

13.1.1.6. The Contractor shall be responsible for engaging experienced personnel or a representative of the manufacturer to perform the commissioning of items of equipment. The attendance of such representatives shall be indicated on the commissioning program.

13.1.1.7. The Contractor shall supply all necessary personnel required during commissioning of equipment supplied by the Contractor including specialists to check out and assist with start-up and calibration of equipment for optimum operation and to meet guaranteed performance. The field personnel provided by the Contractor shall be capable, qualified, and able to perform the duties required to the satisfaction of the Project Manager and shall be vested with authority to make decisions binding on the Contractor.

13.1.1.8. The Contractor shall provide all tools, including special tools, and test equipment having current calibration certificates, which will be required by his personnel for commissioning.

13.1.1.9. The Contractor shall furnish necessary technical services as required to resolve any technical and operating problems as they develop.

13.1.1.10. During commissioning the Contractor shall liaise closely with the Project Manager, particularly regarding availability of ancillary equipment provided by others, e.g., conveyors and wagons which may not always be available to the Contractor.

13.1.1.11. The Contractor shall maintain a diary of all events during commissioning and record all test results. On the completion of commissioning, he shall prepare and submit to the Project Manager a report recording the commissioning of the Machine.

13.1.1.12. The Contractor is fully responsible for the performance of the plant and the involvement of the Transnet Port Terminals Saldanha operators shall in no way relieve the Contractor from his responsibility for the Machine under the Contract.

13.1.1.13. The Contractor shall implement and conduct training. The Transnet Port Terminals Saldanha operators shall be used for plant operation during no-load commissioning, load commissioning and performance testing as detailed in the following sections as a minimum and as further detailed in the Contractor's training manual.

13.1.1.14. The Contractor shall supply all necessary oils and lubricants for equipment requiring oil and lubrication, in accordance with the manufacturer's instructions, and shall be responsible for lubrication of all equipment before and during pre-commissioning and no-load commissioning. The Contractor shall use the Transnet Port Terminals Saldanha's standard lubricants whenever possible.

13.1.2 Transnet Port Terminals Saldanha's Responsibilities

The Transnet Port Terminals Saldanha will make available to the Contractor power and, subject to availability, ancillary equipment during the commissioning period. Transnet Port Terminals Saldanha will provide any operating personnel required for the ancillary equipment.

13.2 Commissioning No-Load Operation:

13.2.1 Tippler Drive Motors

13.2.1.1.The procedures described in this section apply to operation of the following motors and their associated control circuitry and Tippler cells.

- Tippler Entry Drive Motor
- Tippler Exit Drive Motor.

13.2.1.2. Pre-Requisites

13.2.1.2.1. The Drives Commissioning Engineer shall be involved with all the checking, setting up and testing of the AC drive cubicles described in this section.

13.2.1.2.2. All checks and tests in previous sections of this schedule have been satisfactorily completed.

13.2.1.2.3. All 'Permit to Work' clearances on the Tippler have been cleared and their associated warning and safety barriers have been removed.

13.2.1.2.4. Special barriers shall be placed around the potentially dangerous areas of the Tippler motor drive pinions going to be rotated during this procedure.

13.2.1.2.5. Ensure all personnel are informed that the Tippler motors could be operating without warning, that they are aware of the potential dangers which will then exist and know what actions to take in the event of such situations occurring.

13.2.1.2.6. In conjunction with the Mechanical Commissioning Engineer, ensure that there are sufficient restraints applied to the Tippler Cells to prevent any movement during these tests.

13.2.1.2.7. The Tippler area shall be free of wagons.

13.2.1.2.8. PLC and Intouch SCADA are fully operational.

13.2.1.3. Energising Each Tippler Motor on No-Load

13.2.1.3.1. Disconnect the relevant drive couplings to allow no-load operation of the Tippler drive motors.

13.2.1.3.2. At the MCC ensure that all the respective Tippler main AC drive supply 400V isolators and 110V AC control supply circuit breakers are closed.

13.2.1.3.3. At the Tippler AC drive cubicles ensure all respective isolators and circuit breakers are closed.

13.2.1.3.4. Carry out any remaining AC drive parameter set-up, start-up and tuning procedures as detailed in the Siemens AC Drive Instruction Manual Commissioning Instructions.

13.2.1.3.5. Carry out tests to confirm the emergency stop circuitry for the Tippler motors is operating correctly.

13.2.1.3.6. In conjunction with the Drives Engineer and the PLC Engineer ensure that when the VVVF drive normal brake release signals are energised, that the brakes release, and the relevant signals are received at the PLC.

13.2.1.3.7. In conjunction with the PLC Commissioning Engineer ensure that when the emergency stop circuit is complete the tippler emergency brake is released, and the signal is received at the PLC.

13.2.1.3.8. In conjunction with the PLC Engineer ensure that when the emergency stop circuit is tripped the tippler emergency brake is engaged and there is no feedback signal at the PLC.

13.2.1.3.9. Operate each Tippler AC drive and its associated drive motor. Perform functional tests to confirm that each drive 'system' is operating satisfactorily, including the motor's tacho speed encoder, thermistor, and anti-condensation heater circuit.

13.2.1.3.10. Ensure the AC drive Profibus signals are communicating correctly, and the signals are calibrated correctly:

- Speed reference
- Speed feedback
- Torque feedback.

Note

It will be necessary to have the Tippler brakes available. In conjunction with the PLC Engineer, make the relevant temporary changes to allow all the Tippler brakes to be released on command of the AC Drive being tested.

13.2.1.3.11. After the individual Tippler AC drives have been set-up and operated successfully, switch off the Tippler AC drives and replace the drive couplings removed.

13.2.1.4. Operating Tippler on No-Load

13.2.1.4.1. Operate both Tippler AC drives as a 'system' under no load conditions at all the speeds specified in the Results Table, recording the values of voltage, current and frequency.

13.2.1.4.2. Set the maximum 'Maintenance Mode' speed of each Tippler cell to 6.0 degrees/second.

13.2.1.4.3. Isolate the MCC motor starters for the Tippler Brake Motors and remove any temporary PLC changes made.

13.3 Operational Tests in Maintenance Mode

13.3.1 Entry Wheel Grippers (No Wagons)

The Contractor will carry out the following:

13.3.1.1. Pre-Requisites

13.3.1.1.1. All checks and tests in previous have been satisfactorily completed.

13.3.1.1.2. All 'Permit to Work' clearances on the Entry Wheel Grippers have been cleared and their associated warning and safety barriers have been removed.

13.3.1.1.3. Special barriers shall be placed around the potentially dangerous areas of the Entry Wheel Grippers.

13.3.1.1.4. Ensure all personnel are informed that the Entry Wheel Grippers could be operating without warning, that they are aware of the potential dangers which will then exist and know what actions to take in the event of such situations occurring.

13.3.1.1.5. The Entry Wheel Grippers area shall be free of wagons.

13.3.1.1.6. PLC and Intouch SCADA are fully operational.

13.3.1.1.7. The Entry Wheel Grippers released limit switches have been set up in accordance with the relevant drawings.

13.3.1.2. Commission the Entry Wheel Grippers Hydraulic Systems

Commission the Entry Wheel Grippers Hydraulic Power Pack and hydraulic system in accordance with the Manufacturers Instruction Manual. This should include but not be limited to:

- Checking for correct rotation of all Motors & Pumps
- Flushing the system for at least two hours using temporary filters
- Fitting new filters after flushing
- Inspecting all pipework for leaks and rectify any found.
- Ensuring correct pressures are attained.
- Ensuring all safety devices are fully functional.
- Checking correct operation all PLC inputs and outputs at the hydraulic power pack.

Note

This procedure will require the Entry Wheel Grippers Pump Motor and 110V AC control supply circuit breakers to be closed when required at the MCC.

13.3.1.3. Operating the Entry Wheel Grippers #1, #2, #3

13.3.1.3.1. At the Intouch SCADA Station on the Control Desk select Maintenance Mode.

13.3.1.3.2. At the Wheel Grippers Hydraulic Power Pack Check for correct operation of all its functions from all the relevant Local Control Stations (Pump Start / Stop etc).

13.3.1.3.3. With the assistance of the Mechanical Commissioning engineer close the Wheel Grippers and set the closed gaps in accordance with the relevant drawings.

13.3.1.3.4. At its LCS open the Wheel Grippers. Check that the Grippers return to the required set positions.

13.3.1.3.5. Operate the Wheel Grippers to check for correct operation of all the limit / Pressure switches and their signals back to the PLC.

13.3.1.3.6. Operate the Wheel Grippers to measure and record the pressures, operating times, pressure and settings, record results and present the results to the Transnet Project Manager for review and approval in principle.

13.4 Operational Tests In 'Local' Mode

13.4.1 Exit Wheel Grippers (No Wagons)

The Contractor will carry out the following:

13.4.1.1. Pre-Requisites

13.4.1.1.1. All checks and tests in previous sections of this schedule have been satisfactorily completed.

13.4.1.1.2. All 'Permit to Work' clearances on the Exit Wheel Grippers have been cleared and their associated warning and safety barriers have been removed.

13.4.1.1.3. Special barriers shall be placed around the potentially dangerous areas of the Exit Wheel Grippers.

13.4.1.1.4. Ensure all personnel are informed that the Exit Wheel Grippers could be operating without warning, that they are aware of the potential dangers which will then exist and know what actions to take in the event of such situations occurring.

13.4.1.1.5. The Exit Wheel Grippers area shall be free of wagons.

13.4.1.1.6. PLC and Intouch SCADA are fully operational.

13.4.1.1.7. The Gripper limit switches have been set up in accordance with the relevant drawing.

13.4.1.2. Commission the Exit Wheel Grippers Hydraulic System

Commission the Exit Wheel Grippers Hydraulic Power Pack and hydraulic system in accordance with the OEM Instruction Manual. This should include but not be limited to:

- Filling with oil
- Checking for correct rotation of all the motors
- Flushing the system for at least two hours using temporary filters
- Fitting new filters after flushing
- Inspecting all pipework for leaks and rectify any found.
- Ensuring correct pressures are attained.
- Ensuring all safety devices are fully functional.
- Checking correct operation all PLC inputs and outputs at the hydraulic power pack.

Note
This procedure will require the Exit Wheel Grippers Pump Motor supply 400V isolators and 110V AC control supply circuit breakers to be closed when required at the MCC, and Maintenance Mode to be set at the Control Desk.

13.4.1.3. Operating the Exit Wheel Grippers

13.4.1.3.1. At the Intouch SCADA Station on the Control Desk select Maintenance Mode.

13.4.1.3.2. At the Wheel Grippers Hydraulic Power Pack Check for correct operation of all its functions from all the relevant Local Control Stations (Pump Start / Stop etc).

13.4.1.3.3. At its LCS open the Grippers. Check that the Grippers return to the required set positions.

13.4.1.3.4. At its LCS operate the Grippers to check for correct operation of all the limit / Pressure switches and their signals back to the PLC.

13.4.1.3.5. Operate the Grippers to measure and record the pressures, operating times, pressure and settings record results and present the results to the Transnet Project Manager for review and approval in principle.

13.5 Operational Tests In 'Local' Mode

13.5.1 Positioner (No Wagons)

The Contractor will carry out the following:

13.5.1.1. Pre-Requisites

13.5.1.1.1. The Siemens Commissioning Engineer shall be involved with all the checking, setting up and testing of the AC drive cubicles described in this section.

13.5.1.1.2. All checks and tests in previous sections of this schedule have been satisfactorily completed.

13.5.1.1.3. All 'Permit to Work' clearances on the Positioner have been cleared and their associated warning and safety barriers have been removed.

13.5.1.1.4. Special barriers shall be placed around the potentially dangerous areas of the Positioner.

13.5.1.1.5. Ensure all personnel are informed that the Positioner could be operating without warning, that they are aware of the potential dangers which will then exist and know what actions to take in the event of such situations occurring.

13.5.1.1.6. The Positioner area shall be free of wagons.

13.5.1.1.7. PLC and Intouch SCADA are fully operational.

13.5.1.2. Commission the Positioner Lock-off Stop Pushbuttons

Press the Lock-off Stop Pushbuttons and check for correct operation of their associated circuitry. Rectify any problems found.

13.5.1.3. Commission the Positioner Warning Devices

Force respective PLC outputs as required to check correct operation of the Warning Beacon and Warning Siren for the Positioner.

13.5.1.4. Commission the Tippler Warning Devices

Force respective PLC outputs as required to check correct operation of the Warning Beacons and Warning Sirens for Tippler Entry and Tippler Exit.

13.5.1.5. Commission the Positioner Lubrication Systems

13.5.1.5.1. Commission the Positioner Lubrication Systems for operation in accordance with their OEM's Instruction Manuals. This should include but not be limited to:

- Filling with lubricant(s)
- Checking for correct rotation of the pump motor and air compressor
- Inspecting all pipework for leaks and rectify any found.
- Ensuring correct pressures are attained.
- Ensuring all safety devices are fully functional.
- Checking correct operation all associated PLC inputs and outputs for these systems.

13.5.1.5.2. This procedure will require the Positioner Lubrication Pump and 400V isolators and 110V AC control supply circuit breakers to be closed when required at the MCC.

13.5.1.5.3. Force respective PLC outputs as required to check correct delivery of lubricant at each delivery point and feedback signals to the PLC.

13.5.1.6. Commission the Positioner Limit Switches

13.5.1.6.1. Set up the following Positioner travel limit switches in accordance with the relevant drawing:

- Positioner Forward Overtravel Limit
- Positioner Forward Limit
- Positioner Reverse Limit
- Positioner Reverse Overtravel Limit.

13.5.1.6.2. Set up the following Positioner Arm limit switches in accordance with the relevant drawing:

- Positioner Arm Lowered
- Positioner Arm Lowered Slowdown Limit
- Positioner Arm Raised
- Positioner Arm Raised Slowdown Limit
- Commission the Last Car laser.

13.5.1.6.3. Ensure the Last Car laser pair are energised then block the beam to ensure correct operation and feedback signals to the PLC.

13.5.1.7. Commission the Positioner travel motion over normal travel range

13.5.1.7.1. At the Intouch SCADA Station on the Control Desk select Maintenance Mode.

13.5.1.7.2. At the Positioner LCS check for correct operation of all its functions except the arm engage & arm raise pushbuttons.

13.5.1.7.3. From its LCS drive the Positioner along the track over its NORMAL range of travel to perform functional tests to confirm that the mechanical drive 'system' is operating satisfactorily.

13.5.1.7.4. From its LCS drive the Positioner along the track over its NORMAL range of travel to perform functional tests to confirm that the Encoder is operating satisfactorily and feedback to the PLC.

13.5.1.7.5. Operate each of the limit switches to ensure correct operation and feedback signals to the PLC.

13.5.1.7.6. Drive the Positioner along the track at the design speeds, recording the results in Results Table, as the test proceeds.

13.5.1.8. Commission the Positioner travel motion overtravel recovery

13.5.1.8.1. At the Positioner LCS move the Positioner at slow speed into the FORWARD overtravel limit switch. Ensure that the Positioner stops under the action of the Forward Overtravel Limit Switch.

13.5.1.8.2. At the Intouch SCADA panel, acknowledge the overtravel alarm.

13.5.1.8.3. At the Positioner LCS, push and hold the Travel Joystick in the 'back' direction, noting that the alarm sounds, and the Positioner automatically moves back out from the over travelled position. When it is safely within range of NORMAL travel the joystick can be released and the Positioner should stop.

13.5.1.8.4. At the Positioner LCS move the Positioner at slow speed into the REVERSE overtravel limit switch. Ensure that the Positioner stops under the action of the Reverse Overtravel Limit Switch.

13.5.1.8.5. At the Intouch SCADA panel, acknowledge the overtravel alarm.

13.5.1.8.6. At the Positioner LCS, push and hold the Travel Joystick in the 'forward' direction, noting that the alarm sounds, and the Positioner automatically moves forward out from the over travelled position. When it is safely within range of NORMAL travel the joystick can be released and the Positioner should stop.

13.5.1.9. Commission the Positioner Arm

13.5.1.9.1. At the Intouch SCADA Station on the Control Desk select Maintenance Mode.

13.5.1.9.2. Operate each of the Positioner Arm limit switches to ensure correct operation and feedback signals to the PLC.

13.5.1.9.3. From the Positioner LCS, operate the Positioner Arm between the fully Engaged and fully raised positions to ensure correct mechanical operation.

13.5.1.10. Commission the Positioner Encoder

13.5.1.10.1. Using the PLC Programmer to monitor PLC input, ensure the encoder count input to the PLC increases as the Encoder shaft is rotated in the forward direction (if necessary, reverse the Encoder signal to ensure this correct situation).

13.5.1.10.2. To ensure correct set-up and operation of the Encoder, move the Positioner under Maintenance control mode to the fully reversed to Buffer Stop position.

13.5.1.10.3. Use the 'Reset to Pre-set' facility to reset the encoder to its pre-determined value.

13.5.1.10.4. Move the Positioner under Maintenance control to the fully forward to Buffer Stop position and then check the encoder value. If the encoder value is incorrect to the distance travelled re-calibrate the settings within the PLC software and download the new settings to the encoder. Move the positioner and re-check the PLC value change is consistent with the distance travelled.

13.5.1.10.5. When the Encoder/encoder has been set-up correctly as above, move the Positioner to the each of the positions and record the encoder count and present the results to the Transnet Project Manager for review and approval in principle.

13.5.1.11. Commission the Positioner Arm Gap Laser

(Note a rake of 20 wagons central in the tippler will be required, the Contractor will need to plan this in advance and will notify the Transnet Project Manager accordingly).

13.5.1.11.1. Set up the Positioner Arm Gap #1 and Positioner Arm Gap #2.

13.5.1.11.2. Ensuring these lasers are energised, ensure correct operation and feedback signals to the PLC.

13.5.1.12. Check Operation of Positioner temperature and vibration sensors

13.5.1.12.1. Check the temperature and Vibration sensors on all travel drive motors to ensure they are operating correctly.

13.5.1.12.2. Ensure the temperature and Vibration signals are being received correctly at the PLC.

13.6 Operational Tests In 'Maintenance' Mode – Tippler (No Wagons)

The Contractor will carry out the following:

13.6.1. Pre-Requisites

13.6.1.1. The Drives Commissioning Engineer shall be involved with all the checking, setting up and testing of the AC drive cubicles described in this section.

13.6.1.2. All checks and tests in previous sections of this schedule have been satisfactorily completed.

13.6.1.3. All 'Permit to Work' clearances on the Tippler have been cleared and their associated warning and safety barriers have been removed.

13.6.1.4. Special barriers shall be placed around the potentially dangerous areas of the Tippler.

13.6.1.5. Ensure all personnel are informed that the Tippler could be operating without warning, that they are aware of the potential dangers which will then exist and know what actions to take in the event of such situations occurring.

13.6.1.6. The Tippler area shall be free of wagons.

13.6.1.7. PLC and Intouch SCADA are fully operational.

13.6.2. Commission the Tippler Lubrication Systems

13.6.2.1. Commission the Tippler Lubrication Systems for operation in accordance with their Manufacturers Instruction Manuals. This should include but not be limited to:

- Filling with lubricant(s)

- Checking for correct rotation of the pump motor
- Inspecting all pipework for leaks and rectify any found.
- Ensuring correct pressures are attained.
- Ensuring all safety devices are fully functional.
- Checking correct operation all associated PLC inputs and outputs for these systems.

13.6.2.2. Force respective PLC outputs as required to check correct delivery of lubricant at each delivery point and feedback signals to the PLC.

13.6.3. Commission the Tippler Limit Switches

13.6.3.1. Set up the following Tippler limit switches in accordance with the relevant Drawings:

- Overtravel Return Limit
- At Rail Level Limit
- Not Over tipped Limit
- Overtravel Tip Limit.

13.6.3.2. Operate each of the limit switches to ensure correct operation and feedback signals to the PLC.

13.6.4. Commission the Tippler Local Control Stations

13.6.4.1. At the Intouch SCADA Station on the Control Desk select Maintenance Mode.

13.6.4.2. Check the Profibus Communications to the Main PLC CPU from all the Tippler Local Control stations. Correct any malfunctions.

13.6.4.3. At the Tippler LCS station #1 (Tip side) check for correct operation of all its control operators into the PLC.

13.6.4.4. At the Tippler LCS station #2 (non-Tip side) check for correct operation of all its control operators into the PLC.

13.6.4.5. At the Tippler LCS station #1 check for correct operation of all its indicators out from the PLC.

13.6.4.6. At the Tippler LCS station #2 check for correct operation of all its indicators out from the PLC.

13.6.5. Commission the Tippler Entry Clear lasers

Ensure the Tippler Entry Clear laser pair are energised then block the beam to ensure correct operation and feedback signals to the PLC.

13.6.6. Commission the Tippler Exit Clear lasers.

Ensure the Tippler Exit Clear laser pair are energised then block the beam to ensure correct operation and feedback signals to the PLC.

13.6.7. Check Operation of Tippler Temperature and Vibration Sensors

13.6.7.1. Check the temperature and vibration sensors on the Tippler to ensure they are operating correctly.

13.6.7.2. Ensure the temperature and vibration signals are being received correctly at the PLC.

13.6.8. Commission the Tippler Encoders

13.6.8.1. Using the PLC Programmer to monitor PLC input, ensure the encoder count input to the PLC increases as the Encoder shaft is rotated in the Tippler tip direction.

13.6.8.2. To ensure correct set-up and operation, slowly move the Tippler under Maintenance Mode to the fully tipped Buffer Stop position.

13.6.8.3. Use the 'Reset to Pre-set' facility reset the encoder to the required positional value.

13.6.8.4. Move the Tippler under Maintenance control to the fully returned to Buffer Stop position and then check the encoder count input to the PLC. If the encoder value is incorrect to the rotational angle travelled re-calibrate the settings within the PLC software and download the new settings to the encoder. Move the tippler and re-check the PLC value change is consistent with the rotational angle travelled.

13.6.8.5. When the encoders have been set-up correctly as above, move the Tippler to each of the positions and record the encoder count and present the results to the Transnet Project Manager for review and approval in principle.

13.6.9. Commission the Tippler Drive Motion Over Normal Travel Range

13.6.9.1. At the Intouch SCADA Station on the Control Desk select Maintenance Mode.

13.6.9.2. At the Tippler Cell LCS (Non-Tip Side) check for correct functionality of all the separate operations and equipment controlled from that LCS.

13.6.9.3. At the Tippler Cell LCS (Non-Tip Side) operate the Tippler and check for correct operation electrically and mechanically over the normal operating range of travel.

13.6.9.4. At the Tippler Cell LCS (Tip Side) operate the Tippler and check for correct operation electrically and mechanically over the normal operating range of travel.

13.6.10. Commission the Tippler Overtravel Recovery

13.6.10.1. Temporarily disable (i.e., short circuit the N/C contact and open circuit the N/O contact) the Tippler Overtravel Return and Overtravel Tip limit switches.

13.6.10.2. At the Tippler Cell LCS (Tip Side) move the Tippler at slow speed into the Overtravel Tip limit switches. Ensure that the Tippler stops under the action of that switch.

13.6.10.3. At the Intouch SCADA panel, acknowledge the overtravel alarm.

13.6.10.4. At the Tippler Cell LCS (Tip Side), press and hold the Tippler Return pushbutton, noting that the alarm sounds, and the Tippler automatically moves back out from the over travelled position. When it is safely within range of NORMAL travel the pushbutton can be released and the Tippler should stop.

13.6.10.5. At the Tippler Cell LCS (Tip Side) move the Tippler at slow speed into the Overtravel Return limit switches. Ensure that the Tippler stops under the action of that switch.

13.6.10.6. At the Intouch SCADA panel, acknowledge the overtravel alarm.

13.6.10.7. At the Tippler Cell LCS (Tip Side), press and hold the Tippler Tip pushbutton, noting that the alarm sounds, and the Tippler automatically moves back out from the over travelled position. When it is safely within range of NORMAL travel the pushbutton can be released and the Tippler should stop.

13.6.10.8. Remove the temporary modifications made in step 20.6.9.1 to the Tippler Overtravel Return and Overtravel Tip limit switches.

13.6.11. Tippler Motion No-Load Tests

Set the parameters of the Tippler to the speeds as specified in the Control System Level 1 & 2 Documents as computed and developed by the Contractor, then confirm satisfactory operation at those speeds entering the required data and submitting the data to the Transnet Project Manager for approval in principle.

13.6.12. Over Tipping the Empty Tippler in Maintenance Mode

13.6.12.1. On Intouch SCADA, move the Tippler to the extended tip position.

13.6.12.2. On Intouch SCADA, return the Tippler back to rail level.

13.7 Operational Tests in Semi-Auto Mode (No Wagons)

The Contractor will carry out the following:

13.7.1 Pre-Requisites

13.7.1.1. Drives Commissioning Engineer need to be present for these tests.

13.7.1.2. All checks and tests in previous sections of this schedule have been satisfactorily completed.

13.7.1.3. All 'Permit to Work' clearances on the Positioner have been cleared and their associated warning and safety barriers have been removed.

13.7.1.4. Ensure all personnel are informed that all the Positioner, Tippler and Train Holding Devices will be operating without warning, that they are aware of the potential dangers which will then exist and know what actions to take in the event of such situations occurring.

13.7.1.5. All Positioner, Tippler and Train Holding Device areas shall be free of wagons.

13.7.1.6. PLC and Intouch SCADA are fully operational.

13.7.2 Initialising System for 'Semi-Auto' Mode

13.7.2.1. Ensure the Control System is healthy, i.e., all the Emergency Stop and Lock-off Stop pushbuttons have been reset and the Intouch SCADA, Profibus and Ethernet communications are operating correctly.

13.7.2.2. Ensure the Positioner and Tippler Overtravel Switches are reset.

13.7.2.3. Ensure in Maintenance Mode that:

- Positioner is fully back.
- Positioner Arm is fully raised.
- Train Holding Arm is fully Raised.
- Tippler is at rail level.
- Entry Wheel Grippers are fully released.
- Exit Wheel Grippers are fully released.
- The beam of the Last Car laser pair broken (block with a temporary cover).

13.7.2.4. On Intouch SCADA, ensure Loco Permit is not selected.

13.7.2.5. On Intouch SCADA, acknowledge and reset all alarms. Rectify any alarms that do not readily reset.

13.7.2.6. On Intouch SCADA, select 'Semi-Auto', then press 'Start Auxiliaries' and then check that all auxiliaries have started.

13.8 Operating Complete Car Tippler System In 'Semi-Auto' Mode (Individual Movements Through 'Next Step' Button)

The Contractor will carry out the following:

13.8.1. On Intouch SCADA Press the Next Step Pushbutton, the Entry Wheel Grippers will engage.

13.8.2. On Intouch SCADA Press the Next Step Pushbutton, the Tippler will move to the normal tip position.

13.8.3. On Intouch SCADA Press the Next Step Virtual Pushbutton, the Tippler will travel back to rail level. Wait at least 60 seconds before proceeding with the next step.

13.8.4. On Intouch SCADA Press the Next Step Pushbutton, the Positioner will travel to the arm engage position.

13.8.5. On Intouch SCADA Press the Next Step Pushbutton, the Positioner Arm will extend (Positioner must be in Arm Engage position.

13.8.6. On Intouch SCADA Press the Next Step Pushbutton, the Entry Wheel Grippers will release.

13.8.7. On Intouch SCADA Press the Next Step Pushbutton, the Positioner will travel to the Train Holding Arm Engage position.

13.8.8. On Intouch SCADA Press the Next Step Pushbutton, the Exit Wheel Grippers and train holding arm will engage.

13.8.9. On Intouch SCADA Press the Next Step Pushbutton, the Tippler will move to the normal tip position.

13.8.10. On Intouch SCADA Press the Next Step Pushbutton, the Tippler will return back to rail level.

13.8.11. On Intouch SCADA Press the Next Step Pushbutton, the Positioner arm will retract to the fully retracted position. The positioner will then travel back to the arm engage position. The Entry wheel grippers will engage at the pre-determined position.

13.8.12. On Intouch SCADA Press the Next Step Pushbutton, the positioner arm will engage, the entry & exit grippers will retract, and the Train Holding Arm will raise. The system is now ready to repeat the sequence.

13.9 Operational Tests In 'Auto' Mode (No Wagons)

The Contractor will carry out the following:

13.9.1. Pre-Requisites

13.9.1.1. Siemens Commissioning Engineer need not be present for these tests but should be available to give telephone support if required.

13.9.1.2. All checks and tests in previous sections of this schedule have been satisfactorily completed.

13.9.1.3. All 'Permit to Work' clearances on the Positioner have been cleared and their associated warning and safety barriers have been removed.

13.9.1.4. Ensure all personnel are informed that all the Positioner, Tippler and Train Holding Devices will be operating without warning, that they are aware of the potential dangers which will then exist and know what actions to take in the event of such situations occurring.

13.9.1.5. All Positioner, Tippler and Train Holding Device areas shall be free of wagons.

13.9.1.6. PLC and Intouch SCADA are fully operational.

13.9.2. Initialising System for 'Auto' Mode

13.9.2.1. Ensure the Control System is healthy, i.e., all the Emergency Stop and Lock-off Stop pushbuttons have been reset and the Intouch SCADA Profibus and Ethernet communications are operating correctly.

13.9.2.2. Ensure the Positioner and Tippler Overtravel Switches are reset.

13.9.2.3. Ensure in Maintenance Mode that:

- Positioner is fully reversed.
- Positioner Arm is fully retracted.
- Tippler is at rail level.
- Entry Wheel Grippers are fully released.
- Exit Wheel Grippers are fully released.
- The beam of the Last Car laser pair is broken (block with a temporary cover).

13.9.3. Operating Complete Dual Wagon Tippler System in 'Auto Mode'

13.9.3.1. On InTouch SCADA, select 'Start Cycle' then confirm the following events occur in sequence:

- The Entry Wheel Grippers release
- The Positioner moves to the fully forward position.
- The Entry Wheel Grippers engage.
- The Exit Wheel Grippers engage.

13.9.3.2. Tip Cycle

- The Tippler moves to normal tip position before returning to rail level and at the same time the Positioner Arm raises, and the Positioner returns to the Arm Engage position.
- The Exit Wheel Grippers release.
- The Entry Wheel Grippers engage at a pre-determined positioner position.
- The Positioner moves to the arm engage position.
- The Positioner Arm engages.
- The positioner moves to the fully forward position (THD Engage Position)
- The Exit Wheel Grippers engage.

13.9.3.3. When ready to simulate the end of the train, to conclude the 'Auto' sequence test, uncover the Last Car laser whilst the positioner is travelling forward, then confirm the following events occur in sequence:

- The Tippler moves to normal tip position before returning to rail level and at the same time the Positioner Arm raises, and the Positioner returns to the fully back position.
- The Positioner Travel VVVF drives are de-energised, and the brakes are applied.
- Nothing else occurs.

13.9.3.4. When ready to simulate the hauling away of the wagons select 'Loco Permit' at the Intouch SCADA, then confirm the following events occur in sequence:

- The Exit Wheel Grippers release
- The Entry Wheel Grippers release.

13.9.4. Stopping the 'Auto' Mode by Removal of 'Tippler Permissive' Signal

13.9.4.1. Remove the 'Tippler Permissive' signal while the Tippler is tipping and confirm that the tip/return cycle is completed, and further tipping is inhibited until the signal is re-instated.

13.9.4.2. Remove the 'Tippler Permissive' signal while the Tippler is returning and confirm that the return cycle is completed, and further tipping is inhibited until the signal is re-instated.

13.9.4.3. Remove the 'Tippler Permissive' signal while the Positioner is moving forward and confirm that the Positioner movement continues normally and stops when the next Tippler tip cycle is inhibited. Confirm that further tipping continues when the signal is restored.

13.9.4.4. Remove the 'Tippler Permissive' signal while the Positioner is moving back and confirm that the Positioner movement continues normally and stops when the next Tippler tip cycle is inhibited. Confirm that further tipping continues when the signal is restored.

13.9.4.5. Remove the 'Tippler Permissive' signal while the Entry Wheel Grippers are engaging and confirm that the Lock movements continues normally and stops when the next Tippler tip cycle is inhibited. Confirm that further tipping continues when the signal is restored.

13.9.4.6. Remove the 'Tippler Permissive' signal while the Entry Wheel Grippers are releasing and confirm that the Lock movements continues normally and stops when the next Tippler tip cycle is inhibited. Confirm that further tipping continues when the signal is restored.

13.9.4.7. Remove the 'Tippler Permissive' signal while the Exit Wheel Grippers are engaging and confirm that the Gripper movements continues normally and stops when the next Tippler tip cycle is inhibited. Confirm that further tipping continues when the signal is restored.

13.9.4.8. Remove the 'Tippler Permissive' signal while the Exit Wheel Grippers are releasing and confirm that the Gripper movements continues normally and stops when the next Tippler tip cycle is inhibited. Confirm that further tipping continues when the signal is restored.

13.9.5. Locomotive and Wagon Clearances Through Tippler System

This procedure is to test the clearances of the completed Dual Wagon Tippler system for the passage of locomotive and wagons.

13.9.6. Pre-Requisites

13.9.6.1.1. All checks and tests in previous sections of this schedule have been satisfactorily completed.

13.9.6.1.2. All electrical systems are fully operational.

13.9.6.1.3. A locomotive, and some empty wagons, hereafter in this section called "the train", are available at the entry side for movement through the Car Tippler system as required during this testing procedure.

13.9.7. Testing Locomotive and Wagon Clearances

Ensure in Maintenance Mode that:

- Positioner Arm is fully raised.
- Tippler is at rail level.
- Entry Wheel Grippers are fully released.
- Exit Wheel Grippers are fully released.

13.9.7.1.1. Select Loco Permit at the Intouch SCADA Station. Check that the Loco Lights go green.

13.9.7.1.2. De-select Loco Permit and 'fault' each of the conditions above, ensuring then that Loco Permit cannot be selected, and the Loco Light remains red.

13.9.7.1.3. Ensure that the conditions in above are restored. Select Loco Permit at the Intouch SCADA Station. Check that the Loco Lights go green.

13.9.7.1.4. Arrange for the train to be driven very slowly through the Entry Wheel Grippers, past the Positioner, through Tippler Cells and through the Exit Wheel Grippers

Note

All clearances should be checked at all times whilst the train is moving, and the train stopped before any foul occurs. Rectify any problems found.

13.9.7.1.5. De-select Loco Permit.

13.9.8. Setting Up Train Position Control Points

13.9.8.1. From the Positioner LCS engage the Positioner Arm with the wagons.

13.9.8.2. By slowly operating the Positioner in Maintenance Mode, move the train as required to set-up or confirm the settings for correct operation of the following items:

- Last Car arm lasers
- Tippler Entry Clear lasers
- Tippler Exit Car lasers.
- Positioner Forward Slowdown limit
- Positioner Reverse Slowdown limit
- Positioner Forward Limit
- Positioner reverse Limit
- Positioner Encoder settings
- Positioner Drive systems
- Rectify any problems found.

13.9.8.3. Use the Positioner to haul the wagons along the full range of travel. Check for correct settings of all Positioner VVVF drive parameters.

13.10 Full Operational Test In 'Auto' Mode (Complete Train of full Wagons)

The Contractor will carry out the following:

13.10.1 Pre-Requisites

13.10.1.1. All checks and tests in previous sections of this schedule have been satisfactorily completed.

13.10.1.2. All electrical systems are fully operational.

13.10.1.3. A rake of at least 12 full wagons, i.e., 6 coupled pairs, hereafter in this section called "the train", are available with the 1st and 2nd wagons placed in the correct dumping position on the Tippler.

13.10.2 Initialising System for 'Auto' Mode

Select Auto mode the Intouch SCADA system.

13.10.3 Operating Complete Car Tippler System in 'Auto' Mode

On Intouch SCADA, select 'Start Cycle' then confirm the following events occur in sequence:

13.10.3.1. An alarm sounds for 15 seconds then the Tippler moves to normal tip position before returning to rail level and at the same time the Positioner moves to the arm engage position.

13.10.3.2. The Positioner arm engages.

13.10.3.3. The Entry Wheel Grippers release.

13.10.3.4. The Positioner moves to the fully forward position.

13.10.3.5. The Exit Wheel Grippers engage.

13.10.3.6. The Entry Wheel Grippers engage as the positioner returns to the back limit.

13.10.4 Tip Cycle

13.10.4.1. The Tippler moves to normal tip position before returning to rail level and at the same time the Positioner Arm raises, and the Positioner returns to the fully back position.

13.10.4.2. The Entry Wheel Grippers engage at a pre-set positioner travel position.

13.10.4.3. The Positioner moves to the arm engage position.
13.10.4.4. The Positioner arm engages.

13.10.4.5. The Entry & Exit Wheel Grippers release.

13.10.4.6. The Exit Wheel Grippers engage.

Note

Keep observing the hoppers to ensure no blockages or material overflow.

13.10.4.7. After the automatic movement of wagons that uncovers the beam of the Last Car Arm laser pair, confirm the following events occur in sequence:

- The Tippler moves to normal tip position before returning to rail level and at the same time the Positioner Arm raises, and the Positioner returns to the fully back position.
- The Positioner Travel VVVF drives are de-energised, and the brakes are applied
- Nothing else occurs.

13.10.4.8. When ready to simulate the hauling away of the wagons select 'Loco Permit' at the Intouch SCADA, then confirm the following events occur in sequence:

- The Exit Wheel Grippers release
- The Entry Wheel Grippers release.

14 Mechanical Site Commissioning for the Wagon Unloading Station

14.1 Introduction & General Instructions

14.1.1 General

This section describes as a minimum the method and sequence of commissioning and site testing for all mechanical equipment supplied by the Contractor for the Wagon Unloading Station.

14.1.2 Deviations

14.1.2.1. Any deviation to the tolerance requirements of the drawings produced by the Contactor is to be reported to the Transnet Project Manager in the form of a concession request for review/comment and acceptance or otherwise.

14.1.2.2. Prior to the start of these tests ensure that all downstream conveyors are fully clear.

14.1.2.3. The site "No Load", commissioning and performance "Loaded" tests, shall be performed by the Transnet Port Terminal operations personnel under supervision of the Contractor's technical personnel. All training with respect to Transnet Port Terminals personnel will have been completed prior to Commissioning taking place.

14.1.2.4. Transnet Port Terminals shall prepare wagons loaded with iron ore, measurement instruments, electrical power, etc., and all required personnel for the tests.

14.1.2.5. All hydraulic oil and lubricants for site tests to be supplied by the Contractor.

14.1.2.6. Before commencing any individual or system "Loaded" and commissioning tests the Transnet Project Manager must confirm to the Contractor that all downstream equipment, not of

Contractors design, i.e., conveyors, stackers etc., necessary for the removal of the iron ore are working satisfactorily.

14.1.2.7. The purpose of this section is as follows: -

14.1.2.7.1. To instruct and advise the inspection and test personnel such that they may prepare the Wagon Unloading System for Performance Tests in an accurate, safe, economical, and efficient manner.

14.1.2.7.2. To enable the Transnet Project Manager to review the schedule and therefore comment on any part of it before testing commencing.

14.1.2.7.3. To enable the inspection, test, and Transnet Port Terminals personnel to have all the materials, tools and test equipment available prior to testing commencing.

14.1.2.7.4. To verify the ballast requirements of the Tippler.

14.1.2.7.5. To establish a sequence for inspection and testing and therefore provide the basis for a site programme.

14.2 Hoppers and Apron Feeders

Reference Drawings:
Annexure A
Appendix A Drawing List

Referenced Documents
Annexure

14.2.1. Check that the hoppers and feeders have been installed as per the relevant drawings. Particular attention should be given to the clearances around the feeder. Any deviations from the specified tolerances to be recorded and captured for updating of manufacturing drawings to As-Built drawings.

14.2.2. Check that the electrical system has been installed as per the relevant drawings. Check that all cables are adequately supported and protected from damage from falling ore and mechanical movement.

14.2.3. Check the lubrication systems have been installed as described in the relevant drawings and lubrication schedule of the grease lubrication OEM. Pipes must be adequately supported and protected from damage from mechanical movement.

14.2.4. Check the gearboxes are filled in accordance with the lubrication schedule of the gearbox OEM.

14.2.5. Check that the Hopper material level sensor system has been installed in accordance with the manufacturer's instructions.

14.2.6. Check the Hopper liners have been installed and are secured.

Note - It is very important that the surface of the tiles must be flush with the surface of adjacent tiles. There should be no steps between adjacent edges.

14.2.7. Check the operation of the Knife Gate Assembly ensure that all the knife gates are able to extend and retract.

14.2.8. Select 'Maintenance' on the TOCR. Operation of the feeders will now be carried out from the local control station.

14.2.9. Check operation of all Apron Feeders and clearances between adjacent chutes and skirts.

14.2.10. In the Tippler Control Room, select "Semi-Automatic". The Apron Feeders should now be under full sequential control via the PLC and can be single stepped through its automated cycle.

Note - Non-essential personnel must be restricted from entering the area.

14.2.11. During the feeder operations, observe motor voltages and currents for the feeders.

Feeder Motor	Voltage	Current Amps
No 1		
No 2		
No 3		
No 4		
No 5		

14.3 Train Holding Devices

The Contractor will conduct the following works, namely:

Reference Drawings
Annexure A
Appendix A Drawing List

14.3.1. Check that the Gripper units have been assembled as described in the Contractor's drawings. Particular attention shall be given to each Gripper unit's relationship to the main rails.

14.3.2. Check the security of all bolted components and foundation bolts, particularly the rail clip fasteners.

14.3.3. Set each Gripper bar gap to the dimensions as shown on Contractor's drawings and check that the offset of this gap in relation to the main rail is correct.

14.3.4. Check that the lubrication system has been installed to the requirements the grease lubrication OEM. Check that all pipe runs are secure, primed with grease and all discharge valves are set.

14.3.5. If necessary, operate lubrication pump to ensure that all points requiring grease have been lubricated.

14.3.6. Check that the hydraulic system has been installed to the requirements shown on THE Contractors drawings and the hydraulic OEM requirements. Check that all pipe runs and hoses are secure, and all connections are adequately tightened and free from leaks when the system is pressurised. Work thru OEM Pre-commissioning document.

14.3.7. Check that all electrical supply cables and conduits are connected and restrained in a secure manner.

14.3.8. Select 'Maintenance' at the TOCR. Control of the wheel grippers can now be carried out at their respective local control stations.

14.3.9. Ensure that grippers engage and retract fully.

14.3.10. During operation, check that there is no binding of the pins and bushes.

14.3.11. Check that limit switches are adjusted to trip when the grippers are in the retracted position.

14.3.12. Ensure Gripper units engage and retract within the time allocated on the Plant Time Cycle C07 & C08.

14.3.13. Record the following:

Activity	Entry Grippers	Exit Grippers	Required reading
Time to Engage			2.5s nom.
Time to Release			2.5s nom.
Maximum pressure at cylinders during operation			Bar
Hydraulic Power Unit Motor Current			Amps

14.4 Positioner

The Contractor will conduct the following works, namely:

Reference Drawings

Annexure A
Appendix A Drawing List

Referenced Documents
Annexure

14.4.1. Check that the positioner and track have been assembled and installed as per the Contractors drawings. Particular attention shall be given to the installation and alignment of positioner track and racks and their relationship to the main track as shown on the Contractors drawings. Any setting dimension found not to comply with those specified shall be recorded and submitted to the Transnet Project Manager for assessment. Should any deviations be encountered, such deviations will be corrected before the commissioning can proceed.

14.4.2. Check the secureness of all bolted components and foundation bolts.

14.4.3. Check gearboxes are filled with oil to manufacturers requirements. Record in pre-commissioning protocol.

14.4.4. Check that the lubrication systems have been installed to the grease lubrication OEM requirements. Check that all pipe runs are secure, purged and primed with grease.

14.4.5. Check that the drive brake system has been installed to the suppliers' requirements. Ensure the OEM supplier has commissioned the sub-system prior to integration work off pre-commissioning protocol.

14.4.6. Check that the electrical supply cables and conduits are connected and restrained in a secure manner.

14.4.7. Release and lock off all positioner drive brakes.

14.4.8. Check that the rack is adequately coated with lubricant. Note - this will normally be applied by spray during positioner travel.

14.4.9. Run each travel drive motor on the positioner individually and check that direction of rotation is the same for each pinion by observing the motion of the positioner.

14.4.10. Check positioner pinion mesh and guide roller clearances as required in Contractor's drawings.

14.4.11. Reset brakes.

14.4.12. Ensure that the travel limit switches are correctly assembled and securely mounted on the festoon support system as shown on Contractor's drawings and are functioning in accordance with the Electrical Site Commissioning Method Statement. Ensure that there are no obstructions in the path of movement of the festoon towing arm.

14.4.13. Ensure that lasers are aligned and securely installed as shown on Contractor's drawings and are functioning in accordance with the lasers OEM requirements.

14.4.14. Operate the positioner main arm for several cycles ensuring that there is free movement of all links, pins, and rollers.

14.4.15. Check that the head is capable of lowering to the 908 mm dimension stated on Contractor's drawings from main rail level to underside of head and record below.

Main Rail to Underside Head Dimension	Required Dim
	mm

14.4.16. Check that the arm position limit switches are adjusted to trip in the raised and lowered positions.

14.4.17. Operate positioner last wagon arm for several cycles ensuring that there is free movement of the rotary actuator. Check that the head is capable of lowering to the 840 dimension as per the Contractors drawings from main rail level to centre line of head. Also check that the arm will swing completely to the rest position and record both values below:

	Actual Value	Required Value
Rail to Centreline of Head Dimension		840mm
Arm swing angle		°

14.4.18. Check that the last car arm position limit switches are adjusted to trip in the swung positions.

14.4.19. Operate positioner last wagon arm coupler mechanism for several cycles ensuring that there is free movement of the coupler pin linkage and hydraulic cylinder. Check that the coupler is set for both the engaged and release positions.

14.4.20. Run Positioner along the entire length of track in "inch" mode in both directions with no wagon present. Stop the positioner at regular intervals and check that guide roller and track clearances correspond to those specified in the Contractors drawings. Re-adjust guide rollers if necessary.

14.4.21. Inspect surface of rack for evidence of any hard contact with pinions, indicated by bright polished areas on the tooth face. Check guide roller setting as per Contractor's drawings and adjust if necessary.

14.4.22. Check operation of all travel limit switches.

14.4.23. Repeat actions 21.5.20 - 21.5.22 with positioner at slow speed.

14.4.24. Repeat actions 21.5.20 - 21.5.22 with positioner at full speed.

14.4.25. Run positioner at slow speed to end stops at both ends of travel and check that the hydraulic buffers contact the end stops at the same time. Weld on suitable packing plate to stop face if necessary.

14.4.26. At the same time, check the stroke and freedom of movement of the positioner festoon system. Refer to festoon OEM supplier specification.

14.5 Tippler

Reference Drawings:
Annexure A
Appendix A Drawing List

The Contractor will conduct the following works, namely:

14.5.1. Check that the tippler cage has been assembled and installed as described in the Contractors drawings. Particular attention should be given to support roller settings and main cage assembly tolerances. Any setting dimensions found not to comply with those specified shall be recorded and submitted to the Transnet Project Manager for assessment. Should any deviations be discovered, these shall be rectified first before any further commissioning can carry on.

14.5.2. Check the security of all bolted components and foundation bolts.

14.5.3. Ensure gearboxes are filled with oil to manufacturers requirements.

14.5.4. Check that the lubrication system has been installed to the grease lubrication OEM requirements.

14.5.5. Check that all pipe runs are secure, primed with grease and all discharge valves are set. If necessary, operate lubrication pumps to ensure that all points requiring grease have been purged, pressurised, and lubricated.

14.5.6. Check that tippler racks have been adequately coated with lubricant.

14.5.7. Check that the electrical supply, cables, and conduits are connected and restrained in a secure manner.

14.5.8. Check that all tippler rotation limit switches are set as shown on the Contractors drawings and are functioning correctly.

14.5.9. Check that the platform rails are aligned with the main rails to within ±3mm both laterally and vertically.

14.5.10. Check connection of electrical supply to drive units this must be carried out in conjunction with the Siemen's engineer.

14.5.11. Remove temporary installation beams and restraints to free the tippler cage.

14.5.12. "Inch" rotates the cell through one complete cycle (to 180° and return) to check for correct mesh between the rack and pinion.

14.5.13. Inspect surface of racks for evidence of any hard contact with pinion, indicated by bright polished areas on the tooth face.

14.5.14. Note: This condition, i.e. no wagon during tip cycle, produces the maximum tooth load case for the tippler.

14.5.15. During inch rotation test to 180° also check the following: -

14.5.15.1. Rack and pinion engagement is satisfactory.

14.5.15.2. Working clearances between rotating cage and foundations are satisfactory. Also, between the rotating cage and the dust cowl.

14.5.15.3. Clamp gear operation is satisfactory and contacts their fully tipped stops without any interference.

14.5.15.4. Clearance with locking racks.

14.5.15.5. Clearance with tippler drive pinion bearing cartridges.

14.5.15.6. Observe any signs of lateral movement of end ring rail relative to flanged support rollers.

14.5.15.7. Note: Support roller flanges and rail head must be kept well lubricated during rotation.

14.5.15.8. Check rotational operation of all encoder limits.

14.5.16. During inch rotation test check operation of clamp gear assemblies through their full range of. Ensure there is no binding of links, pins or bushes. Check for lubrication pipework snags over full movement of clamps. In particular check that the tip side clamps are clear of any obstruction from the side pad.

14.5.17. Rotate empty tippler cage through one complete tip and return cycle to 150° at slow speed and repeat checks outlined in 14.6.15 and 14.6.16.

14.5.18. Rotate empty tippler cage through one complete tip and return cycle to 150° at full speed and check for smooth operation.

14.5.19. Back rotate the tippler to confirm that the operation of the overtravel limit switch at -2.5 degrees and that buffers contact the stops at the same time. Weld on suitable packing plate to the stop face if necessary.

14.5.20. Forward rotate the tippler to confirm the operation of the overtravel limit switch at 181° degrees and that buffers contact the stops at the same time. Weld on suitable packing to the stop face if necessary.

14.6 Dust Extraction System

The Contractor will conduct the following works in accordance with the following, namely:

Reference Drawings
Annexure A

Appendix A: Drawing List

Reference Documents
Annexure C: Technical Specification Dust Extraction/Handling Plant
Annexure F: Dust Extraction Control Philosophy
Annexure D: Electrical Inspection _Dust Plant Report
Annexure N: Data Sheet Dust Collection (Bag House)

The Contractor will develop a commissioning method statement for the dust extraction equipment. The Contractor will be required to provide such a method statement to the Transnet Project Manager for review and approval in principle. The Method statement must align with the requirements of the relevant Dust Extraction System Specifications, Data Sheet and Control Philosophy. (Refer Reference Documents listed ablove). Compliance with the Atmospheric Emissions Licence to be included in reports.

14.7 System No Load Test (Individual Loaded Test)

The Contractor will conduct the following works, namely:

14.7.1 Train Holding Devices

14.7.1.1. Functional operations of the Train Holding Devices are to be carried out in strict compliance with Electrical Commissioning Method Statement.

14.7.1.2. Transnet will provide a minimum rake of 14 empty CR5 wagons.

14.7.1.3. Locate the rake of wagons in the tippler system positioning the rake with the second pair of wagons central in the tippler. Check clearances of the wagon in the tippler as the rake is pushed through.

14.7.1.4. Check that all 8 wagon wheels are aligned with the entry wheel gripper units and engage the wheel grippers. Ensure the gripper bars are contacting the wagon wheel rims and that the wheels are central in the gripper units.

14.7.1.5. Repeat the engage and retract cycle of the entry grippers and record the operating times.

Operation	Recorded Time (sec.)	Required Time (sec.)
Entry Gripper Engage		2.5
Entry Gripper Retract		2.5

14.7.1.6. In conjunction with system "loaded" ensure there is no relative movement of bogie wheels to entry gripper units at any stage due to the ripple effect of the rake of loaded wagons.

14.7.1.7. Check that the 4 wagon wheels are aligned with the exit wheel gripper units and engage wheel grippers. Ensure the gripper bars are contacting the wagon wheel rims and that the wheels are central in the gripper units.

14.7.1.8. Repeat the engage and retract cycle of the exit grippers and record the operating times.

Operation	**Recorded Time (sec.)**	**Required Time (sec.)**
Exit Gripper Engage		2.5
Exit Gripper Retract		2.5

14.7.1.9. In conjunction with system "loaded" ensure there is no relative movement of bogie wheels to exit gripper units at any stage due to the ripple effect of the rake of empty wagons

14.7.2 Positioner

14.7.2.1. Travel and functional operations of the positioner are to be carried out in strict compliance with Electrical Commissioning Method Statement compiled by the Contractor. Careful attention must be given to the effective operation of the drive transmission, the travel limits and extent of positioner travel.

14.7.2.2. To ensure that full functional test of the plant equipment can be carried out, a minimum of 14 empty wagons are required.

14.7.2.3. Prior to loco marshalling into the Wagon Unloading system the following conditions must be satisfied: -

- Control System Healthy
- Positioner located at its datum position.
- Positioner main arm raised.
- Positioner last car arm swung out of the way.
- Tippler aligned and stationary at rail level.
- Tippler clamps fully raised. Note - clamp counterweight arms to be in contact with stop faces
- Tippler drive brakes on
- Entry tracks clear.
- All wheel grippers retracted.

14.7.2.4. Bringing in a new train.

14.7.2.4.1. The loco brings in an empty train under locomotive control and positions it such that the coupler between wagons 1 and 2 is located centrally on the tippler platform.

CAUTION

The Contractor must ensure that Locomotive Braking and Accelerating should be minimised whilst the locomotive is travelling through the Tippler. Locomotive driver's mirrors should be folded in flush with the body to maximise clearance with the retracted clamps.

14.7.2.4.2. Check relative clearance between the locomotive and the following components during this operation: -

- End Rings and 'U' Frame Structures & Guide Blocks
- Clamps
- Side Pad & Tip Side Guide Blocks
- Cross Beam Guide Blocks
- End Ring Spill Plates and Covers.

14.7.2.5. Positioner Maintenance Set-Up Operation

14.7.2.5.1. Using the local control station mounted on the positioner, the operator travels the positioner to a position where the arm is in line with the drawbar between wagons 5 and 6.

14.7.2.5.2. Arm locating lasers (mounted on the positioner) to be adjusted to achieve the correct stopping position for main arm engagement.

Note: Whichever direction the positioner is travelling, the first laser coming clear will cause the positioner to ramp down to stop and the second laser will check that it is clear. Both lasers need to be clear before the main arm can be extended.

14.7.2.5.3. The operator then extends the main arm to engage over the drawbar between wagons 5 and 6 and checks that the arm head is clear of any obstructions.

14.7.2.5.4. The operator checks that all the gripper units are retracted and operates the positioner in a forward direction until wagons 3 and 4 are central in the tippler. Checks should also be made that the resolver 'ramp down', 'creep' and stop settings are correct and that the wagon wheels are stationary before the exit grippers are engaged.

14.7.2.5.5. The operator engages the exit wheel grippers.

14.7.2.5.6. Check that the tippler 'entry' lasers are clear, with the wagons held by the exit wheel grippers and that wagons 3 and 4 are correctly positioned in the tippler.

14.7.2.5.7. Raise the positioner main arm and travel back to correctly position the main arm in line with the drawbar between wagons 7 and 8, checking that the resolver 'ramp down' setting and arm laser operation is correct.

14.7.2.5.8. While the positioner is travelling back the operator engages the entry wheel grippers.

14.7.2.5.9. The operator then lowers the main arm to engage over the drawbar between wagons 7 and 8 and checks that the arm head is clear of any obstructions.

14.7.2.5.10. The entry and exit wheel grippers are released.

14.7.2.5.11. The operator moves the positioner in a forward direction until wagons 5 and 6 are central in the tippler. Checks should also be made that the resolver 'ramp down', 'creep' and stop settings are correct and that the wagon wheels are stationary before the exit grippers are engaged.

14.7.2.5.12. The above sequence 14.8.1.7.1 through 14.8.1.7.12 should be repeated until wagons 11 and 12 are central in the tippler and the Contractor site engineer is satisfied with the position set-up.

14.7.2.5.13. The last two wagons are to be positioned in the tippler using the positioner last car arm. At the end of the previous cycle the operator engages the exit wheel grippers.

14.7.2.5.14. The operator raises the main positioner arm and travels the positioner back to its positioner back limit which is located such that it is possible to swing the last car arm.

14.7.2.5.15. While the positioner is travelling back the operator engages the entry grippers.

14.7.2.5.16. The operator swings the last car arm and releases the entry and exit grippers.

14.7.2.5.17. The operator travels the positioner forward at slow speed so that the coupler on the last car arm engages with the rear coupler of the 14th and last wagon. Proper engagement of the couplers is to be checked prior to further travel.

14.7.2.5.18. The operator then travels the positioner forward at slow speed until the 13th and 14th wagons are positioned centrally in the tippler.

14.7.2.5.19. After the exit wheel grippers are engaged the coupler release mechanism is operated to disengage the coupler and the operator travels the positioner back until the last car arm is clear and can be raised.

14.7.2.5.20. The positioner is then travelled back to the positioner back limit.

14.7.2.5.21. Reposition the rake of wagons such that wagons 1 & 2 are positioned centrally on the tippler.

14.7.2.5.22. Using positioner manual control repeat 14.8.2.5.1 to 14.8.2.5.21.

14.7.2.6. Positioner Semi-Automatic Operation

14.7.2.6.1. The operator pre-sets the tippler control system with the number of wagons to be tipped. Pre-setting is achieved via the SCADA system on the control room desk.

Note: Wagon detection lasers must be provided to recognise the last wagon in the event of incorrectly entering the number of wagons.

14.7.2.6.2. With wagons 1 and 2 re-positioned centrally on the tippler platform, the operator travels the positioner to a position where the arm is in line with the drawbar between wagons 5 and 6. The positioner automatically stops in this position using the lasers, which also confirm the gap for the arm.

14.7.2.6.3. The operator then lowers the positioner main arm to engage over the drawbar between wagons 5 and 6.

14.7.2.6.4. The operator checks that all the gripper units are retracted.

14.7.2.6.5. The operator operates the positioner through the normal forward cycle checking for possible positional errors.

14.7.2.6.6. The positioner travels forward and positions wagons 3 and 4 in the tippler.

14.7.2.6.7. The exit grippers are engaged.

14.7.2.6.8. The positioner main arm is raised, and the positioner then travels back two wagon lengths and stops.

14.7.2.6.9. While the positioner is travelling back the entry grippers are engaged.

14.7.2.6.10. The positioner main arm is lowered over the drawbar between wagons 7 & 8.

14.7.2.6.11. The entry and exit grippers are retracted.

14.7.2.6.12. The positioner is then travelled forward two wagon lengths thus positioning the next two wagons centrally in the tippler.

14.7.2.6.13. The exit grippers are engaged.

14.7.2.6.14. The positioner main arm is raised, and the positioner travels back two wagon lengths and stops.

14.7.2.6.15. Steps 14.8.2.6.9 thru 14.8.2.6.14 are repeated until the rake is correctly positioned for last wagon handling as detected by the laser or the number of wagons as previously set have been indexed. In the latter case further cycles will need to be completed by entering a new number of wagons to be tipped and restarting the sequence. Ensure that deceleration and stopping limits are set correctly and to observe positioner arm head location over the drawbar between the wagons and holding arm location over the couplers.

14.7.2.6.16. The last wagon operation is carried using Positioner On-board Manual control.

14.7.2.7. Positioner Automatic Operation

Note: Tippler "No Load" testing to be completed prior to this operation.

14.7.2.7.1. With the plant in manual mode, the positioner in the back position, 'last car arm swung out of the way and positioner main arm raised, retract the wheel grippers to enable locomotive access to reposition the rake of wagons with 1 & 2 on the tippler platform for the following tests.

14.7.2.7.2. The operator selects automatic control.

14.7.2.7.3. Providing the wagons are correctly positioned the entry and exit grippers engage, the tippler rotates, and the positioner travels forward to position the main arm at the gap between wagons 5 and 6.

14.7.2.7.4. The positioner main arm lowers over the drawbar.

14.7.2.7.5. When the tippler has returned to rail level the wheel grippers retract and the positioner travels forward to position the next pair of wagons in the tippler.

14.7.2.7.6. Subsequent automatic cycles continue until the end of the train, or the pre-set number of wagons have been tipped leaving the last two wagons to be positioned using the last car arm.

14.7.2.7.7. Repeat 14.8.2.7.1 to 14.8.2.7.6 using loaded wagons. Note this is to be carried out in conjunction with the other major parts of the plant when they have been fully dry commissioned. This includes the tippler, hoppers & feeders, conveyor 308, dust extraction equipment.

14.7.2.7.8. Ensure the positioner can perform a complete cycle within the time allocated on the plant time cycle and record below when handling CR5 wagons.

Operation handling CR5 Wagons	**Recorded Time (sec.)**	**Required Time (sec.)**
Positioner Forward Travel		37.33
Main Arm Raise		6.5
Positioner Rear Travel		17.4
Main Arm Engage		6.5
Total Cycle		76.5

14.7.2.7.9. Repeat 14.8.2.7.8 handling CR13 or CR14 wagons.

14.7.3 Tippler

14.7.3.1. Functional operation of the tippler is to be carried out in strict compliance with Electrical Commissioning Method Statement compiled by the Contractor. Careful attention must be given to the effective operation of drive transmission, freedom of movement of clamp gear, the extent of any longitudinal movement of cage during rotation.

14.7.3.2. The test operations are to be carried out in conjunction with the Drives Engineer.

14.7.3.3. With the tippler at rail level and using the same rake of 14 CR5 empty wagons position the first two wagons onto the tippler. Check they are positioned correctly.

14.7.3.4. Rotate the tippler at slow speed to 90° and observe operation of clamp gear assemblies.

14.7.3.5. At 90° carry out the following checks: -

- That there is full contact between the side pad and the wagon body.

- That there is a positive clamping action and full contact between all clamps and still faces of wagons.

- That there is a positive clamping action and full contact between wagon wheels and platform rails.
- There is clearance between the clamp arm and the rear face of the side pad.

- That all clamp counterweight arms are not engaged with the stop pads.

14.7.3.6. Continue rotation of the tippler to normal tip position (150°) and repeat checks in 14.8.3.4.

14.7.3.7. Check that the stopping angles for the normal tip condition have not varied.

14.7.3.8. Return the tippler to rail level at slow speed and check the following: -

- That clamp gear assemblies return to the normal retracted position.

- The stopping angles for normal return and over return conditions have not varied

- The platform rail and main rails are aligned to within ±3mm both laterally and vertically in the normal return position.

14.7.3.9. Repeat 14.8.3.3 thru 14.8.3.6 until 4 empty wagons have been checked through the tipping cycle.

14.7.3.10. After completion of with two wagons positioned on the tippler, rotate the tippler at full speed to normal tip position (150°) and repeat checks as 14.8.3.4 and 14.8.3.5.

14.7.3.11. Return the tippler to rail level at full speed and repeat checks as 14.8.3.6.

14.7.3.12. Ensure that all hoppers are clear of material and feeders, conveyors, dust extraction equipment are working.

14.7.3.13. Position two full wagons onto the tippler. Check they are positioned correctly.

14.7.3.14. Rotate the tippler at slow speed to normal tip position (actual tip angle to be recorded) and observe the following: -

- That there is full contact between the side pad and the wagon body.
- That there is a positive clamping action and full contact between all clamp beams and still faces of wagon.
- That there is a positive clamping action and full contact between wagon wheels and platform rails.
- The stopping angle at the normal tip condition has not varied.
- The spillage of material around the end ring spill plates.

14.7.3.15. Return the tippler to rail level at slow speed and observe the following:

- That the clamp gear assemblies return to the normal raised position, (counterweight arms in contact with stop pads).
- The stopping angle at normal return condition has not varied.
- The platform rails and main rails are aligned to within ±3mm both laterally and vertically in the normal return position.

14.7.3.16. Position the next two full wagons onto the tippler and check they are positioned correctly.

14.7.3.17. Repeat checks 14.8.3.12 and 14.8.3.13 with the tippler rotating at full speed.

Note - after 3 full wagon tips of material the feeder gates will open, and the feeders will start to discharge material onto conveyor 308. When the hopper has subsequently been emptied to the low level the feeders will automatically stop leaving a bed of ore in the bottom of the hopper for subsequent tips. Unless the feeders are restarted under manual control to completely empty the hoppers the feeder gates will remain open.

14.7.3.18. Rotate the tippler through a complete cycle and check it can perform this cycle within the time allocated.

14.8 System Loaded Test (Total Sequential Operation)

14.8.1. In conjunction with the Electrical Commissioning Method Statement compiled by the Contractor carry out a total sequential operation under load conditions of the complete system.

14.8.2. Check that all operations function correctly.

14.8.3. Ensure there is no relative movement of the bogie wheels to gripper units, at any stage, due to the ripple effect of the rake of empty wagons.

14.8.4. A loaded train will be provided by Transnet Port Terminals.

Wagons Handled (in pairs with solid drawbar)

	CR5 **Ore Wagon**	**CR13 & 14** **Ore Wagon**
Gross Weight (tonnes)	2 x 104	2 x 120
Tare Weight (tonnes)	2 x 19	2 x 20
Length O/Couplers (m)	2 x 10.5	2 x 10.5
Wagon Height (m)	2.43	2.643 max
Wagon Width (m)	3.0	3.0

14.8.5. Continue tipping until Contractor Site Supervisor as well as TPT Engineering Manager is assured of acceptable operation.

14.8.6 Load Commissioning

14.8.6.1. Load commissioning shall not proceed until all pre-commissioning checks and tests have been completed and signed off by the Transnet Project Manager.

14.8.6.2. The minimum wagons to pass through the tippler during load commissioning shall be: -

- Four trains of 110 CR5 wagons.
- Three trains of 110 CR13 wagons
- Three trains of 110 CR14 wagons.

14.8.6.3. Each of these wagon type trains is to be offloaded within the allotted time as stipulated in performance specification.

Note: The cycle times for positioner and tippler shall be set long initially and gradually decreased whilst performance is monitored closely. The test shall aim to reduce the cycle time to the design value toward the end of the rake.

14.8.6.4. Caution is required when operating the tippler at reduced speeds. Material discharge trajectory is altered, and spillage may occur.

14.8.6.5. The trains are to be unloaded using automatic mode except that the following interruptions shall occur naturally or shall be simulated arbitrarily during commissioning, as per the following: -

- Emergency stops.
- Power loss
- Stop instructions, safeties and interlocks associated with equipment external to the tippler, positioner, wheel grippers, feeders, and conveyor 308 including all auxiliary drives which affect the tippler.
- Stop instructions, safeties and interlocks associated with the tippler, positioner, wheel grippers, feeders, and conveyor 308.

14.8.6.6. Chart recordings shall be made of the following parameters: -

- Position (rotation or linear as appropriate)
- Volts
- Amps
- Frequency
- Kilowatts
- Brake application sequence
- Positioner Main Arm operating time and pressures
- Positioner Last Wagon operating time and pressures
- Gripper's application times and pressures
- Reducer bearing and support roller bearing temperatures.
- Noise emission levels at agreed locations.

14.8.6.7. Recordings are required for no-wagon, empty wagon and maximum CR5, CR13 & CR14 wagon loads at normal operating speed and slow (maintenance) speed.

14.8.7 Performance Testing

14.8.7.1. The performance testing is to be carried out as soon as practicable after Load Commissioning has been completed.

14.8.7.2. The performance test shall operate for a minimum of 5 rakes of 110 CR5 ore wagons and 5 rakes of 110 CR13 or CR14 wagons. During the performance testing, no further adjustments shall be performed.

14.8.7.3. The performance test of the tippler, positioner, wheel grippers, feeders, and conveyor 308 shall achieve the required cycle times and feed rates for each component and the entire system.

14.8.7.4. Time taken for the handling of the train by the locomotive to position the first two wagons and the handling of the last two wagons by the positioner in the Standard Operating Procedure (SOP) Manual control mode is not included in the test time.

14.8.7.5. Timing will start when the tippler commences rotation at the start of the train and finishes when the tippler returns to rail level at the end of the train ready for the last two wagons to be manually positioned in the tippler.

14.8.7.6. Any time required for operator rest, change or breaktime is to be deducted from the overall time taken.

14.8.7.7. Delays caused by failure of equipment not supplied by the Contractor, or abnormal operating conditions such as heavy rain, strong wind, power failure, etc., is to be deducted from the overall time taken.

Note the times taken for each of the trains handled.

Train of CR5 Wagons	**A Total Time (min)**	**B Delay Time (min)**	**A-B Nett Time (min)**	**C Wagons Tipped**	**C x 60/ (A-B) Rate/ Hour**
1					
2					
3					
4					
5					

Train of CR13 Wagons	**A Total Time (min)**	**B Delay Time (min)**	**A-B Nett Time (min)**	**C Wagons Tipped**	**C x 60/ (A-B) Rate/ Hour**
1					
2					

Train of CR13 Wagons	**A Total Time (min)**	**B Delay Time (min)**	**A-B Nett Time (min)**	**C Wagons Tipped**	**C x 60/ (A-B) Rate/ Hour**
3					
4					
5					

Train of CR14 Wagons	**A Total Time (min)**	**B Delay Time (min)**	**A-B Nett Time (min)**	**C Wagons Tipped**	**C x 60/ (A-B) Rate/ Hour**
1					
2					
3					
4					
5					

14.8.7.8. Periodic checks on the operation of the tippler, positioner, holding arm, wheel grippers, hoppers, feeders, and conveyor 308 shall be carried out to determine satisfactory operation of equipment. In particular check for:

- Alignment of rails at tippler return to rail level.
- Satisfactory positioning of wagons in the tippler cage
- Positioner main arm gap finding.
- Wheel Gripper engagement.
- Detection of last wagon by photocells.
- Satisfactory gearbox oil temperature.
- Satisfactory bearing temperatures.
- Lubrication of tippler rack satisfactory.
- Lubrication of positioner rack satisfactory.
- Tippler support roller to rail contact and lubrication
- Positioner support & guide roller to rail contact and lubrication.

14.8.7.9. Feeder operation, including trimming to minimise feeder stoppages due to hoppers emptying below low level between tip cycles and prevent delays to subsequent cycles as a result of the hoppers overfilling.

14.8.7.10. Conveyor 308 operation.

14.8.7.11. Operation of Dust Extraction Equipment.

15 Quality Assurance

15.1 General

15.1.1 Quality Control by Equipment Supplier

15.1.1.1. The Contractor is responsible to implement a Quality Assurance (QA) program.

15.1.1.2. The Contractor is responsible for the of preparing and submitting to the Project Manager all the documentation required for the surveillance activities.

15.1.1.3. The Contractor's QA program shall be required to include Inspection and Test Plans (ITPs) with a schedule of inspections and tests to be performed upon each major component or sub-assembly and the stage of production at which each inspection or test shall be performed.

15.1.1.4. The ITPs shall include the work to be completed at each stage, and include the inspection and testing required.

15.1.1.5. The test/inspection controlling specification or procedure reference shall be nominated along with the pass criteria or verifying documentation and results to be recorded. The ITPs shall include a space for "signing off" by the Equipment Supplier's designated QC personnel for each completed stage. Work should not proceed further until each stage has been "signed off" and confirmed as "Inspected – OK" by the Equipment Supplier's QC personnel.

15.1.1.6. All progress shall be reported on an "Inspected – OK" basis.

15.1.2 Witness and Hold Points

15.1.2.1. The ITPs shall clearly identify witness and hold points as nominated and agreed by the Supervisor. The Supervisor will advise the Contractor of the specific stages in the production process, at which the Supervisor wishes to witness tests performed by the Contractor or to perform independent inspection or testing. These points will be nominated following the receipt and review of the Contractor Supplier's ITPs by the Supervisor.

15.1.2.2. Witness points are defined as critical steps in manufacturing and testing, whereby the Contractor shall advise the Project Manager an agreed time in advance of the operation so that it may be witnessed by the Project Manager.

15.2 Responsibility of the Contractor

15.2.1. The Contractor shall bear full responsibility for supply of a product(s) to the Project Manager, in part or in whole, which conform fully to the quality requirements given in the Specification and the quality requirements necessary for the intended application. This responsibility shall include all items or services provided to the Contractor by the Contractor's suppliers and/or sub-contractors, which form, in part or in whole, the product(s) provided to the Project Manager.

15.2.2. The Contractor shall be responsible for providing certification of materials, workmanship and components utilized in the Work, and for performance of tests to verify the quality of the Work. Such certifications and tests shall include, but not necessarily be limited to, those certifications and tests specified in the portion of the Technical Specifications, which pertains to each aspect of the Work.

15.2.3. The Project Manager reserves the right to conduct design audits and field stress level tests on the structures. Defects so identified shall result in the Contractor being responsible to bear the costs of rectification as well as cost of subsequent design audit and field tests. Design review, inspection or testing performed by the Supervisor, or its omission, shall in no way relieve the Contractor of the responsibility to provide product(s) of the required quality.

15.3 Project Manager Supplied Items

15.3.1. The Contractor shall advise the Project Manager of specific quality requirements of any items to be provided by the Project Manager to the Contractor, in order to be consistent with the quality requirements of the final product. Such items may include, but are not limited to: design data, engineering designs and drawings, materials, consumables, foundations, components, sub-assemblies, and/or services.

15.3.2. The Project Manager shall provide certification to the Contractor of supplied items upon request from the Contractor.

15.3.3. In the event of disagreement between the Project Manager and the Contractor regarding quality requirements for Transnet supplied items, the Project Manager decision shall prevail, subject to the provisions of the General Conditions.

15.4 Materials Control

15.4.1 Identification of Materials

The Contractor shall employ adequate materials control procedures to ensure that each different type, grade, or size of materials or components, including Transnet supplied items, remain identifiable until incorporated into the Work.

15.4.2 Records

15.4.2.1. The Contractor shall maintain records to determine the location of each identifiable lot of each type, grade or size of material received at the Contractor's plant(s) and either used in the Work, consumed during fabrication, scrapped, or retained as part of future inventory.

15.4.2.2. These records shall list quantities received arranged by weight, volume, piece count, or other suitable measure, so that an audit of such records may be quantitatively balanced.

15.4.2.3. The Contractor shall make such records available to the Project Manager upon request.

15.4.3 Traceability

15.4.3.1. When traceability is required for individual components or sub-assemblies, the specific requirements will be given in the portion of this Technical Specification, which pertains to the individual component or sub-assembly.

15.4.3.2. The Contractor shall provide the Supervisor with written descriptions and procedures for special processes and test methods to be performed on site by others (e.g., welding, painting, bolt tensioning, NDT, etc.). The procedures shall outline the precautions to be employed to ensure that work performed on site meets the same standards of quality as work performed elsewhere.

15.5 Design Assurance

15.5.1. The Contractor shall provide copies of design calculations and/or design drawings to the Project Manager for independent review when so required by these Technical Specifications or upon request from the Project Manager.

15.5.2. The Contractor shall provide copies of shop (fabrication) drawings and all revisions thereto, upon the Supervisor's request.

15.6 Manufacturing Surveillance

15.6.1 Supervisor Surveillance

15.6.1.1. The Project Manager, through his supervisor, intends to monitor the progress of work and to conduct an independent inspection and testing program to provide verification that the quality of the Work meets required standards.

15.6.2 Release Following Hold Points

The Contractor shall obtain the signature of the Supervisor, upon documents authorising release of items for further processing following hold points for the Supervisor.

15.6.3 Non-Conformance Report

In the event the Supervisor's inspection detects non-conformance to QA requirements at any time after approval by the Contractor's QA, the Contractor will be presented with a copy of a non-conformance report as per TIMS Procedure 013 (Occurrence and Non-Conformance Management) prepared by the Supervisor which outlines the nature of the problem. The Contractor shall then prepare and submit to the Project Manager, in writing, details of corrective action to be taken and dates of implementation. The effect of this on the project program shall be stipulated in this report. Any costs incurred by the non-conformance will be for the Contractor's account.

15.7 Objectives of Supervisor's QA

15.7.1 Evaluation of Contractor's Production and QA

15.7.1.1. A primary objective of the Supervisor's surveillance is to verify that Contractor's manufacturing processes and QA program are performing in a satisfactory manner. Therefore, the occurrence of a small percentage of defects in product components during manufacture will not be considered a non-conformance under the Supervisor's QA program, provided that the Contractor's QC correctly detects the defects and corrective action is undertaken according to established procedures.

15.7.1.2. If the percentage of defective components is unreasonably high, the defects are not correctly identified by Contractor's QC, or identified defects, or non-conformances are not corrected in an approved manner, then the Contractor will be issued a non-conformance report and shall be required to take prompt corrective action.

15.7.2 Supervisor's Quality Inspections

15.7.2.1. Another important objective of the Supervisor's QA program is to verify the quality of the Work by independent inspection and testing entities. The extent and intensity of this independent inspection, performed by the Supervisor at Transnet's cost, will be determined in part by the results of the evaluation of Contractor's work.

15.7.2.2. At the Supervisor's option, the independent inspection may include:

15.7.2.2.1. Re-tests of items tested by the Contractor, using same test methods as the Contractor.

15.7.2.2.2. Re-tests of items tested by the Contractor, using alternative test methods to those used by Contractor.

15.7.2.2.3. Tests of items not tested by the Contractor.

15.7.2.3. Any non-conformances detected by the Supervisor's testing shall be resolved. The Contractor shall be responsible for all costs associated with a failed test.

15.8 Corrections of Non-Conformances

15.8.1. Prior to final approval by the Supervisor, all non-conformances shall be corrected by the Contractor at the Contractor's cost.

15.8.2. If the Supervisor discovers non-conformances to the Specification at any stage after approval by the Contractor's QA, the Supervisor will immediately verbally advise the Contractor and, as soon as practical, in writing, and will request correction as per the preceding paragraph within a time period stipulated by the Supervisor.

15.9 Quality Control Records

15.9.1. Copies of the Contractor's quality control records shall be submitted to the Project Manager, without charge, as required by the Specifications or as requested by the Supervisor.

15.9.2. The Contractors shall retain and archive the originals of the Contractor's Quality Control Records for a minimum of five (5) years following delivery of Contractor's products. Additional copies of these records shall be provided, without charge to the Project Manager, upon request of the Supervisor.

15.10 Quality Control and Documentation

15.10.1 Personnel Qualifications

15.10.1.1. All personnel engaged in design and production of the Work shall be qualified by education, training, testing and/or experience for the work to be performed.

15.10.1.2. The Contractor shall provide to the Project Manager, upfront, on request and/or as required by these Technical Specifications, objective evidence confirming the competency of each person engaged in performance of the Work.

15.10.2 Certification Of Work

15.10.2.1. All work shall satisfy the requirements of all Inspection Authorities having jurisdiction.

15.10.2.2. The Contractor shall obtain all necessary permits and pay all fees in connection therewith, including fees for inspection of drawings; and, upon completion of the Work, shall obtain certification of approval from the Inspection Authorities for the Project Manager.

15.11 Design Review

15.11.1 General

15.11.1.1. As outlined in the Quality Assurance, the Contractor is required to undertake his own Design Verification process.

15.11.1.2. In addition, as part of the Supervisor 's quality surveillance activities, it is Project Manager's intent to perform a separate, independent design review of portions of the Work.

15.11.1.3. It is not planned that the Project Manager will carry out a full review of the Contractor's design; however, the scope of design review may be extended if there is evidence of non-conformance to Agreement design requirements.

15.11.1.4. The Contractor shall give all necessary assistance to the Project Manager and his designated representatives to facilitate Project Manager review. However, any independent review carried out by the Project Manager, or his designated representative, shall not relieve the Contractor of his full responsibility for the system dynamic analysis design, detail design, manufacture, shop testing and performance testing of the Work in accordance with the relevant section of these Technical Specifications; and any actions of the Project Manager's design review team shall not diminish the Contractor's obligation.

15.11.1.5. The design of all portions of the Work may be reviewed at the Project Manager discretion.

15.11.1.6. The Contractor shall submit design drawings and calculations for the specific aspects listed to the Project Manager sufficiently in advance of production to permit the Project Manager's design review to take place. Subsequent to the Project Manager's initial review, the Contractor shall be prepared to hold discussions and/or attend meetings to clarify or to reach agreement on possible design modifications.

15.11.1.7. The Contractor shall make allowance in his proposed Schedule of Work for the foregoing activities and shall submit his estimate of their duration to the Project Manager for review. The Project Manager's design review activities shall be incorporated as "hold points" on the Inspection and Test Plan, with the schedule.

16 Submittals

16.1 General

16.1.1. The Contractor shall submit to the Project Manager documentation and drawings, including all revisions thereof, required for the project management, design, furnishing of equipment, fabrication, erection, installation, maintenance, and operation of the Machine.

16.1.2. The Contractor's schedule should be based on a turnaround time of two (2) weeks, not including mail delivery time, for review of drawings and documents by the Supervisor.

16.1.3. All submittals shall be in the English language.

16.1.4. Any rework required because of documents not meeting the requirements of these Technical Specifications shall not be grounds for an extension of time for completion of the Work and/or additional cost to Transnet Port Terminals Saldanha.

16.1.1 Submittals Shall Include the Following as Minimum:

21.1.1.1. Design Brief

21.1.1.2. Project Management Procedures

21.1.1.3. Equipment Specifications

21.1.1.4. Control System Level 1,2 & 3

21.1.1.5. Control System Quality Plan

21.1.1.6. Operators Cab & SCADA Specification

21.1.1.7. PLC I/O Schedule

21.1.1.8. Device Schedule

21.1.1.9. Level 2 PLC Control Sequence Descriptions

21.1.1.10. Drawings

21.1.1.11. Calculations

21.1.1.12. Erection Procedures

21.1.1.13. Commissioning Procedures

21.1.1.14. Installation, Operation, and Maintenance Manuals

21.1.1.15. Quality Assurance Manual

21.1.1.16. Contract Quality Plan

21.1.1.17. Programs.

16.2 Project Management Procedures

To ensure the timely delivery of the Machine, the Contractor shall compile a comprehensive set of Project Management Procedures and submit these to the Project Manager for review at the commencement of the project.

16.3 Drawings

16.3.1 General.

16.3.1.1. All drawings shall be produced in AutoCAD latest release.

16.3.1.2. Drawing submittal schedules shall be established at the time of Notice to Proceed and shall be mutually agreed to between the Supervisor and the Contractor. Drawings shall be issued for review in a sequence schedule and not bunched. Drawings required for cross-referencing during review shall be submitted with the drawings to which they relate.

16.3.1.3. The Contractor shall submit certified drawings for all of the detailed items supplied under the agreement and related equipment provided by others.

16.3.1.4. Drawing transmittals indicating the distribution shall accompany each issue.

16.3.2 Layout Drawings.

The Contractor shall submit certified drawings of all machine layouts or general arrangement drawings including, but not limited to motion extreme positions and limits. The arrangements shall indicate the location of major equipment components with requirements for installation, removal, and maintenance clearances.

16.3.3 Structural Drawings.

The Contractor shall submit general arrangement and detail drawings showing the Machine steel structure and the loads for which it is designed. The drawings shall include but not be limited to:

16.3.3.1. Overall general arrangements showing leading dimensions and the relationship of all the parts of the Machine.

16.3.3.2. Additional drawings as required showing details with dimensions and member sizes of large structural assemblies and sub-assemblies of the Machine.

16.3.3.3. Loading diagrams showing:

- Loads and their points of application.
- External reactions corresponding to the applied loads.
- Internal reactive forces between Machine components.

16.3.3.4. Typical connection details showing welding and bolting requirements. Connection details shall show the relationship between the members comprising the joint.

16.3.4 Mechanical Drawings.

The Contractor shall submit general arrangement and detail drawings showing all mechanical components and equipment assemblies, sub-assemblies and details including proprietary equipment. The drawings shall include but not be limited to:

16.3.4.1. Overall arrangements showing leading dimensions of the Machine.

16.3.4.2. General arrangement and details of each component

16.3.4.3. General arrangement and details of the material transfer points, head chute with deflector plate, liner arrangements, walkways, and platforms.

16.3.4.4. Arrangements, diagrams, and details of all hydraulic, pneumatic, lubrication, and dust suppression systems

16.3.4.5. Manufacturer's certified arrangement and detail drawings of all equipment and components purchased by the Contractor.

16.3.5 Electrical Drawings.

The Contractor shall submit certified drawings of all electrical power and control system equipment including, but not limited to:

16.3.5.1. Electrical Equipment Single Line Diagram

16.3.5.2. General Arrangement drawings showing locations of all major items of electrical equipment, control equipment and lighting fixtures.

16.3.5.3. Control, instrumentation, and alarm system block and wiring diagrams.

16.3.5.4. Main cable/conduit routing drawings and schedules

16.3.5.5. Equipment lists indicating equipment voltages, rating, manufacturer, type and where applicable, fault current ratings.

16.3.5.6. Operator Panel Arrangements to scale

16.3.6 Erection Drawings.

16.3.6.1. The Contractor shall provide erection drawings required for the Machine to be fully assembled and erected on site.

16.3.6.2. Erection drawings shall include, but not be limited to the following:

16.3.6.2.1. Sequence field assembly, installation and erection layouts identifying all components and clearance requirements.

16.3.6.2.2. Weights and centres of gravity of major assemblies

16.3.6.2.3. Connection details for major assemblies showing welding and bolting requirements at all connections.

16.3.6.2.4. Field run conduit and cable drawings, schedules, and wiring diagrams.

16.3.7 As-Built Drawings.

16.3.7.1. The Contractor shall provide the Project Manager with complete sets of certified A3 size As-Built Drawings plus electronic copies in AutoCAD format. The As-Built Drawings shall show all details of the Plant as actually built or constructed.

16.3.7.2. As-Built Drawings shall include Family Tree, all general arrangement drawings, detail drawings, all mechanical component drawings, including fully dimensional detail drawings and material specifications for all internal and external components, drawing index on Excel Format, and all electrical drawings.

16.3.7.3. On completion of any part of the work, the Contractor shall mark-up and provide to the Transnet Port Terminals Saldanha Representative two (2) sets of drawings marked up in red with all the field changes incorporated by the Contractor in the equipment.

16.3.7.4. Final "As-Built" drawings submitted to the Project Manager shall include two (2) copies printed in A3 size and two (2) sets of compact disc copies in AutoCAD format.

16.3.7.5. All As-Built drawings shall be delivered to the Project Manager and accepted by the Project Manager prior to the issue of the Certificate of Total Performance.

16.3.7.6. Layout drawings of all bought-out equipment.

16.3.7.7. As-Built Bill of Quantities of the Plant in Excel format.

16.4 Calculations

The Contractor shall submit for review by the Transnet Project Manager, copies of design calculations and all explanatory notes including, but not limited to the following:

- Hand calculations
- Finite Element Analysis Models
- Power and load calculations
- Other design calculations as requested by the Project Manager.

16.5 Erection Procedures

The Contractor shall submit, within ten (10) working days of Notice to Proceed, a detailed project program for the Project Manager to review.

16.6 Commissioning Procedures

The Contractor shall submit written commissioning procedures, no later than thirty (30) days prior to the commencement of commissioning, for review by the Project Manager.

16.7 Installation, Operation, and Maintenance Manuals

16.7.1. The Contractor shall submit to the Project Manager for review two (2) draft copies of Installation, Operation, Maintenance and Training Manuals for all of the equipment covered by Machine Specifications.

16.7.2. After the Supervisor review, the Contractor shall revise the manuals to the Supervisor satisfaction, issue complete revised sets of Installation, Operation, Maintenance and Training Manuals not less than thirty (30) days prior to the equipment shipment.

16.7.3. The final issue of the manuals shall be six (6) sets of hard copies bound in A4 size, three-ring binders and two (2) sets of electronic files in MS Word and PDF format on compact disks.

16.7.4. The language of these manuals shall follow the Machine Specifications.

16.8 Quality Assurance Manual

The Contractor shall provide two (2) copies of Contractor's Quality Assurance (QA) manual within two (2) weeks of the Notice to Proceed. It shall be supplemented or revised to incorporate all actions necessary to bring the Contractor's quality assurance program into full conformance with the Specifications and submitted with a new revision number.

16.9 Quality Plan

16.9.1. The Contractor shall provide two (2) copies of the detailed Quality Plan intended to be employed for the work. The Quality Plan shall be provided within two (2) weeks of the Notice to Proceed, and shall include:

21.9.2.1. Inspection and Test Plans (ITP's).

21.9.2.2. Quality Assurance (QA) and Quality Control (QC) activities to be performed by the Contractor, his suppliers and sub-contractors.

16.9.2. During the course of production, the Contractor shall periodically update the Quality Plan and schedule to reflect actual conditions and shall provide two (2) copies of each such revision.

16.9.3. At the completion of the work, the Contractor shall submit a quality dossier to the Project Manager incorporating all quality related documentation including but not limited to:

16.9.6.1. Design review checklist

16.9.6.2. Material certificates

16.9.6.3. Dimension sheets

16.9.6.4. Welding inspection reports

16.9.6.5. Heat treatment reports

16.9.6.6. Electrical equipment tests

16.9.6.7. Duly completed ITPs.

16.9.6.8. Initial equipment setting

16.9.6.9. Performance and overload test results

16.9.6.10. Baseline measurements

16.9.6.11. Signed-Off Erection Method Statement

16.9.6.12. Signed-Off Commissioning Method Statement.

17 Technical Documentation

17.1 General

17.1.1. The Transnet drawing system of issue or revision identification shall be used and entered on drawings and documentation. The term "Latest Revision" shall not be used.

17.2 Format Standards

17.2.1. All Contractor furnished drawings, sketches and diagrams shall conform to the following minimum requirements:

17.2.1.1. The drawings shall be created in the AutoCAD format release 2012 or later and submitted in DWG format.

17.2.1.2. The Contractor shall store all the data package information electronically as well as in hardcopy format.

17.2.1.3. Electronic transmission of drawings and data shall also be addressed to the Project Manager via the Project Manager's document control.

17.2.1.4. The Contractor shall note software format and version on all transmissions. The preferred word processing and spreadsheet formats are "MS Word" and "Excel".

17.3 Issuance and Approvals

17.3.1. All drawings and data shall be submitted electronically with a covering numbered Transmittal Note identifying the Contract Number and list all documents included, showing the revision number of each document where appropriate and stating the purpose of the issue i.e., "Issued for Project Manager review".

17.3.2. In the event that the issued drawings and/or data are not approved by the Project Manager, the Contractor shall revise the documentation without delay and issue a new revision not later than 2 weeks after the receipt of the rejected documentation.

17.4 PLC and HMI Programs

The Contractor will provide the Programmable Logic Control (PLC) and Human Machine Interface (HMI) licensed software on the original manufacturer's discs. The customised programs shall be provided in the electronic format on CD's and in hardcopy printout.

17.5 Calculations

17.5.1. Small attachments and computer printouts that would be impractical to file on their own and lacking space for identification, shall be glued to standard blank calculation sheets.

17.5.2. All calculations shall clearly show reference to design codes, design criteria, standards, design data, etc., and conclusions shall be highlighted. All assumptions shall be listed.

17.5.3. Calculations shall be clear, legible, and concise and be set out in such a way as to be easily located, followed, and understood by others.

17.5.4. Each calculation shall carry in its heading the following information:

17.6 Installation, Operation, Maintenance and Training Manuals

17.6.1 General Requirements.

17.6.1.1. The manuals form an integral part of the Contract and shall be submitted in accordance with this specification. It is the Contractor's responsibility to supply manuals for all items of the equipment covered by this specification, which shall require installation, operation or maintenance.

17.6.1.2. The Contractor shall commence compilation of the manuals immediately upon approval of drawings. If drawing approval is not applicable, manual compilation shall commence on receipt of Order/Contract.

17.6.1.3. It is the Contractor's responsibility to ensure that all sub-orders, issued for the equipment supply covered by this Specification, highlight all the requirements for the manuals as stipulated in this Specification.

17.6.1.4. Manuals must be comprehensive and contain simple and valid procedures and instructions to form a reliable and easy source of access to all information necessary for the following functions:

17.6.1.5.1. Safety of personnel and protection of equipment during installation, operation and maintenance of the equipment.

17.6.1.5.2. Installation.

17.6.1.5.3. Commissioning.

17.6.1.5.4. Operation.

17.6.1.5.5. Maintenance.

17.6.1.5. The manuals will be used as an aid to the training of operation and maintenance personnel and should therefore make maximum use of exploded views, technical illustrations, charts, trees and tables.

17.6.1.6. The material in the manual must be presented in logical sequence.

17.6.1.7. It should be remembered that manuals will be required by three distinctly different groups engaged in separate functions:

17.7.1.7.1. The Contractor's personnel for installation and commissioning of the equipment.

17.7.1.7.2. The Transnet Port Terminals Saldanha operators of the equipment.

17.7.1.7.3. The Transnet Port Terminals Saldanha maintenance personnel and maintenance sub-Contractors.

17.6.1.8. Each of these groups will be expected to operate to a large degree independent of each other. It is therefore essential that the manuals for each of these three functions are separate or can be separated without loss of identity or completeness. Some drawings will have to be included in more than one of the installations operation or maintenance manuals to maintain their integrity.

17.6.1.9. The "Draft" submission shall allow for review by Transnet Port Terminals Saldanha and all required amendments. The manuals shall be complete and of such quality that only minor rectification work may have to be necessary to render the manuals acceptable for "Final" issue.

17.6.1.10. The Project Manager may reject reviewed manuals for non-compliance with the Specifications.

17.6.2 Relevant Content

17.6.2.1. Each manual must contain all the relevant information pertaining to the subject equipment.

17.6.2.2. Relevant data in "chart" or "table" form shall be boxed in using heavy black lines to facilitate clear reproduction. Irrelevant information to the equipment shall not be included in the manuals.

17.6.2.3. All irrelevant information that cannot be excluded shall be "boxed" and cross-hatched. The end result must not detract from the overall presentation of the manual.

17.6.2.4. Separate manuals shall be provided for installation, operation, and maintenance. Manuals for proprietary items of equipment may combine these functions in a single manual provided that each function is allocated a separate section clearly marked with a suitable divider.

17.6.2.5. Safety instructions must be included in each section of the manual where applicable.

17.6.3 Drawings and Diagrams.

17.7.4.1. Drawings and diagrams incorporated in the manuals shall be reduced to A3 size and folded twice into boundaries of an A4 size sheet.

17.7.4.2. A complete list of all drawings (by number and title) required to produce the Plant, (subject to exclusions under manufacturers' rights) shall be included. The drawings included in the manual shall be marked with an asterisk.

17.6.4 Content Requirement.

17.6.4.1. The manuals shall include:

17.6.4.1.1. Specifications and technical data for the Plant and each of its components.

17.6.4.1.2. As built general arrangement drawings of the Plant and each of its components.

17.6.4.1.3. Maintenance and lubrication instructions, which shall include but not be limited to maintenance "trouble shooting" guides and instructions for the servicing of components and proprietary items.

17.6.4.2. Preventative maintenance and lubrication instructions to include:

17.6.5.2.1. Preventative maintenance program

17.6.5.2.2. Recommended service interval.

17.6.5.2.3. Service procedures

17.6.5.2.4. Diagram showing service location.

17.6.5.2.5. List of parts, materials and tools required for each service.

17.6.5.2.6. Complete list of lubricants and their characteristics

17.6.5.2.7. Volume of lubricants required for each piece of equipment.

17.6.5.2.8. Base line data for lubricating oil characteristics for an oil sample analysis program.

17.6.5.2.9. Parts details and parts list including identification of the component such as:

- Manufacturer
- Model
- Serial Number
- Location.

17.6.5.2.10. Component cross-section and/or exploded diagram of parts, which shall include reference to a complete part number list.

17.6.5.2.11. Internal wiring diagrams where applicable.

17.6.5.2.12. Detailed instructions on how to order replacement parts, including name, address and telephone number of the component supplier or local alternative Contractor of replacement parts.

17.6.5.2.13. Repair and overhaul instructions to include detailed procedure for repair and overhaul of each component.

17.6.5.2.14. Detailed shop drawings. Information to be provided on detail shop drawings shall include but not be limited to:

- Endplay
- Backlash
- Dimensions and tolerances
- Bolt torque settings
- Pressure settings
- Other relevant data.

17.6.5.2.15. Recommended spare parts list for each component, and approximate replacement lead times.

- Operating instructions and control logic including:
- Detailed operating procedures with step-by-step instructions of the pre-operation requirements, starting, and operating procedures.
- Two (2) weather protected copies, in proper language of routine operating procedures and safety instructions shall be provided for prominent display in the operator's cab.

17.7 Manual Layout Requirements

17.7.1 Installation Manual.

17.7.1.1. **Section 1** – Introduction. This section shall state:

17.7.1.1.1. Equipment Number

17.7.1.1.2. Equipment Description

17.7.1.1.3. Machine Location.

17.7.1.2. **Section 2** – Index. This section shall include two subsections: Section Index and Detailed Index. The "Section Index" shall identify all sections of the manual against divider titles. The "Detailed Index" shall locate equipment data both by section and page numbers. Each item to which an equipment number has been allocated shall be included in this index.

17.7.1.3. **Section 3** - Equipment Function. This section Includes a brief statement of the function of the equipment within the overall Machine equipment.

17.7.1.4. **Section 4** - Installation and Commissioning. This section shall clearly detail all necessary information for the installation and commissioning including at least the following:

17.7.1.4.1. Receipt and storage instructions.

17.7.1.4.2. Safety precautions.

17.7.1.4.3. Test Certificates.

17.7.1.4.4. Special hoisting, slinging, placement, and alignment data including maximum assembly weight.

17.7.1.4.5. Pre-commissioning checks of oil/lubrication levels and types - guard placement - direction of rotation - isolation and stopping methods - protection devices and fuses to be checked - bearing preloads.

17.7.1.4.6. Pre-setting instruction for adjustable items, highlighting any dangers associated with incorrect adjustment.

17.7.1.4.7. Initial start running times - load limits - audio and visual checks, running adjustments - bearing temperature parameters - performance parameters.

17.7.1.4.8. Re-lubrication, re-torquing, re-adjustment, or any other manufacturer's requirements prior to operation.

17.7.1.4.9. Special tools.

17.8 Operation Manual.

17.8.1. **Section 1** – Introduction. The requirement is as for Section 1 - Installation Manual.

17.8.2. **Section 2** – Index. The requirement is as for Section 1 - Installation Manual.

17.8.3. **Section 3** - The requirement is as for Section 1 - Installation Manual.

17.8.4. **Section 4** – Operation. This section shall clearly detail in logical sequence, all the necessary information for the safe operation of the equipment and shall include at least the following:

17.8.4.1. A full technical specification for the Plant.

17.8.4.2. A detailed description and explanation of function of all operator controls.

17.8.4.3. Safety precautions.

17.8.4.4. Pre-start and start-up procedures.

17.8.4.5. Shutdown procedures.

17.8.4.6. Emergency stop facilities.

17.8.4.7. Upper and lower operating limits.

17.8.4.8. Meter readings - flow rates - problem indications.

17.8.4.9. Failure or emergency procedures.

17.8.4.10. Relevant reduced drawings - general arrangements, assemblies and electrical schematics.

17.9 Maintenance Manual.

17.9.1. **Section 1** – Introduction. The requirement is as for Section 1 - Installation Manual.

17.9.2. **Section 2** – Index. The requirement is as for Section 1 - Installation Manual.

17.9.3. **Section 3** - The requirement is as for Section 1 - Installation Manual.

17.9.4. **Section 4** – Maintenance. This section shall clearly detail all the necessary information for the safe and efficient maintenance of the equipment and shall include information on, at least, the following:

17.9.4.1. A full technical manufacturer's specification.

17.9.4.2. A technical description of all components.

17.9.4.3. A full parts list, cross-referenced with section/exploded view drawings and illustrations.

17.9.4.4. Detailed maintenance instruction for all components and including repair, overhaul, change out and installation procedures.

17.9.4.5. Recommended inspections and frequencies.

17.9.4.6. Electrical data and drawings.

17.9.4.7. Lubrication schedules.

17.9.4.8. Logical Troubleshooting charts, in fault tree diagram form, that list potential failures and methods to correct them. Associated times to perform the correction as appropriate.

17.9.4.9. Special Tools.

17.10 Training Manual.

17.10.1. A comprehensive training manual with pictures and text shall be provided to enable Transnet Port Terminals Saldanha Training Department to compile the final training manuals for operator training, including first line maintenance.

17.10.2. Pictures must be in a digital format, preferably in a JPEG high resolution format, supplied on a DVD to enable Transnet Port Terminals Saldanha Training Department to edit their training content.

17.10.3. The pictures supplied of the part must have a description as well as a location of the respective on the machine.

17.10.4. The pictures must also be provided with the following information, namely:

17.10.4.1. Explain the function of the part and what maintenance is required to prevent pre-mature failure.

17.10.4.2. The maintenance intervals for the respective part (minor and major).

17.10.4.3. Describe what maintenance personnel have to maintain, in order to prevent pre-mature failure of the part.

17.10.4.4. Provide a maintenance methodology to follow when maintaining the part.

17.11 Manufacturer's Data Report

17.11.1. The MDR shall be include but not be limited to:

17.11.1.1. Signed-off Inspection and Test Plans
17.11.1.2. Marked-up As-built drawings.
17.11.1.3. Details of Non-Conforming Items/Correction Actions/Concessions
17.11.1.4. Dimensional Inspection Reports
17.11.1.5. Baseline data on measured stress, vibration, thermal imaging, and other measurements taken during testing.

17.11.2. The Contractor shall be responsible for compiling the MDR in a single volume, bound in an A4 size 3-ring binder and indexed. The Contractor shall also be responsible for obtaining the relevant documentation from his sub-constructors and including this documentation in the MDR.

18 Spare Parts

18.1 Requirements

The Contractor shall submit detailed lists, pricing, and delivery times of all recommended spare parts for:

18.1.1. Commissioning and start-up spares required.

18.1.2. Twelve (12) months of operation spares required.

18.2 Strategy

18.2.1. The determination of spare parts shall be broken down into two (2) categories:

18.2.1.1. Wear parts

18.2.1.2. Strategic/critical spares.

18.2.2. Strategic spare requirements shall be proposed by the Contractor.

18.3 Spare Parts Listing

18.3.1. The spare parts list shall contain the following information:

18.3.1.1. Part identification, model and/or serial numbers and description in sufficient detail including size, weight and material

18.3.1.2. Quantity of like parts of each model number of the equipment

18.3.1.3. Recommended quantity of each spare part

18.3.1.4. Unit cost of each part including the price of sets and pairs as required.

18.3.1.5. Delivery lead time for each item

18.3.1.6. Total quantity of items (instrument, pumps, motors, etc) supplied

18.3.1.7. Supplier's name, address, company designation and other information

18.3.1.8. Supplier's designation (shop order numbers, etc) if applicable

18.3.1.9. Total price of all spare parts recommended.

19 Environmental Constraints and Management

19.1. All work is to be conducted in accordance with the principles of the National Environmental Management Act, 1998 (Act No. 107 of 1998) but not limited to other applicable regulations as well as acceptable environmental good practices. In addition, the Contractor is expected to comply with all applicable Municipal bylaws and associated permits, licenses, etc. held by the iron ore Terminal. The following documents included in the Annexures of the works information provide the minimum acceptable standards that shall be adhered to:

19.1.1. TIMS 002 Policy Commitment Statement

19.1.2. TIMS Construction Environmental Management Plan

19.1.3. TIMS Contractor Environmental and Sustainable Specification Guideline

19.2. The above requirements shall be applicable to the main Contractor and its service providers. The Contractor must comply with all the requirements of the Transnet Integrated Management System (TIMS) Procedures. These procedures must strictly be adhered to and shall be monitored.

19.3. The Contractor must sign the Declaration of Understanding as a commitment to abide with TPT Environmental Governance Framework and Project Environmental Specifications. Sufficient environmental budget must be allocated to meet all the project environmental requirements for the duration of the contract.

19.4. The Contractor shall perform the works and all construction activities within the Site and Working Areas having due regard to the environment and to environmental management practices as more particularly described within the TIMS procedures. The TIMS procedures describe in detail the roles and responsibilities of the project team with respect to Environmental Management. In addition, it describes the main requirements that the Contractor must comply with during the construction phase to ensure that the environment is considered, negative impacts are avoided/minimised and positive impacts are encouraged.

19.5. The TIMS procedures describe the minimal acceptable standards for environmental management for a range of environmental aspects commonly encountered on construction projects and sets environmental objectives and targets, to which the Contractor observes and complies.

19.6. The TIMS procedures describe the specific environmental standards applicable to the works (the site and the working areas) as required by the relevant project environmental authorisations (EA's).

19.7. The Contractor will be required to submit an environmental file to TPT post award of tender. Reference to the TIMS procedures for requirements of the environmental file submission. A Site access certificate shall not be granted until the environmental file has been approved by the Employer.

19.8. The overarching obligations of the Contractor under the Contractors Environmental Plan before construction activities commence on the Site and/or Working Areas is to provide environmental method statements for all construction operations at the Site and/or Working Area by the Contractor and if requested by the Construction Manager and to comply with the following:

- The Contractor shall identify the kinds of environmental impacts that will occur because of their activities and accordingly prepare separate method statements describing how each of these impacts will be prevented or managed so that the standards set out in the TIMS procedures are achieved. The method statements will be prepared in accordance with the requirements set out in the Contractors Environmental Plan. These method statements shall form part of the environmental file. The Contractor shall ensure that his management, foremen and the general workforce, as well as all suppliers and visitors to Site have attended the Environmental Induction Programme prior to commencing any work on Site. If new personnel commence work on the Site during construction, the Contractor shall ensure that these personnel undergo the Environmental Induction Programme and are made aware of the environmental specifications on Site. All associated costs of the above, including waste removal and disposal is for the cost of the Contractor.

19.9. Where required, one of the first actions to be undertaken by the Contractor shall be to erect and maintain a temporary fence along the boundaries of the Site and Working Areas as applicable, and around any no-go areas identified on the layout plans.

19.10. The Contractor shall be responsible for rehabilitating and cleaning all areas to the satisfaction of the Project Manager or Environmental Officer as detailed in the TIMS procedures. Sufficient environmental budget must be allocated to achieve this including all environmental requirements for the project for the duration of the contract. Compliance to the Atmospheric Emissions License requirements must be adhered to.

19.11. The Contractor must ensure that its Sub-contractors comply with the TIMS Environmental procedures. Costs for waste removal and disposal are for the account of the Contractor.

20 Project Execution

20.1 Strategy

20.1.1. The project has five (5) distinct phases of execution, namely:

- Project Definition and Set-up phase
- Design phase (for work not completed)
- Procurement and fabrication phase
- Construction phase
- Commissioning, handover, and close-out phase.

20.1.2. TPT's project team will fulfil the role of Project Manager and Supervisor. The full extent of the Project Management body of knowledge will be applied during all phases of execution, focussing on the following areas:

- Scope management
- Integration management
- Time (schedule) management
- Cost management
- Risk management
- Human resource management
- Quality management
- Communication management.

20.1.3. Procurement and Contract management will be performed by the Contractor. All contract documentation for construction contracts will be based on the NEC3 Engineering and Construction Contract options A. All contract documentation, including measurement and payment, management of progress, management of early warnings and variation orders will be controlled by the Contractor and supported by Transnet's enterprise management software (SAP).

20.2 Project Definition and Set-up phase:

The set-up activities required to be prepared for the delivery of the project as part of the Contractor's scope of services are as follows:

20.2.1. Develop baseline schedule for the entire project covering all project packages, which shall be configured around the program requirements indicated by latest proposal submitted by the

Contractor at tender stage. This schedule will be further developed once all contracts are awarded and the schedules as prepared by the Contractor's sub-contractors are submitted.

20.2.2. Develop a baseline project cost model which shall include a Work Breakdown Structure (WBS) which shall be used to measure cost and schedule progress, based on cost estimation work completed to date by the Contractor.

20.2.3. Develop scope of works schedules including detailed battery limits, tie-ins, and interface requirements between the various contracts on the project.

20.2.4. Compile a Risk Management Plan in conjunction with the Transnet Risk Manager.

20.2.5. Development supplementary management plans to support the Project Execution Plan, namely:

- Health and Safety Management Plan
- Quality Management Plan
- Project Controls Management Plan
- Document Management Plan
- Engineering Management Plan.

20.3 Managed Contractor's Procurement, Fabrication, and Construction Phases:

20.3.1. The key focus of the Contractor's project team during these phases is to actively manage the Managed Sub-Contractor's project progress and quality for adherence to project schedule, cost, quality and SHEQ objectives.

20.3.2. Once the Contractor establishes on site in Saldanha Bay, the Contractor shall mobilize the Project Manager, Construction Manager, discipline Engineers, Quality Control supervisor, Site Administrator, Health and Safety manager, and a Project Controls lead to site. The site-based team shall co-ordinate the site construction activities of the various site based sub-contractors to avoid delays to the project completion, and to eliminate possible interference with the Transnet Port Terminals Saldanha operations.

20.3.3. Discipline Engineering resources will be mobilised to site during the construction phase to supervise, manage, and inspect work performed by the various construction teams which form part of the Managed Contractor's construction and erection contingent.

20.3.4. Where deviations from requirements are detected in the activities performed by the Managed Contractor's sub-contractors, the Contractor's project team will issue appropriate directions for corrective actions to be taken and will apply prudent management practices to minimize detrimental impacts on project outcomes.

20.3.5. Deviations detected in the activities performed by other consultants and contractors outside the Contractor's scope of management will be brought to the attention of TPT for corrective action to be taken.

20.3.6. The Quality Assurance Management of off-site procurement, fabrication work, and on-site construction activities must be described in the project Quality Management Plan to be submitted by the Contractor. Critical activities or components requiring inspection will be determined during the design review process and initial review of the Managed Contractor's Inspection and Test Plans (ITP's) and Quality Control Plans (QCP's).

20.4 Commissioning, Hand-Over and Close-Out Phase:

The site-based Contractor's project team will manage and co-ordinate all testing, commissioning, and training activities that will be carried out by the respective construction sub-contractors. This will include:

20.4.1. Preparation of an overarching testing and commissioning plan for integration of the Contractor's testing and commissioning plans with Transnet Port Terminals Saldanha operating environment.

20.4.2. Continuous review of the Contractor's detailed testing and commission plans.

20.4.3. Manage the overall testing and commissioning process such that this is under the control of the Managed Contractor and is properly co-ordinated with Transnet Port Terminals Saldanha's operations for operation of the plant overall and for facilitating involvement of Transnet Port Terminals Saldanha's operations personnel as part of operational readiness training.

20.4.4. Witnessing the actual commissioning tests that will be carried out by the Contractor's sub-contractors and ensure that the performance of the machines comply with the specified parameters.

20.4.5. Co-ordinate the operational readiness training that will be delivered by the Managed Contractor training personnel.

20.4.6. Reviewing all hand-over documentation including drawings, operating and maintenance manuals and critical equipment settings lists etc., which shall include red-lining of drawings for back-draughting by the Managed Contractor's design office to produce the final as-built documentation.

20.5 Constraints

The execution of the project shall be subject to the following constraints, which shall be managed by the project team within the limitations placed upon them by these factors:

20.5.1. Existing operations:

No site activity performed by any of the Contractor's sub-contractors may restrict Transnet Port Terminals Saldanha off-loading activities, unless it is a planned shutdown arranged through the proper procedures with the Transnet Port Terminals Saldanha operational team. The management of the tie-ins with the existing installation of the electrical works, controls, and instrumentation with the Terminal Control Sysytem, will be co-ordinated by the Transnet Project Manager with the assistant of the Contractor.

20.5.2. Environmental:

The management of the site activities shall at all times consider the preservation of the environment, and all steps shall be taken to manage any environmental risk during construction.

20.6 Dependencies

The successful commissioning and handing over of the Plant and supporting infrastructure are dependent on the following related activities:

20.6.1. The integration of the tippler PLC controller with the Terminal Control System (TCS).

20.6.2. The co-ordination between the various designers and sub-contractors responsible for the above-mentioned works, for timely completion of the works.

20.7 Project Management

20.7.1. The Contractor will provide with his submission a comprehensive organogram with all the responsible disciplines along with the Curriculum Vitae of all the disciplines which will be involved.

20.7.2. The Contractors Project Manager will ultimately be responsible for the successful delivery of the project. He will manage the project team assigned to the project to execute the various disciplines successfully.

20.7.3. The Project Manager will initially during the set-up and design phases be based in the Contractor's home office, and travel to the site location for occasional site meetings and reporting sessions with the stakeholders.

20.7.4. The Contractor will be responsible to manage pre-compiled procedures, guidelines, document templates, and work instructions to guide the project team through different stages of the project and perform work of a standard and uniform nature whenever required to act in response to a specific challenge.

20.7.5. The Contractor Project Manager will be the single responsible person and point of contact on behalf of the Contractor.

20.8 Construction

20.8.1 Construction Organisation and Responsibilities

20.8.1.1. The Contractors construction management organisation must be structured to supervise the work of the Contractor's sub-contractors and to co-ordinate the various other contract construction activities to deliver the total project scope. The full extent of the construction organization will be documented in the Contractor's Construction Management Plan, a document to be developed during the course of the early stages of the project once the Contractor has been appointed.

20.8.1.2. A Hazard risk identification session prior to the commencement of construction and erection shall be conducted and facilitated by the Contractor risk manager. The objective of this session shall be to identify all risks associated with the construction and erection on site, and to have a risk management plan in place to ensure that all risks are acknowledged and addressed.

20.8.2 Work Package Management

The Contractor's Construction Manager will have staff designated to supervise construction activities, and supervisors will be appointed in terms of the **NEC3: Engineering and Construction Contract Option A**.

20.8.3 Site Administration

Contractor's supervisors will be co-ordinated by the Contractor's Project Manager and for site management and related aspects report to the Construction Manager.

20.8.4 Construction Project Procedures

20.8.4.1. The Managed Contractor will provide the majority of the construction procedures and documents applicable to the construction of the Plant and all its associated mechanical, electrical, control, instrumentation, and dust extraction infrastructure. The procedures and documents that will be provided to the TPT representative for review and approval shall include the following:

20.8.4.1.1. Erection Method Statements for the completion of the train unloading station and balance of plant.

20.8.4.1.2. Erection drawings and Bills of Materials

20.8.4.1.3. Electrical installation scope of works

20.8.4.1.4. Lift studies including associated method statement and risk assessments.

20.8.4.1.5. TIMS Contractor Compliance File

20.8.4.1.6. List of specialist resources required during the construction and installation.

20.8.4.1.7. Erection company/s site organogram and applicable labour resource plans and procedures.

20.8.4.2. The Construction Manager will ensure that the employees of the Contractor will comply with Transnet Site Specific SHEQ procedures for the duration of the erection and commissioning phases.

20.8.5 Constructability Plan

A constructability plan will be compiled in close co-operation with the Contractor's Project Manager, Engineering Manager and appointed Erection Sub-Contractor Site Manager. The constructability plan will be reviewed by the Project Manager in conjunction with Transnet Port Terminals Saldanha Operations and Engineering.

20.8.6 Security and Access Procedures

Security and access procedures will be in accordance with Transnet Port Terminals Security and Access procedures. The Contractor construction manager will ensure that the sub-contractors comply fully with Transnet Port Terminals requirements.

20.8.7 Quality Assurance, Inspection and Testing Procedures

Quality Assurance, inspection and testing procedures will be in strict compliance with the specified standards, procedures, and specifications listed in this document. The Contractor's construction manager with assistance from the Contractor's discipline engineers and supervisors will sign-off important milestones in accordance with the contract specifications.

20.8.8 Field Engineering Including As-Built Drawings

The Contractors construction manager will ensure that the Contractor updates drawings with the latest changes as erection of the different structures are completed. It's expected that the Contractor will place on site relevant engineers authorized to red-line drawings for revision by the Contractor's Engineering Office. All field engineering decisions will be reviewed and approved by the Contractor's design engineers before implementation. The TPT discipline engineers will ensure that the field engineering has been approved and signed-off by the Contractor's Engineering Office before its implementation.

20.8.9 Completion and Hand-Over

20.8.9.1. Completion of erection and hand-over of each section of work to the Contractor's commissioning team will only take place once all the steps identified in the erection method statements have been properly followed and signed-off by all (Site Engineer, Erection sub-contractor Site Manager, Erection sub-contractor Quality Assurance & Control Supervisor, TPT Project Manager and Supervisor).

20.8.9.2. Hand-over of the different section of the Works to the Contractor commissioning team will only happen once the Contractor commissioning team has signed off approval of the completed erected plant and all the erection defects list items have been rectified and accepted in Principle by the Transnet Project Manager.

20.9 Safety

20.9.1. All project personnel shall comply with the project's commitment to a safe workplace with the focus on ZERO HARM.

20.9.2. Transnet Port Terminals Saldanha is the owner/client as referenced to in the Occupational Health & Safety Act and Regulations, 85 of 1993 (OHS Act).

20.9.3. In relation to SHEQ issues, Transnet Port Terminals Saldanha Tippler 3 Project Director appoints the Project Manager for the project with authority to exercise such authority as is necessary in conformity with the OHS Act.

20.9.4. The Contractor's primary legal obligations are to:

20.9.4.1. Comply with all relevant SHEQ legislation.

20.9.4.2. Comply with all specific Transnet Port Terminals Saldanha policies.

20.9.4.3. Comply with all contractual requirements for Health and Safety, including ISO 45001: 2018 Occupational Health and Safety Management Systems - Requirements.

20.9.4.4. Comply with relevant industry standards and codes of practice contingent with the scope of works.

20.9.4.5. Consider the lessons learned from past projects and apply these to the current project where applicable.

20.9.5. A full-time, site-based Health and Safety manager will be mobilized to site once construction activities by the Contractor commence on site. The responsibilities of this SHEQ manager shall be as follows:

20.9.5.1. Ensure that all contract personnel complete the required site safety inductions; in accordance with TPT SHEQ induction.

20.9.5.2. Ensure that all site-based staff have completed site entry medical examinations.

20.9.5.3. Ensure compliance by all site-based contractors of OH&S legislation, site Health and Safety regulations, safe work procedures, and SHEQ best practice processes.

20.9.5.4. Perform regular SHEQ audits on site-based contractors.

20.9.5.5. Ensure that H&S statistics are regularly submitted for reporting purposes to the Project Manager.

20.9.5.6. Ensure that all sub-contractors submit Method Statements and Risk Assessments of all activities identified in the SHEQ Management Plans for review and approval prior to commencement of the activity.

20.9.5.7. Ensure that incident reporting, notifications, and investigations are done in accordance with Transnet Port Terminals TIMS 013 procedure.

20.9.5.8. Conduct regular Health and Safety awareness campaigns amongst all contract personnel on site.

20.9.5.9. Ensure that all legal appointments in terms of legislation are in place.

20.9.5.10. Ensure that contractors have daily toolbox talks, SHEQ review meetings, and safety talks.

20.9.5.11. Attend HAZOP and Hazard risk identification sessions with sub-contractors when required.

20.9.5.12. Ensure that injury management plans are in place at all work locations.

20.9.5.13. Supervise regular testing on site for alcohol and illegal substances of all site-based staff.

20.9.5.14. Ensure that all contractors maintain site records of SHEQ documentation.

20.9.5.15. Ensure that all contractors are aligned with Transnet Port Terminals Saldanha's emergency response plans and evacuation procedures.

21 Project Controls

21.1 Document Management

21.1.1. The Contractor document controller is responsible for the registration, issue, distribution, filing and subsequent reporting of all project deliverables produced on the project relating to the scope of work executed by the Contractor that requires revision and version control.

21.1.2. The document controller's specific duties on the project shall be as follows:

21.1.2.1. Manage the distribution, review update, revision control, and final issuing for use of all Aurecon internally produced deliverables including any deliverables that require distribution monitoring.

21.1.2.2. Collate, archive, and distribute reference documents.

21.1.2.3. Collate, archive, and distribute supplier/contractor's documentation (where relevant).

21.1.2.4. Collect, archive, and distribute technical and progress reports (weekly/monthly/annually, etc.).

21.1.2.5. Re-production and subsequent distribution of technical documents for use by site staff.

21.1.2.6. Collect, archive, and distribute to originator's (TPT) and any other third-party review comments.

21.1.2.7. Document Distribution to project members, both internally and externally, including TPT, Contractors sub-contractors and Contractors Consultants.

21.1.2.8. Any associated Document Control reporting actions throughout the duration of the project.

21.2 Project Reporting

Followed to determine overall project progress.

21.3 Baseline Management

Three (3) different baselines are applicable to the project.

21.3.1. **<u>Initial Baseline</u>**. This baseline, with its associated budget and schedule is the agreed baseline at the start of the process.

21.3.2. **Approved Baseline**. The approved baseline consists of the initial baseline plus any approved changes with its associated cost and scheduled impact.

21.3.3. **Control Baseline**. The control baseline consists of the approved baseline plus any unapproved changes with its associated cost and scheduled impact.

21.3.4. **Re-baseline**. A re-baseline has the effect of re-setting the Approved baseline to a new initial budget, thereafter one will again have approved and unapproved changes which creates new approved and control baselines.

21.4 Change Types

21.4.1. Various types of changes can be identified. Typically, the following Change Types will originate through the course of a project (list is not exhaustive):

21.4.1.1. Budget Shifts.

21.4.1.2. Scope Changes.

21.4.1.3. Technical Changes.

21.4.1.4. Schedule Changes.

21.4.2. The Contractor will then assign an appropriate engineering resource to the change request to perform a change impact assessment – all possible aspects of the impact will be assessed.

21.4.3. The Contractor will then issue the Change Request with all supporting documentation to TPT.

21.4.4. A TPT Change Committee will review the assessment findings; either rejects it, refers for further assessments, or recommends the change to Transnet Port Terminals Saldanha.

21.4.5. If the change is approved by Transnet Port Terminals Saldanha, the Contractor will then be requested to generate a Variation Order and issue for implementation. The Contractor and TPT will both be responsible to update the project Change Register.

21.4.6. Once changes are formally approved a Contract Variation Order or Compensation Event (process as defined in the Contract) will be registered (if required by the change itself) by the TPT Commercial Administrator to formally complete the Commercial aspect of the Change Management Process.

21.5 Issue Management

21.5.1. An "Issues Register" schedule will be maintained by the Contractor Project Manager and used to track the progress with resolving issues of importance which require resolution and actions to be taken. The sources of issues to be logged in this register can be any of the following:

21.5.1.1. Action items from progress meetings.

21.5.1.2. Instructions from the Project Manager raised in formal meetings or via other communication methods.

21.5.1.3. Issues noted during site inspections, surveillances of Contractors' activities, or documentation.

21.5.1.4. Health, Safety, or Environmental issues noted by any team member requiring further action.

21.5.2. Contractor resources will be allocated to each issue requiring further action and will be prioritized in accordance with the possible impact it may have on the project if not resolved by the deadline noted. The Issues Register will be revisited at each progress meeting and updated by the Contractor for distribution to TPT.

21.6 Project Control Processes

The following project controls processes will be used by the Contractor:

21.6.1. Engineering progress measurement: Manage the engineering process by breaking the effort down into work packages and deliverables. Progress percentages will be attributed to each deliverable to obtain an accurate measurement of overall progress and earned value performance.

21.6.2. Planning and Scheduling: Primavera P6 R8.3 software is a widely used tool for planning projects and programs, and a software system that is compatible is prescribed for use on this project.

21.6.3. Document Control: One-drive Microsoft.

22 Progress Measurement and Performance

22.1. Progress will be tracked at task level on the various schedules. As activities are completed progress per activity will be accrued, which will roll up to summary level, and eventually to Work Package level.

22.2. The following sections deals with overall progress at a rolled-up level and also provides guidelines for measurement at a detailed level should the need arise.

22.3 Overall Project Progress

Total project physical progress will bring together the project elements of Engineering, Procurement, Fabrication, Demolishing, Construction and Commissioning as a single measure even though work of a differing nature and complexity is being undertaken by various functions and entities.

22.3.1. Planned installed works packages curves will be generated by the quantities in the Control Budget with dates in the Baseline Schedule.

22.3.2. Actual installed works packages will be extracted from a combination of the installation contractors, quantity surveyors, project engineers, construction supervisors and project controls staff depending on requirements of the project.

22.3.3. Actual progress within the individual works packages will be measured as a percentage of the equivalent installed quantities over budgeted quantities.

22.4 Commissioning Progress

22.4.1. Overall commissioning progress shall be based on the ratio of the number of test sheets completed divided by the total number of test sheets for the commissioning pro-rated to the activity costed weight.

22.4.2. Test sheets shall be grouped by systems to be commissioned in order to report system completion.

23 Reporting

23.1 Calendar

The project reporting calendar key dates include the information in **Table 24** below.

Table 7: Reporting timetable

Event	Date
All month end contributions issued to TPT PM	Last working day of each month
Draft monthly report available for internal review	5th working day of each month
Final monthly report issued to Transnet Port Terminals Saldanha	7th working day of each month
Period cut off	25th day of every month
Invoice cut off	25th day of every month
Weekly Report information issue to TPT PM	Issued by COB every Monday
Weekly reports	Issued to Transnet Port Terminals Saldanha by COB every Tuesday

23.2 Monthly Progress Report

23.2.1. The Monthly Project Progress Report involves the collation of baseline data and distributing performance information to stakeholders. The report will be distributed by the Contractor Project Manager on a monthly basis and will require input with regard to cost, progress, issues, health and safety, quality, and risks from all Discipline Leads and Contractors sub-contractors. These inputs will be requested at regular intervals as agreed, but additional requests may be made on an ad-hoc basis.

23.2.2. A detailed monthly report will be published by COB Day 7th working day of each month and highlights (not limited to, sections only included when appropriate):

- Executive Summary
- Project Management
- SHEQ Management
- Engineering Management

    - Project Interfaces and Boundary Limits.
- Project Controls
    - Cost.
    - Schedule.
- Quality Management
- Risk Management
- Fabrication and Manufacturing
- Construction
    - Permits and Approvals.
- Commissioning.

23.3 Weekly Report

A weekly report will be published by COB Tuesdays and highlight:

- Safety
- Schedule – Milestone Reporting
- Activities (this week and look ahead).

23.4 Formal Health and Safety Reporting

TPT and the Contractor H&S officers will agree the deliverables and reporting that will take place as well as the formats thereof.

23.5 Project Meetings

The following recurring meetings will be held on the project:

Project Progress Meetings are scheduled between the Project Teams of TPT and Transnet Port Terminals Saldanha. These meetings may involve the Contractor and/or other Consultants.

23.5.1. TPT Internal Monthly Progress and Review Meetings

At these meetings the focus will be on obtaining and confirming information provided by the Contractor Project Manager for compilation of the Monthly Progress Report for the period including safety, progress, status of deliverables and detailed cost reports with s-curves, and project costs showing planned, earned, forecast and actual costs, cash flow indication for the next period. Review meetings will assess the status of the project and decide on any action that needs to be taken, if any.

23.5.2. Health and Safety Meetings

Once site has established various H&S meetings will take place on a weekly and monthly basis, including alignment meetings with TPT and the Contractors sub-contractors.

23.5.3. Formal Design Review Meetings

Formal reviews with the Contractors Project Team will be scheduled at milestones or critical project stages in line with the relevant procedures.

23.5.4. Contractors' Sub-Contractor's Kick-Off Meetings

Contractors' sub-contractor's kick-off meeting will be carried out with prior to work commencing for all new Contractors. The kick-off meeting will:

23.5.4.1. Introduce TPT team members to the Contractors.

23.5.4.2. Define lines of communication and levels of authority; and

23.5.4.3. Confirm the scope of the project, design basis, parameters, and performance expectations.

23.5.5. Site Meeting with Contractor

Site meetings will be held between the Contractor and TPT in accordance with the Contractor's Construction Management Plan.

23.5.6. Steercom Meetings

These meetings will be held every 6 weeks to discuss high level issues.

24 Project Quality Assurance

24.1 Project Quality Management Plan

The Quality Management services will be provided by the Contractor during the design, fabrication and construction phases of the Project will cover the following:

24.1.1. Review of the designs by the Contractor for compliance with all specified quality standards and specifications.

24.1.2. Review of the designs by the Contractor for compliance with all statutory requirements.

24.1.3. Preparation of a Project Quality Management plan integral to the Project Execution Plan (PEP).

24.1.4. Review and assess the Contractor's quality plan, inspection, and test plans (ITPs), QCP's and other key quality related documentation.

24.1.5. Perform any supplementary audits on the Quality Management systems and processes if necessary.

24.1.6. Review the quality audits performed by the Contractor on their key suppliers, sub-contractors, and manufacturers, and perform additional reviews of the quality management processes followed by these entities if necessary.

24.1.7. Once QCP's are submitted, determine which sections of the works will be subjected to "Hold" and "Witnessed Inspections" on the most cost-effective manner. The value of the section of works will be taken into consideration when these decisions will be made, and attention will be focused on the high value, long lead critical components which have been identified during the Risk Management process as those items which have the largest impact and probability to affect the project outcome negatively.

24.1.8. Facilitate the identified Quality Control surveillance interventions as required during the manufacturing and construction phases in accordance with the QCP's submitted by the managed Contractor and agreed.

24.1.9. Submit to TPT details of the 3rd party inspection individuals to be used for selected quality control surveillance inspections. These individuals, once approved by TPT, will be utilized to perform selected Quality Control inspections at the premises of key component suppliers and manufacturers to ensure that quality management processes are followed, as well as to perform random sampling testing and surveillance according to the approved QCP for the particular section of the works.

24.1.10. The abovementioned surveillance inspections will be done on a cost-efficient basis, and duplication of surveillance activities will be avoided.

24.1.11. Should non-conformances be identified, these will be recorded in a register by the Contractor's Quality Manager with follow-up actions consisting of either a corrective action plan submitted by the originator of the non-conformance, or the submission of concession application for consideration. The review of a concession will entail the submission of the concession in the format as described in the Contractor's Quality Management Plan, and review by TPT of the proposed deviation for final approval or rejection.

24.1.12. Site quality control during construction will be done by the Contractor's discipline engineers on site, assisted by the Contractor Quality Lead where required.

24.1.13. Liaise with the Contractor's sub-contractor's QA/QC personnel to ensure compliance with the agreed quality management systems.

24.1.14. Ensure that Manufacturer's Data Records are submitted and finally included in the equipment data books to be compiled by the Contractor at the end of the project.

24.1.15. Control the release for shipment of equipment by authorizing release certificates, this will be subject to TPT release.

24.2 Review and Audits

24.2.1 Vendor Quality Audits

24.2.1.1. TPT will review the outcome of the Quality Management system audits done on the quality management systems in place of the preferred equipment suppliers, major vendors and fabricators which will be employed on this project by the Contractor.

24.2.1.2. Should any issues require review or assessment, the TPT Quality manager will issue a report on the outcome to the Contract Project Manager. A decision will then be made between the two parties on further auditing requirements and/or corrective actions to be taken by the Contractor Project Manager on the preferred equipment suppliers, major vendors and fabricators which will be employed on this project.

24.2.1.3. These audit results will be scrutinized for compliance with acceptable best practices and specific project requirements, as well as compliance with TPT and Transnet standards of Quality management. Should further audits or corrective actions be required, the Contractor will be notified to take the necessary step to ensure alignment and compliance at his own cost.

25 Transition to Operations

25.1 Approval Criteria

The approval criteria to signify handover to Transnet Port Terminals Saldanha will be specified in the Commissioning and Hand-over plan to be prepared by the Contractor and submitted to TPT for review and approval. The metrics to be recorded to confirm compliance with the specified performance criteria, the methods of measurement, and the duration of tests shall be as specified in the engineering technical specifications that form part of the Contract between Transnet and the Managed Contractor. Concessions to the recording and measurement durations will only be considered if operational requirements limit the full duration of the testing to determine if specified performance has been achieved, or if the feed rate of material required to prove compliance with capacity specifications cannot be achieved.

25.2 Hand-Over

25.2.1. On completion of the tests as specified and agreed in the Commissioning and Hand-over Plan to be prepared by the Contractor, the Contractor shall supply completion test certificates and such prescribed statutory documents as are required certifying that the Plant is in complete working order and that all working parts have been lubricated according to manufacturers' instructions.

25.2.2. The Contractor's work shall be considered acceptable upon demonstration of conformance to the Technical Specifications and Standards contained in the Contract, and its suitability for the commencement of commercial service and that the performance tests have been successfully completed.

25.2.3. The TPT Construction Manager will ensure that all relevant pre-commissioning and commissioning activities have been successfully completed before presenting the Plant to Transnet Port Terminals Saldanha Operations for approval.

25.3 Training

Training shall be as specified in the technical specifications contained in the Contract, and shall consist of the following:

25.3.1 Operational Training

25.3.1.1. The Contractor shall train selected Transnet Port Terminals Saldanha operational personnel during Commissioning and Performance testing to operate the Plant during load conditions and certify the level of satisfactory competency on completion. Training will consist of theoretical; classroom-based training, as well as hands-on practical operational training.

25.3.1.2. Six (6) sets of the operational training manual shall be compiled by the Contractor for distribution to and retention by the Transnet Port Terminals Saldanha operators.

25.3.2 Maintenance Training

The Commissioning Engineers from the Contractor shall train Transnet Port Terminals Saldanha maintenance staff in all technical maintenance aspects of the respective Plant. Six (6) sets of the full maintenance training manual shall be compiled for distribution to and retention by the Transnet Port Terminals Saldanha maintenance teams.

25.3.3 Operational Support

The defects liability period shall be 12 months from date of handover to Transnet Port Terminals Saldanha. For details of the operational support to be provided by the Contractor during the defect's liability period, refer to the Contract.

25.3.4 Operational Readiness

1.1.1.1.1. At least 3 months prior to commencement of commissioning, Transnet Port Terminals Saldanha shall nominate the Operational Readiness team consisting of the following:

31.3.4.1.1. The operators that will be operating the Plant.

31.3.4.1.2. The maintenance team responsible for planned and emergency maintenance of the Plant.

31.3.4.1.3. Any management or engineering team members involved in planning or management functions.

25.3.4.1. The Operational Readiness team shall during the period leading up to commissioning, participate in the project execution activities as much as possible, to ensure that the team becomes familiar with the technical aspects of the new Plant. The team shall also shadow the project commissioning team during commissioning and hand-over to witness the operations and performance of the Plant.

25.3.4.2. Transnet Port Terminals Saldanha will nominate from the ranks of the Operational Readiness team those members that will be trained by the Contractor.

26 Project Close-Out

26.1 Project Close-Out Review

26.1.1. The Transnet Project Manager shall arrange the project close-out review in conjunction with the Contractor Project Manager prior to final completion of the commissioning and hand-over. The objective of the project Close-Out Review is to achieve total project closure in a controlled and organised manner, following hand-over of the completed works. This will ensure that all accountabilities relating to the project are either discharged or handed over to Transnet Port Terminals Saldanha operations as appropriate.

26.1.2. The scope of the Close-Out Review will include the following activities:

26.1.2.1. Review the efficiency of the project in meeting the original time, cost, and resources targets as set during the planning phase.

26.1.2.2. Record and communicate any lessons which can be beneficial (to either or both Transnet Port Terminals Saldanha and the TPT Project Management Team) for future projects.

26.1.3. Ensure that all project documentation (i.e., Deliverable-Documents, Reports, Quality Files, As-Built Drawings, and Training Manual, as appropriate) have been submitted and accepted, and that copies thereof have been properly archived.

26.1.4. Ensure that transfer of control from the Project Team to the Owner (i.e., operations) is carried out smoothly; it covers (and should address any pertaining to) project aspects such as conformance to quality requirements, operational readiness on the part of the Owner, legal accountability. In a nutshell, this activity concerns itself with two (2) items:

26.1.4.1. Extent to which the completed Plant is "fit-for-purpose", and

26.1.4.2. Readiness of the Owner to take control of the completed facility.

26.1.5. To establish the extent to which engineering designs and construction works have satisfied operational requirements, the Project Team will conduct a Technical Review, following Handover and Approval.

26.1.6. Ensure that all supplies and services have been delivered as per orders and contracts, and that the TPT Contracts Administrator along with the Contractor Project Manager has verified that that all claims are documented and resolved, that final payments have been made, and that all project accounts are reconciled and formally closed.

26.2 Project Close-Out Report

The Project Close-Out Report will be drafted in-line with Transnet requirements. The project Close-Out Report will include the following headings:

26.2.1. Outstanding Risks, Issues and Deliverables: Any risks, issues, and deliverables that will be identified as outstanding at the time of project Close-Out shall be listed together with a definition of their nature, proposed resolution, and accountability (i.e., person responsible and timelines).

26.3 Warranty And Supplier Support

The warranty of the Plant is twelve months from the date of handover to Transnet Port Terminals Saldanha. Once the Plant has been handed over to Transnet Port Terminals

Saldanha Operations, the responsibility of the Plant transfers from the Contractor Project Team to Transnet Port Terminals Saldanha Operations. Any breakdowns of the equipment due to poor quality of manufacture, installation and erection will have to be addressed to the Contractor's after-sales team who should have a representative on site for the first six (6) months after hand-over to deal with any breakdowns associated quality related issues of manufacture, installation, or erection.

27 Annexures (Supporting Documents)

Annexure A: Ashton Bulk Report Train Unloading System _Balance of Plant

Appendix A	Drawings List
Appendix B	Site Scope Work
Appendix C	Tippler Alignment Survey Report
Appendix D	Electrical Inspection _Dust Plant Report
Appendix E	Site Inspection Photos
Appendix G	Schedule of Enabling Works
Appendix H	Scoping Site Inspection Reports
Appendix I	Design Engineering and IP

Annexure B: Technical Specification PLC SCADA

Annexure C: Technical Specification: Dust Extraction/Handling Plant

Annexure D: Technical Specification Mechanical/Electrical

Annexure E: Master Operating Philosophy Plant (Tippler Unit/Apron Feeders/Dust Collection)

Annexure F: Dust Extraction Control Philosophy

Annexure G: Apron Feeder Control Philosophy

Annexure H: Knife Gate Control Philosophy

Annexure I: Technical Specification (Wagon Tipplers, Feeders, Dust House)

Annexure J: Data Sheet (Dual Wagon Tippler)

Annexure K: Technical Specification Apron Feeder

Annexure L: Data Sheet Apron Feeder

Annexure M: Technical Specification Dust Collection

Annexure N: Data Sheet Dust Collection (Bag House)

Appendix A

Project Drawing List

9144-1_D01	Family Tree of Train Unloading System & Balance of Plant
49055271	GA of Unit Train Unloading System
49055272	Assembly of Cage Link Rotary Tippler
49055208	Tippler Cage
49055207	Assembly of Tippler Rotating Structures
49055232	Assembly of Support Rollers
49055245	Assembly of Train Positioner
49055255	Assembly of Train Holding Devices
TIPP3-DJB-001	GA of Dust Cowl and Deflector Wall/Barrier
TIPP3-DAA-001	GA of Chute Work, Hoppers and Apron Feeder Chutes

9144-1_D01 - SALDANHA BAY
TIPPLER 3
UNIT TRAIN UNLOADING SYSTEM

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ashton bulk
materials handling

TRAIN UNLOADING SYSTEM MECH / HYD / LUB EQUIPMENT - FAMILY TREE (MAP) OF DRAWINGS & BILLS OF QUANTITES

Index Number	TRANSNET Drawing No.	Supplier Drawing No.	Tier 1	Tier 2	Tier 3	Tier 4	Revision	Designer	Supplier
TRAIN UNLOADING SYSTEM - MECHANICAL									
1	1924701-0-000- M-GA-0072	49055271	49055271 GENERAL ARRANGMENT OF UNIT TRAIN UNLOADING SYSTEM				0	AB	TENOVA / TZME
WAGON TIPPLER									
2	1924701-0-000- M-GA-0073	49055272	49055272 ASSEMBLY OF LINK CAGE ROTARY TIPPLER				1	AB	TENOVA / TZME
3	1924701-0-000- M-GA-0008	49055207		49055207 ASSEMBLY OF TIPPLER ROTATING STRUCTURES			1	AB	TENOVA / TZME
4	1924701-0-000- M-GA-0009	49055208			49055208 ASSEMBLY OF CAGE STRUCTURE		1	AB	TENOVA / TZME
5	1924701-0-000- M-GA-0010	49055209				49055209 ASSEMBLY OF END RING - LEFT HAND (ENTRY)	2	AB	TENOVA / TZME
6	1924701-0-000- M-GA-0011	49055210				49055210 ASSEMBLY OF END RING - RIGHT HAND (EXIT)	3	AB	TENOVA / TZME
7	1924701-0-000- M-GA-0012	49055211				49055211 ASSEMBLY OF PLATFORM	2	AB	TENOVA / TZME
8	1924701-0-000- M-GA-0013	49055212				49055212 ASSEMBLY OF SIDE BEAM	2	AB	TENOVA / TZME
9	1924701-0-000- M-GA-0014	49055213				49055213 ASSEMBLY OF BALLAST BEAM	1	AB	TENOVA / TZME
10	1924701-0-000- M-GA-0032	49055231				49055231 ASSEMBLY OF SIDE & BALLAST BEAM PIVOT SHAFT	1	AB	TENOVA / TZME
11	1924701-0-000- M-GA-0081	49055280				49055280 ASSEMBLY OF CAGE LINK	4	AB	TENOVA / TZME
12	1924701-0-000- M-GA-0082	49055281				49055281 ASSEMBLY OF TORQUE BRACKET NON TIP SIDE LH	2	AB	TENOVA / TZME
13	1924701-0-000- M-GA-0083	49055282				49055282 ASSEMBLY OF TORQUE BRACKET TIP SIDE LH	2	AB	TENOVA / TZME
14	1924701-0-000- M-GA-0084	49055283				49055283 ASSEMBLY OF TORQUE BRACKET NON-TIP SIDE RH	2	AB	TENOVA / TZME
15	1924701-0-000- M-GA-0085	49055284				49055284 ASSEMBLY OF TORQUE BRACKET TIP SIDE RH	2	AB	TENOVA / TZME
16	1924701-0-000- M-GA-0086	49055285				49055285 ASSEMBLY OF PLATFORM PIVOT SHAFT	1	AB	TENOVA / TZME
17	1924701-0-000- M-GA-0020	49055219			49055219 ASSEMBLY OF END RING RAILS		2	AB	TENOVA / TZME
18	1924701-0-000- M-GA-0021	49055220			49055220 ASSEMBLY OF TIPPLER DRIVE RACKS		0	AB	TENOVA / TZME
19	1924701-0-000- M-GA-0022	49055221			49055221 ASSEMBLY OF WAGON CLAMP GEAR		3	AB	TENOVA / TZME
20	1924701-0-000- M-GA-0023	49055222			49055222 ASSEMBLY OF TIPPLER BALLAST		0	AB	TENOVA / TZME
21	1924701-0-000- M-GA-0024	49055223			49055223 ASSEMBLY OF SIDE PAD		2	AB	TENOVA / TZME
22	1924701-0-000- M-GA-0025	49055224			49055224 ASSEMBLY OF PLATFORM WALKWAYS		1	AB	TENOVA / TZME
23	1924701-0-000- M-GA-0026	49055225			49055225 ASSEMBLY OF PLATFORM RAILS		2	AB	TENOVA / TZME
24	1924701-0-000- M-GA-0028	49055227			49055227 ASSEMBLY OF SPILL PLATES		0	AB	TENOVA / TZME
25	1924701-0-000- M-GA-0033	49055232		49055232 ASSEMBLY OF SUPPORT ROLLERS			0	AB	TENOVA / TZME
26	1924701-0-000- M-GA-0034	49055233			49055233 ASSEMBLY OF LOCATING SUPPORT ROLLERS		0	AB	TENOVA / TZME
27	1924701-0-000- M-GA-0035	49055234				49055234 ASSEMBLY OF FLANGED SUPPORT ROLLER	0	AB	TENOVA / TZME
28	1924701-0-000- M-GA-0074	49055273			49055273 ASSEMBLY OF NON-LOCATING SUPPORT ROLLERS		0	AB	TENOVA / TZME
29	1924701-0-000- M-GA-0036	49055235				49055235 ASSEMBLY OF PLAIN SUPPORT ROLLER	0	AB	TENOVA / TZME
30	1924701-0-000- M-GA-0037	49055236		49055236 ASSEMBLY OF TIPPLER DRIVE GEAR			1	AB	TENOVA / TZME
31	1924701-0-000- M-GA-0078	49055277		49055277 ASSEMBLY OF ROTATIONAL BUFFERS			1	AB	TENOVA / TZME
32	1924701-0-000- M-GA-0029	49055228		49055228 ASSEMBLY OF TIPPLER ROTATIONAL LIMIT SWITCHES			0	AB	TENOVA / TZME
33	1924701-0-000- M-GA-0030	49055229		49055229 ASSEMBLY OF TIPPLER MAINTENANCE LOCK			0	AB	TENOVA / TZME
34	1924701-0-000- M-GA-0031	49055230		49055230 ASSEMBLY OF GROUT PACKING			0	AB	TENOVA / TZME
35	1924701-0-000- M-GA-0090	49055290		49055290 ASSEMBLY OF GROUND MOUNTED THRUST PADS			0	AB	TENOVA / TZME
36	1924701-0-000- M-GA-0038	49055237		49055237 TIPPLER LUBRICATION INSTALLATION			0	AA / xx	TENOVA / TZME
TRAIN POSITIONER									
37	1924701-0-000- M-GA-0046	49055245	49055245 ASSEMBLY OF TRAIN POSITIONER				0	AB	TENOVA / TZME
38	1924701-0-000- M-GA-0047	49055246		49055246 ASSEMBLY OF POSITIONER MAIN FRAME			3	AB	TENOVA / TZME
39	1924701-0-000- M-GA-0048	49055247		49055247 ASSEMBLY OF POSITIONER ARM & RAISE MECHANISM			2	AB	TENOVA / TZME
40	1924701-0-000- M-GA-0049	49055248			49055248 ASSEMBLY OF POSITIONER ARM STRUCTURE & HEAD		0	AB	TENOVA / TZME
74	No Transnet Drawing Number	49055303			49055303 ASSEMBLY OF RAISED ARM REACTION BRACKET MOD			AB	TENOVA / TZME
41	1924701-0-000- M-GA-0040	49055239		49055239 ASSEMBLY OF POSITIONER ARM LATCH			0	AB	TENOVA / TZME
42	1924701-0-000- M-GA-0050	49055249		49055249 ASSEMBLY OF LAST WAGON ARM			5	AB	TENOVA / TZME
43	1924701-0-000- M-GA-0096	49055295			49055295 ASSEMBLY OF LWA HEAD		4	AB	TENOVA / TZME
44	1924701-0-000- M-GA-0099	49055298				49055298 ASSEMBLY OF LAST WAGON ARM COUPLER	0	AB	TENOVA / TZME
45	1924701-0-000- M-GA-0041	49055240		49055240 ASSEMBLY OF GUIDE ROLLERS			0	AB	TENOVA / TZME
46	1924701-0-000- M-GA-0042	49055241		49055241 ASSEMBLY OF SPRUNG SUPPORT ROLLER			2	AB	TENOVA / TZME
47	1924701-0-000- M-GA-0043	49055242		49055242 ASSEMBLY OF FIXED SUPPORT ROLLER			1	AB	TENOVA / TZME
48	1924701-0-000- M-GA-0044	49055243		49055243 ASSEMBLY OF DRIVE CARTRIDGE			0	AB	TENOVA / TZME
49	1924701-0-000- M-GA-0092	49055291		49055291 ASSEMBLY OF LONG TRAVEL ENCODER			1	AB	TENOVA / TZME
50	1924701-0-000- M-GA-0045	49055244		49055244 ASSEMBLY OF POSITIONER ACCESS			0	AB	TENOVA / TZME
51	1924701-0-000- M-GA-0052	49055251		49055251 POSITIONER HYDRAULIC INSTALLATION			0	AB / AA	TENOVA / TZME
52	1924701-0-000- M-GA-0053	49055252		49055252 POSITIONER LUBRICATION INSTALLATION			4	AB / xx	TENOVA / TZME
53	1924701-0-000- M-GA-0097	49055296			49055296 ASSEMBLY OF LUBRICATION PINION		0	AB	TENOVA / TZME
73	1924701-0-000- M-GA-0102	49055301		49055301 ASSEMBLY OF LONG TRAVEL CARTRIDGE ENCODER			0	AB	TENOVA / TZME
54	1924701-0-000- M-GA-0054	49055253	49055253 ASSEMBLY OF POSITIONER TRACK				2	AB	TENOVA / TZME
55	1924701-0-000- M-GA-0065	49055264		49055264 ASSEMBLY OF POSITIONER TRACK REAR MODULE			0	AB	TENOVA / TZME
56	1924701-0-000- M-GA-0066	49055265		49055265 ASSEMBLY OF POSITIONER TRACK INNER MODULE			1	AB	TENOVA / TZME
57	1924701-0-000- M-GA-0067	49055266		49055266 ASSEMBLY OF POSITIONER TRACK FRONT MODULE			1	AB	TENOVA / TZME
58	1924701-0-000- M-GA-0068	49055267		49055267 ASSEMBLY OF 5-RACK POSITIONER TRACK MODULE			1	AB	TENOVA / TZME
59	1924701-0-000- M-GA-0077	49055276		49055276 ASSEMBLY OF 3-RACK POSITIONER TRACK MODULE			1	AB	TENOVA / TZME
60	1924701-0-000- M-GA-0055	49055254	49055254 ASSEMBLY OF POSITIONER CABLE FESTOON SYSTEM				1	AB	TENOVA / TZME
TRAIN HOLDING DEVICES									
61	1924701-0-000- M-GA-0056	49055255	49055255 ASSEMBLY OF TRAIN HOLDING DEVICES				0	AB	TENOVA / TZME
62	1924701-0-000- M-GA-0057	49055256		49055256 ASSEMBLY OF WHEEL GRIPPER UNIT			4	AB	TENOVA / TZME
63	1924701-0-000- M-GA-0058	49055257		49055257 TRAIN HOLDING DEVICE HYDRAULIC INSTALLATION			0	AB/AA	TENOVA / TZME
64	1924701-0-000- M-GA-0098	49055297		49055297 ASSEMBLY OF GRIPPER PIT LADDER			0	AB	TENOVA / TZME
65	1924701-0-000- M-GA-0060	49055259	49055259 ASSEMBLY OF PLANT CONTROL SWITCHES				0	AB	TENOVA / TZME
TRAIN UNLOADING SYSTEM - CIVIL WORKS									
66	1924701-0-000- C-LA-0003	49055200	49055200 TIPPLER & PLANT FOUNDATION DETAILS				8	AB	
67	1924701-0-000- C-LA-0005	49055202		49055202 POSITIONER FOUNDATION DETAILS			8	AB	
68	1924701-0-000- C-LA-0004	49055201		49055201 TRAIN HOLDING DEVICES FOUNDATION DETAILS			3	AB	
TRAIN UNLOADING SYSTEM - HYDRAULIC SYSTEM									
POSITIONER HYDRAULIC SYSTEM									
75	No Transnet Drawing Number	32261.A3	32261.A3 HYDRAULIC PIPE ASSEMBLY FOR MAIN ARM - POSITIONER				C	AA	
76	No Transnet Drawing Number	CY-AM025D021	CY-AM025D021 25mm BORE 14mm ROD DOUBLE ACTING HYDRAULIC CYLINDER				2	ALLEY HYDRAULICS	
77	No Transnet Drawing Number	32262.A3	32262.A3 POSITIONER ANCILARY PIPE ASSEMBLY				C	AA	
78	No Transnet Drawing Number	31661.A3	31661.A3 HYDRAULIC CYLINDER SPECIAL - 40-22-100				A	AA	
79	No Transnet Drawing Number	EC.30173.A3	EC.30173.A3 ELECTRICAL CONNECTION FOR POSITIONER ARM HPU				B	AA	
80	No Transnet Drawing Number	GA.30346.A3	GA.30346.A3 ARM ACTUATOR 1250 STROKE 125-90				1	AA	
81	No Transnet Drawing Number	GA.30371.A3	GA.30371.A3 HYDRAULIC POWER UNIT FOR POSITIONER ARM WITH SLEW				C	AA	
82	No Transnet Drawing Number	HC.30141.A3	HC.30141.A3 HYDRAULIC CIRCUIT FOR POSITIONER ARM HPU SYMBOLS				D	AA	
TRAIN HOLDING DEVICES HYDRAULIC SYSTEM									
83	No Transnet Drawing Number	31985.A3	31985.A3 PIPE ASSEMBLY FOR GRIPPER				C	AA	
84	No Transnet Drawing Number	803160	803160 WHEEL GRIPPER HYDRAULIC ACTUATOR				P1	AB	
85	No Transnet Drawing Number	EC.30180.A3	EC.30180.A3 ELECTRICAL CONNECTION FOR GRIPPER HPU				D	AA	
86	No Transnet Drawing Number	GA.30336.A3	GA.30336.A3 HYDRAULIC POWER UNIT FOR GRIPPER DRIVE				C	AA	
87	No Transnet Drawing Number	HC.30148.A3	HC.30148.A3 HYDRAULIC CIRCUIT FOR GRIPPER HPU WITH QUICK CONNECTION				A	AA	
TRAIN UNLOADING SYSTEM - LUBRICATION SYSTEM									
88	No Transnet Drawing Number	PL_AU_920486	PL_AU_920486 TIPPLER & POSITIONER UNIT 1 & 2				-	BIJUR-DELIMON	
89	No Transnet Drawing Number	EZL05A40M050101010500X01	EZL05A40M050101010500X01 TIPPLER & POSITIONER Z1				-	BIJUR-DELIMON	
90	No Transnet Drawing Number	EPR05A40M020105M00X01	EPR05A40M020105M00X01 TIPPLER & POSITIONER M1				-	BIJUR-DELIMON	

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TIPPLER 3
UNIT TRAIN UNLOADING SYSTEM

Revision: A
Issue Date: 17-Sep-21
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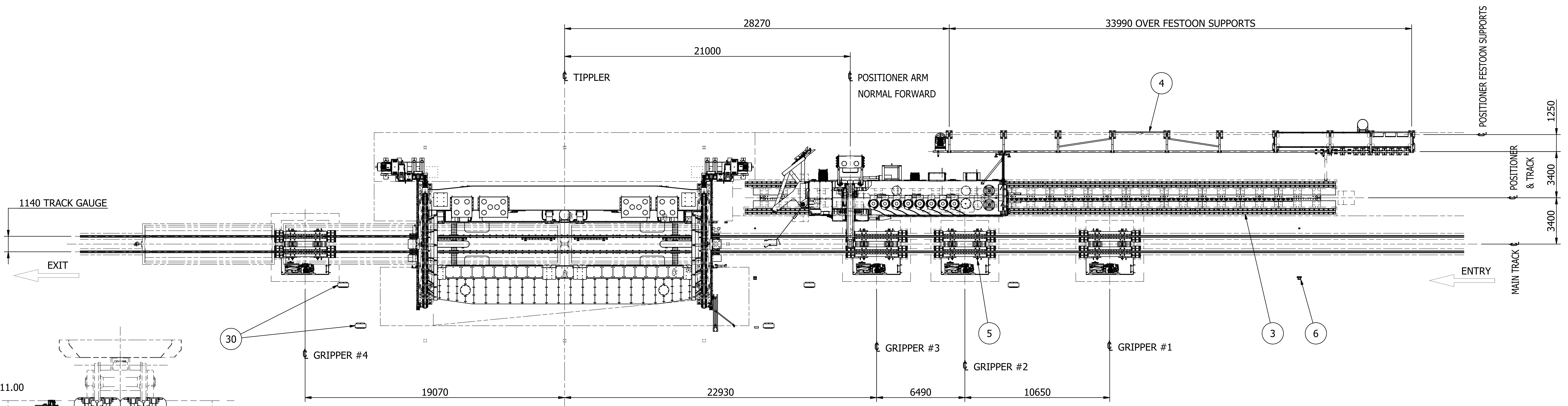
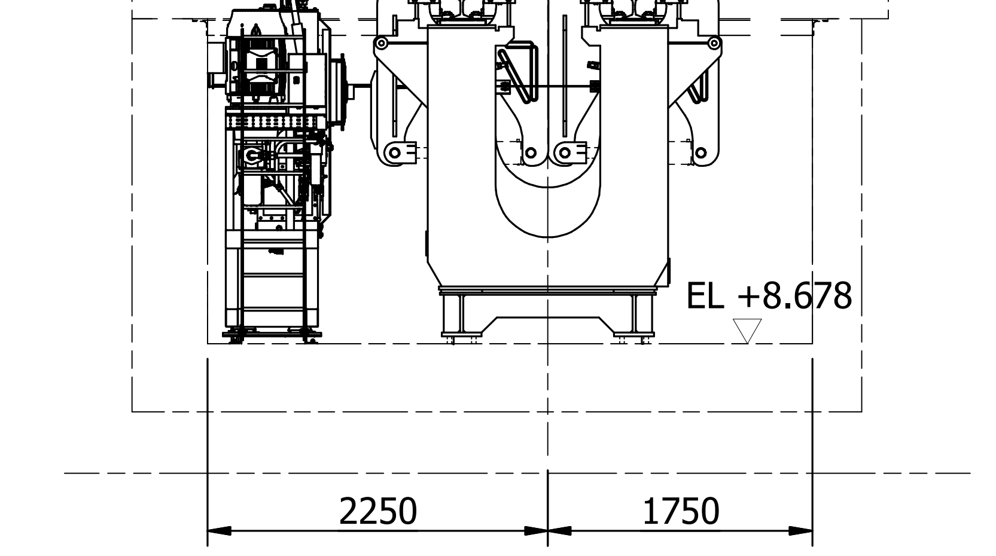
ashton bulk
materials handling

BALANCE OF PLANT MECH / HYD / LUB EQUIPMENT - FAMILY TREE (MAP) OF DRAWINGS & BILLS OF QUANTITES

Index Number	TRANSNET Drawing No.	Supplier Drawing No.	Tier 1	Tier 2	Tier 3	Tier 4	Revision	Designer	Supplier
BALANCE OF PLANT - MECHANICAL									
1	1924701-0-000- M-AR-0001	TIPP3-FAA-001	TIPP3-FAA-001 TIPPLER VAULT MECHANICAL ARRANGEMENT				0B	TAFR	TBC
2	1924701-0-000- C-LA-0007	TIPP3-BAA-002	TIPP3-BAA-002 CIVIL OUTLINES CAST-IN PLATES				1	TAFR	TBC
MECHANICAL HOPPERS & CHUTES									
3	1924701-0-000- G-AR-0001	TIPP3-DAA-001	TIPP3-DAA-001 GENERAL ARRANGEMENT CHUTE WORK HOPPERS AND APRON FEEDER CHUTES				01	TAFR	TBC
4	1924701-0-000- S-AR-0007	TIPP3-DAD-001		TIPP3-DAD-001 APRON FEEDER CHUTE 1 DETAILS				TAFR	TBC
5	1924701-0-000- S-AR-0008	TIPP3-DAD-002		TIPP3-DAD-002 APRON FEEDER CHUTE 2 DETAILS			0	TAFR	TBC
6	1924701-0-000- S-AR-0009	TIPP3-DAD-003		TIPP3-DAD-003 APRON FEEDER CHUTE 3 DETAILS			0	TAFR	TBC
7	1924701-0-000- S-AR-0013	TIPP3-DEA-001		TIPP3-DEA-001 STRUCTURAL ARRANGEMENT STEEL HOPPER 1 DETAILS			0	TAFR	TBC
8	1924701-0-000- S-AR-0014	TIPP3-DEA-002		TIPP3-DEA-002 STRUCTURAL ARRANGEMENT STEEL HOPPER 2 DETAILS			0	TAFR	TBC
9	1924701-0-000- S-AR-0015	TIPP3-DEA-003		TIPP3-DEA-003 STRUCTURAL ARRANGEMENT STEEL HOPPER MAINTENANCE DOOR DETAILS			0	TAFR	TBC
10	1924701-0-000- S-AR-0016	TIPP3-DEA-004		TIPP3-DEA-004 STRUCTURAL ARRANGEMENT CAST-IN STEEL HOPPER 1 DETAILS			0	TAFR	TBC
11	1924701-0-000- S-AR-0017	TIPP3-DEA-005		TIPP3-DEA-005 STRUCTURAL ARRANGEMENT STEEL HOPPER 2 DETAILS			0	TAFR	TBC
12	1924701-0-000- S-AR-0018	TIPP3-DEA-006		TIPP3-DEA-006 STRUCTURAL ARRANGEMENT CAST-IN STEEL HOPPER 3 DETAILS			0	TAFR	TBC
13	1924701-0-000- M-AS-0005	No Drg.No.			No Drg.No. IRON ORE TIPPLER 3 CAST-IN CHUTES LINER PALTE FIXING SHT 1-7		0B	QUALITY ENG	QUALITY ENG
14	1924701-0-000- M-DE-0003	No Drg.No.			No Drg.No. CAST-IN CHITES LINER PLATE DETAILS SHT 1-4		A	QUALITY ENG	QUALITY ENG
15	1924701-0-000- S-AR-0022	TIPP3-DAD-004		TIPP3-DAD-004 STRUCTURAL ARRANGEMENT TEMPORARY SPACER CHUTE DETAILS			0	TAFR	TBC
16	1924701-0-000- M-GA-0089	TIPP3-MKG-001	TIPP3-MKG-001 ISOLATION GATE GENERAL ASSEMBLY				C	TAFR	TBC
	1924701-0-000- M-SC-0001	TIPP3-MKG-002		TIPP3-MKG-002 ISOLATION GATE GATE FRAME ASSEMBLY			C?	TAFR	TBC
	1924701-0-000- M-SC-0002	TIPP3-MKG-003		TIPP3-MKG-003 ISOLATION GATE KNIFE CARTRIDGE ASSEMBLY			C?	TAFR	TBC
	1924701-0-000- M-SC-0003	TIPP3-MKG-004		TIPP3-MKG-004 ISOLATION GATE KNIFE ASSEMBLY			C	TAFR	TBC
	1924701-0-000- M-SC-0004	TIPP3-MKG-005		TIPP3-MKG-005 ISOLATION GATE GATE KNIFE ASSEMBLY			C	TAFR	TBC
17	1924701-0-000- S-GA-0001	TIPP3-CAA-001	TIPP3-CAA-001 GENERAL ARRANGEMENT CAST-IN HOPPERS & CAST-IN PLATES SUPPORT STEELWORK				0	TAFR	TBC
18	1924701-0-000- S-AR-0019	TIPP3-CAA-002	TIPP3-CAA-002 STRUCTURAL ARRANGEMENT CAST-IN HOPPERS & PLATES SUPPORT STEEL WORK - DETAILS				0	TAFR	TBC
19	1924701-0-000- M-SC-0007	TIPP3-CAA-003		TIPP3-CAA-003 GENERAL ARRANGEMENT APRON FEEDER LIFTING FRAME			0	TAFR	TBC
20	No Transnet Drawing Number	TIPP3-BAA-004 / 008	TIPP3-BAA-004 / 008 X						
21	1924701-0-000- S-AR-0020	TIPP3-BAA-013		TIPP3-BAA-013 STRUCTURAL ARRANGEMENT CONCRETE HOPPER - CAST-IN PLATE DETAILS			0	TAFR	TBC
22	1924701-0-000- S-GA-0009	TIPP3-DGA-004	TIPP3-DGA-004 GENERAL ARRANGEMENT CHUTE WORK HOPPERS & APRON FEEDER CHUTES				B	TAFR	TBC
23	1924701-0-000- S-LA-0001	TIPP3-WFA-002		TIPP3-WFA-002 LAYOUT OF APRON FEEDER HOPPERS			C	TAFR	TBC
24	1924701-0-000- S-LA-0002	TIPP3-WFA-003		TIPP3-WFA-003 LAYOUT OF APRON FEEDER SUPPORT STEEL STRUCTURE			0C	TAFR	TBC
25	1924701-0-000- S-LA-0003	TIPP3-WFA-004	TIPP3-WFA-004 LAYOUT OF APRON FEEDER CHUTES				0B	TAFR	TBC
MECHANICAL APRON FEEDER									
26	1924701-0-000- M-GA-0001	EB0009-B100-EAK-001	EB0009-B100-EAK-001 5 OFF 1830 W X 2184 LG D4 APRON FEEDER GENERAL ARRANGEMENT				0	TAKRAF	TAKRAF
27	1924701-0-000- M-GA-0120	EB0009-B100-DHA-001		EB0009-B100-DHA-001 5 OFF 1830 W X 2184 LG D4 APRON FEEDER SAFETY GUARDS GENERAL ARRANGEMENT			0	TAFR	TBC
28	1924701-0-000- S-AR-0004	TIPP3-CBA-001	TIPP3-CBA-001 STRUCTURAL ARRANGEMENT TIPPLER VAULT STEELWPRK APRON FEEDER SUPPORT STEEL DETAILS				0	TAFR	TBC
29	1924701-0-000- S-AR-0006	TIPP3-CBA-003	TIPP3-CBA-003 STRUCTURAL ARRANGEMENT TIPPLER VAULT STEELWPRK APRON FEEDER SUPPORT STEEL DETAILS				0	TAFR	TBC
30	1924701-0-000- S-AR-0005	TIPP3-CBA-002	TIPP3-CBA-002 STRUCTURAL ARRANGEMENT UNDER VAULT CRAWL BEAMS				1	TAFR	TBC
31	1924701-0-000- S-AR-0010	TIPP3-DAF-001	TIPP3-DAF-001 STRUCTURAL ARRANGEMENT APRON FEEDER UNDERPAN 1 DETAILS				0	TAFR	TBC
32	1924701-0-000- S-AR-0011	TIPP3-DAF-002	TIPP3-DAF-002 STRUCTURAL ARRANGEMENT APRON FEEDER UNDERPAN 2 DETAILS				0	TAFR	TBC
33	1924701-0-000- S-AR-0012	TIPP3-DAF-003	TIPP3-DAF-003 STRUCTURAL ARRANGEMENT APRON FEEDER UNDERPAN 3 DETAILS				0	TAFR	TBC
MECHANICAL DUST COWL									
34	1924701-0-000- M-GA-0088	TIPP3-DJB-001	TIPP3-DJB-001 GENERAL ARRANGEMENT DUST COWL & DEFLECTOR WALL/BARRIER				0	TAFR	TBC
35	1924701-0-000- S-GA-0001	TIPP3-DJB-002	TIPP3-DJB-002 STRUCTURAL ARRANGEMENT DUST COWL ASSEMBLY DETAIL				0	TAFR	TBC
	1924701-0-000- S-AR-0023	TIPP3-DJB-006		TIPP3-DJB-006 STRUCTURAL ARRANGEMENT DUST COWL TYPICAL VIEWS - RING BEAM & SHELL PANEL DETAILS			0	TAFR	TBC
	1924701-0-000- S-AR-0024	TIPP3-DJB-007		TIPP3-DJB-007 STRUCTURAL ARRANGEMENT DUST COWL MAINTENANCE DOOR & SIDE PANEL DETAILS			0	TAFR	TBC
	1924701-0-000- S-AR-0026	TIPP3-DJB-009			TIPP3-DJB-009 STRUCTURAL ARRANGEMENT DUST COWL SHELL PANEL DEVELOPMENT DETAILS		0	TAFR	TBC
	1924701-0-000- S-AR-0025	TIPP3-DJB-008		TIPP3-DJB-008 STRUCTURAL ARRANGEMENT DUST COWL MAINTENANCE DOOR & SIDE PANEL DETAILS			0	TAFR	TBC
36	1924701-0-000- S-AR-0002	TIPP3-DJB-003	TIPP3-DJB-003 STRUCTURAL ARRANGEMENT DEFLECTOR WALL / BARRIER SUPPORT STEELWORK DETAILS				0	TAFR	TBC
	1924701-0-000- S-AR-0021	TIPP3-DJB-005		TIPP3-DJB-005 STRUCTURAL ARRANGEMENT DUST COWL TRUNNION BASE SPILL PLATES			0	TAFR	TBC
	1924701-0-000- S-AR-0003	TIPP3-DJB-004		TIPP3-DJB-004 STRUCTURAL ARRANGEMENT DUST COWL DEFLECTOR WALL / BARRIER DETAILS			0	TAFR	TBC
MECHANICAL DUST EXTRACTION SYSTEM									
37	1924701-0-000- M-GA-0007	B100-JKA-001	B100-JKA-001 ARRANGEMENT OF BAG FILTERS & DUCTING				2	TAFR	TBC
38	1924701-0-000- F-PF-0001	B100-CAA-017	B100-CAA-017 ARRANGEMENT OF DUST MONITOR ACCESS PLATFORM				0	TAFR	TBC
39	1924701-0-000- P-PI-0001	B100-PID-001	B100-PID-001 PIPING & INSTRUMENTATION DIAGRAM - SHEET 1 OF 7				1	TAFR	TBC
	1924701-0-000- P-PI-0001	B100-PID-002	B100-PID-002 PIPING & INSTRUMENTATION DIAGRAM - SHEET 2 OF 7				3	TAFR	TBC
	1924701-0-000- P-PI-0001	B100-PID-003	B100-PID-003 PIPING & INSTRUMENTATION DIAGRAM - SHEET 3 OF 7				3	TAFR	TBC
	1924701-0-000- P-PI-0001	B100-PID-004	B100-PID-004 PIPING & INSTRUMENTATION DIAGRAM - SHEET 4 OF 7				2	TAFR	TBC
	1924701-0-000- P-PI-0001	B100-PID-005	B100-PID-005 PIPING & INSTRUMENTATION DIAGRAM - SHEET 5 OF 7				3	TAFR	TBC
	1924701-0-000- P-PI-0001	B100-PID-006	B100-PID-006 PIPING & INSTRUMENTATION DIAGRAM - SHEET 6 OF 7				3	TAFR	TBC
	1924701-0-000- P-PI-0001	B100-PID-007	B100-PID-007 PIPING & INSTRUMENTATION DIAGRAM - SHEET 7 OF 7				2	TAFR	TBC
40	1924701-0-000- S-GA-0007	B100-CAA-017	B100-CAA-017 ARRANGEMENT OF DUST MONITOR ACCESS PLATFORM				B	TAFR	TBC
BALANCE OF PLANT - CIVIL WORKS									
	1924701-0-000- C-LA-0006	TIPP3-BAA-001	TIPP3-BAA-001 APRON FEEDER SUPPORT STRUCTURE CIVIL OUTLINES				0	TAFR	
	1924701-0-000- C-LA-0011	TIPP3-BAA-009	TIPP3-BAA-009 CIVIL OUTLINES DUST COWL				0	TAFR	
	1924701-0-000- C-LA-0012	TIPP3-BAA-010	TIPP3-BAA-010 CIVIL OUTLINES DUST COWL DEFLECTOR WALL/BARRIER				1	TAFR	
	1924701-0-000- C-LS-0001	TIPP3-BAA-011	TIPP3-BAA-011 DUST COWL CIVIL LOADS SHEET				0B	TAFR	
	1924701-0-000- C-LS-0002	TIPP3-BAA-012	TIPP3-BAA-012 DEFELCTOR WALL/BARRIER CIVIL LOADS SHEET				0	TAFR	
	1924701-0-000- C-LA-0010	B100-BAA-001	B100-BAA-001 DUST EXTRACTOR SYSTEM CIVIL OUTLINE				5	TAFR	
	1924701-0-000- C-LA-0010	B100-BAA-001	B100-BAA-001 DUST EXTRACTOR SYSTEM CIVIL LOADS (SHEET 2)				2	TAFR	
	1924701-0-000- C-LA-0001	TIPP3-WFA-001	TIPP3-WFA-001 LAYOUT OF VAULT GEOMETRY				0C	TAFR	
	1924701-0-000- C-LA-0008	TIPP3-BAA-003	TIPP3-BAA-003 CIVIL OUTLINES CRAWL BEAMS - CAST-IN ITEMS				3	TAFR	
	1924701-0-000- C-LA-0009	TIPP3-BAA-004	TIPP3-BAA-004 CONCRETE HOPPER CAST-IN CHUTES				3	TAFR	
BALANCE OF PLANT - HYDRAULIC SYSTEM									
	NO DRAWINGS OR BOQ PROVIDED		KNIFE GATE HYDRAULIC SYSTEM					OIL TECH	OIL TECH
BALANCE OF PLANT - LUBRICATION SYSTEM									
	NO DRAWINGS OR BOQ PROVIDED		APRON FEEDER LUBRICATION SYSTEM					LINCOLN	LINCOLN



PLAN VIEW ON TRAIN UNLOADING SYSTEM

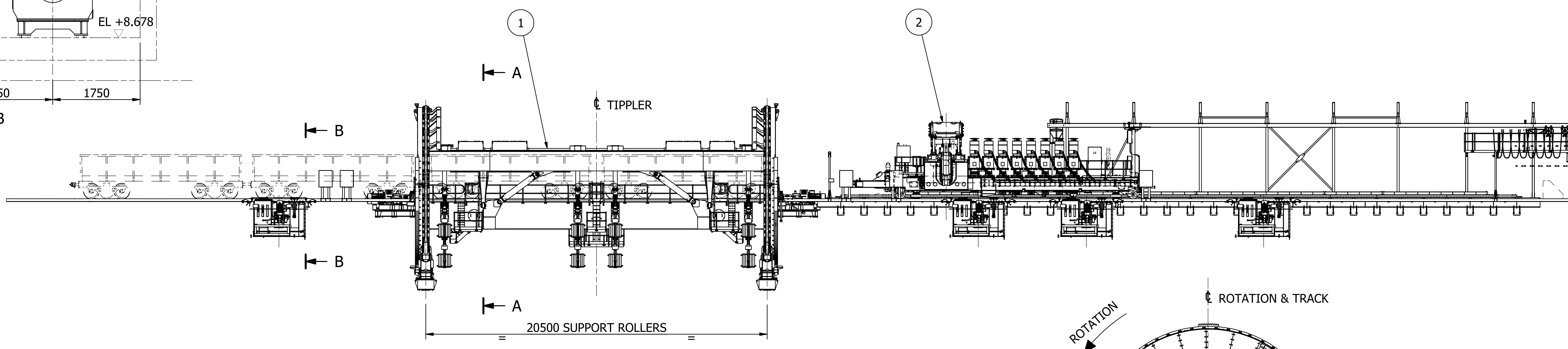


SECTION B-B

SCALE 1 : 50

GRIPPER PIT

TYP 4 LOCNS



PLANT DATA:

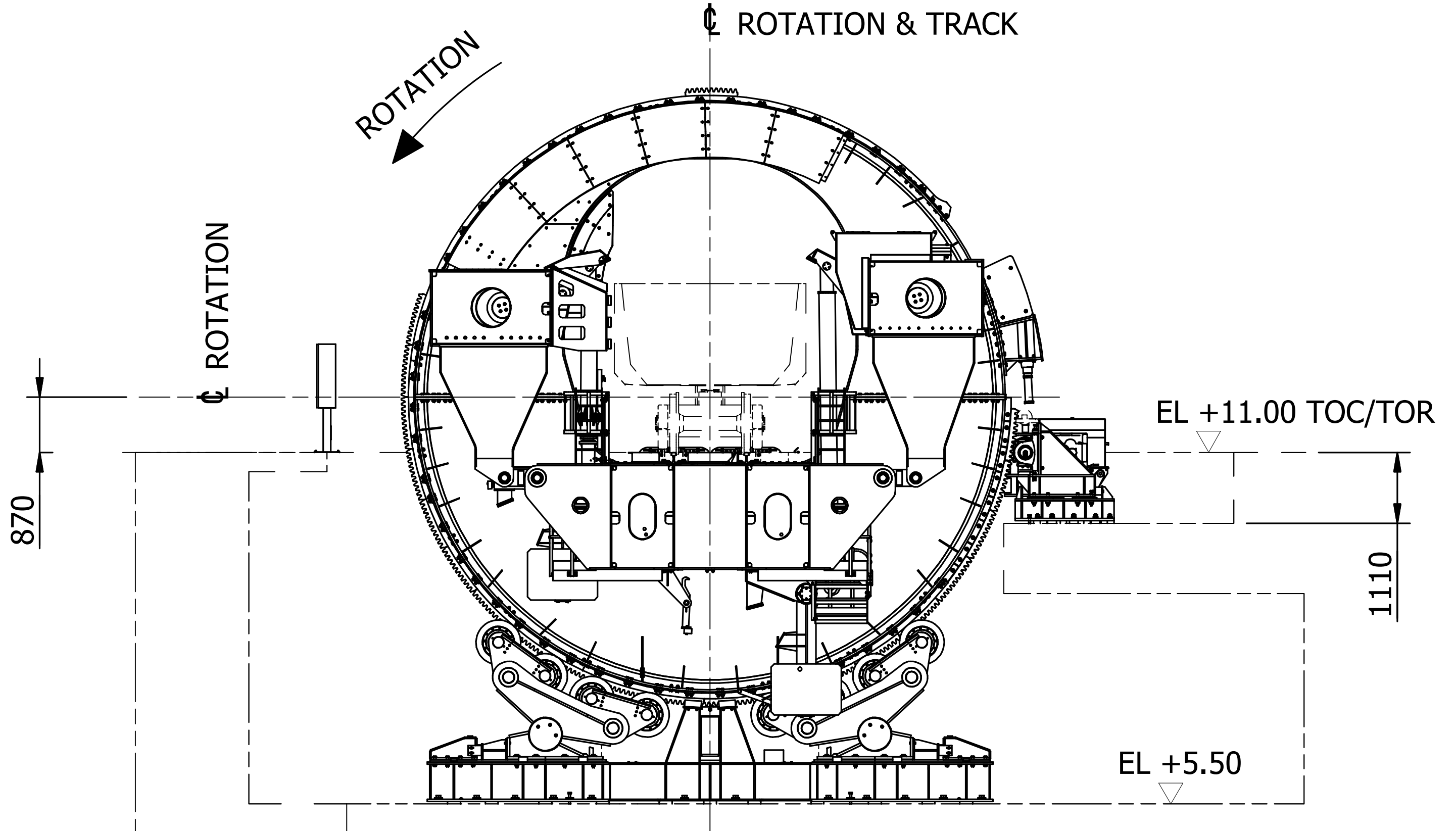
OVERALL PLANT CYCLE:	82 SECONDS - DESIGN / 90 SECONDS - RATED	
PLANT THROUGHPUT:	8800 TONNES PER HOUR - DESIGN / 8000 TONNES PER HOUR - RATED	
WAGONS IN TRAIN:	140	
WAGON DATA:	TYPE	CR13 & CR14
	LENGTH OVER COUPLERS	21.0m (COUPLED PAIR)
	HEIGHT OVERALL	2.648m
	WIDTH	3.0m
	GROSS WEIGHT	120 tonnes
	TARE	20 tonnes
	CAPACITY	100 tonnes (MAX)
LOCOMOTIVE TYPE:	DIESEL -	TYPE 43
THROUGH PASSAGE	ELECTRIC -	TYPE 15E

MATERIALS HANDLED: IRON ORE

NORMAL BULK DENSITY	=	2.3 t/m³
MAX BULK DENSITY	=	3.0 t/m³
NORMAL LUMP SIZE	=	0.2 TO 5mm
MAX LUMP SIZE	=	13 TO 27mm

TIPPLER OPERATING CHARACTERISTICS:

No OF TIPS / WAGONS PER Hr	=	DESIGN 44 / 88 , RATED 40 / 80
NORMAL TIP ANGLE	=	165°
MAX TIP ANGLE	=	180° (MAINTENANCE)



SECTION A-A

SCALE 1 : 100

TAKRAF TENOVA

REVIEW LABEL

Discipline	Discipline Engineer Name	Discipline Engineer Signature	Date yyyy-mm-dd

NOTES: 1. DO NOT SCALE DRAWING - ONLY DIMENSIONS SHOWN TO BE USED.
2. THE CONTRACTOR SHALL VERIFY ALL CONDITIONS, DIMENSIONS AND LEVELS ON THE SITE AND NOTIFY THE NEC SUPERVISOR OF ANY VARIATIONS BEFORE CONSTRUCTION.

DIMENSIONS IN MILLIMETERS & DEGREES.
GENERAL MANUFACTURING TOLERANCES
UNLESS STATED OTHERWISE (PLUS OR MINUS)

RANGE	MACH	FAB	CAST
0-500	0.25	2	2
501-1000	0.5	3	4
1001-2000	1.0	4	6
ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

UNLESS OTHERWISE SPECIFIED IDENTIFY THE ITEM WITH THE DRAWING NUMBER AND ISSUE LEVEL AT ◬ AND IN THE MANNER SHOWN.

MASS.	N/A
MATERIAL.	
SPEC.	
NOTES.	

DRAWN TO BS 8888

THIRD ANGLE PROJECTION

Rev.	Drawing Sheet No.	yes no Part List	See technical modification report No.	Day	Name

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

TAKRAF TENOVA

Project Number:
AC0339

Drawing Number: 49055271
BG: 9921

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
0	FIRST ISSUE	RCJ	RHW	JMD	**-**-18

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE		
DRAWN	RCJ	R. Jackson	19	04	18
CHECKED	RHW	RHWood.	**	**	18
MECHANICAL	JMD		**	**	18
PROJECT ENG.	ASM		**	**	18
PROJECT MAN.	D.STARK		**	**	18

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG			
C&I. ENG.			
ENG. MNG.			

PR.ENG. / PR.TECH./PR. ARCH

NAME	RICHARD WOOD	DATE
SIGNATURE	RHWood.	** ** 18
REG. NUMBER	70386304	
SCALE :	1:150 UOS	A1

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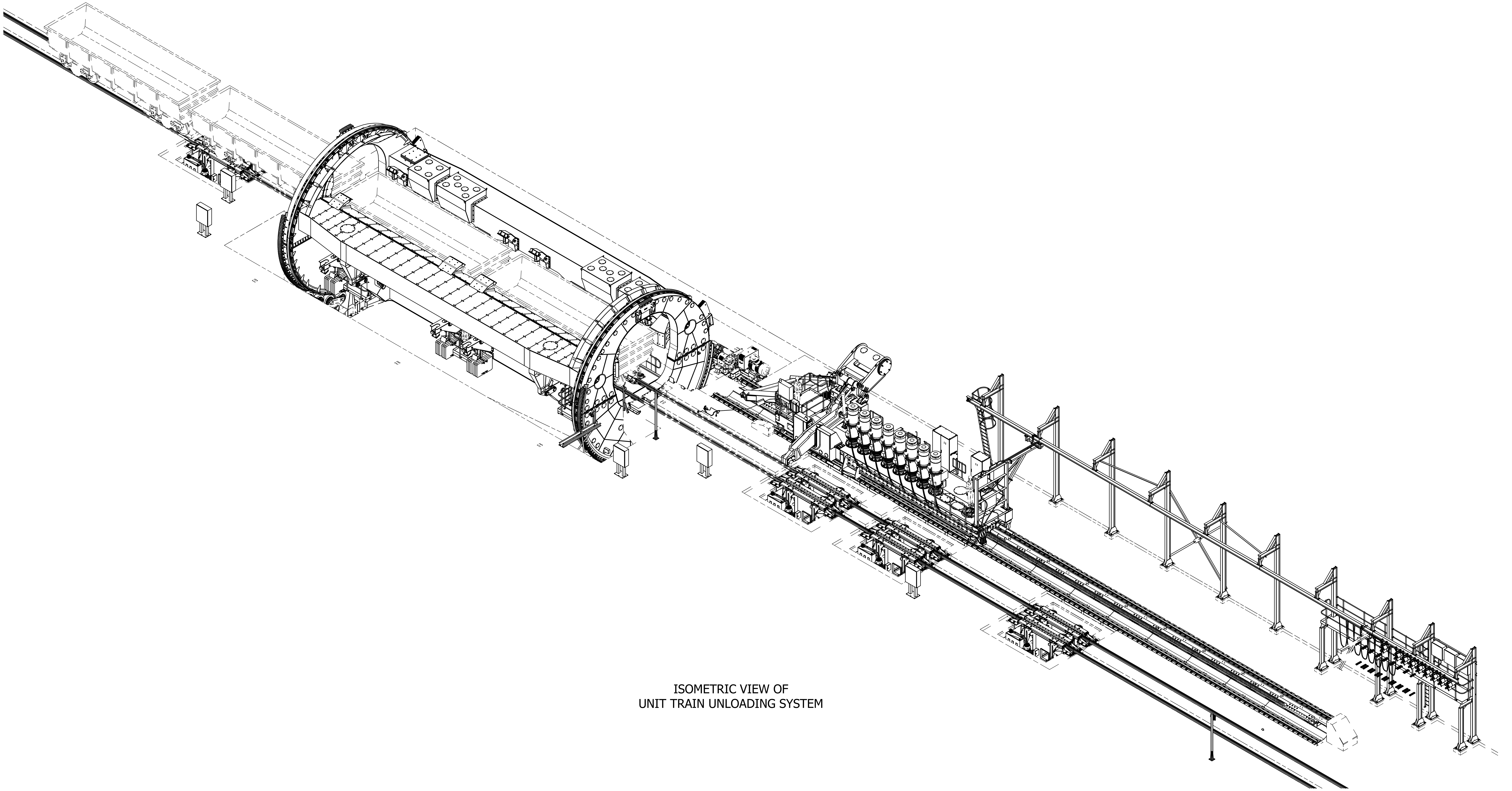
8001
TEL: 021 940 1999
FAX: 086 677 2455

PORT OF SALDANHA

IRON ORE TIPPLER 3

GA OF UNIT TRAIN UNLOADING SYSTEM

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0072	1	0	JV



ISOMETRIC VIEW OF
UNIT TRAIN UNLOADING SYSTEM

TAKRAF TENOVA

REVIEW LABEL

Discipline	Discipline Engineer: Name	Discipline Engineer: Signature	Date yyyy-mm-dd

NOTES:
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DIMENSIONS IN MILLIMETERS & DEGREES.
GENERAL MANUFACTURING TOLERANCES
UNLESS STATED OTHERWISE (PLUS OR MINUS)

RANGE	MACH	FAB	CAST
0-500	0.25	2	2
501-1000	0.5	3	4
1001-2000	1.0	4	6
ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

UNLESS OTHERWISE SPECIFIED IDENTIFY THE ITEM WITH THE DRAWING NUMBER AND ISSUE LEVEL AT ◆ AND IN THE MANNER SHOWN.

MASS.	N/A
MATERIAL.	
SPEC.	
NOTES.	

DRAWN TO BS 8888

THIRD ANGLE PROJECTION

Rev.	Drawing Sheet No.	yes Part List	no Part List	See technical modification report No.	Day	Name

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

TAKRAF TENOVA

Project Number:
AC0339

Drawing Number: 49055271
BG: 9921

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
0	FIRST ISSUE	RCJ	RHW	JMD	**-**-18

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE		
DRAWN	RCJ	R. Jackson	19	04	18
CHECKED	RHW		**	**	18
MECHANICAL	JMD		**	**	18
PROJECT ENG.	ASM		**	**	18
PROJECT MAN.	D.STARK		**	**	18

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH
NAME: RICHARD WOOD
SIGNATURE: RHWood. DATE: ** ** 18
REG. NUMBER: 70386304
SCALE : 1:100
A1

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8001
TEL: 021 940 1999
FAX: 086 677 2455

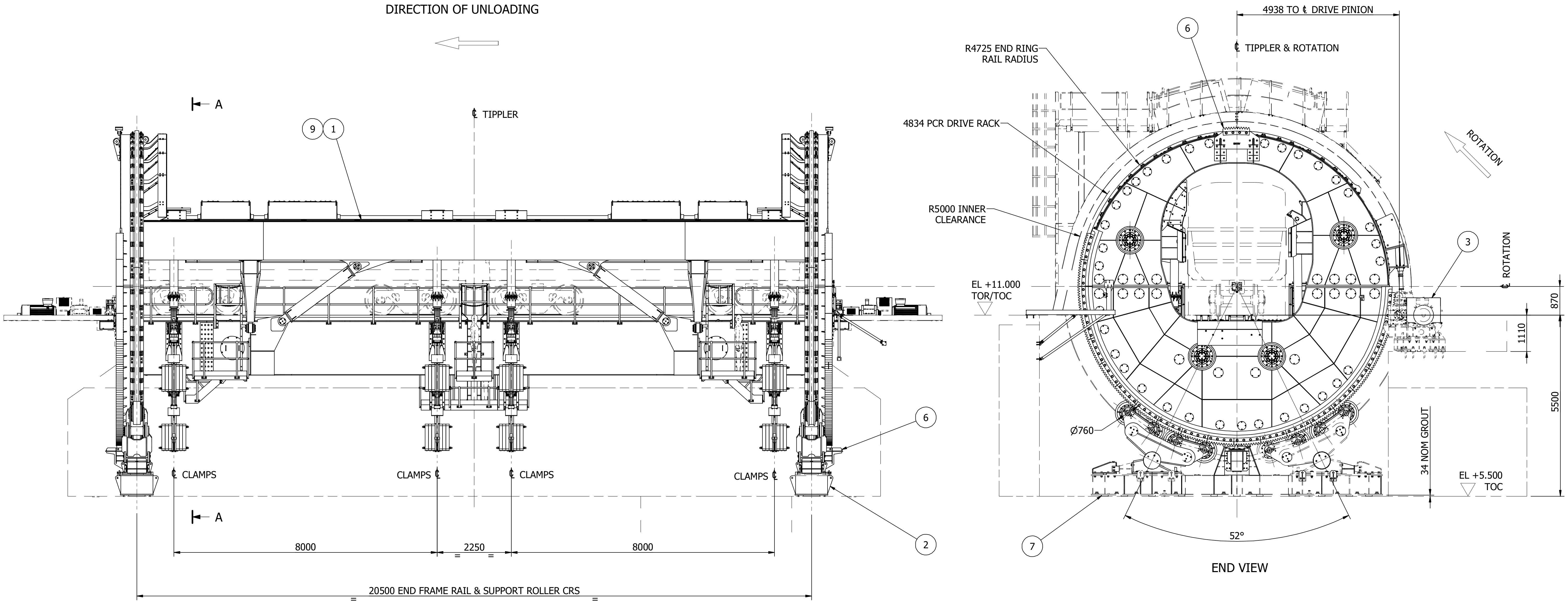
TRANSNET

PORT OF SALDANHA

IRON ORE TIPPLER 3

GA OF UNIT TRAIN UNLOADING SYSTEM

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0072	2	0	JV



TECHNICAL DATA

TIPPLER:

TIME TO TIP & RETURN	30 secs
NORMAL ANGLE OF TIP	165°
MAX ANGLE OF TIP	180°

MASS INCLUDES BALLAST MASS OF 27918 kg

WAGONS:

GROSS WEIGHT	120 tonnes
TARE WEIGHT	20 tonnes
MAX HEIGHT (EMPTY)	2648 mm
MAX WIDTH	3000 mm
MAX LENGTH	21000 mm

LOCOMOTIVE:

TYPE	1 TRANSNET CLASS 34D
LENGTH	17982 mm
MAX MASS	113 tonnes
TYPE	2 TRANSNET CLASS 43D
LENGTH	20256 mm
MAX MASS	130 tonnes
TYPE	3 TRANSNET CLASS 15E
LENGTH	24378 mm
MAX MASS	180 tonnes

TAKRAF TENOVA

REVIEW LABEL

Discipline	Discipline Engineer Name	Discipline Engineer Signature	Date yyyy-mm-dd

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES: 1. DO NOT SCALE DRAWING - ONLY DIMENSIONS SHOWN TO BE USED.
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DIMENSIONS IN MILLIMETERS & DEGREES.
GENERAL MANUFACTURING TOLERANCES
UNLESS STATED OTHERWISE (PLUS OR MINUS)

RANGE	MACH	FAB	CAST
0-500	0.25	2	2
501-1000	0.5	3	4
1001-2000	1.0	4	6
ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

UNLESS OTHERWISE SPECIFIED IDENTIFY THE ITEM WITH THE DRAWING NUMBER AND ISSUE LEVEL AT ▽ AND IN THE MANNER SHOWN.

MASS.	379122 kg
MATERIAL.	
SPEC.	
NOTES.	

DRAWN TO BS 8888
THIRD ANGLE PROJECTION

Rev.	Drawing Sheet No.	yes Part List	no	See technical modification report No.	Day	Name

TAKRAF TENOVA

Project Number: AC0339

Drawing Number: 49055272

BG: 4100

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	UPDATED TO AS DESIGNED STATUS	EMD	RCJ	JMD	09-07-18
0	FIRST ISSUE	RCJ	DWB	JMD	05-12-17

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE		
DRAWN	RCJ	R. Jackson	04	12	17
CHECKED	DWB		04	12	18
MECHANICAL	JMD		05	12	18
PROJECT ENG.	ASM		05	12	18
PROJECT MAN.	D.STARK		05	12	18

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

		DATE
NAME	RICHARD WOOD	
SIGNATURE	RJWood.	05 12 17
REG. NUMBER	70386304	
SCALE :	1:60	A1

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163 UYS KRIGE DRIVE,
PLATTEKLOOF,
8001
TEL: 021 940 1999
FAX: 086 677 2455

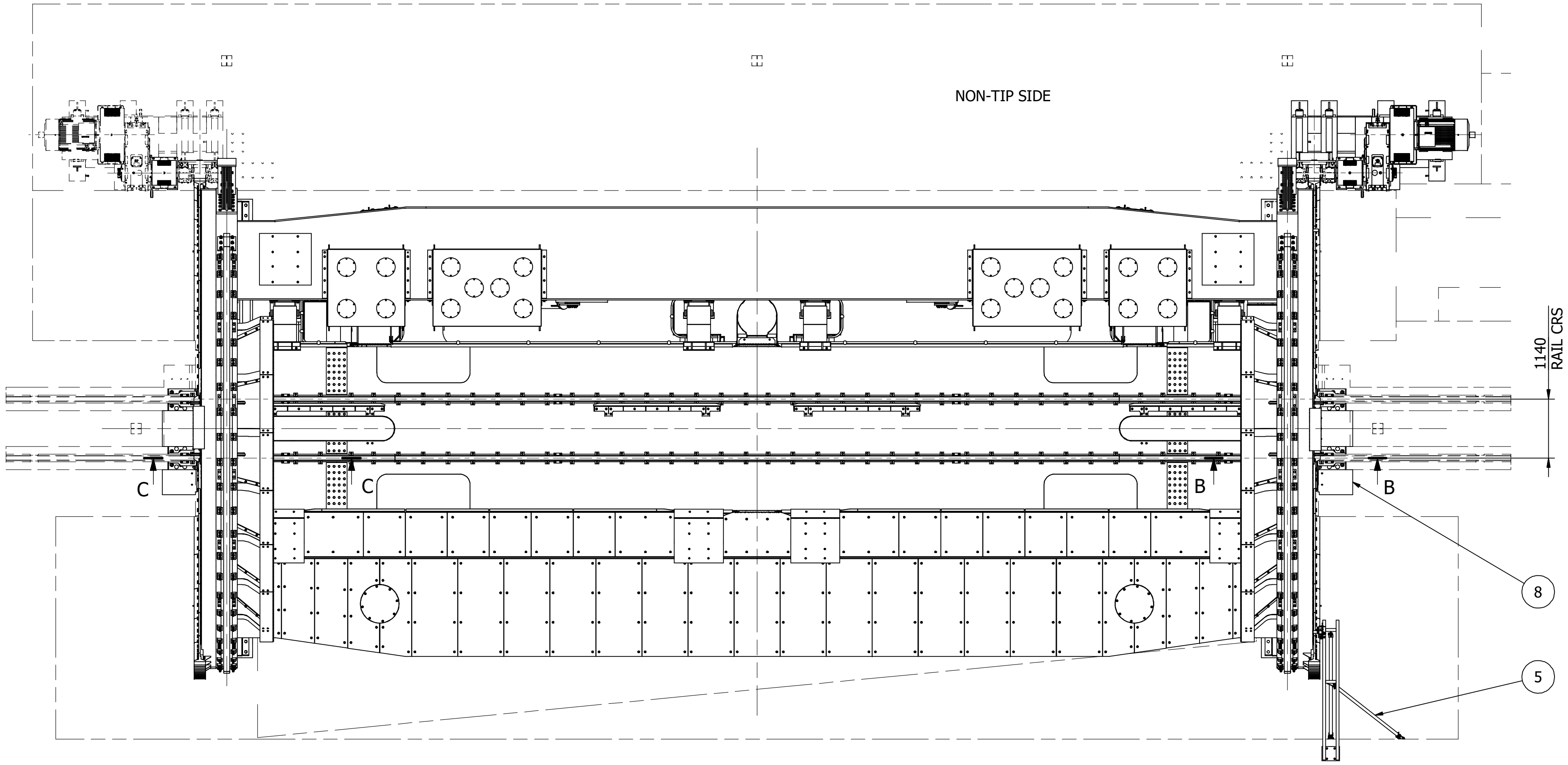
PORT OF SALDANHA

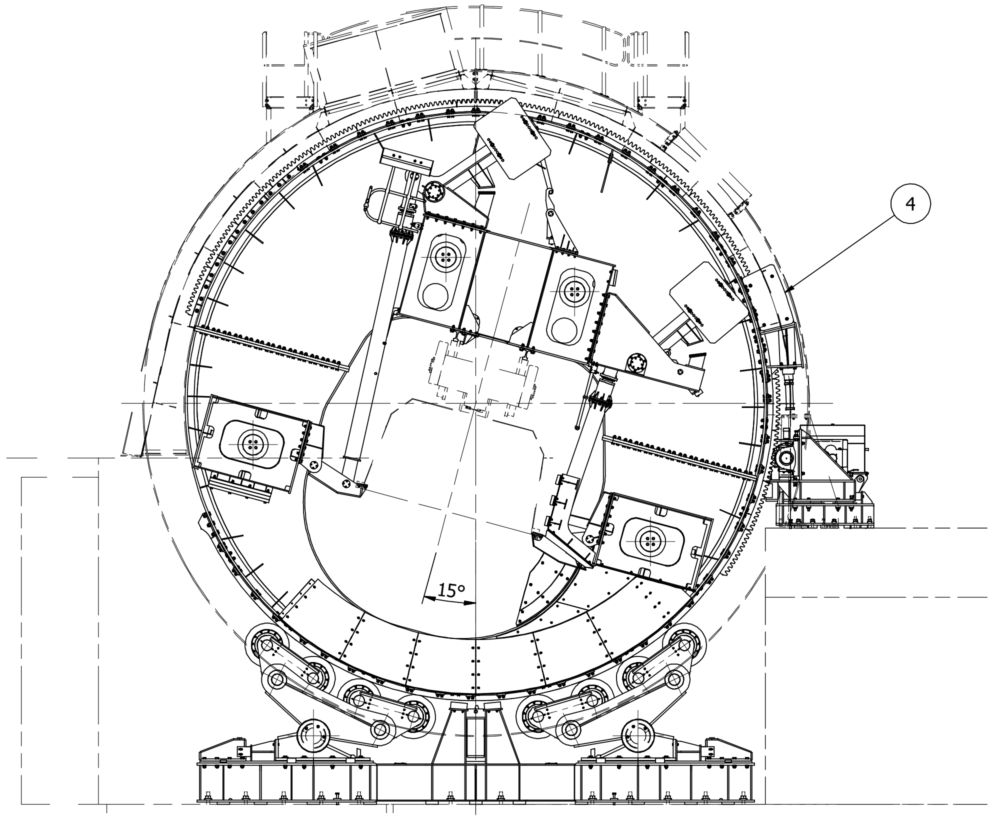
IRON ORE TIPPLER 3

ASSEMBLY OF LINK CAGE ROTARY TIPPLER

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0073	1	1	JV

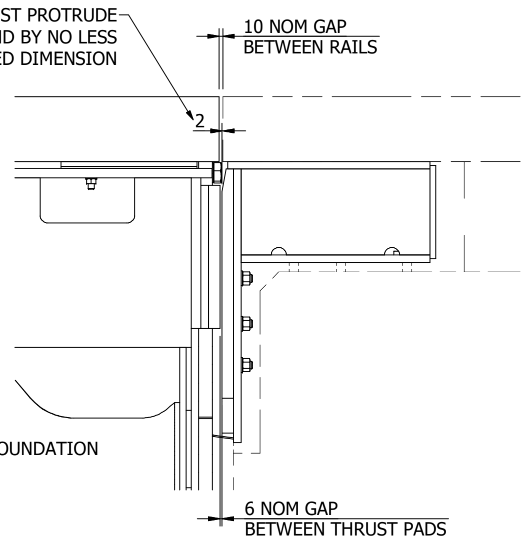
DIRECTION OF UNLOADING





SECTION A-A

165° ROTATION



SECTION B-B

SPACING BETWEEN TIPPLER AND FOUNDATION
SECTION C-C SIMILAR

SCALE 1:10

TAKRAF TENOVA

REVIEW LABEL

Discipline	Discipline Engineer		Date yyyy-mm-dd
	Name	Signature	

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES: 1. DO NOT SCALE DRAWING - ONLY DIMENSIONS SHOWN TO BE USED.
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DIMENSIONS IN MILLIMETERS & DEGREES.
GENERAL MANUFACTURING TOLERANCES
UNLESS STATED OTHERWISE (PLUS OR MINUS)

RANGE	MACH	FAB	CAST
0-500	0.25	2	2
501-1000	0.5	3	4
1001-2000	1.0	4	6
ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

UNLESS OTHERWISE SPECIFIED IDENTIFY THE ITEM WITH THE DRAWING NUMBER AND ISSUE LEVEL AT ◬ AND IN THE MANNER SHOWN.

MASS.	379122 kg
MATERIAL.	
SPEC.	
NOTES.	

DRAWN TO BS 8888

THIRD ANGLE PROJECTION

Rev.	Drawing Sheet No.	yes Part List	no	See technical modification report No.	Day	Name

TAKRAF TENOVA

Project Number:
AC0339

Drawing Number: 49055272

BG: 4100

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	UPDATED TO AS DESIGNED STATUS	EMD	RCJ	JMD	09-07-18
0	FIRST ISSUE	RCJ	DWB	JMD	05-12-17

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE		
DRAWN	RCJ	R. Sadrom	04	12	17
CHECKED	DWB		04	12	18
MECHANICAL	JMD		05	12	18
PROJECT ENG.	ASM		05	12	18
PROJECT MAN.	D.STARK		05	12	18

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG.			
C&I. ENG.			
ENG. MNG.			

PR.ENG. / PR.TECH./PR. ARCH

NAME	RICHARD WOOD	DATE		
SIGNATURE	RJWood.	05	12	17
REG. NUMBER	70386304			
SCALE :	1:60	A1		

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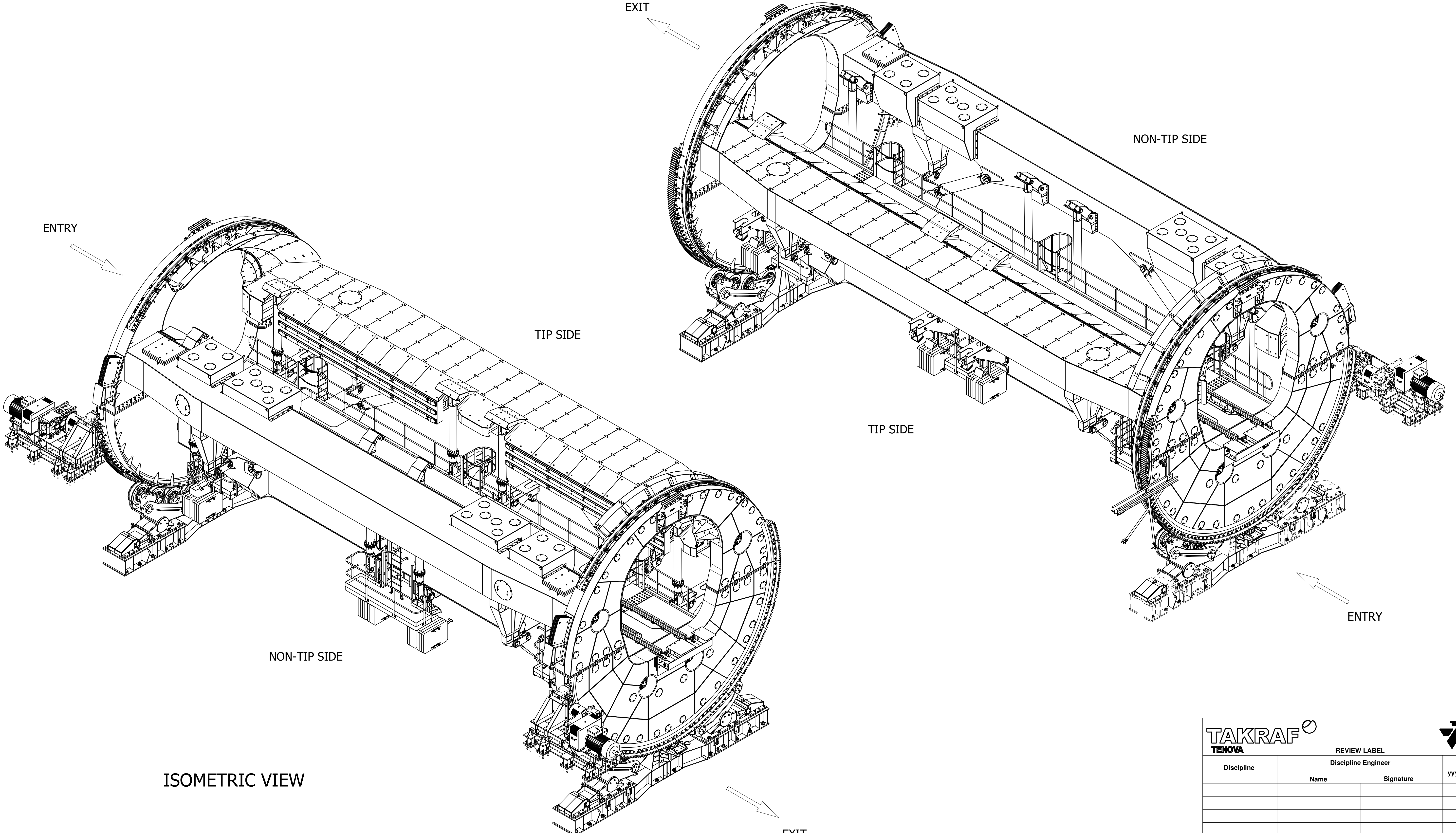
PORT OF SALDANHA

IRON ORE TIPPLER 3

ASSEMBLY OF LINK CAGE ROTARY TIPPLER

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0073	2	1	JV



ISOMETRIC VIEW

TAKRAF
TENOVA

REVIEW LABEL

Discipline	Discipline Engineer Name	Signature	Date yyyy-mm-dd

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

MASS.	379122 kg
MATERIAL.	
SPEC.	
NOTES.	

DRAWN TO BS 8888

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED IDENTIFY THE ITEM WITH THE DRAWING NUMBER AND ISSUE LEVEL AT ◊ AND IN THE MANNER SHOWN.

Rev.	Drawing Sheet No.	yes / no Part List	See technical modification report No.	Day	Name

TAKRAF
TENOVA

Project Number:
AC0339

Drawing Number: 49055272
BG: 4100

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	UPDATED TO AS DESIGNED STATUS	EMD	RCJ	JMD	09-07-18
0	FIRST ISSUE	RCJ	DWB	JMD	05-12-17

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TITLE	NAME	SIGN	DATE		
DRAWN	RCJ	R. Jackson	04	12	17
CHECKED	DWB		04	12	18
MECHANICAL	JMD		05	12	18
PROJECT ENG.	ASM		05	12	18
PROJECT MAN.	D.STARK		05	12	18

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME RICHARD WOOD
DATE 05 12 17
SIGNATURE RJ Wood.
REG. NUMBER 70386304
SCALE : 1:40
A1

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TRANSNET

PORT OF SALDANHA

IRON ORE TIPPLER 3

ASSEMBLY OF LINK CAGE
ROTARY TIPPLER

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0073	3	1	JV

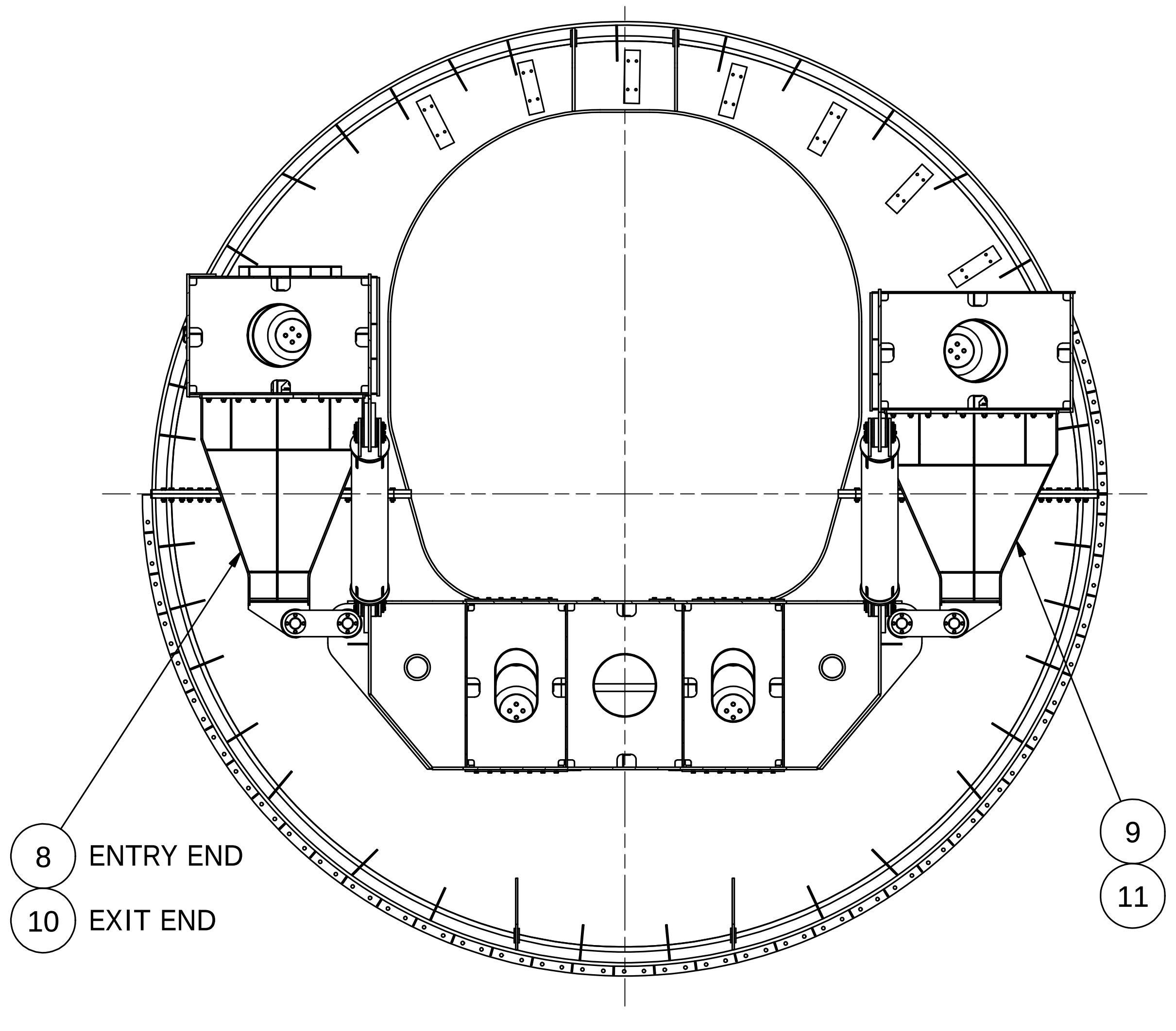
NOTES:

1. ASSEMBLE, ALIGN & PROTECT FOR SHIPMENT IN ACCORDANCE WITH:

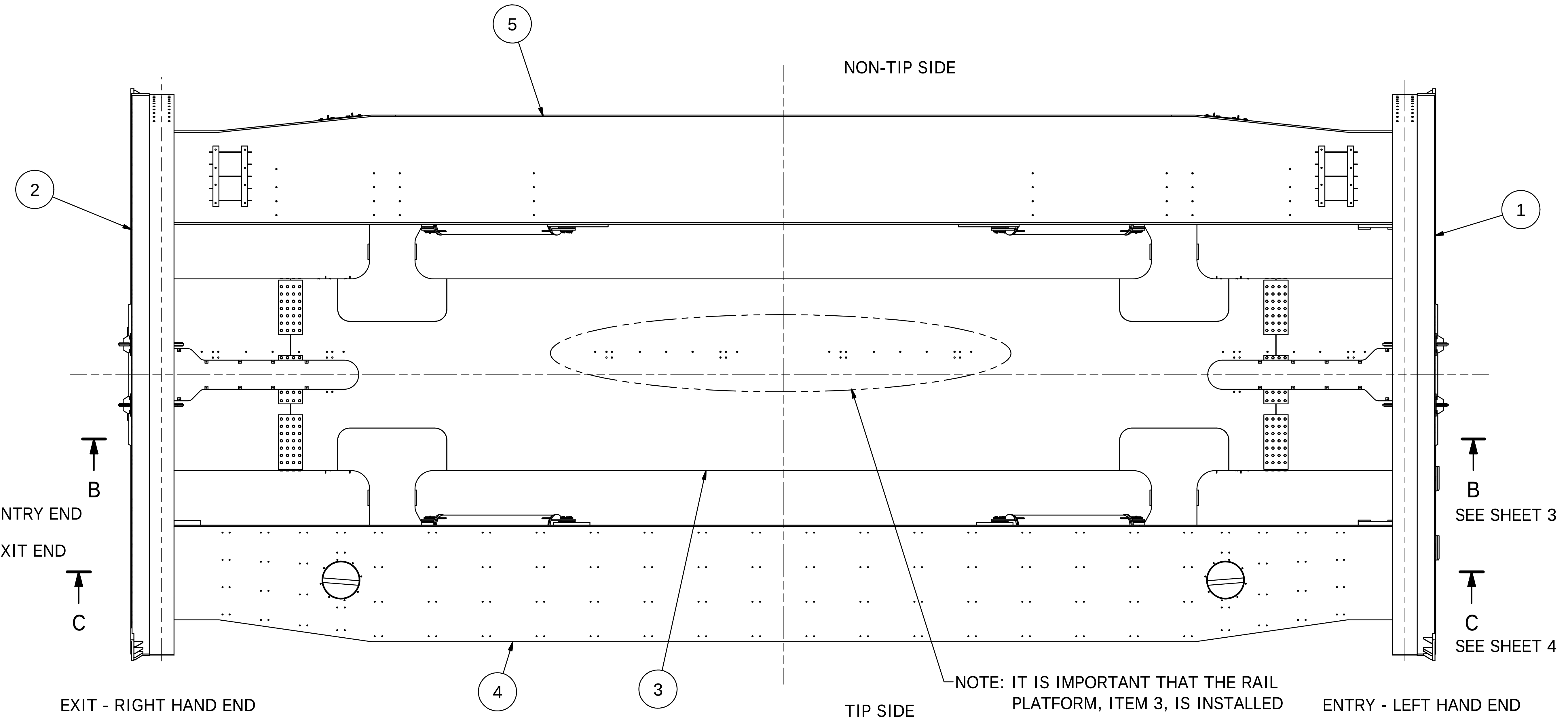
ASSOCIATED ASSEMBLY/SUB-ASSEMBLY DRAWINGS.
MECHANICAL SHOP ASSEMBLY & INSPECTION SCHEDULE
QUALITY ASSURANCE INSPECTION PROCEDURES
CONTRACT MANUFACTURING SPECIFICATION
SURFACE TREATMENT SPECIFICATION
PACKING, TRANSPORT & SHIPPING SCHEDULE

TOOLS, JIGS & PROCEDURES:

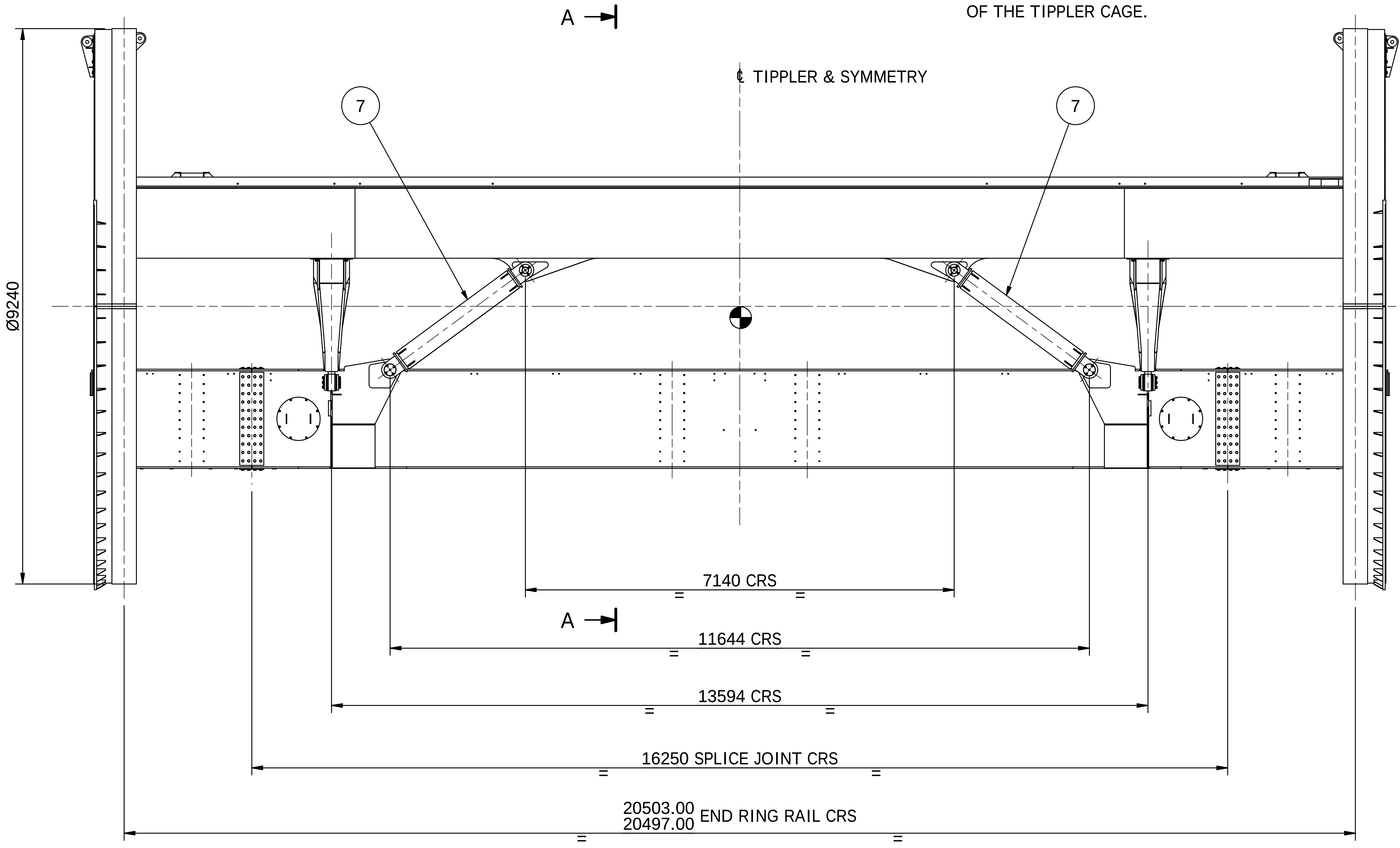
49055288 PIVOT SHAFT INSTALLATION TOOLS
49055286 CAGE STRUCTURE MACHINING JIG
49055300 TIPPLER CAGE ALIGNMENT JIG
59060560 SHOP ASSEMBLY SEQUENCE DIAGRAMS

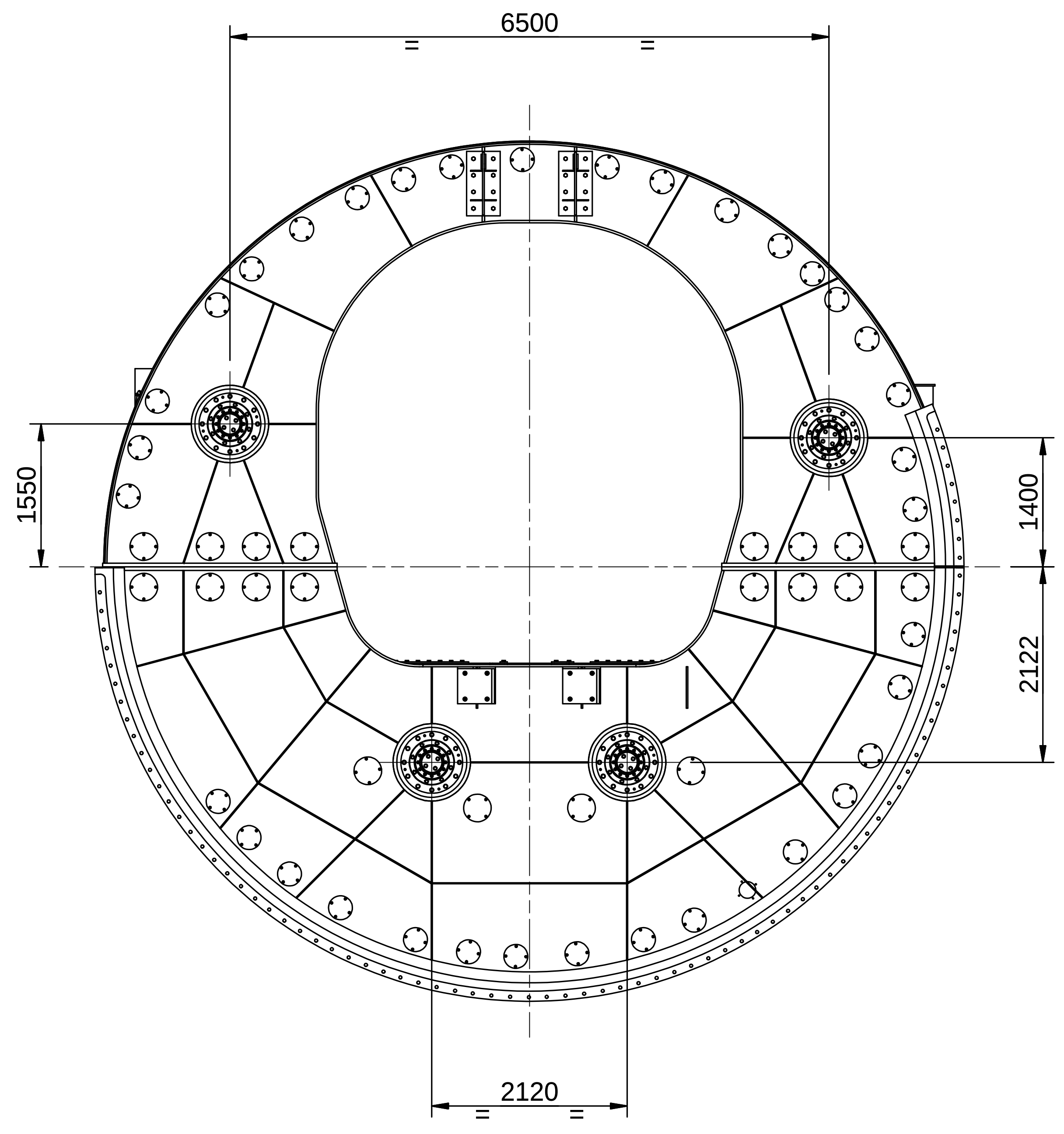


SECTION A-A

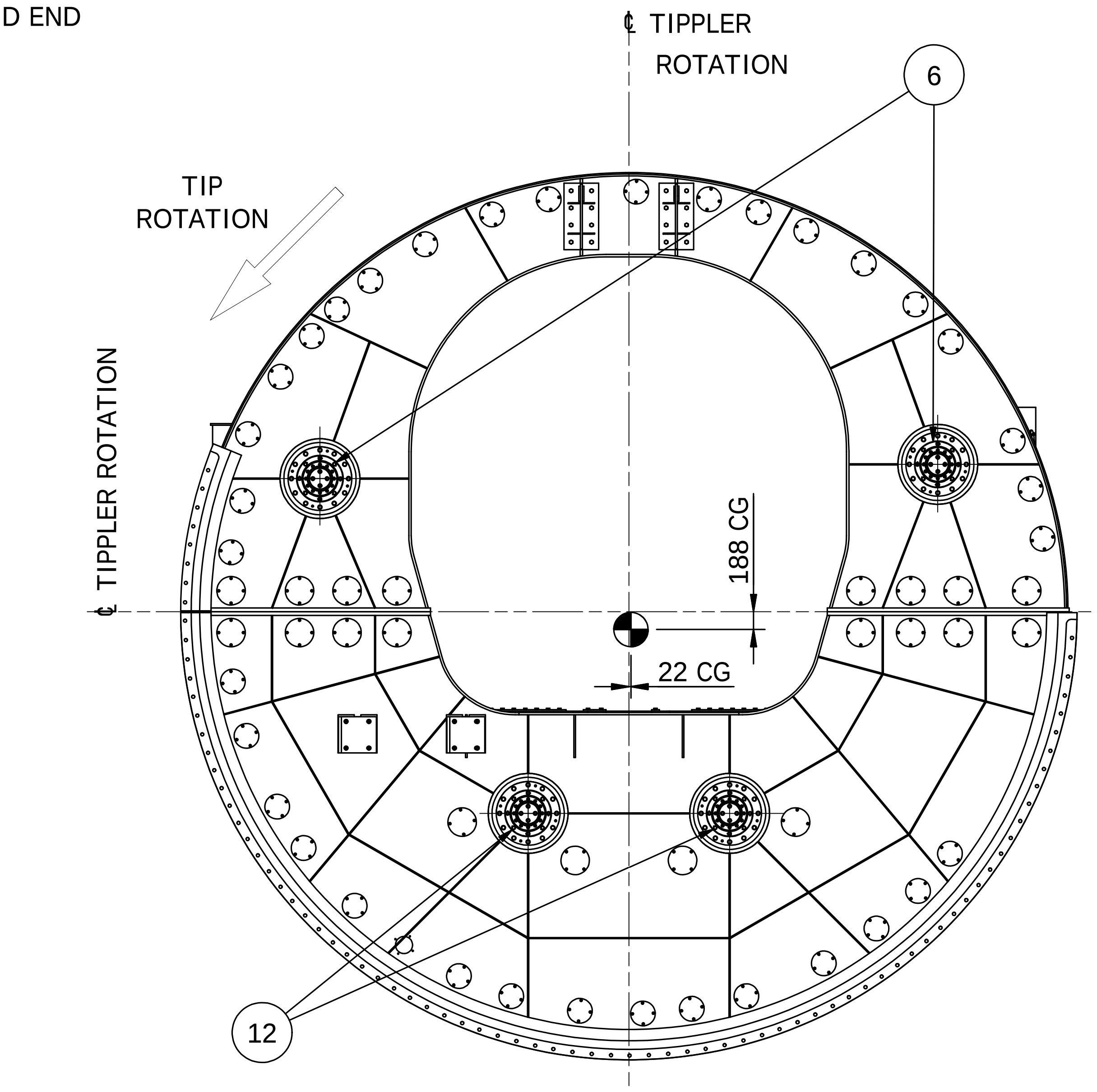


NOTE: IT IS IMPORTANT THAT THE RAIL PLATFORM, ITEM 3, IS INSTALLED IN THE CORRECT ORIENTATION. HOLE GROUP INDICATED TO BE LOCATED ON THE NON-TIP SIDE OF THE TIPPLER CAGE.





VIEW ON EXIT - RIGHT HAND END



VIEW ON ENTRY - LEFT HAND END

TAKRAF TENOVA

Discipline	Discipline Engineer Name	Discipline Engineer Signature	Date yyyy-mm-dd

REVIEW LABEL

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

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MASS.	191964 kg
MATERIAL.	
SPEC.	
NOTES.	

DRAWN TO BS 8888
THIRD ANGLE PROJECTION

Rev.	Drawing Sheet No.	yes Part List	no Part List	See technical modification report No.	Day	Name

TAKRAF TENOVA

Project Number: AC0339

Drawing Number: 49055208

BG: 4101

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	SHEETS 3 & 4 ADDED	EMD	RHW	ASM	12-03-18
0	FIRST ISSUE	RCJ	RHW	JMD	18-05-17

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE		
DRAWN	RCJ	R. Sachim	18	05	17
CHECKED	RHW	RyWood.	24	05	17
MECHANICAL	DWB		20	06	17
PROJECT ENG.	ASM		26	06	17
PROJECT MAN.	D.STARK		30	06	17

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME	RICHARD WOOD	DATE
SIGNATURE	RyWood.	30 06 17
REG. NUMBER	70386304	
SCALE :	1:60 UOS	A1

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TRANSNET

PORT OF SALDANHA

IRON ORE TIPPLER 3

ASSEMBLY OF CAGE STRUCTURE

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0009	1	1	JV

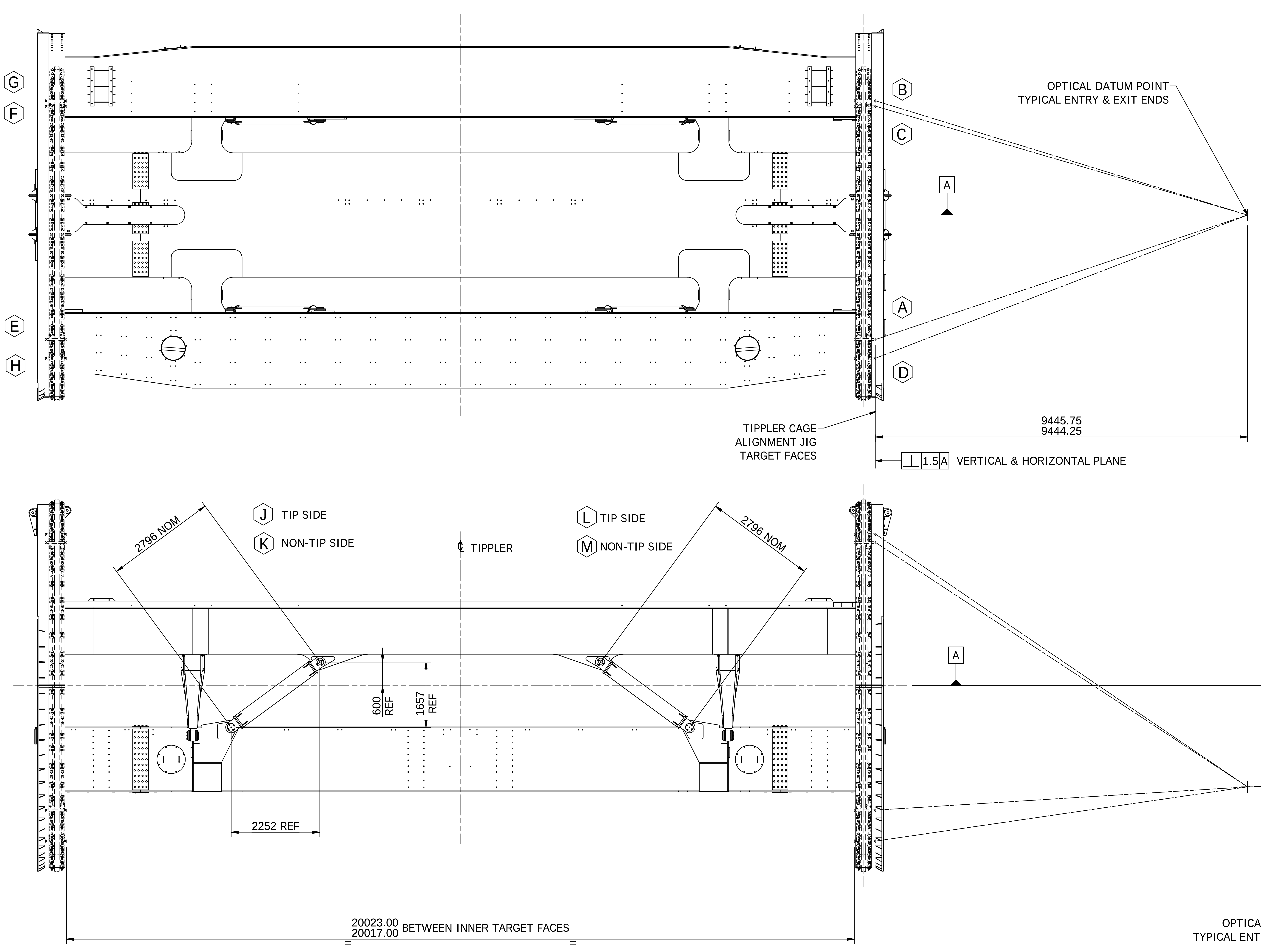
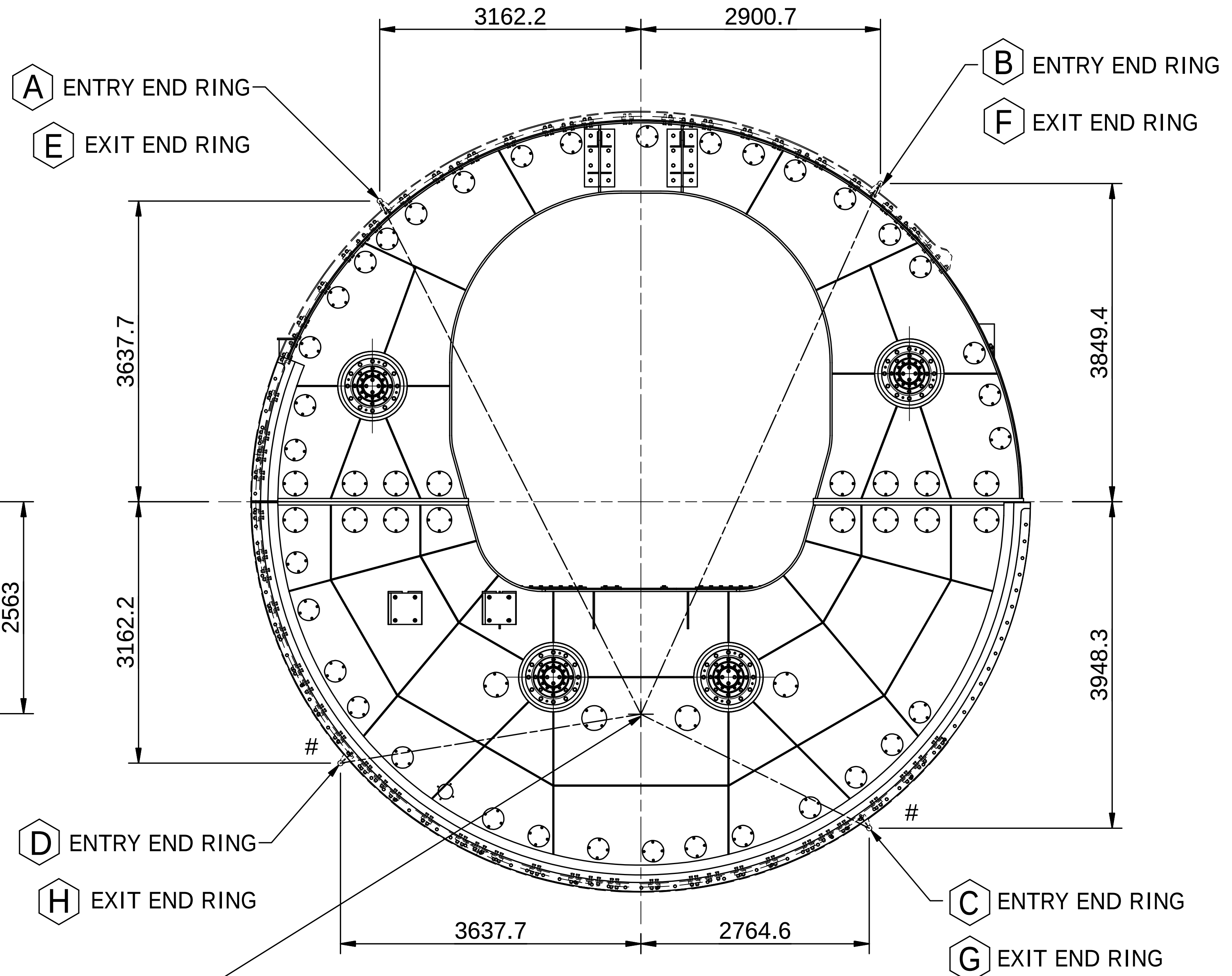


TABLE 1		NOMINAL DIMENSION	MEASURED DIMENSION - OPTICAL DATUM POINT TO
ENTRY	A	9445 ± 0.75	
	B		
	C		
	D		
EXIT	E		
	F		
	G		
	H		

TABLE 2		NOMINAL DIMENSION	MEASURED DIMENSION BETWEEN TARGETS
ENTRY TO EXIT	A - E	20020 ± 3	
	B - F		
	C - G		
	D - H		

TABLE 3	NOMINAL DIMENSION	MEASURED DIMENSION BETWEEN PINS
J	2796	
K		
L		
M		

MEASURE AFTER FINAL WELDING OF CAGE LINKS



VIEW ON ENTRY END RING

REMOVE 2 LOWER RACK SEGMENTS PER END RING TO PROVIDE LINE OF SIGHT WHERE INDICATED THUS #.

TAKRAF TENOVA

REVIEW LABEL			
Discipline	Discipline Engineer		Date yyyy-mm-dd
	Name	Signature	

DRAWING NO.	REFERENCE
REFERENCE DRAWINGS	

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ABOVE 2000	2.0	6	10

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MASS. 191964 kg
MATERIAL.
SPEC.
NOTES.

DRAWN TO BS 8888
THIRD ANGLE PROJECTION

Rev.	Drawing Sheet No.	yes no Part List	See technical modification report No.	Day	Name

TAKRAF TENOVA

Project Number:
AC0339

Drawing Number: 49055208
BG: 4101

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	SHEETS 3 & 4 ADDED	EMD	RHW	ASM	12-03-18
0	FIRST ISSUE	RCJ	RHW	JMD	18-05-17

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TITLE	NAME	SIGN	DATE		
DRAWN	RCJ		18	05	17
CHECKED	RHW		24	05	17
MECHANICAL	DWB		20	06	17
PROJECT ENG.	ASM		26	06	17
PROJECT MAN.	D.STARK		30	06	17

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH
NAME RICHARD WOOD
SIGNATURE — DATE 30 06 17
REG. NUMBER 70386304
SCALE : 1:60 UOS
A1

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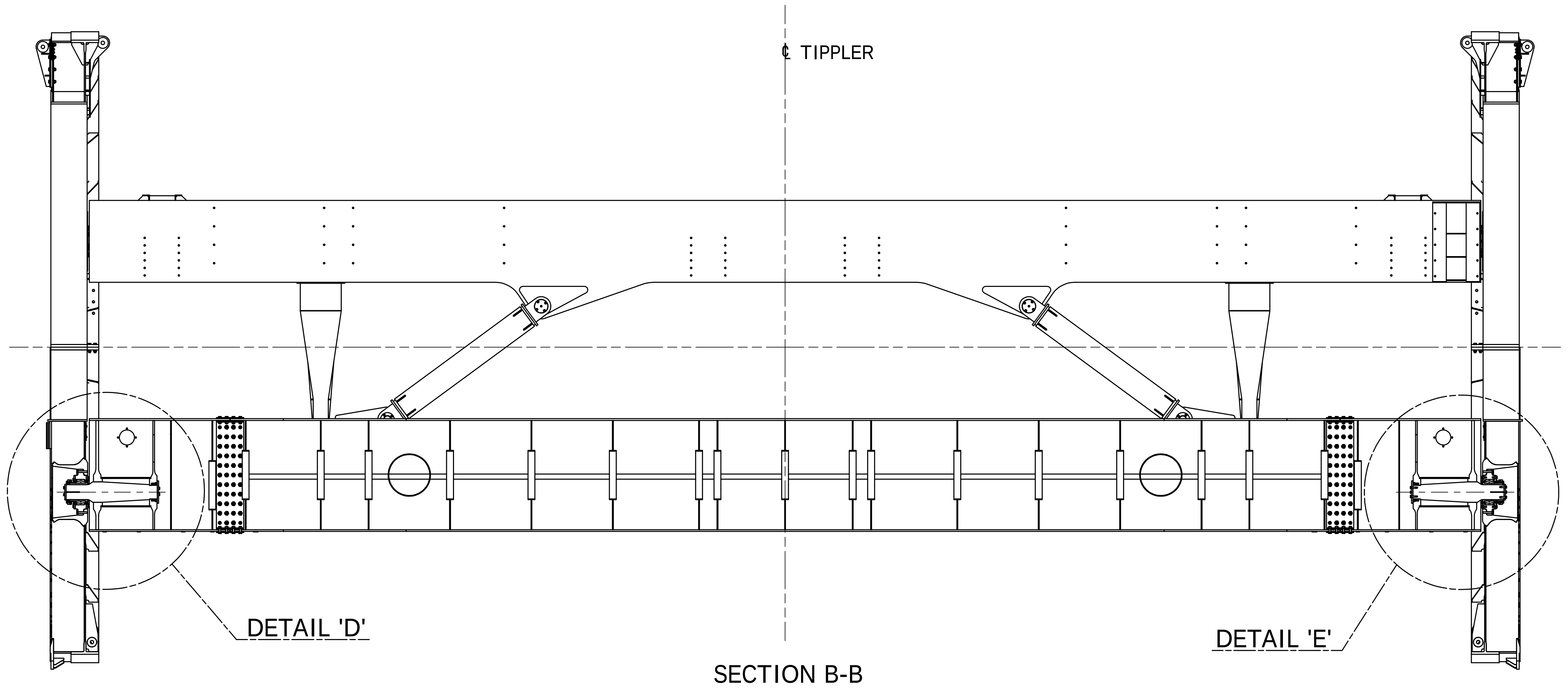
TRANSNET

PORT OF SALDANHA

IRON ORE TIPPLER 3

ASSEMBLY OF CAGE STRUCTURE

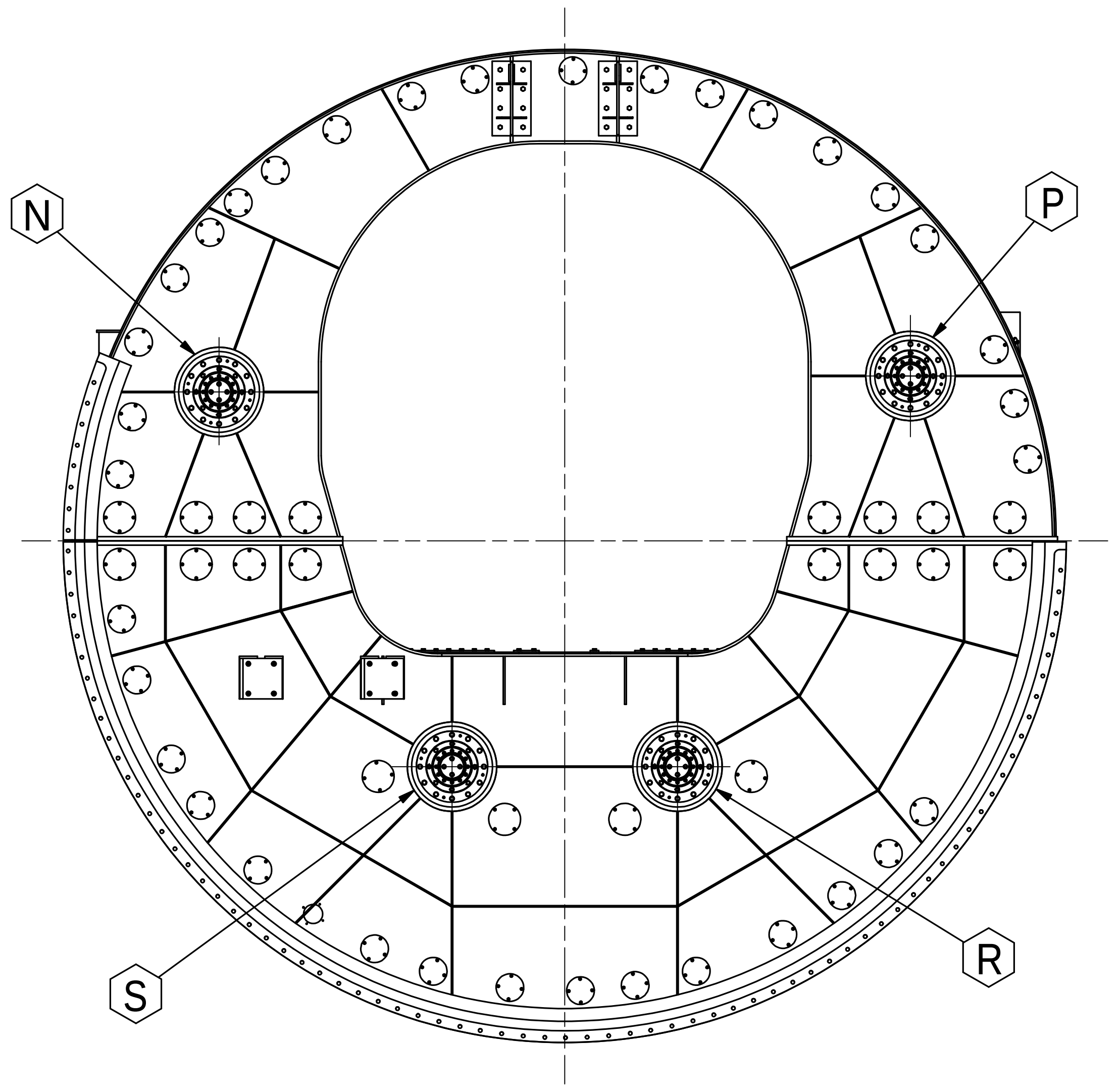
PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0009	2	1	JV



SECTION B-B

SCALE 1 :60

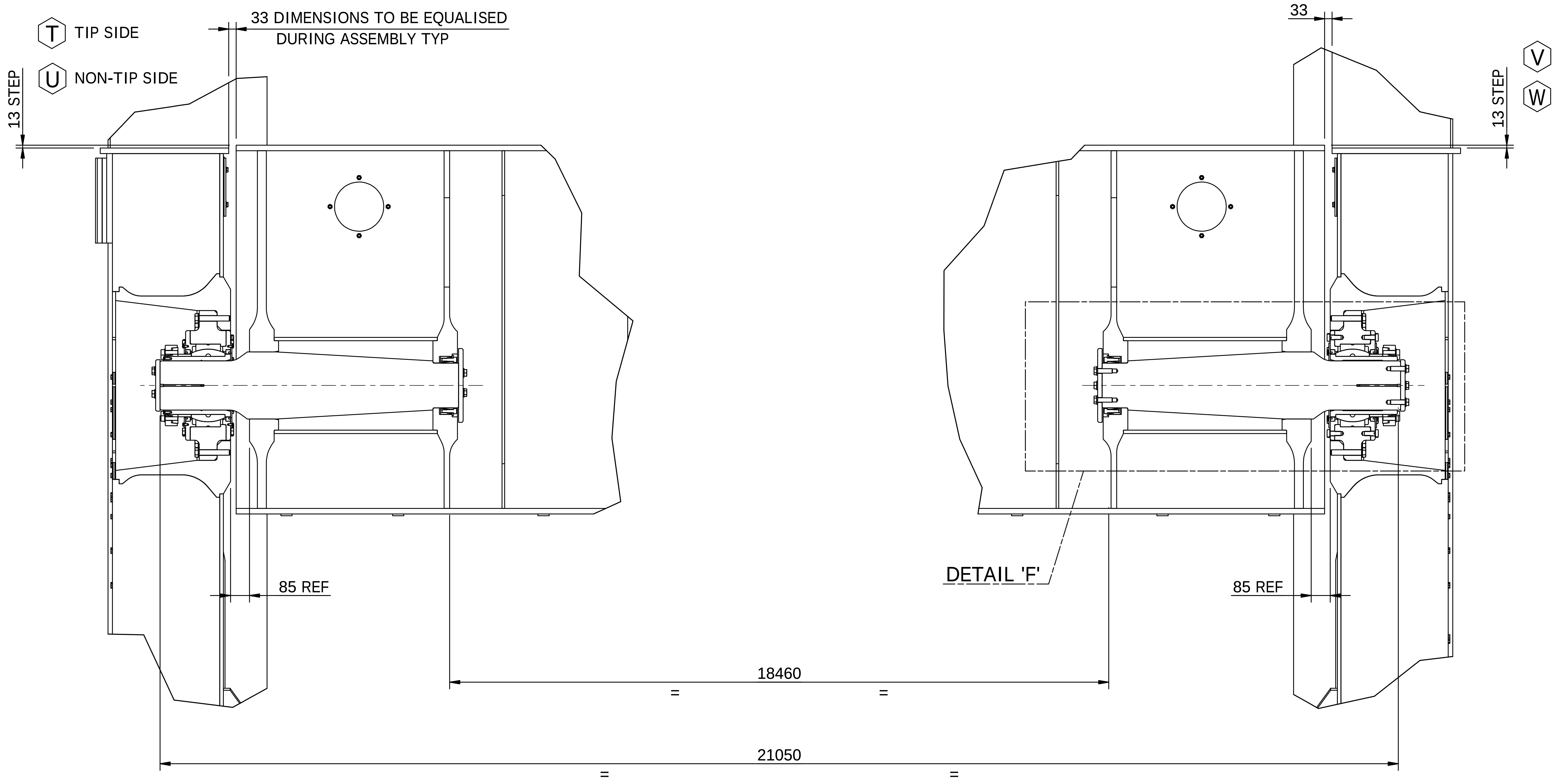
TYPICAL 2 RAIL PLATFORM CONNECTION LOCNS



VIEW ON ENTRY - LEFT HAND END

TABLE 4		LOCATION	NOMINAL DIMENSION	MEASURED DIMENSION
ENTRY	N	OUTER	15.0	
		INNER	5.0	
	P	OUTER	15.0	
		INNER	5.0	
	R	OUTER	15.0	
		INNER	5.0	
	S	OUTER	15.0	
		INNER	5.0	
EXIT	N	OUTER	15.0	
		INNER	5.0	
	P	OUTER	15.0	
		INNER	5.0	
	R	OUTER	15.0	
		INNER	5.0	
	S	OUTER	15.0	
		INNER	5.0	

TABLE 5	LOCATION	NOMINAL DIMENSION	MEASURED DIMENSION
T	TIP SIDE	13.0	
U	NON-TIP SIDE		
V	TIP SIDE		
W	NON-TIP SIDE		

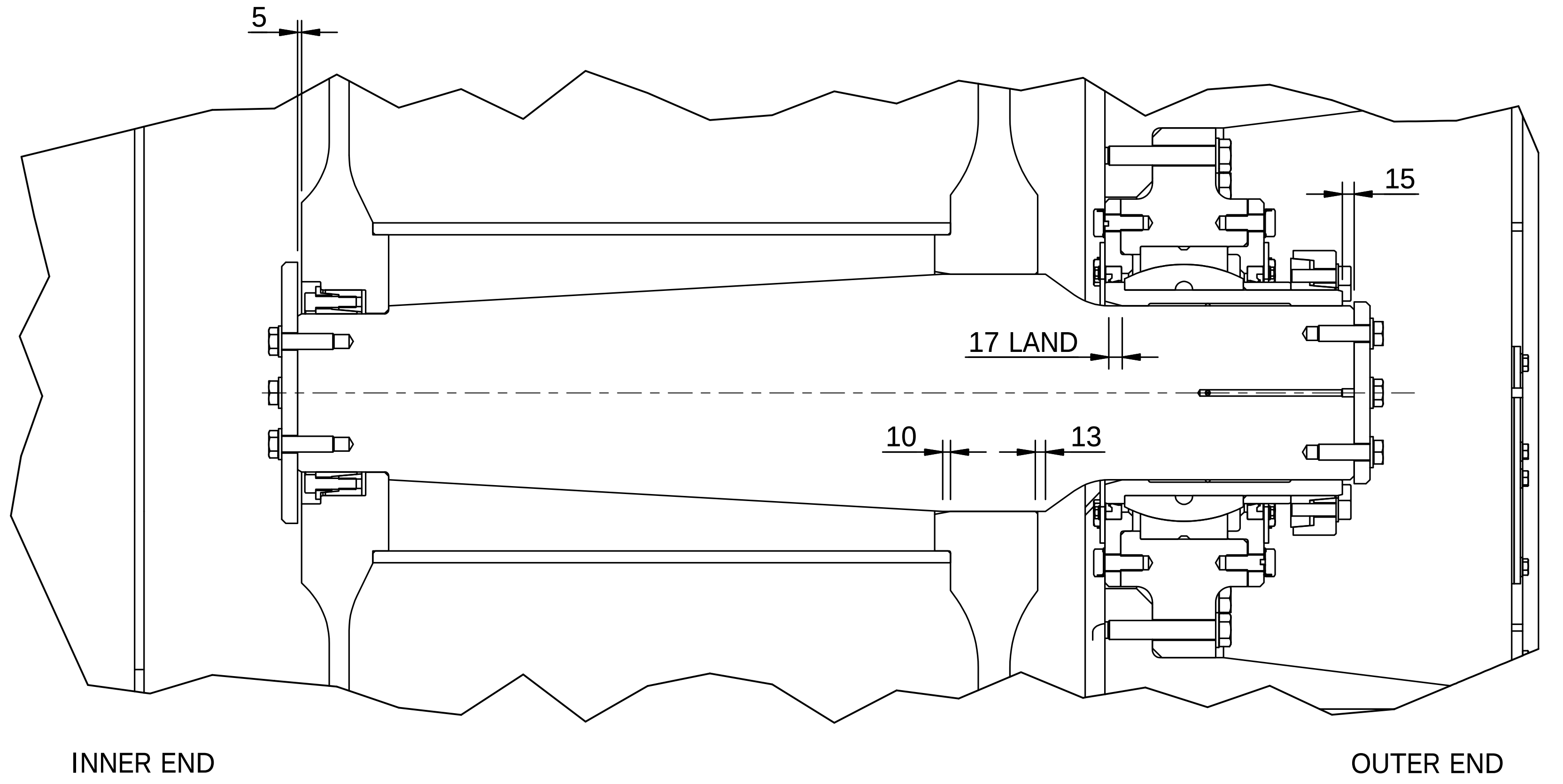


DETAIL 'D'

SCALE 1 : 15

DETAIL 'E'

SCALE 1 : 15



DETAIL 'F'

SCALE 1:7.5

TYPICAL 8 LOCATIONS

TAKRAF TENOVA

REVIEW LABEL

Discipline	Discipline Engineer		Date yyyy-mm-dd
	Name	Signature	

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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MASS.	191964 kg
MATERIAL.	
SPEC.	
NOTES.	

THIRD ANGLE PROJECTION

Rev.	Drawing Sheet No.	yes no Part List	See technical modification report No.	Day	Name

TAKRAF TENOVA

Project Number:
AC0339

Drawing Number: 49055208

BG: 4101

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	SHEETS 3 & 4 ADDED	EMD	RHW	ASM	12-03-18
0	FIRST ISSUE	RCJ	RHW	JMD	18-05-17

REVISIONS

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TRANSNET CAPITAL PROJECTS			
TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS			
TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH
NAME RICHARD WOOD DATE
SIGNATURE 30 06 17
REG. NUMBER 70386304
SCALE : A1

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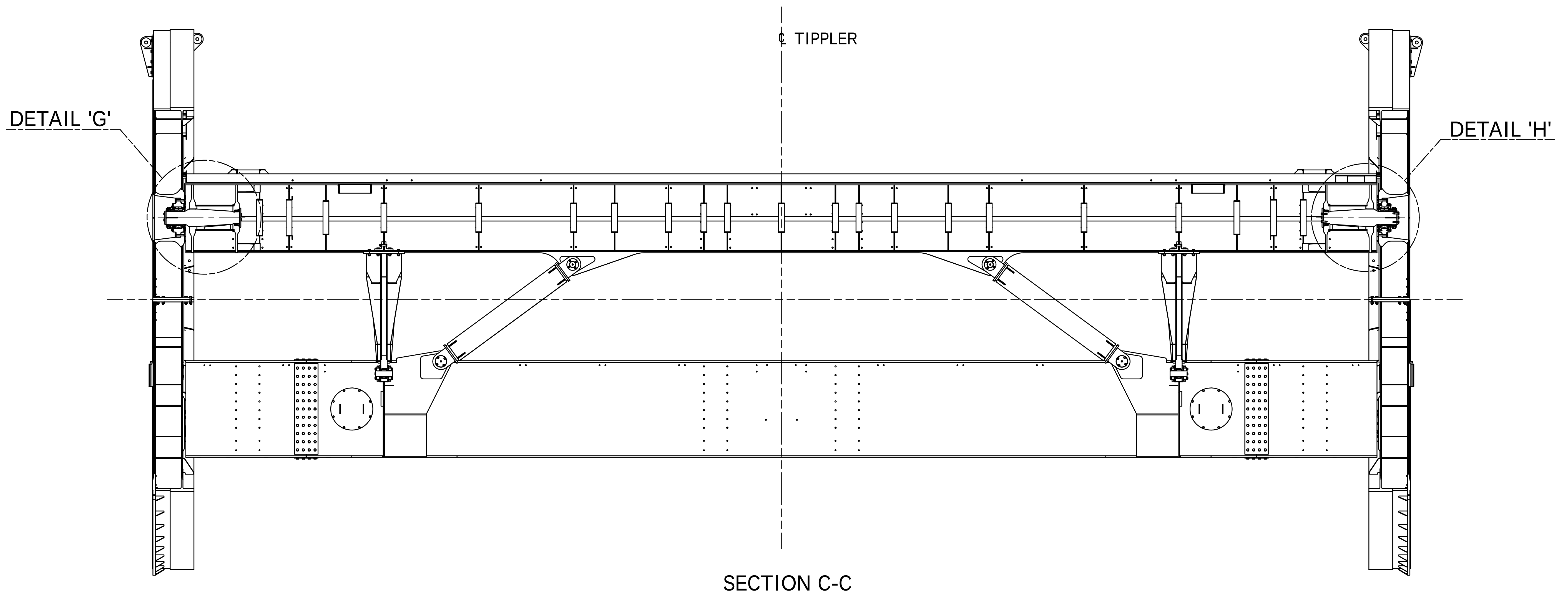
TRANSNET

PORT OF SALDANHA

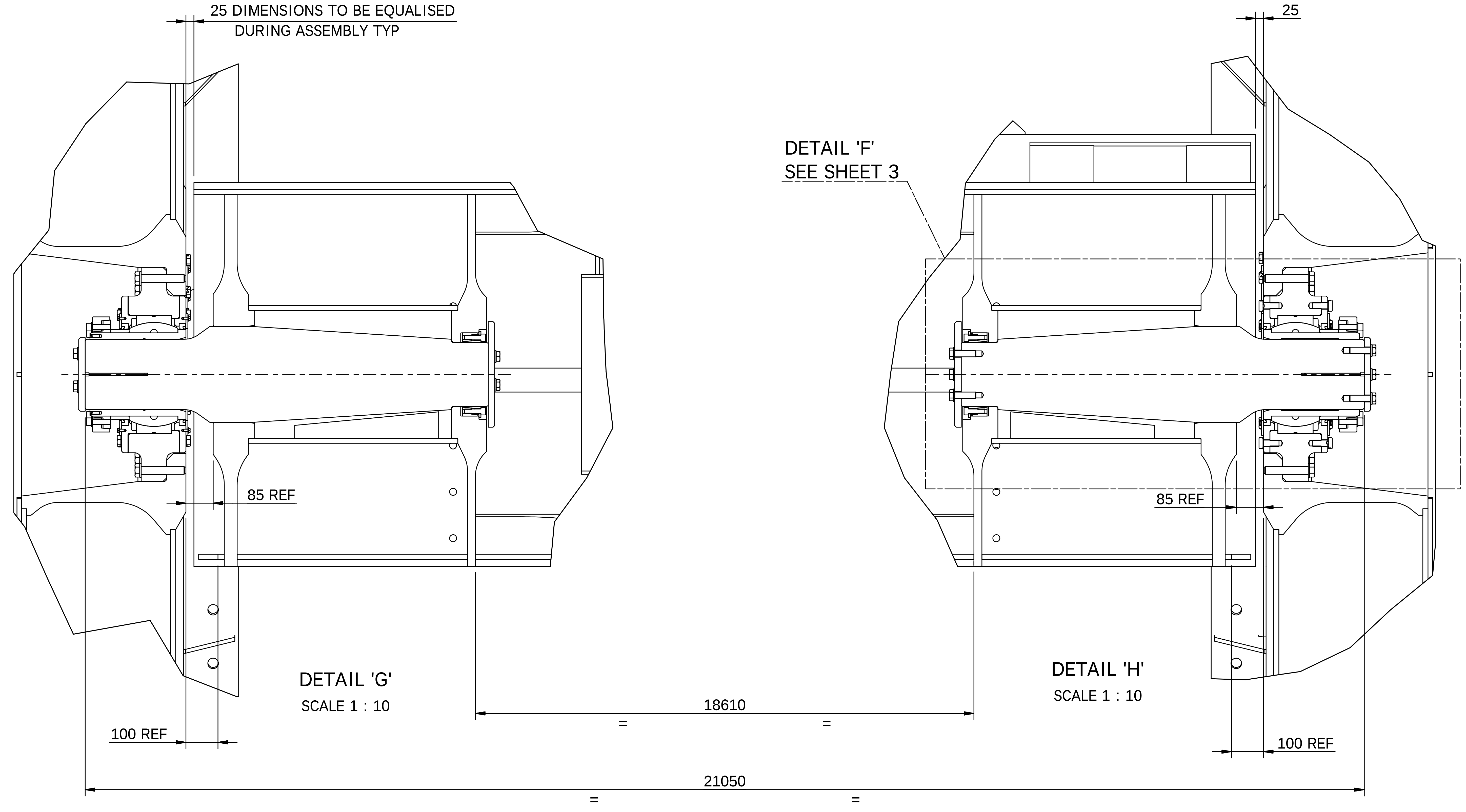
IRON ORE TIPPLER 3

ASSEMBLY OF CAGE STRUCTURE

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0009	3	1	JV



SECTION C-C
SCALE 1:60
TYPICAL SIDE BEAM & BALLAST BEAM



DETAIL 'G'
SCALE 1 : 10

DETAIL 'H'
SCALE 1 : 10

SHOP ASSEMBLY PROCEDURE

1. THE INFORMATION REQUIRED TO ASSEMBLE & ALIGN THE TIPPLER CAGE IS INCLUDED IN THIS DRAWING & THE DRAWINGS & DOCUMENTS LISTED IN THE NOTES INCLUDED ON SHEET 1.

2. PARTICULAR REFERENCE SHALL BE MADE TO THE TIPPLER CAGE SHOP ASSEMBLY SEQUENCE DIAGRAMS - DRAWING 59060560.

3. IT IS IMPORTANT THAT THE TIPPLER CAGE IS ASSEMBLED & PRECISELY ALIGNED IN ACCORDANCE WITH THIS PROCEDURE TO ENSURE THAT:

   - THE TIPPLER CAGE ROTATES IN A CONSISTENT MANNER WITHOUT LONGITUDINAL MOTION THROUGHOUT THE TIP AND RETURN CYCLE.

   - INDETERMINATE FORCES ARE NOT TRANSMITTED TO THE TIPPLER CAGE THAT WOULD HAVE A DETERIMENTAL EFFECT ON THE FATIGUE LIFE OF THE STRUCTURE.

   - TO COMPLY WITH THE STRUCTURAL DESIGN ANALYSIS OF THE TIPPLER CAGE.

   ALTERNATIVE PROCEDURES MUST BE APPROVED BY THE DESIGNER.

4. INSTALL CAGE ALIGNMENT JIGS IN ACCORDANCE WITH THE INSTRUCTIONS INCLUDED ON DRAWING 49055300. IT IS IMPERATIVE THAT EACH JIG IS INSTALLED AT THE CORRECT LOCATION AS DEFINED BY MATCH & DATUM MARKING UNDERTAKEN DURING INITIAL END RING RAIL & JIG INSTALLATION.

5. THE PRIMARY PURPOSE OF THIS PROCEDURE IS TO:

   - ALIGN THE CAGE END RINGS IN ALL PLANES WITHIN THE TOLERANCES SPECIFIED. PARTICULAR ATTENTION IS TO BE GIVEN TO AVOIDING ANY PARALLELOGRAM EFFECTS DEVELOPING DURING ASSEMBLY. IN ADDITION TO THE SURVEYING METHODS OUTLINED IN THIS PROCEDURE, THE MANUFACTURER IS EMPLOY ANY OTHER MEANS DEEMED NECESSARY TO ENSURE THE TOLERANCES & THE INTENT OF THE PROCEDURE IS ACHEIEVED.

   - THE PIVOT SHAFT CONNECTIONS ARE COMPLETED IN THE MANNER REQUIRED BY THE ASSOCIATED DRAWINGS.

   - ENSURE THAT ALL FINAL SETTING DIMENSIONS ACHIEVED DURING SHOP ASSEMBLY ARE RECORDED IN THE TABLES 1 TO 5 INCLUDED IN THIS DRAWING & CONFIRMED TO THE DESIGNER PRIOR TO FINAL WELDING OF THE CAKE LINK TUBULAR BRACES.

   - ENSURE THAT THE RECORDED DIMENSIONS ARE RE-CHECKED/RE-RECORDED DURING SITE INSTALLATION.

SITE INSTALLATION PROCEDURE

A. IN THE EVENT THAT THE TIPPLER CAGE IS TO BE DISMANTLED FOR SHIPMENT TO SITE, THE SHOP ASSEMBLY PROCEDURE SHALL BE REPEATED IN FULL DURING SITE ERECTION & ALL DIMENSIONAL CHECKS SHALL BE COMPARED WITH THE SHOP ASSEMBLY RECORDINGS.

   CONSIDERATION SHOULD BE GIVEN TO WHETHER FINAL WELDING OF CAGE LINKS IS UNDERTAKEN AT THE SHOP ASSEMBLY PHASE OR WHETHER THIS OPERATION IS UNDERTAKEN DURING SITE ASSEMBLY & ALIGNMENT OF THE TIPPLER CAGE.

   IF THE TIPPLER CAGE ASSEBMLY IS TO BE UNDERTAKEN AT SITE, CONSIDERATION SHOULD BE GIVEN TO THE AVAILABILITY OF SUITABLE TOOLS/INSTALLATION/LIFTING EQUIPMENT, THE AVAILABLE LAY DOWN AREA & AVAILABILITY OF SPACE.

B. IN THE EVENT THAT THE TIPPLER CAGE IS TO BE TRANSPORTED & INSTALLED AT SITE WITHOUT DISMANTLING, THE TIPPLER CAGE SHALL BE LIFTED, SUPPORTED & PROTECTED DURING ALL LIFTING, TRANSPORT & SHIPPING OPERATIONS IN A MANNER AGREED WITH THE DESIGNER.

   THE DIMENSIONAL CHECKS OUTLINED IN THIS DOCUMENT SHALL BE REPEATED & RECORDED PRIOR TO THE TIPPLER BEING INSTALLED ON THE SUPPORT ROLLERS.

C. DIMENSIONS CHECKS RELATING TO THE PIVOT CONNECTIONS (TABLE 4) ARE TO BE REPEATED AFTER THE TIPPLER IS INSTALLED ON THE SUPPORT ROLLERS.

D. REFER TO ASSEMBLY OF ROTATING STRUCTURES DRAWING 49055207 FOR THE SHOP ASSEMBLY PROCEDURE OF ASSEMBLIES ATTACHED TO THE TIPPLER CAGE.

TAKRAF
TENOVA

REVIEW LABEL

Discipline	Discipline Engineer Name	Discipline Engineer Signature	Date yyyy-mm-dd

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES: 1. DO NOT SCALE DRAWING - ONLY DIMENSIONS SHOWN TO BE USED.
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DIMENSIONS IN MILLIMETERS & DEGREES.
GENERAL MANUFACTURING TOLERANCES
UNLESS STATED OTHERWISE (PLUS OR MINUS)

RANGE	MACH	FAB	CAST
0-500	0.25	2	2
501-1000	0.5	3	4
1001-2000	1.0	4	6
ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

MASS.	191964 kg
MATERIAL.	
SPEC.	
NOTES.	

DRAWN TO BS 8888
THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED IDENTIFY THE ITEM WITH THE DRAWING NUMBER AND ISSUE LEVEL AT ▼ AND IN THE MANNER SHOWN.

Rev.	Drawing Sheet No.	yes Part List	no Part List	See technical modification report No.	Day	Name

TAKRAF
TENOVA

Project Number:
AC0339

Drawing Number:
49055208

BG:
4101

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	SHEETS 3 & 4 ADDED	EMD	RHW	ASM	12-03-18
0	FIRST ISSUE	RCJ	RHW	JMD	18-05-17

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE		
DRAWN	RCJ		18	05	17
CHECKED	RHW		24	05	17
MECHANICAL	DWB		20	06	17
PROJECT ENG.	ASM		26	06	17
PROJECT MAN.	D.STARK		30	06	17

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME RICHARD WOOD
DATE
SIGNATURE 30 06 17
REG. NUMBER 70386304
SCALE :

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8001 FAX: 086 677 2455

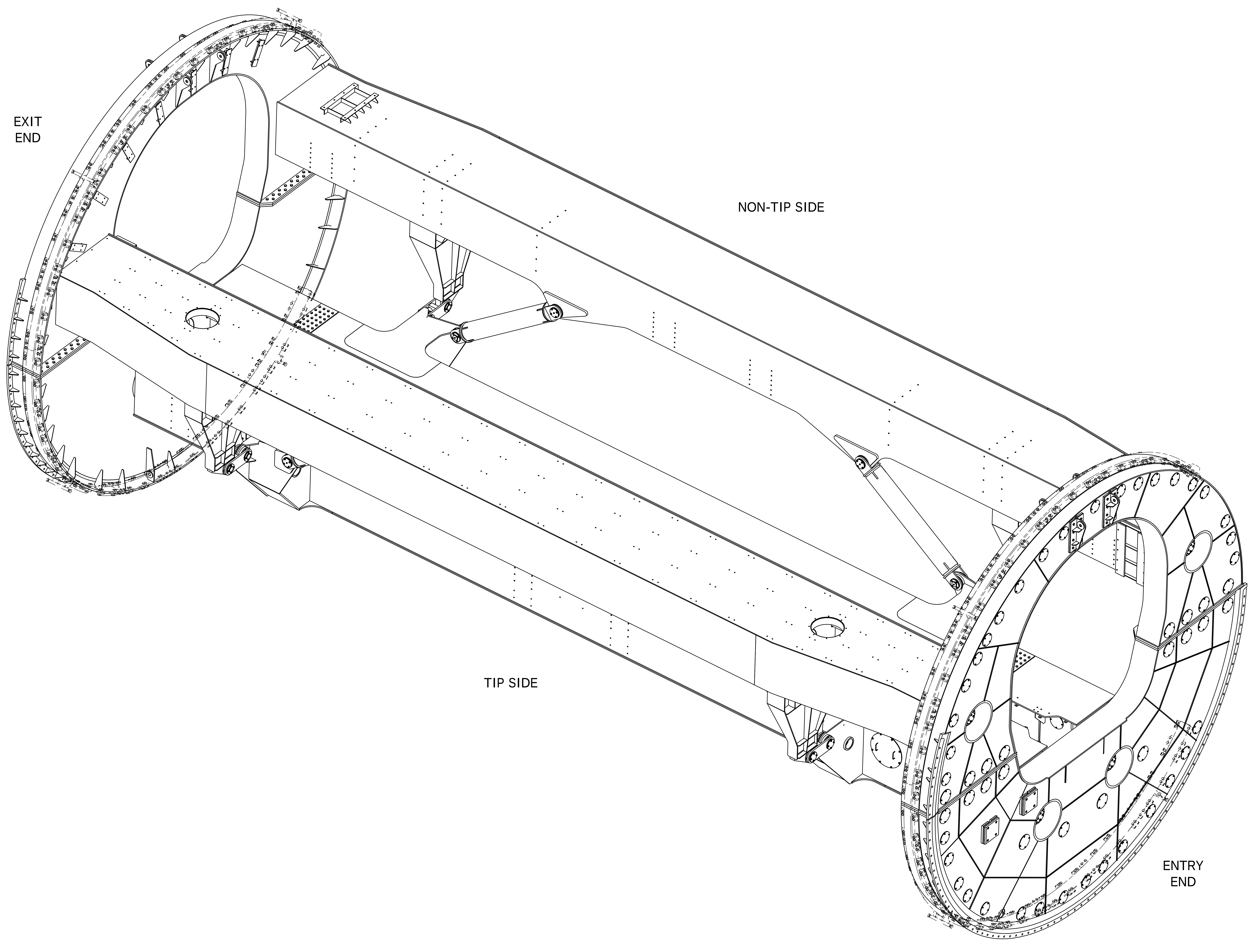
TRANSNET

PORT OF SALDANHA

IRON ORE TIPPLER 3

ASSEMBLY OF CAGE STRUCTURE

	PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
A1	1924701	0	000	M	GA	0009	4	1	JV



TAKRAF TENOVA

REVIEW LABEL

Discipline	Discipline Engineer Name	Signature	Date yyyy-mm-dd

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DIMENSIONS IN MILLIMETERS & DEGREES.
GENERAL MANUFACTURING TOLERANCES
UNLESS STATED OTHERWISE (PLUS OR MINUS)

RANGE	MACH	FAB	CAST
0-500	0.25	2	2
501-1000	0.5	3	4
1001-2000	1.0	4	6
ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

MASS.	191964 kg
MATERIAL.	
SPEC.	
NOTES.	

DRAWN TO BS 8888
THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED IDENTIFY THE ITEM WITH THE DRAWING NUMBER AND ISSUE LEVEL AT ▽ AND IN THE MANNER SHOWN.

Rev.	Drawing Sheet No.	Part List yes	no	See technical modification report No.	Day	Name

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

TAKRAF TENOVA

Project Number: AC0339

Drawing Number: 49055208

BG: 4101

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	SHEETS 3 & 4 ADDED	EMD	RHW	ASM	12-03-18
0	FIRST ISSUE	RCJ	RHW	JMD	18-05-17

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE		
DRAWN	RCJ	R. Sachon	18	05	17
CHECKED	RHW	RHWood.	24	05	17
MECHANICAL	DWB		20	06	17
PROJECT ENG.	ASM		26	06	17
PROJECT MAN.	D.STARK		30	06	17

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME RICHARD WOOD
SIGNATURE RHWood. DATE 30 06 17
REG. NUMBER 70386304
SCALE : 1:40 UOS
A1

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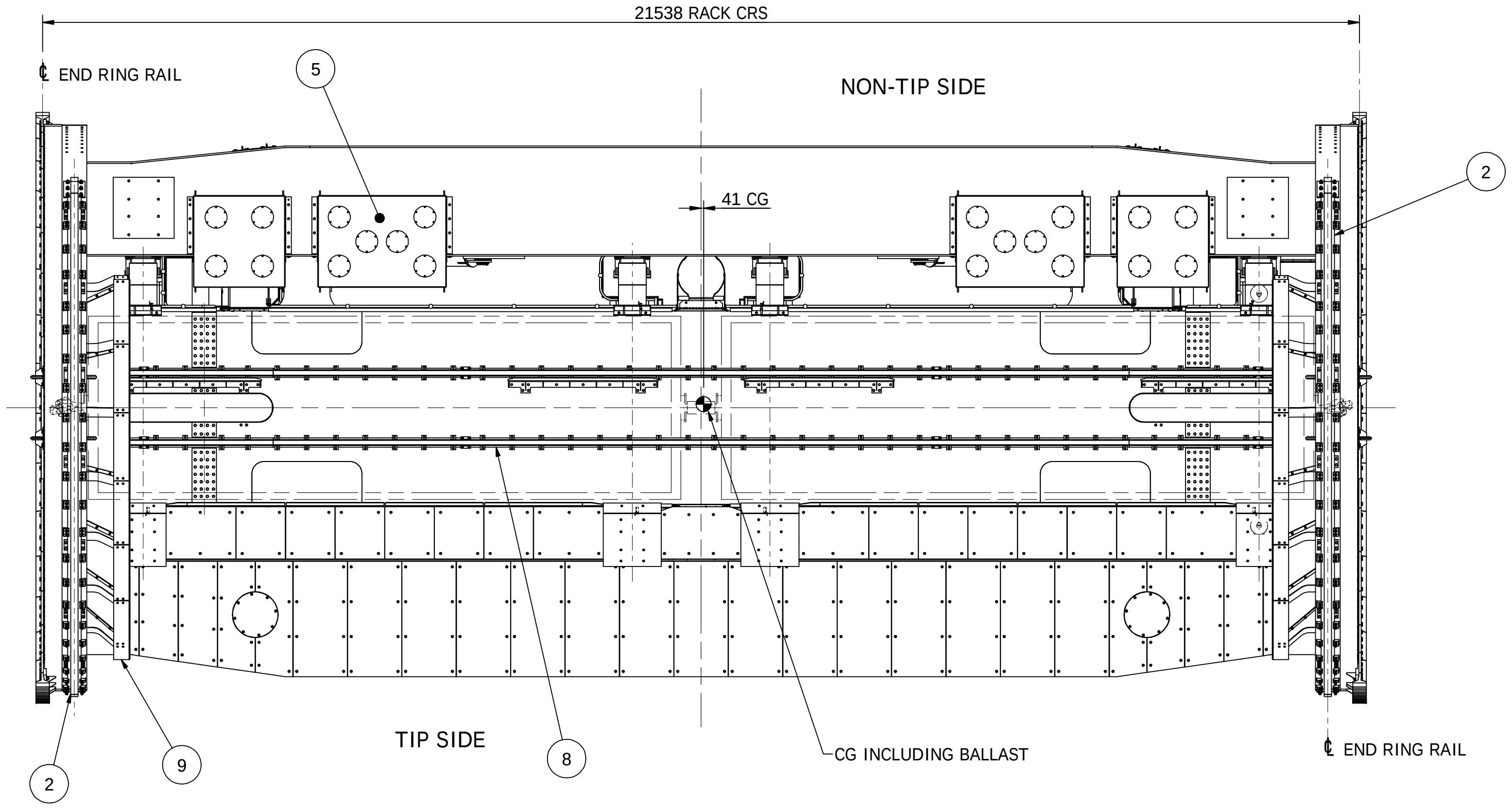
TRANSNET

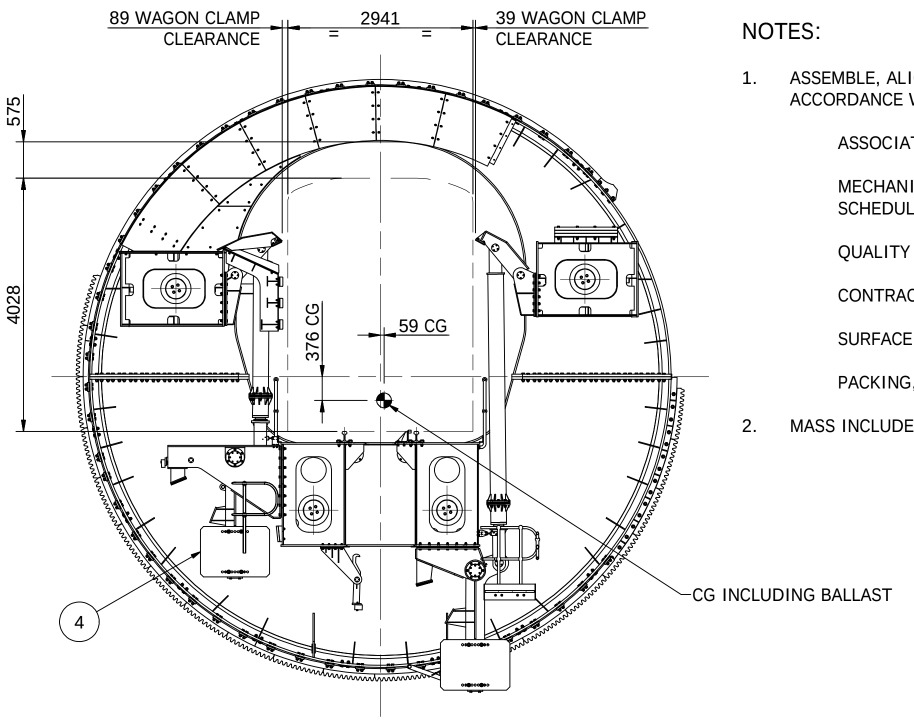
PORT OF SALDANHA

IRON ORE TIPPLER 3

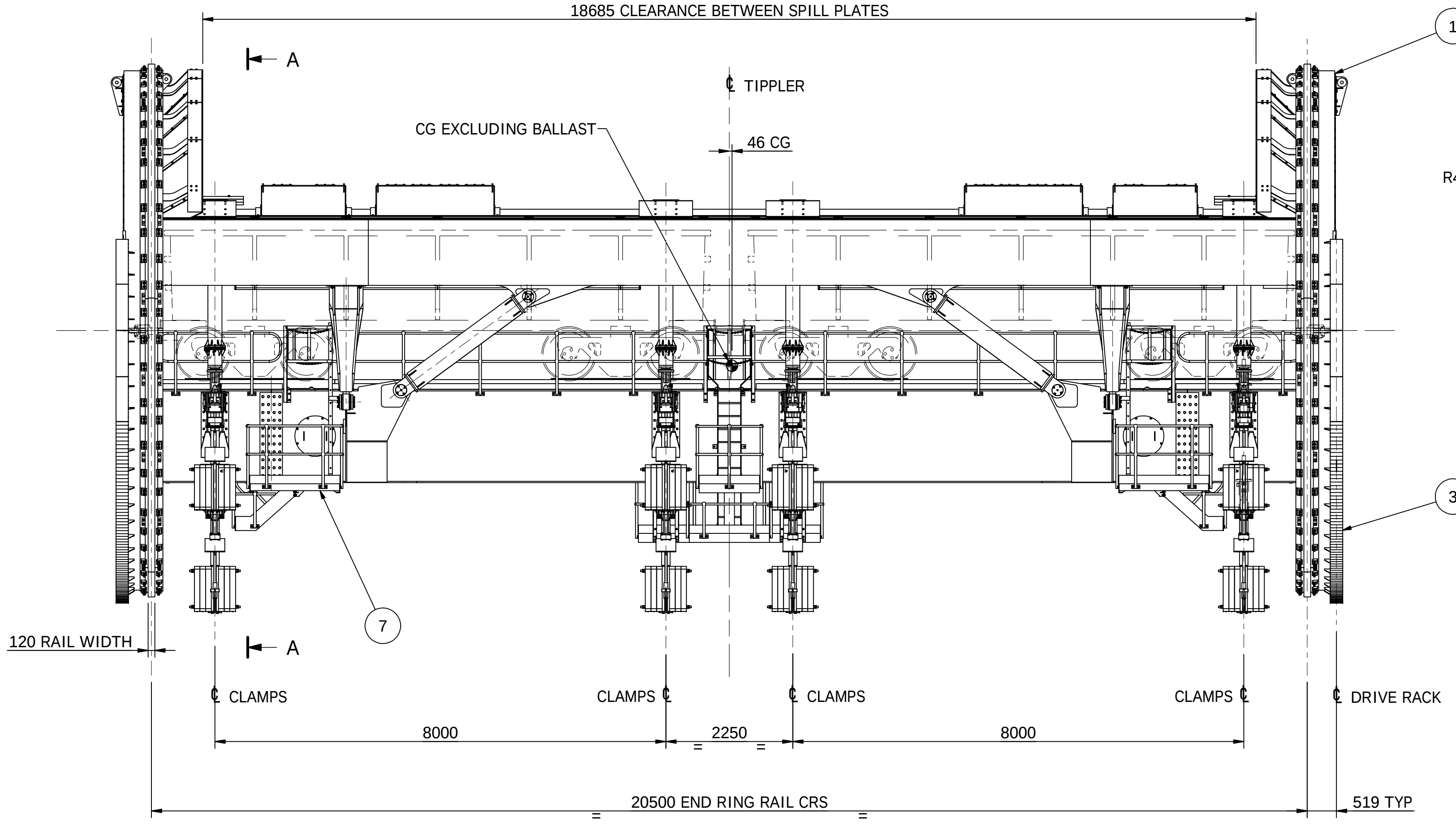
ASSEMBLY OF CAGE STRUCTURE

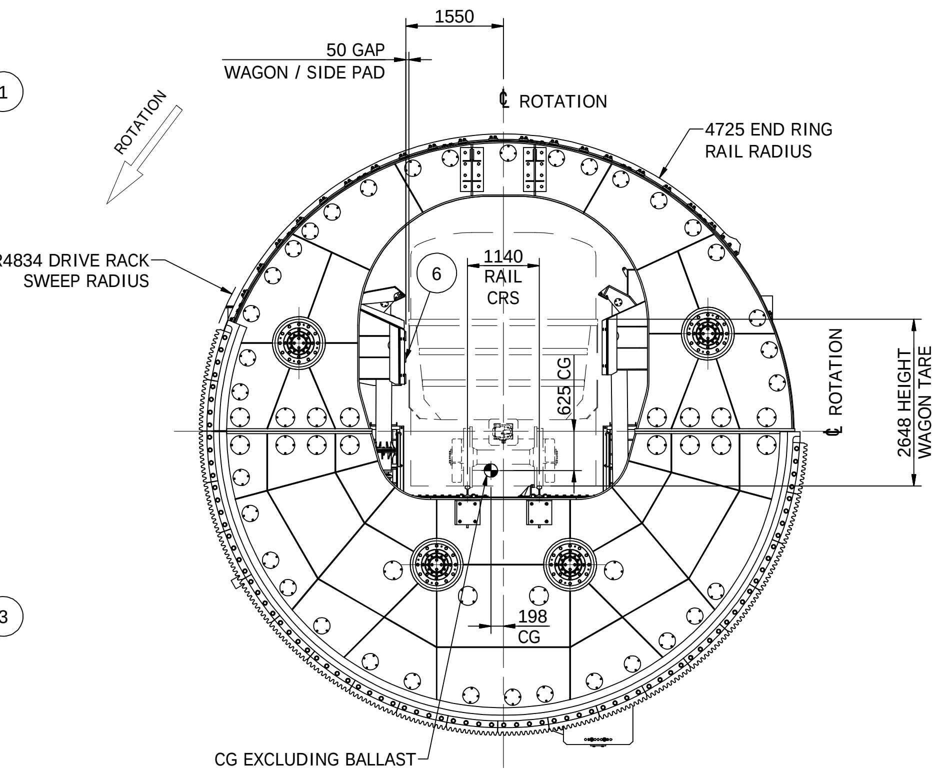
PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0009	5	1	JV





SECTION A-A





DIRECTION OF UNLOADING

NOTES:

1. ASSEMBLE, ALIGN & PROTECT FOR SHIPMENT IN ACCORDANCE WITH:

   ASSOCIATED ASSEMBLY/SUB-ASSEMBLY DRAWINGS.

   MECHANICAL SHOP ASSEMBLY & INSPECTION SCHEDULE

   QUALITY ASSURANCE INSPECTION PROCEDURES

   CONTRACT MANUFACTURING SPECIFICATION

   SURFACE TREATMENT SPECIFICATION

   PACKING, TRANSPORT & SHIPPING SCHEDULE

2. MASS INCLUDES BALLAST MASS OF 27918 kg

TAKRAF
TENOVA

REVIEW LABEL

Discipline	Discipline Engineer		Date yyyy-mm-dd
	Name	Signature	

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES: 1. DO NOT SCALE DRAWING - ONLY DIMENSIONS SHOWN TO BE USED.
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DIMENSIONS IN MILLIMETERS & DEGREES.
GENERAL MANUFACTURING TOLERANCES
UNLESS STATED OTHERWISE (PLUS OR MINUS)

RANGE	MACH	FAB	CAST
0-500	0.25	2	2
501-1000	0.5	3	4
1001-2000	1.0	4	6
ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

MASS.	303316 kg
MATERIAL.	
SPEC.	
NOTES.	

DRAWN TO BS 8888

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED IDENTIFY THE ITEM WITH THE DRAWING NUMBER AND ISSUE LEVEL AT ◊ AND IN THE MANNER SHOWN.

Rev.	Drawing Sheet No.	yes no Part List	See technical modification report No.	Day	Name

TAKRAF
TENOVA

Project Number:
AC0339

Drawing Number: 49055207
BG: 4000

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	UPDATED TO AS DESIGNED STATUS	EMD	RHW	JMD	09-07-18
0	FIRST ISSUE	GBL	RHW	JMD	07-10-17

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE		
DRAWN	GBL		06	07	17
CHECKED	RHW		07	10	17
MECHANICAL	DWB		07	10	17
PROJECT ENG.	ASM		07	10	17
PROJECT MAN.	D.STARK		07	10	17

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME RICHARD WOOD
SIGNATURE — DATE 07 10 17
REG. NUMBER 70386304
SCALE : 1:60
A1

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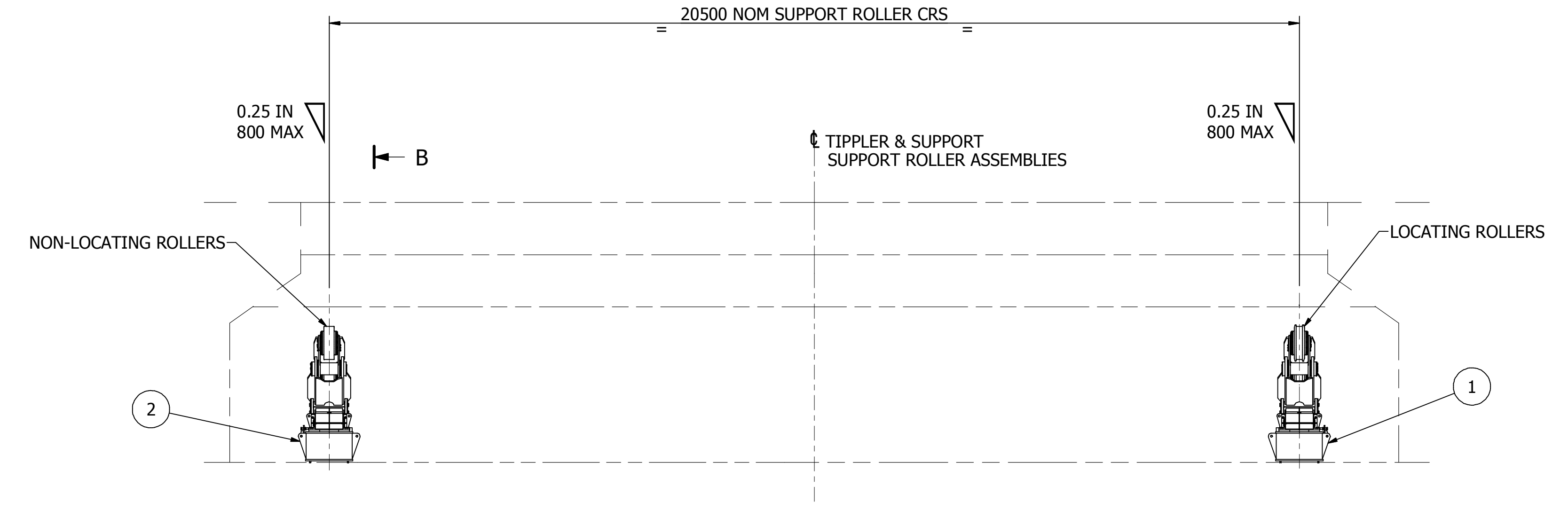
PORT OF SALDANHA

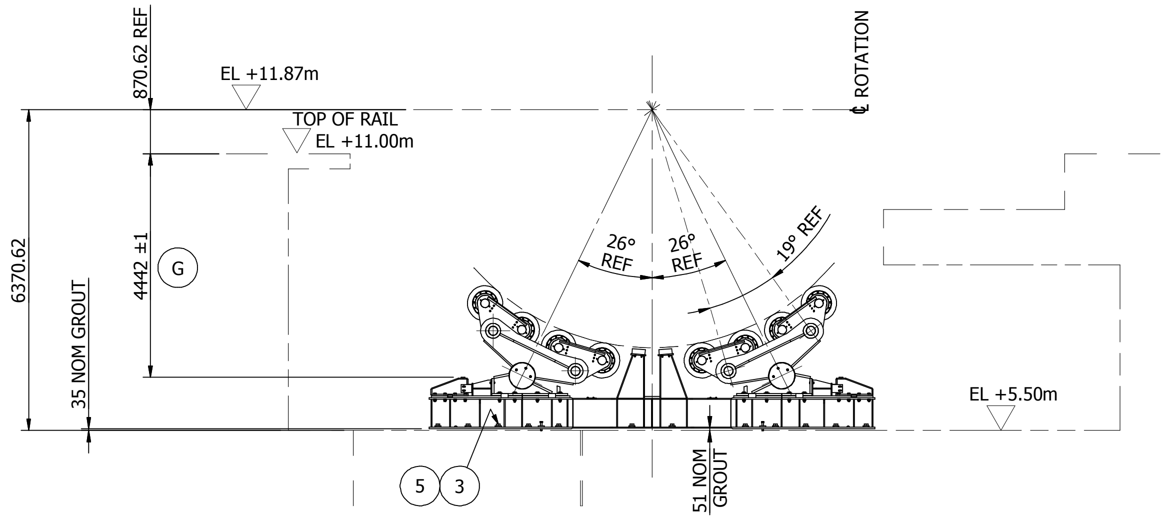
IRON ORE TIPPLER 3

ASSEMBLY OF TIPPLER ROTATING STRUCTURE

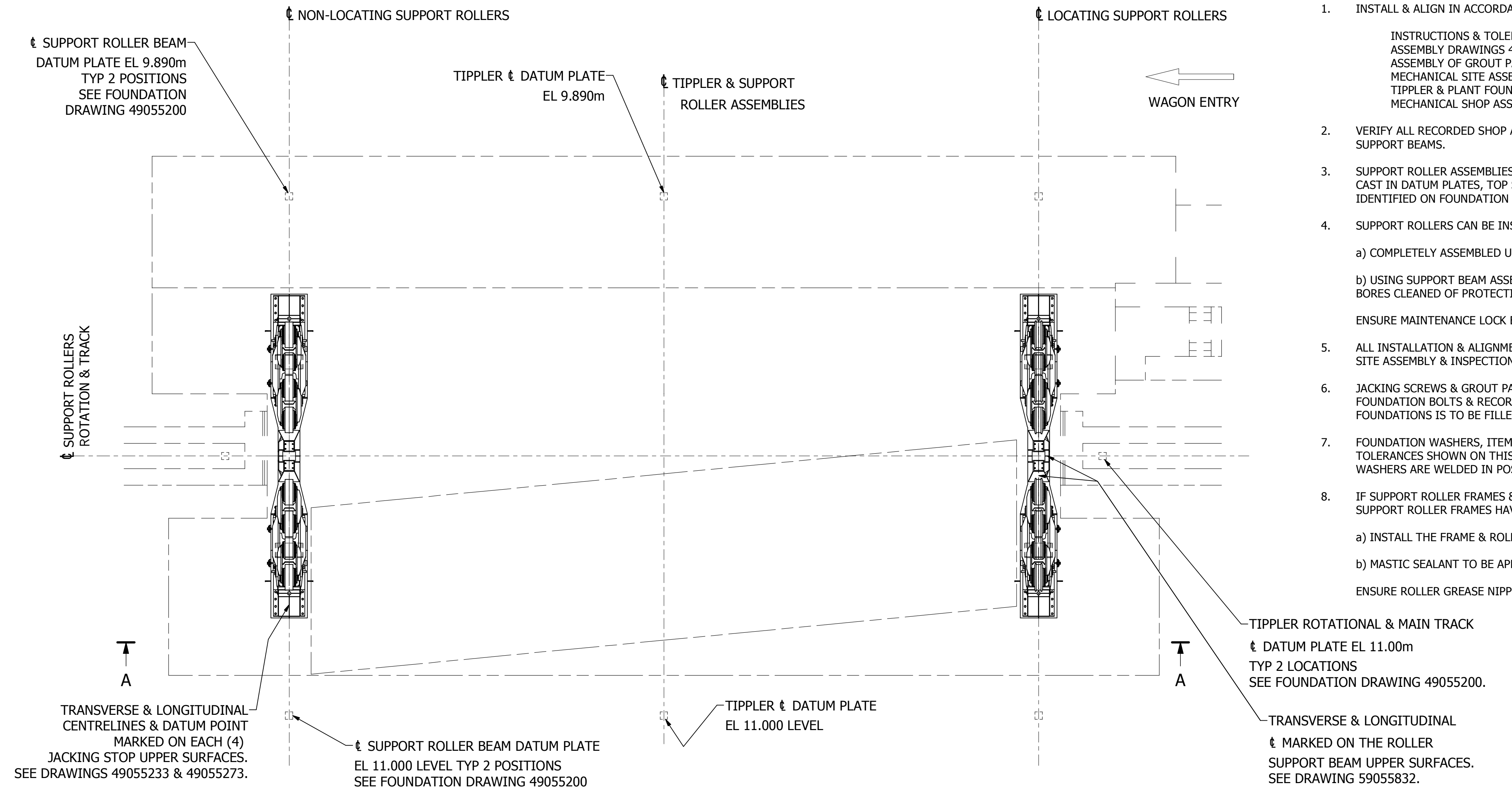
PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0008	1	1	JV



SECTION A-A



SECTION B-B



SITE ASSEMBLY PROCEDURE:

1. INSTALL & ALIGN IN ACCORDANCE WITH & REFERENCE TO:

   INSTRUCTIONS & TOLERANCES INCLUDED ON THIS DRAWING
   ASSEMBLY DRAWINGS 49055233 & 49055273
   ASSEMBLY OF GROUT PACKING DRAWING 49055230
   MECHANICAL SITE ASSEMBLY & INSPECTION PROCEDURE
   TIPPLER & PLANT FOUNDATION DETAILS DRAWING 49055200
   MECHANICAL SHOP ASSEMBLY & INSPECTION PROCEDURE (FOR RECORDED SHOP ASSEMBLY DIMENSIONS)

2. VERIFY ALL RECORDED SHOP ASSEMBLY DIMENSIONS. IT IS IMPERATIVE THAT THE JACKING STOPS ARE CORRECTLY ALIGNED & FIXED TO THE ROLLER SUPPORT BEAMS.

3. SUPPORT ROLLER ASSEMBLIES TO BE INSTALLED & ALIGNED IN ACCORDANCE WITH MECHANICAL SITE INSTALLATION METHOD STATEMENT & USING CAST IN DATUM PLATES, TOP SURFACE OF THE ROLLER SUPPORT BEAMS & JACKING STOP DATUMS AS PRIMARY ALIGNMENT REFERENCE POINTS AS IDENTIFIED ON FOUNDATION DRAWINGS & THIS DRAWING.

4. SUPPORT ROLLERS CAN BE INSTALLED AS:

   a) COMPLETELY ASSEMBLED UNITS INCLUDING ROLLERS OR,

   b) USING SUPPORT BEAM ASSEMBLIES ONLY FOR INITIAL ALIGNMENT WITH ROLLER ASSEMBLIES INSTALLED AFTER FOR FINAL ALIGNMENT. ENSURE PIVOT BORES CLEANED OF PROTECTIVE MATERIALS & PIVOT PINS FULLY GREASED ON ASSEMBLY.

   ENSURE MAINTENANCE LOCK BRACKETS & ROLLER GREASE NIPPLES FACE OUTWARDS.

5. ALL INSTALLATION & ALIGNMENT DIMENSIONS ARE TO BE RECORDED IN ACCORDANCE WITH THE REQUIREMENTS OF THIS DRAWING & THE MECHANICAL SITE ASSEMBLY & INSPECTION PROCEDURE.

6. JACKING SCREWS & GROUT PACKERS TO BE USED TO ALIGN & LEVEL THE SUPPORT BEAMS. FOLLOWING ALIGNMENT, FULL TIGHTENING OF THE FOUNDATION BOLTS & RECORDING OF ALL REQUIRED ALIGNMENT DIMENSIONS, THE GAP BETWEEN THE UNDERSIDE OF THE BEAMS AND THE FOUNDATIONS IS TO BE FILLED WITH FULL STRENGTH GROUT.

7. FOUNDATION WASHERS, ITEM 3, TO BE WELDED TO THE ROLLER SUPPORT BEAM TO MAINTAIN SETTINGS. IT IS ESSENTIAL THAT THE DIMENSIONS & TOLERANCES SHOWN ON THIS DRAWING ARE ACHIEVED. ANY VARIATIONS MUST BE ADVISED TO THE DESIGNER BEFORE GROUTING & THE FOUNDATION WASHERS ARE WELDED IN POSITION.

8. IF SUPPORT ROLLER FRAMES & ROLLER ASSEMBLIES WERE REMOVED FROM ROLLER SUPPORT BEAM ASSEMBLIES PRIOR TO INSTALLATION, OR IF THE SUPPORT ROLLER FRAMES HAVE BEEN MOVED DURING INSTALLATION;

   a) INSTALL THE FRAME & ROLLER ASSEMBLIES IN ACCORDANCE WITH THE REQUIREMENT OF ASSEMBLY DRAWINGS 49055233 & 49055273.

   b) MASTIC SEALANT TO BE APPLIED IN THE JOINTS BETWEEN THE FRAMES AND PIVOT BLOCKS TO SEAL THE GREASED PIVOT PINS.

   ENSURE ROLLER GREASE NIPPLES FACE AWAY FROM THE TIPPLER CENTRE.

TAKRAF
TENOVA
TRANSNET

REVIEW LABEL

Discipline	Discipline Engineer		Date yyyy-mm-dd
	Name	Signature	

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES: 1. DO NOT SCALE DRAWING - ONLY DIMENSIONS SHOWN TO BE USED.
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DIMENSIONS IN MILLIMETERS & DEGREES.
GENERAL MANUFACTURING TOLERANCES
UNLESS STATED OTHERWISE (PLUS OR MINUS)

RANGE	MACH	FAB	CAST
0-500	0.25	2	2
501-1000	0.5	3	4
1001-2000	1.0	4	6
ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

MASS.	50988 kg
MATERIAL.	
SPEC.	
NOTES.	

DRAWN TO BS 8888
THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED IDENTIFY THE ITEM WITH THE DRAWING NUMBER AND ISSUE LEVEL AT ◬ AND IN THE MANNER SHOWN.

Rev.	Drawing Sheet No.	yes Part List	no Part List	See technical modification report No.	Day	Name

TAKRAF
TENOVA

Project Number:
AC0339

Drawing Number:
49055232

BG:
4112

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0	FIRST ISSUE	RGF	ASM	JMD	08-03-17

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE		
DRAWN	RGF		08	03	17
CHECKED	ASM		10	03	17
MECHANICAL	JMD		13	03	17
PROJECT ENG.	DWB		17	03	17
PROJECT MAN.	D.STARK		17	03	17

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME RICHARD WOOD
DATE 17 03 17
SIGNATURE RWood.
REG. NUMBER 70386304
SCALE :
A1

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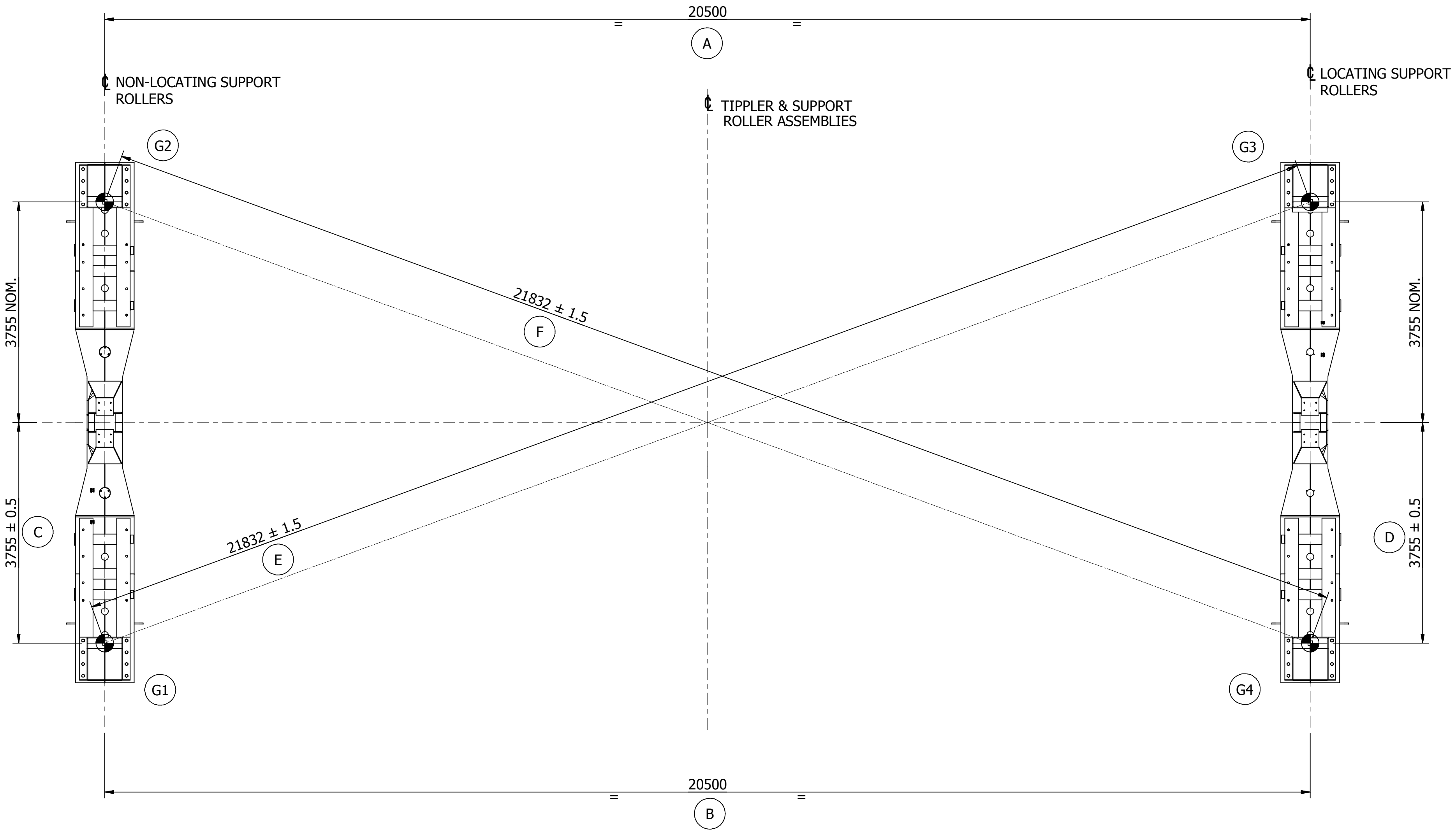
TRANSNET

PORT OF SALDANHA

IRON ORE TIPPLER 3

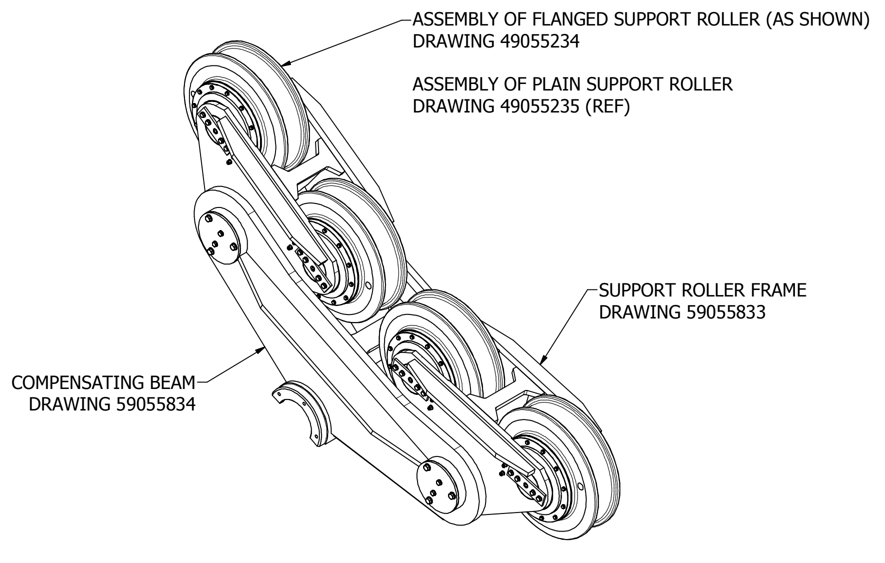
ASSEMBLY OF SUPPORT ROLLERS

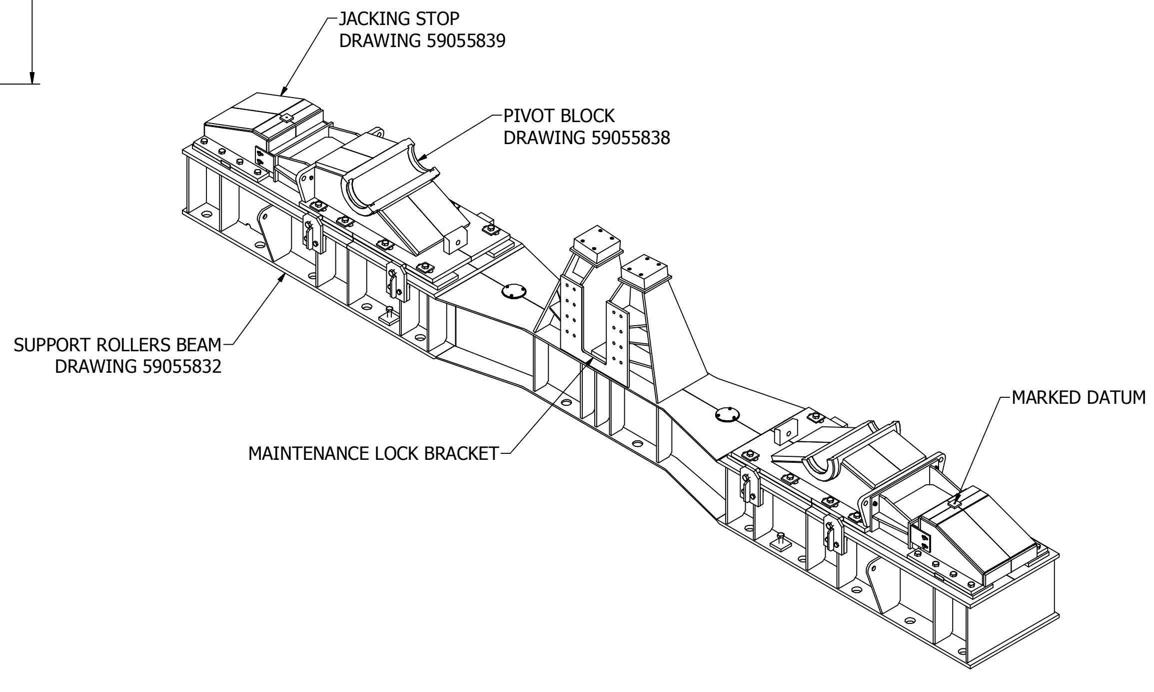
PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
XXXXXXX	X	XXX	X	XX	000X	1	0	JV



PLAN VIEW SHOWING TOLERANCES BETWEEN MACHINED DATUMS ON JACKING STOPS

(SUPPORT ROLLER FRAMES & ROLLER ASSEMBLIES OMMITTED FOR CLARITY)





INSTALLATION & ALIGNMENT RECORD

DIMENSION REFERENCE	NOMINAL / DRAWING DIMENSION	RECORDED DIMENSION
A	20500	
B	20500	
C	3755	
D	3755	
E	21832	
F	21832	
G1	4442	
G2	4442	
G3	4442	
G4	4442	

TAKRAF
TENOVA

REVIEW LABEL

Discipline	Discipline Engineer Name	Discipline Engineer Signature	Date yyyy-mm-dd

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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UNLESS STATED OTHERWISE (PLUS OR MINUS)

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501-1000	0.5	3	4
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ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

UNLESS OTHERWISE SPECIFIED IDENTIFY THE ITEM WITH THE DRAWING NUMBER AND ISSUE LEVEL AT ◊ AND IN THE MANNER SHOWN.

MASS. 50988 kg
MATERIAL.
SPEC.
NOTES.

DRAWN TO BS 8888
THIRD ANGLE PROJECTION

Rev.	Drawing Sheet No.	yes no Part List	See technical modification report No.	Day	Name

TAKRAF
TENOVA

Project Number:
AC0339

Drawing Number: 49055232
BG: 4112

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
0	FIRST ISSUE	RGF	ASM	JMD	08-03-17

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CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE		
DRAWN	RGF	R. Fyer	08	03	17
CHECKED	ASM		10	03	17
MECHANICAL	JMD		13	03	17
PROJECT ENG.	DWB		17	03	17
PROJECT MAN.	D.STARK		17	03	17

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG.			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH
NAME RICHARD WOOD
DATE 17 03 17
SIGNATURE RJWood.
REG. NUMBER 70386304
SCALE :
A1

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TEL: 021 940 1999
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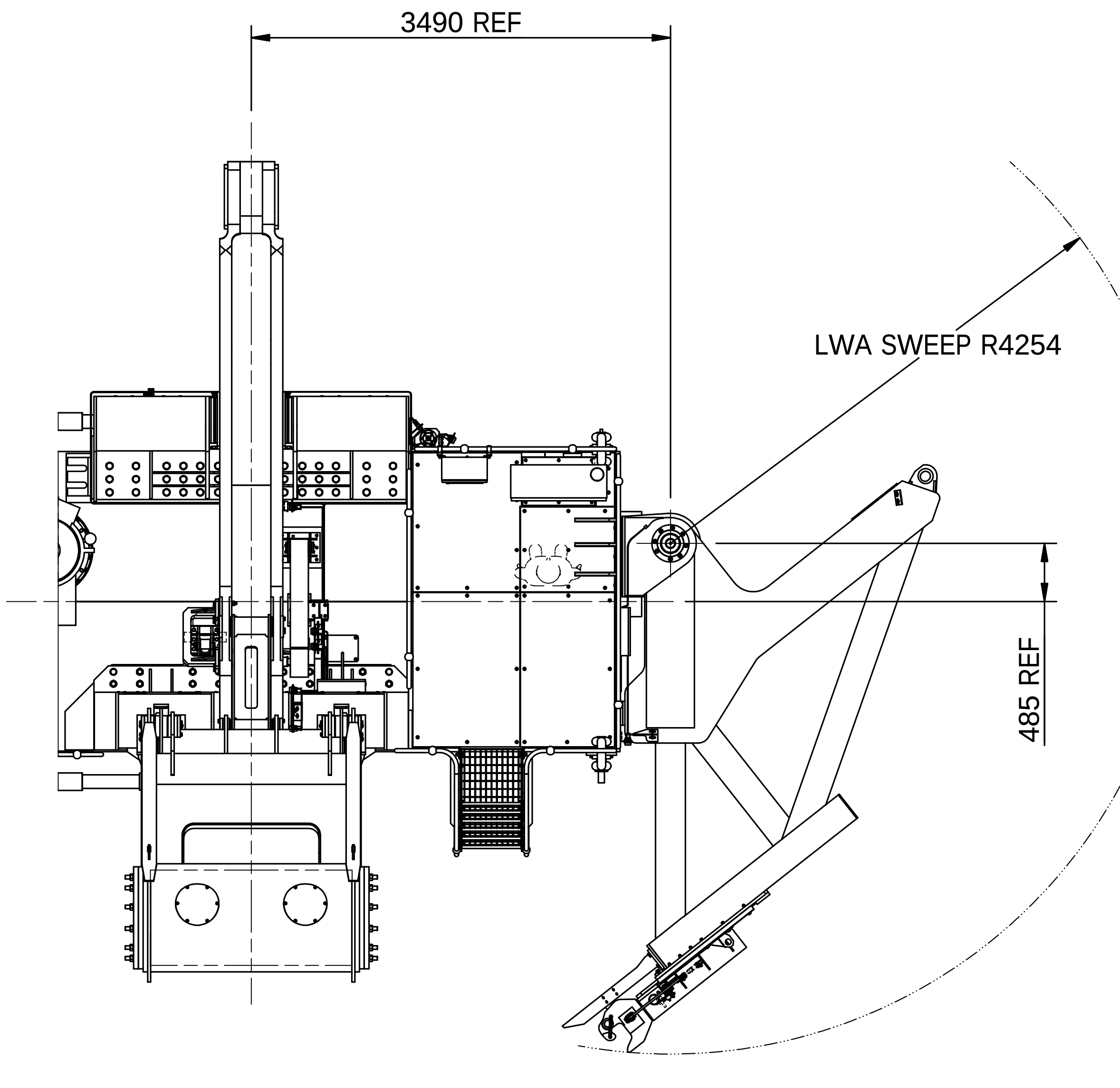
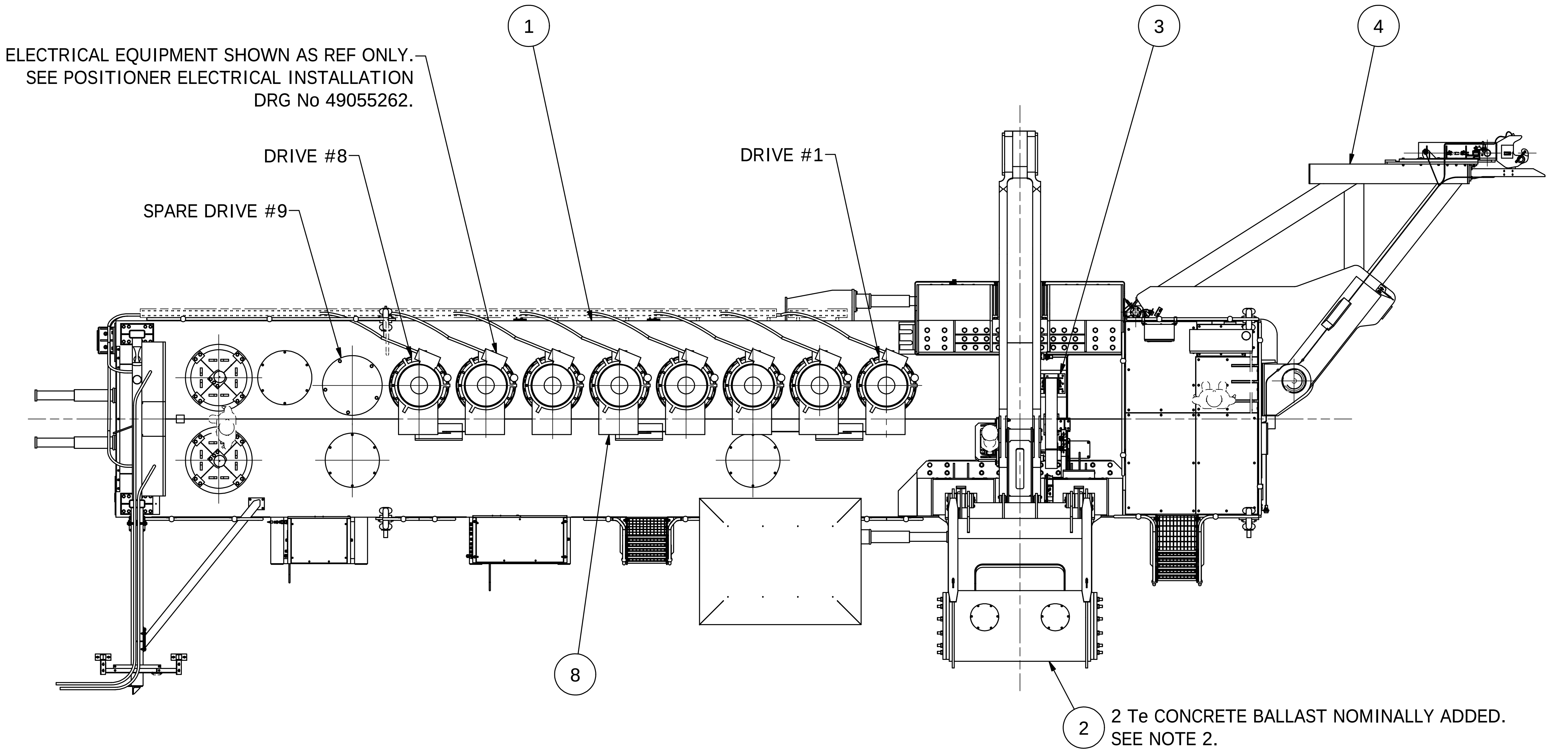
TRANSNET

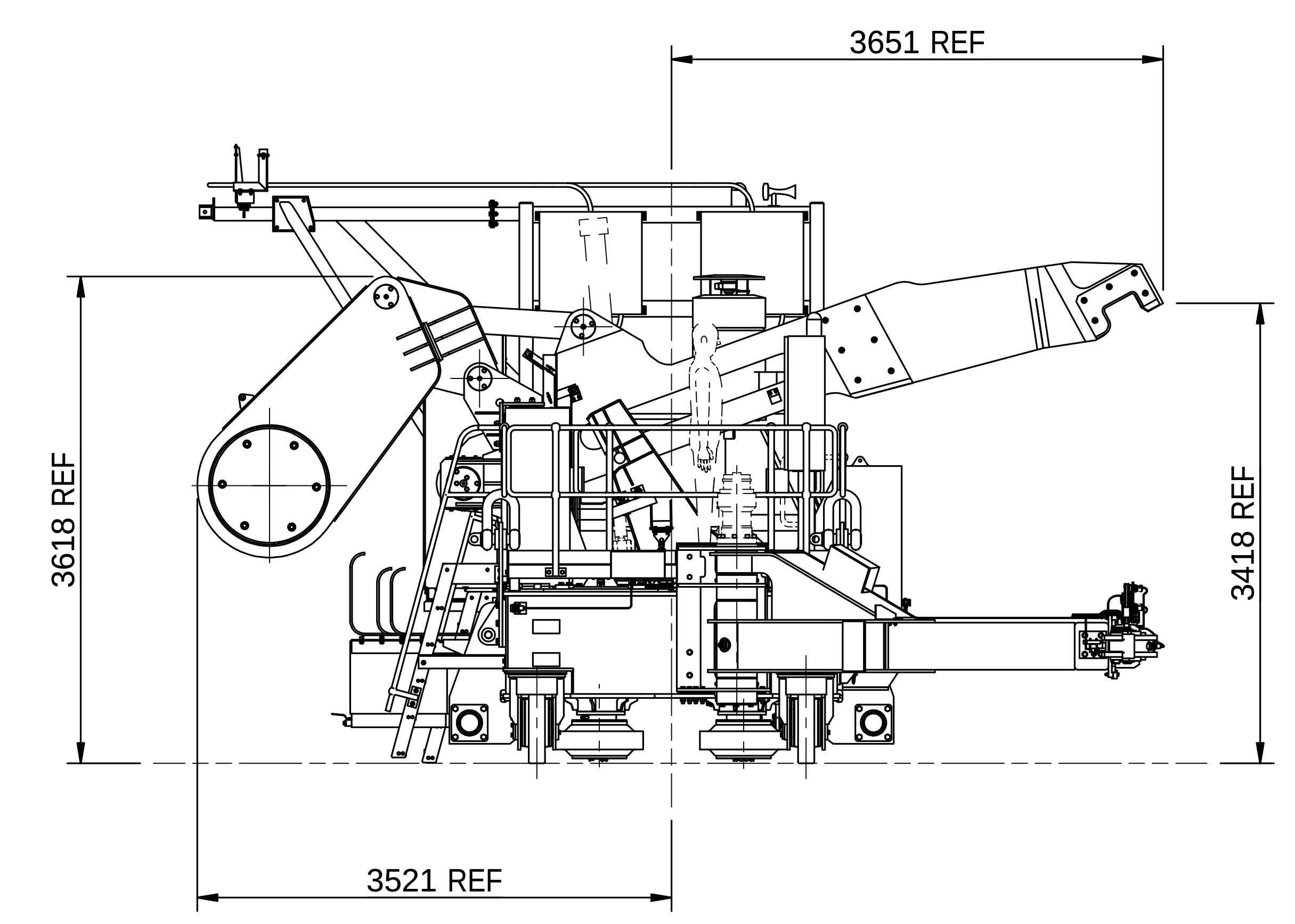
PORT OF SALDANHA
IRON ORE TIPPLER 3
ASSEMBLY OF SUPPORT ROLLERS

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
XXXXXXX	X	XXX	X	XX	000X	2	0	JV

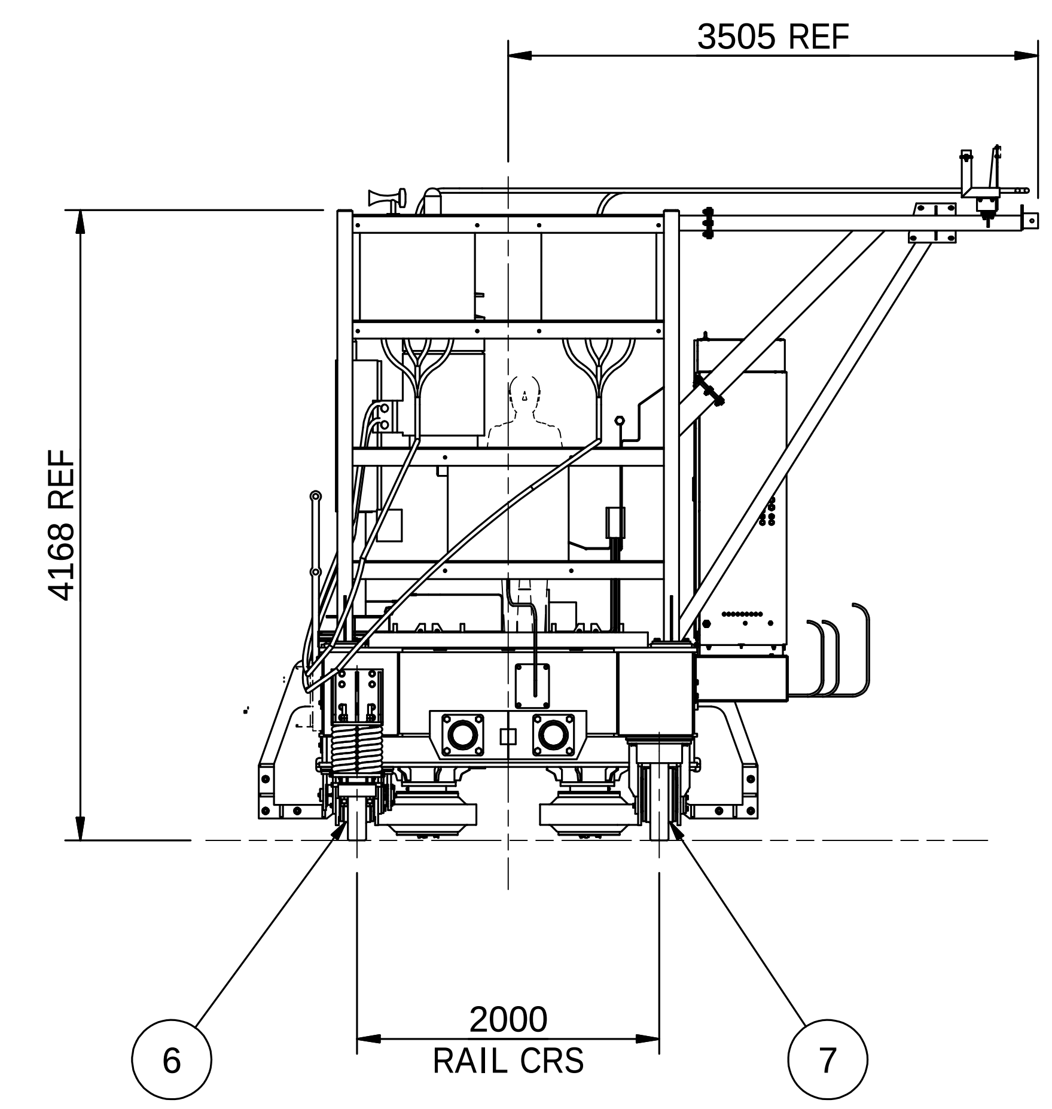


VIEW SHOWING LWA RETRACTED

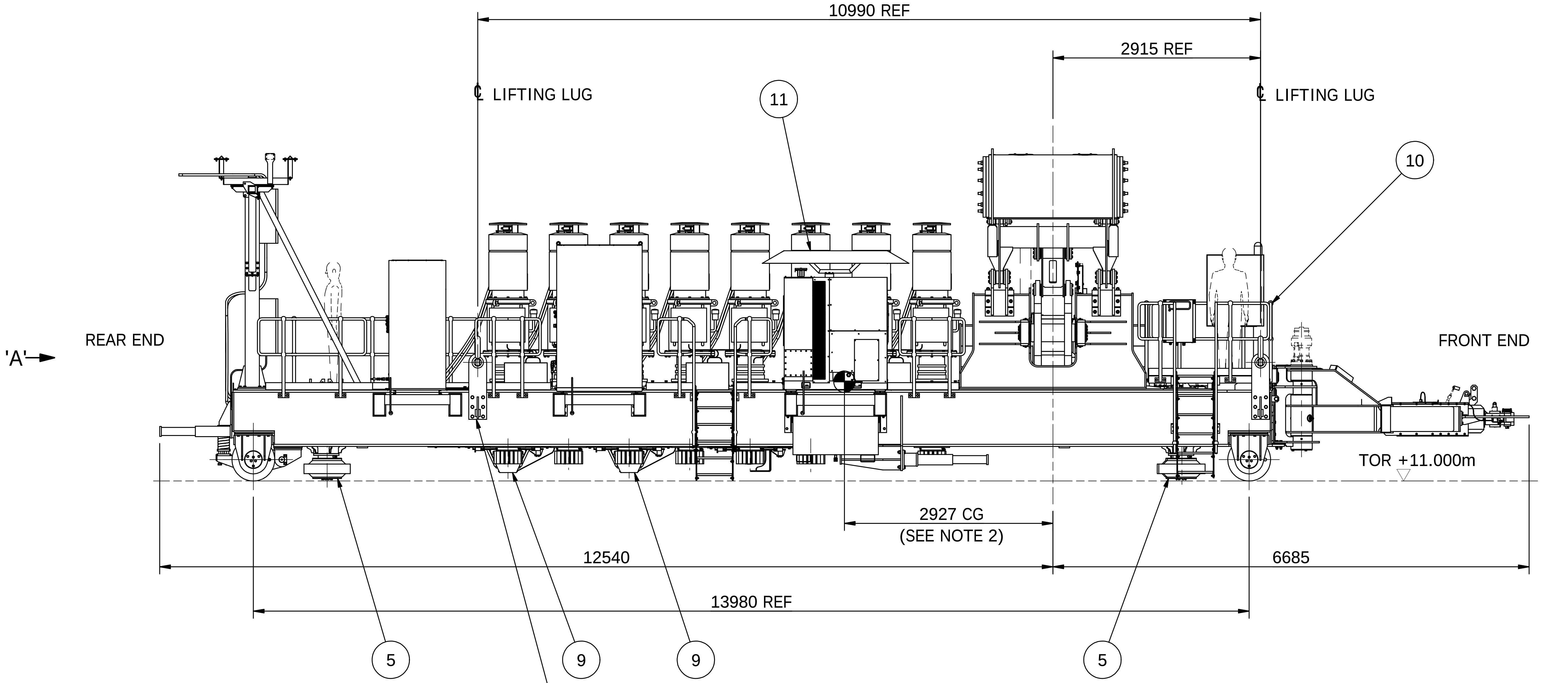




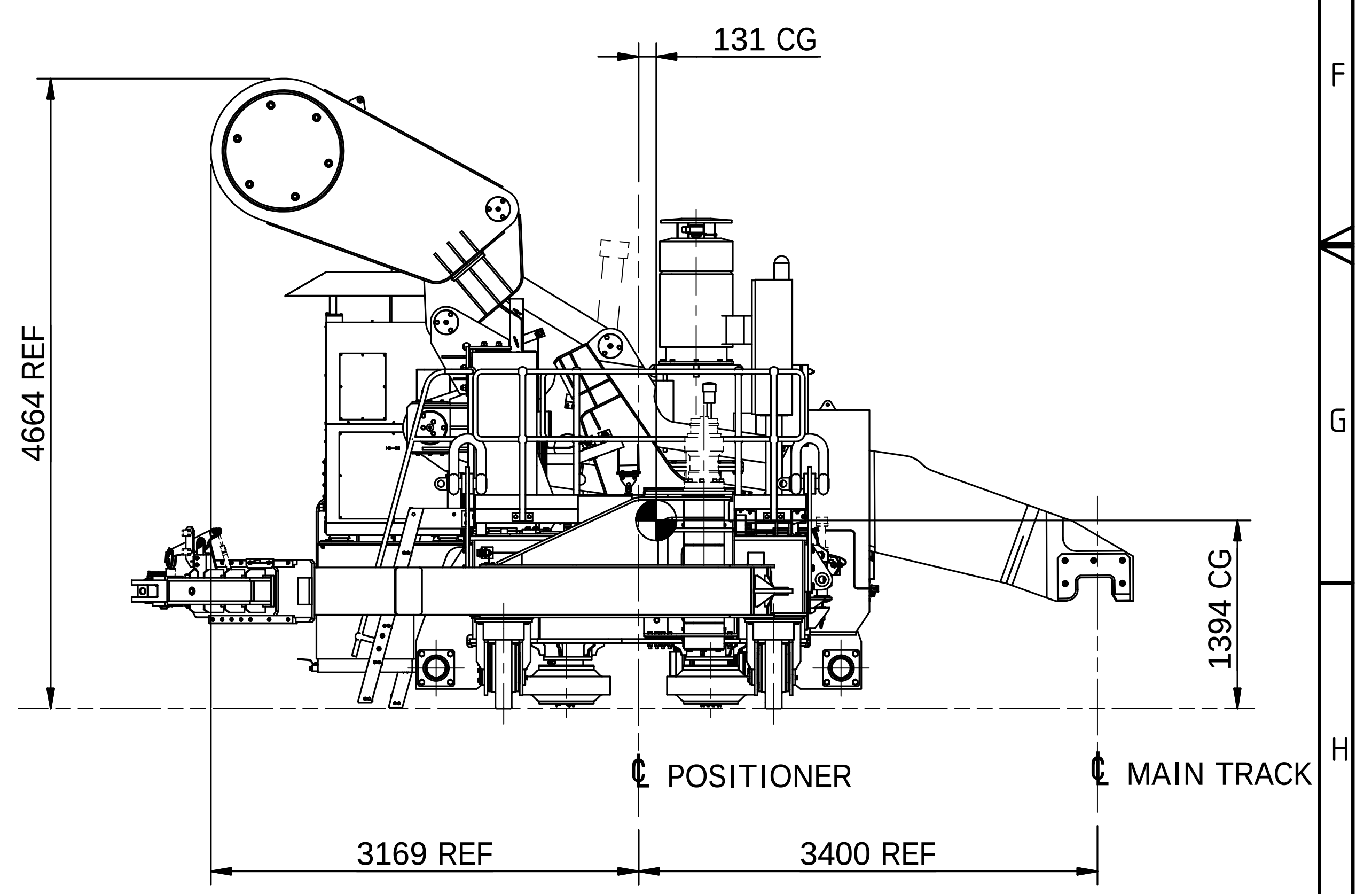
VIEW SHOWING ARM RAISED TO CLEAR WAGON
(WITH LAST WAGON ARM EXTENDED)



VIEW ON ARROW 'A'



TEMPORARY LIFTING BRACKETS FOR
USE WHEN LIFTING ASSEMBLED POSITIONER.
REMOVE WHEN NOT IN USE.
NOTE: SOME HANDRAILING
REQUIRES REMOVING FOR VERTICAL LIFT.
(SEE SHEET 5 FOR LIFTING REQUIREMENTS).



VIEW SHOWING ARM LOWERED
(WITH LAST WAGON ARM RETRACTED
& TOWING ARM REMOVED FOR CLARITY)

NOTES:

1. ASSEMBLE, ALIGN & PROTECT FOR SHIPMENT IN ACCORDANCE WITH:
   - THIS DRAWING INCLUDING SHOP INSTALLATION PROCEDURE
   - MECHANICAL SHOP ASSEMBLY & INSPECTION PROCEDURE
   - MECHANICAL SITE ASSEMBLY & INSTALLATION PROCEDURE
   - QUALITY ASSURANCE INSPECTION PROCEDURE
   - CONTRACT MANUFACTURING SPECIFICATION
   - PACKING, TRANSPORT & SHIPPING PROCEDURE
2. MASS AS SHOWN = 77020 kg
   ELECTRICS = 5783 kg
   CONCRETE BALLAST = 2000 kg

   TOTAL MASS = 84803 kg

   CG SHOWN FOR TOTAL MASS.

TAKRAF TENOVA REVIEW LABEL

Discipline	Discipline Engineer		Date yyyy-mm-dd
	Name	Signature	

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES: 1. DO NOT SCALE DRAWING - ONLY DIMENSIONS SHOWN TO BE USED.
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DIMENSIONS IN MILLIMETERS & DEGREES.
GENERAL MANUFACTURING TOLERANCES
UNLESS STATED OTHERWISE (PLUS OR MINUS)

RANGE	MACH	FAB	CAST
0-500	0.25	2	2
501-1000	0.5	3	4
1001-2000	1.0	4	6
ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

UNLESS OTHERWISE SPECIFIED IDENTIFY THE ITEM WITH THE DRAWING NUMBER AND ISSUE LEVEL AT ▼ AND IN THE MANNER SHOWN.

MASS.	SEE NOTE 2
MATERIAL.	
SPEC.	
NOTES.	

DRAWN TO BS 8888
THIRD ANGLE PROJECTION

Rev.	Drawing Sheet No.	yes Part List	no	See technical modification report No.	Day	Name

TAKRAF TENOVA

Project Number:
AC0339

Drawing Number: 49055245
BG: 2100

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	SEE SHEETS 6 - 9	EMD	RCJ	JMD	19-02-19
0	FIRST ISSUE	RCJ	RHW	JMD	26-06-18

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE		
DRAWN	RCJ	R. Jackson	04	06	18
CHECKED	RHW	RHWood.	25	06	18
MECHANICAL	JMD		26	06	18
PROJECT ENG.	ASM		26	06	18
PROJECT MAN.	D.STARK		26	06	18

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH
NAME RICHARD WOOD
DATE 26 06 18
SIGNATURE RHWood.
REG. NUMBER 70386304
SCALE : 1:50
A1

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PORT OF SALDANHA
IRON ORE TIPPLER 3
ASSEMBLY OF TRAIN POSITIONER
SHEET 1 OF 9

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0046	1	1	JV

ISOMETRIC VIEW
SHOWING POSITIONER IN 'FORWARD' MODE
WITH ARM RAISED & LWA ENGAGED
LOOKING FROM TRACK SIDE

ISOMETRIC VIEW
SHOWING POSITIONER IN 'NORMAL' MODE
WITH ARM LOWERED & LWA RETRACTED
LOOKING FROM LAND SIDE

TAKRAF TENOVA

REVIEW LABEL

Discipline	Discipline Engineer Name	Signature	Date yyyy-mm-dd

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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MASS.	SEE SHEET 1
MATERIAL.	
SPEC.	
NOTES.	

DRAWN TO BS 8888

THIRD ANGLE PROJECTION

Rev.	Drawing Sheet No.	yes / no Part List	See technical modification report No.	Day	Name

TAKRAF TENOVA

Project Number:
AC0339

Drawing Number: 49055245

BG: 2100

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1	SEE SHEETS 6 - 9	EMD	RCJ	JMD	19-02-19
0	FIRST ISSUE	RCJ	RHW	JMD	26-06-18

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PROJECT ENG.	ASM		26	06	18
PROJECT MAN.	D.STARK		26	06	18

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME RICHARD WOOD — DATE
SIGNATURE R.H.Wood. — 26 06 18
REG. NUMBER 70386304
SCALE : 1:30 — A1

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TRANSNET

PORT OF SALDANHA

IRON ORE TIPPLER 3

ASSEMBLY OF TRAIN POSITIONER

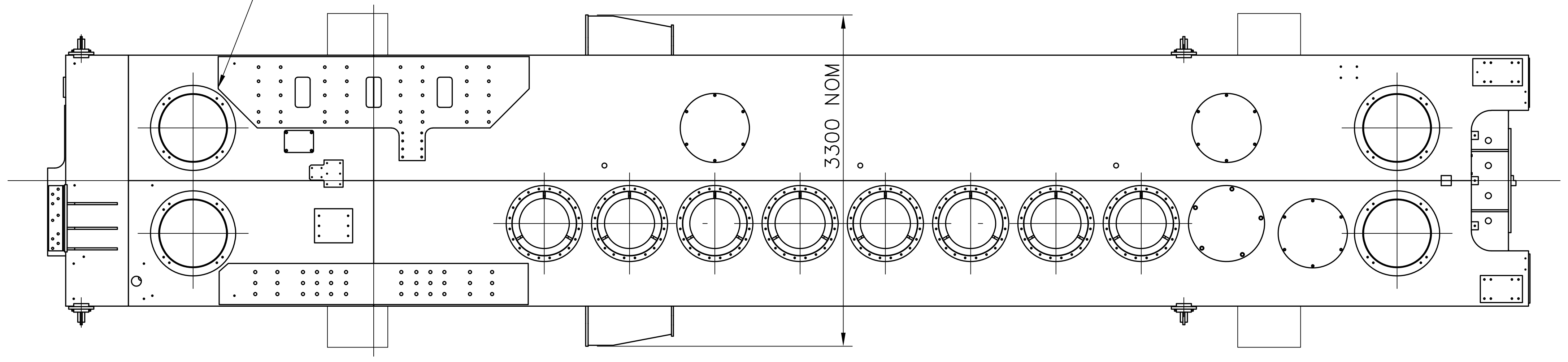
SHEET 2 OF 9

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0046	2	1	JV

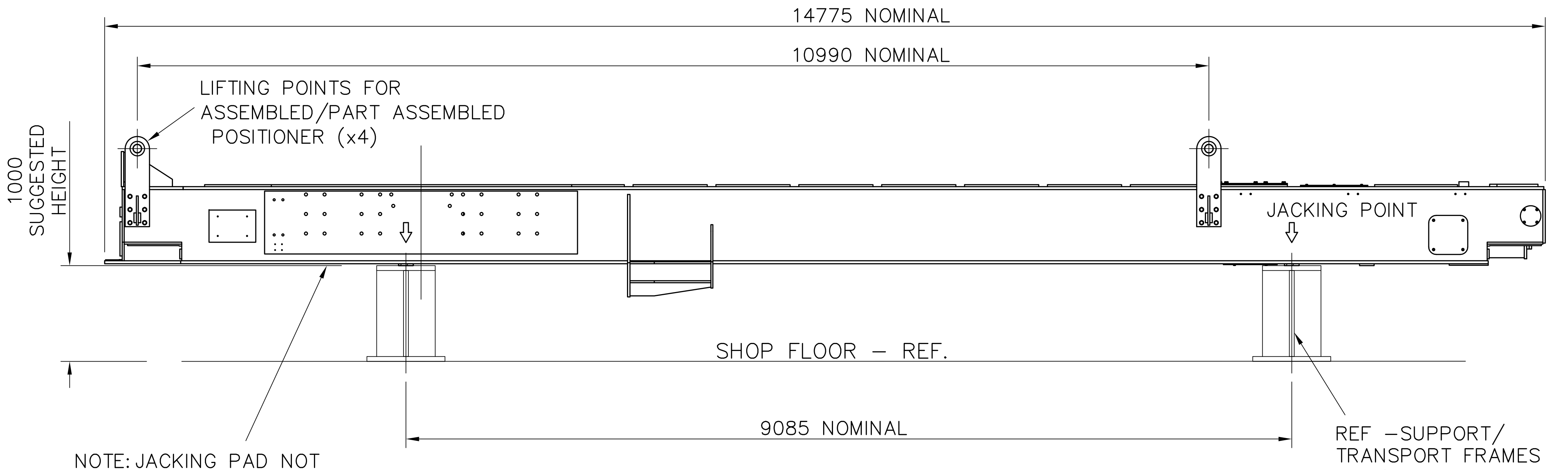
SHOP ASSEMBLY PROCEDURE

Ⓐ

MACHINED TOP DATUM (GUIDE ROLLER/DRIVE CARTRIDGE MOUNTING SURFACES) – LEVEL IN ALL HORIZONTAL PLANES



PLAN VIEW



LIFTING POINTS FOR ASSEMBLED/PART ASSEMBLED POSITIONER (x4)

NOTE: JACKING PAD NOT USED TO ALLOW ROOM FOR GUIDE ROLLER

REF –SUPPORT/ TRANSPORT FRAMES DESIGN BY OTHERS LOCATE AT JACKING POINTS

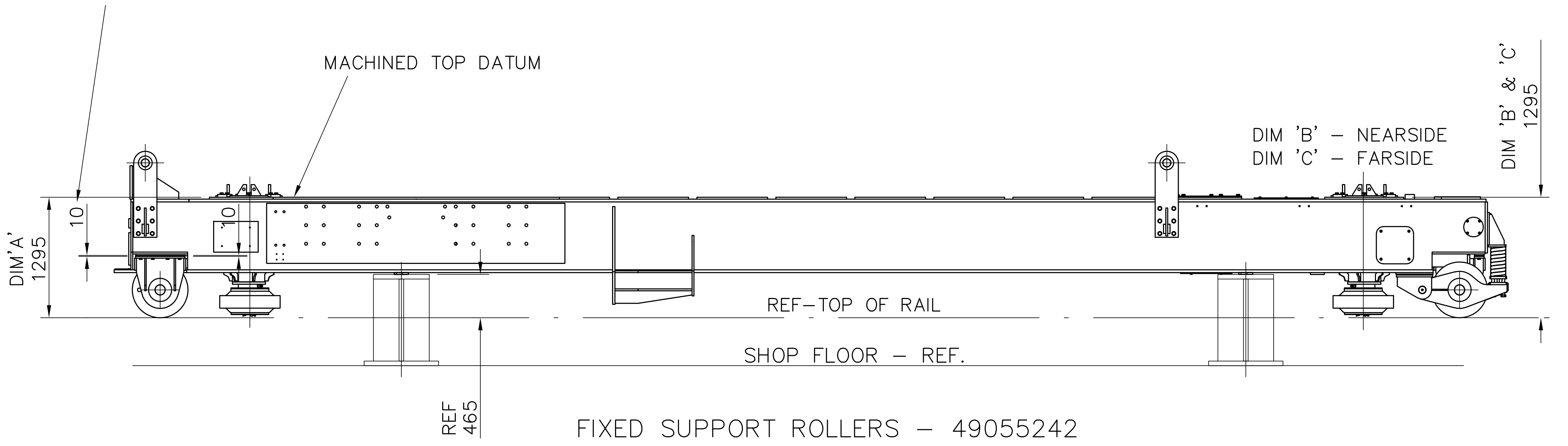
POSITIONER MAIN FRAME SUPPORT & LEVELLING

Ⓑ

TABLE 1 - INSTALLATION & ALIGNMENT RECORD		
DIMENSION	DRAWING	RECORDED DIMENSION
A	1295	
B	1295	
C	1295	

ADJUST 10 THK NOM PACKING SET TO ACHIEVE DIMN SHOWN FROM MACHINED TOP DATUM TO UNDERSIDE OF FIXED ROLLER – TYPICAL ALL FIXED SUPPORT ROLLERS.
NOTE; ALL UNUSED PACKING TO BE RETAINED & TAKEN TO SITE FOR POSSIBLE ADDITIONAL SITE ADJUSTMENT.

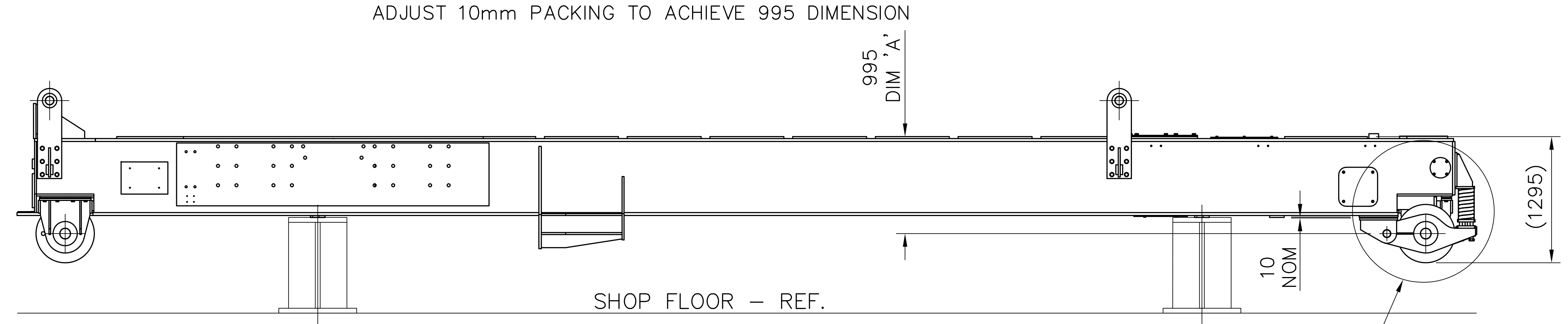
MACHINED TOP DATUM

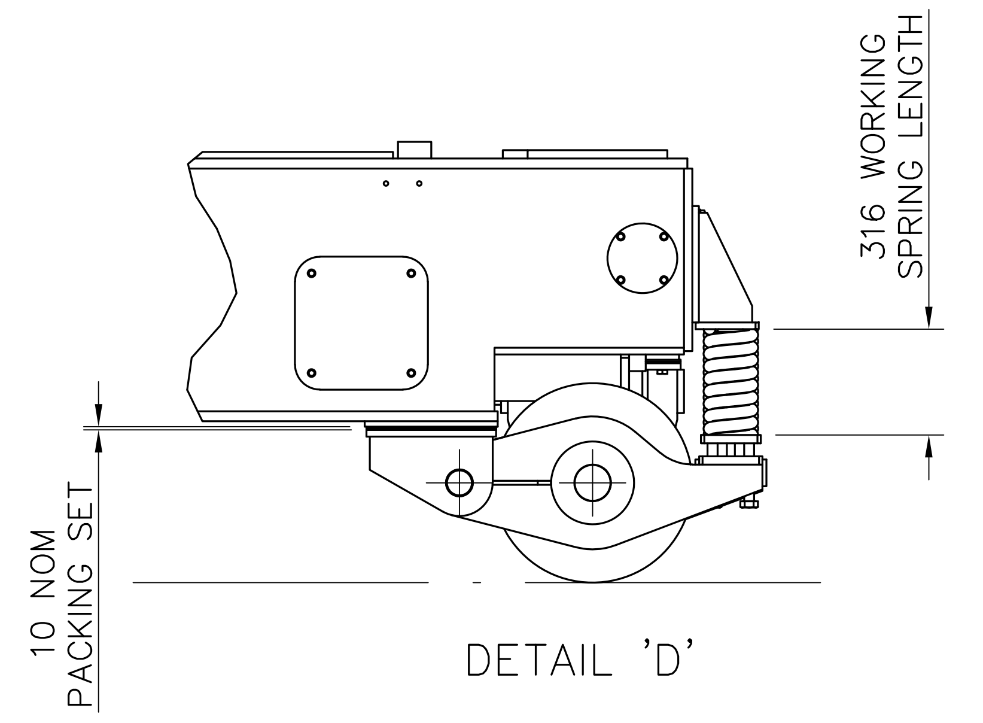


FIXED SUPPORT ROLLERS – 49055242

Ⓒ

REFER TO DRAWING 49055241 FOR ROLLER ASSEMBLY
ADJUST 10mm PACKING TO ACHIEVE 995 DIMENSION





DETAIL 'D'

SPRUNG SUPPORT ROLLERS – 49055241

TABLE 2 - INSTALLATION & ALIGNMENT RECORD		
DIMENSION	DRAWING	RECORDED DIMENSION
A	995	

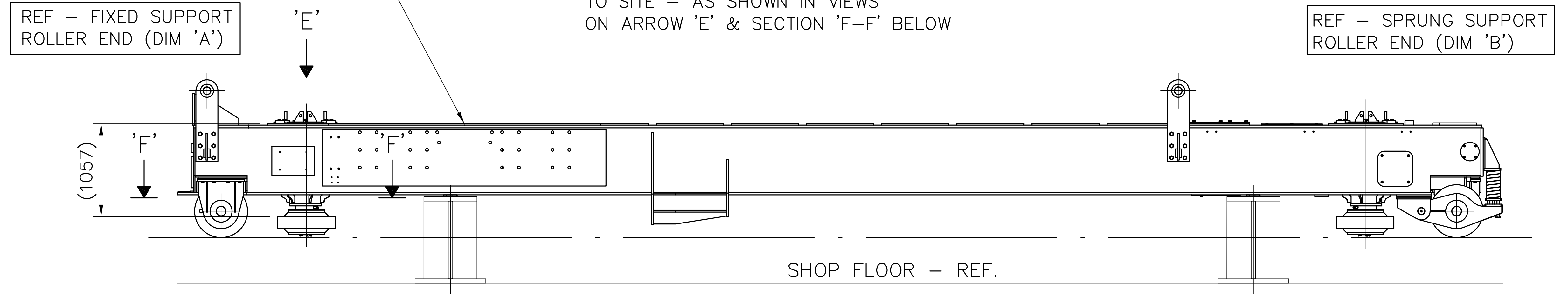
Ⓓ

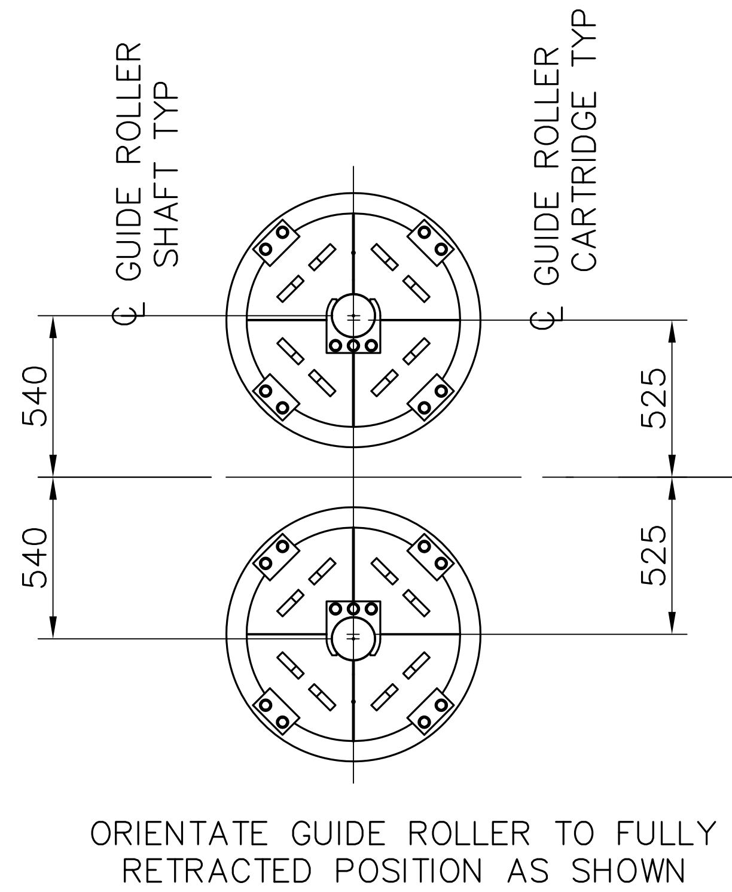
MACHINED TOP DATUM

GUIDE ROLLERS ON THE NON-DRIVE SIDE TO BE IN RETRACTED POSITION FOR SHIPPING TO SITE – AS SHOWN IN VIEWS ON ARROW 'E' & SECTION 'F-F' BELOW

REF – FIXED SUPPORT ROLLER END (DIM 'A')

REF – SPRUNG SUPPORT ROLLER END (DIM 'B')





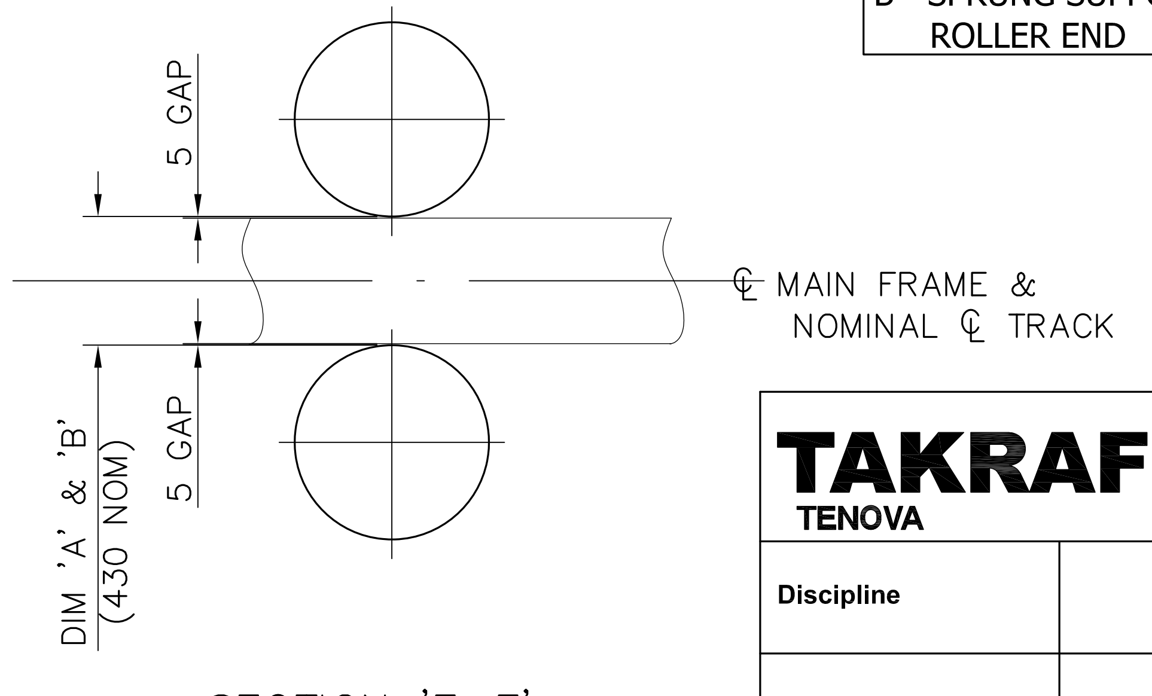
ORIENTATE GUIDE ROLLER TO FULLY RETRACTED POSITION AS SHOWN

VIEW ON ARROW 'E'
TYPICAL BOTH ENDS

NON–DRIVE SIDE

DRIVE SIDE

NOTE:
5mm GAPS BETWEEN GUIDE ROLLERS & REACTION BAR IN FULL RETRACTED POSITION – DRIVE & NON-DRIVE SIDES



SECTION 'F–F'
TYPICAL BOTH ENDS

TABLE 3 - INSTALLATION & ALIGNMENT RECORD		
DIMENSION	DRAWING	RECORDED DIMENSION
A - FIXED SUPPORT ROLLER END	430	
B - SPRUNG SUPPORT ROLLER END	430	

GUIDE ROLLERS – 49055240

TAKRAF TENOVA

REVIEW LABEL

Discipline	Discipline Engineer		Date yyyy-mm-dd
	Name	Signature	

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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501-1000	0.5	3	4
1001-2000	1.0	4	6
ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

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MASS: SEE SHEET 1
MATERIAL:
SPEC.:
NOTES:

DRAWN TO BS 8888
THIRD ANGLE PROJECTION

Rev.	Drawing Sheet No.	yes / no Part List	See technical modification report No.	Day	Name

TAKRAF TENOVA

Project Number: AC0339

Drawing Number: 49055245
BG: 2100

NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	SEE SHEETS 6 - 9	EMD	RCJ	JMD	19-02-19
0	FIRST ISSUE	RCJ	RHW	JMD	26-06-18

REVISIONS

CONTRACTOR / CONSULTANT

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CHECKED	RHW	RJWood	25 06 18
MECHANICAL	JMD		26 06 18
PROJECT ENG.	ASM		26 06 18
PROJECT MAN.	D.STARK		26 06 18

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG.			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH
NAME: RICHARD WOOD
SIGNATURE: RJWood — DATE: 26 06 18
REG. NUMBER: 70386304
SCALE: 1:50 UOS
A1

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TRANSNET

PORT OF SALDANHA
IRON ORE TIPPLER 3
ASSEMBLY OF TRAIN POSITIONER
SHEET 3 OF 9

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0046	3	1	JV

Ⓔ SHOP ASSEMBLY PROCEDURE

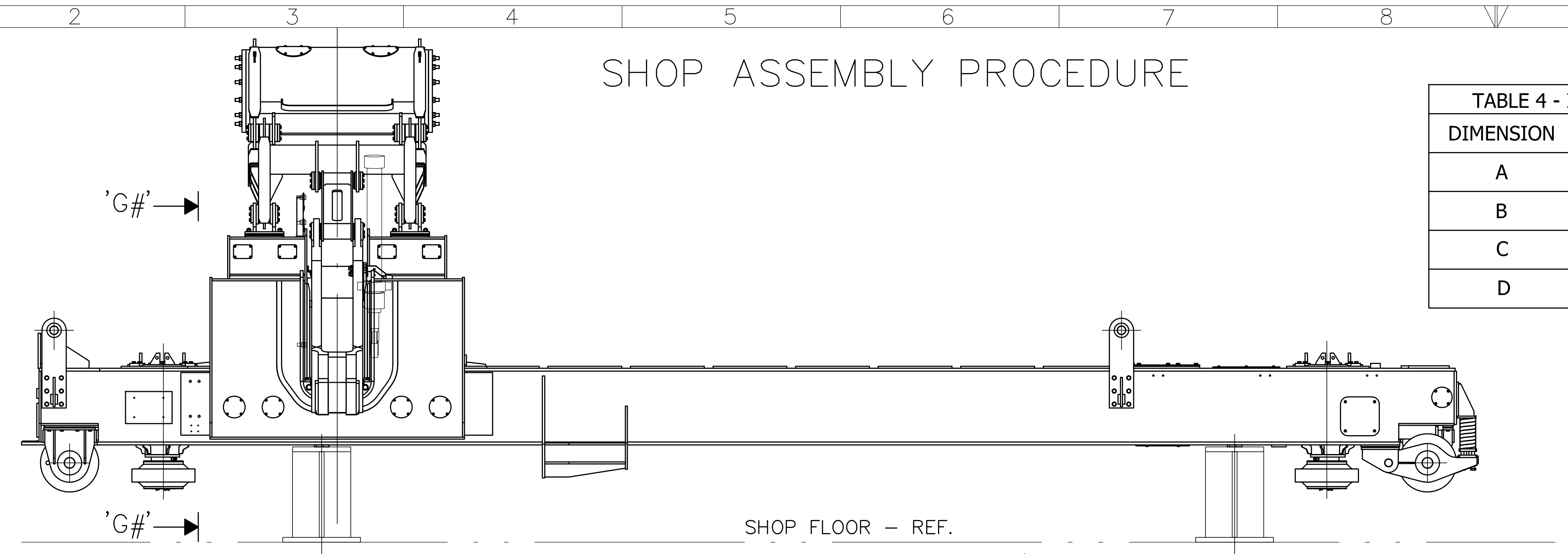
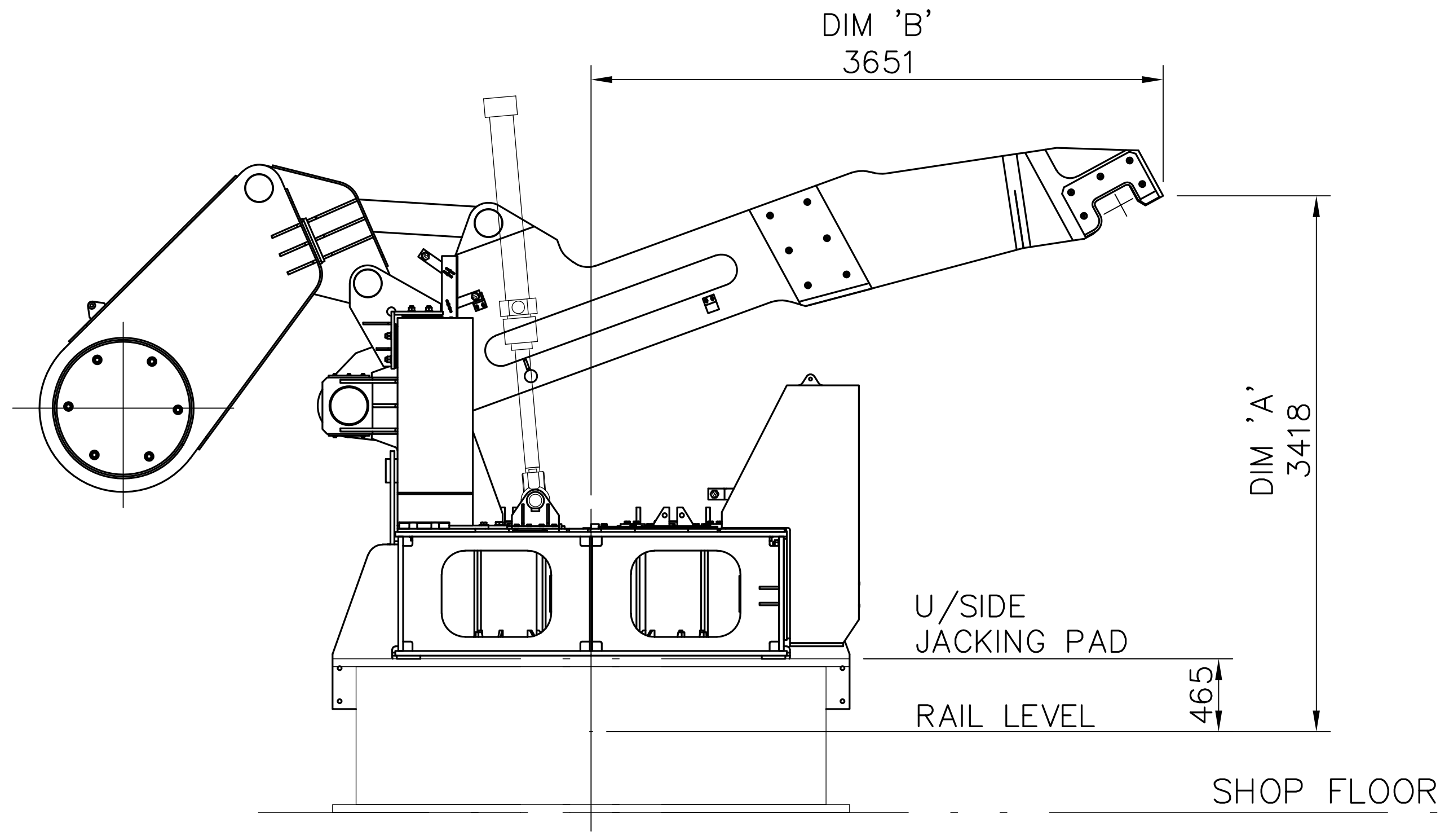
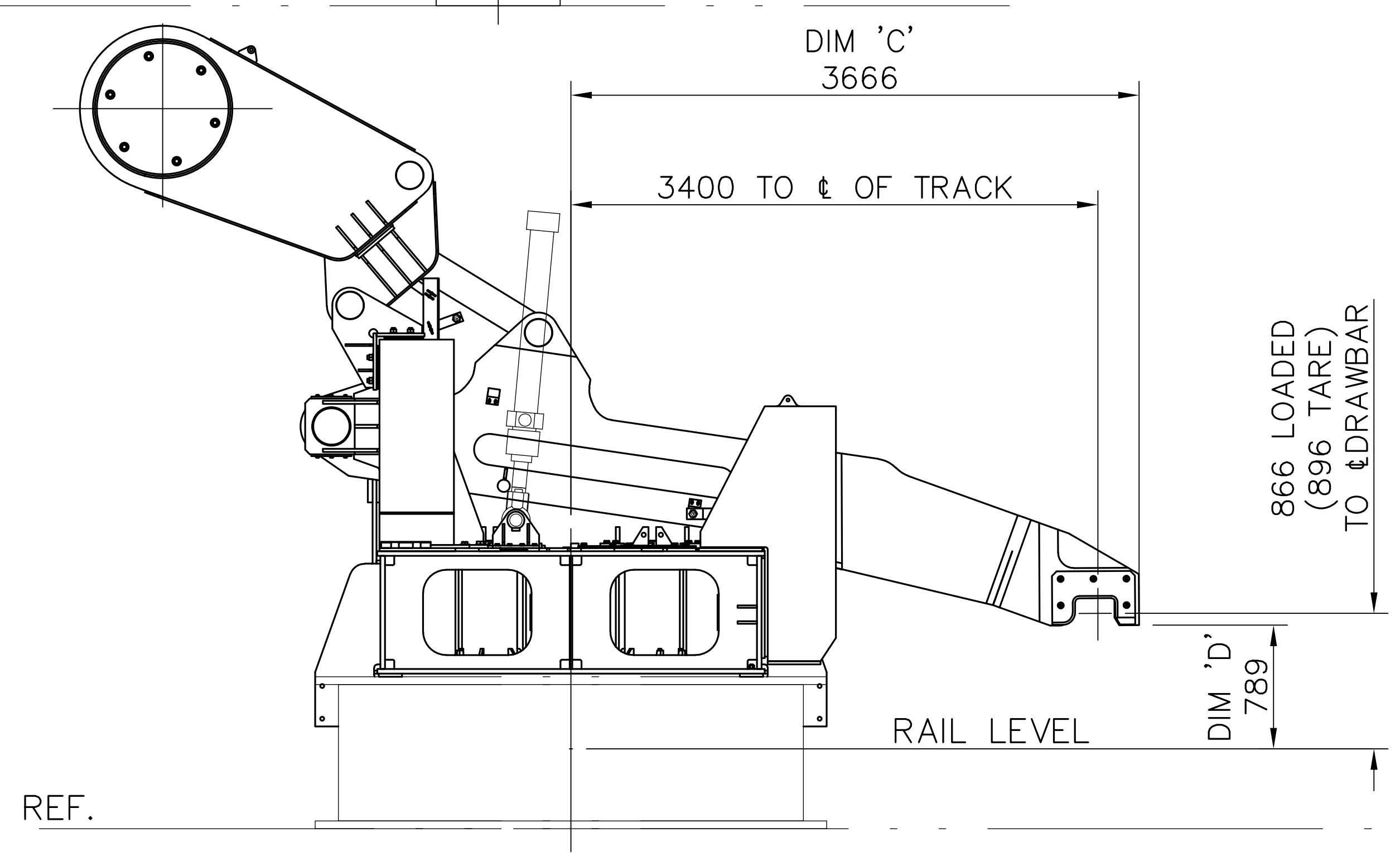


TABLE 4 - INSTALLATION & ALIGNMENT RECORD		
DIMENSION	DRAWING	RECORDED DIMENSION
A	3418	
B	3651	
C	3666	
D	789	



SECTION 'G1–G1'

POSITIONER ARM – RAISED

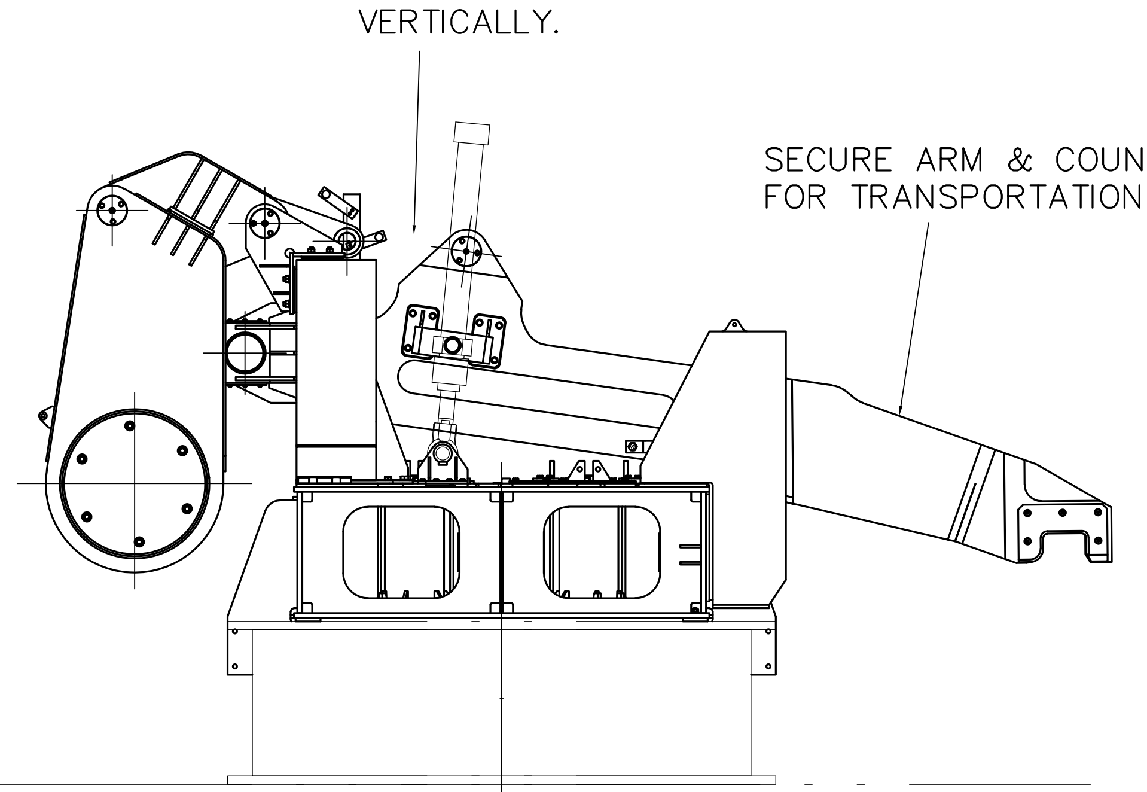


SECTION 'G2–G2'

POSITIONER ARM – LOWERED

REMOVE THIS LINK (DRG No 59057811) TO ALLOW COUNTERWEIGHT TO HANG VERTICALLY.

SECURE ARM & COUNTERWEIGHT FOR TRANSPORTATION.

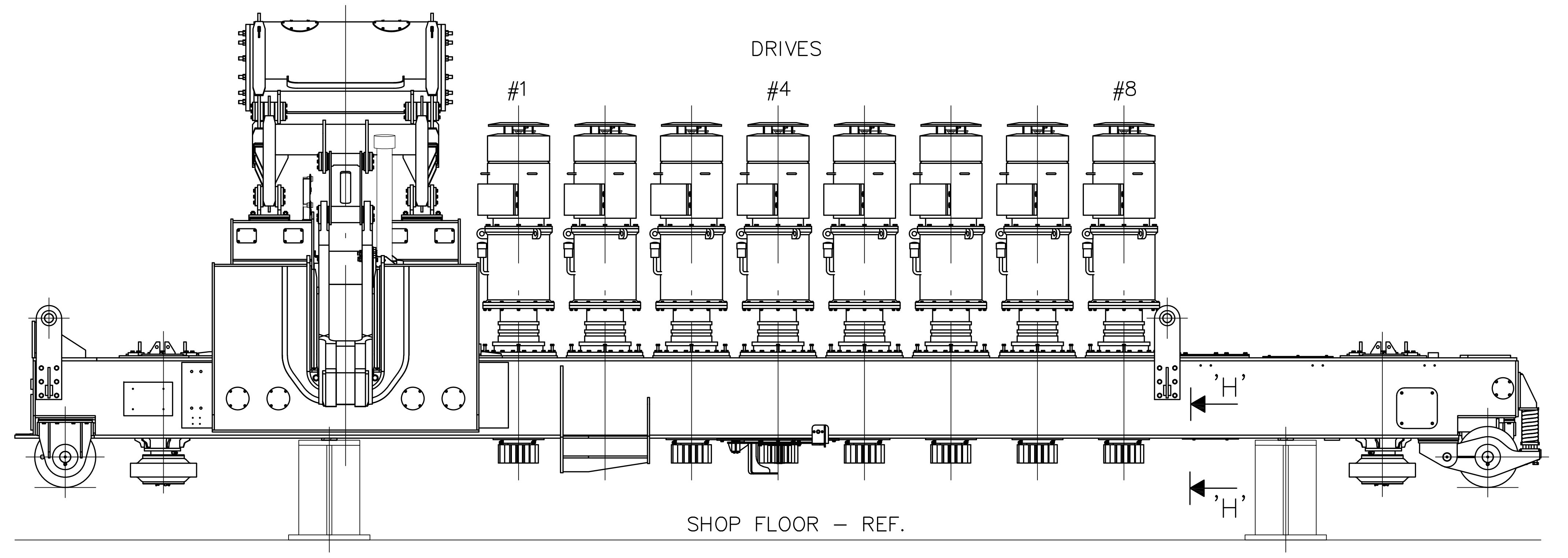


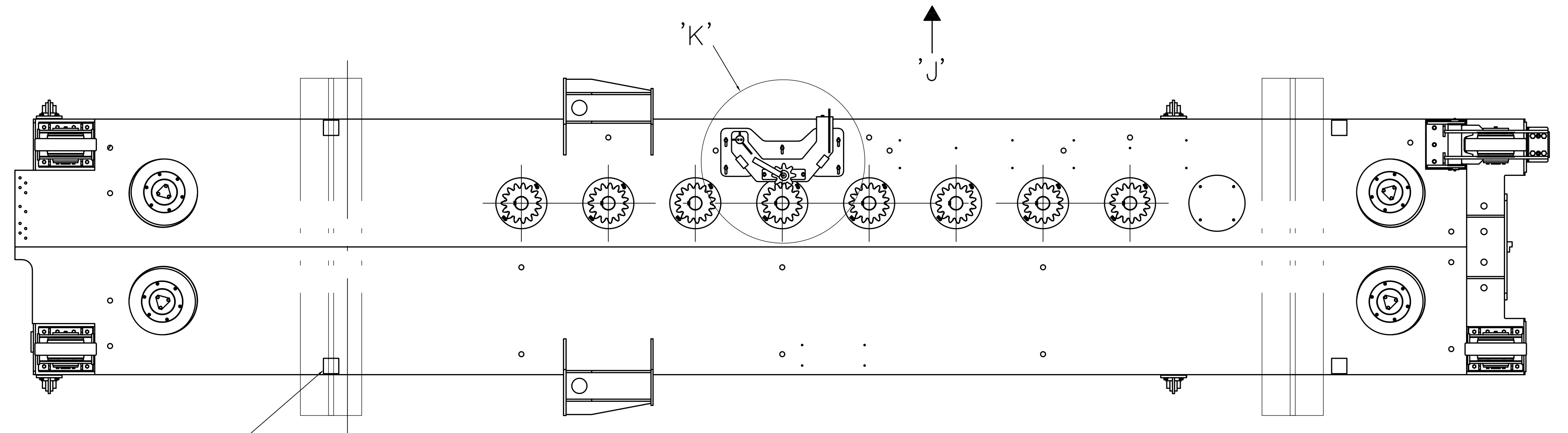
SECTION 'G3–G3'

POSITIONER ARM & COUNTERWEIGHT
IN TRANSPORTATION MODE

POSITIONER ARM – 49055247

Ⓕ



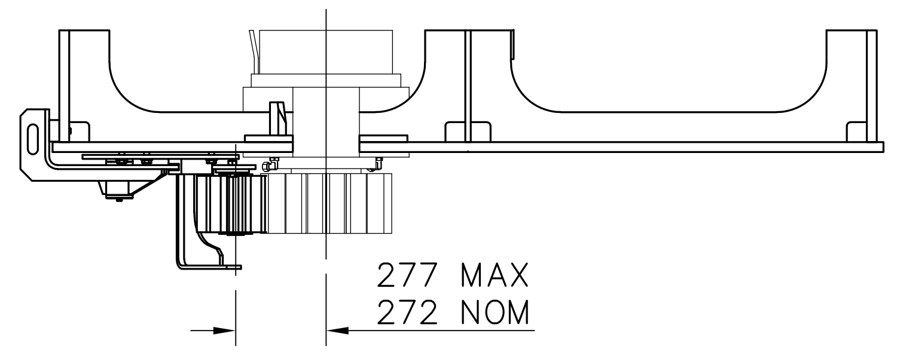


REF – JACKING PADS

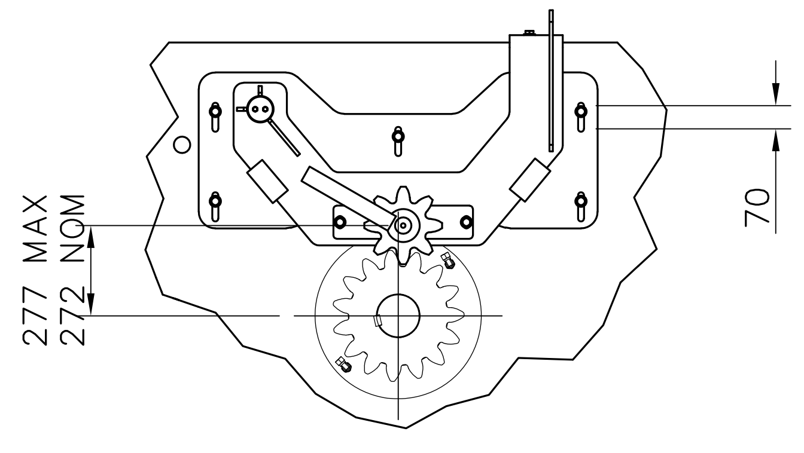
VIEW ON ARROW 'J'

LUBRICATION MODULE – 49055252 / 49055296

NOMINAL 272mm CENTRES, LUBRICATION PINION TO DRIVE PINION USE 70mm SLOTS IN BRACKET TO ADJUST BACKLASH ACCORDINGLY TO ACHIEVE OPTIMUM MESHING – DO NOT EXCEED 277mm



PART SECTION 'H–H'



DETAIL 'K'

TAKRAF
TENOVA

TRANSNET

Discipline	REVIEW LABEL Discipline Engineer Name	 Signature	Date yyyy-mm-dd

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

MASS	SEE SHEET 1
MATERIAL	
SPEC.	
NOTES	

DRAWN TO BS 8888

THIRD ANGLE PROJECTION

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Rev.	Drawing Sheet No.	yes	no	See technical modification report No.	Day	Name

Part List

TAKRAF
TENOVA

Project Number:
AC0339

Drawing Number: 49055245
BG: 2100

NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	SEE SHEETS 6 - 9	EMD	RCJ	JMD	19-02-19
0	FIRST ISSUE	RCJ	RHW	JMD	26-06-18

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PROJECT MAN.	D.STARK		26	06	18

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG.			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME	RICHARD WOOD	DATE		
SIGNATURE	RJWood	26	06	18
REG. NUMBER	70386304			
SCALE :	1:45 UOS	A1		

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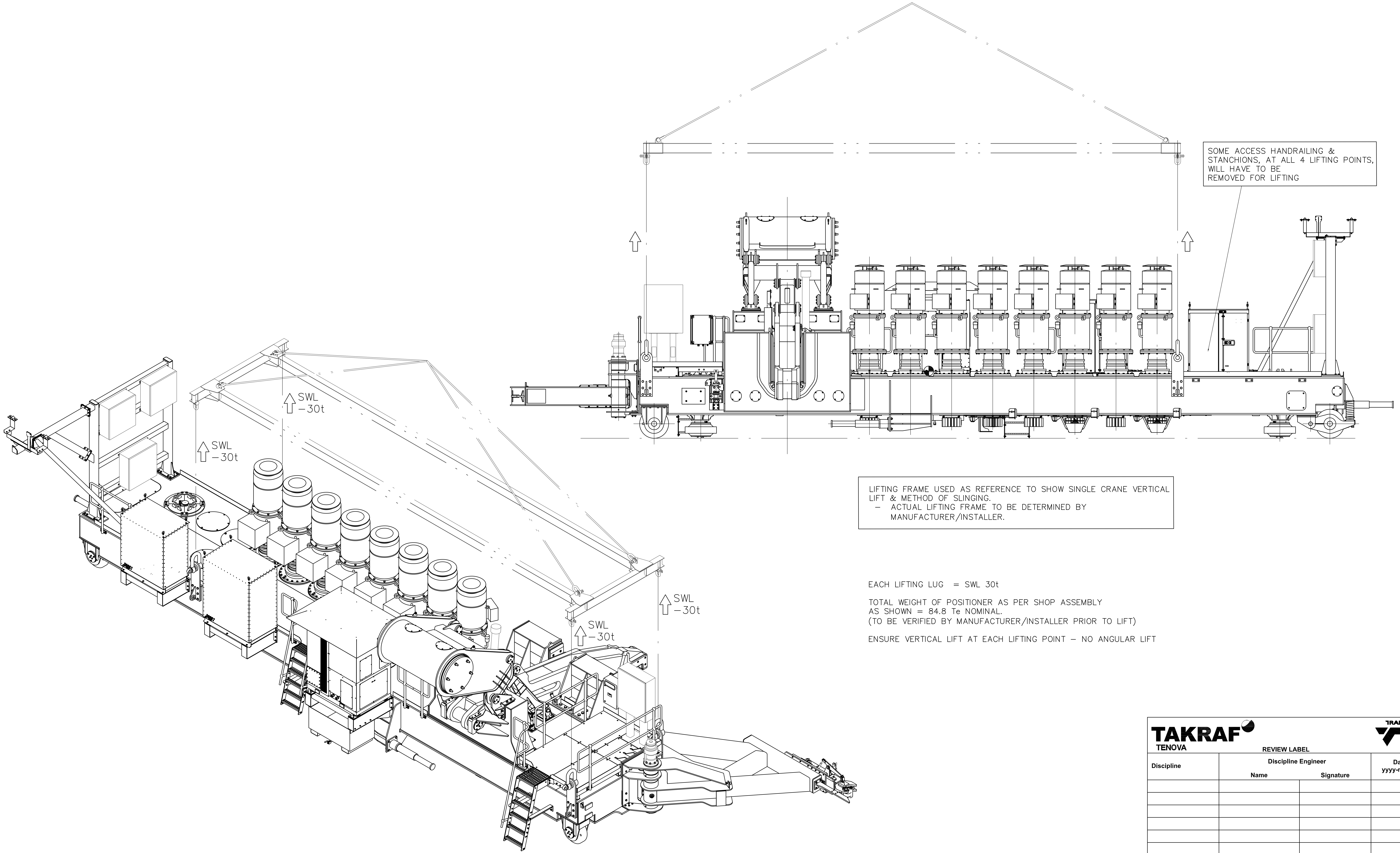
PORT OF SALDANHA

IRON ORE TIPPLER 3

ASSEMBLY OF TRAIN POSITIONER

SHEET 4 OF 9

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0046	4	1	JV



SOME ACCESS HANDRAILING & STANCHIONS, AT ALL 4 LIFTING POINTS, WILL HAVE TO BE REMOVED FOR LIFTING

LIFTING FRAME USED AS REFERENCE TO SHOW SINGLE CRANE VERTICAL LIFT & METHOD OF SLINGING.
- ACTUAL LIFTING FRAME TO BE DETERMINED BY MANUFACTURER/INSTALLER.

EACH LIFTING LUG = SWL 30t

TOTAL WEIGHT OF POSITIONER AS PER SHOP ASSEMBLY AS SHOWN = 84.8 Te NOMINAL.
(TO BE VERIFIED BY MANUFACTURER/INSTALLER PRIOR TO LIFT)

ENSURE VERTICAL LIFT AT EACH LIFTING POINT – NO ANGULAR LIFT

TAKRAF
TENOVA

REVIEW LABEL

Discipline	Discipline Engineer		Date yyyy-mm-dd
	Name	Signature	

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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DIMENSIONS IN MILLIMETERS & DEGREES.
GENERAL MANUFACTURING TOLERANCES
UNLESS STATED OTHERWISE (PLUS OR MINUS)

RANGE	MACH	FAB	CAST
0-500	0.25	2	2
501-1000	0.5	3	4
1001-2000	1.0	4	6
ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

MASS	SEE SHEET 1
MATERIAL	
SPEC.	
NOTES	

DRAWN TO BS 8888

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED IDENTIFY THE ITEM WITH THE DRAWING NUMBER AND ISSUE LEVEL AT ◊ AND IN THE MANNER SHOWN.

Rev.	Drawing Sheet No.	Part List yes	Part List no	See technical modification report No.	Day	Name

TAKRAF
TENOVA

Project Number:
AC0339

Drawing Number:
49055245

BG:
2100

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	SEE SHEETS 6 - 9	EMD	RCJ	JMD	19-02-19
0	FIRST ISSUE	RCJ	RHW	JMD	26-06-18

REVISIONS

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TITLE	NAME	SIGN	DATE		
DRAWN	RCJ	R. Jackson	04	06	18
CHECKED	RHW	RJ Wood	25	06	18
MECHANICAL	JMD		26	06	18
PROJECT ENG.	ASM		26	06	18
PROJECT MAN.	D.STARK		26	06	18

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG.			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME	RICHARD WOOD	DATE		
SIGNATURE	RJ Wood	26	06	18
REG. NUMBER	70386304			
SCALE :	1:60 UOS	A1		

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TRANSNET

PORT OF SALDANHA

IRON ORE TIPPLER 3

ASSEMBLY OF TRAIN POSITIONER

SHEET 5 OF 9

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0046	5	1	JV

SITE INSTALLATION PROCEDURE

(A) ASSEMBLING POSITIONER ONTO POSITIONER TRACK

POSITIONER TO BE INITIALLY LOCATED BETWEEN BUFFER STOPS CONVENIENT FOR CRANE LIFT WITH FORWARD END GUIDE ROLLER COINCIDENT WITH A TRACK MODULE CROSS MEMBER AS SHOWN.

POSITIONER TO BE INITIALLY LOCATED BETWEEN BUFFER STOPS CONVENIENT FOR CRANE LIFT WITH FORWARD END GUIDE ROLLER COINCIDENT WITH A TRACK MODULE CROSS MEMBER AS SHOWN.

REMOVE NON-DRIVE SIDE GUIDE ROLLERS PRIOR TO INSTALLING POSITIONER.

REMOVE A SINGLE RACK SEGMENT (INSTALLATION DATUM).

REMOVE 2 RACK SEGMENTS ADJACENT TO REAR

NOTE:

BOLTS FOR THE 3 RACK SECTIONS, ITEMS 7, 14 & 15 ON ASSEMBLIES 49055264/5/6, TO BE REMOVED & REPLACED WITH NEW ITEMS:

⑮⑯⑰

CHECK 430 DIMENSION 'A & 'B' AS SHOWN ON SHEET 3 ('D' GUIDE ROLLERS) TO ENSURE DRIVE SIDE GUIDE ROLLER IS IN CORRECT ORIENTATION.

REMOVE FORWARD & REAR NON-DRIVE SIDE GUIDE ROLLERS PRIOR TO INSTALLING POSITIONER.

TAKRAF
TENOVA

TRANSNET

REVIEW LABEL

Discipline	Discipline Engineer		Date yyyy-mm-dd
	Name	Signature	

REFERENCE DRAWINGS

DRAWING NO.	REFERENCE

NOTES:
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DIMENSIONS IN MILLIMETERS & DEGREES.
GENERAL MANUFACTURING TOLERANCES
UNLESS STATED OTHERWISE (PLUS OR MINUS)

RANGE	MACH	FAB	CAST
0-500	0.25	2	2
501-1000	0.5	3	4
1001-2000	1.0	4	6
ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

UNLESS OTHERWISE SPECIFIED IDENTIFY THE ITEM WITH THE DRAWING NUMBER AND ISSUE LEVEL AT ◆ AND IN THE MANNER SHOWN.

MASS	SEE SHEET 1
MATERIAL	
SPEC.	
NOTES	

DRAWN TO BS 8888

THIRD ANGLE PROJECTION

Rev.	Drawing Sheet No.	yes no Part List	See technical modification report No.	Day	Name

TAKRAF
TENOVA

Project Number:
AC0339

Drawing Number: 49055245
BG: 2100

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
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PROJECT MAN.	D.STARK		26	06	18

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG.			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME RICHARD WOOD
DATE 26 06 18
SIGNATURE RHWood
REG. NUMBER 70386304
SCALE : NTS
A1

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TRANSNET

PORT OF SALDANHA

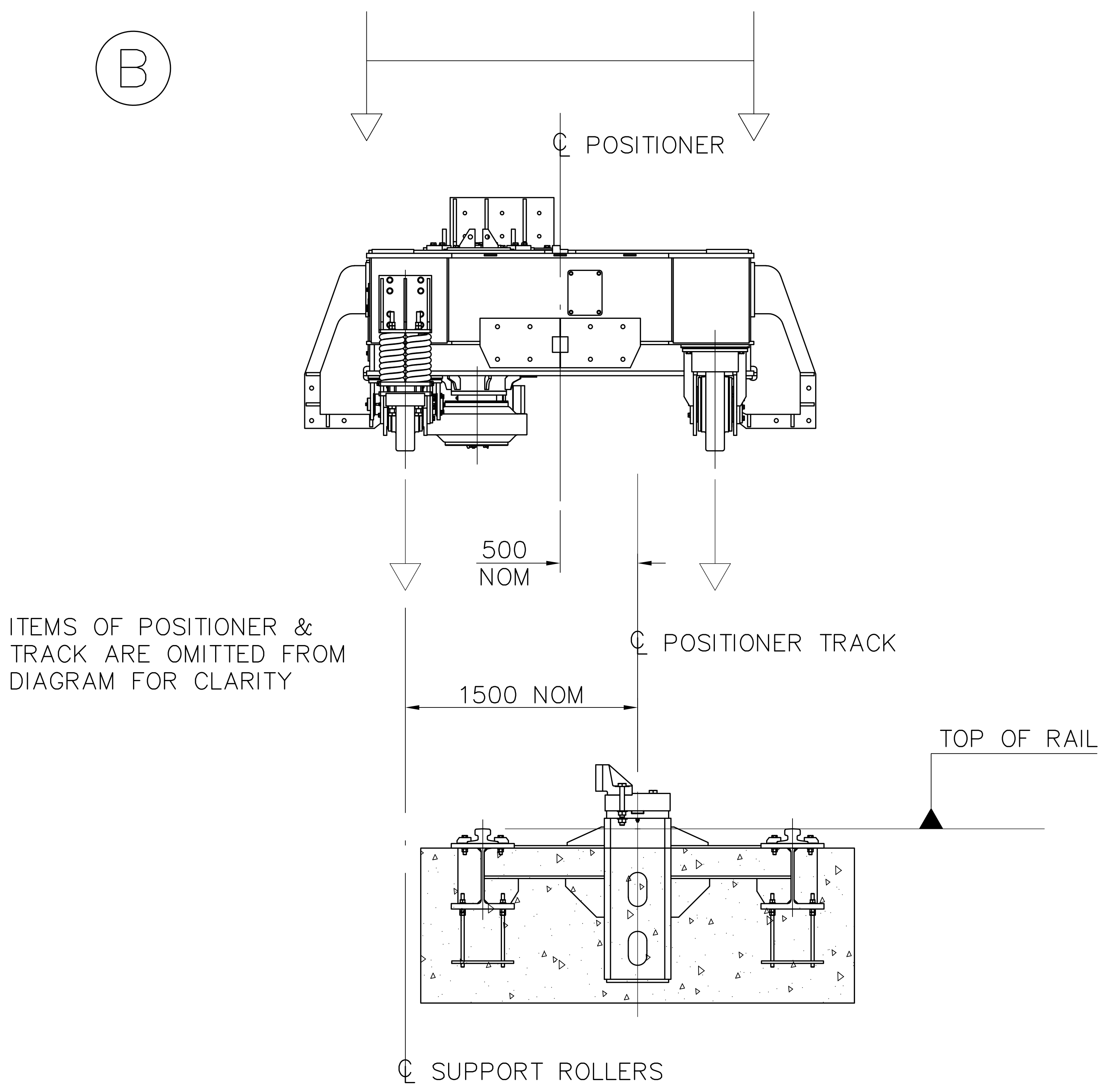
IRON ORE TIPPLER 3

ASSEMBLY OF TRAIN POSITIONER

SHEET 6 OF 9

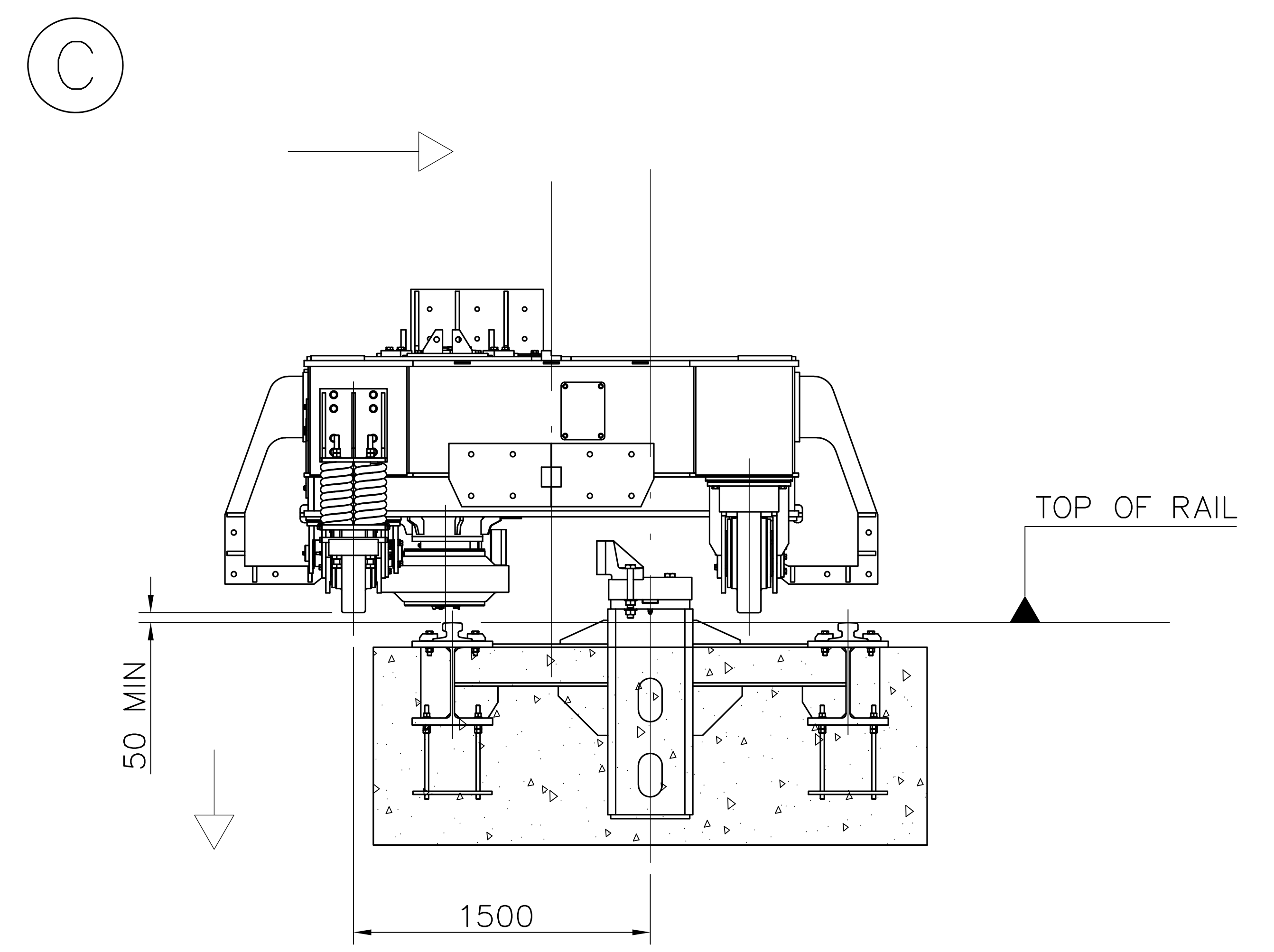
PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0046	6	1	JV

SITE INSTALLATION PROCEDURE



PRIOR TO INSTALLING POSITIONER ON TRACK, REMOVE NON-DRIVE SIDE GUIDE ROLLERS AND ENCODER ASSEMBLY.

LOWER POSITIONER TO WITHIN 50mm OF RAILS BIASED TOWARDS DRIVE SIDE OF TRACK.

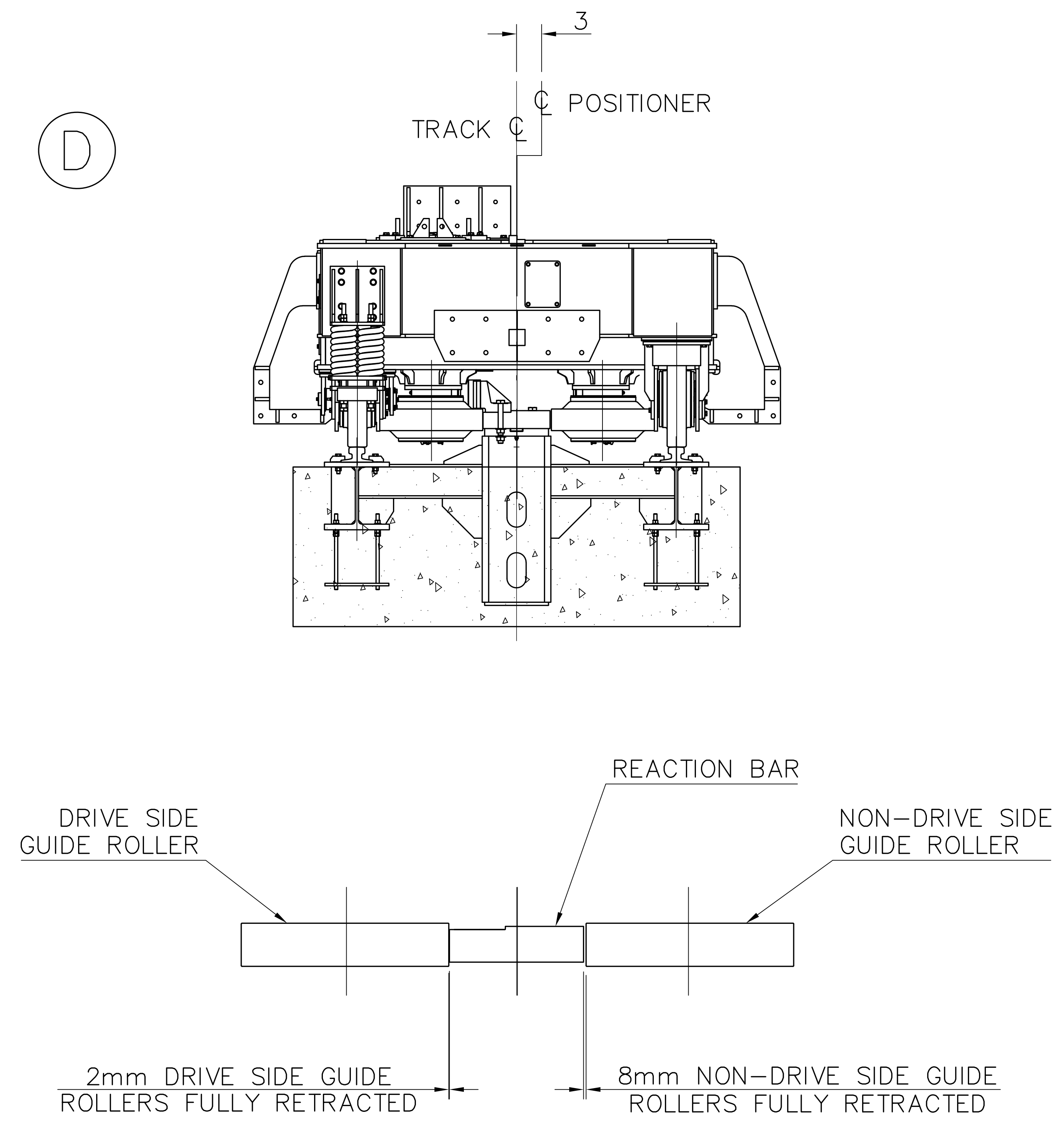


PRIOR TO HORIZONTAL MOVEMENT OF POSITIONER, ENSURE DRIVE PINIONS ARE ALIGNED TO ENGAGE WITH DRIVE RACK, DRIVE CARTRIDGE BRAKES TO BE RELEASED AND DRIVE SIDE GUIDE ROLLERS ARE IN THE FULLY RETRACTED POSITION.

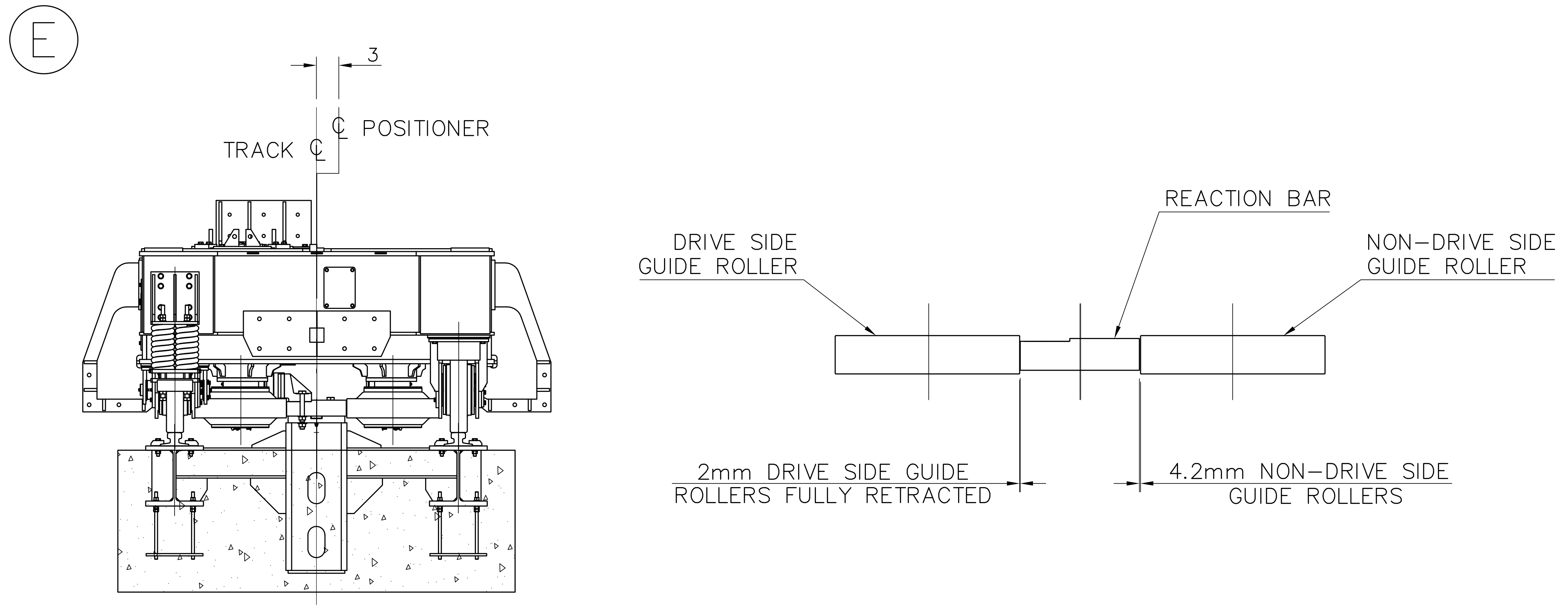
MOVE POSITIONER HORIZONTALLY UNTIL ALL DRIVE PINIONS ARE ENGAGED WITH THE DRIVE RACK AND IN FULL TOOTH FLANK CONTACT.

PRIOR TO LOWERING THE POSITIONER ONTO THE RAILS, APPLY GREASE TO THE RAIL DIRECTLY UNDER THE SUPPORT ROLLERS TO AID FURTHER LATERAL MOVEMENT/ADJUSTMENT.

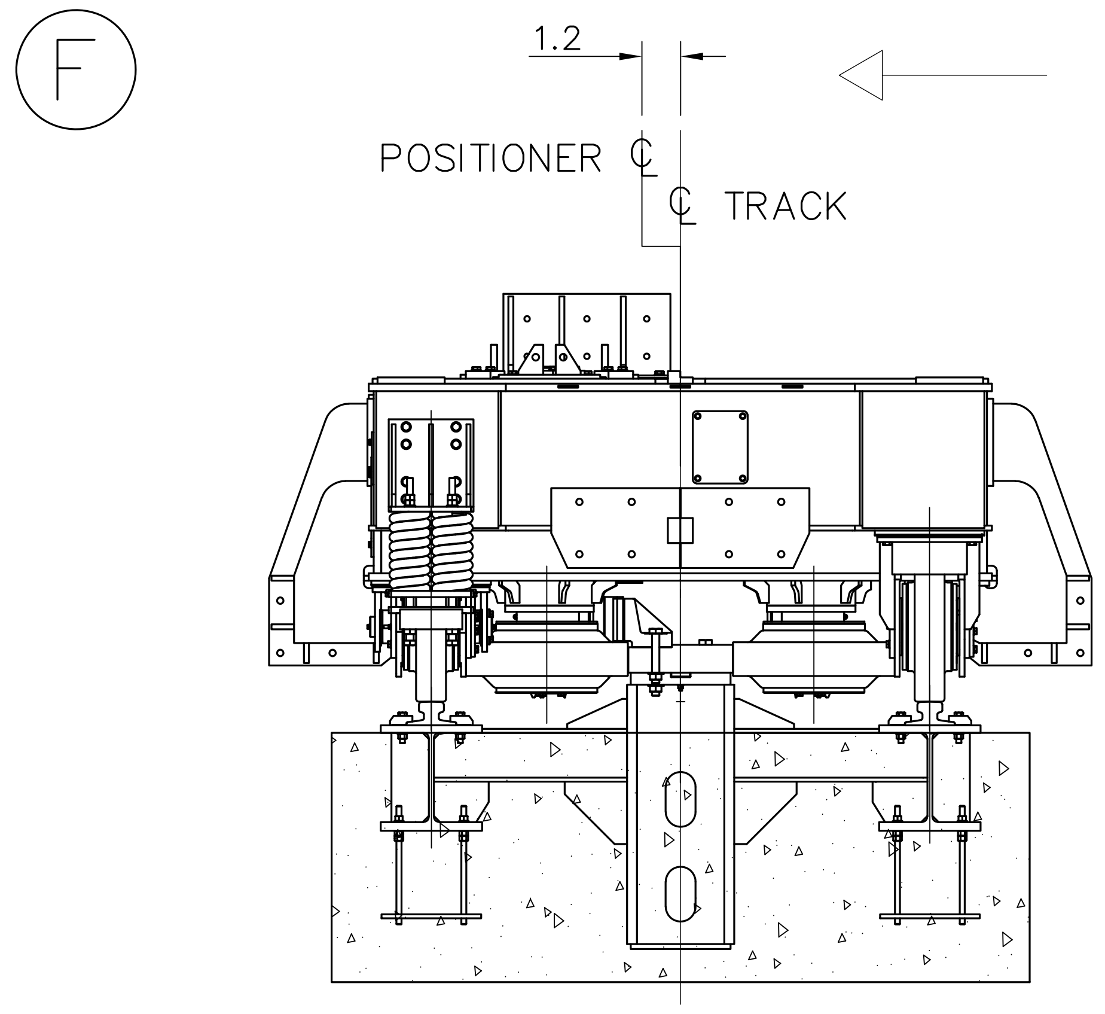
LOWER THE POSITIONER ONTO THE RAILS.

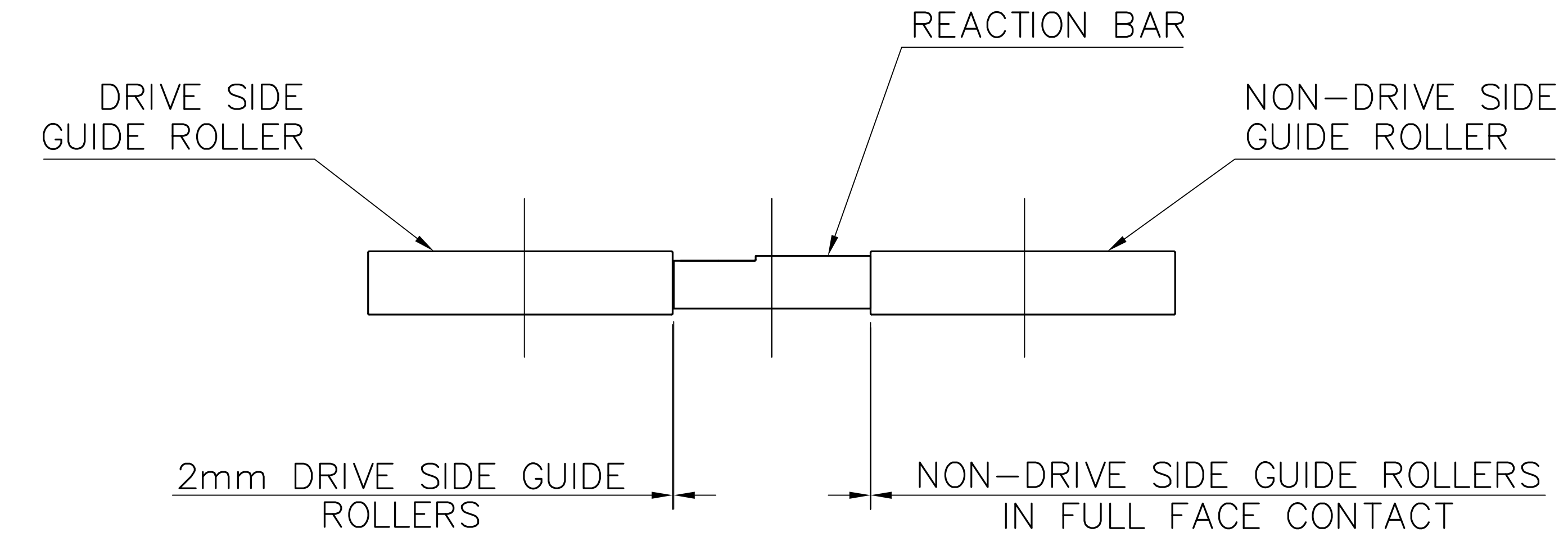


INSTALL THE NON-DRIVE SIDE GUIDE ROLLERS IN THE FULLY RETRACTED POSITION.



ROTATE NON-DRIVE SIDE GUIDE ROLLERS TO CLEAR REACTION BAR BY 4.2mm.





MOVE POSITIONER 4.2mm HORIZONTALLY IN THE DRIVE DIRECTION UNTIL NON-DRIVE SIDE GUIDE ROLLERS ARE IN HARD CONTACT WITH REACTION BAR. CLEARANCE BETWEEN DRIVE SIDE GUIDE ROLLERS AND REACTION BAR WILL INCREASE TO 6.2mm.

ROTATE THE DRIVE SIDE GUIDE ROLLERS TO CLEAR THE REACTION BAR BY 2mm.

RACK AND PINION BACKLASH IN THIS CONDITION IS 2.9mm.

TABLE 5 - INSTALLATION & ALIGNMENT RECORD

DIMENSION	DRAWING DIM	RECORDED DIMENSION
DRIVE SIDE GUIDE ROLLER - FWD	2.0	
DRIVE SIDE GUIDE ROLLER - REAR	2.0	

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES: 1. DO NOT SCALE DRAWING - ONLY DIMENSIONS SHOWN TO BE USED.
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GENERAL MANUFACTURING TOLERANCES
UNLESS STATED OTHERWISE (PLUS OR MINUS)

RANGE	MACH	FAB	CAST
0-500	0.25	2	2
501-1000	0.5	3	4
1001-2000	1.0	4	6
ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

UNLESS OTHERWISE SPECIFIED IDENTIFY THE ITEM WITH THE DRAWING NUMBER AND ISSUE LEVEL AT ◆ AND IN THE MANNER SHOWN.

MASS	SEE SHEET 1
MATERIAL	
SPEC.	
NOTES	

DRAWN TO BS 8888
THIRD ANGLE PROJECTION

Rev.	Drawing Sheet No.	yes Part List	no	See technical modification report No.	Day	Name

TAKRAF
TENOVA

Project Number:
AC0339

Drawing Number: 49055245
BG: 2100

NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	SITE INSTALLATION PROCEDURE REVISED	EMD	RCJ	JMD	19-02-19
0	FIRST ISSUE	RCJ	RHW	JMD	26-06-18

REVISIONS

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TITLE	NAME	SIGN	DATE
DRAWN	RCJ		04 06 18
CHECKED	RHW		25 06 18
MECHANICAL	JMD		26 06 18
PROJECT ENG.	ASM		26 06 18
PROJECT MAN.	D.STARK		26 06 18

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG.			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME RICHARD WOOD
SIGNATURE
DATE 26 06 18
REG. NUMBER 70386304
SCALE : NTS

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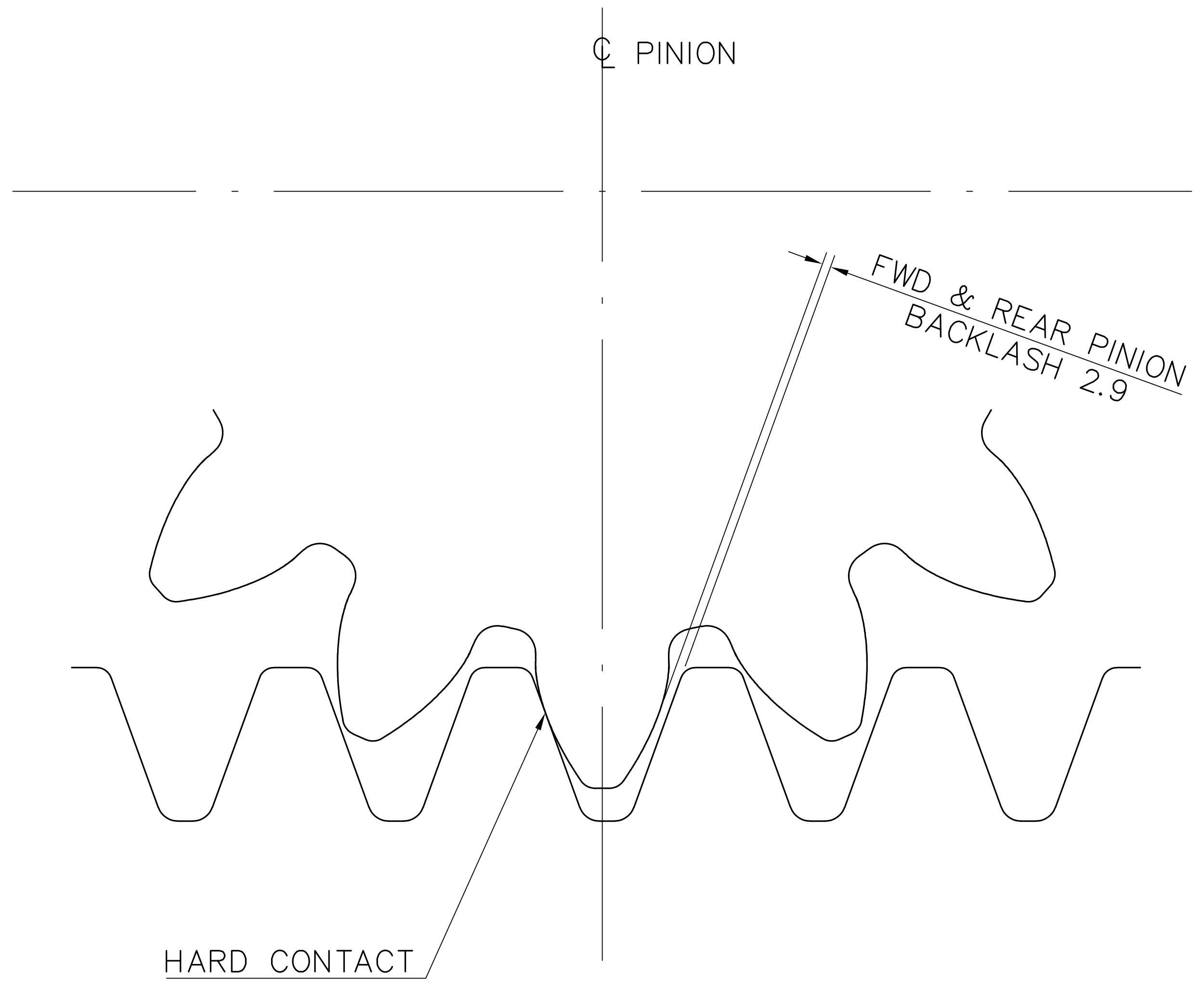
PORT OF SALDANHA
IRON ORE TIPPLER 3
ASSEMBLY OF TRAIN POSITIONER
SHEET 7 OF 9

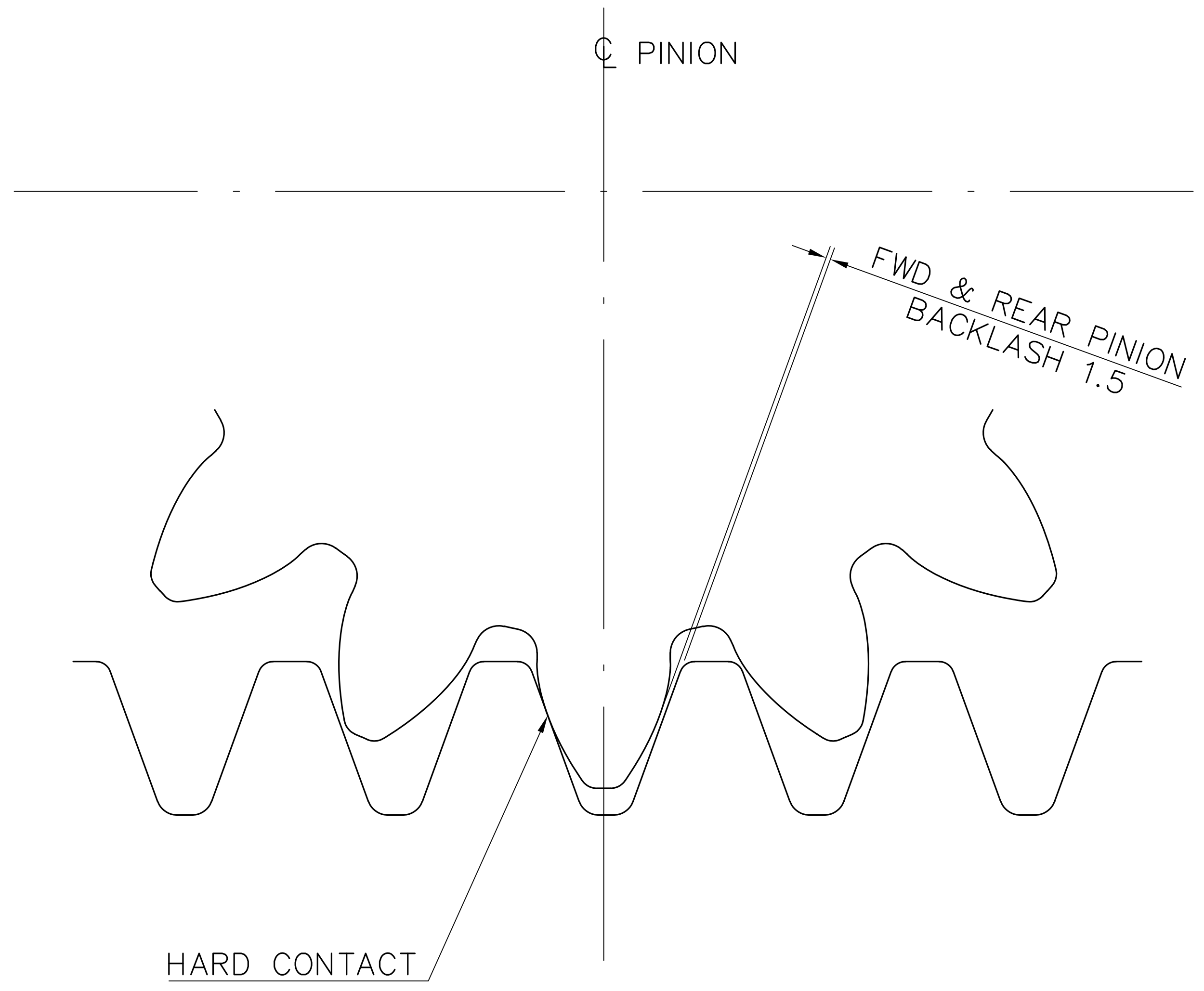
PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0046	7	1	JV



MAXIMUM BACKLASH WITH NON−DRIVE SIDE GUIDE ROLLERS
IN FULL FACE CONTACT WITH REACTION BAR

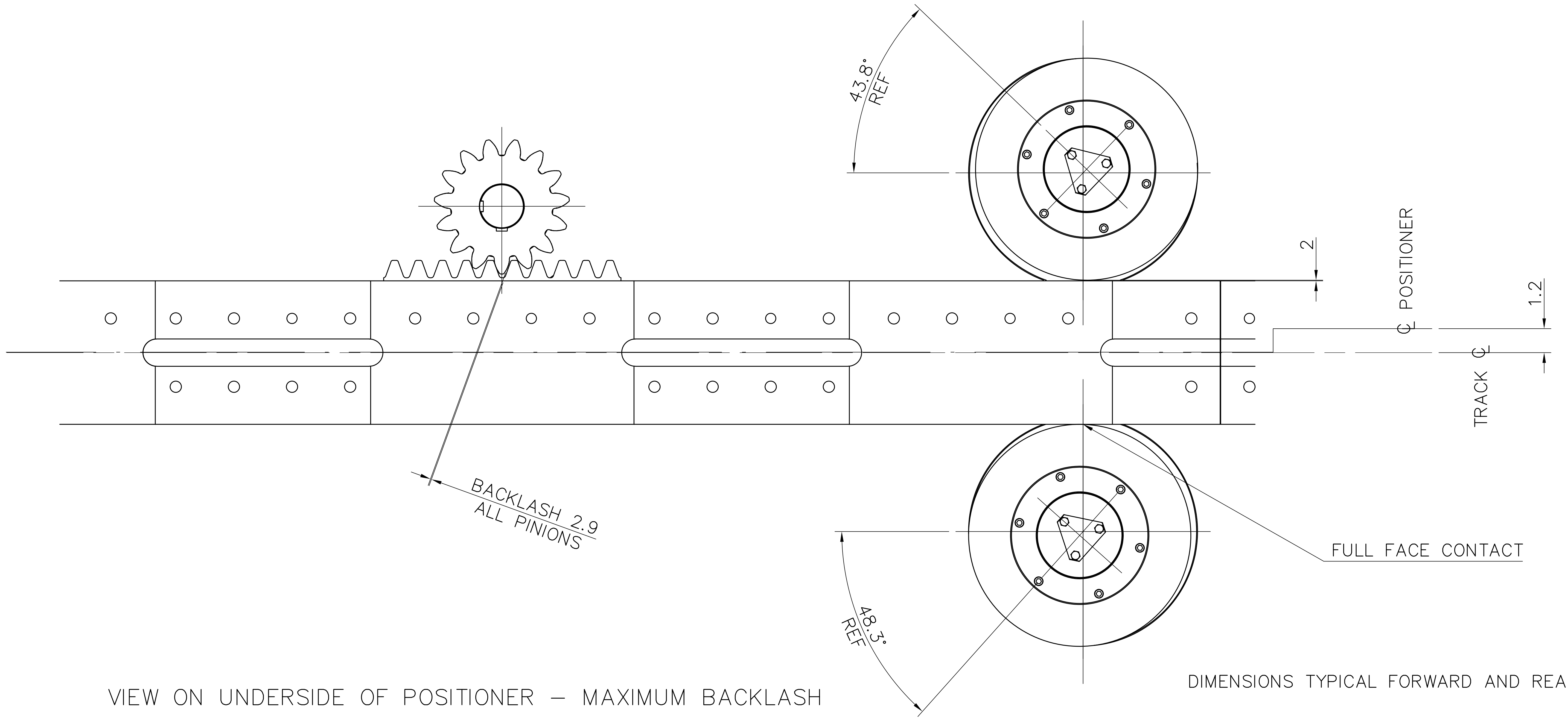
TABLE 6 - INSTALLATION & ALIGNMENT RECORD		
DIMENSION	DRAWING DIM	RECORDED DIMENSION
MAX PINION BACKLASH - FWD	2.9	
MAX PINION BACKLASH - REAR	2.9	

CHECK BACKLASH & RECORD DIMENSION
BETWEEN RACK & PINION IN FORWARD #1
END & REAR #8 DRIVE PINION.



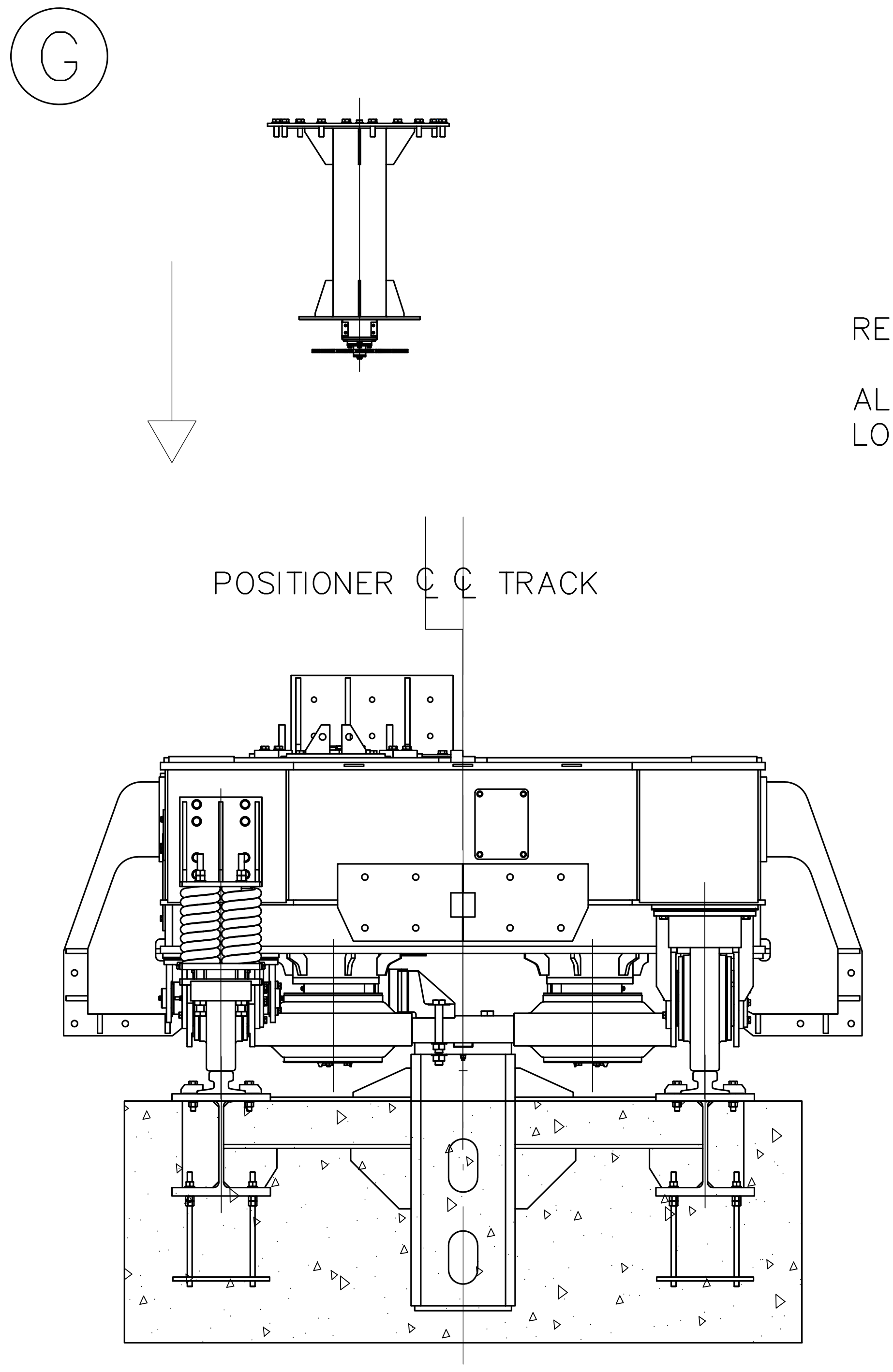
MINIMUM BACKLASH WITH DRIVE SIDE GUIDE ROLLERS
IN FULL FACE CONTACT WITH REACTION BAR

(REFERENCE)



VIEW ON UNDERSIDE OF POSITIONER – MAXIMUM BACKLASH

DIMENSIONS TYPICAL FORWARD AND REAR



REINSTALL ENCODER ASSEMBLY INTO POSITIONER.

ALIGN ENCODER PINION WITH DRIVE RACK DURING LOWERING.

TAKRAF
TENOVA

REVIEW LABEL

Discipline	Discipline Engineer Name	 Signature	Date yyyy-mm-dd

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES: 1. DO NOT SCALE DRAWING - ONLY DIMENSIONS SHOWN TO BE USED.
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DIMENSIONS IN MILLIMETERS & DEGREES.
GENERAL MANUFACTURING TOLERANCES
UNLESS STATED OTHERWISE (PLUS OR MINUS)

RANGE	MACH	FAB	CAST
0-500	0.25	2	2
501-1000	0.5	3	4
1001-2000	1.0	4	6
ABOVE 2000	2.0	6	10

REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

MASS	SEE SHEET 1
MATERIAL	
SPEC.	
NOTES	

DRAWN TO BS 8888

THIRD ANGLE PROJECTION

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Rev.	Drawing Sheet No.	yes Part List	no Part List	See technical modification report No.	Day	Name

TAKRAF
TENOVA

Project Number:
AC0339

Drawing Number: 49055245
BG: 2100

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	SITE INSTALLATION PROCEDURE REVISED	EMD	RCJ	JMD	19-02-19
0	FIRST ISSUE	RCJ	RHW	JMD	26-06-18

REVISIONS

CONTRACTOR / CONSULTANT

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TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG.			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME RICHARD WOOD
SIGNATURE RJWood
DATE 26 06 18
REG. NUMBER 70386304
SCALE : NTS
A1

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TRANSNET

PORT OF SALDANHA

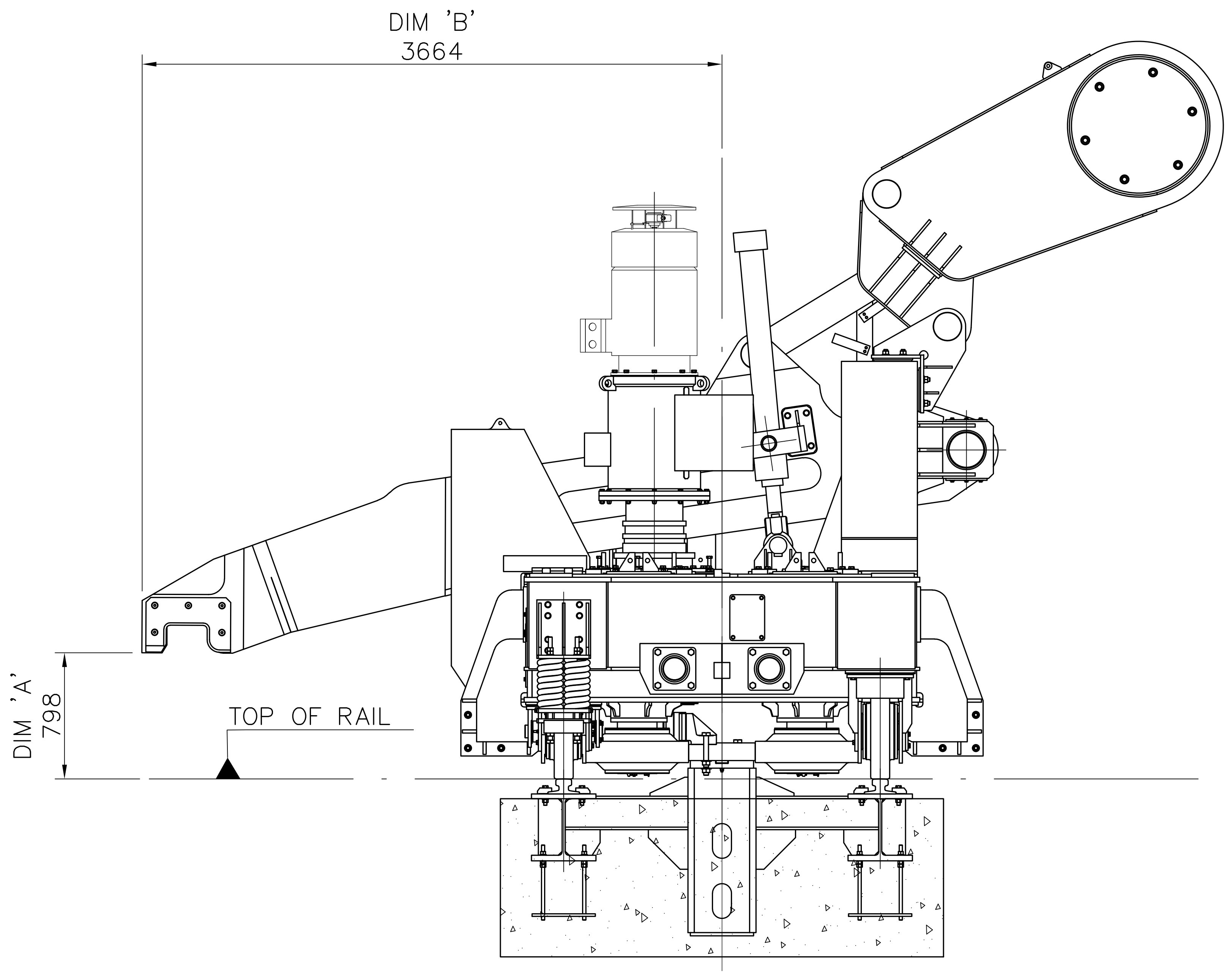
IRON ORE TIPPLER 3

ASSEMBLY OF TRAIN POSITIONER

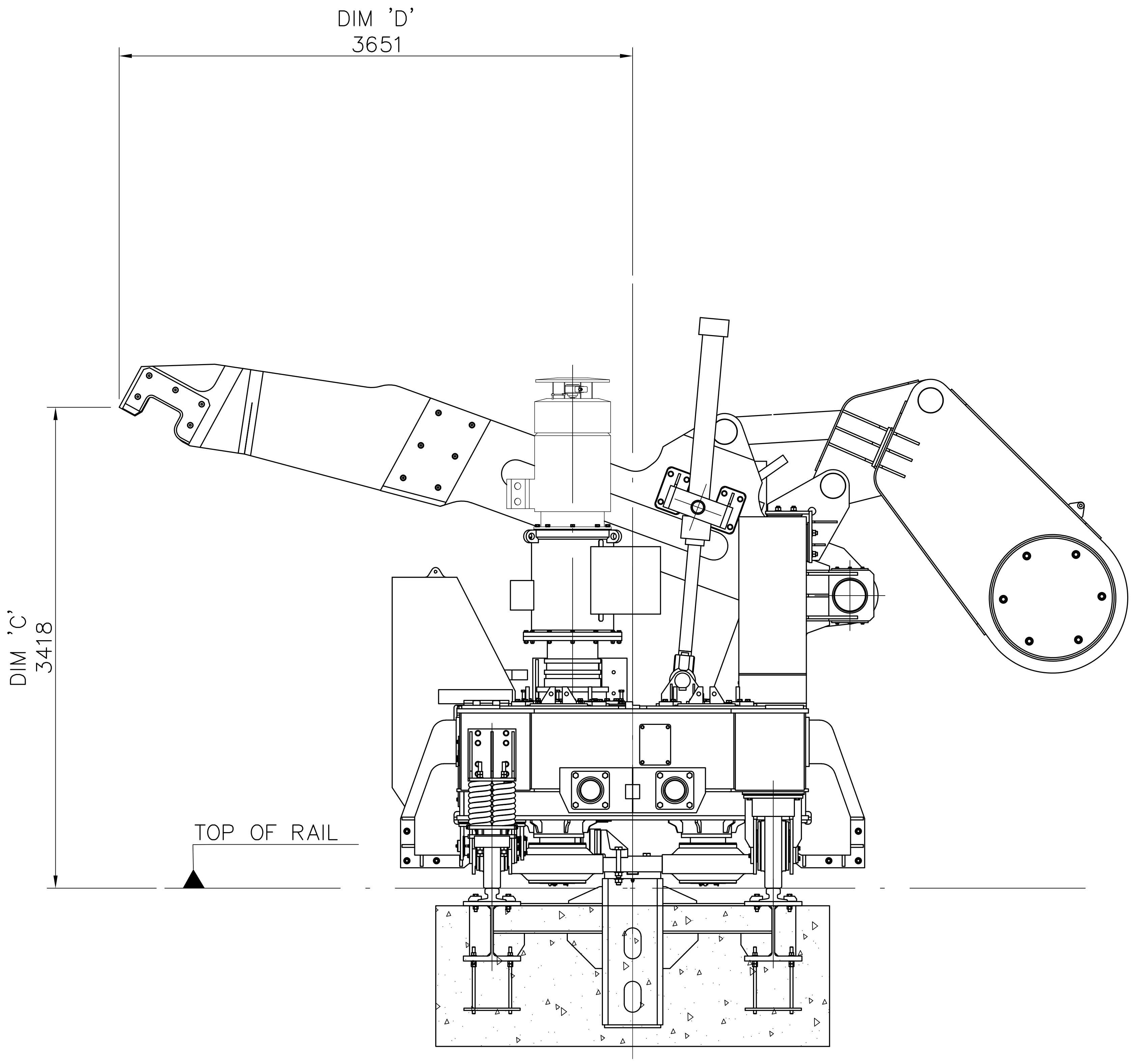
SHEET 8 OF 9

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0046	8	1	JV

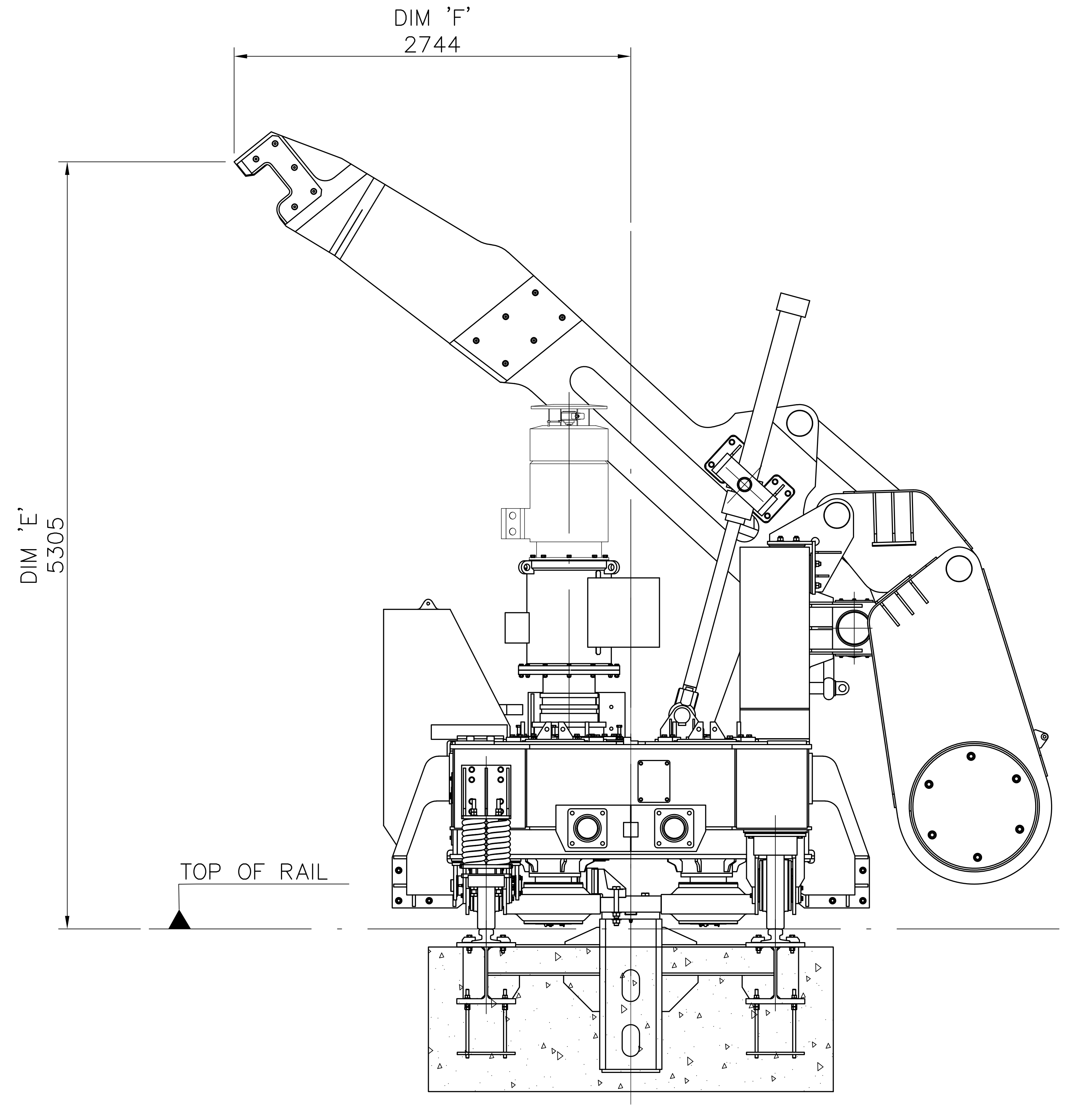
H



POSITIONER ARM LOWERED
CHECK DIMENSION



POSITIONER ARM WAGON CLEAR
CHECK DIMENSION



POSITIONER ARM LOCO CLEAR
CHECK DIMENSION

TABLE 7 - INSTALLATION & ALIGNMENT RECORD

DIMENSION	DRAWING DIM	RECORDED DIMENSION
A	798	
B	3664	
C	3418	
D	3651	
E	5305	
F	2744	

WITH POSITIONER ARM IN EACH POSITION SHOWN, RECORD CHECK DIMENSIONS IN TABLE 8

TAKRAF
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REVIEW LABEL

Discipline	Discipline Engineer Name	Discipline Engineer Signature	Date yyyy-mm-dd

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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MASS	SEE SHEET 1
MATERIAL	
SPEC.	
NOTES	

DRAWN TO BS 8888
THIRD ANGLE PROJECTION

Rev.	Drawing Sheet No.	Part List yes	Part List no	See technical modification report No.	Day	Name

TAKRAF
TENOVA

Project Number:
AC0339

Drawing Number: 49055245
BG: 2100

NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	SHEET 9 ADDED	EMD	RCJ	JMD	19-02-19
0	FIRST ISSUE	RCJ	RHW	JMD	26-06-18

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MECH. ENG.			
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CIVIL ENG.			
STRUCT. ENG.			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME RICHARD WOOD
SIGNATURE RHWood
DATE 26 06 18
REG. NUMBER 70386304
SCALE : NTS

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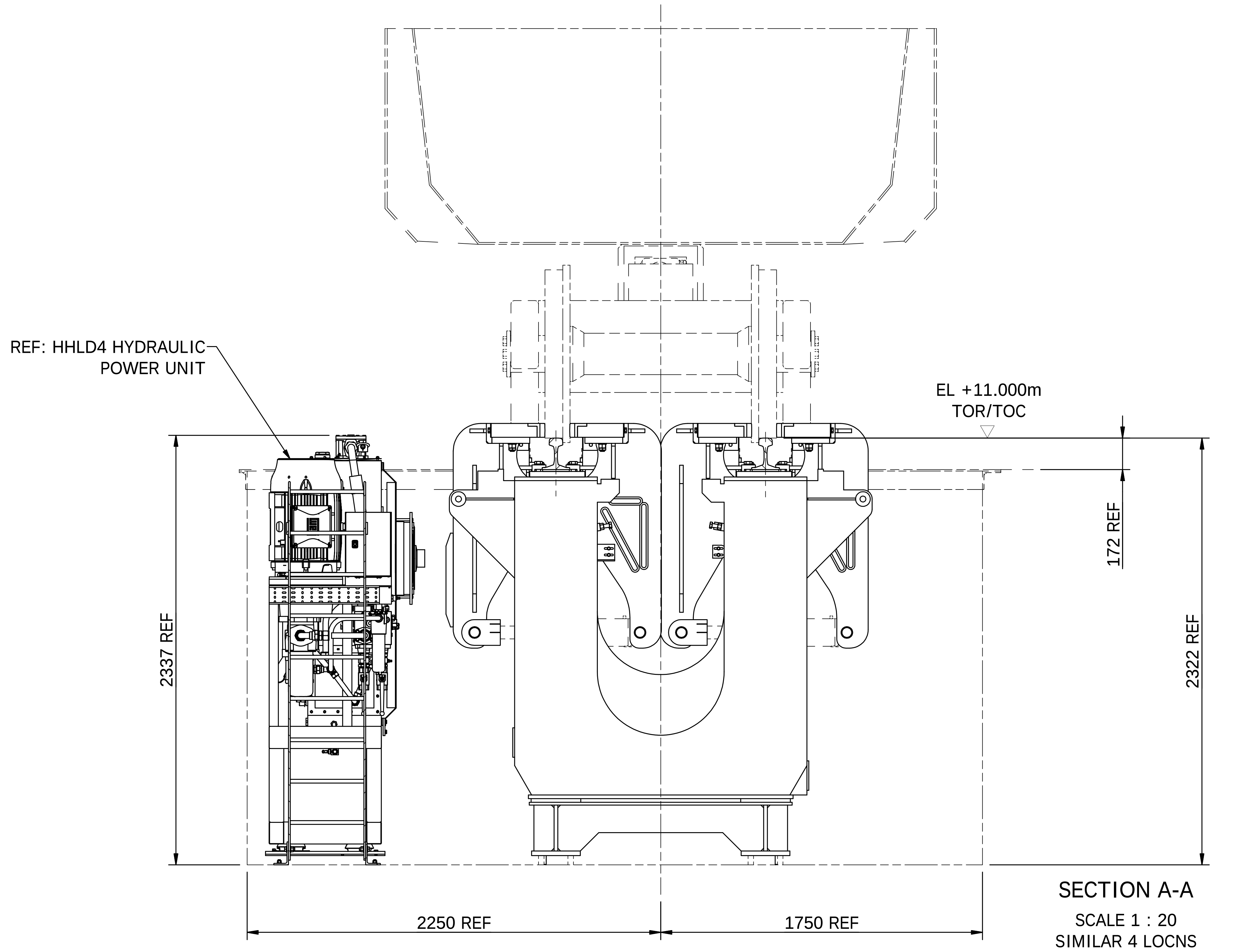
PORT OF SALDANHA

IRON ORE TIPPLER 3

ASSEMBLY OF TRAIN POSITIONER

SHEET 9 OF 9

	PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
A1	1924701	0	000	M	GA	0046	9	1	JV



SECTION A-A

SCALE 1 : 20
SIMILAR 4 LOCNS

NOTES:

1. FOR DETAILS OF TRAIN HOLDING DEVICES FOUNDATIONS SEE DRG 49055201.
2. FOR DETAILS OF TIPPLER & PLANT FOUNDATIONS SEE DRG 49055200.
3. INDIVIDUAL ITEMS MUST NOT BE GROUTED UNTIL AFTER FINAL ALIGNMENT CHECKS HAVE BEEN CARRIED OUT.
4. CENTRE LINE OF MAIN TRACK & CENTRE LINE OF TIPPLER ARE TO BE CONSIDERED PRIMARY DATUMS. ALL OTHER SPECIFIED DATUMS ARE TO BE SET OUT USING THE PRIMARY DATUMS.

TAKRAF
TENOVA

REVIEW LABEL

Discipline	Discipline Engineer Name	 Signature	Date yyyy-mm-dd

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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REFER ALSO TO MANUFACTURING SPECIFICATION.
WELD SYMBOLS BS EN 22553. SURFACE FINISH BS 1134

MASS.	53602 kg
MATERIAL.	
SPEC.	
NOTES.	

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THIRD ANGLE PROJECTION

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Rev.	Drawing Sheet No.	yes no Part List	See technical modification report No.	Day	Name

TAKRAF
TENOVA

Project Number:
AC0339

Drawing Number:	BG:
49055255	1100

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REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE		
DRAWN	RCJ		04	10	17
CHECKED	RHW		13	03	18
MECHANICAL	JMD		13	03	18
PROJECT ENG.	ASM		13	03	18
PROJECT MAN.	D.STARK		13	03	18

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME	RICHARD WOOD	DATE		
SIGNATURE		13	03	18
REG. NUMBER	70386304			
SCALE :	1:100 UOS	A1		

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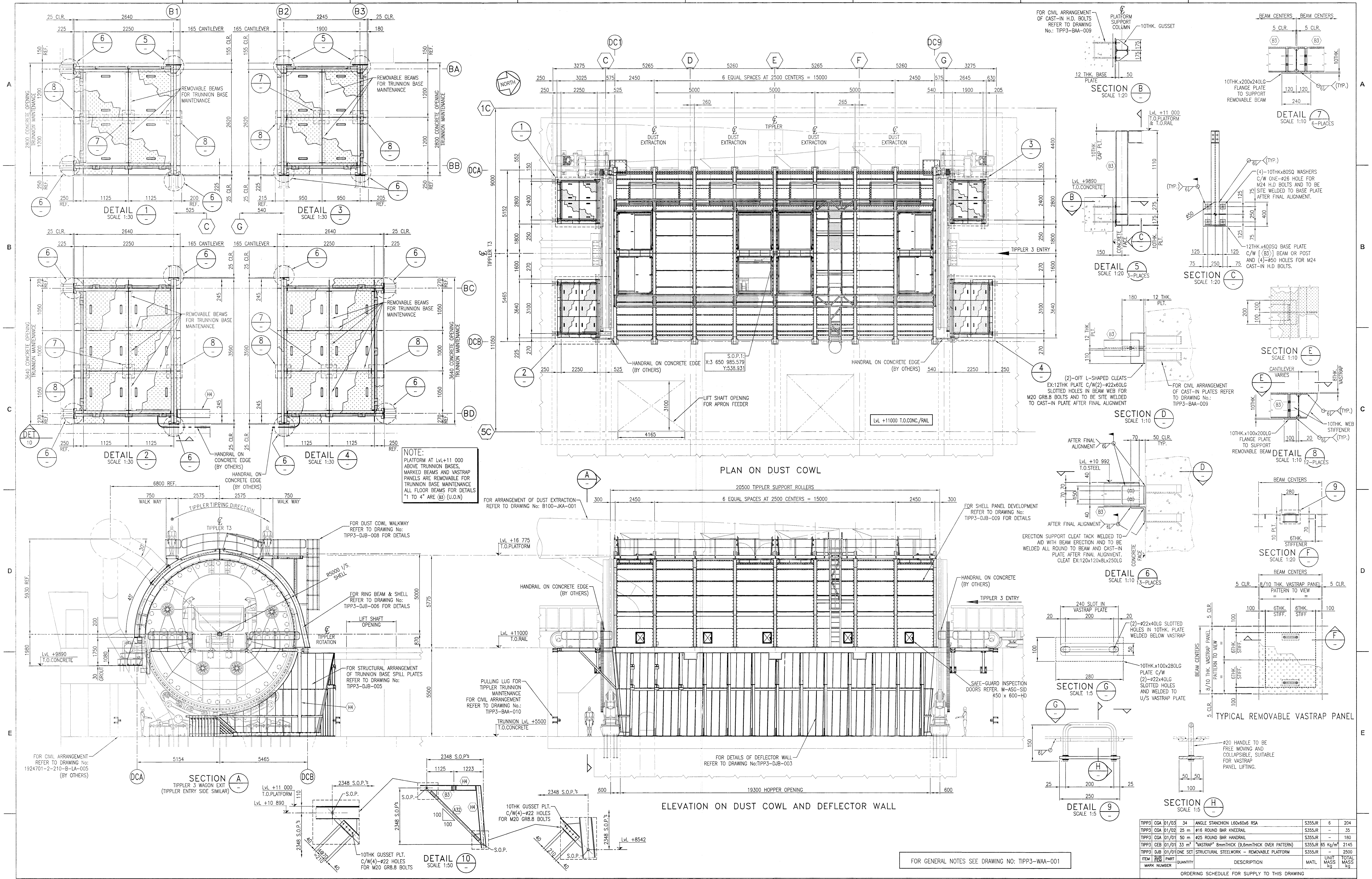
8001
TEL: 021 940 1999
FAX: 086 677 2455

PORT OF SALDANHA

IRON ORE TIPPLER 3

ASSEMBLY OF TRAIN HOLDING DEVICES

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0056	1	0	JV



NOTE:
PLATFORM AT LvL+11 000 ABOVE TRUNNION BASES, MARKED BEAMS AND VASTRAP PANELS ARE REMOVABLE FOR TRUNNION BASE MAINTENANCE ALL FLOOR BEAMS FOR DETAILS "1 TO 4" ARE (B3) (U.O.N)

FOR GENERAL NOTES SEE DRAWING NO: TIPP3-WAA-001

TIPP3	CGA	01/03	34	ANGLE STANCHION L60x60x6 RSA	S355JR	6	204
TIPP3	CGA	01/02	25 m	ø16 ROUND BAR KNEERAIL	S355JR	–	35
TIPP3	CGA	01/01	50 m	ø25 ROUND BAR HANDRAIL	S355JR	–	180
TIPP3	CEB	01/01	33 m²	"VASTRAP" 8mmTHICK (9,6mmTHICK OVER PATTERN)	S355JR	65 Kg/m²	2145
TIPP3	DJB	01/01	ONE SET	STRUCTURAL STEELWORK – REMOVABLE PLATFORM	S355JR	–	2500
ITEM	SUB ITEM	PART	QUANTITY	DESCRIPTION	MATL	UNIT MASS kg	TOTAL MASS kg
MARK NUMBER							

ORDERING SCHEDULE FOR SUPPLY TO THIS DRAWING

DRAWING NO.	REFERENCE
TIPP3-BAA-009	CIVIL OUTLINE DUST COWL
TIPP3-DJB-009	DUST COWL- SHELL PANEL DEVELOPMENT
TIPP3-DJB-008	STRUCTURAL ARRANGEMENT - DUST COWL WALKWAY DETAILS
TIPP3-DJB-007	DUST COWL MAINTENANCE DOORS & SHELL PANEL DTAILS
TIPP3-DJB-006	DUST COWL TYPICAL VIEWS RING BEAM & SHELL PANELS
TIPP3-DJB-005	STRUCTURAL ARRANGEMENT - DUST COWL TRUNNION BASE-SPILL PLATES
TIPP3-DJB-004	STRUCTURAL ARRANGEMENT - DUST COWL DEFLECTOR WALL DETAILS
TIPP3-DJB-003	STRUCTURAL ARRANGEMENT - DUST COWL DEFLECTOR WALL/ BARRIER DETAILS
TIPP3-DJB-002	STRUCTURAL ARRANGEMENT - DUST COWL DETAILS
TIPP3-FAA-001	TIPPLER VAULT-MECHANICAL ARRANGEMENT

REFERENCE DRAWINGS

NOTES

1. DO NOT SCALE DRAWING - ONLY DIMENSIONS SHOWN TO BE USED.

2. THE CONTRACTOR SHALL VERIFY ALL CONDITIONS, DIMENSIONS AND LEVELS ON THE SITE AND NOTIFY THE NEC SUPERVISOR OF ANY VARIATIONS BEFORE CONSTRUCTION.

STEEL MEMBER SIZE LEGEND

H4 203x203x46 Kg/m A32 L100x100x8 RSA	B3 203x133x25 Kg/m

TAKRAF TENOVA

REVIEW LABEL

Discipline	Discipline Engineer Name	Signature	Date yyyy-mm-dd

TAKRAF TENOVA

Project Number:
AC0339/G0299

TGER Drawing Number:
–

TAFR Drawing Number:
TIPP3-DJB-001

NO.	DESCRIPTION	BY	CHKD	APPD	DATE
0	ISSUED FOR CONSTRUCTION		BRC		28/09/'18
B	DRAWING GENARALLY UPDATED	W.S.			30/01/'18
A	ISSUED FOR CLIENT COMMENT	W.S.			26/04/'17

REVISIONS

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CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE
DRAWN	W.STRYDOM		26 04 '17
CHECKED	B.R.CAMPBELL	BRC	14 06 '18
STRUCTURAL	D.NIEMANN		28 09 '18
PROJECT ENG.	W.RUSSELL		28 09 '18
PROJECT MAN.	K.NDLOVU		28 09 '18

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG.			
C&I. ENG.			
ENG. MNG.			

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH. / PR. ARCH
NAME: D.NIEMANN
SIGNATURE:
DATE: 28 09 '18
REG. NUMBER: 9170011
SCALE : 1:75
A0

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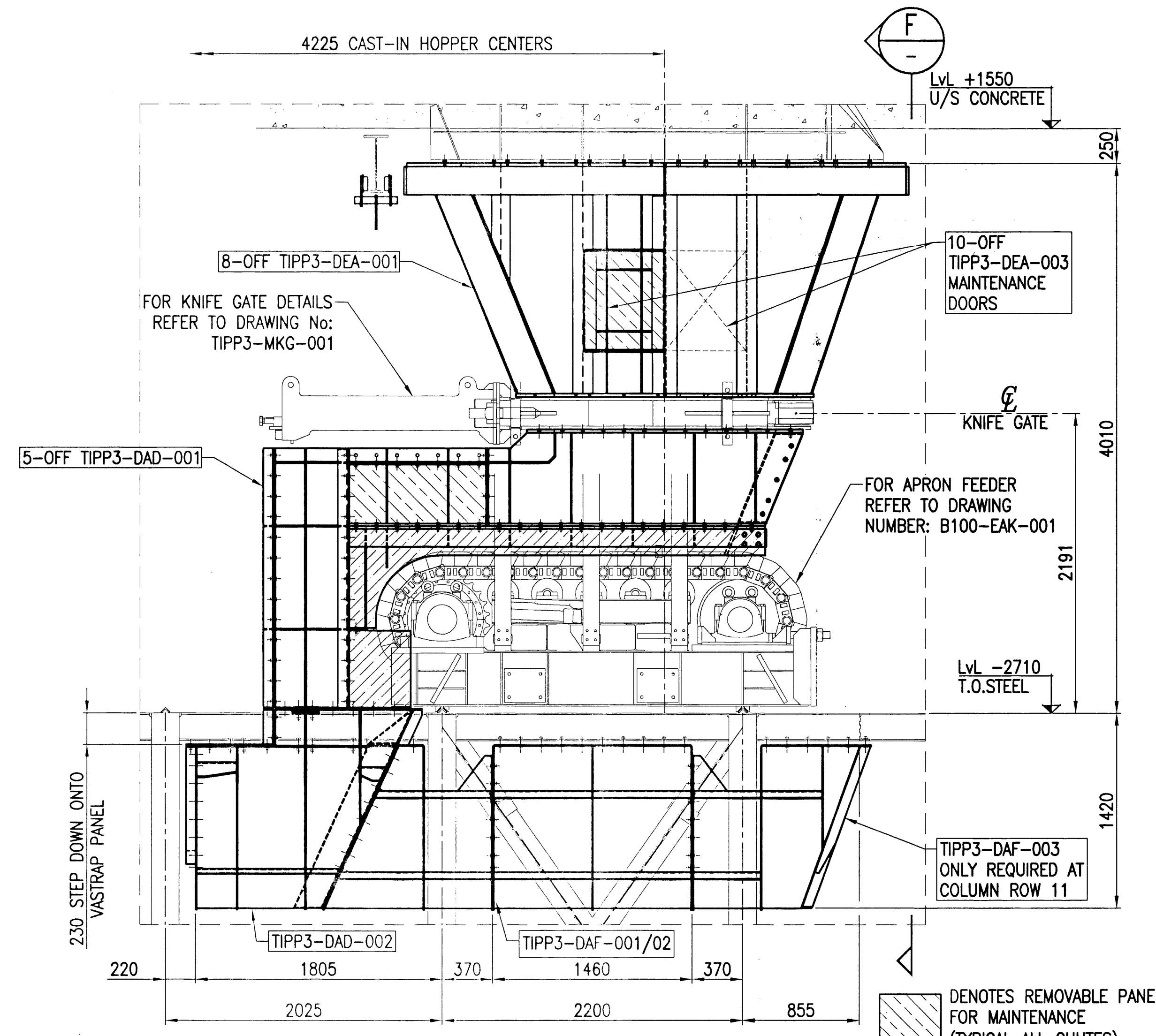
FAX: 086 677 2455

PORT OF SALDANHA

IRON ORE TIPPLER 3
GENERAL ARRANGEMENT
DUST COWL AND DEFLECTOR WALL/BARRIER

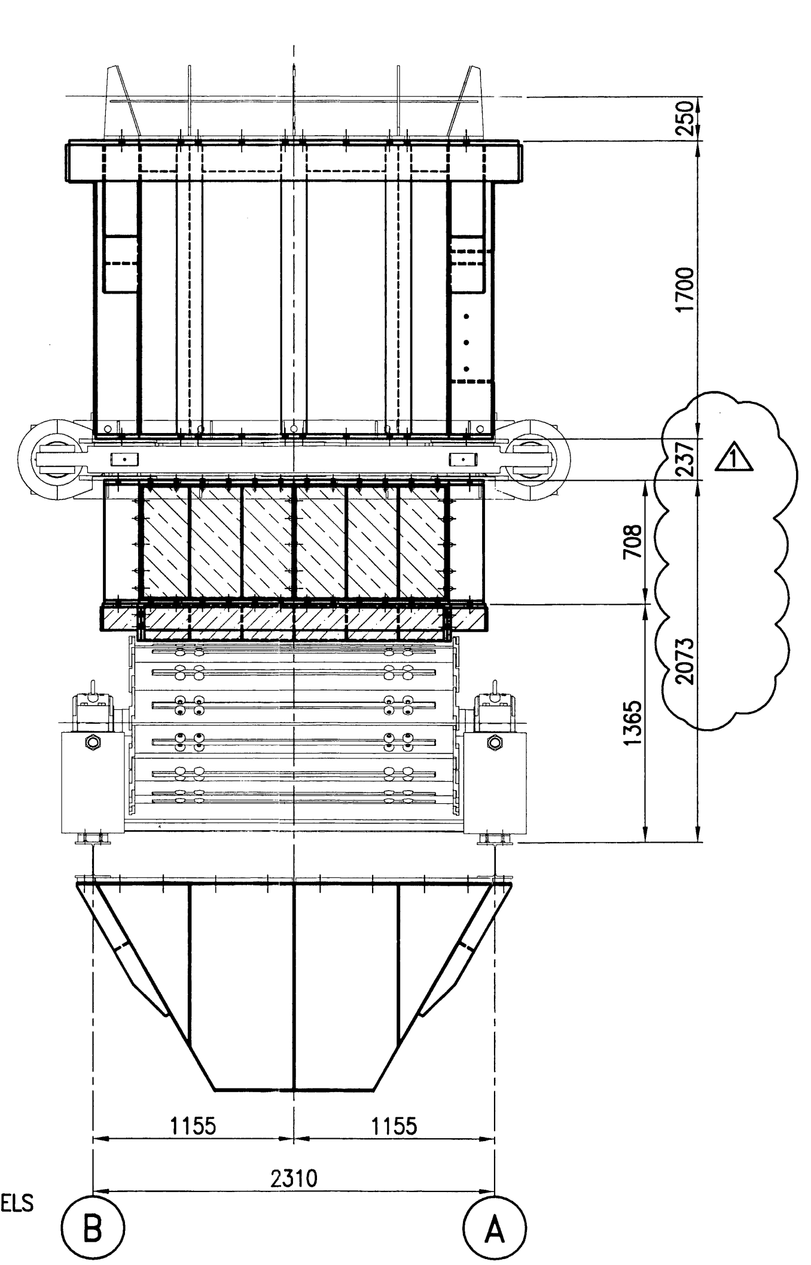
PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	M	GA	0088	01	00	JV



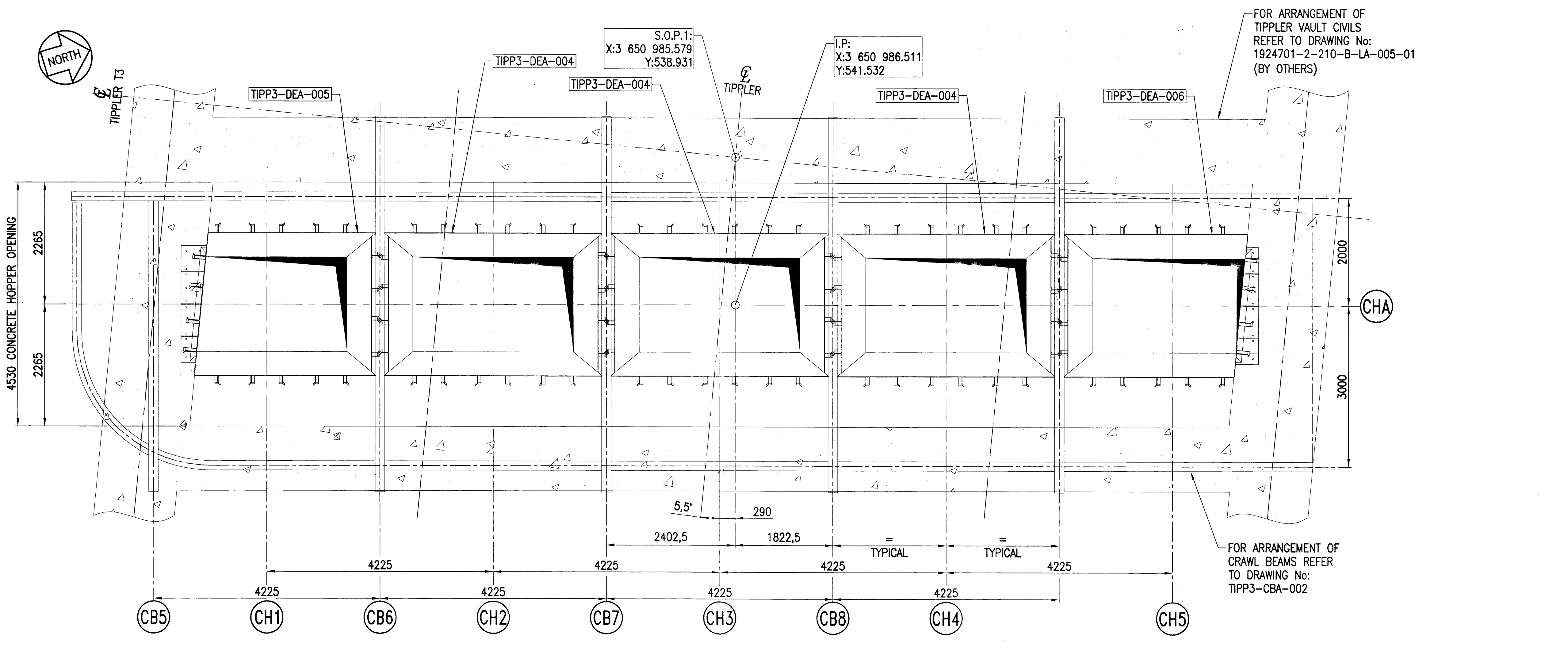
TYPICAL DETAIL ①
SCALE 1:30

▨ DENOTES REMOVABLE PANELS FOR MAINTENANCE (TYPICAL ALL CHUTES)

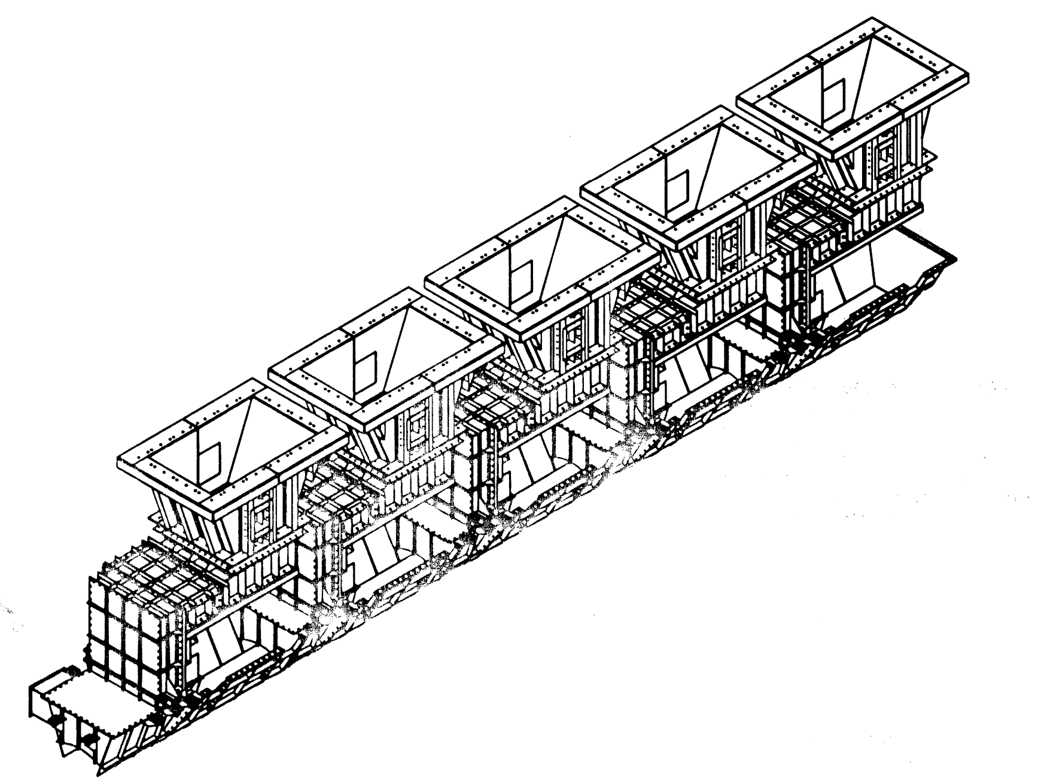
▨ DENOTES REMOVABLE PANELS FOR APRON FEEDER EXTRACTION (TYPICAL ALL CHUTES)



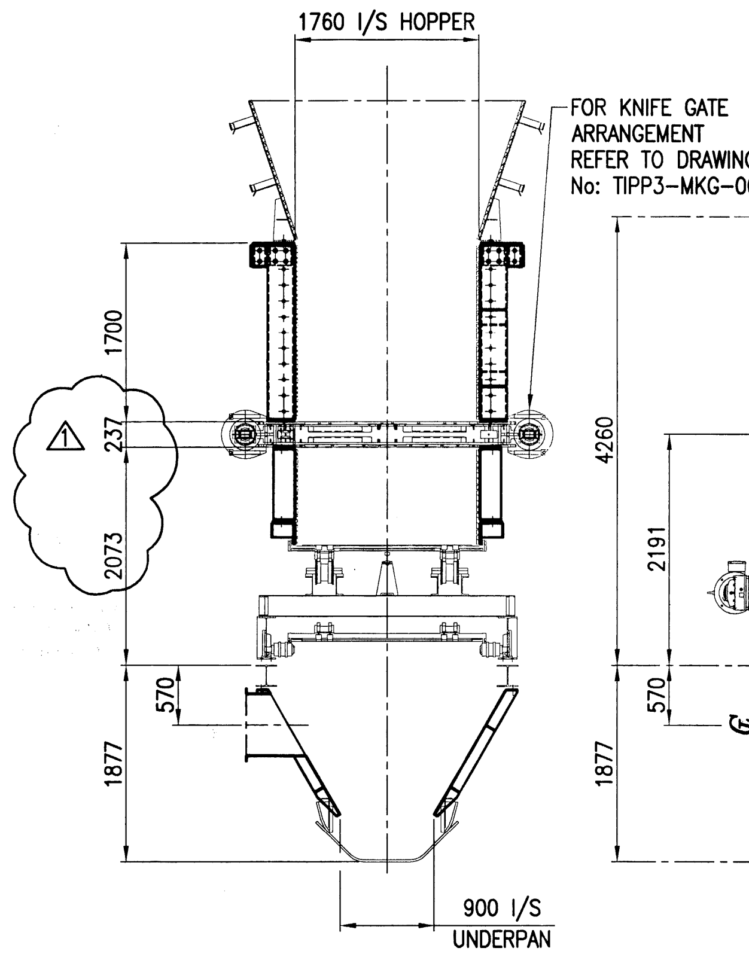
ELEVATION Ⓕ
SCALE 1:30



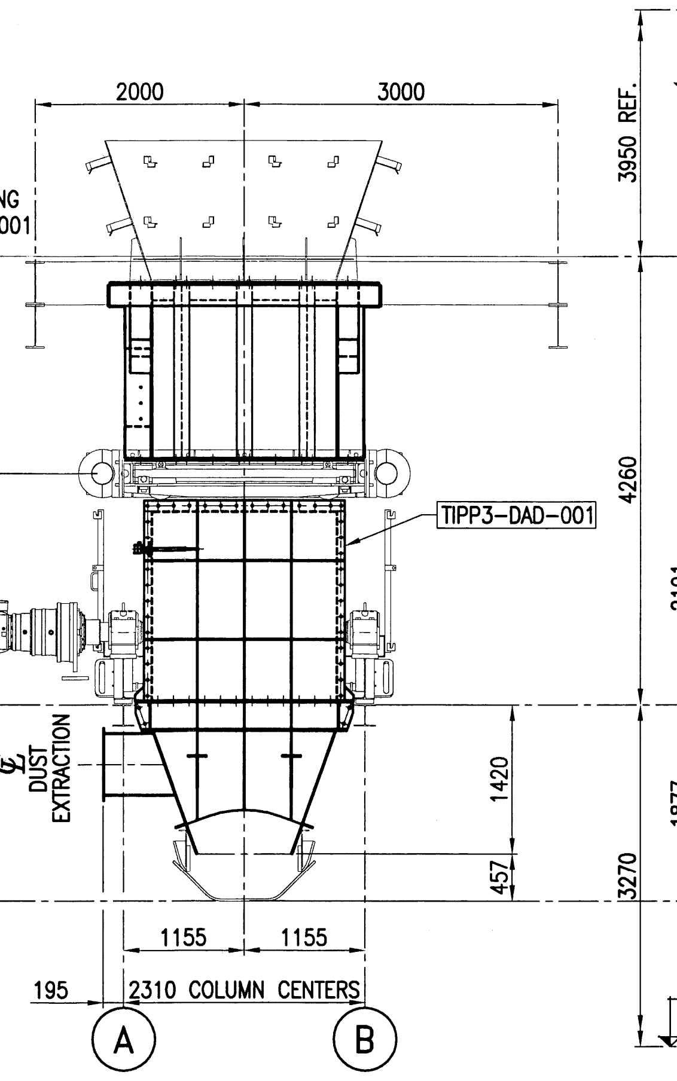
PLAN Ⓒ
LvL +1550 U/S CONCRETE



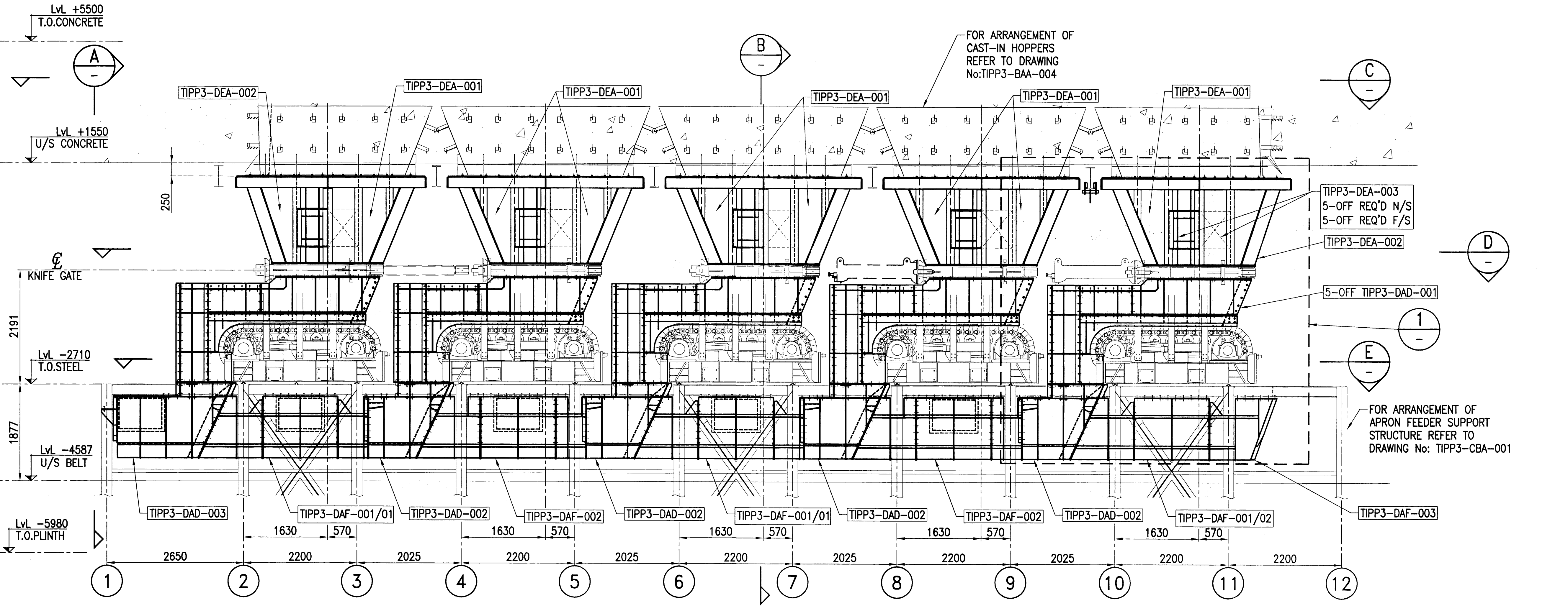
ISOMETRIC VIEW



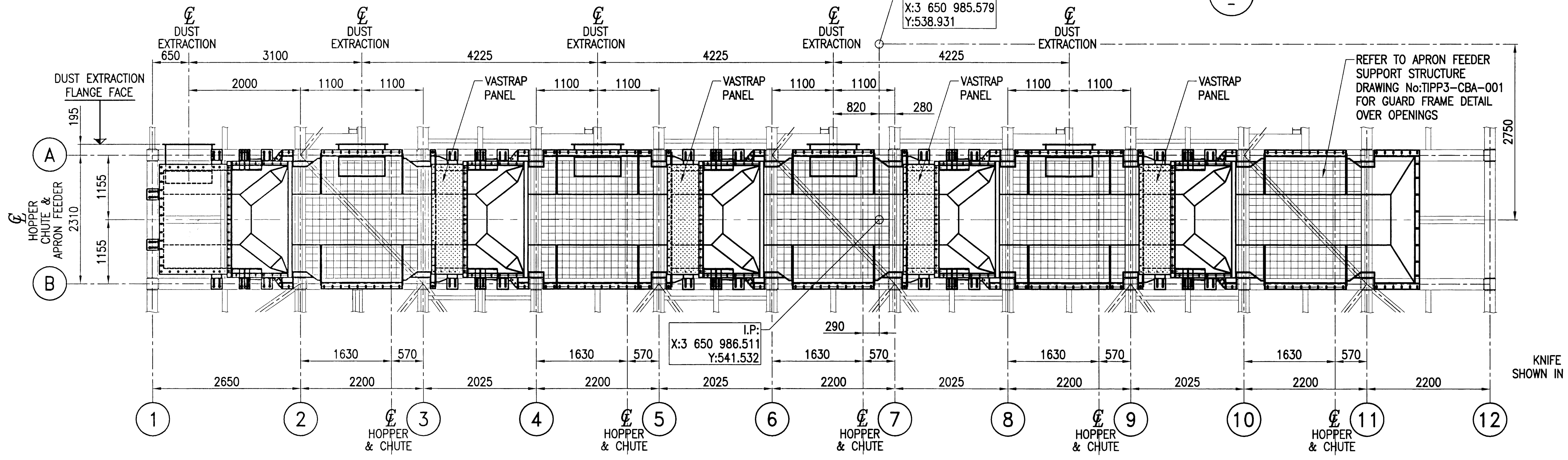
SECTION Ⓑ



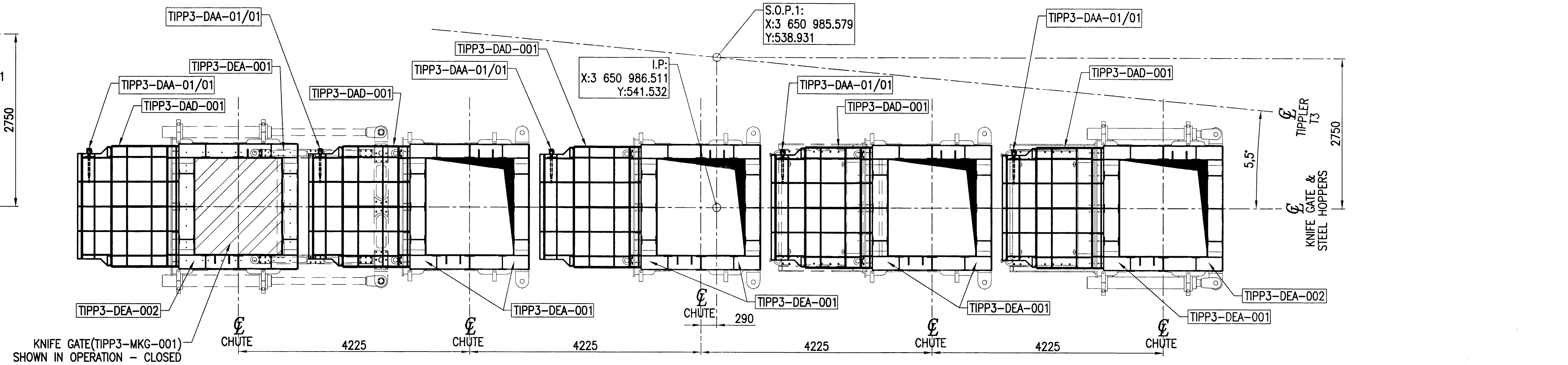
ELEVATION Ⓐ



ELEVATION ON CHUTEWORK (HOPPERS AND APRON FEEDER CHUTES)



SECTION Ⓔ
LvL +2710 T.O.STEEL
APRON FEEDERS
OMITTED FOR CLARITY



PLAN Ⓓ
KNIFE GATE LvL

ITEM	SUB ITEM	PART	QUANTITY	DESCRIPTION	MATL	UNIT MASS kg	TOTAL MASS kg
TIPP3	DAF	003	ONE SET	APRON FEEDER UNDERPAN 3	S355JR	–	440
TIPP3	DAF	002	2-OFF	APRON FEEDER UNDERPAN 2	S355JR	915	1830
TIPP3	DAF	01/02	ONE-OFF	APRON FEEDER UNDERPAN "1" WITHOUT DUST EXTRACTION	S355JR	–	810
TIPP3	DAF	01/01	2-OFF	APRON FEEDER UNDERPAN "1X" WITH DUST EXTRACTION	S355JR	860	1720
TIPP3	DAD	003	ONE SET	APRON FEEDER CHUTE 3	S355JR	–	1456
TIPP3	DAD	002	4-OFF	APRON FEEDER CHUTE 2	S355JR	1150	4600
TIPP3	DAD	001	5-OFF	APRON FEEDER CHUTE 1	S355JR	3435	17175
TIPP3	DAA	01/01	5-OFF	BLOCKED CHUTE DETECTOR-VEGAVIB 63 (FLANGED VERSION)	–	–	–
TIPP3	DEA	003	10-OFF	MAINTENANCE DOOR	S355JR	160	1600
TIPP3	DEA	002	2-OFF	STEEL HOPPER 2	S355JR	1890	3780
TIPP3	DEA	001	8-OFF	STEEL HOPPER 1	S355JR	2050	16400
MARK NUMBER							

ORDERING SCHEDULE FOR SUPPLY TO THIS DRAWING

DRAWING NO.	REFERENCE
TIPP3-FAA-001	TIPPLER VAULT-MECHANICAL ARRANGEMENT
B100-EAK-001	GENERAL ARRANGEMENT - 1830 W x 2184 LG D4 APRON FEEDER
TIPP3-DEA-001	STRUCTURAL ARRANGEMENT - STEEL HOPPER 1 - DETAILS
TIPP3-DAF-001	STRUCTURAL ARRANGEMENT - APRON FEEDER UNDERPAN 1
TIPP3-DAD-001	STRUCTURAL ARRANGEMENT - APRON FEEDER CHUTE 1 DETAILS
TIPP3-CBA-001	STRUCTURAL ARRANGEMENT - TIPPLER VAULT STEELWORK
TIPP3-BAA-004	CONCRETE HOPPER CAST-IN CHUTES

REFERENCE DRAWINGS

NOTES

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TAKRAF
TENOVA

Project Number:
AC0339/G0299

TGER Drawing Number:
–

TAFR Drawing Number:
TIPP3-DAA-001

NO.	DESCRIPTION	BY	CHKD	APPD	DATE
1	KNIF GATE GAP WAS 246		BRC		09/05/'18
0	ISSUED FOR CONSTRUCTION	W.S.	M.PET.	W.R.	12/03/2018
B	ISSUED FOR CLIENT REVIEW	W.S.	M.PET.	M.THOR.	03/07/2017
A	ISSUED FOR CIRCULATION AND CHECKING	W.S.			06/06/2017

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE
DRAWN	W.STRYDOM		12 03 '18
CHECKED	B.R. CAMPBELL	BRC.	12 03 '18
STRUCTURAL	D.NIEMANN		12 03 '18
PROJECT ENG.	W.RUSSELL		12 03 '18
PROJECT MAN.	K.NDLOVU		12 03 '18

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
SIGNAL ENG.			
MECH. ENG.			
ELEC. ENG.			
CIVIL ENG.			
STRUCT. ENG.			
C&I. ENG.			
ENG. MNG.			

PR.ENG. / PR.TECH. / PR. ARCH
NAME: D.NIEMANN
SIGNATURE: DATE 12 03 '18
REG. NUMBER: 9170011
SCALE : 1:50
A0

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TRANSNET

PORT OF SALDANHA

IRON ORE TIPPLER 3
GENERAL ARRANGEMENT
CHUTE WORK
HOPPERS AND APRON FEEDER CHUTES

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	0	000	G	AR	0001	01	01	JV

Appendix B

Phase 2 - Site Work Scope

ashton bulk
materials handling

Appendix B - Phase 2 Site Work Scope

Tier 1	Tier 2	Tier 3	Tier 4	Description of Work Required	**Continuation Work** (Work Required to Complete Installation Under Original Contract)	**Refurbishment Work** (Work Required Due to Time Lapsed Since Termination & Poor Storage Conditions)	**Remedial Work** (Work Required Due to Incorrect or Premature Installation)
Tippler							
	Tippler Rotating Structures			Apply Transnet surface protection repair procedure to corroded and paint damaged areas		✓	
		Tippler Cage Structure		Lift out of vault & re-align			✓
				Random 20% torque tightness tests on splice joint bolts			✓
				Remove one bolt & nut assembly from each splice joint for analysis			✓
			End Ring - LH	Random 20% torque tightness tests on flange joint bolts			✓
				Remove one bolt & nut assembly from each flange joint for analysis			✓
			End Ring - RH	Random 20% torque tightness tests on flange joint bolts			✓
				Remove one bolt & nut assembly from each flange joint for analysis			✓
			Platform				
			Side Beam	Access Side Beam internals to inspect welds and surface coating			✓
			Ballast Beam	Access Ballast Beam internals to inspect welds and surface coating			✓
			Side & Ballast Beam Pivot Shafts	Check torque tightness of inner shrink discs fasteners			✓
				Replace outer shrink disc with correct item			✓
			Cage Link				
			Torque Bracket Non-Tip LH	Random 20% torque tightness tests on flange joint bolts			✓
			Torque Bracket Tip LH	Random 20% torque tightness tests on flange joint bolts			✓
			Torque Bracket Non-Tip RH	Random 20% torque tightness tests on flange joint bolts			✓
			Torque Bracket Tip RH	Random 20% torque tightness tests on flange joint bolts			✓
			Platform Pivot Shaft	Check torque tightness of inner shrink discs fasteners			✓
				Replace outer shrink disc with correct item			✓
		End Ring Rails		Re-align			✓
		Tippler Drive Racks		Random 20% torque tightness tests on Rack bolts			✓
				Check pitching of Rack segments	✓		
		Wagon Clamp Gear					
		Tippler Ballast		Calculate quantity and add ballast	✓		
		Side Pad		Manufacture and install missing wear plates			✓
		Platform Walkways					
		Platform Rails		Random 20% torque tightness tests on rail clamp bolts			✓
		Spill Plates					
	Support Rollers			Apply Transnet surface protection repair procedure to corroded and paint damaged areas			
		Locating Support Rollers		Dismantle, clean and re-assemble with fresh grease all pivots		✓	
			Flanged Support Roller	Rebuild with new bearings and seals. Check existing bearings for serviciability		✓	
		Non-Locating Support Rollers		Dismantle, clean and re-assemble with fresh grease all pivots		✓	
			Plain Support Roller	Rebuild with new bearings and seals. Check existing bearings for serviciability		✓	
	Tippler Drive Gear			Remove and return to OEM for rebuild of gearbox and motor		✓	
				Install and align	✓		
	Rotational Buffers			Install	✓		
	Tippler Rotational Limit Switches			Install	✓		
	Tippler Maintenance Lock						
	Grout Packing						
	Ground Mounted Thrust Pads			Finish grouting and adjust clearance with Tippler	✓		
	Tippler Lubrication Installation			Install	✓		
Positioner				Apply Transnet surface protection repair procedure to corroded and paint damaged areas		✓	
				Align on Tracks			
	Main Frame			Install buffers	✓		
	Arm & Raise Mechanism			Random 20% torque tightness tests on rear pedestal bolts			✓
				Remove one bolt & nut assembly from rear pedestal joint for analysis			✓
				Remove old and install new pedestal			✓
				Dismantle counterwight mechanism, clean pins and bushes and re-assemble with fresh grease		✓	
				Add ballast to counterweight box	✓		
				Shim main arm to achieve correct arm lowered position	✓		
		Arm Structure & Head					
		Raised Arm Reaction Brackets		Install	✓		
	Arm Latch			Install actuator	✓		
	Last Wagon Arm			Dismantle main pivot, clean pin and bushes and re-assemble with fresh grease		✓	
		Last Wagon Arm Head		Remove LWA head, clean sliding head and re-assemble with fresh grease		✓	
				Remove shear pin, clean and re-assemble with fresh grease		✓	
				Replace coupler alignment tool			✓
			Last Wagon Arm Coupler	Un-seize and dismantle coupler, clean and re-assemble with fresh grease		✓	
				Install spring	✓		
	Guide Rollers			Rebuild with new bearings and seals. Check existing bearings for serviciability		✓	
				Re-install		✓	

Tier 1	**Tier 2**	**Tier 3**	**Tier 4**	**Description of Work Required**	**Continuation Work** (Work Required to Complete Installation Under Original Contract)	**Refurbishment Work** (Work Required Due to Time Lapsed Since Termination & Poor Storage Conditions)	**Remedial Work** (Work Required Due to Incorrect or Premature Installation)
				Adjust to achieve correct drive pinion clearance	✓		
	Sprung Support Roller			Rebuild with new bearings and seals. Check existing bearings for serviciability		✓	
				Re-install		✓	
				Install springs and adjust tension	✓		
	Fixed Support Roller			Rebuild with new bearings and seals. Check existing bearings for serviciability		✓	
				Re-install		✓	
	Drive Cartridge			Remove and return to OEM for rebuild of gearbox and motor		✓	
				Re-install		✓	
	Long Travel Encoder			Adjust backlash of existing unit	✓		
	Positioner Access			Remanufacture and install handrailing at trackside rear end			✓
				Reinforce handrailing on LCS platform adjacent to main arm	✓		
	Positioner Hydraulic Installation			Install HPU, support frame and Bund	✓		
				Install rotary actuator, main arm actuator, LWA latch actuator and coupler latch actuator	✓		
				Install piping	✓		
	Positioner Lubrication Installation			Install 2x lubrication units and support frames	✓		
		Lubrication Pinion		Install	✓		
	Long Travel Cartridge Encoder			Manufacture, supply and install			✓
Positioner Track				Apply Transnet surface protection repair procedure to corroded and paint damaged areas		✓	
	Track Rear Module						
	Track Inner Module			Tighten loose rack section			✓
				Loosen rail clips, close gaps between adjacent rail and re-tighten clips			✓
	Track Front Module			Loosen rail clips, close gaps between adjacent rail and re-tighten clips			✓
	5 Rack Track Module			Tighten bolts	✓		
				Install missing fitted bolts			✓
	3 Rack Track Module			Tighten bolts	✓		
				Install missing fitted bolts			✓
Cable Festoon System				Apply Transnet surface protection repair procedure to corroded and paint damaged areas		✓	
				Complete ladder installation	✓		
				Install towing link	✓		
Train Holding Devices				Apply Transnet surface protection repair procedure to corroded and paint damaged areas		✓	
	Wheel Gripper Unit			Remove Support Frame from pit, dismantle Gripper units, clean and re-assemble with new pins and fresh grease.		✓	
				Install Gripper jaw assemblies on Support Frames and align.	✓		
				Install complete unit in foundation, align, bolt down and grout.	✓		
				Install foundation pieces and Gripper Stops	✓		
				Install cover plates			✓
	Train Holding Device Hydraulic Installation			Install HPU	✓		
				Install THD actuators	✓		
	Train Holding Device Pit Ladder			Install	✓		
Plant Control Switches				Apply Transnet surface protection repair procedure to corroded and paint damaged areas		✓	
				Install Support Posts	✓		
Apron Feeder Supports				Apply Transnet surface protection repair procedure to corroded and paint damaged areas		✓	
	Support Steelwork			Random 20% torque tightness tests on joint bolts			✓
	Access						
Conveyor Feed Chutes				Apply Transnet surface protection repair procedure to corroded and paint damaged areas		✓	
				Complete installation	✓		
Apron Feeder Feed Chutes				Apply Transnet surface protection repair procedure to corroded and paint damaged areas		✓	
				Complete installation	✓		
Apron Feeders							
	Apron Feeder Unit			Install drive	✓		
				Install and align	✓		
	Apron Feeder Hydraulic Installation						
	Apron Feeder Lubrication Installation			Supply piping and fittings		✓	
				Install	✓		
Knife Gates							
	Knife Gate Unit						
	Knife Gate Hydraulic Installation						
Knife Gate Feed Hoppers				Resolve mis-alignment with conveyor Feed Chutes		✓	
				Complete installation	✓		
Impact Wall				Remove Impact Wall for Tippler removal & re-install later			✓
				Design review of Impact Wall			✓
				Replacement of Support Roller Dust Shrouds			✓
				Notching of non-tip side hopper to clear Tippler Wagon Clamp Ballast Weights			✓
Hopper Liner Plates				Design, supply and install liner plates for concrete cast in-situ hopper and Impact Wall			✓

Tier 1	Tier 2	Tier 3	Tier 4	Description of Work Required	**Continuation Work** (Work Required to Complete Installation Under Original Contract)	**Refurbishment Work** (Work Required Due to Time Lapsed Since Termination & Poor Storage Conditions)	**Remedial Work** (Work Required Due to Incorrect or Premature Installation)
				Install liner plates for Apron Feeder feed chutes	✓		
				Install liner plates for conveyor feed chutes	✓		
Crawl Beams				Design review & strength check			✓
Dust Cowl				Apply Transnet surface protection repair procedure to corroded and paint damaged areas		✓	
				Remove and re-install			✓
Dust Extraction System	Ducting			Design, manufacture and supply new dog-leg section		✓	
				Install	✓		
	Bag House			Apply Transnet surface protection repair procedure to corroded and paint damaged areas		✓	
				Complete installation	✓		
				Respective OEMs to refurbish and test where necessary:			
				Dust Blower		✓	
				Immersion Tanks		✓	
				Immersion Tank Pressure Gauges, Safety Valves, Drain valves		✓	
				Solenoid Valves		✓	
				Screw Conveyors		✓	
				Knife Gate Valves, Rotary Vane Feeders, Double Flap Valves		✓	
				Bagfilters		✓	
				Install filter bags	✓		
				Install screw conveyors, valves and piping	✓		
				Install Knife Gate Valves, Rotary Vane Feeders, Double Flap Valves	✓		
				Install Dust Blower	✓		
				Install Immersion Tanks - 6 off	✓		
				Install immersion tank pressure gauges, safety valves and drain valves	✓		
				Install blow pipes	✓		
				Install solenoid valves - 66 off	✓		
				Install hopper mesh supports	✓		
				Install hopper mesh - 6 off	✓		
				Install access doors	✓		
				Install plenum closing plate next to Dust Silo	✓		
				Install plenum access steps, grab handles and safety cages	✓		
				Epoxy seal between stitch welds on Bag Filter Housings			✓
				Seal weld internal bag plate over all joints	✓		
				Grout structure to foundations	✓		
	Dust Silo			Apply Transnet surface protection repair procedure to corroded and paint damaged areas		✓	
				Complete installation	✓		
				Respective OEMs to refurbish and test where necessary:			
				Over Pressure Relief Valve		✓	
				Diverter Chute		✓	
				Pug Mill		✓	
				Knife Gate Valve, Rotary Vane Feeder		✓	
				Loading Spout Hand Winch		✓	
				Water Supply Pressure Gauge		✓	
				Install pug mill and piping	✓		
				Install truck loading spout	✓		
				Install over-pressure relief valve	✓		
				Install diverter chute	✓		
				Install Knife Gate valve, Rotary Vane Feeder	✓		
				Install water supply	✓		
				Install loading spout hand winch	✓		
				Install ball valve for water supply	✓		
				Grout structure to foundations	✓		
	Compressed Air System			Respective OEMs to refurbish and test where necessary:			
				Air Compressors		✓	
				Desiccant Dryers		✓	
				Particulate Filters		✓	
				Pressure Gauges		✓	
				Remove air receivers, pressure test and re-install		✓	
		Compressor House		Complete installation	✓		
				Install air compressors	✓		
				Install desiccant dryers	✓		
				Install particulate filters	✓		
				Install piping and valves	✓		
				Install pressure gauges	✓		
				Install air reciever pressure gauges, safety valves and drain valves	✓		

Tier 1	**Tier 2**	**Tier 3**	**Tier 4**	**Description of Work Required**	**Continuation Work** (Work Required to Complete Installation Under Original Contract)	**Refurbishment Work** (Work Required Due to Time Lapsed Since Termination & Poor Storage Conditions)	**Remedial Work** (Work Required Due to Incorrect or Premature Installation)
				Install cladding	✓		
				Load test crawl beams	✓		
				Supply trolley hoists			✓
				Install trolley hoists	✓		
	Main Fan			Assemble fan on foundations	✓		
				Install drive motor	✓		
				Install bearing temperature sensors	✓		
	Electrical and Control System			Return sequential controllers to OEM for condition checking		✓	
				Install sequential controllers in S/S enclosures	✓		
				Respective OEMs to refurbish and test where necessary:			
				Double Flap Valve Solenoids		✓	
				Speed Switch Mounts for Rotary Vane Feeders		✓	
				Install all instruments and devices	✓		
Main Track Supports				Design, manufacture, supply and install			✓

Appendix C

Tippler Alignment Survey Report & Engineering Assessment

Engineering Assessment Notes

The Site Survey was undertaken with Ashton Bulk in attendance and the results have been assessed in detail during subsequent reviews. Based on the datums established during the survey and specification (accuracy) of the industry leading surveying equipment, the following has been established:

I. All results are consistent with both the established datums (absolute) and individually analysed location (relative).

II. Manual measurements have confirmed the survey results in several points of consideration.

III. The misalignment relates to the End Rings, End Ring Rails and Drive Racks. The trend is similar for each of these components but the magnitude of deviation differs.

IV. The magnitude of deviation of the End Rings and End Ring Rails is such that the sides of the Rail Head would contact and exert excessive sideways force upon the flanges of the Locating Support Rollers. This would result in damage and also impose forces on the Tippler Cage for which it has not been designed, or need to be designed, under normal modes of operation.

V. The magnitude of deviation of the End Rings and End Ring Rails is also of an extent that the Tippler Cage will travel in the longitudinal/axial direction during rotation, i.e. it will “Corkscrew”. This movement will exacerbate the condition and effects outlined in Item IV above, thus increasing the unwarranted and indeterminate sideways forces on the Support Rollers and Tippler Cage.

VI. While the End Ring T-section and the End Ring Rail follow the same trend of misalignment as shown by the graphs on the AB Summary Sheet, there is a deviation in the centre of End Ring Rail to centre of End Ring Web which exceeds the drawing tolerance of ± 1.5mm. Refer to the numbers highlighted in blue on the Survey Summary Sheet. Whilst efforts will be made to improve this deviation during Tippler re-alignment, it will not be possible to completely correct the error. This offset in centre distance where exceeding ± 1.5mm will induces a rotation in the T-section of the End Ring which will increase localised stress levels and potentially the fatigue life of the End Ring Structure.

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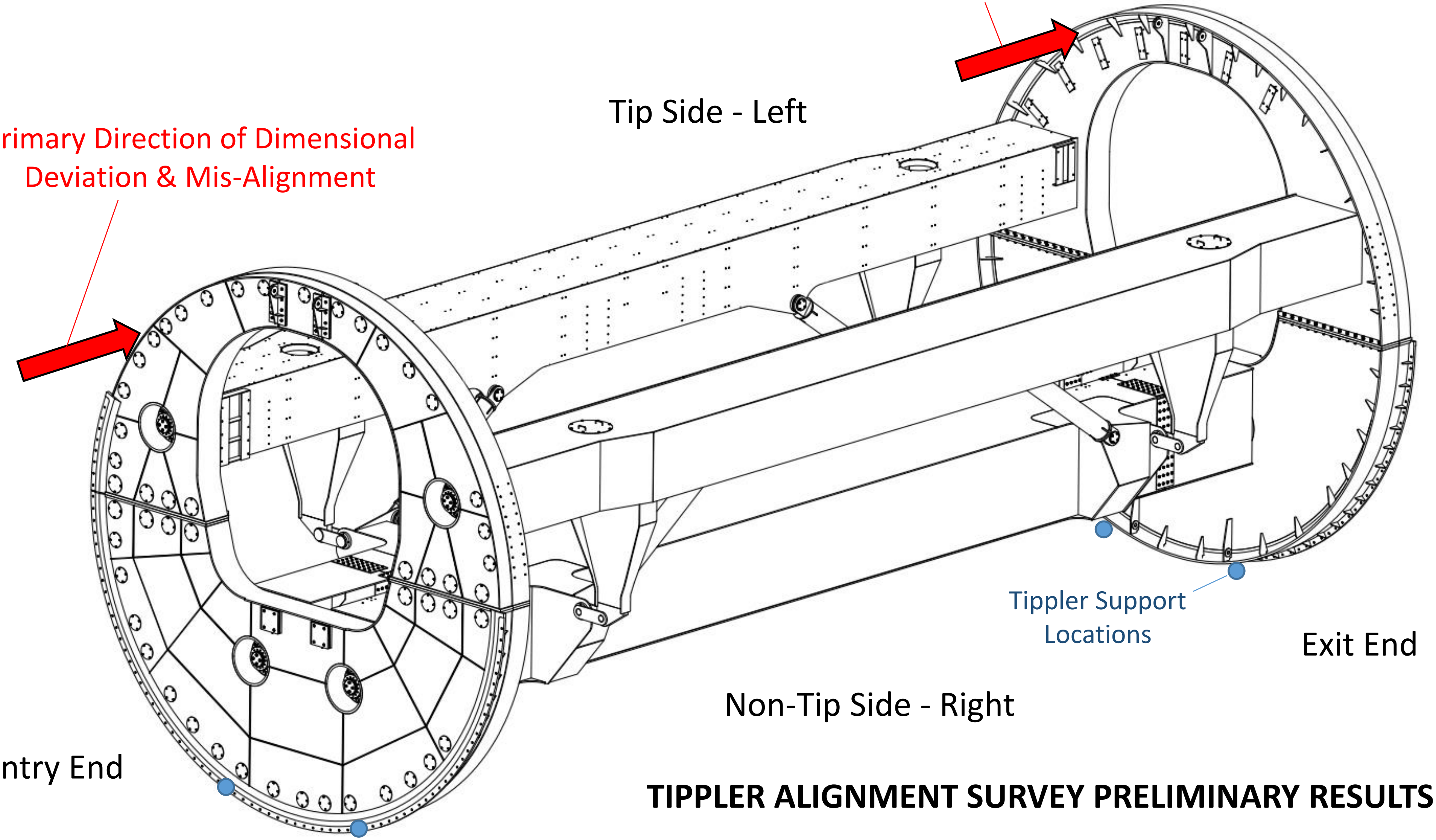
TIPPLER ALIGNMENT SURVEY PRELIMINARY RESULTS



Primary Direction of Dimensional Deviation & Mis-Alignment

Tip Side - Left

Primary Direction of Dimensional Deviation & Mis-Alignment

Tippler Support Locations

Exit End

Non-Tip Side - Right

Entry End

Surveys for Informed Decisions & Design

SURVEY REPORT

Project: Saldanha Iron Ore Terminal - Tippler 3 As-Built Report
Date of Survey: 16 to 18 March 2022
Our Reference: Tippler 3_As-Built Survey Report_170322

KZN: 035 7890421
Suite #3
Quay Walk Building
Tuzi Gazi Waterfront
Richards Bay

EC: 082 4659740
426 Sardinia Bay Road
Port Elizabeth

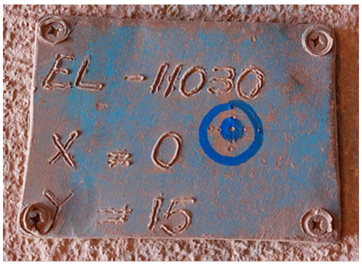
Saldanha Tippler 3 As-Built Survey
Introduction

Machine Baseline

Tippler 3 has 2 Centreline Benchmarks established during the construction of the civils for the housing of the tippler. These benchmarks are punched points on stainless plates fixed on the floor at the rail level. These points constitute the Primary Machine Baseline at the Entry and Exit ends.
The coordinate and elevation values for these benchmarks are punched on the stainless steel plates. The Entry Benchmark was adopted as the Primary Point and the Exit Benchmark was used as the Zero direction for the Machine Baseline. The points were surveyed to check the baseline length and the height difference as per the punched coordinate values.

Name	X	Y	Z
ENTRY	0.000	-15.000	11.000
EXIT	0.000	15.000	11.300

ENTRY Benchmark



EXIT Benchmark

The punched values on the Benchmark plates indicate the Machine Baseline: Entry to Exit

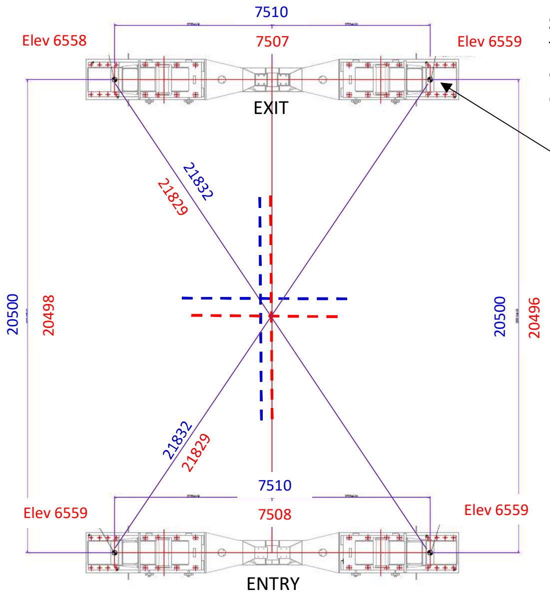
Baseline Length **30.000m**
Height Difference **+0.030m**
The survey of these points indicated the following:
Baseline Length **30.008m** (Difference: +0.008m)
Height Difference of **-0.033m** (Difference: -0.063m).

Further survey checks were performed to establish the accuracy of scribed height values on the concrete columns and walls on the Ground Floor and in the Basement. These height checks were all 0.030m lower then the written values on the scribe marks.
This indicated that the punched height of the Primary Entry Benchmark (11.000m) is 0.030m lower than than the height marks used to construct the civils and install the tippler.
The surveyed values of the Machine Baseline indicate that the punched height values of the points were transposed and incorrectly punched on the plates. By adopting the height value of 11.033m for the Primary Entry Benchmark the height difference between the Entry and Exit Benchmarks is true and values of the scribed height marks on the concrete columns and walls become accurate.

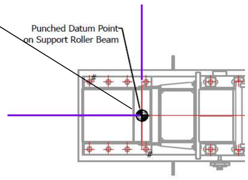
Machine Basline: New Adopted Benchmark Values

Name	X	Y	Z
ENTRY	0.000	-15.004	11.033
EXIT	0.000	15.004	11.000

These new values for the ENTRY and EXIT Benchmarks were adopted as the Machine Baseline and this baseline was transferred down to the basement for the survey of the Support Roller Bases to determine their accuracy of installation.



Support Roller Beam Survey:
The positions of the punched Datum Points on the Jacking Stops of the Support Beams were indicated as the alignment and elevation points for positioning of the Beams.



Blue is Design Dimension / **Red** is Surveyed Dimension

Blue dashed line is the Tippler Centre as per the adopted Machine Baseline Benchmark points
Red dashed line is the Tippler Centre as per the surveyed position of the Support Roller Beams
Difference: X +0.009m
Y -0.029m

Conclusion: The As-Built position of the Support Roller Beams does not relate to the Primary Machine Baseline installed on the ground floor. The elevations of the Primary Machine Baseline as adopted are correct. As such this As-Built Survey of Tippler 3 has been based on the centrelines defined by the Datum Points on the jacking stops of the Support Roller Beams as these surveyed dimensions are sound.
We would advise that the Benchmark plates on the ground floor be removed and replaced with fresh plates that can be correctly positioned to match the baseline adopted from the Support Roller Beams.

Survey Methodology

The initial survey indicated that the installed Machine Baseline Benchmarks were unrelated to the installed position of the Tippler. We could not locate any other official benchmark positions and thus created a new Primary Benchmark System from the surveyed position and alignment of the Support Roller Bases. A series of Reflective Wall Targets were installed in positions outside and inside the Tippler Building at strategic positions for future reference should another survey of the tippler be required and to assist with positioning of new Machine Baseline Benchmark plates.

A series of Laser Scan Targets were placed at strategic positions surrounding the tippler to enable accurate positioning of the laser scan data. These were surveyed from the new Primary Benchmark System to ensure that the laser scan data of the tippler structure and components was directly related to the installed positions of the Support Roller Beams.

Survey Equipment

Survey of Benchmarks and positioning of additional benchmarks
Instrument:
Leica MS50 Multistation
Angular Accuracy - 1"
Distance Accuracy - 1mm + 1.5ppm
Single Point Position Accuracy - 0,5mm

3D Laser Scan Survey of Tippler Structure and Components
Instrument:
Leica P40 Scanstation
Angular Accuracy - 8"
Distance Accuracy - 1,2mm + 10ppm
Single Point Position Accuracy - 3mm at 50m

Tippler 3 As-Built Survey Report 170322

Contents

1.0) Tippler 3_As-Built Survey Report_170322
1.1) Tippler 3_ As-Built Survey_Support Roller Beams_170322
1.2) Tippler 3_As-Built Survey_Entry Locating Roller Offsets_170322
1.3) Tippler 3_As-Built Survey_Exit Non-Locating Roller Offsets_170322
1.4) Tippler 3_ As-Built Survey_End Ring Rail Offsets_170322
1.5) Tippler 3_As-Built Survey_T-Section Offsets_170322
1.6) Tippler 3_As-Built Survey_Pivot Pin Offsets_170322

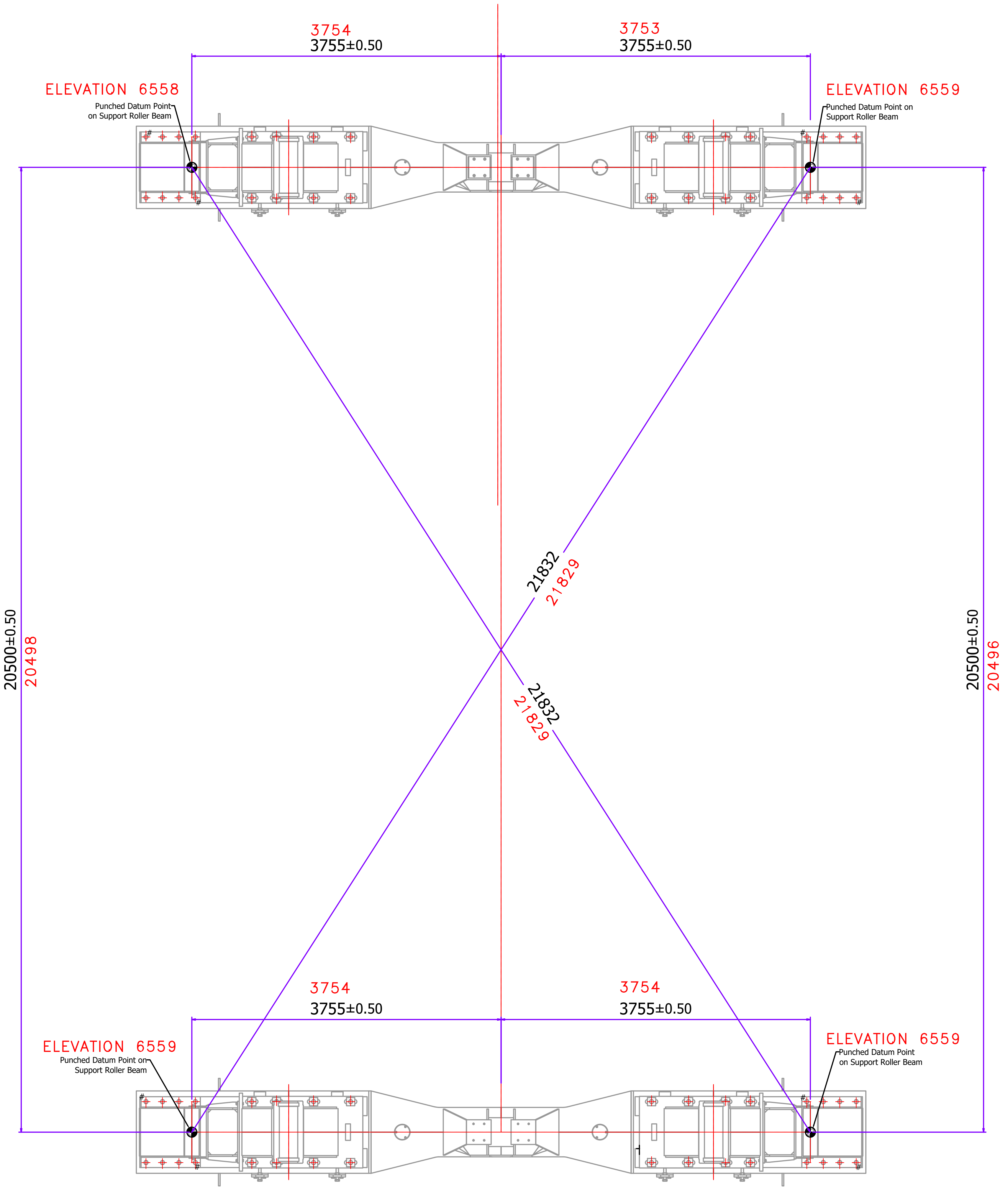
Signed:

Bradley Inggs
Registered Geomatics Technologist (GTg ES499)

Tippler 3 - Support Roller Beams Offsets

Note: The measurements were taken on the punch marks on the Datum Plates

Red Text is the Surveyed Dimensions



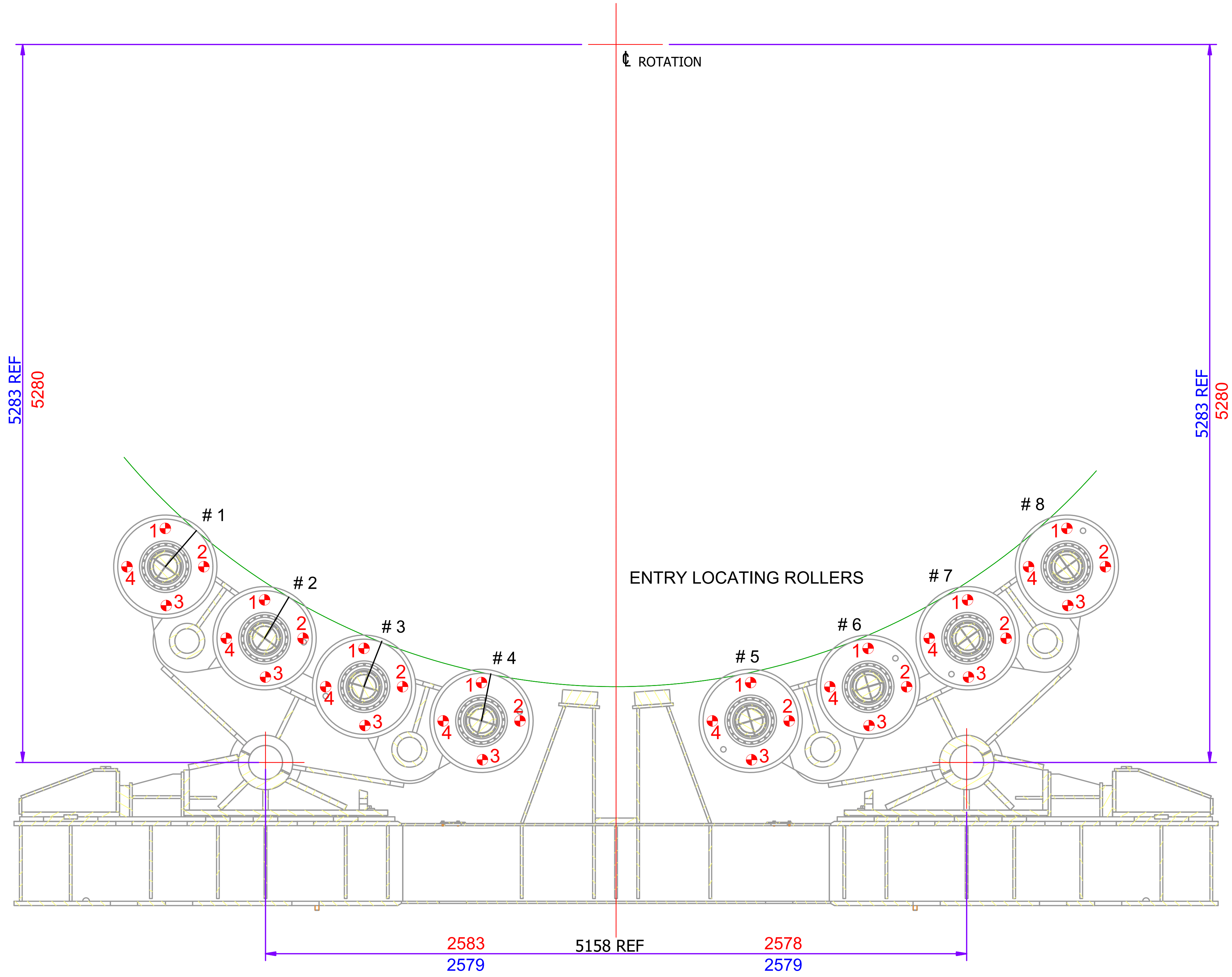
Tippler 3 - Locating Roller Offsets from the Tippler Centreline

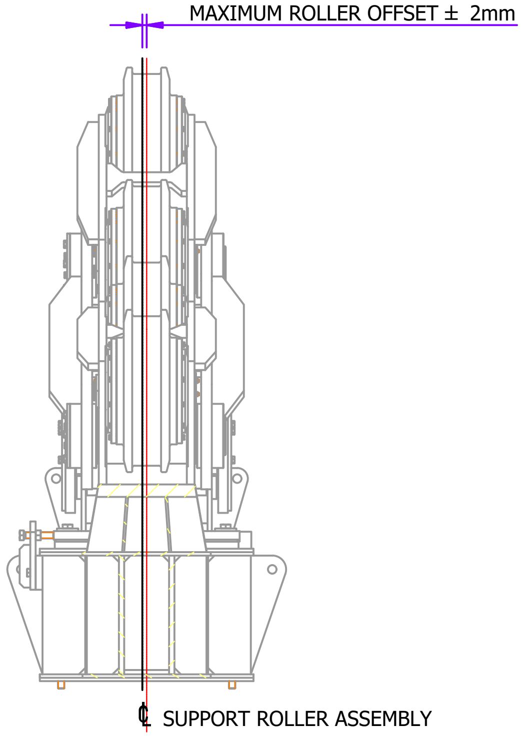
Measured point is on the outside of the roller (107.5mm Offset to Centre of Roller)

Red Text is the Entry End As-Built Measurements

Blue Text is the Design Dimensions

View is from the Entry End Ring toward the Exit End Ring





ENTRY LOCATING ROLLERS

#1	Measured	Design	Offset	#2	Measured	Design	Offset	#3	Measured	Design	Offset	#4	Measured	Design	Offset	#5	Measured	Design	Offset	#6	Measured	Design	Offset	#7	Measured	Design	Offset	#8	Measured	Design	Offset
1	10249	10250	-1	1	10248	10250	-2	1	10248	10250	-2	1	10248	10250	-2	1	10246	10250	-4	1	10246	10250	-4	1	10245	10250	-5	1	10246	10250	-4
2	10248	10250	-2	2	10247	10250	-3	2	10249	10250	-1	2	10247	10250	-3	2	10247	10250	-3	2	10248	10250	-2	2	10247	10250	-3	2	10246	10250	-4
3	10249	10250	-1	3	10247	10250	-3	3	10251	10250	1	3	10248	10250	-2	3	10247	10250	-3	3	10249	10250	-1	3	10247	10250	-3	3	10246	10250	-4
4	10250	10250	0	4	10247	10250	-3	4	10251	10250	1	4	10248	10250	-2	4	10246	10250	-4	4	10247	10250	-3	4	10245	10250	-5	4	10246	10250	-4
	mm	mm	mm		mm	mm	mm		mm	mm	mm		mm	mm	mm		mm	mm	mm		mm	mm	mm		mm	mm	mm		mm	mm	mm

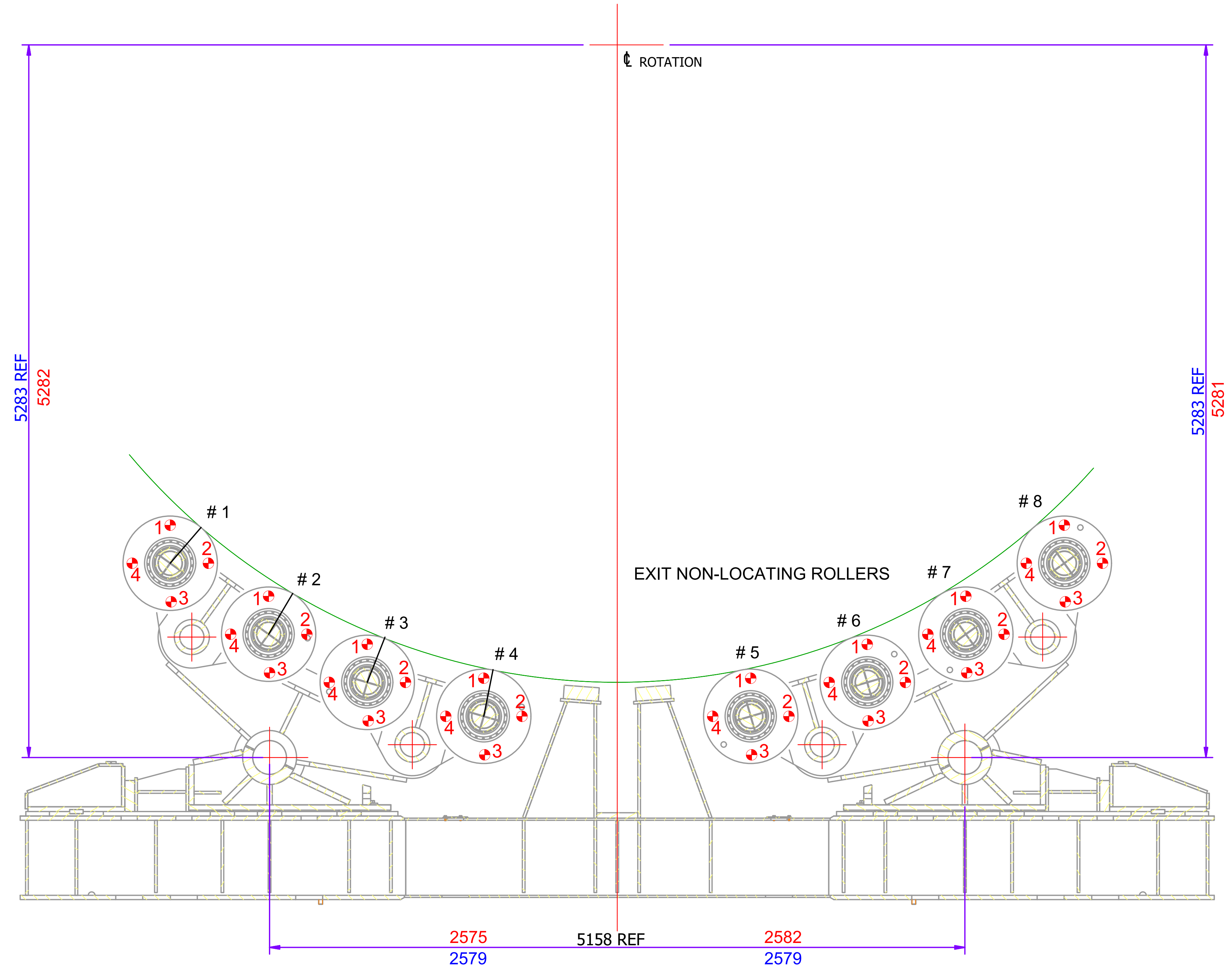
Tippler 3 - Non-Locating Roller Offsets from the Tippler Centreline

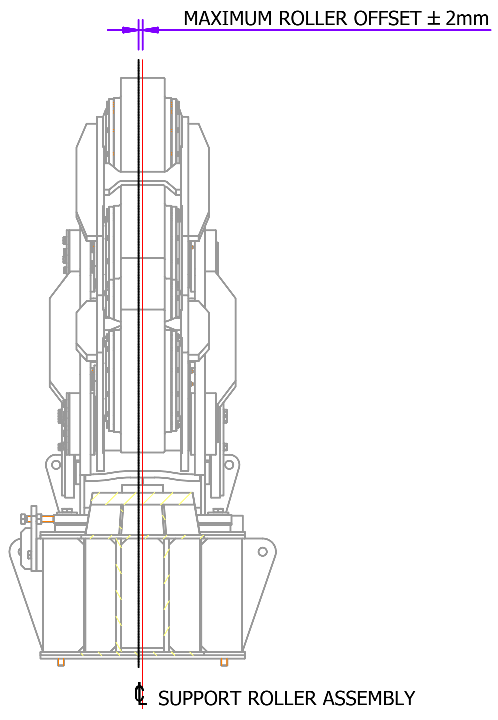
Measured point is on the outside of the roller (107.5mm Offset to Centre of Roller)

Red Text is the Exit End As-Built Measurements

Blue Text is the Design Dimensions

View is from the Exit End Ring toward the Entry End Ring





EXIT NON-LOCATING ROLLERS

#1	Measured	Design	Offset	#2	Measured	Design	Offset	#3	Measured	Design	Offset	#4	Measured	Design	Offset	#5	Measured	Design	Offset	#6	Measured	Design	Offset	#7	Measured	Design	Offset	#8	Measured	Design	Offset
1	10248	10250	-2	1	10248	10250	-2	1	10247	10250	-3	1	10248	10250	-2	1	10251	10250	1	1	10251	10250	1	1	10250	10250	0	1	10250	10250	0
2	10248	10250	-2	2	10248	10250	-2	2	10248	10250	-2	2	10248	10250	-2	2	10251	10250	1	2	10250	10250	0	2	10250	10250	0	2	10250	10250	0
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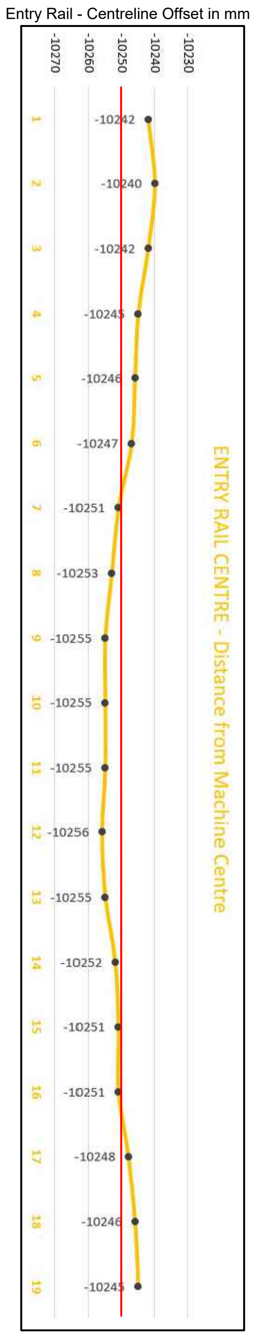
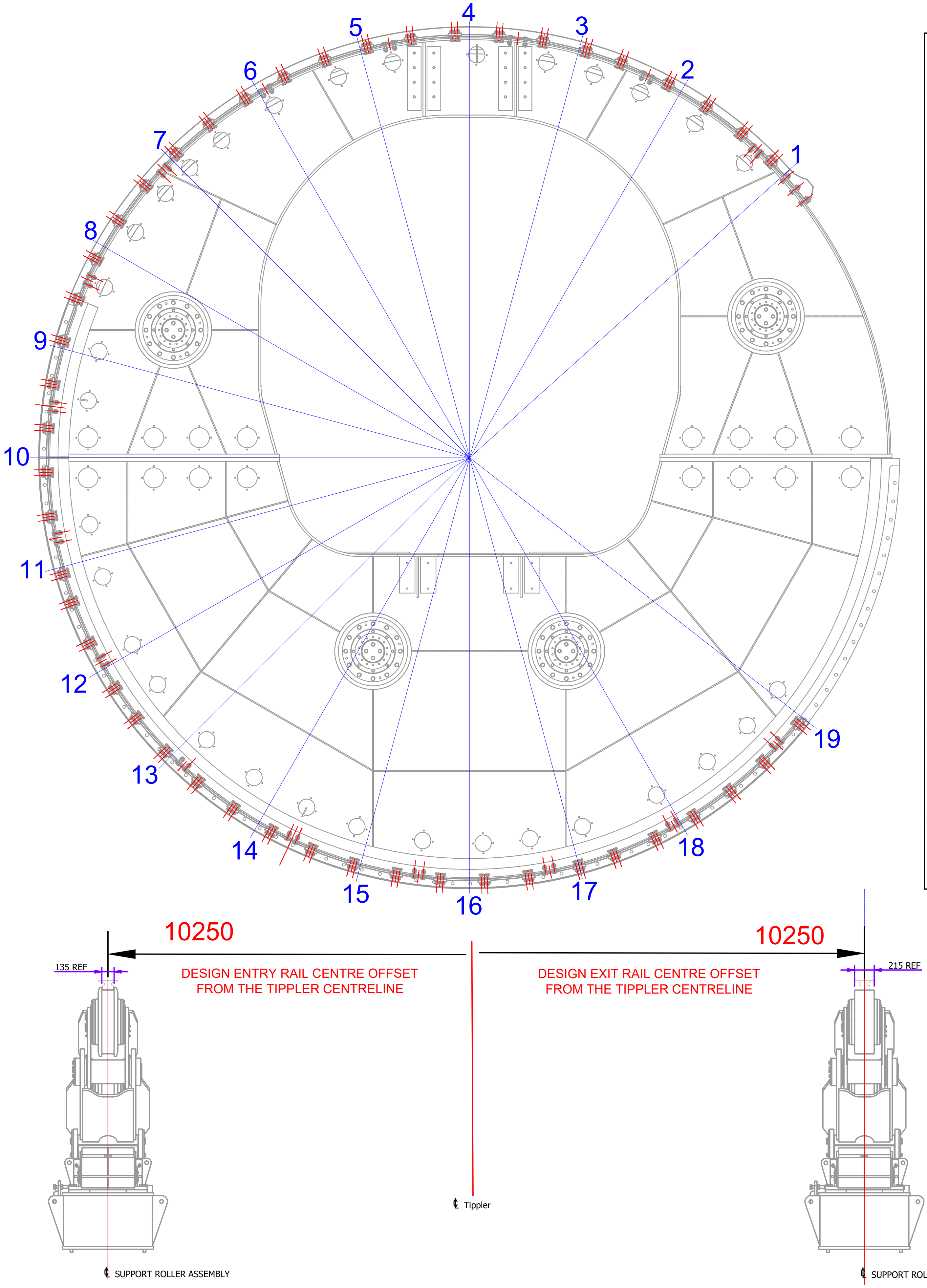
4	10248	10250	-2	4	10248	10250	-2	4	10248	10250	-2	4	10248	10250	-2	4	10251	10250	1	4	10250	10250	0	4	10250	10250	0	4	10250	10250	0
	mm	mm	mm		mm	mm	mm		mm	mm	mm		mm	mm	mm		mm	mm	mm		mm	mm	mm		mm	mm	mm		mm	mm	mm

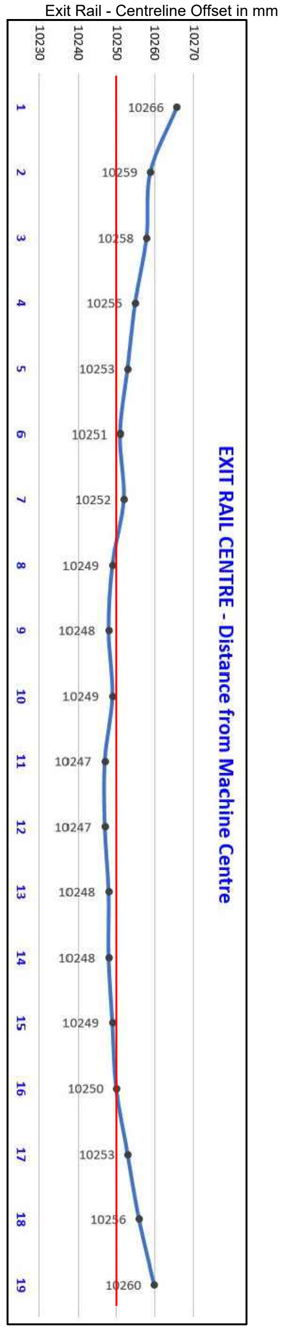
Tippler 3 - Rail Centreline Offsets from the Tippler Centreline

Measured point is on the outside of the rail (60mm Offset to Centre Rail)
Points measured at 15 Degree Segments
Note: Points 4 & 5 Derived by interpolation between
adjacent points as the line of sight was obscured at these points

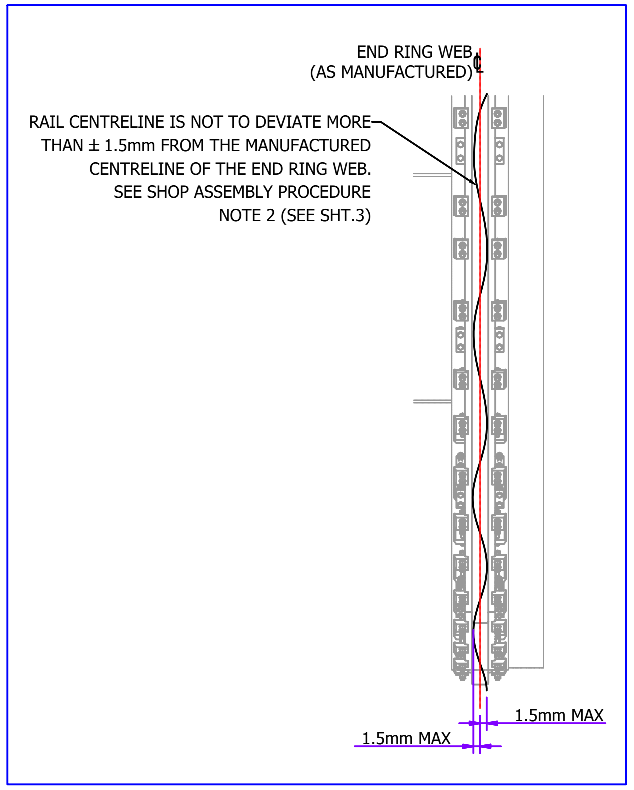
View is from the Entry End Ring toward the Exit End Ring


Entry Rail - Centreline Offset in mm




Exit Rail - Centreline Offset in mm

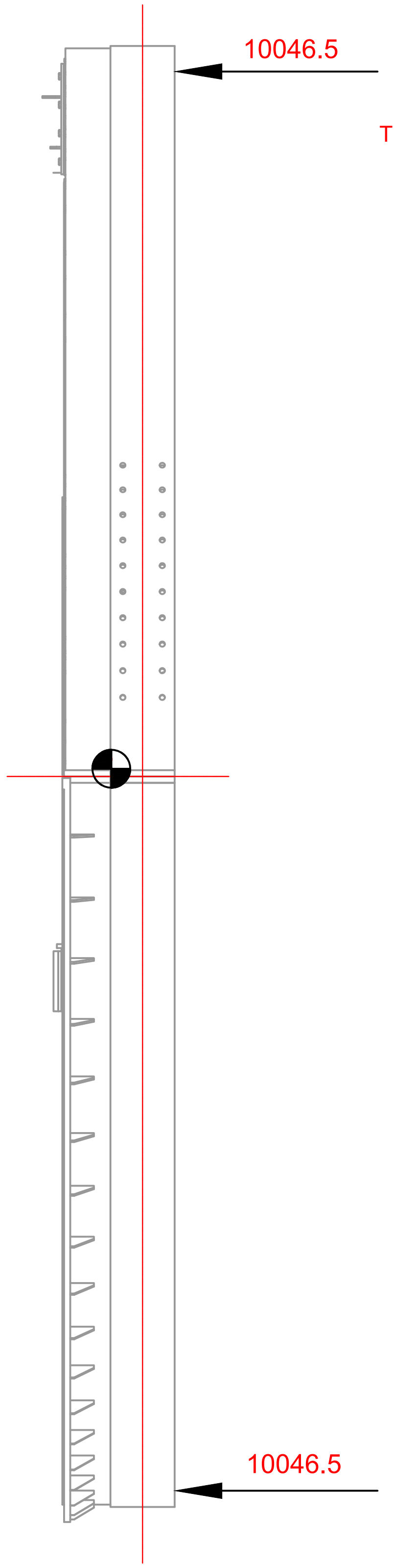
End Ring Rail Assembly Note



Tippler 3 - T-Section Offsets from the Tippler Centreline

Measured point is on the inside edge of the T-Section (203.5mm Offset to Centre End Ring)
Points measured at 30 Degree Segments
Note: Points 10, 11 & 12 do not have measurements
as the line of sight was obscured at these points

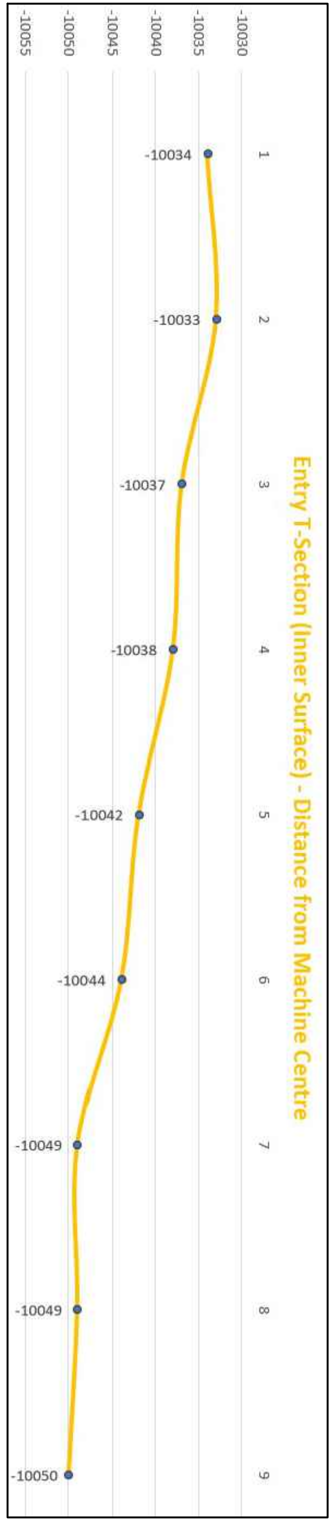
View is from the Entry End Ring toward the Exit End Ring

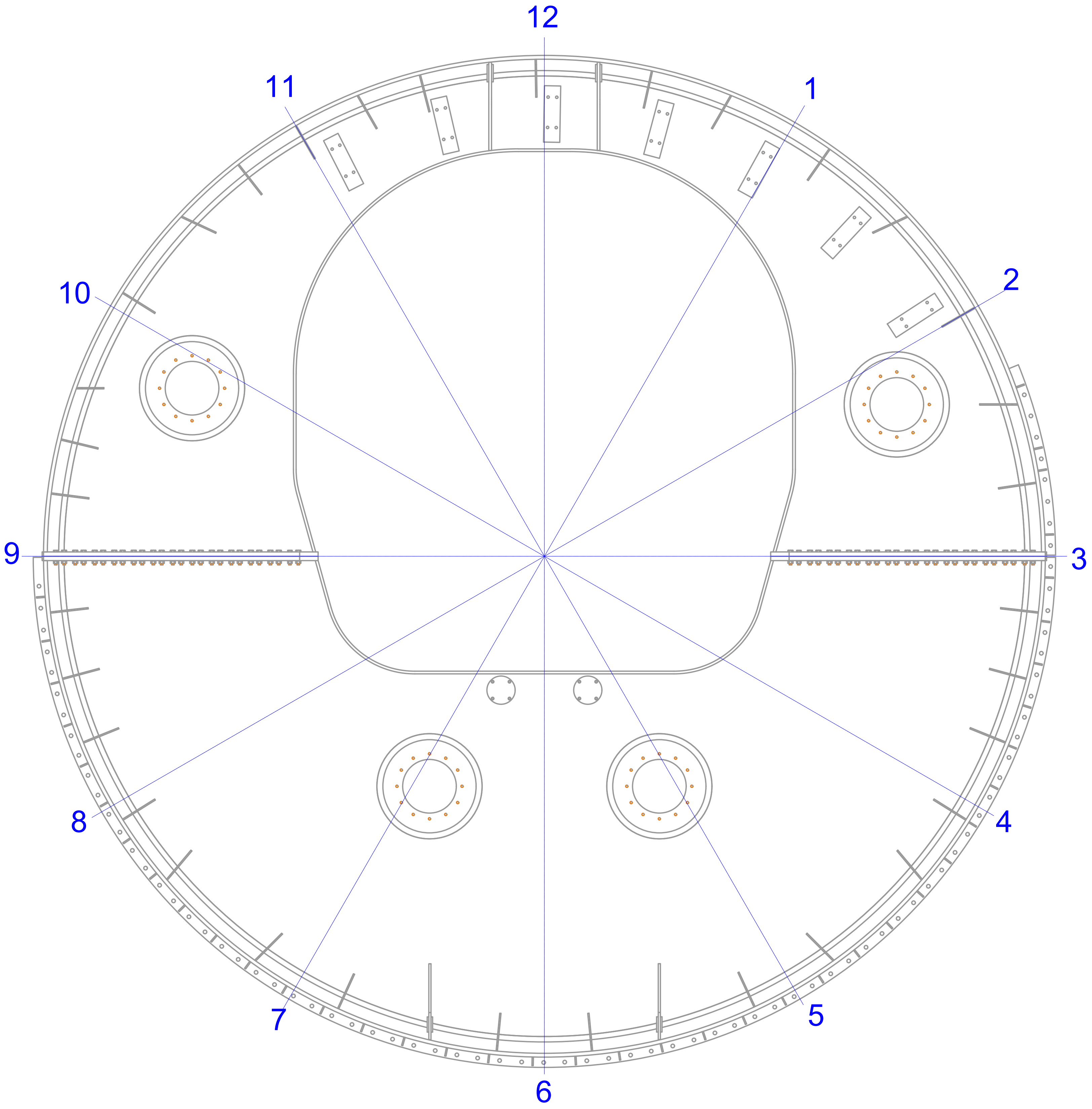


DESIGN OFFSET OF INNER T-SECTION EDGE FROM THE TIPPLER CENTRE LINE

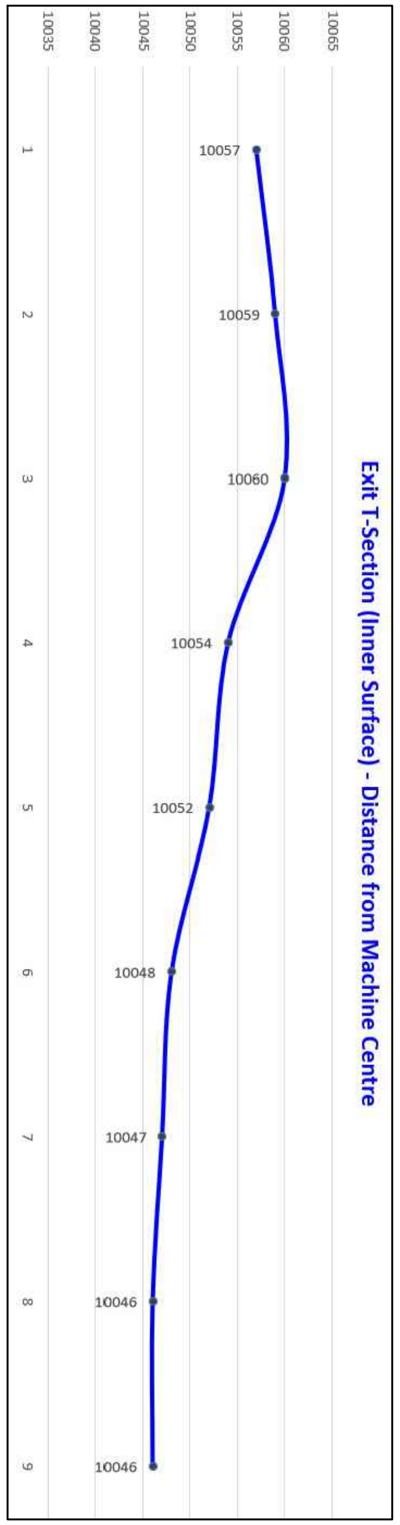
DESIGN OFFSET OF INNER T-SECTION EDGE FROM THE TIPPLER CENTRE LINE

Entry T-Section - Inside Edge Offset in mm





Exit T-Section - Inside Edge Offset in mm



Tippler 3 - Pivot Pin offsets from the Tippler Centreline

View is from the Entry End Ring toward the Exit End Ring

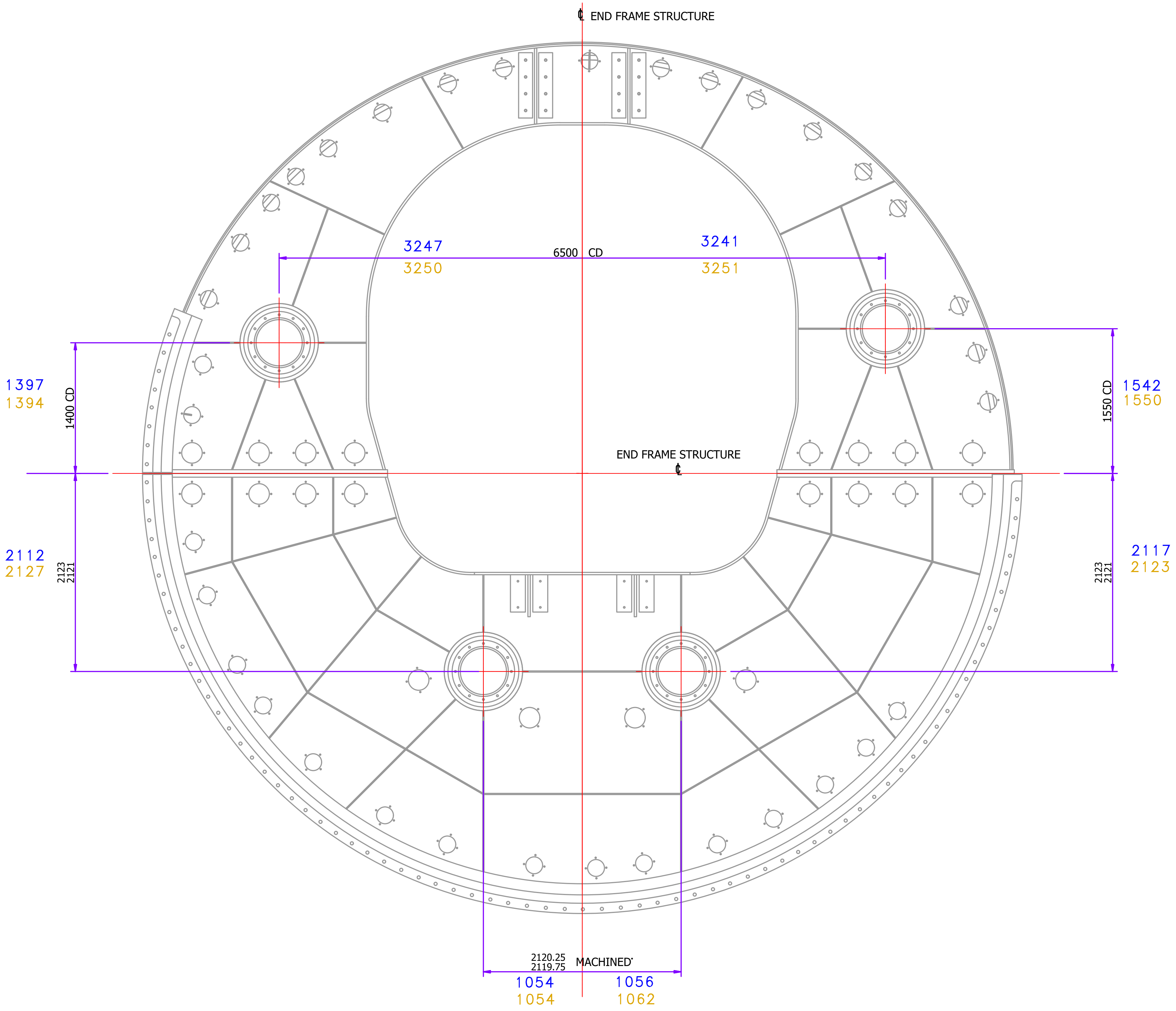
Note: The measurements were taken on the centres of the cover plates

This assumes that the cover plate positioning holes were placed according to the pin bore position

View is from the Entry End Ring toward the Exit End Ring

Gold Text is the Entry End As-Built Measurements

Blue Text is the Exit End As-Built Measurements

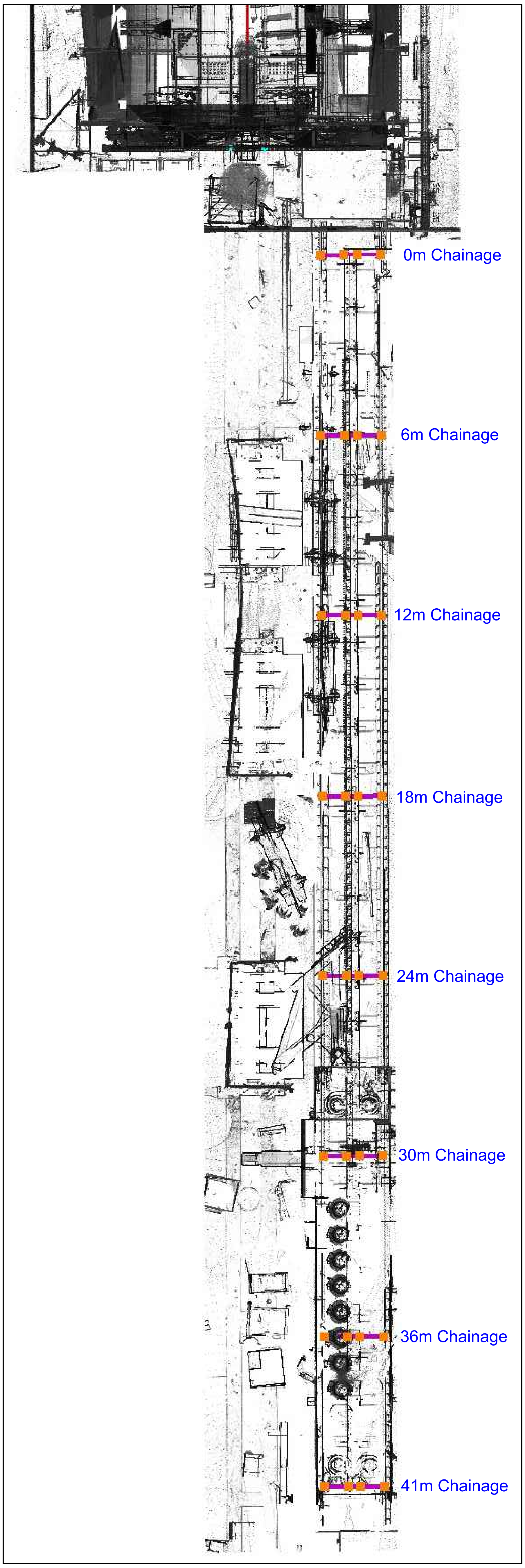


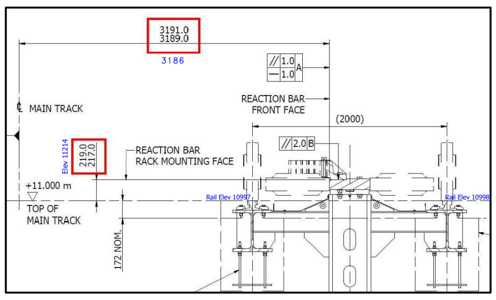
Tippler 3 - Positioner Bar Offsets from the Tippler Centreline
Positioner Bar and Rail Elevations

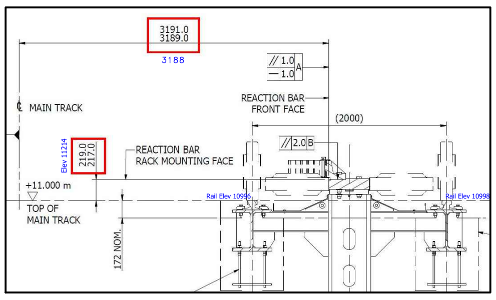
Text in Red Border is the Design Measurement

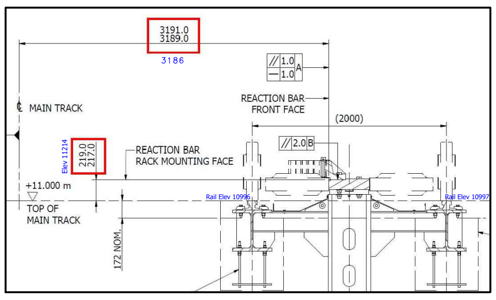
Blue Text is the As-Built Measurement

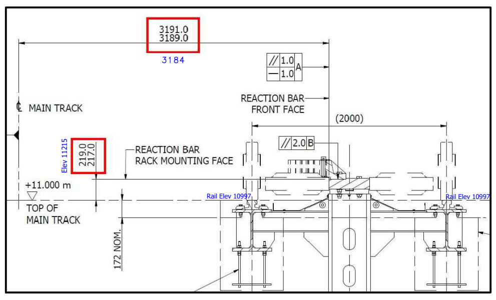
View is from the Exit End Ring toward the Entry End Ring

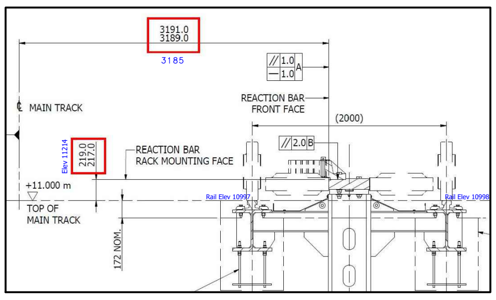


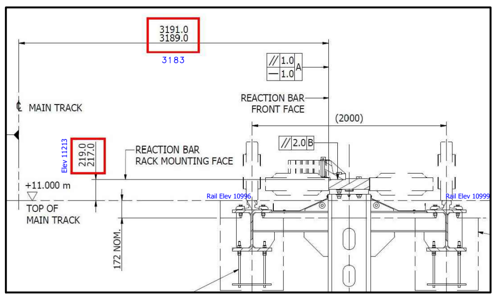


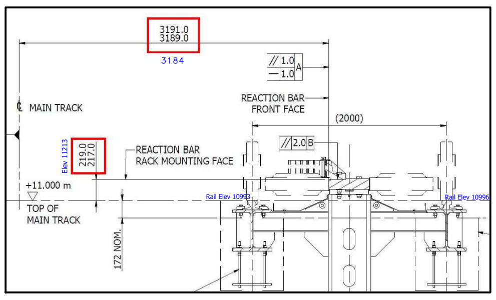


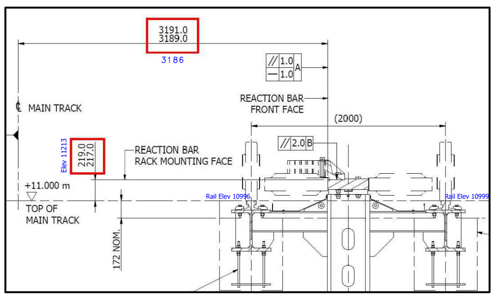








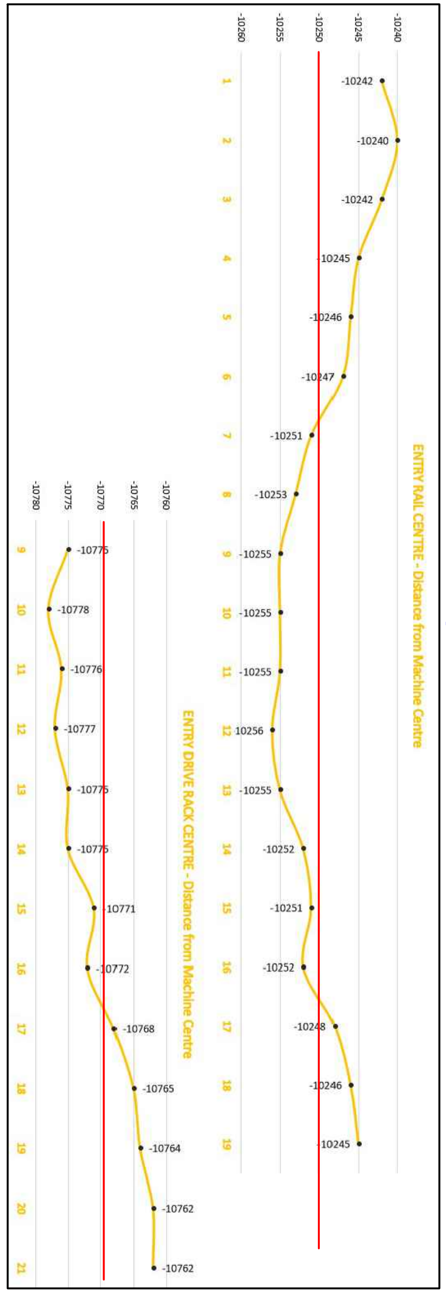


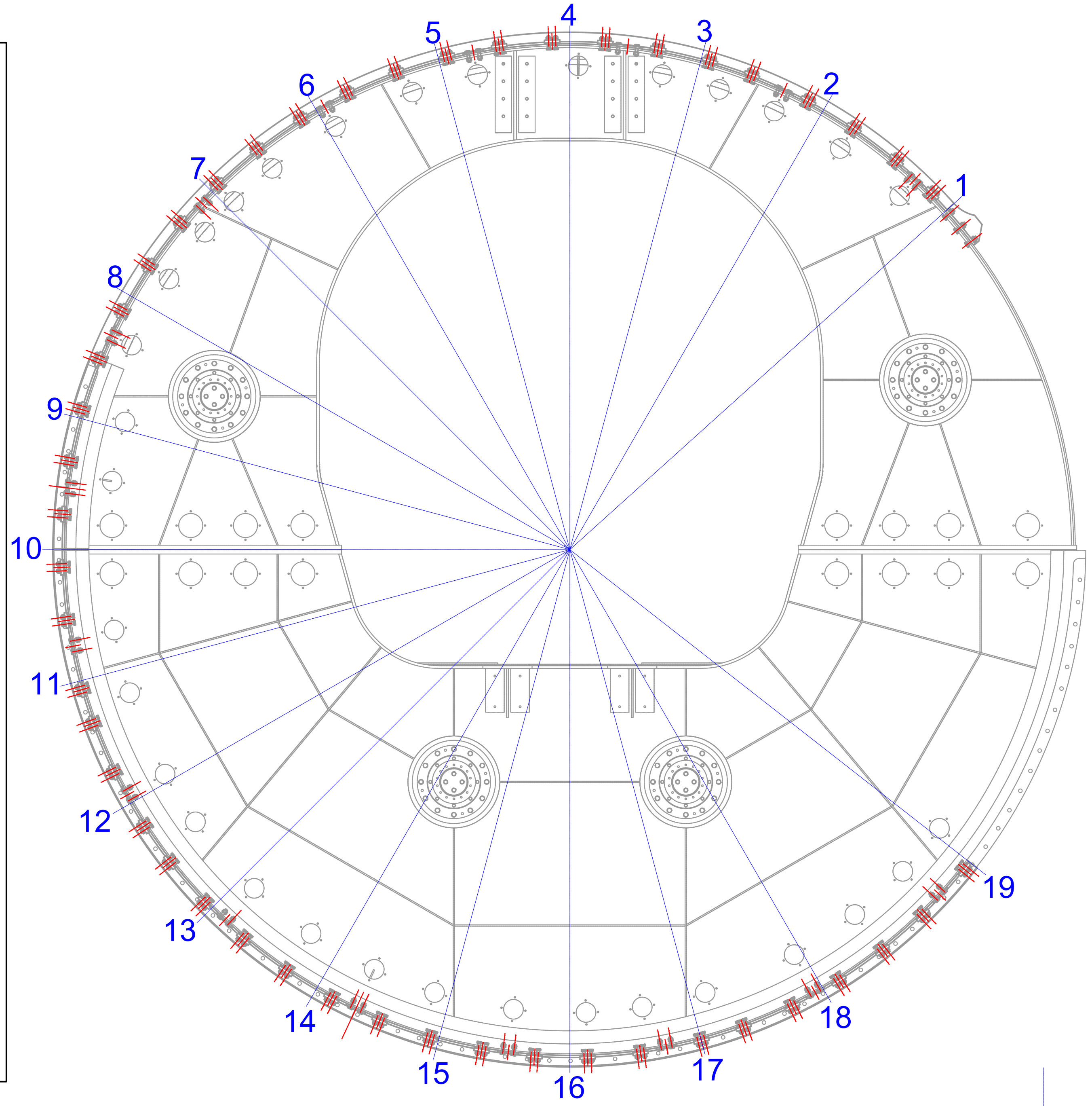


Tippler 3 - Gear Rack and Rail Centreline Offsets from the Tippler Centreline

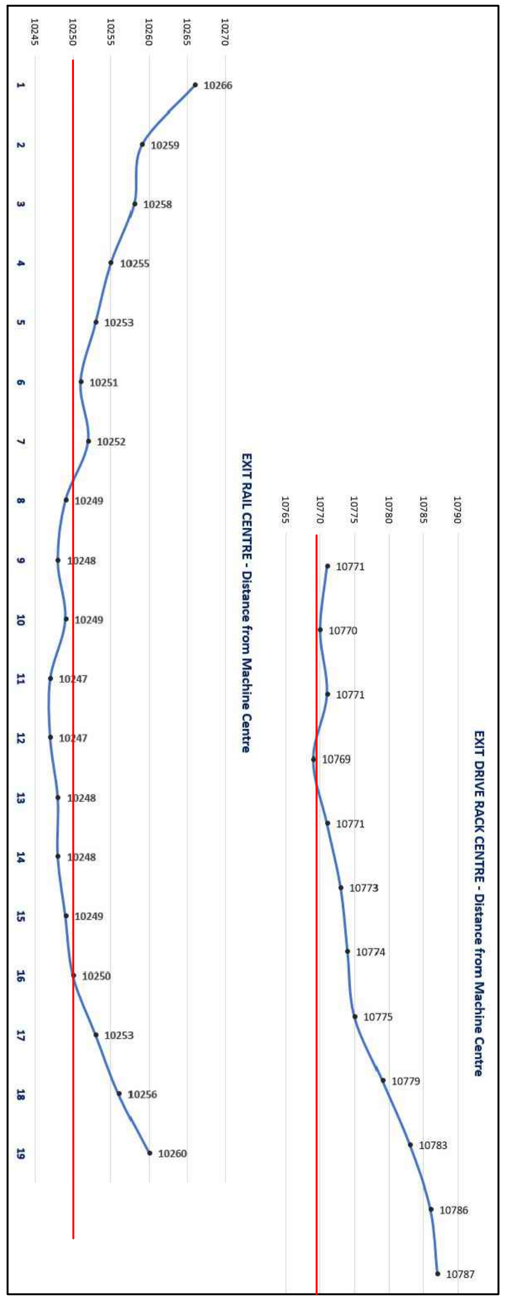
Measured Point is on the outside of the Gear Rack (110mm Offset to Centre)
Measured point is on the outside of the Rail (60mm Offset to Centre Rail)
Points measured at 15 Degree Segments
Note: Points 4 & 5 on the Rail are derived by interpolation between adjacent points as the line of sight was obscured at these points
View is from the Entry End Ring toward the Exit End Ring

Entry Drive Rack and Rail - Centreline Offset in mm

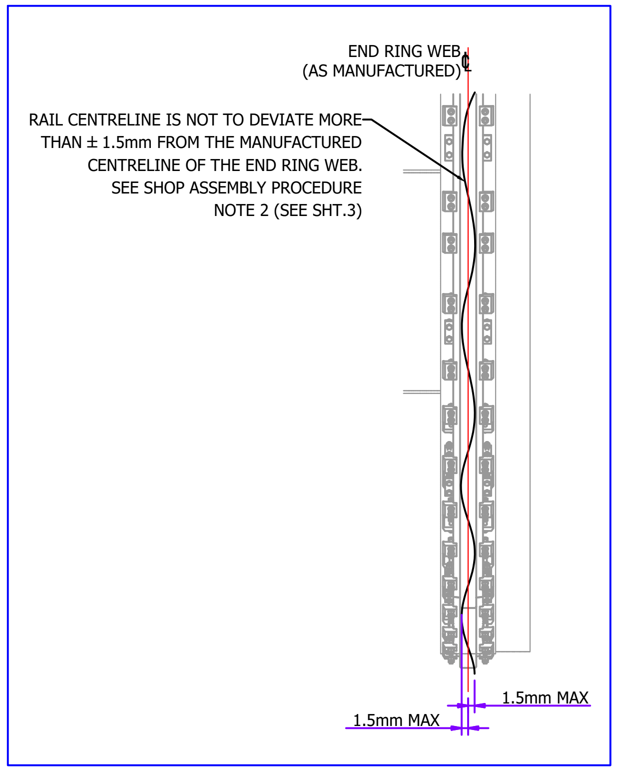




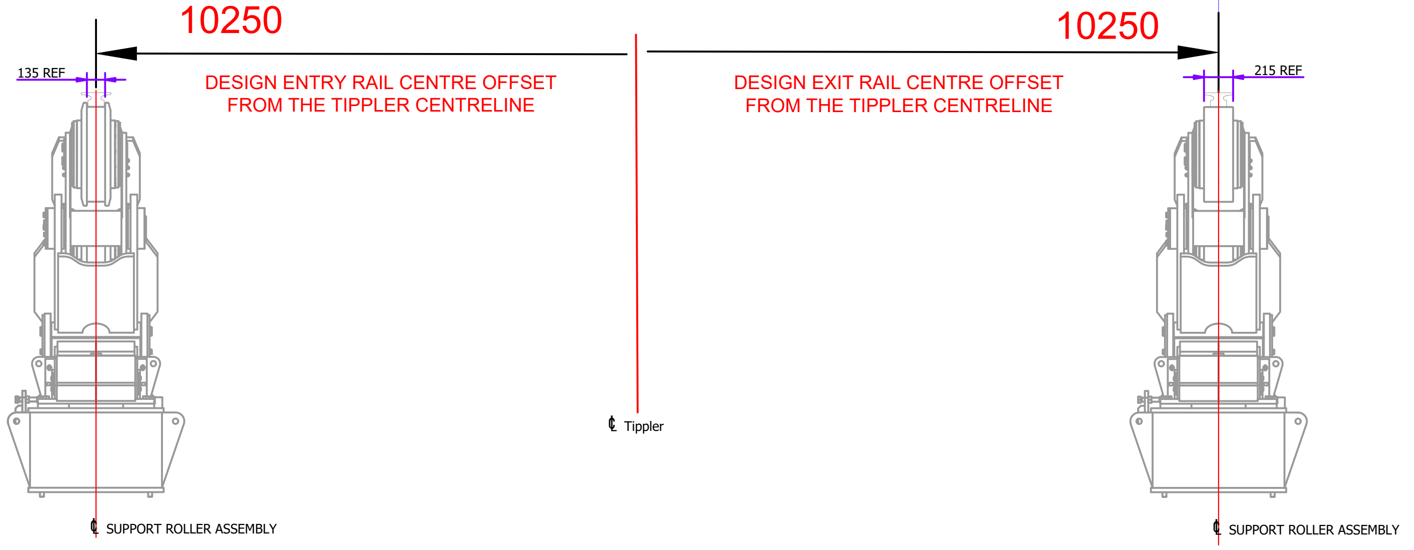
Exit Gear Rack and Rail - Centreline Offset in mm



End Ring Rail Assembly Note



RAIL CENTRELINE IS NOT TO DEVIATE MORE THAN ± 1.5mm FROM THE MANUFACTURED CENTRELINE OF THE END RING WEB. SEE SHOP ASSEMBLY PROCEDURE NOTE 2 (SEE SHT.3)



DESIGN ENTRY RAIL CENTRE OFFSET FROM THE TIPPLER CENTRELINE

DESIGN EXIT RAIL CENTRE OFFSET FROM THE TIPPLER CENTRELINE

ASHTON BULK ENGINEERING ASSESSMENT OF TIPPLER SURVEY REPORT

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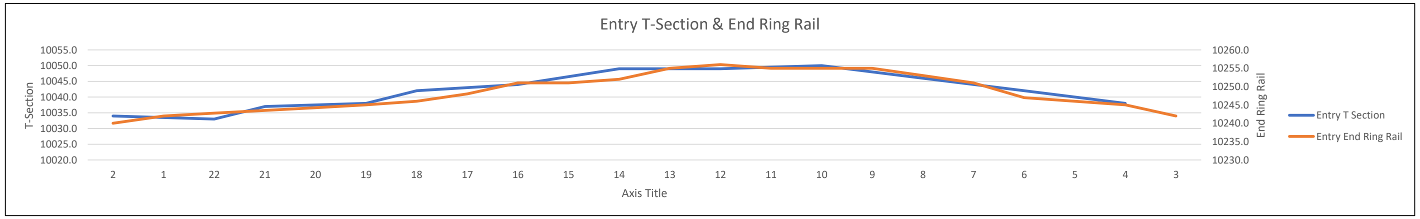
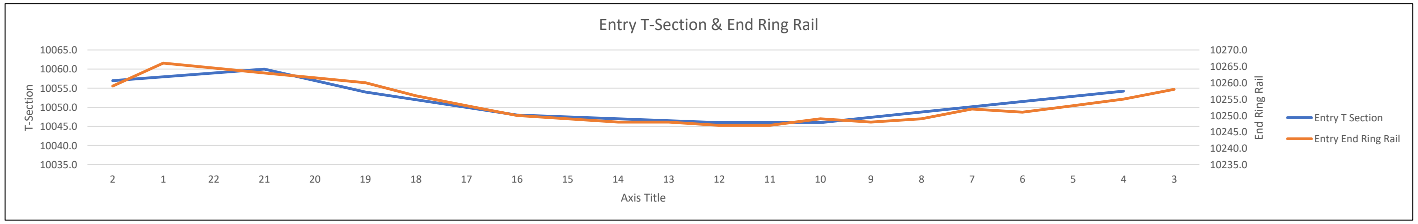
Rail Centrelines	20500	Drive Rack Centrelines	21538	Inside T-sections	20093	**Date:**	03-May-22
Tippler CL to outside of Rail	10250	Tippler CL to outside of Drive Rack	10769	Tippler CL to inside T-section	10046.5	**Revision:**	A

	Entry T-Section			**Entry End Ring Rail**				**Entry Drive Rack**		**Exit Drive Rack**		**Exit End Ring Rail**				**Exit T-Section**						
	NOM Dim = 10046.5	SIDD T-section Target Loc'n	Surveyed Dim From Tippler Centreline	NOM Dim = 10250	SIDD Rail Target Loc'n	Surveyed Dim From Tippler Centreline	Rail Offset From T-Section CL	Surveyed Dim From Tippler Centreline	NOM Dim = 10769	NOM Dim = 10769	Surveyed Dim From Tippler Centreline	Rail Offset from T-Section CL	Surveyed Dim From Tippler Centreline	SIDD Rail Target Loc'n	NOM Dim = 10250	Surveyed Dim From Tippler Centreline	SIDD T-section Target Loc'n	NOM Dim = 10046.5	T-Section to T-Section	NOM Dim = 20093	Rail CL to Rail CL	NOM Dim = 20500
	Displacement			Displacement					Displacement	Displacement					Displacement			Displacement		Displacement		Displacement
TDC +30	-12.5	1	10034.0	-10.0	2	10240.0	-2.5					1.5	10259.0	2	9.0	10057.0	1	10.5	20091.0	-2.0	20499.0	-1.0
				-8.0	1	10242.0							10266.0	1	16.0						20508.0	8.0
	-13.5	2	10033.0	-7.3	22	10242.8	-6.3					-2.0	10264.5	22	14.5	10059.0	2	12.5	20092.0	-1.0	20507.3	7.3
T SIDE	-9.5	3	10037.0	-6.5	21	10243.5	-3.0	10762.0	-7.0			0.5	10263.0	21	13.0	10060.0	3	13.5	20097.0	4.0	20506.5	6.5
				-5.8	20	10244.3		10762.0	-7.0	18.0	10787.0		10261.5	20	11.5						20505.8	5.8
	-8.5	4	10038.0	-5.0	19	10245.0	-3.5	10764.0	-5.0	17.0	10786.0	-2.5	10260.0	19	10.0	10054.0	4	7.5	20092.0	-1.0	20505.0	5.0
	-4.5	5	10042.0	-4.0	18	10246.0	-0.5	10765.0	-4.0	14.0	10783.0	-0.5	10256.0	18	6.0	10052.0	5	5.5	20094.0	1.0	20502.0	2.0
				-2.0	17	10248.0		10768.0	-1.0	10.0	10779.0		10253.0	17	3.0						20501.0	1.0
BDC	-2.5	6	10044.0	1.0	16	10251.0	-3.5	10772.0	3.0	6.0	10775.0	1.5	10250.0	16	0.0	10048.0	6	1.5	20092.0	-1.0	20501.0	1.0
				1.0	15	10251.0		10771.0	2.0	5.0	10774.0		10249.0	15	-1.0						20500.0	0.0
	2.5	7	10049.0	2.0	14	10252.0	0.5	10775.0	6.0	4.0	10773.0	2.5	10248.0	14	-2.0	10047.0	7	0.5	20096.0	3.0	20500.0	0.0
				5.0	13	10255.0		10775.0	6.0	2.0	10771.0		10248.0	13	-2.0						20503.0	3.0
	2.5	8	10049.0	6.0	12	10256.0	-3.5	10777.0	8.0	0.0	10769.0	2.5	10247.0	12	-3.0	10046.0	8	-0.5	20095.0	2.0	20503.0	3.0
				5.0	11	10255.0		10776.0	7.0	2.0	10771.0		10247.0	11	-3.0						20502.0	2.0
NT SIDE	3.5	9	10050.0	5.0	10	10255.0	-1.5	10778.0	9.0	1.0	10770.0	0.5	10249.0	10	-1.0	10046.0	9	-0.5	20096.0	3.0	20504.0	4.0
				5.0	9	10255.0		10775.0	6.0	2.0	10771.0		10248.0	9	-2.0						20503.0	3.0
	-0.5	10	10046.0	3.0	8	10253.0	-3.5					3.3	10249.0	8	-1.0	10048.8	10	2.3	20094.8	1.8	20502.0	2.0
				1.0	7	10251.0							10252.0	7	2.0						20503.0	3.0
	-4.5	11	10042.0	-3.0	6	10247.0	-1.5					4.0	10251.0	6	1.0	10051.5	11	5.0	20093.5	0.5	20498.0	-2.0
				-4.0	5	10246.0							10253.0	5	3.0						20499.0	-1.0
TDC	-8.5	12	10038.0	-5.0	4	10245.0	-3.5					2.8	10255.0	4	5.0	10054.3	12	7.8	20092.3	-0.8	20500.0	0.0
				-8.0	3	10242.0							10258.0	3	8.0						20500.0	0.0
	-13.5	Min	10033.0		Min	10240.0	-6.3					-2.5	10247.0	Min		10046.0	Min		20091.0	Min	20498.0	Min
	-4.7	Mean	10041.8		Mean	10248.4	-2.7					1.2	10254.0	Mean		10052.0	Mean		20093.8	Mean	20502.5	Mean
	3.5	Max	10050.0		Max	10256.0	0.5					4.0	10266.0	Max		10060.0	Max		20097.0	Max	20508.0	Max
	-5.0	Mid	10041.5		Mid	10248.0	-2.9					0.8	10256.5	Mid		10053.0	Mid		20094.0	Mid	20503.0	Mid

Tippler Centre Line

Unsurveyed Section Analysis (10-12)							Unsurveyed Section Analysis (10-12)
Location 1	10034	Location 1	10242.0	10266.0	Location 1	10057	Location 1
Location 9	10050	Location 19	10245.0	10260.0	Location 19	10046	Location 9
Difference	16	Difference	3.0	-6.0	Difference	-11	Difference
No of sectors unsurveyed	4	No of sectors unsurveyed	4	4	No of sectors unsurveyed	4	No of sectors unsurveyed
Av displacement / sector	4	Av displacement / sector	0.75	-1.5	Av displacement / sector	-2.75	Av displacement / sector





Appendix D

Reference Documents

Electrical Site Inspection Report

Dust Extraction Report

Tiprow Controls (Pty) Ltd

Site Inspection Report

Customer:	**Saldanha Tippler 3 Project - Transnet**	**Contract No.:**	**IAC: P220534**
Work Carried Out By:	**Jaco de Waal & Egon Herrmann**		

Engineering & Documentation

1. TUS (IAC produced documents)
   - Documentation to be reviewed to confirm “issued for construction” status. Whilst construction drawings have been issued and construction work proceeded on the basis of such documentation the revision status of the documentation as “Issued for construction” was questioned by Transnet and stated as not approved for construction.
   - Tag numbers and cable numbers to be reviewed and where applicable changed to reflect Transnet specification.
2. Balance of plant (documentation produced by others)
   - All tag numbers and cable numbers to be revised to Transnet specification 1924701-SP-0006
   - Documentation is available only in PDF format and must be re-produced in native file format.
   - Existing redlined documentation must be revised to as-built.
   - All “issued for construction” drawings must be re-submitted to Transnet for approval since it was stated that construction drawings have not been approved and the contractor was not authorised to proceed with construction on the basis of the drawings.
3. Summary of findings:
   - Drawings produced by IAC are up to standard and require changes where Transnet specifications were not communicated to IAC following engineering reviews (i.e. tag number specification).
   - BOP drawings are not available in native *.dwg format and needs to be re-produced incorporating all comments and changes required by Transnet as well as available redlined documents/comments.

Site Inspections

1. Location of equipment
   - All drive and control systems were located and are on site.
2. Condition of equipment
   - With the exception of a few minor issues such as damaged hinges, scratches and damaged switch handles the equipment is in good condition.
   - The dust plant 3.3kV variable speed drive was stored outside since it first arrived on site and upon inspection it was found that the hermetical seal on the packaging was compromised and therefore it is assumed that the drive was exposed to the elements and water ingress is very likely. It was also determined that this drive is no longer produced by Siemens and it is recommended that a new replacement Generation 5 drive be procured as a matter of urgency.
     - Delivery: 35 working weeks – DAP Transnet Saldanha port.
     - Siemens commissioning engineer for 5 days on site.
   - All drive motors (Positioner, Tippler, Apron Feeder and Dust plant main blower) have been located and will have to be sent to WEG and Siemens for assessment and refurbishment.
   - All low voltage VSD’s will require inspection and testing on site to be performed by the Cape Town office of Siemens. Pricing for this is yet to be received from Siemens.

3. Installation and procurement progress

- LV switch room:
  - All panels are located and installed. Panel support design must be reviewed, and support bracing (bolt-on) is suggested since the panel supports are unstable and allows for too much lateral movement.
  - Shipping split wiring must be re-done since the wiring appears to have been done in a rush and is not to proper standard.
  - Torquing of busbars have been checked and is complete.
  - Cable support system supply and installation: Complete
  - Cable supply and installation: 0%
  - Small power and lighting (by others): UPS commissioning is incomplete.
  - Small power and lighting (by others): Sub DB’s installed and connected.
  - Small power and lighting (by others): Plant wiring and installation complete. COC to be confirmed and copy of as-built circuit diagrams required for co-ordination purposes.
  - Resin encapsulated busbar system to incomer: 0%
    - Resin encapsulated busbar system to incomer.
- Server room:
  - PLC: Located and installed
  - Cable support system supply and installation: Supply – complete, Installation 0%
  - Cable supply and installation: 0%
- Control room
  - Control desks: located – note, location of control desks to be reviewed.
  - Cable routing to be reviewed since ducting occupies the service void.
- Site Installation - General
  - Cable support system supply: 100%
  - Cable support system field installation: 100%
  - Cable supply: 0%
  - Cable installation: 0%
- Positioner
  - Festoon system saddles: mechanically installed.
  - Cable support system supply: 100%
  - Cable support system on board installation: 0%
  - Festoon cable supply: 100%
  - General cable supply: 0%
  - Cable and support system installation: 0%
- Tippler
  - Cable support system supply: 100%
  - Cable support system field installation: 90%
  - Cable supply: 0%
  - Cable installation: 0%
- Apron Feeders
  - Cable support system supply: 100%
  - Cable support system field installation: 90%
  - Cable supply: 0%
  - Cable installation: 0%
- Local control stations & RIO panels
  - Cable support system supply: 100%
  - Cable support system field installation: 0%
  - Cable supply: 0%
  - Cable installation: 0%
- Wheel grippers
  - Cable support system supply: 100%
  - Cable support system field installation: 0%
  - Cable supply: 0%
  - Cable installation: 0%

- Dust Plant
    - Cable support system supply: 0%
    - Cable support system field installation: 0%
    - Cable supply: 0%
    - Cable installation: 0%
    - MV VSD installation: Sub-station not complete
    - Main blower fan MV drive motor not mounted.
- Main cable support system from Switch room via cable tunnel:
    - Cable support system supply: 95%
    - Cable support system field installation: 0%
    - Cable supply: 0%
    - Cable installation: 0%
    - Note: Some racks still need to be positioned and secured inside the main cable tunnel. This should take 3-5 days to complete.
- Instrumentation brackettry:
    - Very little brackets exist for the mounting of instrumentation. This is specifically relevant to the BOP. Electrical installation quote to provide for this.

4. Summary

- The 450kW medium voltage VFD is a major item for consideration. It is recommended that the existing drive on site be scrapped and in its place a Gen 5 drive be purchased as soon as possible in order not to delay the start of commissioning.
- According to Siemens the generation 4 drive has been discontinued and replaced by a more efficient generation 5 drive which is not interchangeable with the generation 4 drive.
- Even if it was possible to use the generation 4 drive (assuming that there is no damage), Siemens will not guarantee the drive. If they were to extend the warrantee on the drive the cost to do so would be the equivalent of a new drive.

AED030 – Ashton Bulk

Transnet Saldanha Tippler 3

Dust Control System

Site Audit Report

08 April 2022

Report by: C. Van Niekerk

Purpose of Report

The purpose of this report is to record all observations made during the site audit of Tippler 3 Dust Control System at Transnet Saldanha project site in Western Cape.

Equipment List

Reference Drawing: AED008-B100-WBA-001

2 off – 594-WS-6000-BE Bagfilters
1 off – 450kW Fan Set
1 off – 40m³ Storage Silo
1-set – Pneumatic Conveying System and Piping
1-set – Inlet Ducting, Orifice Plates and Supports
1-set – Compressed Air System and Piping

Site Audit

An audit of the Dust Control System was completed on 30/03/2022.

The following observations were made :

Equipment Inspection

The following equipment Air Envirotech recommend be sent back to the OEM to inspect the equipment over all condition and report what actions are required to bring the equipment back to commissioning status. Details as follow:

Supplier: TEC Dust Control

1) 2-off Autel Eco-S20 Sequential Controllers for Control and Operation of Bagfilter Pulse System

2) 6-off 10” Immersion Tanks c/w 11-off 2” Integrated Valves each for Bagfilter Pulse System

3) 10-off 2” Spare Integrated Valves for Bagfilter Pulse System

4) 66-off Solenoid Valves for Bagfilter Pulse System Control and 21-off Spare

5) Immersion Tank Kit consisting of:
6-off Pressure Gauges for 1-off each Immersion Tank
6-off Safety Valves for 1-off each Immersion Tank
6-off Drain Valves for 1-off each Immersion Tan
12-off Plugs for 2-off each Immersion Tank

Important notes to this supply (Prior OEM inspection):

- The Immersion Tanks were fabricated to SANS 347 and will need to be pressure tested and signed off by the AIA.
- The Sequential Controllers were supplied in manufacturer standard plastic enclosures and will have to be put over in S/S Panels as per specification.

- All Pressure Gauges to be pressure tested.

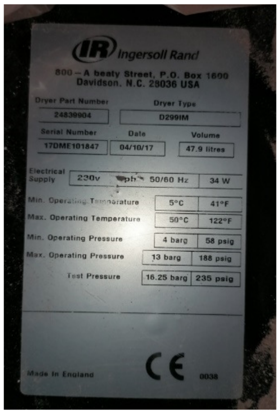
<u>Supplier: Ingersoll Rand</u>

1) 2-off UP5-22-7,5 Rotary Screw Compressors c/w Remote Start / Stop Wiring Harness ea. for Compressed Air System

Ingersoll Rand
Industrial Technologies
MACHINE TYPE SCREW AIR COMPRESSOR
MACHINE MODEL UP1122/UP5-22-7.5
SERIAL NUMBER UCV1019294
MAX ALLOWABLE WORKING PRESSURE (kpa) 7.5
INPUT SHAFT POWER (KW) 22
MOTOR/ENGINE SPEED (rev/min) 1480
GROSS MASS (kg) 540
400
3/5
2018

Ingersoll Rand
Industrial Technologies
MACHINE TYPE SCREW AIR COMPRESSOR
MACHINE MODEL UP1122/UP5-22-7.5
SERIAL NUMBER UCV1019109
MAX ALLOWABLE WORKING PRESSURE (kpa) 7.5
INPUT SHAFT POWER (KW) 22
MOTOR/ENGINE SPEED (rev/min) 1480
GROSS MASS (kg) 540
VOLTS 400
3/5
2018

2) 2-off D299 IM Modular Desiccant Dryers for Compressed Air System



Ingersoll Rand
800 – A beaty Street, P.O. Box 1600
Davidson. N.C. 28036 USA

Dryer Part Number	Dryer Type	
24839904	D299IM	
Serial Number	Date	Volume
17DME101847	04/10/17	47.9 litres

Electrical Supply	230v ph ~ 50/60 Hz	34 W
Min. Operating Temperature	5°C	41°F
Max. Operating Temperature	50°C	122°F
Min. Operating Pressure	4 barg	58 psig
Max. Operating Pressure	13 barg	188 psig
Test Pressure	16.25 barg	235 psig

Made In England
CE 0038

Ingersoll Rand
800 – A beaty Street, P.O. Box 1600
Davidson. N.C. 28036 USA

Dryer Part Number: 24839904
Dryer Type: D299IM
Serial Number: 17DME101846
Date: 04/10/17
Volume: 47.9 litres
Electrical Supply: 230v 1ph 50/60 Hz 34 W

Min. Operating Temperature	5°C	41°F
Max. Operating Temperature	50°C	122°F
Min. Operating Pressure	4 barg	58 psig
Max. Operating Pressure	13 barg	188 psig
Test Pressure	16.25 barg	235 psig

Made In England
CE 0038

3) 6-off Particulate Filters (Pre-Dryer and Post-Dryer) for Compressed Air System

Ingersoll Rand
FA400ID
CCN 24232340
CCN 24242190
CCN 24335036
SN. 12434817
Min/max
1,5°C/80°C
35°F/176°F
0barg/17,2barg
0psig/250psig
MADE IN SLOVENIA

Ingersoll Rand
FA400IH
CCN 24232381
CCN 24242224
CCN 24335028
SN. 12435017
Min/max
1,5°C/80°C
35°F/176°F
0barg/17,2barg
0psig/250psig
MADE IN SLOVENIA

Ingersoll Rand
FA230ID
CCN 24232258
CCN 24242125
CCN 24335036
SN. 05843315
Min/max
1,5°C/80°C
35°F/176°F
0barg/17,2barg
0psig/250psig
MADE IN SLOVENIA

4) 2-off R6A-1100kPa 2140m³ Air Receivers for Compressed Air System

5) Air Receiver Kit consisting of:
2-off Pressure Gauges for 1-off each Air Receiver
2-off Safety Valves for 1-off each Air Receiver
2-off Auto Drain Valves for 1-off each Air Receiver
2-off 3/4" Manual Drain Valves for 1-off each Air Receiver

Important notes to this supply (Prior OEM inspection):

- The Air Receivers were fabricated to SANS 347 and will need to be pressure tested and signed off by the AIA.
- All Pressure Gauges to be pressure tested.
- Compressors will need to be serviced before first start-up.
- Desiccant will need to be replaced before Dryer first start-up.

Supplier: Trojan Fans

1) 1-off 30kW MPR Multi-Stage Blower for Pneumatic Conveying System

2) Blower Spares consisting of:
2-off Plummer Block and Bearing assemblies
1-off Outlet Compensator (Material only)
1-off Coupling

Supplier: Bulkmatic Solids Machinery (BSM)

1) 1-off Silo Over Pressure Relief Valve OPV-150

2) 1-off Pneumatic Actuated Diverter Chute DC-0300-P-SYS for Silo Paddle Mixer or Truck discharge

Supplier: Tenova Mining and Minerals

1) 1-off 3kW Paddle Mixer for Silo discharge

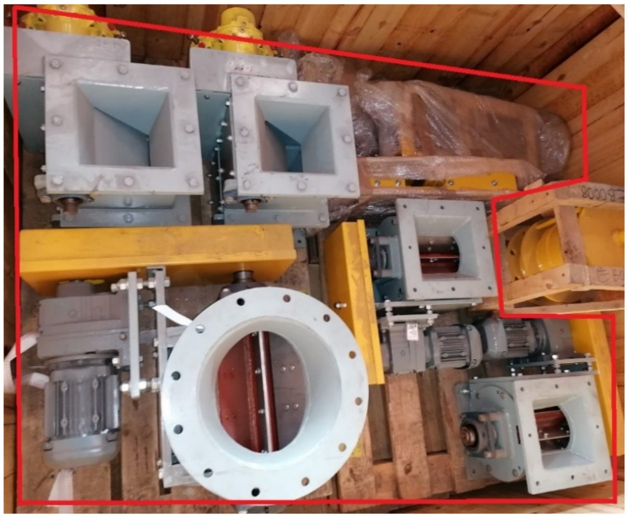
Supplier: PD Engineering

1) 2-off 2,2kW V-Trough Screw Conveyors for Bagfilter discharge

2) 1-off Manual Retractable Loading Spout for Silo discharge

Supplier: 4b Africa

1) 2-off Hand Wheel Knife Gate Valves 4BSG200-HW-SQ for Bagfilter discharge
   2-off 0,37kW Rotary Vane Feeders 4BRVA200-S-ST-SQ for Bagfilter discharge
   2-off Kinetrol Actuated Double Flap Valves 4BFV200-DP-RQ for Bagfilter discharge
   1-off Hand Wheel Knife Gate Valve 4BSG300-HQ-RD for Silo discharge
   1-off 0,75kW Rotary Vane Feeder 4BRVAR300-S-SR-RD c/w 1-off Whirligig Mount for Rotary Vane Feeder Speed Switch for Silo discharge



2) 4-off Limit Switch Boxes and 4-off Solenoids for 1-off ea. Kinetrol Actuator

3) 3-off Whirligig Speed Switch Mounts for 1-off ea. Rotary Vane Feeder

Supplier: Dymot Engineering

1) 1-off Hand Winch 300S for Manual Retractable Loading Spout for Silo discharge

Supplier: BWF Environmental Dynamics

1) 1200-off Polyester Needle Felt 550g/m² ePTFE Filter Bags for Bagfilters

2) 100-off Polyester Needle Felt 550g/m² ePTFE Spare Filter Bags for Bagfilters

<u>Supplier: Rhomberg Instruments</u>

1) 1-off Pressure Gauge for Paddle Mixer Water Supply

2) 2-off Pressure Gauges for 1-off ea. Pressure Regulating Valves of Compressed Air System

<u>Supplier: Zest WEG</u>

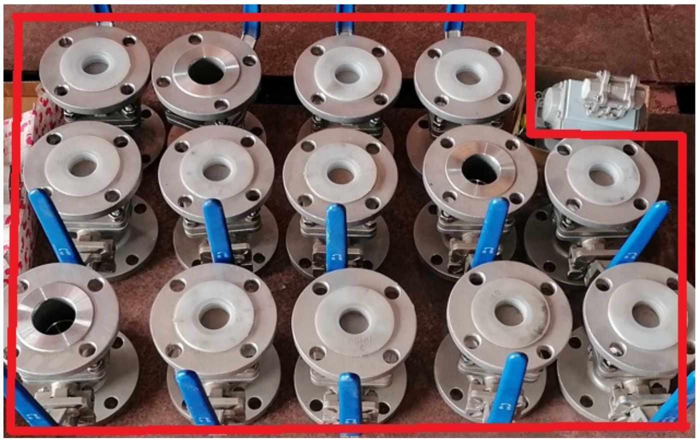
1) 1-off 450kW Motor for Extraction Fan (No Photo available)

==

The following equipment Air Envirotech recommend be kept in safe (under roof) storage at site and supply a spare of each as critical for commissioning as they are still in a good condition for operation. Details as follow:

<u>Supplier: Invincible Valves</u>

1) 14-off S/S 50NB Manual Ball Valves for Compressed Air System



Supplier: DLM Valves

1) 5-off S/S 25NB Manual Ball Valves for Compressed Air System and Paddle Mixer Water Supply
   2-off S/S 15NB Manual Ball Valves for Compressed Air System and Paddle Mixer Water Supply
   5-off S/S 8NB Manual Ball Valves for Compressed Air System and Paddle Mixer Water Supply

Supplier: Klinger Mzansi

1) 2-off S/S 50NB Pressure Regulating Valves for Compressed Air System
   2-off BR 50NB Pressure Relief Valves for Compressed Air System

2) 1-off CI 125NB Butterfly Valve for Pneumatic Conveying System

3) 1-off S/S 15NB Pneumatic Actuated Ball Valve for Paddle Mixer Water Supply

Supplier: Temperature Controls (via Universal Fans)

1) 2-off Temperature Sensors for Extraction Fan Bearings

Supplier: IFM Electronic

1) 4-off Pressure Indicating Transmitters for Compressed Air System
   11-off Speed Switches for Rotating equipment i.e. Screw Conveyors, Rotary Vane Feeders and Paddle Mixer

2) 7-off Wireable Sockets for Speed Switches

3) 3-off Proximity Sensors for Flow Control equipment i.e. Knife Gates

4) 3-off Level Switches for Blocked detection i.e. Bagfilters and Truck discharge

5) 1-off Flow Indicating Transmitter c/w Connection Sockets for Paddle Mixer Water Supply

6) 17-off Connection Cables c/w Additional Cable Roll for Instruments

Supplier: Spray Nozzle

1) 6-off Mist Spray Nozzles for Paddle Mixer Water Supply

Supplier: Rhomberg Instruments

1) 1-off S/S 15NB O-Siphon c/w BR 15NB Gauge Cock for Paddle Mixer Water Supply Pressure Gauge

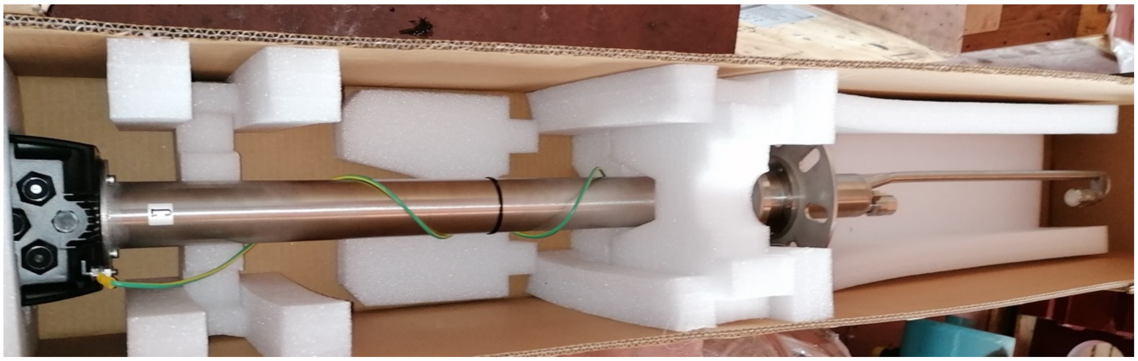
Supplier: Chick Henderson

1) 11m Yellow Line Rubber Hose for Bagfilter Pulse System

2) 132-off 78mm – 86mm B-Series Hose Clamps c/w 3-off Spare

Supplier: Ansyco SA

1) PCME Stack Flow 400 Sensor for Clean Air Ducting Flow Monitoring



2) PCME 990 Pro 2 Controller System for Clean Air Ducting Particulate Monitoring

Supplier: Flowseal Engineering

1) 2-off 2500mm I/Dia. 350mm F/F Fabric Expansion Joint for Ducting

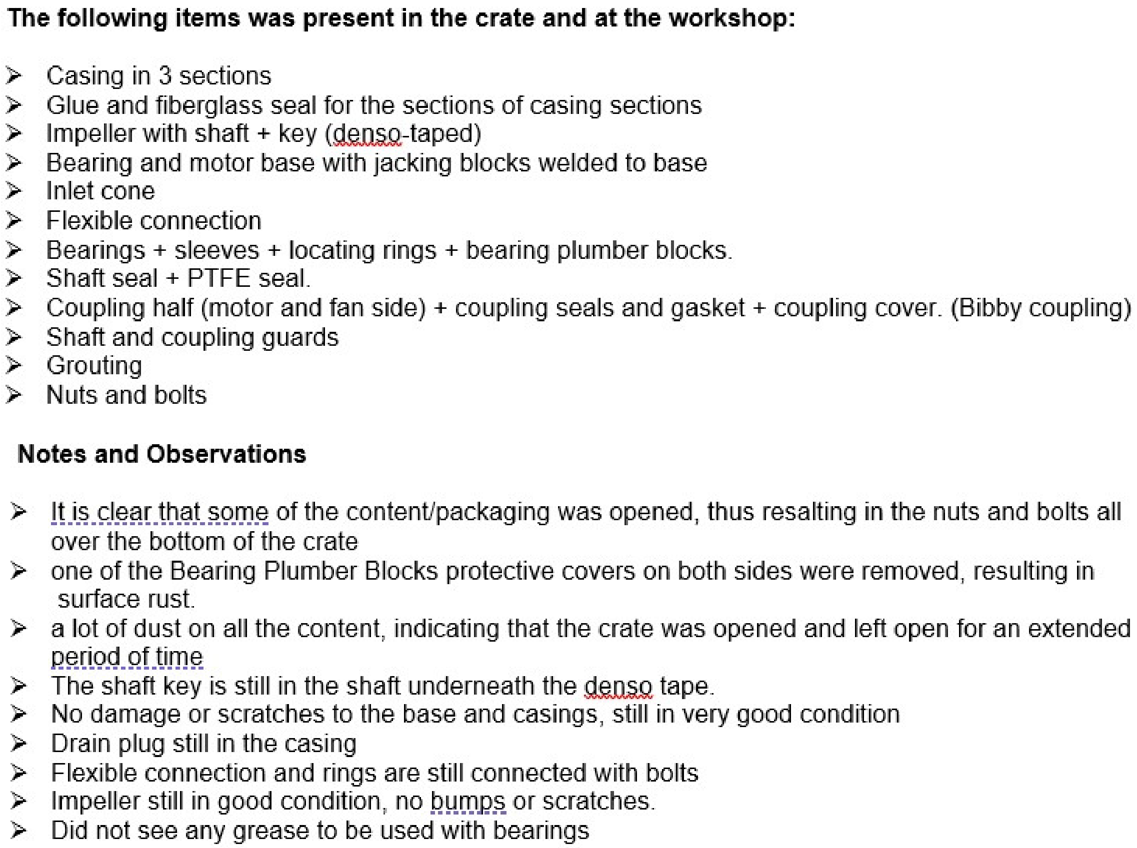
Supplier: SA Filter Cages

1) 1240-off E-Galv.Wire Cages for Bagfilters (No Photo available, all cages stored in Breedt Asia Workshop)

2) 100-off Spare E-Galv.Wire Cages for Bagfilters

Supplier: Universal Fans

1) 1-off HDBC-I 2260 SISW Fanset (No Photo available, Fanset stored in Breedt Asia Workshop)
   Fanset was already inspected by Universal Fans maintenance specialist with the following comments:



The following items was present in the crate and at the workshop:

- Casing in 3 sections
- Glue and fiberglass seal for the sections of casing sections
- Impeller with shaft + key (denso-taped)
- Bearing and motor base with jacking blocks welded to base
- Inlet cone
- Flexible connection
- Bearings + sleeves + locating rings + bearing plumber blocks.
- Shaft seal + PTFE seal.
- Coupling half (motor and fan side) + coupling seals and gasket + coupling cover. (Bibby coupling)
- Shaft and coupling guards
- Grouting
- Nuts and bolts

Notes and Observations

- It is clear that some of the content/packaging was opened, thus resalting in the nuts and bolts all over the bottom of the crate
- one of the Bearing Plumber Blocks protective covers on both sides were removed, resulting in surface rust.
- a lot of dust on all the content, indicating that the crate was opened and left open for an extended period of time
- The shaft key is still in the shaft underneath the denso tape.
- No damage or scratches to the base and casings, still in very good condition
- Drain plug still in the casing
- Flexible connection and rings are still connected with bolts
- Impeller still in good condition, no bumps or scratches.
- Did not see any grease to be used with bearings

The following equipment Air Envirotech could not locate on site and has most likely not been procured for this project. Details as follow:

- 1-off Vibration Detection Sensor for Extraction Fan Bearings
- 1-off Silo Level Transmitter
- 2-off Retractable Loading Spout Dust Socks
- 1-lot Electrical and Lighting Accessories and Equipment c/w Cabling

==

Bagfilter, Silo and Supporting Structures Inspection

Air Envirotech inspected the Bagfilter and Silo c/w Support Structures. The following will need to be rectified in order to complete the installation and to ready the plant for commissioning:

Compressor and Dryer Housing (Takraf Drg. Ref. EB0008-B100-CAA-011)

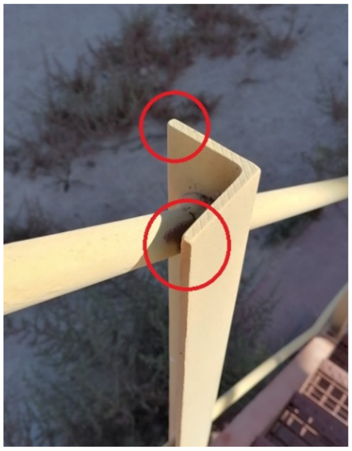
- Access Doors was located on site and need to be installed.

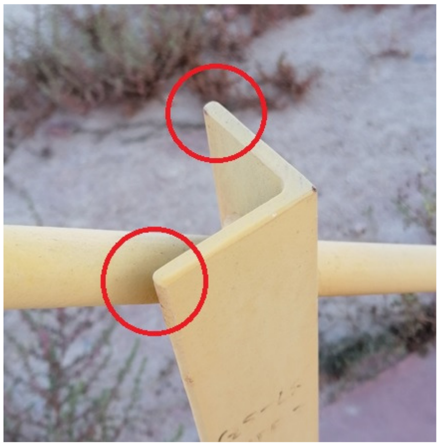
- No Sheeting located on site. Sheeting will need to be supplied and fitted. At least 1-bay to be translucent for natural light during daytime.

- Crawl Beams need to be painted yellow and clearly state the S.W.L. – 1 TONNE on each. Notice board will have to be procured with note – ONLY ONE CRAWL HOIST ALLOWED TO DO LIFTING AT A TIME. No Crawl Hoists or end stops located on site. Crawl Hoist will have to be procured with end stops and installed to exit Crawl Beam (drilling allowed for)

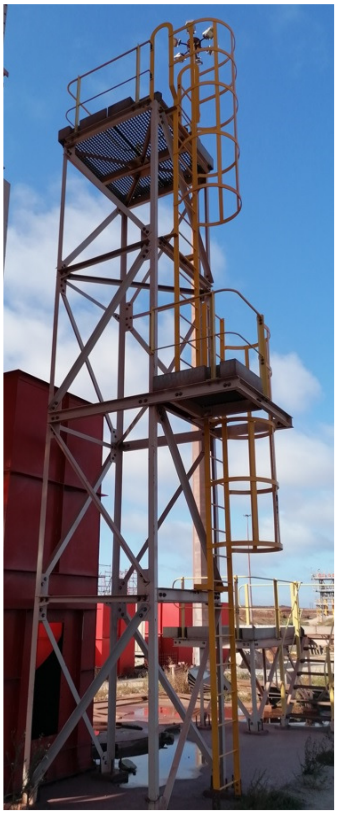
Bearing Access Platform (Takraf Drg. Ref. EB0008-B100-CAA-015)

- Sharp edges on railing noted that need to be chamfered.



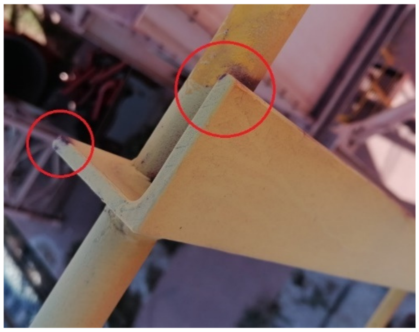


Dust Monitor Access Platform (Takraf Drg. Ref. EB0008-B100-CAA-018)



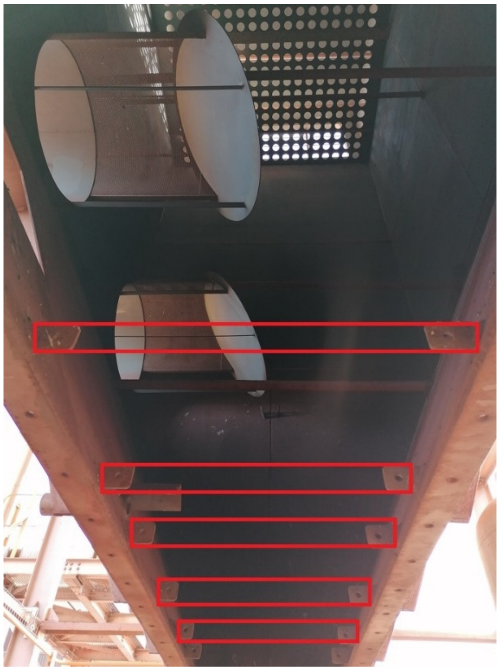

- Catladder support legs to be fixed to concrete with either Chemical Anchors or RAWL Bolts. Slotted support leg angles do not have corrosion protection applied.


- Sharp edges on railing noted that need to be chamfered.

Bagfilters and Access Platforms (Takraf Drg. Ref. EB0008-B100-CAA-001
EB0008-B100-CAA-002
EB0008-B100-GKA-013)

- Not all Hopper Mesh Supports installed and none located on site. 18-off required in total, 9-off each for respective Bagfilter. Only 3-off installed. (Liaise with Breedt Asia)



- No Hopper Mesh Panels installed. 6-off required in total, 3-off each for respective Bagfilter. Only 3-off located on site. (Liaise with Breedt Asia)

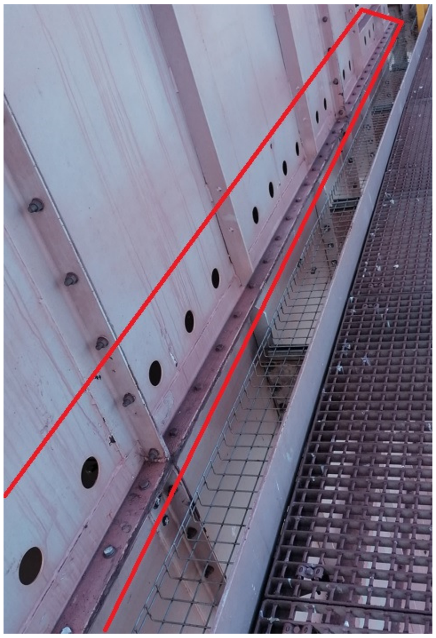
- Sharp edges on railing noted that need to be chamfered (Hopper Access Platforms)

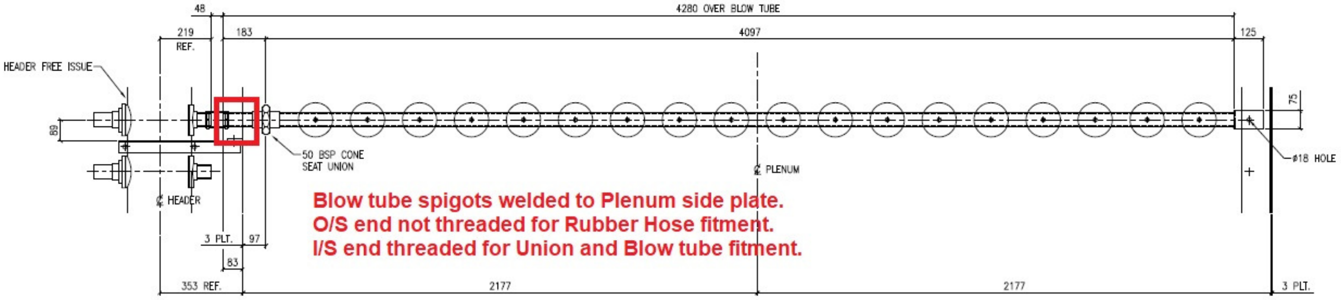
- Hopper Access Doors not installed. 2-off required in total, 1-off each for respective Bagfilter. 2-off Doors located on site. Fixing Bracket sets not located (Liaise with Breedt Asia)

- 1-off railing section bent on Hopper Access Platform and will need to rectified.

- Opening in Plenum adjacent Silo. Closure plate not procured. Opening to be measured, designed, manufactured and installed. Opening is not part of the filter design and only 1-off opening is required for Ducting outlet on opposite end.

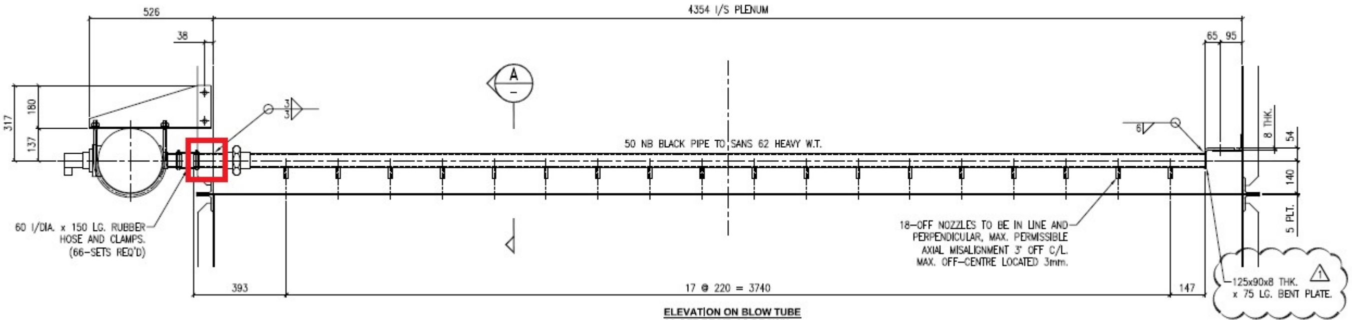
- Blow Tube Spigots not installed and none located on site. 66-off required in total, 33-off each for respective Bagfilter. Spigots to be procured and installed.





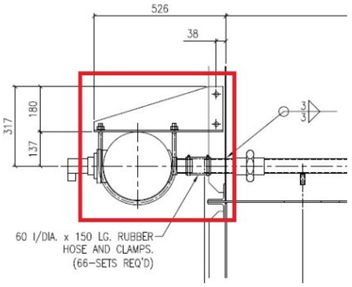
Blow tube spigots welded to Plenum side plate.
O/S end not threaded for Rubber Hose fitment.
I/S end threaded for Union and Blow tube fitment.

PLAN ON BLOW TUBE

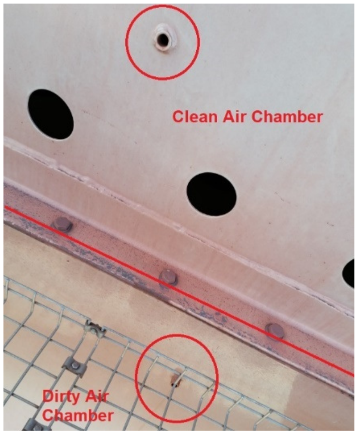


ELEVATION ON BLOW TUBE
66-OFF REQ'D AS DRAWN
(33-OFF EACH FOR BAGFILTER A & B)

- ➢ Immersion Tank Support Brackets c/w U-Bolts not installed and not located on site.12-off required in total 6-off each for respective Bagfilters. (Liaise with Breedt Asia)

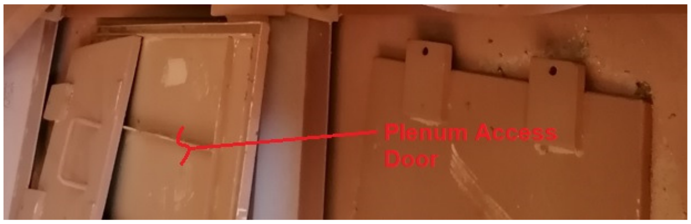


- ➢ 4-off Differential Pressure sockets required in Plenum and Bagfilter Housing side plates. 2-off installed on Bagfilter ‘B’, 1-off hole drilled in Clean air chamber of Bagfilter ‘A’. No socket or hole in Bagfilter ‘A’ Dirty air chamber.



- Blow Tube Pipe fabrication incomplete. Raw material identified on site. Blow Tube Pipe accessories to be procured, manufactured and installed.

- Plenum Access Doors not installed. 4-off required in total, 2-off each for respective Bagfilter. 4-off Doors located on site. Fixing Bracket sets not located (Liaise with Breedt Asia)



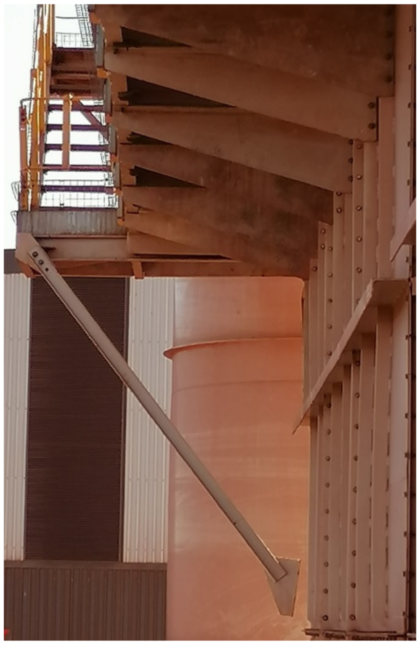
- Plenum Access Steps not installed. 4-off required in total, 2-off each for respective Bagfilter. All 4-off located on site.

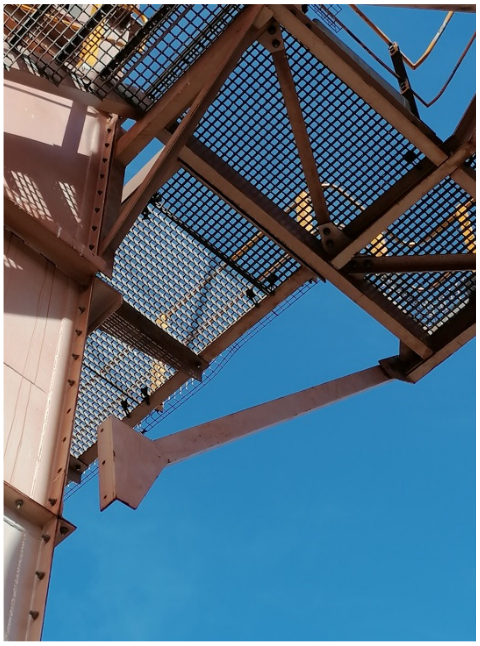
- Plenum Access Grab Handles not installed. 8-off required in total, 4-off each for respective Bagfilter. All 8-off located on site.

- Plenum Safety Cages not installed. 4-off required in total, 2-off each for respective Bagfilter. All 4-off located on site.

- Selected railing stanchion does not have corrosion protection applied.

- Access Platform Knee Brace Support to be installed correctly.

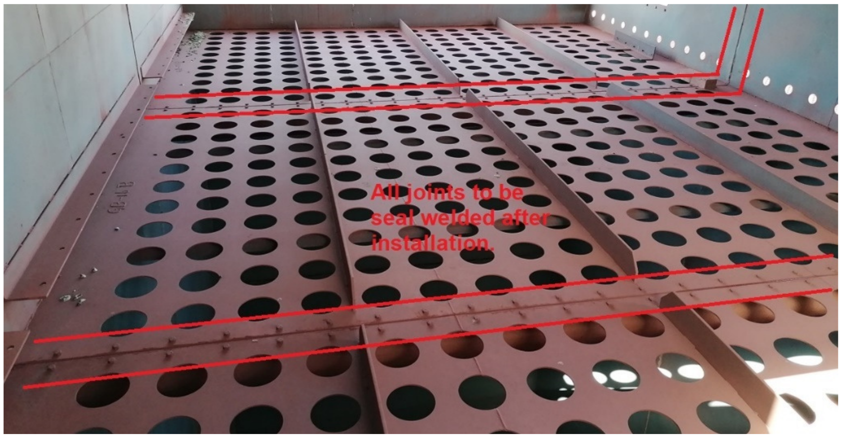




- Economizer Back Plate drilling only on Bagfilter ‘B’. Drilling to be completed on Bagfilter ‘A’. Back Plate to be re-procured due to change over to S/S panel with different drilling.

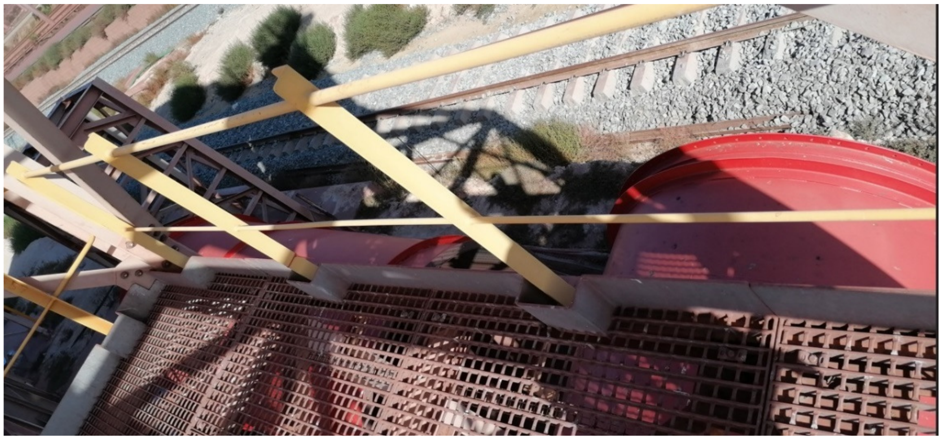
- No epoxy sealer applied between space welding. It was noted on the detailed engineering drawings to have all areas between space welding filled with an approved epoxy sealer after primer. All space welded stiffeners to be wire brushed and apply an approved epoxy sealer to avoid rust forming behind stiffeners that has not been welded.

- After installation, complete bagfilter housing, including internal bag plate to be seal welded over all joints.



Silo and Access Platform (Takraf Drg. Ref. EB0008-B100-DEA-001)

- Railing installed incorrectly. Back of angles to face platform walk area.



- Selected railing section does not have corrosion protection applied.

- Crawl Beam need to be painted yellow and clearly state the S.W.L. – 1 TONNE. No Crawl Hoist or end stops located on site. Crawl Hoist will have to be procured with end stops and installed to Crawl Beam (drilling allowed for)

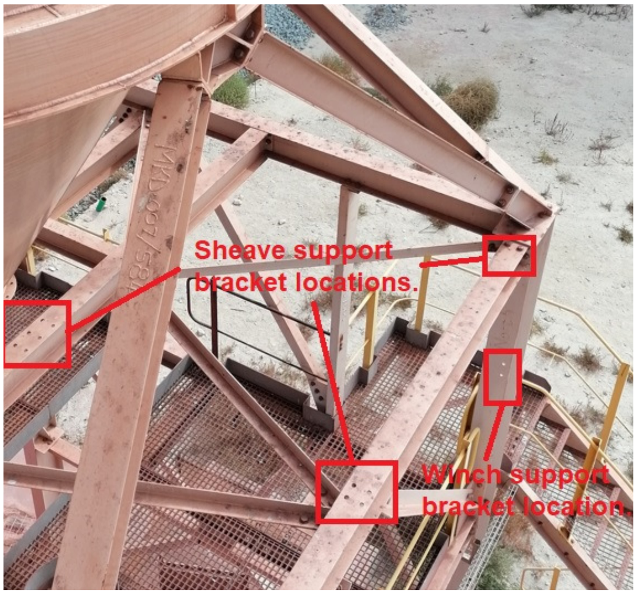
- Paddle Mixer rear bracket drilling not in beam. Drilling to be done and item number welding ground flat for Paddle Mixer support footings. (Liaise with Breedt Asia)

- No HD bolts cast in concrete form staircase base. Staircase base to be fixed to concrete with either Chemical Anchors or RAWL Bolts.

- Grouting to be done on complete structure base.

- Cross beam 005/S51 not installed and not located on site. (Liaise with Breedt Asia)

- Retractable Loading Spout Sheave support brackets not installed. 3-off in total. 1-off located on site, 2-off not located on site. Winch support bracket not installed and not located on site. (Liaise with Breedt Asia)

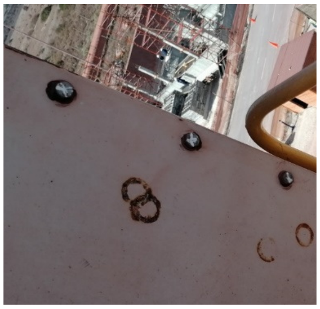


- Silo top inspection hatch cover fasteners to be installed. (Liaise with Breedt Asia)

- Paddle Mixer return feed piping not procured. Pipe route to be measured, designed, manufactured and installed.

Additional notes for Bagfilter and Silo c/w Support Structures

- Air Envirotech recommend a structural engineer to inspect, comment and sign-off on the installed units and support structures.
- Selected fasteners and plate surfaces indicate signs of rust (as indicated below) and has to be inspected and rectified.



- Selected HD Bolt surface lengths to be trimmed to required lengths.

Ducting, Pneumatic and Compressed Air Piping Inspection

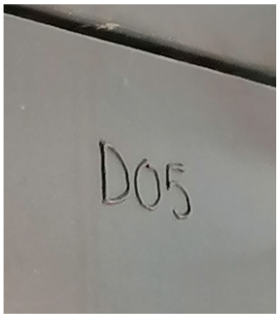
Air Envirotech inspected the Ducting, Pneumatic and Compressed Air Piping c/w Supports. The following will need to be rectified in order to complete the installation and to ready the plant for commissioning:

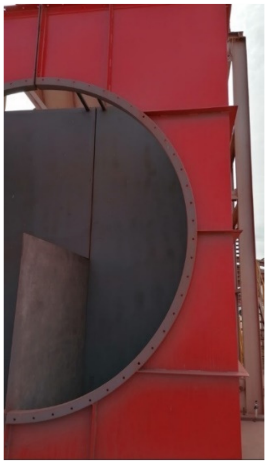
Ducting (Takraf Drg. Ref. EB0008-B100-JKA-001
EB0008-B100-DEA-001)

- No ducting has been installed except for items D05 & D06. The following was located on site:







D07


D07


D08


D09


D10


D11


D12


D13


D14


D15


D16


D17


D18

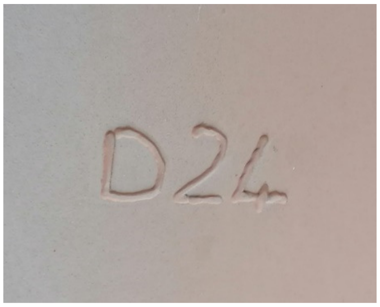

D19

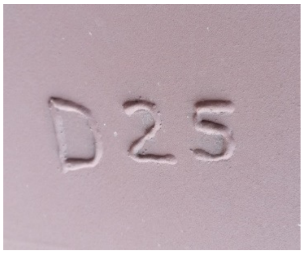

D20


D21


D22


D23


D24

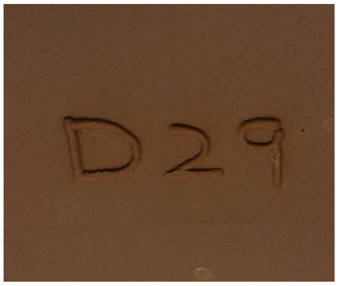

D25


D26


D27


D26


D28


D29


D30


D31


D32


D33


Redundant
D34


Redundant


Item D35
Redundant


Redundant
D36


Redundant

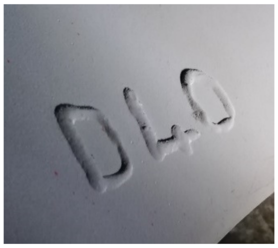

Redundant
D37


Redundant


Redundant
D38


Redundant


D39


D40


D41


D42


D43

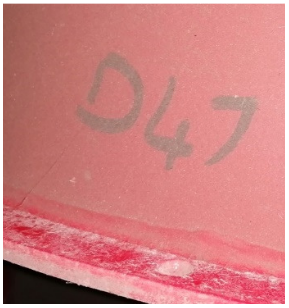

Item D44


D45

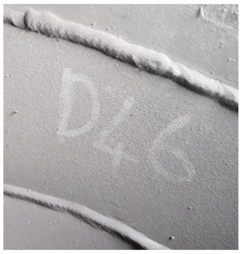

D46


D46


Item D44

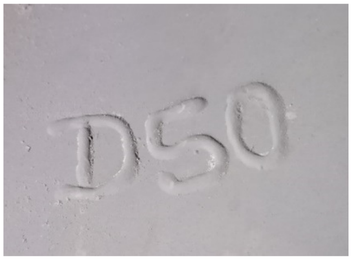

D47

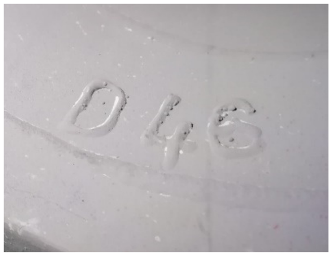

D48




Item D44


D49

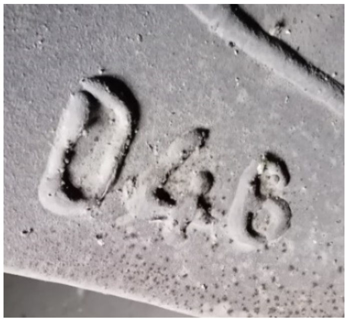

D50


D46


Item D44


D51


D52


D46


Item D44

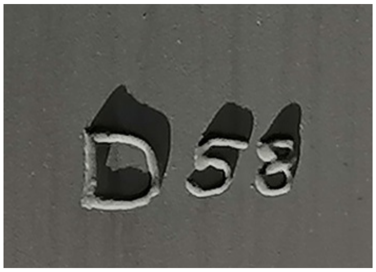

D53


D57


D54

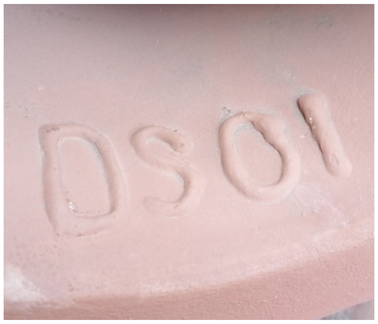

D57


D55


D58


D56

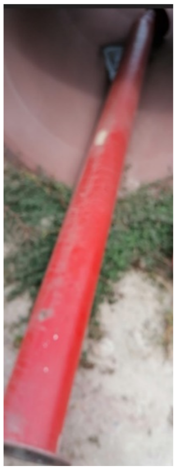

59


DS01


Item DS02


DS03


DS04




DS05


DS06

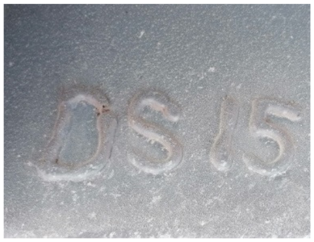

DS07


DS08

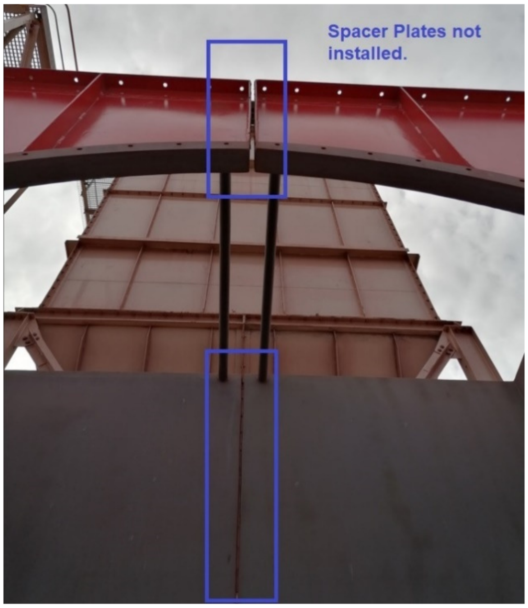

DS09


DS10


DS11



- No Sealer or Fasteners were located on site.
- On Items D05 & D06 the following comments:
    - No Spacer Plates installed to accommodate Anti-Swirl Plate installation. Spacers were not located on site.


Spacer Plates not installed.

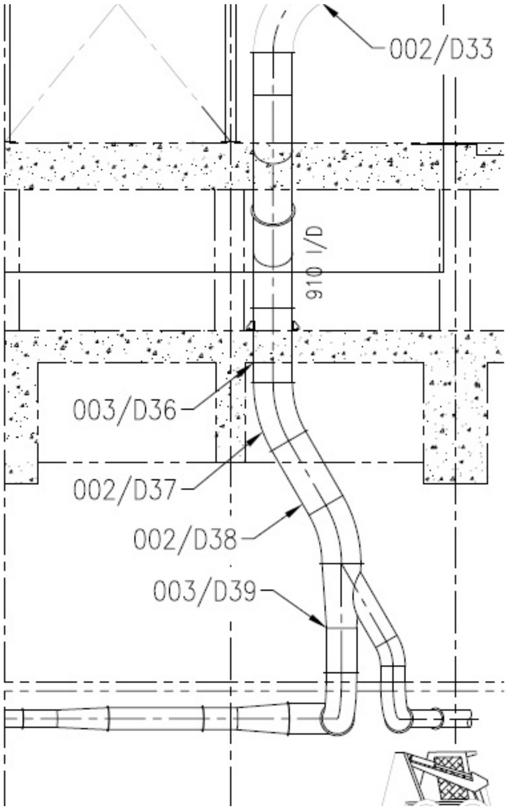
- Selected HD Bolt surface lengths to be trimmed to required lengths.

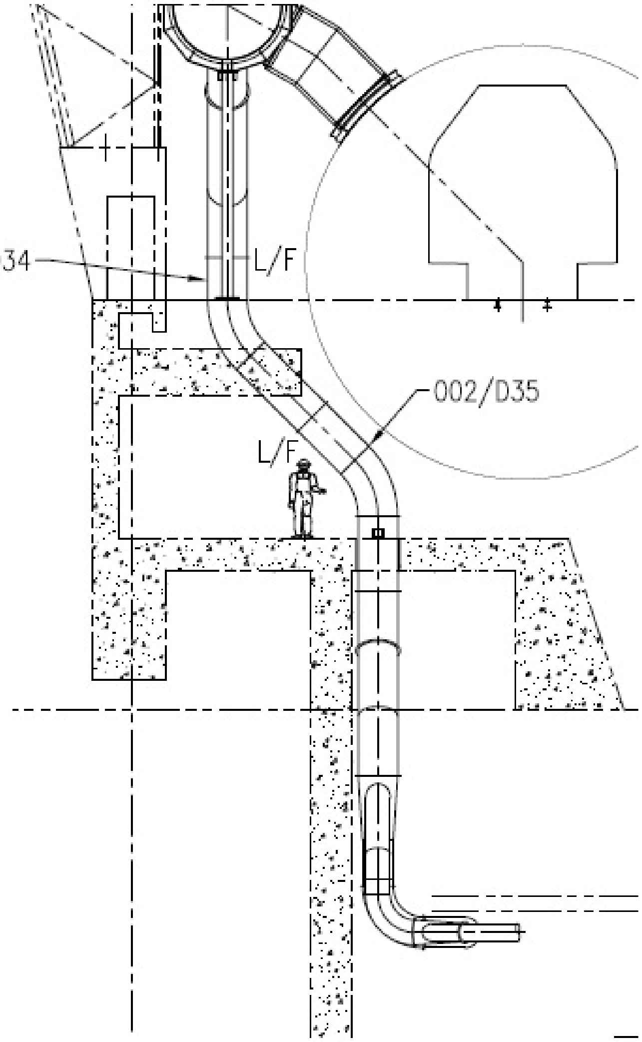
- Items D05 & D06 must be seal welded to Bottom Plate.

- Item D05 Inspection Door not installed. 1-off required and located on site.

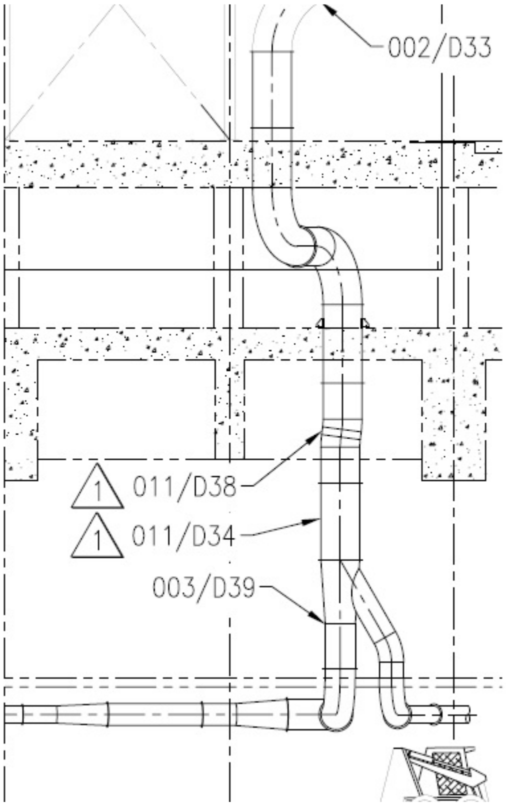
- Item D56 Closure plate not procured. Opening to be measured, designed, manufactured and installed. Opening is not part of the ducting design and only 1-off opening is required on the other end where D55 bolts to.
- Ducting items D34, D35, D36, D37 and D38 is redundant ducting due to incorrect cut hole location in cast concrete by the civil contractor. New replacement sections are to be measured, designed, manufactured and installed as follow:

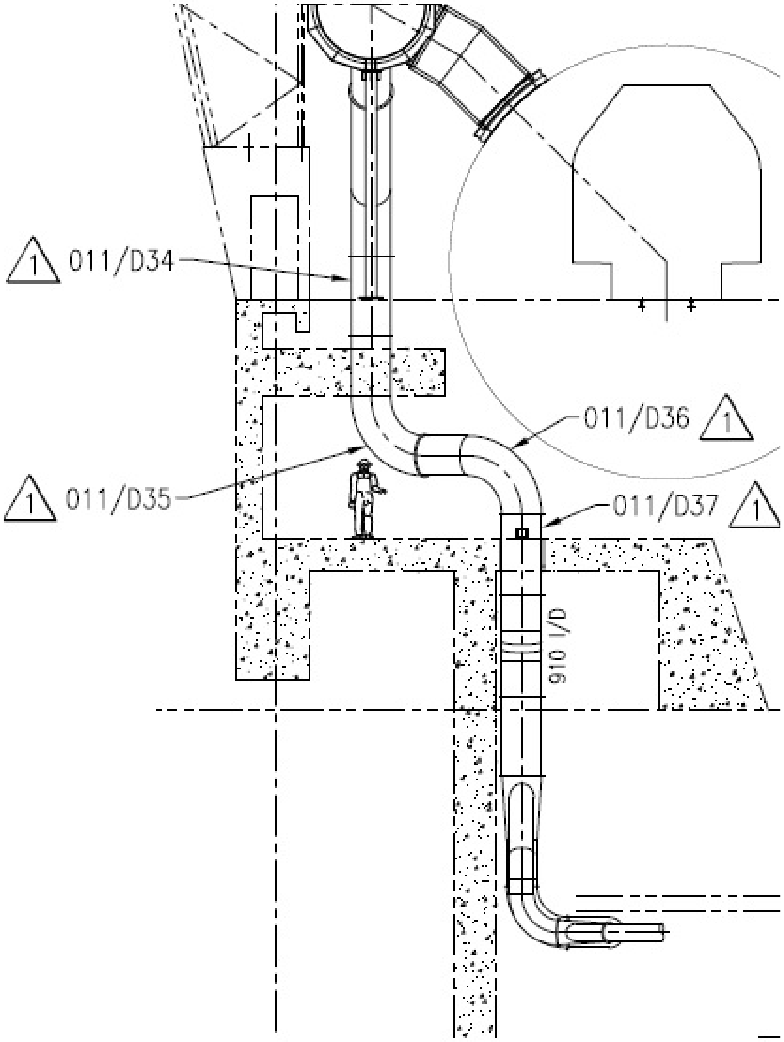
Routing as per original design:





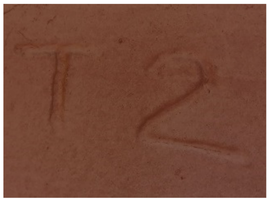
Revised routing to suit incorrect cut hole location in cast concrete:



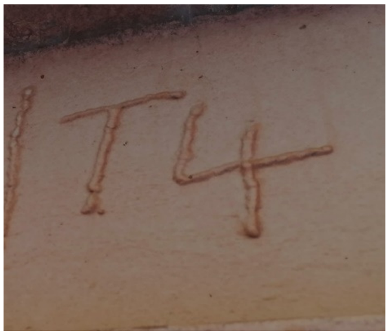


- 1-off Column Duct Support T9 on grid 1e-L installed in position.

- 1-off Duct Support T2-G / F and T3-G / F placed in position. Support to be aligned correctly and fixed to concrete with HD Bolts.



- Supports Trestles T1-G / F, T4-G / F, T5-G / F, T6-1c / 1d, T7-K / J and T8-K / J not installed. All located on site. No sliding joint plates located on site for T5 & T7.



- 1-off Column Duct Support located with no item number. 3-off not located on site. T9 on grid 1f-L, T10 on grid 1g-L, T11 on grid 1h-L and T12 on grid 1k-L. Column Duct Supports T10 on grid 1g-L and T11 on grid 1h-L are braced. 5-off Column Duct Supports required in total.

- No Hanger Duct Supports Installed. 3-off U-type and 4-off O-type required. All Hanger Duct Supports located on site.

- 3-off Horseshoe type Orifice Plate sets located on site. 3-off required in total.

- 1-off Large Round Orifice Plate located on site, 1-off required in total. Orifice Plate is redundant due to re-designed ducting required due to incorrect cut hole location in cast concrete by the civil contractor. New replacement section is to be measured, designed, manufactured and installed.

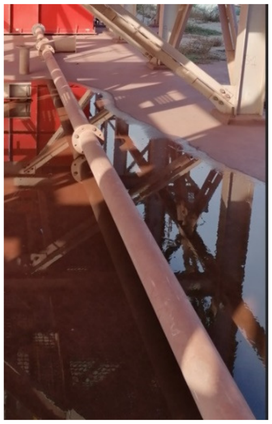
- 3-off Rectangular type Orifice Plate sets located on site. 1-off Rectangular type Orifice Plate half set located on site. 1-off Rectangular type Orifice Plate half set and complete set not located on site. 5-off sets required in total.



Pneumatic Conveying System and Piping (Takraf Drg. Ref. EB0008-B100-XAA-001

- Blower support frame not installed. 1-off frame required and located on site.

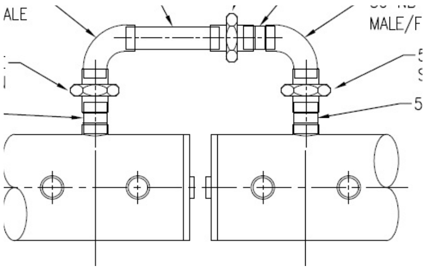
- Pneumatic Pipe Lines partially fitted. All piping located on site. 7-off Straight sections, 1-off Straight + Cone section, 2-off 90 degree bend sections and 2-off Feeding Tee sections required in total.



- Pipe supports installed (No photos). No Gaskets and support U-Bolts not located on site.

Compressed Air System and Piping (Takraf Drg. Ref. EB0008-B100-JKA-002
EB0008-B100-JKA-003)

- Compressed Air piping c/w gaskets, fasteners and supports not procured. Pipe routing to be designed, manufactured and installed.
- Immersion Tank joint pipes not located on site. 4-off required in total, 2-off each for respective Bagfilter.



We trust that the above meets with your approval.

Please do not hesitate to contact us should you wish to discuss or clarify any part of this report.

Yours sincerely,

Chris Van Niekerk
Director of Engineering

Air Envirotech (Pty) Ltd.
Tel : +27 84 504 1449
E-Mail : chrisvn@airenvirotech.com

Appendix E

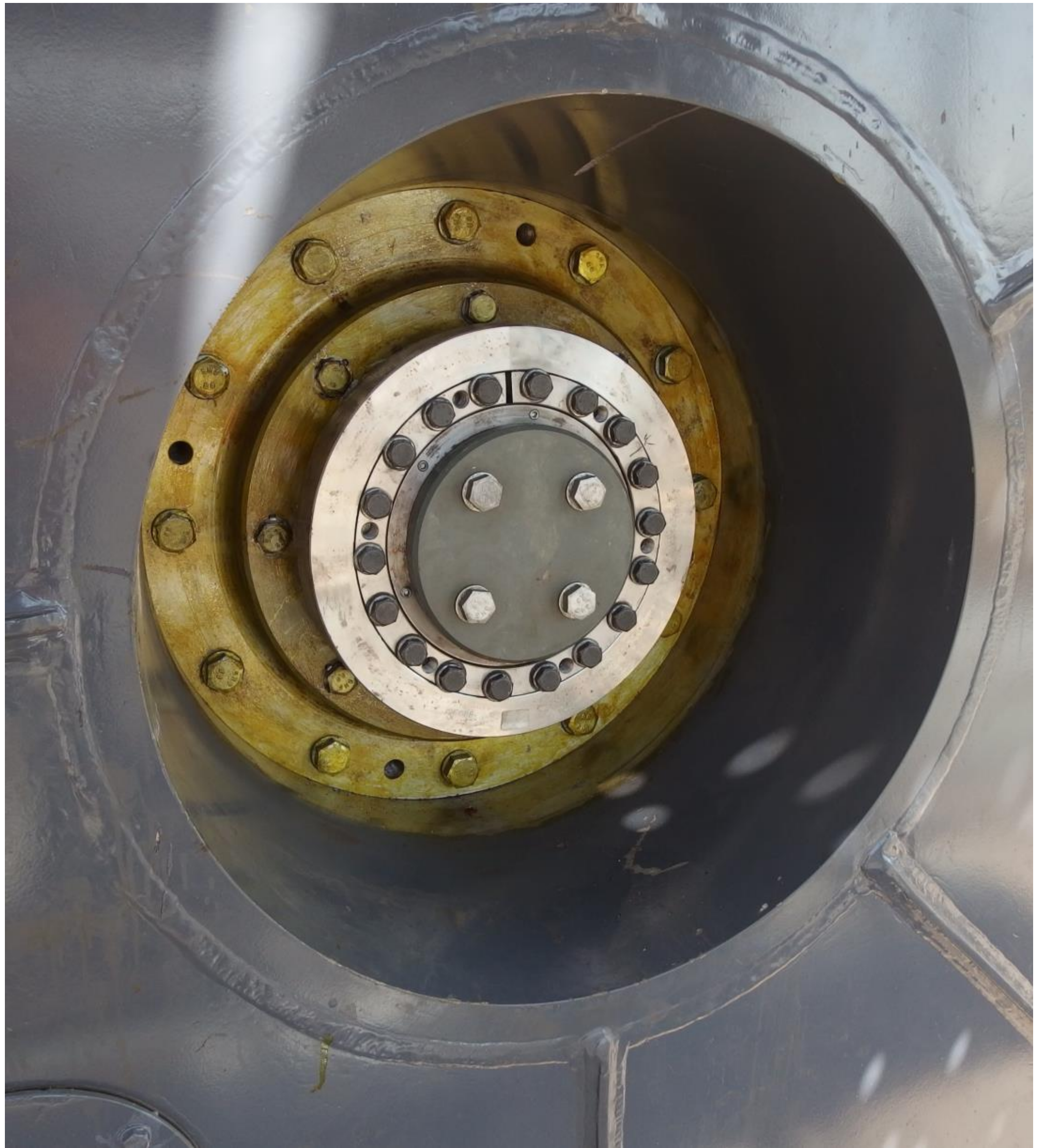
Site Inspection Photographs

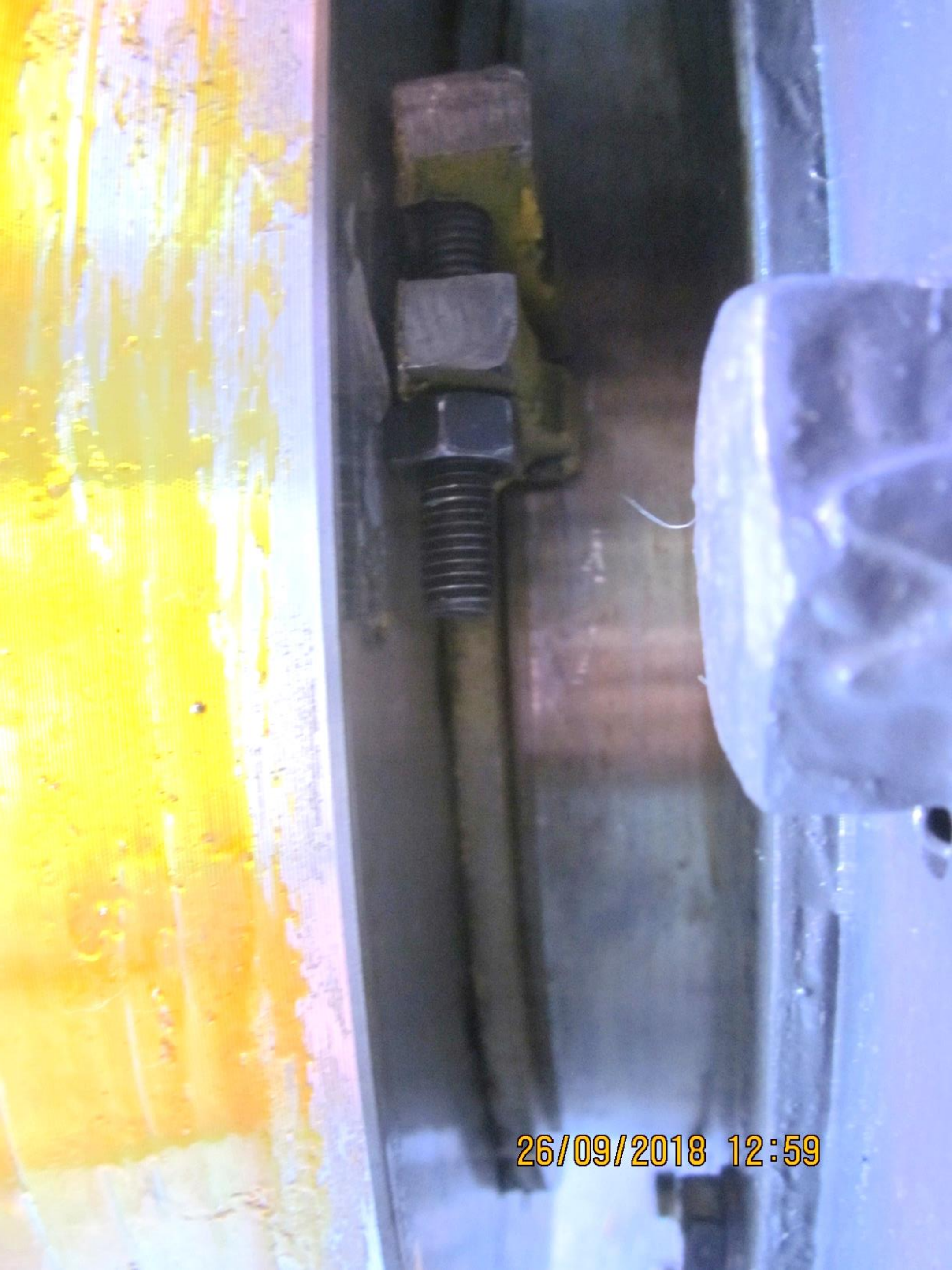
This Appendix contains selected copies of photographs included in the Site Inspection Plans which indicate the subject matter of the this report. Reference should be made to the Site Inspection Plans for further information regarding the condition of the equipment.

Photo 1

Incorrect Shrink Disc

Tippler Pivot Shaft Temporary Spacer





26/09/2018 12:59

ashton bulk
materials handling

Photo 2

Tippler Pivot Shaft Condensation

ashton bulk
materials handling

Photo 3

Tippler Cage Link

Mis-Alignment

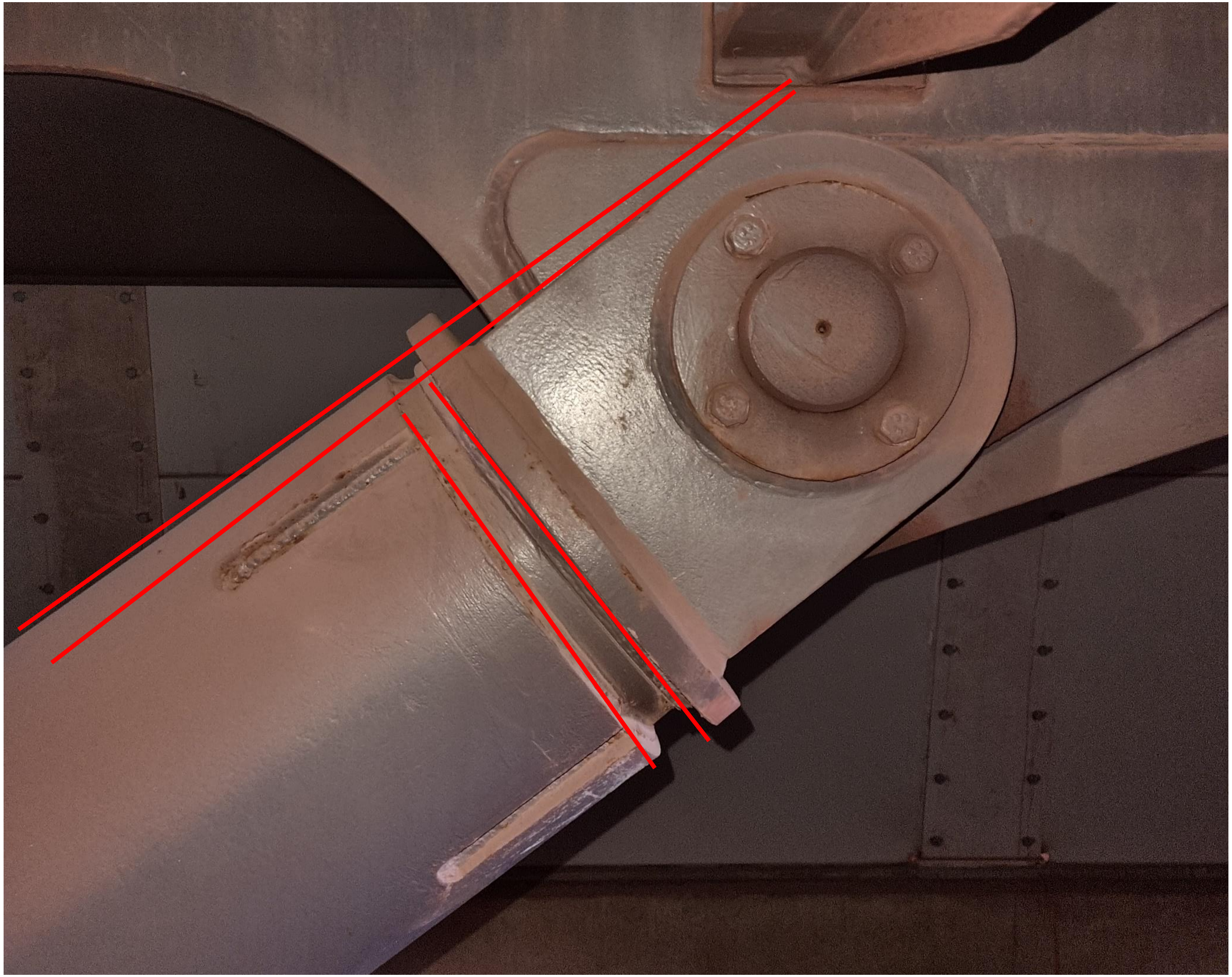


Photo 4

Torque Reaction
Bracket Mis-Alignment

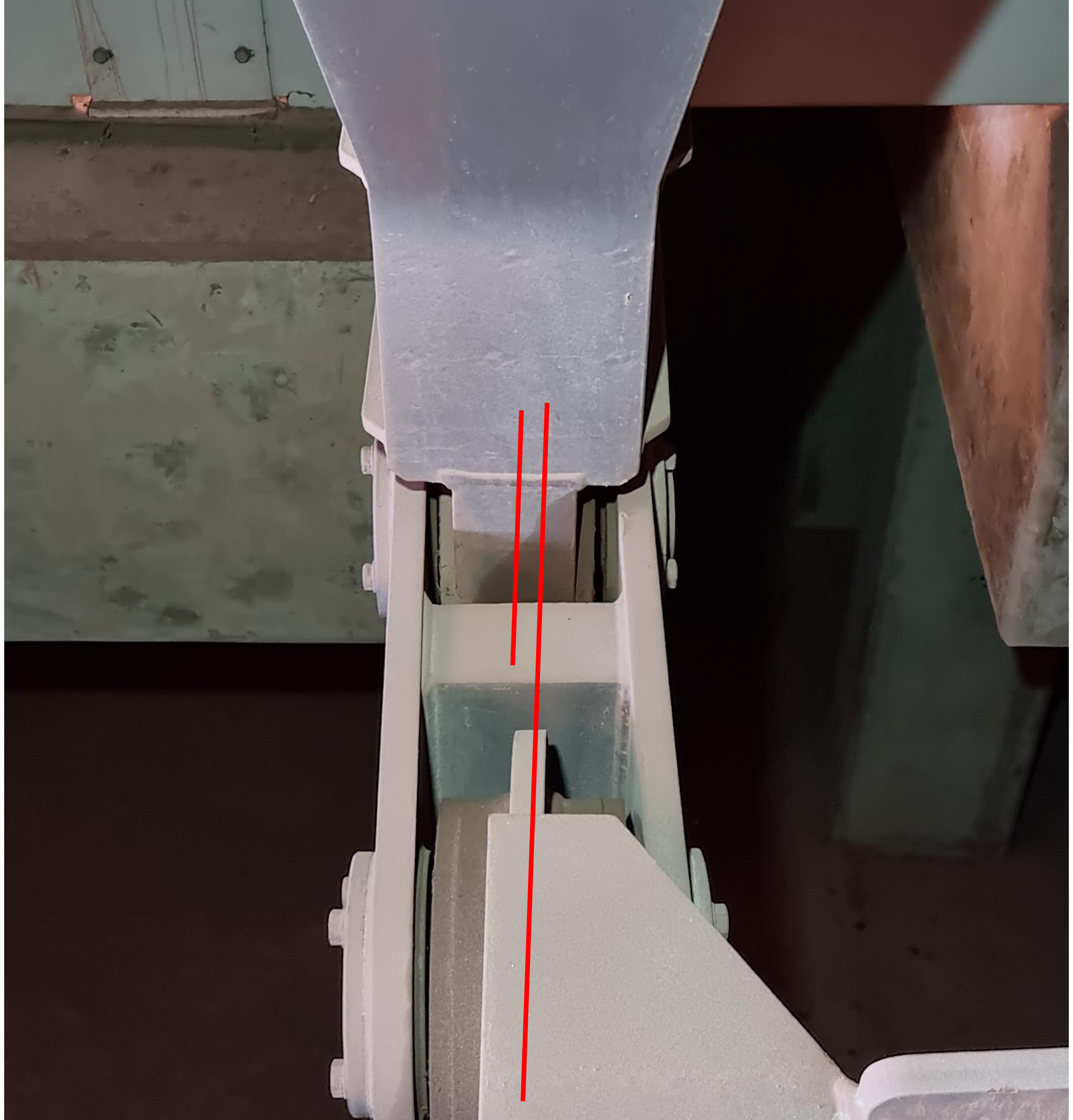


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Photo 5

Tippler Rail Platform Internal Surface Corrosion

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Photo 6

Positioner Front Pedestal Poor Quality Weld

Photo 7

Positioner Main Frame Internal Surface Corrosion

Photo 8

Wheel Gripper – Pivot Pin, Fitted Bolt & Shim Corrosion

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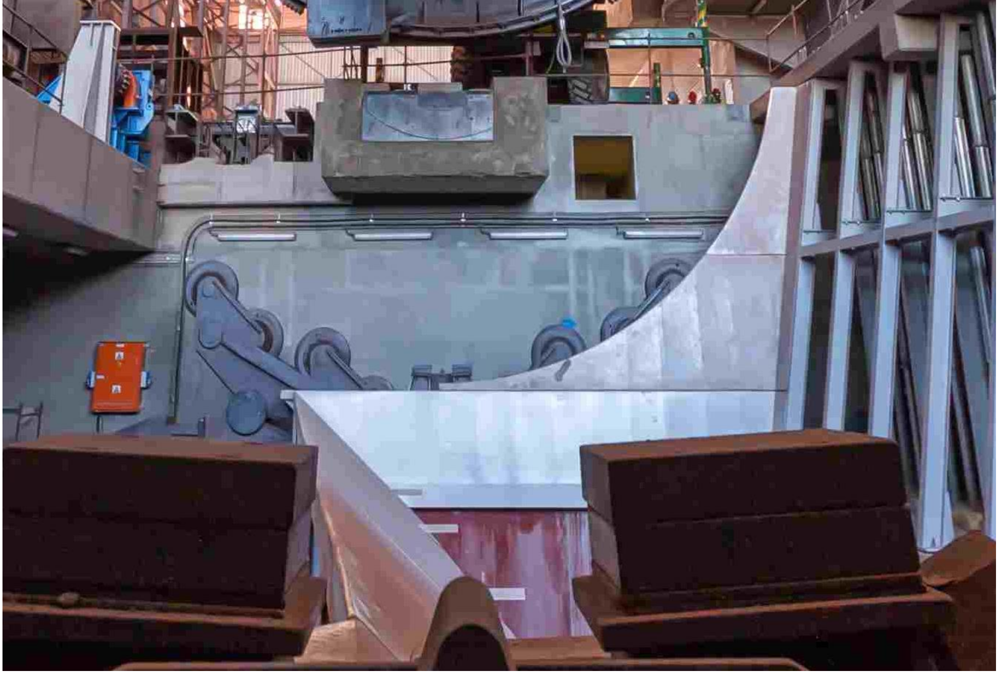

Photo 9

- Non-Tip Side Deflector Wall - Insufficient Clearance with Wagon Clamp Ballast Weights
- Dust Shroud Short at Hopper End

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Photo 10

Incomplete Manufacture – Absence of Machining

Photo 11

Incorrect Lubrication Hose Fittings

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Photo 12

Apron Feeder Chute Support Mis-Alignment

Appendix G

Schedule of Enabling Works

SALDANHA BAY TIPPLER 3 – INTERIM ENABLING WORK SCOPE PROPOSAL

Following the Phase 1 site inspections, the works and activities listed below are required to prepare for, and reduce the duration of, Phase 2.

1. Site Establishment & General Transport - Breedt Asia
   - Consolidate equipment currently stored inside the Tippler building and selective equipment outside of the Tippler building to Breedt works. This excludes excluding Dust Extraction ducting and support structures.
   - Monthly storage cost for all items from December 2021 to July 2022 – 8 Months
   - Removal of Tippler Drives (2) and transport to Brevini SA.
   - Removal of Positioner Drives (8) and transport to Brevini SA.
   - Transport of Apron Feeder Drives (5) to Brevini SA.
   - Removal of Gripper Frames for relocation at Breedt Asia works and provision of replacement floor plate supports (support currently provided by the Gripper Frames which are not intended or design for supporting trucks or cranes).
   - Transport of Dust Extraction VFD, Air Inlets and 450 kW Drive Motor to Siemens in Elansfontein, SA.
   - Consolidate all remaining equipment that is not to be stored at Breedt Asia into an outside laydown and storage area.
2. Removal of Dust Cowl including match marking, store in designated laydown area outside Tippler Building - Breedt Asia.
3. Hardcore access to Tippler Building at North and South ends to allow mobile crane and transport truck entry - Breedt Asia.
4. Full consolidation and cataloguing of all equipment including location/re-location ready for sequenced of use immediately at commencement of Phase 2. Identification of all necessary parts for replacement/manufacture for Phase 2. To include one month's services of:
   - One (1) Mechanical Engineer
   - One (1) Electrical Engineer
   - One (1) QS/Administrator
5. Detailed review of all quality data packs provided to AB by Transnet during course of Phase 1 Scoping exercise. This exercise is very important to understand whether all production objectives were achieved by TZME and other manufacturers and what additional inspections such as weld testing may be required. To include one month's the services of:
   - Scanning Documents and Administration where only hard copies have been provided to Transnet by Takraf
   - QA Engineer
   - Welding Engineer (part time)

6. Inspection of Dust Extraction Variable Speed Drive, Air Inlets and Drive Motor at Siemens facility in Elansfontein, SA by Siemens engineer from Germany.

7. Hopper Liner Type and Fitting Method Selection and Final Agreement with SA Supplier - Quality Engineering Ltd.

8. Buss Bar manufacturer site inspection visit to agree location and design.

9. Dismantling, internal inspection and determination of the condition of the mechanical Drives by Brevini ready for direct inspection by AB and Transnet. Important for identifying any necessary replacement long lead items and potential agreement by Brevini on extended product warranties. Service covers:
    - 2 x Tippler Drives
    - 8 x Positioner Drives
    - 5 x Apron Feeder Drives

10. Dismantling, internal inspection and determination of the condition of the large Electric Motors ready for direct inspection by AB and Transnet. Important for identifying any necessary replacement long lead items and potential agreement by Siemens on extended product warranties. Service covers:
    - 2 x Tippler Motors
    - 8 x Positioner Motors
    - 5 x Apron Feeder Motors

11. Dismantling, internal inspection and refurbishment with new seals as necessary of all hydraulic actuators including:
    - 1 x Positioner Main Arm Actuator
    - 1 x Main Arm Latch Actuator
    - 1 x Coupler Release Actuator
    - 1 x Last Wagon Arm Latch Actuator
    - 1 x Last Wagon Arm Rotary Actuator
    - 16 x Wheel Gripper Actuators

    Note – Knife Gate actuators have been excluded at this stage until a solution on their suitability is reached.

12. Fill all 5 HPUs with fresh hydraulic oil and using the HPU test rig, power up all 5 HPUs and repeat Factory Acceptance Test procedure. Protect for further 6 months potential storage. Important for identifying any necessary replacement long lead items and potential agreement by Advances Actuators on extended product warranties. Service covers:
    - 1 x Positioner Hydraulic Power Unit
    - 4 x Wheel Gripper Hydraulic Power Units

13. Evaluate existing Knife Gate design and suitability with the consideration of alternative designs (Spile Bars etc).

14.Control System Engineering

Undertake:

- Review of plant control requirements with Transnet Engineering, TFR and other interested parties to finalise control system requirements and complete final software program.
- Re-visit train hauling force calculations and Positioner drive calculations to include for Brake Wagon operations and effects on empty rake of wagons.

15.Project Management & General Engineering

- Mechanical Engineer for Construction / Installation Pricing
- Electrical Engineer for Construction / Installation Pricing
- Overall Project Management of activities listed in Items 1 to 15.

16 Removal of Tippler Cage for Re-Alignment

Appendix H

Phase 1 Scoping Site Inspection Summaries

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Phase 1 Scoping Site Inspection Summary - TUS

This summary Document to be Read in Conjunction with Site Inspection Reports for TUS

Contract Number	*9144-1*
Contract Name	*Saldanha Bay Phase 1 Scoping*
Revision	*A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	**OEM BOM Number**	**Native Format / PDF**	**SIP Number(s)**			
Tippler Support Rollers	Drawings & Documents		AB Drawings Obtained in PDF format Only. * AB Original Source Drawings & BOMs used for Scoping.	49055232 49055233 49055234 49055273 49055235	49055232 49055233 49055234 49055273 49055235	No* / Yes	25 26 27 28 29	Engineering - information supplied by Transnet incomplete, AB have all necessary information including 3D models, drawings and BOMs in native format.	**Basic Engineering Requirement:** None. AB original engineering and design information adequate. **Harmonisation Engineering:** A new series of Transnet drawing numbers to be taken out for all TUS drawings, to align complete Plant under one number series. Remove Takraf logo from all drawing borders.	Where identified thus *, AB have relied on Original Source Drawings, BOMs and supporting engineering records.
	Inspect For General Condition & Manufacture As Designed Check Alignment Determine Condition of All Components inc. Bearings/Rotate Rollers Check Anchor Bolts Torque Tightened Check Structural & Mechanical Bolts Torque Tightened (10%) Confirm Whether Lubrication System Installed Lubricate Bearings etc as Necessary	Tippler Support Rollers Installed & Fully Grouted.	Datum marks on the ends of the Support Beams have been made by hand, disregarding the Ashton Bulk manufacturing instructions, resulting in a maximum deviation of 2mm in the lateral direction from the drawing dimensions. The Support Roller drawing states a maximum tolerance of +/- 0.5mm between the centres of the Support Beams. Survey results show a -2mm deviation on the Tip Side and -4mm deviation on the Non-Tip Side from the specified drawing dimension. Both the Locating & Non Locating Support Roller drawing states a maximum tolerance of +/- 2mm on the alignment of Support Roller centres relative to the Support Roller Beam. Survey results show a 3mm deviation on the Tip Side and 5mm deviation on the Non-Tip Side from the specified drawing dimension. The Locating Support Rollers have uneven gaps between the Support Roller flanges and edge face of End Ring Rails. The displacement is in opposite directions on the Tip and Non-Tip sides. Silicone sealant has not been applied between the Compensating Beams and Pivot Blocks to protect from dust or damp ingress. Silica gel desiccant has not been provided in the accessable box sections as required by clause 3.3 of the Ashton Bulk manufacturing specification. This has resulted in internal corrosion in serveral instances due to condensation. Lubrication system has not been installed.					The equipment is generally fit for purpose but one Support Roller assembly requires longitudinal re-alignment. Refer to recommendations.	Risk was identified in operating the Tippler with Support Roller bearings that had been installed under load for two years without any periodic rotation. It is recommended to remove all 16 Plain and Flanged Support Rollers assemblies, dismantle and re-assemble with new bearings, seals and grease. Retain existing bearings if considered serviceable for addition to Transnet spare stock. Shim Non-Tip Side Support Roller Set complete, including Pivot Bracket to re-establish longitudinal alignment. Complete a 20% sample torque tightness bolt check for each critical bolt group. Send 1 bolt per critical connection for mechanical and chemical analysis.	Refer to Tippler 3_As-Built Survey Report 17.03.22 for details of Support Roller alignment. Inspection was undertaken of all bolted connections of the TUS. Accessibility to undertake a torque tightening check of all TUS primary/structural bolted connections was not possible due to limited accessibility and health and safety concerns at this stage of the process. Torque tightening checks to be undertaken during Phase 2. Refer to Recommendations.
	Review QA Data Pack (Takraf) Review of Installation Alignment Records		The QA pack provided to Transnet by Takraf and as supplied to AB relating to the Tippler, Positioner and Wheel Gripper manufacturing and supply processes are incomplete. The format of the QA pack does not permit all data/records for a given component to be logically identified. Indexes are provided but do not relate to all assemblies and components. Several elements of the equipment are not indexed. The folders in which the QA data is compiled are poorly titled and several of the folders are empty. Of the information that is included can be summarised as follows: Vital quality records for some equipment does not exist. Some pdf files cannot be accessed/opened. Records for some indexed documents are not provided, only the index exists. Records such as material certificates (mechanical/chemical) as provided have been combined into a single document and are not cross related to individual drawing or component identification numbers. No records of the critical structures of the TUS having been stress relieved have been provided.					These documentary records are not fit for purpose in their current state.	No visiual observations of the equipment identified quality deficiencies or defects, in the absence of full documentary records, further investigation required to fully verify quality of manufacture.	The observations relating to the QA Data Pack are applicable to all TUS equipment.

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Phase 1 Scoping Site Inspection Summary - TUS

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Contract Number *9144-1*
Contract Name *Saldanha Bay Phase 1 Scoping*
Revision *A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Tippler Rotating Structures - Tippler Cage	Drawings & Documents		AB Drawings Obtained in PDF format Only. * AB Original Source Drawings & BOMs used for Scoping.	49055208 49055209 49055210 49055211 49055212 49055213 49055231 49055280 49055281 49055282 49055283 49055284 49055285 49055219 49055220	49055208 49055209 49055210 49055211 49055212 49055213 49055231 49055280 49055281 49055282 49055283 49055284 49055285 49055219 49055220	No* / Yes	4 5 6 7 8 9 10 11 12 16 17 18	Engineering - information supplied by Transnet incomplete, AB have all necessary information including 3D models, drawings and BOMs in native format.	**Basic Engineering Requirement:** None. AB original engineering and design information adequate. **Harmonisation Engineering:** A new series of Transnet drawing numbers to be taken out for all TUS drawings, to align complete Plant under one number series. Remove Takraf logo from all drawing borders.	Where identified thus *, AB have relied on Original Source Drawings, BOMs and supporting engineering records.
	Inspect For General Condition & Manufacture As Designed Check Alignment Determine Condition of All Components Confirm Method of Rotatonal Constraint Confirm Assembly Status of Side Beam & Ballast Beam Pivot Shafts Confirm Assembly Status of Platform Pivot Shafts Check Structural & Mechanical Bolts Torque Tightened (10%) Lubricate Bearings etc as Necessary	Tippler Rotating Cage Structures Installed on Support Rollers.	Misalignment of the Tippler Cage has been proven by 3D survey of the Tippler. Refer to Tippler 3_As-Built Survey Report 17.03.2022. The Tippler Cage drawing states a maximum tolerance of +/- 3mm between the centres of the End Rings. Survey results show a 13.5mm deviation at both the Entry and Exit End Rings from the specified drawing dimension. In the plan view, the mis-alignment of both End Rings skew in the same direction, creating a parallelogram effect in the Exit End Ring direction. The manufactured structures have been subject to inspection and quality assurance procedures of Takraf and Transnet and accepted. A significant number of the primary load bearing welds and surface fettling on the structures are considered not to be visually compliant with the standards laid out in the Ashton Bulk Manufacturing Specification or accepted industry standards. This does not signify that the primary structural welds will not be adequate. During Phase 2, Ashton Bulk will engage qualified weld inspectors to carry out sample Non-Destructive Testing and visual inspection of critical welds. All results will be reported to Transnet prior to any remedial works considered necessary. Refer to individual SIPs for detailed observations. The following issues are of note: The Platform and Side Beam Pivot Shafts were inspected. It was confirmed that the incorrect Shrink Discs have been installed and require replacement. On removal of the Pivot compartment covers excessive condensation and corrosion was apparent. The main bearing will have been subjected to these unacceptable conditions. The Cage Link Bracing Members have been installed with unacceptable levels of angular misalignment. One of the Torque Brackets has been installed with unacceptable levels of angular misalignment. The End Ring Rails are noted to have been installed with wander that is outside of drawing tolerance. The lower Drive Racks that were removed for the installation of the Tippler have not been fully replaced and aligned. Extensive surface corrosion observed in the accessible box section members due to the absence of instructions for the manufacturer to provide Silica gel desiccant in all sealed compartments. The Tippler is held using the Tippler Rotational Maintenance Lock design for the purpose. Insufficient safe access was available to lubricate bearings.					The general condition of the Tippler Rotating Cage is fit for purpose subject to proposed recommendations.	Weld testing and potential requirement for localised repair. Replacement of the Cage Link Bracing Members. Replacement of one Torque Bracket. Replacement of Shrink Discs. Replacement of Main Pivot Bearings. Review options for remedial surface treatment to internal box sections. Touch up surface repair of external surfaces. Complete a 20% sample torque tightness bolt check for each critical bolt group. Send 1 bolt per critical connection for mechanical and chemical analysis.	Refer to Tippler 3_As-Built Survey Report 17.03.22 for details of Tippler Cage alignment. Inspection was undertaken of all bolted connections of the TUS. Accessibility to undertake a torque tightening check of all TUS primary/structural bolted connections was not possible due to limited accessibility and health and safety concerns at this stage of the process. Torque tightening checks to be undertaken during Phase 2. Refer to Recommendations.
	Review QA Data Pack (Takraf) Review of Installation Alignment Records		Refer to general QA comments included in Tippler Support Roller summary. Other issues such as the Bracing Members and Torque Links misalignment had not been identified in the QA Data Pack. The QA Data relating to the Tippler Rotating Cage incorrectly stated the Cage had been aligned in accordance with the designers recommendations.					These documentary records are not fit for purpose in their current state.	In the absence of full documentary records, further investigation required to fully verify quality of manufacture.	

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Phase 1 Scoping Site Inspection Summary - TUS

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Contract Number *9144-1*
Contract Name *Saldanha Bay Phase 1 Scoping*
Revision *A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Tippler Clamp Gear	Drawings & Documents		AB Drawings Obtained in PDF format Only. * AB Original Source Drawings & BOMs used for Scoping.	49055221	49055221	No* / Yes	19	Engineering - information supplied by Transnet incomplete, AB have all necessary information including 3D models, drawings and BOMs in native format.	**Basic Engineering Requirement:** None. AB original engineering and design information adequate. **Harmonisation Engineering:** A new series of Transnet drawing numbers to be taken out for all TUS drawings, to align complete Plant under one number series. Remove Takraf logo from all drawing borders.	Where identified thus *, AB have relied on Original Source Drawings, BOMs and supporting engineering records.
	Inspect For General Condition & Manufacture As Designed Determine Condition of All Components Confirm Assembly Status Check Structural & Mechanical Bolts Torque Tightened (10%)	Clamp Gear Installed on Tippler Cage Structure	Clamp Gear has been manufactured in accordance with the design requirements with the exception of missing limit switch brackets and dimensional inconsistencies of material flow cowls which will require further investigation during initial rotation of the Tippler. A clash between the Non-Tip Side Clamp Ballast Blocks and the ground mounted Hopper Spill Plates when the Tippler over travels in the return direction was noted.					The general condition of the Clamp Gear is fit for purpose subject to proposed recommendations.	Investigate clearances of material flow cowls. Replace limit switch brackets. Modify Hopper Spill Plates to clear Clamp Ballast Weights. Complete a 20% sample torque tightness bolt check for each critical bolt group. Send 1 bolt per critical connection for mechanical and chemical analysis.	Inspection was undertaken of all bolted connections of the TUS. Accessibility to undertake a torque tightening check of all TUS primary/structural bolted connections was not possible due to limited accessibility and health and safety concerns at this stage of the process. Torque tightening checks to be undertaken during Phase 2. Refer to Recommendations.
	Review QA Data Pack (Takraf) Review of Installation Alignment Records		Refer to general QA comments included in Tippler Support Roller summary.					These documentary records are not fit for purpose in their current state.	In the absence of full documentary records, further investigation required to fully verify quality of manufacture.	

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Phase 1 Scoping Site Inspection Summary - TUS

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Contract Number *9144-1*
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Revision *A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Tippler Ancillary Structures	Drawings & Documents		AB Drawings Obtained in PDF format Only. * AB Original Source Drawings & BOMs used for Scoping.	49055222 49055223 49055224 49055225 49055227	49055222 49055223 49055224 49055225 49055227	No* / Yes	20 21 22 23 24	Engineering - information supplied by Transnet incomplete, AB have all necessary information including 3D models, drawings and BOMs in native format.	**Basic Engineering Requirement:** None. AB original engineering and design information adequate. **Harmonisation Engineering:** A new series of Transnet drawing numbers to be taken out for all TUS drawings, to align complete Plant under one number series. Remove Takraf logo from all drawing borders.	Where identified thus *, AB have relied on Original Source Drawings, BOMs and supporting engineering records.
	Inspect For General Condition & Manufacture As Designed Determine Condition of All Components Confirm Assembly Status Check Structural & Mechanical Bolts Torque Tightened (10%)	Tippler Rotating Cage Structures Installed on Support Rollers.	The ancillary structures include the Side Pad, Spill Plates, Platform Walkways, Platform Rails and Ballast. The Ballast has not been installed and the Ballast Pltes have been identified at site. Other structures have been manufactured in accordance with the design requirements other than minor potential clashes between Side Pad material deflector plates and Clamp Gear. Some weld finishing is not compliant with necessary standards but will not affect the function of these structures.					The general condition of the Tippler Ancillary Structures is fit for purpose subject to fitting of Ballast Plates and checking of potential clashes with Clamp Gear.	Investigate clearances of material flow cowls. Complete a 20% sample torque tightness bolt check for each critical bolt group. Send 1 bolt per critical connection for mechanical and chemical analysis.	Inspection was undertaken of all bolted connections of the TUS. Accessibility to undertake a torque tightening check of all TUS primary/structural bolted connections was not possible due to limited accessibility and health and safety concerns at this stage of the process. Torque tightening checks to be undertaken during Phase 2. Refer to Recommendations.
	Review QA Data Pack (Takraf) Review of Installation Alignment Records		Refer to general QA comments included in Tippler Support Roller summary.					These documentary records are not fit for purpose in their current state.	In the absence of full documentary records, further investigation required to fully verify quality of manufacture.	

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Phase 1 Scoping Site Inspection Summary - TUS

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Contract Number *9144-1*
Contract Name *Saldanha Bay Phase 1 Scoping*
Revision *A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Tippler Drives	Drawings & Documents		AB Drawings Obtained in PDF format Only. * AB Original Source Drawings & BOMs used for Scoping.	49055236	Yes	No* / Yes	30	Engineering - information supplied by Transnet incomplete, AB have all necessary information including 3D models, drawings and BOMs in native format.	**Basic Engineering Requirement:** None **Harmonisation Engineering:** A new series of drawing numbers to be taken out for all TUS drawings, to align complete Plant under one number series. Remove Takraf logo from all drawing borders.	Where identified thus *, AB have relied on Original Source Drawings, BOMs and supporting engineering records.
	Inspect For General Condition & Manufacture As Designed Check Alignment Determine Condition of All Components Check Structural & Mechanical Bolts Torque Tightened (10%) Confirm Whether Lubrication System Installed Lubricate Bearings etc as Necessary	Tippler Drives Located at Entry and Exit Ends of Tippler.	Drive Pinions are excessively corroded. Base Frames have not been installed on the correct grout packers, aligned or grouted. Encoders have not been fitted. Lubrication system not fitted. Gear Reducers filled with oil and appeared to be over-filled compared with usual practices.					The equipment is generally fit for purpose but requires refurbishment, alignment and grouting in place. Refer to recommendations.	Remove Drive complete and return to mechanical drive supplier and motor supplier OEMs. Gearboxes and Motors to be fully re-assembled with new bearings and seals. Motors will have windings checks and whole unit re-aligned before return to site. Drive supplier shall recommend whether to fill the Gear Reducer with oil or corrosion inhibitor depending on predicted time standing before use. Use electric wire brush to remove localised corrosion on Drive Pinions and protect with appropriate surface protection compound.	Gear Reducers were shipped to site with corrosion inhibitor to protect internal surfaces based on client (Tenova) undertaking first fill of oil within original project operational timescales.
	Review QA Data Pack (Takraf) Review of Installation Alignment Records		A complete QA Data Pack from the Drive supplier, Brevini is not available in the QA information provided to AB. Some folders are empty.					There are insufficnet quality records.	No visiual observations of the equipment identified quality deficiencies or defects, in the absence of full documentary records, further investigation required to fully verify quality of manufacture.	

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Phase 1 Scoping Site Inspection Summary - TUS

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Site Inspection Reports for TUS

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Contract Name *Saldanha Bay Phase 1 Scoping*
Revision *A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Positioner Main Frame & Access	Drawings & Documents		AB Drawings Obtained in PDF format Only. * AB Original Source Drawings & BOMs used for Scoping.	49055246 49055244	49055246 49055244	No* / Yes	38 50	Engineering - information supplied by Transnet incomplete, AB have all necessary information including 3D models, drawings and BOMs in native format.	**Basic Engineering Requirement:** None **Harmonisation Engineering:** A new series of drawing numbers to be taken out for all TUS drawings, to align complete Plant under one number series. Remove Takraf logo from all drawing borders.	Where identified thus *, AB have relied on Original Source Drawings, BOMs and supporting engineering records.
	Inspect For General Condition & Manufacture As Designed Determine Condition of All Components Determine Extent of Assembly/Installation of Proprietary Equipment including: Drive Cartridges Hydraulic Installation Lubrication Installation	Positioner Main Frame Installed. Access and Walkways Installed with Minor Omissions.	The Main Frame has been manufactured in accordance with design requirements. Some instances of localised external surface corrosion. Surface corrosion observed in the accessible box section members due to the absence of instructions for the manufacturer to provide Silica gel desiccant in all sealed compartments. Long Travel Buffers have not been fitted and have been located at works of Breedt Asia. The Hydraulic Power Unit Support Frame and Bund are located in the Tippler building but not fitted. All Lifting Plates are fitted to the Main Frame and will need removing. Switch Strikers, Striker Brackets and associated fasteners are missing. Trackside handrailing and associated toe flat do not conform to drawings and do not reach the Towing Arm. Platform Flooring & Positioner Access Flooring present on site but not fitted. The Drive Cartridges are installed. The Hydraulic System and Lubrication System are not installed.					The general condition of the Main Frame and Access is fit for purpose subject to proposed recommendations. Refer also to SIPs for Sub-Assemblies.	Use electric wire brush to remove localised corrosion and apply paint repair procedure. Remove all lifting and jacking brackets and fit bolts in holes. Fit Long Travel Buffers. Manufacture and fit Switch Strikers and Striker Brackets. Re-manufacture and fit trackside handrailing in accordance with drawing requirements. Review options for remedial surface treatment to internal box sections. Touch up surface repair of external surfaces. Install Hydraulic and Lubrication Systems.	
	Review QA Data Pack (Takraf)		Refer to comments included in Tippler Support Roller summary.					These documentary records are not fit for purpose in their current state.	No visiual observations of the equipment identified any significant quality deficiencies or defects, in the absence of full documentary records, further investigation required to fully verify quality of manufacture.	

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Phase 1 Scoping Site Inspection Summary - TUS

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Contract Number *9144-1*
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Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Positioner Arm & Last Wagon Arm	Drawings & Documents		AB Drawings Obtained in PDF format Only. * AB Original Source Drawings & BOMs used for Scoping.	49055247 49055248 49055239 49055249 49055295 49055298	49055247 49055248 49055239 49055249 49055295 49055298	No* / Yes	39 40 41 42 43 44	Engineering - information supplied by Transnet incomplete, AB have all necessary information including 3D models, drawings and BOMs in native format.	**Basic Engineering Requirement:** None **Harmonisation Engineering:** A new series of drawing numbers to be taken out for all TUS drawings, to align complete Plant under one number series. Remove Takraf logo from all drawing borders.	Where identified thus *, AB have relied on Original Source Drawings, BOMs and supporting engineering records.
	Inspect For General Condition & Manufacture As Designed Determine Condition of All Components Determine Extent of Assembly/Installation of Hydraulic System. If not Assembled - Locate of Prop. Equipment. Check Structural & Mechanical Bolts Torque Tightened (10%) Lubricate Bearings etc as Necessary	Positioner Arm Installed. LWA Installed.	**Positioner Arm** The Positioner Main Arm has been installed in accordance with drawing requirements with minor components requiring adjustment and replacement. A clash appears to have taken place between Ballast Arm Link and Ballast Arm. This is believed to be a handling error and will not affect operation. Arm Raise Mechanism Ballast has not been installed. Link to Main Arm Pin, Washers, Pivot Caps and associated fasteners are missing. Trimming plates are missing. Mechanism operating clearances ae in accordance with drawing requirements. Pedestal internal surfaces confirmed painted in accessible areas. Pedestal Shear Flats (item 38) have been fitted. Pedestal to Main Frame bolts have been touched up with paint on the inner side of the Main Frame. Grease issuing from clearances between pin jointed components indicating full lubrication. Weld between Front Pedestal front plate to bottom flange is unacceptable and required repair. Arm structure clearance with Front Pedestal Thrust Plates is slightly tapered on the exit side and a tight fit on the entry side. This will not be detrimental to operation. Adjustment necessary. **Last Wagon Arm** LWA has been installed in accordance with drawing requirements. Final adjustments of travel limits and latching arrangement have not been implimented. LWA Latch pin bore and Latch Actuator mounting face are excessively corroded. Latch Bracket requires adjustment to achieve fit of Latch Pin into LWA. Coupler Alignment Tool is deformed. Locating Pin and Flat Washer are missing. Bolts securing LWA Pivot Bracket to Positioner Main Frame have not been painted. LWA Pivot Pin clearances appear to be correct and overall height dimension from main line track is in accordance with drawing requirements. Limit Switch Bracket location appears to be too close to Latch Bracket. LWA Pivot Pin splined end and Arm top bearing surface are excessively corroded. Coupler spring is missing and mechanism has seized.					The general condition of the Main Arm and LWA are fit for purpose subject to proposed recommendations.	**Positioner Arm** Manufacture and fit Pin, Washers and Pivot Caps. Grind out and re-weld Front Pedestal front plate to bottom flange weld. Apply paint repair procedure. **Last Wagon Arm** Check alignment of LWA latch pin hole with Latch Pin. Replace Coupler Alignment Tool. Alter Limit Switch Bracket to achieve correct fit. Shim LWA Latch Pin Bracket to achieve alignment of Pin with LWA. Remove Arm Head assembly from LWA, dismantle, lubricate and re-assemble. Remove LWA Pivot Pin, remove corrosion, particularly the splined end and re-assemble. Remove Arm Head assembly from LWA complete, dismantle head assembly, lubricate and re-assemble. Remove Coupler assembly from LWA Head complete, dismantle coupler assembly, lubricate and re-assemble. Complete a 20% sample torque tightness bolt check for each critical bolt group. Send 1 bolt per critical connection for mechanical and chemical analysis. Use electric wire brush to remove localised corrosion and apply paint repair procedure.	In addition to the basic recommendations, the following additional works and preplacement of components should be considered: Replace Front Pedestal. The Front Pedestal is a critical load bearing member and any site weld repair may not acheive the original design intent. Given the time that these items have stood idle it is also further recommended that the Main Arm and LWA are fully dismantled, cleaned, inspected and re-assembled to ensure proper operation. Inspection was undertaken of all bolted connections of the TUS. Accessibility to undertake a torque tightening check of all TUS primary/structural bolted connections was not possible due to limited accessibility and health and safety concerns at this stage of the process. Torque tightening checks to be undertaken during Phase 2. Refer to Recommendations.
	Review QA Data Pack (Takraf)		Refer to general QA comments included in Tippler Support Roller summary. Issues such as the clearly unacceptable condition of welding on the Main Arm Front Pedestal had not been identified in the QA Data Pack.					These documentary records are not fit for purpose in their current state.	In the absence of full documentary records, further investigation required to fully verify quality of manufacture.	

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Phase 1 Scoping Site Inspection Summary - TUS

This summary Document to be Read in Conjunction with Site Inspection Reports for TUS

Contract Number *9144-1*
Contract Name *Saldanha Bay Phase 1 Scoping*
Revision *A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Guide Rollers, Support Rollers & Long Travel Encoders	Drawings & Documents		AB Drawings Obtained in PDF format Only. * AB Original Source Drawings & BOMs used for Scoping.	49055240 49055241 49055242 49055291 ⍰		No* / Yes	45 46 47 49	Engineering - information supplied by Transnet incomplete, AB have all necessary information including 3D models, drawings and BOMs in native format.	**Basic Engineering Requirement:** None **Harmonisation Engineering:** A new series of drawing numbers to be taken out for all TUS drawings, to align complete Plant under one number series. Remove Takraf logo from all drawing borders.	Where identified thus *, AB have relied on Original Source Drawings, BOMs and supporting engineering records.
	Inspect For General Condition & Manufacture As Designed Determine Condition of Components	Guide Rollers, Support Rollers & Long Travel Encoders Installed.	**Guide Rollers** Guide Rollers have been installed but fine alignment has not been implimented. Guide Rollers are 10mm low in relation to the Reaction Bar and drawing requirements. **Sprung Support Roller** Sprung Support Roller has been installed but final adjustments have not been implimented. Springs are missing and have not been located on site. **Fixed Support Roller** Fixed Support Rollers have been installed. **Long Travel Encoder** Long Travel Encoders have been installed but alignment between Pinion and Drive Rack has not been implimented. Localised surface corrosion to brackets. Encoder Pinion is excessively corroded, bent and poorly manufactured.					The general condition of the Main Arm and LWA are fit for purpose subject to proposed recommendations. Consideration required regarding the elevation of the Guide Rollers in relation to the Positioner Track, Reaction Bars and Rack Segments. Refer to Recommendations.	**Guide Rollers** Remove Guide Rollers complete, dismantle roller assembly and re-assemble with new bearings and seals. Retain existing bearings if considered serviceable. Insert packing to correct the elevation of the Guide Rollers. **Sprung Support Roller** Remove Sprung Support Roller complete, dismantle roller assembly and re-assemble with new bearings and seals. Retain existing bearings if considered serviceable. Adjust spring tension to achieve correct load dispersal over all four Support Rollers. **Fixed Support Roller** Remove Fixed Support Roller complete, dismantle roller assembly and re-assemble with new bearings and seals. Retain existing bearings if considered serviceable. **Long Travel Encoder** Re-manufacture and fit new Encoder Guards. Use electric wire brush to remove localised corrosion and apply paint repair procedure. **Positioner Elevation** Additional packing is required between the Support Roller Brackets to elevate the Tippler by approximately 10mm.	Given the time that these items have stood idle it is recommended that each assembly is fully dismantled, cleaned, inspected and re-assembled with replacement bearings to ensure proper operation.
	Review QA Data Pack (Takraf)		Refer to comments included in Tippler Support Roller summary.					These documentary records are not fit for purpose in their current state.	No visiual observations of the equipment identified quality deficiencies or defects, in the absence of full documentary records, further investigation required to fully verify quality of manufacture.	

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Phase 1 Scoping Site Inspection Summary - TUS

This summary Document to be Read in Conjunction with Site Inspection Reports for TUS

Contract Number *9144-1*
Contract Name *Saldanha Bay Phase 1 Scoping*
Revision *A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Drive Cartridges	Drawings & Documents		AB Drawings Obtained in PDF format Only. * AB Original Source Drawings & BOMs used for Scoping.	49055243	49055243	No* / Yes	48	Engineering - information supplied by Transnet incomplete, AB have all necessary information including 3D models, drawings and BOMs in native format.	**Basic Engineering Requirement:** None **Harmonisation Engineering:** A new series of drawing numbers to be taken out for all TUS drawings, to align complete Plant under one number series. Remove Takraf logo from all drawing borders.	Where identified thus *, AB have relied on Original Source Drawings, BOMs and supporting engineering records.
	Inspect For General Condition & Manufacture As Designed Check Alignment Determine Condition of All Components Check Structural & Mechanical Bolts Torque Tightened (10%) Confirm Whether Lubrication System Installed Lubricate Bearings etc as Necessary	Drive Cartridges Installed.	Drive Cartridges have been installed but alignment between Pinion and Drive Rack has not been implemented. Drive Pinions are excessively corroded. Drive pinion top faces are largely flush with the top face of the land mounted Racks and 10mm lower than drawing requirements. Majority of the bolts securing the Drive Cartridges to the Main Frame are missing. No oil was visible in any of the sight glasses and the oil level plug was removed on two of the drives and no oil could be detected. There was no evidence of substantial oil leaks on the ground under the drives.					The equipment is generally fit for purpose but requires refurbishment and alignment. Refer to recommendations.	Remove Drive complete and return to mechanical drive supplier and motor supplier OEMs. Gearboxes and Motors to be fully re-assembled with new bearings and seals. Motors will have windings checks. Drive and and motor to be re-assembled and aligned before return to site. Drive supplier shall recommend whether to fill the Gear Reducer with oil or corrosion inhibitor depending on predicted time standing before use. Use electric wire brush to remove localised corrosion on Drive Pinions and protect with appropriate surface protection compound.	Gear Reducers were shipped to site with corrosion inhibitor to protect internal surfaces based on client (Tenova) undertaking first fill of oil within original project operational timescales.
	Review QA Data Pack (Takraf) Review of Installation Alignment Records		A complete QA Data Pack from the Drive supplier, Brevini is not available in the QA information provided to AB. Some folders are empty.					These documentary records are not fit for purpose in their current state.	No visiual observations of the equipment identified quality deficiencies or defects, in the absence of full documentary records, further investigation required to fully verify quality of manufacture.	

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Phase 1 Scoping Site Inspection Summary - TUS

This summary Document to be Read in Conjunction with
Site Inspection Reports for TUS

Contract Number *9144-1*
Contract Name *Saldanha Bay Phase 1 Scoping*
Revision *A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Positioner Cable Festoon System	Drawings & Documents		AB Drawings Obtained in PDF format Only. * AB Original Source Drawings & BOMs used for Scoping.	49055254	Yes	No* / Yes	60	Engineering - information supplied by Transnet incomplete, AB have all necessary information including 3D models, drawings and BOMs in native format.	**Basic Engineering Requirement:** None **Harmonisation Engineering:** A new series of drawing numbers to be taken out for all TUS drawings, to align complete Plant under one number series. Remove Takraf logo from all drawing borders.	Where identified thus *, AB have relied on Original Source Drawings, BOMs and supporting engineering records.
	Locate Positioner Cable Festoon Components Inspect For General Condition & Manufacture As Designed Determine Condition of All Components	Positioner Cable Festoon System Installed.	The installation of rhe Cable Festoon System structure and Cable Carriers is largely complete. Towing Link and Cable Clamps are present at site but not fitted. Ladder Cleats and associated fasteners securing end Access Ladder to the ground are missing.					The equipment is generally fit for purpose. Refer to recommendations.	Fit Towing Link and Cable Clamps. Manufacture and Fit Ladder Cleats and associated fasteners.	
	Review QA Data Pack (Takraf)		Refer to comments included in Tippler Support Roller summary.					These documentary records are not fit for purpose in their current state.	No visiual observations of the equipment identified quality deficiencies or defects, in the absence of full documentary records, further investigation required to fully verify quality of manufacture.	

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Phase 1 Scoping Site Inspection Summary - TUS

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Contract Number *9144-1*
Contract Name *Saldanha Bay Phase 1 Scoping*
Revision *A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Positioner Track	Drawings & Documents		AB Drawings Obtained in PDF format Only. * AB Original Source Drawings & BOMs used for Scoping.	49055253 49055264 49055265 49055266 49055267 49055276	Yes	No* / Yes	54 55 56 57 58 59	Engineering - information supplied by Transnet incomplete, AB have all necessary information including 3D models, drawings and BOMs in native format.	**Basic Engineering Requirement:** None **Harmonisation Engineering:** A new series of drawing numbers to be taken out for all TUS drawings, to align complete Plant under one number series. Remove Takraf logo from all drawing borders.	Where identified thus *, AB have relied on Original Source Drawings, BOMs and supporting engineering records.
	Inspect For General Condition & Manufacture As Designed Check Alignment Determine Condition of All Components Check Structural & Mechanical Bolts Torque Tightened (10%)	Positioner Track Installed & Grouted.	**General:** Preliminary indications show a potential minor mis-alignment of the Positioner Track relative to the site datums. Track has been grouted to correct grout depth.▯ Lateral mis-alignment of the Rail between multiple Modules. Tooth pitching has been checked with Rack gauge and conforms to drawing. Liner Trays are all present at site but have not been fitted. Rail Clips connecting each Module Rail to adjacent Module Frame are missing. Positioner Drive Racks are excessively corroded. **5 & 3 Rack Modules:** HSFG bolts have been installed at all locations, contrary to Ashton Bulk design specifiying 3 Fitted Bolts (item 3) at indicated locations on 5 Rack Positioner Track Module drawing. Zinc plated washers appear to have been installed instead of HSFG washers at Module Frame connections.					The equipment is generally fit for purpose but requires completion. Refer to recommendations.	Fit Liner Trays. Fit missing Rail Clips at all module joints. Use wire brush to remove corrosion on Rack teeth and apply a suitable protective coating. Replace HSFG bolts with Fitted Bolts at indicated locations on 3 Rack Positioner Track Module drawing. Zinc plated washers appear to have been installed instead of HSFG washers at all Module Frame connections. Complete a 20% sample torque tightness bolt check for each critical bolt group. Send 1 bolt per critical connection for mechanical and chemical analysis.	Inspection was undertaken of all bolted connections of the TUS. Accessibility to undertake a torque tightening check of all TUS primary/structural bolted connections was not possible due to limited accessibility and health and safety concerns at this stage of the process. Torque tightening checks to be undertaken during Phase 2. Refer to Recommendations.
	Review QA Data Pack (Takraf) Review of Installation Alignment Records		Refer to comments included in Tippler Support Roller summary.					These documentary records are not fit for purpose in their current state.	No visiual observations of the equipment identified quality deficiencies or defects, in the absence of full documentary records, further investigation required to fully verify quality of manufacture.	

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Phase 1 Scoping Site Inspection Summary - TUS

This summary Document to be Read in Conjunction with Site Inspection Reports for TUS

Contract Number	*9144-1*
Contract Name	*Saldanha Bay Phase 1 Scoping*
Revision	*A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Train Holding Devices	Drawings & Documents		AB Drawings Obtained in PDF format Only. * AB Original Source Drawings & BOMs used for Scoping.	49055255 49055256 49055257 49055297	Yes	No* / Yes	61 62 63 64	Engineering - information supplied by Transnet incomplete, AB have all necessary information including 3D models, drawings and BOMs in native format.	**Basic Engineering Requirement:** None **Harmonisation Engineering:** A new series of drawing numbers to be taken out for all TUS drawings, to align complete Plant under one number series. Remove Takraf logo from all drawing borders.	Where identified thus *, AB have relied on Original Source Drawings, BOMs and supporting engineering records.
	Locate Wheel Gripper Units & Rail Sections Inspect For General Condition & Manufacture As Designed Determine Condition of All Components	Train Holding Devices Not Installed.	The Wheel Gripper Assemblies (8) have been separated from their Base Frames (4). The Base Frames are located in their respective pits in the civil works None of the Base Frames have been aligned, levelled or grouted. 4 Wheel Gripper assemblies are located inside the Tippler building and 4 assemblies are located outside. All pins are corroded, particularly the Cylinder Pins. Unable to access Exit Gripper Unit for inspection due to heavy steel plates over gripper pit. Majority of Rail Shear Blocks are missing. All Fitted Bolts, associated nuts and dowls need replacing due to corrosion. A significant number of Wheel Gripper Rail Clamps are missing. Gripper Bar Shims are not stainless steel in accordance with Transnet specification and need replacing. Arm Stop bolts need removing and threads re-tapping. Majority of Temporary Setup Spacer not fitted and are missing. 1 Gripper Stop missing. Gripper Floor Plates missing.					The Wheel Grippers are not fit for purpose in their current condition.	Remove all Base Frames from respective pits for general refurbishment and re-painting. Fully dismantle all Gripper Assemblies, inspect all components and re-manufacture any components considered unfit for purpose. Refurbish all assemblies, reassemble, lubricate pins and re-paint. Undertake final design of Gripper Floor Plates and manufacture. Refer to Hydraulic System summary sheet regarding potential relocation of Gripper Hydraulic Power Units.	
	Review QA Data Pack (Takraf)		Refer to comments included in Tippler Support Roller summary.					These documentary records are not fit for purpose in their current state.	In the absence of full documentary records, further investigation required to fully verify quality of manufacture.	

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Phase 1 Scoping Site Inspection Summary - BOP

This summary Document to be Read in Conjunction with Site Inspection Reports for BOP

Contract Number *9144-1*
Contract Name *Saldanha Bay Phase 1 Scoping*
Revision *A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Electrical Equipment	Obtain Original Designer/Supplier Drawing & Documents		**TUS:** AB, IAC, Tiprow Drawings and BOMs are complete and of industry best practices.	As Included in SIPS	As Included in SIPS	Yes / Yes	1 - 30	The TUS drawings and documents are fit for purpose.	**TUS Basic Engineering Requirement**: Design suitable panel support steelwork in areas where the existing supporting steelwork has been proven to be insufficiently stiff/robust.	
			BOP: Tenova Drawings Obtained in PDF format Only. No Bills of Material.	As Included in SIPS	No BOMs	No / Yes	1-41	The TUS drawings and documents are not fit for purpose.	**BOP Basic Engineering Requirement**: Engineering required to complete the drawings and produce Bills of Material. Full set of site wiring drawings required.	
	Familiarisation with Design & Drawings		TUS Drawings and BOMs are those originated by AB, IAC and Tiprow. Review of BOP Drawings identified deficiencies in respect of equipment and no site wiring drawings were provided.						**Harmonisation Engineering**: Engineering would be required to separate the BOP electrical systems from building services and lighting and elevate the standard of the BOP equipment to the same level as the TUS drawing and BOM packages.	
	Determine Extent of Electrical Installation - Low Voltage Equipment & Cabling	Most Supply and Control Panels are on Site. Those Located in the Electrics Room are Mechanically Installed. Only Positioner Festoon Cables on Site. No Other Cabling Ordered.	**Low Voltage Equipment:** All the Electrical Power, Drive and Control System Panels and Control Desk have been located and are mounted on supporting steelwork in the Electrics Room and Control Room. The general installation is satisfactory although the arrangement of steel leg supports, to permit bottom entry of cabling is not sufficiently stiff and will require strengthening. This should be undertaken with the panels in-situ to avoid removal and re-installation of the panels. To date, there has been no cabling to the panels other than a single temporary low voltage power supply to the Low Voltage Distribution Board. Internal inspection of each panel has also shown their condition to be satisfactory without indication of current or historical condensation. Although the condition of the panels is acceptable, it cannot be guaranteed that certain critical elements including the variable speed drives will correctly function at time of plant start up and commissioning. On site testing is not possible but a site inspection to make further determinations is possible. Motors are addressed in conjunction with their respective Mechanical Drive assessments.					The TUS Electrical and Control System currently on site is fit for purpose *. The BOP Apron Feeder. Electrical and Control System currently on site is fit for purpose *. Given the time the Electrical and Control Equipment has been laid idle outside of controlled conditions, the fitness for purpose at time of 'power up' cannot be guaranteed.	The routing of Control System cabling between the Electrics Room and Control room require finalisation. The routing of Power and Control System cabling between the Electrics Room and the out lying plant require finalisation. Engineering and drawing of the site installation requires completion. The provision of a number of Variable Speed Drives for each major piece of equipment and back up PLC is strongly recommended.	Design, manufacture and install reinforcements for electrical panel supports. Supply a new generation 5 VFD for the Dust Extraction drive.
	Determine Extent of Electrical Installation - Medium Voltage Equipment	The Medium Voltage Variable Speed Drive and Motor are on Site	**Medium Voltage Equipment - Variable Speed Drive:** The Dust Extraction medium voltage Variable Speed Drive has been stored outside for an indeterminate period of time. Although it remained in its packing crate throughout this period, the hermetic sealing has degraded and split leaving the drive vulnerable to water ingress and the temperature fluctuations of the weather. This drive unit cannot be tested on site in advance of plant start up and commissioning and therefore other alternative testing, inspection or replacement needs to be considered. **Medium Voltage Equipment - Motor:** The large 450kW motor for the Dust Extraction plant, has been stored outside the Tippler building in its packing crate but the hermetic sealing has degraded and split, leaving the motor vulnerable to water ingress and the temperature fluctuations of the weather.					Due to long term outside storage of the VSD and Motor the equipment cannot be guaranteed fit for purpose.	VSD: It is recommended that either the existing Gen4 VSD is thoroughly inspected and refurbished or a Gen5 is purchased and associated system modifications undertaken. Motor: The Motor should be inspected and refurbished.	It has been identified that the drive is a Siemens Generation 4 unit, which Siemens no longer produce, instead making the successor Generation 5. The two generations are significantly different physically, with input and output termination points being in different locations, making a future replacement of the Gen4 with a Gen5 very difficult, requiring a quantity of engineering and thus time consuming. Together with significantly long lead times for the replacement of the drive and complexities regarding the inspection of the existing Gen4 unit, these circumstances require a strategic decision to be made at the earliest date regarding refurbishment of the existing drive or procurement of a new drive.
	Motors - General		Primary drive motors are addressed in conjunction with their respective Mechanical Drive assessments. In addition there are a large quantity of electrical motors across the plant, ranging from 0.37kW to 450kW (MV). Some of the smaller motors have been stored in a packing crate inside the Tippler building, but most of the larger motors are in their installed positions and unprotected.					To be determined.	Inspection and potential refurbishment of all motors is recommended to determine fitness for purpose.	
	Site Cabling & Materials	Racking has been Installed. No Cables have been Ordered	-					-	Undertake Engineering wwork to enable the process of ordering site wiring materials to commence and order site wiring materials.	

Phase 1 Scoping Site Inspection Summary - TUS

This summary Document to be Read in Conjunction with Site Inspection Reports for TUS

Contract Number *9144-1*
Contract Name *Saldanha Bay Phase 1 Scoping*
Revision *A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	**OEM BOM Number**	**Native Format / PDF**	**SIP Number(s)**			
Hydraulic Equipment	Drawings & Documents		AB Drawings Obtained in PDF format Only. * AB Original Source Drawings & BOMs used for Scoping.	49055251 49055257 32261.A3 59059457 32262.A3 31661.A3 EC.30173.A3 59059456 GA.30371.A3 HC.30141.A3 31985.A3 59059579 EC.30180.A3 GA.30336.A3 HC.30148.A3 59059512 59059521 59059513	49055251 49055257 32261.A3 59059457 32262.A3 31661.A3 EC.30173.A3 59059456 GA.30371.A3 HC.30141.A3 31985.A3 59059579 EC.30180.A3 GA.30336.A3 HC.30148.A3 59059512 59059521 59059513	No* / Yes	51 63 75 76 77 78 79 80 81 82 83 84 85 86 87 91 92 93	Engineering - information supplied by Transnet incomplete, AB have all necessary information including 3D models, drawings and BOMs in native format.	**Basic Engineering Requirement:** Further integration engineering necessary based on final drawings obtained from Supplier. Engineering required should Train Holding Device (Wheel Gripper) Hydraulic Power Units be relocated above ground. **Harmonisation Engineering:** A new series of drawing numbers to be taken out for all TUS drawings, to align complete Plant under one number series. Remove Takraf logo from all drawing borders.	Where identified thus *, AB have relied on Original Source Drawings, BOMs and supporting engineering records.
	Check completeness of Hydraulic Systems. Check installation status of Hydraulic Systems. Locate Hydraulic System components if not installed.	Hydraulic Equipment Not Installed.	**Positioner** Positioner Hydraulic System has not been installed and the equipment is stored at the facility of BreedtAsia in Saldanha. The Hydraulic Pipework is crated and located in the Tippler building. The Hydraulic Power Units, Cylinders and Rotary Actuator are all stored in crates, are in generally good condition and show no signs of mishandling or corrosion. Hydraulic Cylinders have been stored on their side for a prolonged period of time, it is likely the seals will have a flattened circumference and will need replacing. Cylinder ports are capped. **Train Holding Devices** Train Holding Device Hydraulic Systems (4) have not been installed and the equipment is located at the facility of Breedt Asia. The Hydraulic Pipework is crated and located in the Tippler building. The Hydraulic Power Units and Cylinders are all stored in crates, are in generally good condition and show no signs of mishandling or corrosion. Hydraulic Cylinders have been stored on their side for a prolonged period of time, it is likely the seals will have a flattened circumference and will need replacing. Cylinder ports are capped.					The Hydraulic Systems are fit for purpose subject to recommendations.	Complete an oil and filter change due to storage of the HPU for more than 2 years. Return all Hydraulic Cylinders to supplier, dismantle assembly and re-assemble with new seals and test. All Hydraulic equipment and associated Pipework to be installed.	
	Review QA Data Pack (Takraf)		No QA documents were located for the Hydraulic Systems.					No QA documents were located for the Hydraulic Systems.	No visiual observations of the equipment identified any significant quality deficiencies or defects, in the absence of full documentary records, further investigation required to fully verify quality of manufacture.	

Phase 1 Scoping Site Inspection Summary - TUS

This summary Document to be Read in Conjunction with Site Inspection Reports for TUS

Contract Number *9144-1*
Contract Name *Saldanha Bay Phase 1 Scoping*
Revision *A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Lubrication Equipment	Drawings & Documents		AB Drawings Obtained in PDF format Only. * AB Original Source Drawings & BOMs used for Scoping.	49055237 49055252 49055296	49055237 49055252 49055296	No* / Yes	36 52 53	Engineering - information supplied by Transnet incomplete, AB have all necessary information including 3D models, drawings and BOMs in native format.	**Basic Engineering Requirement:** Further integration engineering necessary based on final drawings obtained from Supplier. Engineering required should Train Holding Device (Wheel Gripper) Hydraulic Power Units be relocated above ground. **Harmonisation Engineering:** A new series of drawing numbers to be taken out for all TUS drawings, to align complete Plant under one number series. Remove Takraf logo from all drawing borders.	Where identified thus *, AB have relied on Original Source Drawings, BOMs and supporting engineering records.
	Check completeness of Lubrication Systems. Check installation status of Lubrication Systems. Locate Lubrication System components if not installed.	Lubrication Equipment Not Installed.	**Tippler** Tippler Lubrication Systems 1 and 2 have not been installed were located outside of the Tippler building in packing crates. The Lubrication Pipework is missing. Unable to locate Lubrication Pinions and Lubrication Pinion Support Frames. Lubrication Systems 1 and 2, Control Unit and Distribution Boxes are in generally good condition. **Positioner** Positioner Lubrication Systems M1 and Z1 have not been installed were located outside of the Tippler building in packing crates. The Lubrication Pipework is missing. Lubrication Support Frames are present but not fitted. Lubrication System M1 and Z1 are in good condition. End of Line Control Unit is in good condition. Lubrication Pinion has been installed with some components not fitted. Some instances of localised surface corrosion.					The Lubrication Systems are fit for purpose subject to recommendations.	**Tippler** Manufacture and fit Lubrication Pinion Support Frame. Supply and fit Lubrication Pinion. Fit all Lubrication Pumps and End of Lines Units. Supply and fit all Lubrication Pipework and Pipe Fittings. **Positioner** Supply and fit Lubrication Pinion. Fit all Lubrication Pumps and End of Lines Units. Supply and fit all Lubrication Pipework and Pipe Fittings.	
	Review QA Data Pack (Takraf)		No QA documents were located for the Lubrication Systems.					No QA documents were located for the Lubrication Systems.	No visual observations of the equipment identified any significant quality deficiencies or defects, in the absence of full documentary records, further investigation required to fully verify quality of manufacture.	

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Phase 1 Scoping Site Inspection Summary - BOP

This summary Document to be Read in Conjunction with Site Inspection Reports for BOP

Contract Number *9144-1*
Contract Name *Saldanha Bay Phase 1 Scoping*
Revision *A*

Equipment	**Task**	**Location**	**Observations**	**Drawings Provided to AB**				**Fitness for Purpose**	**Recommendations**	**Comments**
				OEM Drawing Number	**OEM BOM Number**	**Native Format / PDF**	**SIP Number(s)**			
Apron Feeder Chute 1	Obtain Original Designer/Supplier Drawing & Documents Familiarisation with Design & Drawings		Tenova Drawings Obtained in PDF format Only. No Bills of Material. Quantity, Layout, Detail and Quality of Drawings - Drawings largely complete but poorly structured and detail difficult to read. Generally suitable for production purposes but possibly led to errors causing mis-alignment.	TIPP3-DAD-001	High Level Lacking Detail	No / Yes	04	Engineering - no supporting information available - calculations etc. No 3D solid models or soft copy drawings available General drawing content and quality sub-standard and probable cause of manufacturing and installation defects. Absence of BOMs is a deficiency.	**Basic Engineering Requirement:** Engineering required to complete the drawings and produce Bills of Material. **Harmonisation Engineering**: Additional engineering would be required to elevate the standard of the BOP equipment to the same level as the TUS drawing and BOM packages.	
	Locate Apron Feeder Chute Components Inspect For General Condition & Manufacture As Designed Determine Condition of All Components	Chutes Partially Installed With Some Significant Mis-alignment	Apron Feeder Chute Details have been partly installed with some components missing. Considerable mis-alignment with Underpans (part nos. TIPP3-DAD-002 & TIPP3-DAD-003) in all locations except northern most Underpan. No Ceramic Liners (items 11 & 12) have been fitted. Removable Panels (item 6, 7, 8 & 10) are present but not fitted. All are located on the bottom level floor. Sealant has been installed in joints.					The equipment is generally fit for purpose but requires re-work and possible some new manufacture of additional spacers to achieve correct alignment.	Complete installation work including making connection with Underpans. Fit all Ceramic Liners and Removable Panels.	There does not appear to be any calculations to determine if the Chutes have been designed to handle the flow of material correctly.
	Review QA Data Pack (Takraf)		From the QA information provided to AB, it was not possible to identify any records relating to the Apron Feeder Chute manufacture or installation.						Further investigation required to verify quality of manufacture and installation.	Work still in progress when Tenova left site.

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Apron Feeder Chutes & Underpans	Obtain Original Designer/Supplier Drawing & Documents Familiarisation with Design & Drawings		Tenova Drawings Obtained in PDF format Only. No Bills of Material. Quantity, Layout, Detail and Quality of Drawings - Drawings largely complete but poorly structured and detail difficult to read. Generally suitable for production purposes but possibly led to errors causing mis-alignment.	TIPP3-DAD-002 TIPP3-DAD-003 TIPP3-DAF-001 TIPP3-DAF-002 TIPP3-DAF-003	High Level Lacking Detail	No / Yes	05	Engineering - no supporting information available - calculations etc. No 3D solid models or soft copy drawings available General drawing content and quality sub-standard and probable cause of manufacturing and installation defects. Absence of BOMs is a deficiency.	**Basic Engineering Requirement:** Engineering required to complete the drawings and produce Bills of Material. **Harmonisation Engineering**: Additional engineering would be required to elevate the standard of the BOP equipment to the same level as the TUS drawing and BOM packages.	
	Locate Apron Feeder Chute & Underpan Components Inspect For General Condition & Manufacture As Designed Determine Condition of All Components	Chutes Partially Installed With Some Significant Mis-alignment and loose/ missing fixings	Apron Feeder Chutes and Underpans have not been installed and were located outside of the Tippler building. Looking in the elevation view, the rear face of each Chute structure is designed to have a 65° inclined bolt joint connection to the Underpan structures. The Chute rear faces have been manufactured with a slight angle in the plan view, creating a mis-alignment between the Chute and Underpan joint connection. To accommodate the manufacturing error, all Underpans have been modified on site to suit and the external stiffeners have been elongated accordingly. This modification has been left un-protected and has extensive surface corrosion in all cases. Bolting of the Apron Feeder Chutes and Underpans to the supporting steelwork has been left unfinished. There are examples of incomplete shim packs, bolts missing and bolts loose. According to the previous mechanical contractor, a steel mesh should have been fitted onto the Apron Feeder support steelwork lugs directly under the Apron Feeders. Reference to this could not be found on drawings supplied by Transnet and items could not be located on site. Due to access limitations only a visual survey could be carried out.					The equipment is generally fit for purpose but requires some re-work and completion to achieve correct alignment.	Clean back corroded areas with electric wire brush and apply paint repair procedure. Design and supply missing items. Complete the installation of all components. Fit liner plates.	There does not appear to be any calculations to determine if the Chutes have been designed to handle the flow of material correctly.
	Review QA Data Pack (Takraf)		From the QA information provided to AB, it was not possible to identify any records relating to the Apron Feeder Chutes & Underpans manufacture or installation.						Further investigation required to verify quality of manufacture and installation.	Work still in progress when Tenova left site.

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				OEM Drawing Number	**OEM BOM Number**	**Native Format / PDF**	**SIP Number(s)**			
Steel Hoppers	Obtain Original Designer/Supplier Drawing & Documents Familiarisation with Design & Drawings		Tenova Drawings Obtained in PDF format Only. No Bills of Material. Quantity, Layout, Detail and Quality of Drawings - Drawings largely complete but poorly structured and detail difficult to read. Generally suitable for production purposes but possibly led to errors causing mis-alignment of Apron Feeder Chutes with Underpans.	TIPP3-DEA-001 TIPP3-DEA-002 TIPP3-DEA-003	High Level Lacking Detail	No / Yes	07 08 09	Engineering - no supporting information available - calculations etc. No 3D solid models or soft copy drawings available General drawing content and quality sub-standard. Absence of BOMs is a deficiency.	**Basic Engineering Requirement:** Engineering required to complete the drawings and produce Bills of Material. **Harmonisation Engineering**: Additional engineering would be required to elevate the standard of the BOP equipment to the same level as the TUS drawing and BOM packages.	
	Locate Steel Hopper Components Inspect For General Condition & Manufacture As Designed Determine Condition of All Components	All Hoppers installed. Maintenance Doors stored on vault floor.	Steel Hopper Details have been installed with some components missing. Maintenance Doors are stored on site, but are missing some of the pins and washers that hold them in place. Access could not be gained for a close inspection of Hoppers, but they appear to conform visually to the drawing supplied. Ceramic Liners (item 2) have not been manufactured.					The equipment is generally fit for purpose but requires some manufacture and installation work to complete.	Manufacture and install Ceramic Liners. Manufacture missing Maintenance Door components. Install Maintenance Doors.	
	Review QA Data Pack (Takraf)		From the QA information provided to AB, it was not possible to identify any records relating to the Steel Hoppers manufacture or installation.						Further investigation required to verify quality of manufacture and installation.	Work still in progress when Tenova left site.

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				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Isolation Gates	Obtain Original Designer/Supplier Drawing & Documents Familiarisation with Design & Drawings		Tenova Drawings Obtained in PDF format Only. No Bills of Material. Quantity, Layout, Detail and Quality of Drawings - Drawings largely complete but poorly structured and detail difficult to read. Generally suitable for production purposes but possibly led to errors causing mis-alignment.	TIPP3-MKG-001 TIPP3-MKG-002 TIPP3-MKG-003 TIPP3-MKG-004 TIPP3-MKG-005	Partially illegiable	No / Yes	16 16a 16b 16c 16d	Engineering - no supporting information available - calculations etc. No 3D solid models or soft copy drawings available General drawing content and quality sub-standard. Absence of BOMs is a deficiency.	**Basic Engineering Requirement:** Engineering required to complete the drawings and produce Bills of Material. **Harmonisation Engineering**: Additional engineering would be required to elevate the standard of the BOP equipment to the same level as the TUS drawing and BOM packages.	
	Locate Isolation Gates Inspect For General Condition & Manufacture As Designed Determine Condition of All Components	Knife Gates not nstalled or Assembled. Located in the Tippler building.	None of the Isolation Gate components have been installed. Only two hydraulic actuators have been supplied. Details and BOM on the drawing are illegible, meaning smaller parts have not been identified. Only one Knife Cartridge Assembly (item 2) has been located. Only one Gate Knife Assembly (item 4) has been located. All the smaller items such as pins, shown on the drawing views, have not been located. Unable to cross reference or identify components on the BOM as it is illegible. A packing crate, located in the Tippler building, contains small components of the Isolation Gates but due to the lack of drawings and illegible BOMs these items cannot be fully identified. The manufacture of the Knife Gates is significantly incomplete and dimensionally incorrect. Takraf's calculations for the force required to operate the Isolation Gate in a hopper full of material do not consider all the forces resisting the Gate's operation, or equate these forces to the capacity of the hydraulic actuators. Further calculation are required to confirm if the Isolation Gate will operate in a full hopper. The GA drg TIPP3-DAA-001 shows if all Isolation Gates are in operation, each complete with a Knife Cartridge and a Gate Knife, they would clash with the adjacent Gate. The aperture through the middle of the Gate Frame has rubber lips to create a seal when the Blade is retracted. These rubber lips are in the path of material flow and would be ripped off by the flowing material very quickly.					The Knife Gates are not fit for purpose as supplied and insufficient claculations have been undertaken to determine the functionality of the Gates..	**Point 1:** It was discussed whether the Knife Gates were the appropriate solution for the application. A final decsion on this point was not reached. **Point 2:** If the Knife Gates are to be retained calculations to prove/disprove the suitability of the currently designed Gates is required. If found to be adequate and fit for purpose, a significant amount of completion and correction work will be required involving removal of the Gates from site to a manufacturing facility. If found to be inadequate, Point 1 will require further consideration. In either case additional engineering will be required.	This is an item of high criticality in respect of project timescales in the event either Point 1 or Point 2 is adopted..
	Review QA Data Pack (Takraf)		From the QA information provided to AB, it was not possible to identify any records relating to the Knife Gates manufacture or installation.						Further investigation required to verify quality of manufacture and installation.	Work still in progress when Tenova left site.

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				OEM Drawing Number	**OEM BOM Number**	**Native Format / PDF**	**SIP Number(s)**			
Apron Feeder Lifting Frame	Obtain Original Designer/Supplier Drawing & Documents Familiarisation with Design & Drawings		Tenova Drawings Obtained in PDF format Only. No Bills of Material. Quantity, Layout, Detail and Quality of Drawings - Drawings largely complete but poorly structured and detail difficult to read. Generally suitable for production purposes.	TIPP3-CAA-003	None	No / Yes	19	Engineering - no supporting information available - calculations etc. No 3D solid models or soft copy drawings available General drawing content and quality sub-standard. Absence of BOMs is a deficiency.	**Basic Engineering Requirement:** Engineering required to complete the drawings and produce Bills of Material. **Harmonisation Engineering**: Additional engineering would be required to elevate the standard of the BOP equipment to the same level as the TUS drawing and BOM packages.	
	Locate Apron Feeder Lifting Frame Components Inspect For General Condition & Manufacture As Designed Determine Condition of All Components	No Items Located on Site	Apron Feeder Spreader Lifting Frame cannot be located for inspection. None of the rigging equipment and beam trolleys have been located on site.					Although not located at site, from a review of the manufacturing drawing, there are concerns about the lifting arrangement and the loads it imposes on the Crawl Beams. With no supporting engineering or calculations, the arrangement will require engineering from scratch and an alternative proposal or modifications made.	Conduct engineering exercise and produce calculations into suitability of lifting arrangement and manufacture and supply any required components.	
	Review QA Data Pack (Takraf)		From the QA information provided to AB, it was not possible to identify any records relating to the Apron Feeder Lifting Frame manufacture or installation.						Further investigation required to verify quality of manufacture and installation.	Work still in progress when Tenova left site.

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				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Apron Feeder General Arrangement 5 Units	Obtain Original Designer/Supplier Drawing & Documents Familiarisation with Design & Drawings		Tenova Drawings Obtained in PDF format Only. Bills of Material is conclusive but doesn't have item numbers. Quantity, Layout, Detail and Quality of Drawings - Only assembly drawing supplied, no parts drawings available. Assembly drawing is reasonably clear.	EB0009-B100-EAK-001	EB0009-B100-EAK-001	No / Yes	26	Engineering - no supporting information available - calculations etc. No 3D solid models or soft copy drawings available.	**Basic Engineering Requirement:** Engineering required to complete the detail drawings. **Harmonisation Engineering**: Additional engineering would be required to elevate the standard of the BOP equipment to the same level as the TUS drawing and BOM packages.	
	Locate: Apron Feeder Chutes Apron Feeder Gate Apron Feeder Operating Mechanism Inspect For General Condition & Manufacture As Designed Determine Condition of All Components	Fully Assembled Units Currently in Storage	Apron Feeders have been largely assembled but not installed and are located at the works of Breedt Asia. Apron Feeder Drive (item 28) has not been fitted. Components connecting to the Apron Feeder Drive (items 5, 7, 8 & 21) are missing. Idler support channels are unstiffened, suggesting they are not adequately designed to withstand the full impact of falling material from the Apron Feeder Chute. Drive end of Head and Tail Drive shafts have some scoring. Lubrication fittings used are predominantly light weight pneumatic fittings and not the duty required for the project. Speed Monitor Bracket (item 12) and Speed Switch (item 20) are missing. Covers have not been designed to protect the Tail Take-up Hand Pump (item 24) from dust and material during machine operation. It was not possible to determine whether the Drive Gear Reducers had been filled with oil due to limited accessibility.					The equipment is generally fit for purpose, but requires some re-work, principally refurbishment of the mechanical drives and motors. Refer to recommendations.	Clean up end of Head and Tail Drive Shafts. Dismantle bearing housing, assess condition and refurbish as necessary. Remove the Drive and Motors complete and return to mechanical drive supplier and motor supplier OEMs. Gearboxes and Motors to be fully re-assembled with new bearings and seals. Motors will have windings checks. Drive supplier shall recommend whether to fill the Gear Reducer with oil or corrosion inhibitor depending on predicted time standing before use.	No calculations to determine if the Apron Feeders have been designed to handle the flow of material correctly.
	Review QA Data Pack (Takraf)		The QA information provided to AB, contains much of the information that would be expected to be found in a QA pack such as - QCP, material certificates, weld procedures, welder qualifications, NDT procedures, NDT results, paint data, concessions and inspection and FAT reports. Non-conformance reports are present in the QA pack but can't be opened.						Conduct thorough review of supplied QA data to identify ommissions.	

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				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Apron Feeder Guards	Obtain Original Designer/Supplier Drawing & Documents Familiarisation with Design & Drawings		Tenova Drawings Obtained in PDF format Only. Bills of Material is conclusive but doesn't have item numbers and is illegiable. Quantity, Layout, Detail and Quality of Drawings - Only assembly drawing supplied, no parts drawings available. Assembly drawing is reasonably clear.	EB0009-B100-DHA-001	EB0009-B100-DHA-001	No / Yes	27	Engineering - no supporting information available - calculations etc. No 3D solid models or soft copy drawings available General drawing content and quality sub-standard. BOM does not use item numbers and is generally illegiable.	**Basic Engineering Requirement:** Engineering required to complete the drawings and produce Bills of Material. **Harmonisation Engineering**: Additional engineering would be required to elevate the standard of the BOP equipment to the same level as the TUS drawing and BOM packages.	
	Locate Apron Feeder Guard Components Inspect For General Condition & Manufacture As Designed Determine Condition of All Components	Fully Assembled Units Currently in Storage	Apron Feeder Safety Guards (GA) have not been installed. Guard Posts (items 1-9) are present but not fitted. Individual Guards (items 11-20) could not be identified from the BOM as it is illegible, total quantity identifiable from the drawing are present but not fitted. All fasteners are missing.					The equipment is generally fit for purpose.	Supply missing fasteners and install Guards.	
	Review QA Data Pack (Takraf)		From the QA information provided to AB, it was not possible to identify any records relating to the Apron Feeder Guards manufacture.							Given the Guards low classification of structural requirements, it is likely that only rudimentary QA documentation was planned for these items, such as dimensional and protective coating checks.

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				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Apron Feeder Support Steel Details	Obtain Original Designer/Supplier Drawing & Documents Familiarisation with Design & Drawings		Tenova Drawings Obtained in PDF format Only. No Bills of Material. Quantity, Layout, Detail and Quality of Drawings - Drawings largely complete but poorly structured and detail difficult to read. Essentially an Design Set Out drawing lacking detail required for production.	TIPP3-CBA-001 TIPP3-CBA-003	High Level Lacking Detail	No / Yes	28 29	Engineering - no supporting information available - calculations etc. No 3D solid models or soft copy drawings available General drawing content and quality sub-standard. Absence of BOMs is a deficiency.	**Basic Engineering Requirement:** Engineering required to complete the drawings and produce Bills of Material. **Harmonisation Engineering**: Additional engineering would be required to elevate the standard of the BOP equipment to the same level as the TUS drawing and BOM packages.	
	Locate: Apron Feed Support Structure Apron Feed Support Structure Walkways Inspect For General Condition & Manufacture As Designed Determine Condition of All Components	Fully Installed	Apron Feeder Support Steelwork has been installed. Close inspection of the higher levels of Support Steelwork was limited and could only be inspected from access platform level. Handrailing added at row 11, sitting perpendicular against the western wall, appears to have a site modification. Majority of fasteners have paint witness marks to indicate bolts have been torque tightened. Apron Feeder drive Torque Reaction Arm anchor bracket is missing at all locations. Some minor localised surface corrosion.					The equipment is generally fit for purpose but requires some new manufacture and installtion of minor components.	Clean off any corrosion with electric wire brush and apply paint repair procedure. Carry out random 20% torque tightness checks. Remove 5 bolts from around the structure for mechanical and chemical analysis. Replace removed bolts with new and torque tighten. Manufacture and install Apron Feeder Drive Torque Reaction Arm Brackets.	
	Review QA Data Pack (Takraf)		From the QA information provided to AB, it was not possible to identify any records relating to the Support Steel manufacture. The QA information relating to installation contains a number of documents including sign offs by the contractor, Tenova and Transnet. There are sign-offs missing in places.						Further investigation required to make a full appraisal of the QA documents	

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				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Crawl Beams	Obtain Original Designer/Supplier Drawing & Documents Familiarisation with Design & Drawings		Tenova Drawings Obtained in PDF format Only. No Bills of Material. Quantity, Layout, Detail and Quality of Drawings - Drawings largely complete but poorly structured and detail difficult to read. Essentially an Design Set Out drawing lacking detail required for production.	TIPP3-CBA-002	None	No / Yes	30	Engineering - no supporting information available - calculations etc. No 3D solid models or soft copy drawings available General drawing content and quality sub-standard. Absence of BOMs is a deficiency.	**Basic Engineering Requirement:** Engineering required to complete the drawings and produce Bills of Material. **Harmonisation Engineering**: Additional engineering would be required to elevate the standard of the BOP equipment to the same level as the TUS drawing and BOM packages.	
	Locate Crawl Beam Components Inspect For General Condition & Manufacture As Designed Determine Condition of All Components	Fully Installed	Under Vault Crawl Beams have been installed. Due to restricted access, only a visual inspection could be made. No measurement checks could be taken. Installation appears complete, with supports grouted to the concrete hopper structure. '5000 KG' has been paint stenciled onto the 5 ton capacity CB1 & CB3 crawl beams. However, the Takraf mechanical erection contractor indicated that the beams have not been load tested. Beams CB1 & CB3 do not form a continuous runway, as would be necessary to transport the Apron Feeder Drives to the acess shaft for craning up to ground level. None of the fixings visible have paint marks on them to indicate torque tighening has been carried out.					AB believe that the 5000 KG load capacity of CB1 & CB3 is insufficient to lift and traverse the Apron Feeders in the arrangement shown on drg TIPP3-CAA-003, despite the load being carried on two beam trolleys.	Carry out an engineering exercise including calculations to check the capacity of the crawl beams arrangement is sufficient for its intended use. If insufficincies in design are found, design, manufacture, install and load test required modifications.	
	Review QA Data Pack (Takraf)		From the QA information provided to AB, it was not possible to identify any records relating to the Crawl Beams manufacture. The QA information relating to installation contains a number of documents including sign offs by the contractor, Tenova and Transnet. There are sign-offs missing in places.						Further investigation required to make a full appraisal of the QA documents	

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				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Tippler Dust Cowl & Access	Obtain Original Designer/Supplier Drawing & Documents Familiarisation with Design & Drawings		Tenova Drawings Obtained in PDF format Only. No Bills of Material. Quantity, Layout, Detail and Quality of Drawings - Drawings largely complete but poorly structured and detail difficult to read. Generally suitable for production purposes but has led to errors in manufacture.	TIPP3-DJB-002	None	No / Yes	35	Engineering - no supporting information available - calculations etc. No 3D solid models or soft copy drawings available General drawing content and quality sub-standard and probable cause of manufacturing and installation defects. Absence of BOMs is a deficiency.	**Basic Engineering Requirement:** Engineering required to complete the drawings and produce Bills of Material. **Harmonisation Engineering**: Additional engineering would be required to elevate the standard of the BOP equipment to the same level as the TUS drawing and BOM packages.	
	Locate Dust Cowl Components Inspect For General Condition & Manufacture As Designed Determine Condition of All Components	Cowl on Site Installed. Access Components on Site - Not Installed.	The Dust Cowl has been left in a partially assembled and installed state, with a number of panels ill-fitting and a significant number of fasteners missing. Despite the above comment, the Dust Cowl has been fully grouted to the floor, both at the columns and where the bottom panels reach the floor. This grouting is considered to have been installed prematurely, without final assembly and alignment of the Dust Cowl being achieved. Sample overall and plate thickness dimensional checks have found the distances between the column rows vary from drawing values by +/-15mm. The majority of the Dust Cowl access has not been assembled or installed. Final fit between the Dust Cowl and Tippler End Rings has not been achieved and weld repairs may be necessary to achieve the correct clearance. The Takraf drawings do not show any rubber lip seal between the Dust Cowl and Tippler End Rings. The design will need modifying to include a sealing arrangement similar to Tippler 2.					The equipment is generally fit for purpose but requires re-work and some new manufacture of panel members components.	Complete installation process, achieving fit up of all panels and components. Complete installation of Dust Cowl access. Adjust seal ring at Dust Cowl ends, possibly by cutting and welding, to achieve consistent gap with Tippler End Rings. Engineer and install a rubber lip seal between Dust Cowl and End Rings	The condition of the Dust Cowl and extent of re-work required does not warrant consideration of complete replacement of the Cowl. Dust Cowl will require removal for Tippler Lift process.
	Review QA Data Pack (Takraf)		From the QA information provided to AB, it was not possible to identify any records relating to the Dust Cowl manufacture. The QA information relating to installation states that the Dust Cowl has been aligned and plummed within the given requirements of the drawings and specification.						Further investigation required to verify quality of manufacture and installation.	

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				Drawings Provided to AB						
Equipment	**Task**	**Location**	**Observations**	**OEM Drawing Number**	**OEM BOM Number**	**Native Format / PDF**	**SIP Number(s)**	**Fitness for Purpose**	**Recommendations**	**Comments**
Tippler Removal Access Platforms	Obtain Original Designer/Supplier Drawing & Documents Familiarisation with Design & Drawings	West Platforms Partially Installed. East Platforms Not Installed.	Tenova Drawings Obtained in PDF format Only. No Bills of Material. Quantity, Layout, Detail and Quality of Drawings - Drawings largely complete but poorly structured and detail difficult to read. Generally suitable for production purposes.	TIPP3-DJB-001	None	No / Yes	34	Engineering - no supporting information available - calculations etc. No 3D solid models or soft copy drawings available General drawing content and quality sub-standard and probable cause of manufacturing ommissions. Absence of BOMs is a deficiency.	**Basic Engineering Requirement:** Engineering required to complete the drawings and produce Bills of Material. **Harmonisation Engineering**: Additional engineering would be required to elevate the standard of the BOP equipment to the same level as the TUS drawing and BOM packages.	
	Locate Access Platform Components Inspect For General Condition & Manufacture As Designed Determine Condition of All Components		Although this drawing is titled "General Arrangement Dust Cowl and Deflector Wall/Barrier", it shows some of the detail and installation arrangements for the removable platforms; intended to allow the Tippler Support Rollers to be lifted out. Both the removable platforms on the western side have not been installed. None of the handrailing shown on the drawing is installed. Some sections could not be located. The removable platform at the North-East corner (detail 4 on the drawing) will need to be modified to provide clearance for the Tippler Rotational Switches.⍰ Fairly extensive surface corrosion. The End Connectors that weld to the cast-in plates (detail 6 on drg) could not be located for the two western assemblies. The design of the removable platforms does not permit easy removal and installation. The floor panels are supported at each location by a permanently installed "picture-frame" of steel work, with a removable cruciform of beams in the middle, bolted in place and the floor panels laid on top. These removable beams are sandwiched between the outer picture-frame which will make them very difficult to remove/install. As removable platforms are encircled by handrailing, it is assumed they can only be used for pedestrian access. For ease-of-use AB would suggest these beams be modified to drop easily into sockets on the picture-frame and rest in place under their own weight.					The equipment is generally fit for purpose but requires some re-work and some new manufacture of minor components.	Engineer and manufacture modification to North-East floor hatch to provide clearance for Tippler Rotational Switches. Manufacture and Install remaining components. Complete installation.	The access platforms in their current form are largely complete with just some small minor components missing and a small modification required to accommodate the Tippler rotational limit switches. The extent of re-work required does not warrant complete replacement. As mentioned under observations, the overall design of the Platforms does not make for easy removal and a complete new design could be produced if Transnet so desired.
	Review QA Data Pack (Takraf)		From the QA information provided to AB, it was not possible to identify any records relating to the Access Platforms manufacture.						Further investigation required to verify quality of manufacture and installation.	Not a plant critical item, so level of QA documentation likely lesser than load bearing and critical structures.

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Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Structural Arrangement Deflector Wall / Barrier Support Steelwork Details	Obtain Original Designer/Supplier Drawing & Documents Familiarisation with Design & Drawings		Tenova Drawings Obtained in PDF format Only. No Bills of Material. Quantity, Layout, Detail and Quality of Drawings - Only drawing supplied provides a combination of site installation and fabrication details, but insufficient detail to be conclusive in either regard.	TIPP3-DJB-003	None	No / Yes	36	Engineering - no supporting information available - calculations etc. No 3D solid models or soft copy drawings available General drawing content and quality sub-standard. Absence of BOMs is a deficiency.	**Basic Engineering Requirement:** Engineering required to complete the drawings and produce Bills of Material. **Harmonisation Engineering**: Additional engineering would be required to elevate the standard of the BOP equipment to the same level as the TUS drawing and BOM packages.	
	Locate Deflector Wall Components Inspect For General Condition & Manufacture As Designed Determine Condition of All Components Deflector Wall Components include: - Tip Side Impact Wall - Non-Tip Side Steel Hopper Wall - Entry and Exit End Dust Shrouds	Structures are Installed. Ground Mounted Structures not Grouted.	It was confirmed that Takraf only designed the Impact Wall for material deflection and failed to consider that the material flow would be directed over the Tippler Side Beam and would fully impact the Wall. Support Roller Dust Shrouds are grossly inadequate to contain tippled material and protect the Support Roller from material flow and dust. Non-Tip Side Steel Hopper Wall has a very small clearance with the Wagon Clamp Counterweights when the Tippler is at zero degree rotation position. There is no room for Tippler return over-run.					The Deflector Wall is not fit for purpose in its present form and wall require strengthening or partial replacement. The upper Dust Shrouds are not fit for purpose and require replacement. The Non-Tip Side Steel Hopper Wall is generally fit for purpose but requires modification to clear Tippler Clamp Gear.	Design, manufacture and install suitable reinforcements to the Deflector wall. This will require modification and replacement of the original components. Design, manufacture and install replacement Support Roller Dust Shrouds. Re-design the Non-Tip Side Steel Hopper Wall and undertake modifications.	
	Review QA Data Pack (Takraf)		From the QA information provided to AB, it was not possible to identify any records relating to the Deflector Wall and Dust Shroud manufacture.						Further investigation required to verify quality of manufacture and installation.	

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Phase 1 Scoping Site Inspection Summary - BOP

This summary Document to be Read in Conjunction with Site Inspection Reports for BOP

Contract Number *9144-1*
Contract Name *Saldanha Bay Phase 1 Scoping*
Revision *A*

Equipment	Task	Location	Observations	Drawings Provided to AB				Fitness for Purpose	Recommendations	Comments
				OEM Drawing Number	OEM BOM Number	Native Format / PDF	SIP Number(s)			
Dust Extraction System	Obtain Original Designer/Supplier Drawing & Documents Familiarisation with Design & Drawings		Tenova Drawings Obtained in PDF format Only. No Bills of Material. Quantity, Layout, Detail and Quality of Drawings - Small quantity of drawings supplied provide a combination of process, fabrication and site installation details, but insufficient detail to be conclusive in any regard.	B100-WBA-001 B100-CAA-001 TIPP3-WBA-001 TIPP3-WBA-002 B100-JKA-001 B100-PID-001_007 B100-CAA-017	None	No / Yes	41	Engineering - no supporting information available - calculations etc. No 3D solid models or soft copy drawings available General drawing content and quality sub-standard. Absence of BOMs is a deficiency.	**Basic Engineering Requirement:** Engineering required to complete the drawings and produce Bills of Material. **Harmonisation Engineering**: Additional engineering would be required to elevate the standard of the BOP equipment to the same level as the TUS drawing and BOM packages.	
	Locate Dust Extraction Sytem Components Inspect For General Condition & Manufacture As Designed Determine Condition of All Components	Partially installed. Many items still to install and some require manufacturing.	Dust Extraction System has been partly installed. Vibration Detection Sensor, Silo Level Transmitter and Electrical and Lighting Accessories are missing. Bag House and Dust Silo have been installed outside. Ducting Support Structures for external Ducting have been located but not installed. Ducting support columns installed within the Tippler building are skewed and have been grouted. Columns will have to be dismantled to allow for the Tippler removal and re-alignment. Ducting sections are scattered throughout the site and need to be consolidated. Wire Cages for Bag Filters are present. 1240 off are located at the works of Breedt Asia. 100 off spare Wire Cages are located on site. Filter Bags are present and located on site. Handrailing and Access installed on the steel support frames outside are excessively corroded. For further details of the condition and location of Dust Extraction System components refer to Air-Enviro Tech report - AED030 - Audit Report - Transnet Saldanha T3. Openings in concrete floor slab at ground level and Tippler Support Roller level which Dust Extraction ductings pass through, have been cast in situ with the wrong offset and new ductings will be required to accommodate this error.					The equipment is generally fit for purpose but requires some re-work and some new manufacture of minor components. The equipment requires a full consolidation process so tha the suplly and installation process can be planned and properly implemented.	Complete Installation of Dust Extraction System. Mechanical sub-assemblies listed in Air-Enviro Tech report to be returned to OEMs for refurbishment. Design, fabricate, supply and install ducting modification to suit error in floor slab. Supply and install Vibration Detection Sensor, Silo Level Transmitter and Electrical and Lighting Accessories. Handrailing to be removed, use electric wire brush to remove corrosion, apply paint repair procedure and re-assemble.	AB have engaged the services of the original plant designer to assist with completing the Tippler 3 Dust Extraction System, and are assured of their full support in completing outstanding engineering, manufacture, refurbishment where necessary and commissioning. It cannot be considered economical or at all feasible to adjust the concrete slab to fix the as-cast error in the slab cut-out which routes the ducting. Designing and supplying the relatively small quantity of ducting sections will be bar far the most cost effective solution.
	Review QA Data Pack (Takraf)		The QA information provided to AB, contains some of the documentation that would be expected for a system such as this. It cannot however be considered to be complete. The installation package is fairly comprehensive.						Further investigation required to make a full appraisal of the QA documents	

Appendix I

Design Engineering & Equipment Intellectual Property Status & Availability

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Saldanha Tippler 3 - Design Engineering & Equipment Intellectual Property Status & Availability

Train Unloading System *	Designer	Project Supplier	Project Input	Current IP Status	Future IP Transfer Status
Train Unloading System - Plant, Mechanical & Structural	Ashton Bulk	(TZME - No IP Implications)	Train Unloading System Engineer & Designer	Retained by Designer	Potential for Designer IP Transfer & Licensing by Agreement
Train Unloading System - Electrical Drives & Control System	IAC / Tiprow	IAC / Tiprow	Electrical & Control System Designer, Supplier & Integrator	Retained by Designer / Supplier	Potential for Designer / Supplier IP Transfer & Licensing by Agreement
Train Unloading System - Electrical Drives & Control System Primary Components	Siemens	IAC / Tiprow	Drive and Control System Component Manufacturer	Retained by Designer / Supplier	No Potential for IP Transfer
Train Unloading System - Hydraulic Systems	Advanced Actuators	Advanced Actuators	Hydraulic System Supplier & Integrator	Retained by Designer / Supplier	Potential for Designer / Supplier IP Transfer & Licensing by Agreement
Train Unloading System - Hydraulic System Primary Components	Kawasaki / Hansa TMP	Advanced Actuators	Hydraulic Component Manufacturer	Retained by Designer / Supplier	No Potential for IP Transfer
Train Unloading System - Lubrication System Primary Components	Bijur Delimon	Bijur Delimon	Lubrication System Designer & Component Manufacturer	Retained by Designer / Supplier	No Potential for IP Transfer
Train Unloading System - Mechanical Drives	Dana Brevini	Dana Brevini	Mechanical Drive Designer & Manufacturer	Retained by Designer / Supplier	No Potential for IP Transfer

Balance of Plant **	Designer	Project Supplier	Project Input	Current IP Status	Future IP Transfer Status
Balance of Plant - Plant Mechanical & Structural	Tenova	Various	Balance of Plant Engineer & Designer	As Provided by Tenova	As Provided by Tenova
Balance of Plant - Electrical Drives & Control System	Tenova	IAC / Tiprow	Electrical & Control System Designer, Supplier & Integrator	As Provided by Tenova	As Provided by Tenova
Balance of Plant - Electrical Drives & Control System Primary Components	Siemens	IAC / Tiprow	Drive and Control System Component Manufacturer	Retained by Designer / Supplier	No Potential for IP Transfer
Balance of Plant - Hydraulic Systems	Oiltech	Oiltech	Hydraulic System Supplier & Integrator	Retained by Designer / Supplier	No Potential for IP Transfer
Balance of Plant - Hydraulic System Primary Components	Unknown	Oiltech	Hydraulic Component Manufacturer	Retained by Designer / Supplier	No Potential for IP Transfer
Balance of Plant - Lubrication Systems	Control Lubrication Systems	Control Lubrication Systems	Lubrication System Designer & Component Manufacturer	As Provided by Tenova	As Provided by Tenova
Balance of Plant - Mechanical Drives	Dana Brevini	Dana Brevini	Mechanical Drive Designer & Manufacturer	Retained by Designer / Supplier	No Potential for IP Transfer
Balabce of Plant - Dust Extraction System	Air Envirotech	Air Envirotech	Dust Extraction System Designer & Component Manufacturer / Supplier	Retained by Designer / Supplier	No Potential for IP Transfer
Balance of Plant - Apron Feeders	Tenova	Tenova	Apron Feeder Designer & Supplier	As Provided by Tenova	As Provided by Tenova
Balance of Plant - Knife Gates	Tenova	Tenova	Knife Gate Designer & Supplier	As Provided by Tenova	As Provided by Tenova
Balance of Plant - Hopper Liners	Quality Engineering	Quality Engineering	Hopper Liner Designer & Supplier	Retained by Designer / Supplier	No Potential for IP Transfer

* Purchase Orders Issued by Takraf GmbH

** Purchase Orders Issued by Tenova

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Saldanha Bay – Tippler 3
Phase 1 Scoping Inspection Report

TRAIN UNLOADING SYSTEM

Unit-Train Tippler, Train Positioner, Wheel Grippers, Hopper, Knife Gates, Apron Feeders, Chutes & Dust Extraction Plant

9144-1_D100_Revision C

REVISION RECORD:					
Revision	**Description**	**Author**	**Checked**	**Approved**	**Date**
A	First Issue. Signed by:	RGF R. Fryer	EMD	JMD	May 2022
B	Clause 11 Added. Clause 8.2 Expanded. Signed by:	RGF R. Fryer	EMD	JMD	20 May 2022
C	Final Version Section 10 – Revised. Appendices h and I added. Client Comments on Approved Version Incorporated.	RGF R. Fryer	EMD	JMD	23 July 2022

ASHTON BULK COPYRIGHT STATEMENT

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49055208	Tippler Cage
49055207	Assembly of Tippler Rotating Structures
49055232	Assembly of Support Rollers
49055245	Assembly of Train Positioner
49055255	Assembly of Train Holding Devices
TIPP3-DJB-001	General Arrangement of Dust Cowl and Deflector Wall/Barrier
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1. INTRODUCTION

1.1 Project Overview

Transnet in South Africa are a State-Owned-Entity (SOE), providing transport, stockpiling and off-loading services for mine operators across the country, handling a variety of commodities.

As part of Transnet's ongoing expansion and replacement of ageing equipment, they have purchased a new Train Unloading System to be installed at their Saldanha Bay site on the Western Cape. It is universally referred to as Tippler 3 or T3.

The system comprises a completely new installation with underground foundations and building housing the following equipment:

- Rotary Wagon Tippler
- Train Positioner
- Wheel Grippers
- Hoppers and Chutes
- Knife Gates
- Apron Feeders
- Dust Extraction Plant
- Electrical Power and Control System

For the purposes of this project, the Tippler, Positioner, Wheel Grippers and associated power and control systems are referred to as the Train Unloading System (TUS). The remaining equipment is referred to as Balance of Plant (BOP).

1.2 Project History

The original contract for design, supply, installation and commissioning of the mechanical, hydraulic and electrical systems was placed with Tenova Takraf Africa (TAFR). This contract was terminated in 2020, at which time the site installation was in progress, and TAFR have no further involvement with the project.

Ashton Bulk (AB) are the designers of the TUS, and provided their design under license to Takraf Germany (TGER) who in conjunction with TAFR manufactured and supplied the equipment. AB were not involved in the partial installation process.

The BOP was not designed by AB and was designed, manufactured and supplied jointly by TAFR and TGER.

AB were contacted in late June 2021 by Transnet, with a view to being engaged to complete the outstanding works to make the plant operational.

In order to facilitate this, AB proposed a two-Phase approach whereby Phase 1 would cover AB engineers determining the condition and state of installation of the equipment, termed Scoping, and Phase 2 would be to carry out the remaining installation and commissioning work in full. The content of this report pertains to Phase 1 Scoping.

1.3 Extent of Scoping & Project Status at Time of Completion of Phase 1

Phase 1 was intended to cover scoping of the TUS and BOP as installed until the time of contract termination including:

- Identification of all installed equipment.
- Identification and ascertain location of all un-installed equipment.
- Evaluation of condition of all equipment.
- Recommendations for setting the equipment to work in accordance with the original contract specification and intent.
- Evaluation of the Tippler alignment.
- Report on the extent and condition of drawings and document provided to Transnet by TAFR.
- Report on the extent and condition of the quality assurance documents and packs provided to Transnet by TAFR.
- Evaluate the possibility and any associated cost of re-introduction of lapsed warranties or consider arrangements for alternative risk protection.
- Estimate the time and cost of completing the installation process.

This process was undertaken on the premise that all design instructions had been followed.

During the Phase 1 inspections it became apparent that the work required to complete the installation process was not simply a matter of picking up the project from where TAFR left off. There are significant additional works required due to:

- Mechanical, hydraulic, lubrication and electrical equipment unprepared for long term storage being left in unsuitable conditions, many components having been left in an unprotected outside environment.
- Moving mechanical equipment, hydraulic and lubrication equipment that has been left in a stationary condition for long periods and requires dismantling, specialist assessment, refurbish and re-testing.
- Critical sophisticated electrical equipment that has been left in an unprotected environment and unpowered state for long periods which requires specialist evaluation before being re-energised and used.
- Design errors relating to the BOP leading to misaligned and ill-fitting parts, and unsuitable and incomplete ‘on-site’ modifications.
- Incomplete manufacture of BOP components which are not in a condition to be installed.
- Significant parts not having been ordered/supplied and still requiring Transnet’s acceptance of the proposed solutions. This relates to the hopper lining materials which are a significant long lead item.
- Incorrect alignment of Wagon Tippler. Tippler installed without proper/prior alignment checks which now requires the Tippler to be removed, re-aligned and re-installed. Refer to Section 2.1.1.

Refer to Appendix B - Phase 2 Work Scope which identifies the categorises of work for completion of installation and reasons for works to be completed.

As part of the Phase 1 Scoping process, AB have generated individual Site Inspection Reports (SIPs) as a basis of inspection and recording of the condition, location and serviceability of each element of the TUS and BOP. Copies of the completed SIPs are in Transnet's possession and form the basis of this Report. Appendix H provides a summary of the SIPs.

2. INSPECTION RECORD

The purpose of this report is to provide an overview of the plant with SIPs containing detailed findings. Unless specifically stated hereafter it is understood that the equipment remains in serviceable condition.

2.1 Mechanical Equipment – Train Unloading System (TUS)

2.1.1 Wagon Tippler

Relevant SIP Numbers: 04 – 24, 30 - 36, 66, 70, 87 - 89

Extent of Equipment Supply Identified:	100%
Extent of Equipment Installed:	100% excluding Ballast

For the purposes of this inspection the Tippler comprises the complete Rotating Structures, as shown on drawing 49055207.

The Tippler was found to be in a generally good condition with allowance made for the time the machine had been left in an open and unprotected environment. Refer to recommendations regarding surface treatment. There are some visually obvious short comings in manufacture, which although undesirable and would not have been acceptable to AB at the time of manufacture, cannot be considered sufficient to require re-work for functional reasons.

Tippler Cage – Drawing 49055208

The main consideration, which is going to extend the work scope for Phase 2 considerably, relates to the Tippler being installed in a mis-aligned state. This has been confirmed by a survey undertaken on AB's behalf by local South African company SIDD. The results of their survey carried out during ABs Phase 1 visit and AB's internal analysis of the survey results are included in Appendix C.

Correct alignment of Tippler Cage structure is essential for accurate rotation without any "corkscrew" effects that induce longitudinal movement of the Cage on the support Rollers. This ensures problem free, long-term service and based on long term experience AB lay down strict procedures for how the correct alignment should be achieved. No prior records of Tippler Cage alignment were provided to AB at time of manufacture in 2018. Records of Tippler Cage alignment at the manufacturer's workshops have been provided to AB by PTP Consultants (Victor Neto) but doubt exists regarding the methods, timing and authenticity of the process.

In any event, after the Tippler had been shipped from China (subjecting the Tippler to vibrational stress relieving effects) and stored on uneven ground for several months in South Africa, it was essential that the Tippler Cage was re-surveyed to establish correct alignment before the Tippler was installed. Post installation, AB have been retrospectively provided with basic survey records of the Tippler Cage after it had been installed on trestles at site for several months. This indicated that the Tippler Cage was twisted due to settlement of the supports. No further detailed survey of the Cage of sufficient accuracy was undertaken before the Tippler was installed. TAFR did not employ the services of AB's Site Engineer.

The extent of misalignment is such that a significant re-alignment process is now necessary. It is not considered the reason is due to damage but probably a lack of care and proper surveying methods in the workshops. Regardless of the original cause, it is AB's opinion that the Cage can be realigned within, or sufficiently close to, the required accuracy and design intent. This can only be achieved by lifting the Tippler from the Support Rollers to enable the End Rings to be relocated.

In addition to misalignment, the incorrect type of Cage Pivot Joint shrink discs (8) were fitted during manufacture and temporary parts fitted to overcome the mis-match with other components. Refer to Appendix E – Photo 1. Despite this issue being recognised prior to shipment from China and new parts ordered, the Tippler was installed without the new components being fitted. Fitment is a very arduous process once the Tippler is installed (they are not a wearing part) so it is recommended that these discs are fitted during the re-alignment process.

For both re-alignment and fitting of the new shrink discs it is necessary to lift the Tippler rotating structure back out of the foundations and support it on temporary supports so that a re-alignment procedure can be carried out and alignment confirmed with a new survey. Lifting of the Tippler will be accomplished with an arrangement similar to that used for installation. It will be necessary to remove the previously installed Tippler Dust Cowl to facilitate the Tippler removal but the proposed contractor has confirmed removal of the Tippler building will not be necessary.

Tippler Pivot Shaft Connections – Drawing 49055231 & 49055285

Access hatches were removed from the outer ends of the Platform, Side Beam and Ballast Beams Pivot Shafts to expose the Pivot Shaft connections at 8 locations. Condensation was found at all inspected locations and in one location in particular, droplets of water were forming on the inside surfaces. Refer to Appendix E – Photo 2. No silica gel bags had been fitted as required by AB Manufacturing Specification. Given the criticality of the components at the Pivot Shafts, further inspection of the main spherical bearings is imperative during re-alignment of the Tippler Cage.

Tippler Cage Links – Drawing 49055280

This design of Tippler features tubular diagonal bracing (Cage Links) to provide restraint and precise alignment to the Cage. These are contributory members to the required fatigue life. One of the requirements of the AB installation and alignment procedure was that these tubular braces be welded at their final length straight and true after alignment of the cage structure has taken place. However, it is visually apparent that the braces have been allowed to sag under their own weight while this welding took place. This has introduced an angular misalignment for which the Tippler was not designed and is likely to introduce secondary moments and associated stresses.

Refer to Appendix E - Photo 3. Once welded, it is not feasible to dismantle Links and re-weld in-situ. It is recommended that consideration is given to replacing these items.

Torque Reaction Brackets – Drawing 49055281 to 49055284 Inclusive

Since the Side and Ballast Beams are connected to the End Rings via large axial pins in rotary bearings, Torque Reaction Brackets are used to restrain the two beams rotationally about their longitudinal axis. These brackets are in turn pin jointed to eyes on the Rail Platform. Some of the Torque Reaction Brackets are misaligned with their respective eyes on the Rail Platform. The effects of the offset, which is pronounced at one of the four Brackets, is under consideration by the AB stress analysis department to determine what remedial/replacement action is required. Refer to Appendix E - Photo 4.

Wagon Clamps – Drawing 49055221

The Wagon Clamps feature tubular tension links with clevis ends, that pull down the Clamp Heads to secure the Wagons during the tipping cycle. The clevis ends are fabrications welded onto the tube end plates. There are eight of these assemblies on the Tippler. Several are displaying a small angular misalignment between the tube and the clevis end, to a greater or lesser extent. This is a fabrication error. Since these items are intended to carry only direct tension loads in service, a misalignment induces a bending moment for which the clevis is not designed. These components should be subject to regular inspection during service.

Surface Protection

The outer painted surfaces were in generally good condition with limited instances of localised degradation and chipping due to mishandling.

Due to limitations of access during the Phase 1 inspection, inspection could only be made inside the Rail Platform and not the Side Beam or Ballast Beam.

Upon removing the access hatch on the Rail Platform, a strong aroma of damp was immediately evident. Further internal inspection revealed that the paint thickness was considerably thinner on the inside, being 125-175 microns vs the 265-400 typically found externally, and being of a different colour suggests that only primer and maybe intermediate coats have been applied internally. Inspection inside the Platform showed patchy surface corrosion throughout and some areas of corrosion flaking off with the paint layer. Refer to Appendix E - Photo 5.

AB’s Manufacturing Specification clearly requires the use of silica gel bags in all sealed compartments. No evidence of the use of gel bags in the box sections was found during inspections.

Recommendations

Lift Tippler from its installed position, set down on temporary support and realign. During the Tippler realignment process, replace the Pivot Shaft Bearings, Seals and Shrink Discs.

It is not recommended that the Wagon Clamps are dismantled and inspected given that all bearings are of the 'plain' type which are not subject/sensitive to localised fretting in the same manner as roller bearings. It is reported that Transnet were to procure a spare set of Tip Side and Non-Tip Side Wagon Clamps and AB recommend that these items are procured in accordance with previous intent.

Whilst the Tippler is removed from the pit, open all accessible box sections for inspection by contractor to obtain advice on remedial works to areas of inner corrosion. After implementing any remedial works install silica gel bags in accordance with AB Manufacturing Specification and properly seal all compartments.

It is recommended that all structural splice joints are shot blasted and re-painted in accordance with the project surface treatment specification after status of fasteners is established – see below.

Conduct a random 20% torque tightness check on all fixings at all structural splice and flange joints. Recorded values should be cross referenced to TAFR QA Records.

Remove one nut and bolt assembly from each structural splice and flange joint and send original for mechanical and chemical composition testing.

Make provision for the replacement of all Tippler Cage Links.

Make provision for the potential replacement of Tippler Torque Brackets pending further input from AB stress department.

2.1.2 Tippler Support Rollers

Relevant SIP numbers: 25 - 29

The Support Rollers comprise several assembly and sub-assembly drawings all of which are identified on drawing 49055232.

The Tippler Support Rollers have been installed in accordance with AB drawing requirements. This has been confirmed by the same 3D survey undertaken for the Tippler Cage. Datum marks required as part of the manufacturing process are no longer clear and will require replacement. One set of (8) Roller Assemblies are mislocated by 4mm in the longitudinal direction and will require minor remedial relocation work during the time the Tippler is lifted for re-alignment.

The oil component of the Support Roller bearing grease has started running out over time.

Recommendations

Due to the extended period of time the Tippler has been sitting idle and weight imposed on the roller bearing whilst stationary, it recommended that whilst the Tippler is removed for re-alignment each set of Roller pairs is removed and dismantled including fitment of new bearings and oils seals, re-assembled with fresh grease and replaced. Based on assessment of the condition of each of the original bearings, these bearings may be re-allocated to spares stock.

Ensure that the set of (8) Rollers currently out of position are re-located prior to replacement of the Tippler.

2.1.3 Tippler Drives

Relevant SIP number: 30

Two opposite handed Tippler Drive assemblies are used, one at each end of the Tippler. Each drive consists of an electric motor, gear reducer, brake, pinion shaft, drive pinion, shaft bearings all mounted on a sub-frame. A Base Frame is provided to secure to the concrete foundations, so that the drive unit complete with sub-frame can be manipulated into alignment with the Tippler Drive Racks and secured to the Base Frame.

The Tippler drives are largely in good visual order and conforming to manufacturing drawings. Both Drive Units have been located in their respective positions but have not been aligned, secured or grouted to the foundations.

A proper internal inspection of the gear reducers or assessment of the other components of the Drives was not possible.

Recommendations

Remove both Tippler Drive assemblies and return to the OEM for dismantling, checking and joint inspection with AB and Transnet. Based on the condition of the components, it is recommended that any part replacement recommended by the OEM is undertaken. As a minimum this should include new bearings, seals, brake pads and springs.

As a parallel exercise, discussions should ensue with the OEM, Transnet and AB regarding warranting the refurbished Drive Units and cost comparisons made with new spare parts/drives to establish the most cost effective method to avoid interruption to commissioning and setting the equipment to work, and achieving maximum availability/reliability during future operation. Refer to Sections 6 and 7 of this Report.

2.1.4 Train Positioner

Relevant SIP Numbers: 37 – 53, 67, 71, 73, 87 – 89, 75 – 82, 91 - 93

Extent of Equipment Supply Identified:	98%
Extent of Equipment Installed:	95%

The Positioner and main sub-assemblies - Support Rollers, Guide Rollers, Main Arm Raise/Lower Mechanism and Last Wagon Arm – as generally shown on drawing number 49055245, were found to be in a generally good condition with allowance made for the time the machine had been left in an open and unprotected environment. At the time of inspection the Positioner had been installed, but not fully aligned, on the Positioner Track. There are some visually obvious short comings in manufacture, which although undesirable and would not have been acceptable to AB at the time of manufacture, cannot be considered sufficient to require re-work for functional reasons other than detailed hereafter.

The welding on the Front Pedestal in particular was found to be of extremely poor quality for such a heavily loaded, fatigue related component. A full penetration weld which joins the front plate, and the bottom flange is very poor, and generally the welding elsewhere is felt to be not of the standard required for a primary load bearing structure. Refer to Appendix E - Photo 6.

Surface Protection

The outer painted surfaces were in generally good condition with limited instances of localised degradation and chipping due to mishandling.

Access could be gained to the Main Frame box section through the designated access holes which had been left open. Internal inspection revealed that the paint thickness was considerably thinner on the inside, being 125-175 microns vs the 265-400 typically found externally, and being of a different colour suggests that only primer and maybe intermediate coats have been applied internally. Patchy surface corrosion was evident throughout and some areas of corrosion flaking off with the paint layer. This was similar to the condition of internal surface protection identified inside the Tippler box sections. Refer to Appendix E - Photo 7.

AB's Manufacturing Specification clearly requires the use of silica gel bags in all sealed compartments. No evidence of the use of gel bags in the box sections was found during inspections.

<u>Recommendations</u>

Dismantle the Arm Raise mechanism. Clean all the pins and bushes and reassemble with fresh grease.

Dismantle the Last Wagon Arm. Clean all the pins and bushes and reassemble with fresh grease.

Remove the three fixed and one sprung Support Rollers. Dis-mantle, clean and reassemble with new bearings, seals and fresh grease. Clean the original bearings, check for serviceability and if suitable re-pack with grease and suitably package for storage to be used in the future.

Remove the four Guide Rollers. Dis-mantle, clean and reassemble with new bearings, seals and fresh grease. Clean the original bearings, check for serviceability and if suitable re-pack with grease and suitably package for storage to be used in the future.

Manufacture new handrail sections on the trackside of the Positioner closest to the Festoon Towing Arm in accordance with manufacturing drawings to the correct length and with the inward turn.

Other than the remedial works described above, some minor tasks remain to complete the installation of the Positioner including alignment of the Positioner on the Positioner Track.

Positioner Drives – Drawing 49055243

The eight Positioner Drives comprise motors, gear reducer, brake, pinion shaft, torque release coupling and drive pinion, all assembled as a single cartridge unit. Each is located at designated locations in the Main Frame. Each drive has two oil fill and level points, one is a sight glass and the other is a level plug. No oil was visible in any of the sight glasses and the oil level plug was removed on two of the drives and no oil could be detected. There was no evidence of substantial oil leaks on the ground under the drives.

The Positioner drives are largely in good visual order and conforming to manufacturing drawings. The Drives have not been aligned with the mating Drive Racks located on the Positioner Track. A proper internal inspection of the gear reducers or assessment of the other components of the Drives was not possible.

Recommendations

Remove all Positioner (8) Drive assemblies and return to the OEM for dismantling, checking and joint inspection with AB and Transnet. Based on the condition of the components, it is recommended that any part replacement recommended by the OEM is undertaken. As a minimum this should include new bearings, seals, brake pads and springs.

As a parallel exercise, discussions should ensue with the OEM, Transnet and AB regarding warranting the refurbished Drive Units and cost comparisons made with new spare parts/drives to establish the most cost effective method to avoid interruption to commissioning and setting the equipment to work, and achieving maximum availability/reliability during future operation. Refer to Sections 6 and 7 of this Report.

2.1.5 Train Positioner Track

Relevant SIP Numbers: 37 – 53, 67, 71, 73, 87 – 89, 75 – 82, 91 - 93

Extent of Equipment Supply Identified:	100%
Extent of Equipment Installed:	98%

The Positioner Track is as shown on drawing 49055253. The Track is installed and fully grouted in position. Rail Clips between each of the five modules are missing and require replacement. Some Rack Segments are loose and fitted bolts required by drawing are currently HSFG bolts and require replacement. A minor misalignment was identified between the Positioner Track centreline and the main track datum centre marks of up to 8mm.

Recommendations

The misalignment discrepancy shall be addressed during in the installation of the main track rails and rail supports. Al missing fasteners shall be replaced.

2.1.6 Wheel Grippers

Relevant SIP Numbers: 61 – 64, 68, 72

Extent of Equipment Supply Identified:	98%
Extent of Equipment Installed:	10%

The four Wheel Grippers as shown on drawing 49055256 are in generally good condition and have been manufactured in accordance with AB drawings and design intent.

The Wheel Gripper units were found at site in an uninstalled and partially dis-mantled state having been fully assembled in the workshops in China. As a result of several major components being stored outside, there was deterioration of the surface treatment. Many of the pivot pins, fitted bolts and shims are badly corroded and will require replacement. Refer to Appendix E – Photo 8.

The Gripper Base and Support Frames are each installed on their cast-in foundation bolts in the Gripper pits, but have not been aligned, bolted down or grouted. They are currently being used to support steel floor plates to accommodate the passage of vehicles and cranes. The Gripper Frames are not designed for this purpose.

As a result of dismantling, it is not possible to assess each unit individually to establish readiness for service.

While they largely conform to the manufacturing drawings, their outside storage in some cases has resulted in fairly extensive refurbishment being necessary before installation.

The ground mounted Foundation Pieces and Gripper Bar stops are not installed.

Recommendations

It is recommended that all the Gripper Frames are immediately removed from the Gripper Pits and relocated with all other Gripper components at a workshop for dismantling and full refurbishment. Components that are too corroded for future use shall be replaced.

Train Holding Devices – Drawing 49055255

It was originally intended that the Wheel Grippers would be arranged to be readily removed as a complete assembly for maintenance and be replaced by a standby unit, thus reducing downtime and increasing availability. To enable speedy replacement the Wheel Grippers are designed with a short length of rail track spanning the Gripper Units so that the Grippers are not entrapped under a continuous main line rails which would prevent the easy Gripper removal/replacement. It has been reported that at a late stage in the design review process a decision was made for the original design concept to be shelved and continuous main line rails be fitted.

Recommendations

The original concept and the importance for the Wheel Grippers to be readily accessible/removable/replaceable was a primary design requirement of the overall TUS design concept. It is recommended that the original design concept is reinstated as shown on drawing 49055256 – Sheet 4. Refer to SIP No. 62. The Gripper hydraulic and electrical systems incorporate quick release couplings to facilitate rapid replacement.

Wheel Gripper Hydraulic Power Unit Location – Drawing 49055257

The original design intent was for the four Hydraulic Power Units (HPUs), to be installed in each of the Gripper pits so that the ground at rail level could be free of obstruction. It was originally intended that the Gripper pits would feature drainage channels so that surface water would flood the pits and also that the pits could be hosed down to remove dust collection. However, no drain age has been provided and if the pit flood or material/dust build up reaches unserviceable levels, the function/performance of the HPUs, and thus the Grippers, will be severely compromised.

Recommendations

It is ABs opinion that in these circumstances the function and performance of the Grippers would be better assured if the Gripper HPUs are located at ground level where they will be easier to maintain, replace components and monitor. Concerns regarding the vulnerability of the HPUs to damage by traffic can be addressed by providing a large tubular section crash barrier or guards around each unit. Transnet's decision is required.

2.2 Mechanical Equipment – Balance of Plant (BOP)

2.2.1 Tippler Dust Cowl

Relevant SIP Numbers: 34 - 35

Extent of Equipment Identified:	95%
Extent of Equipment Installed:	90%

Tippler Dust Cowl Details – Drawings TIPP3-DJB-001 and TIPP3-DJB-002

The Dust Cowl main structure is largely installed. Work remains on the main structure and all the access remains to be installed. The main arch members have been fully grouted in position.

The Cowl Dust Panels are ill-fitting with many clashing with the main structure arch members. A significant number of fixing holes mis-aligned. It is not possible to determine the exact reasons for these issues but it would appear to be a combination of mis-located foundation bolts and incorrect manufacture.

Despite the structure having been installed, it appears that some design work remains to better define how the Dust Cowl seals to the Tippler End Rings and some remedial work will be required.

Since the Tippler has to be removed for re-alignment, the Dust Cowl too will need to be first dismantled and suitably stored at site, pending its correct reinstallation and completion after the Tippler is reinstalled.

Recommendations

A detailed survey needs to be conducted of all Cowl components and recommendations for necessary modifications to existing parts or requirement for newly manufactured parts. The extent of refurbishment work will be significantly lower cost than replacing the complete Cowl. Engineering needs to be undertaken to better define the seal between the Dust Cowl and Tippler End Rings and implement.

2.2.2 Hopper

Relevant SIP Numbers: 22

Extent of Equipment Supply Identified:	100%
Extent of Equipment Installed:	100%

These components were supplied by TAFR and the associated drawing is TIPP3-DGA-004.

The Hopper is of cast in concrete construction and faced with a 10mm thick plate with embedment features to ensure the plate is keyed to the concrete. The Hopper was not accessible for close inspection at time of inspection due to lack of accessibility.

The Hopper is to be lined with ceramic type liners. This is covered in Section 2.2.8.

Recommendations

It is recommended that a 3D scan is undertaken of the Hopper and immediate areas to facilitate necessary future design work of the Hopper Liners. The Hopper is a civil works construction and the accuracy of the concrete and embedded steel plate cannot be guaranteed. A 3D scan can be undertaken when the Tippler Cage is being re-aligned and will be cost effective.

2.2.3 Upper Deflector Wall & Support Roller Dust Shrouds

Relevant SIP Numbers: 34 & 36

Extent of Equipment Supply Identified:	100%
Extent of Equipment Installed:	100% excluding Grouting

Deflector Walls – Drawing TIPP3-DJB-001

Tip Side

Above the concrete hopper is a steel construction Impact Wall consisting of outer face plates and a mounting structure constructed of I beams. When calculating the trajectory of iron ore from the wagons TAFR neglected to account for the effect of the Tippler Side Beam directing material flow outside of the Tippler profile. Such flow would direct material onto the Impact Wall and necessitate the Wall being designed for high impact rather than cursory deflection and designed for the fixing of necessary ceramic liners. This modification will require additional steelwork and modification to existing steelwork.

Non-Tip Side

The Non-Tip Side Deflector Wall has insufficient clearance with the Tippler Wagon Clamp Ballast Weights and will require local modification to increase this clearance. Refer to Appendix E - Photo 9.

Neither the Tip side or Non-Tip Side Deflector Plates are grouted in position.

Support Roller Dust Shrouds – Drawing TIPP3-DJB-001

Dust Shrouds are located at the two ends of the Tippler, inside of the Support Rollers. The purpose of the Shrouds is to protect the Support Rollers from material spillage and dust in conjunction with Tippler mounted radial Spill Plates.

The Dust Shrouds at the Hopper ends are too small to provide any shrouding effect for the Support Rollers and will be entirely ineffective and will necessitate new Shrouds to be designed and supplied. Refer to Appendix E – Photo 9.

Recommendations

Completely remove the existing upper sections of Dust Shrouds and discard. Re-working of the existing upper Shrouds will be time and cost consuming. Tip Side Deflector Wall plates and supports will be assessed for impact capacity and existing parts will be either strengthened or replaced if necessary.

Modify the Non-Tip Side Deflector Wall to clear the motion of the Tippler Wagon Clamps.

2.2.4 Isolation (Knife) Gates

Relevant SIP Numbers: 16, 16a, 16b, 16c, 16d

Extent of Equipment Supply Identified:	90%
Extent of Equipment Installed:	0%

The Isolation Gates as shown on drawing TIPP3-MKG-001 are of the 'Knife' type design.

Design & Approvals

The arrangement of the Gates is not as approved at the time of the 90% design reviews. At some point in time the orientation of the Gates has been rotated 90 degrees. This has altered the general access to parts of the Gates and modified their functionality. For instance, the 90% review approved design provided for all gates being entirely independent of each other. The newly developed design required significant manual intervention to relocate large elements of the Gates from one location another. This would be an extremely arduous and unnecessary process. Confirmation is required from Transnet of their preferred layout, whether Knife Gates are their preferred solution and if so what is their preferred layout. Consideration of other means of isolation should be reviewed, accepted or rejected.

Manufacture & Supply

It has been identified that the Gates have been shipped to site without the manufacturing processes being complete and with dimensional discrepancies. Refer to Appendix E – Photo 10.

Installation

The Knife Gates have not been installed and temporary spacers have been installed instead to make up the dimension difference between mating componentry. It is unknown whether the absence of installation is due to recognition of incomplete manufacture or late delivery. In any event it is fortunate that installation did not occur given the design changes, incomplete manufacture and design discrepancies.

Recommendations

Investigation of design approvals and acceptance is required. Particularly whether the 90 degree re-orientation is acceptable to Transnet. It is the view of AB and PTP Consultants (Victor Neto) that there are several aspects of the Gate design which require a full engineering review to establish whether the Gates would have correctly functioned. Based on the outcome of these assessments this could also lead to a decision making process of whether 'Knife' type gates were the appropriate solution for this application. Other solutions, such a modern Spile Bar System, may be more suitable.

It is also proposed that the Gates are not installed as part of Phase 2 for three reasons:

- It is anticipated that the decision making process for this element of the system will take a length of time which will not permit the installation without delays in view of Transnet required program as outlined to AB at time of Scoping.
- The Gates are included in the system to isolate the Apron Feeders in instances of breakdown or malfunction. The Apron Feeders will be brand new and will have undergone FAT testing. The probability of breakdown will be low. Therefore a 6 to 12 month delay in installing isolation gates is unlikely to present any disruption to plant performance or function during the system's first 12 months of operation.
- Retrospective installation of new Gates can be undertaken during future scheduled shut down periods and will not disrupt or require the removal of the Apron Feeders.

If the project program is extended there will be further opportunity to address the Isolation Gate issues as outlined herein and in SIP reports. At the least, if the existing Knife Gates are retained there will be significant manufacturing completion works to be undertaken.

A separate report relating to the detail of the design and condition of the Knife Gates has been drafted.

Isolation Gate Hydraulic System

It should be noted that the functionality of the hydraulic actuation system for the Gates would be required and evaluation to the suitability for the current design and potential future Gate design.

2.2.5 Apron Feeders

Relevant SIP Numbers: 26

Extent of Equipment Supply Identified:	100%
Extent of Equipment Installed:	0%

The five Apron Feeders as shown on drawing EB0009-B100-EAK-001 are in generally good condition and have been manufactured in accordance with TAFR drawings and design intent.

The Feeders and their drive units are currently located off-site at the works of BreedtAsia premises. On inspection it has been noted that the lubrication distribution blocks have been positioned on the inside of each Apron Feeder frame where they are not accessible or visible. The lubrication hose fittings used are the push-on type normally associated with pneumatic systems and will not be able to endure the system pressures of a lubrication system without breaking. The hose fittings will need to be changed to industrial duty type of fitting. Refer to Appendix E – Photo 11.

<u>Recommendations</u>

The Apron Feeders should remain located at their current storage facility until required for installation. During that period it is recommended that the lubrication distribution blocks are re-located on the outside of Apron Feeder frame and the lubrication fittings are replaced with fitting suitable for application.

Apron Feeder Drives

The five Apron Feeder Drives comprise motors, gear reducer and coupling assembled as a single cartridge unit. Each is mounted on the Feeder head pulley shaft. It was not possible to ascertain whether the gear reducers were oil filled and a proper internal inspection of the gear reducers or assessment of the other components of the Drives was not possible.

Recommendations

Return all Apron Feeder (5) Drive assemblies to the OEM for dismantling, checking and joint inspection with AB and Transnet. Based on the condition of the components, it is recommended that any part replacement recommended by the OEM is undertaken. As a minimum this should include new bearings and seals.

As a parallel exercise, discussions should ensue with the OEM, Transnet and AB regarding warranting the refurbished Drive Units and cost comparisons made with new spare parts/drives to establish the most cost effective method to avoid interruption to commissioning and setting the equipment to work, and achieving maximum availability/reliability during future operation. Refer to Sections 6 and 7 of this Report.

2.2.6 Apron Feeder Feed Chutes & Steel Hoppers

Relevant SIP Numbers: 4, 7, 8 & 9

Extent of Equipment Supply Identified:	98%
Extent of Equipment Installed:	60%

The five Apron Feeder Feed Chutes and associated Steel Hopper as shown on drawings TIPP3-DAA-001, TIPP3-DAD-001, TIPP3-DEA-001, TIPP3-DEA-002 & TIPP3-DEA-003 are in generally good condition. To date the Steel Hoppers, Chutes and supporting work under the concrete cast-in Hopper have been installed. Still to be installed are removable panels, which are to be installed after the Apron Feeders are in place, and lining plates are to be installed in the areas which are in the passage of the material flow.

There is some considerable mis-alignment between the Chute Supports around the Apron Feeder outlet and the conveyor feed chutes at four of the five Apron Feeder locations. Due to limitations of access during the Phase 1 inspection, it could not be established where, or why, the dimensional errors originate. Refer to Appendix E – Photo 12.

The Apron Feeder Support Steelwork drawings show under the Apron Feeders, mesh panels. These could not be located and will need to be supplied under Phase 2.

Recommendations

Manufacture, supply and install missing mesh panels and associated components.

Complete installation of Chutes, including installing new ‘packer pieces’ to achieve alignment of Apron Feeder Chutes and Conveyor Feed Chutes.

Install liner plates.

2.2.7 Conveyor Feed Chutes

Relevant SIP Numbers: 5

Extent of Equipment Supply Identified:	98%
Extent of Equipment Installed:	60%

The Conveyor Feed Chute arrangement is shown on drawings TIPP3-DAF-001/01, TIPP3-DAF-001/02, TIPP3-DAF-002, TIPP3-DAF-003, TIPP3-DAD-002 and TIPP3-DAD-003. Installation is generally complete. It is noted that the Chutes have been modified during installation to enable fitment with mating structures. Several fasteners are missing and further alignment with mating structures is required. Due to limitations of access during the Phase 1 inspection, it could not be established where, or why, the dimensional errors originate. No liner plates have been fitted.

Recommendations

Complete installation of Chutes, including alignment checks and fitting of all necessary fasteners.

2.2.8 Chutes & Steel Hopper Liner Plates

Relevant SIP Numbers:	No SIPs produced for Liner Plates
Extent of Equipment Supply Identified:	100%
Extent of Equipment Installed:	0%

The Liner Plates have been supplied in accordance with the supplier own drawings based on TAFR drawings TIPP3-DAD-001,002,003 and TIPP3-DAE-001,002,003. All Liners have been identified on site. None have been fitted.

Quality Engineering of Cape Town have already designed and supplied wear plates for the following areas:

- Steel hoppers that are bolted to underside of concrete cast in-situ hopper.
- Chute work around Apron Feeders.
- Conveyor feed chutes.

Since these wear plates fix to steel structures that are accessible from the outside, most of these wear plates have threaded studs on their back face and are secured with a nut on the outside of the supporting structure. There are a small quantity which are glued in place, which as Transnet are aware are, extremely difficult and time consuming to remove.

Recommendations

It is recommended that the Liner Plates are consolidated on site or at a local storage facility prior to installation.

2.2.9 Concrete Hopper Liner Plates

Relevant SIP Numbers:	No SIPs produced for Liner Plates
Extent of Equipment Supply Identified:	0%
Extent of Equipment Installed:	0%

Replaceable Ceramic wear plates are to be fitted to the steel facing plate of the Concrete Hopper. The intended supplier has produced drawings of a previously proposed Liner Plate and associated fixing method.

It was established during Phase 1 inspection process that the proposed type of Liners and method of fixing had not been finalised between Transnet, TAFR or the potential supplier, Quality Engineering of Cape Town. In the absence of the necessary approvals no Liner have been ordered to date. This immediately places the final design and supply of these components on the critical path for the installation process.

Whilst the type of Liner being largely agreed as ceramic, the method of fixing is still under review.

Tippler 1 and Tippler 2 wear plates are glued in place but are extremely difficult and time consuming to remove.

Quality Engineering have presented an alternative solution of moulding strong permanent magnets into the back of the wear plates. This makes them easy to attached and can be removed using a crowbar in a notch moulded into the back edge of the wear plate. The magnets are more than strong enough to hold the wear plates in position, but horizontal ribs would need to be welded onto the cast in-situ steel plate facing to stop the wear plates sliding down the hopper under the force of falling material.

AB can confirm that ceramic type Liners are suitable for use in this application but regarding method of fixing. Transnet will need to decide which solution they believe best suits their fixing application method and replacement time.

Recommendations

All parties engage in the process of determining the best fixing method for the application and Transnet’s preferences for ease of replacement on an urgent basis. Once the method is agreed, these items should be ordered on an immediate basis to avoid lead time delays to the installation programme.

2.2.10 Apron Feeder Support Steelwork

Relevant SIP Numbers: 28

Extent of Equipment Identified:	98%
Extent of Equipment Installed:	98%

Apron Feeder Support Steel Details – Drawing TIPP3-CBA-001

The Apron Feeder Support Steelwork was found in a largely installed condition. A significant quantity of the fasteners have had marker paint applied to their heads to indicate they have been torque tightened. Grouting of the structure to its foundations has been completed.

Mesh panels called up on the drawing which should be located under each Apron Feeder. These could not be located during the Phase 1 inspection.

By simple observation it was identified that the supporting steelwork was likely to be proven overstressed by detailed analysis.

Recommendations

Carry out an engineering strength review of the structure to check that the design is fit for purpose.

Carry out torque tightness test on a random 20% sample of the structure fasteners.

Supply and install the mesh panels under the Apron Feeders.

2.3 Hydraulic & Lubrication Equipment

2.3.1 Hydraulic Power Units

Relevant SIP Numbers: 63, 51, 81, 86

Extent of Equipment Identified:	100%
Extent of Equipment Installed:	0%

Positioner Hydraulic Installation – Drawing 49055251

Train Holding Device Hydraulic Installation – Drawing 49055257

Knife Gate Hydraulic Installation – No TAFR Hydraulic Drawing Provided

The Hydraulic Power Units (HPUs) used on the Tippler 3 plant include the following:

- 1 x Train Positioner HPU
- 4 x Wheel Gripper HPUs
- 1 x Knife Gate HPU

The TUS HPUs are all stored in their shipping crates at the works of BreedtAsia and are in visually good condition. These HPUs were originally drained of hydraulic fluid for shipping and having been stored for a prolonged period of time, any residual oil will have drained down or dried out potentially leaving precision machined faces vulnerable to internal degradation.

There is an HPU for the Knife Gates, it has been stored in its packaging as supplied, but was left near the open end of the Tippler building so is subject to changing weather conditions. It appears to be in good visual condition but is deemed to be unfit for purpose in its current design.

While it features some independent controls for the five separate Gates, it is not configured in a manner to provide the level of signalling to the control system/desk usually included for this type of plant and already included in the TUS hydraulic systems. The level of control and signalling is not compatible with the Gates being cycled at the end of unloading each train, thus testing their correct operation regularly.

Recommendations

TUS HPUs

To ensure the good operating condition of the HPUs, a total re-build of each unit would be an extravagant measure to take, so to ensure their problem free operation at time of commissioning it is recommended that the units are fully flushed with new hydraulic fluid and re-run through the OEM FAT testing procedure. This process will undertaken under the direct supervision of the OEM's technical representative.

As a parallel exercise, discussions should ensue with the OEM, Transnet and AB regarding warranting the refurbished HPUs and cost comparisons made with new spare parts to establish the most cost effective method to avoid interruption to commissioning and setting the equipment to work, and achieving maximum availability/reliability during future operation. Refer to Sections 6 and 7 of this Report.

Knife Gate HPU

The Knife Gate HPU is designed to operate only two hydraulic cylinders on the basis only one Gate will be operated at a time. The design philosophy for the Knife Gates still requires input from Transnet Engineering and Maintenance departments therefore until a decision is reached on the future of the Knife Gates, their retention, re-design or replacement, no further action will be taken with this HPU.

2.3.2 Hydraulic Actuators

Relevant SIP Numbers: 63, 51, 76, 78, 80, 84, 91 – 93

Extent of Equipment Identified:	100%
Extent of Equipment Installed:	0%

Positioner Hydraulic Installation – Drawing 49055251

Train Holding Device Hydraulic Installation – Drawing 49055257

Knife Gate Hydraulic Installation – No TAFR Hydraulic Drawing Provided

The hydraulic actuators used on the Tippler 3 plant include the following:

- 1 x Train Positioner Main Arm Actuator
- 1 x Train Positioner Main Arm Latch Actuator
- 1 x Train Positioner Coupler Release Actuator
- 1 x Last Wagon Arm Rotary Actuator
- 1 x Last Wagon Arm Latch Actuator
- 16 x Wheel Gripper Actuators
- 2 x Knife Gate Actuators

All the TUS actuators have been stored in their packing crates at the works of BreedtAsia and are in visually good condition. They have however been unused and stored for a prolonged period of time, lying on their sides. Storage in this orientation risks flat spots developing on the internal seals. Any original hydraulic fluid or internal surface protection will have drained down or dried out potentially leaving precision machined faces vulnerable to internal degradation.

The Knife Gate hydraulic actuators are stored on site in their packing crates. The crates are of a lattice construction and are located near the open end of the Tippler building, so the actuators are subject to changing weather conditions. However, they do appear to be in visually good condition. Until a decision is reached on the future of the Knife Gates and the possibility of their complete replacement no further action will be taken with the actuators.

Recommendations

To ensure problem free operation during commissioning and future service, all TUS these actuators should be rebuilt with new seals as a minimum.

2.3.3 Hydraulic Pipework

Relevant SIP Numbers: 75, 77, 83

Extent of Equipment Identified:	100%
Extent of Equipment Installed:	0%

Hydraulic Pipe Assembly for Main Arm – Positioner – Drawing 32261.A3

Positioner Ancillary Pipe Assembly – Drawing 32262.A3

Pipe Assembly for Gripper – Drawing 31985.A3

Above quoted drawing numbers are supplier generated.

The pipework, hoses and fittings for the Positioner and Wheel Gripper hydraulics was supplied pre-made, flushed and capped. This was found on site in its packing crate.

The only pipework located for the Knife Gates was 20 lengths of galvanised pipe, which according to the packing list is half of what would be required. This has been supplied in an un-made condition and requires cutting, threading, assembly and flushing before use.

Recommendations

Continue to store all components in their current location until Phase 2 assembly and installation.

Until a decision is reached on the future of the Knife Gates and the possibility of their complete replacement, no further action will be taken with the hydraulic pipework.

2.3.4 Lubrication Equipment

Relevant SIP Numbers: 36, 52 - 53

Extent of Equipment Identified:	80%
Extent of Equipment Installed:	0%

Tippler Lubrication Installation – Drawing 49055237

Positioner Lubrication Installation – Drawing 49055252

Assembly of Lubrication Pinion – Drawing 49055296

Apron Feeder Lubrication Installation - No TAFR Lubrication Drawing Provided

The Tippler and Positioner are each equipped with two automatic lubrication systems, one for all the roller bearings and one for the drive rack and pinions. The two systems each operate with a different type of grease, suited to their application.

The Apron Feeders are each equipped with their own automatic lubrication system for the main shaft bearings and their seals.

The Tippler and Positioner main pump units were located in their packing crates, having been stored outside, presumably since their delivery to site before the TAFR contract termination.

The hermetic sealing has been compromised, but since the pump units are located inside sealed cabinets and were tested at the factory so have grease inside them, their serviceability is not doubted. These pump units were moved inside the Tippler building during the Phase 1 works.

The Tippler and Positioner End of Line Control Units and Distribution Blocks were located in their packing crates inside the Tippler building and are in visually good condition.

Items missing are all the pipework, hoses, fittings and the rack lubrication Dummy Pinions for both the Tippler and Positioner.

Apron Feeder lubrication pump units of a completely different design and supply to the Tippler and Positioner lubrication units were found in their packing crate, again having been stored outside, presumably since their delivery to site before the TAFR contract termination. The units are each full of grease, so there shouldn’t be any problem with their operation at commissioning, but a spare pump unit will be sourced as a backup.

Pipework, fittings and hoses are already installed on the Apron Feeder units, but distribution blocks have been located in an inaccessible location on the inside of the Apron Feeder frame. No pipework or fittings for connecting the pump units to the Apron Feeders has been located.

Recommendations

Consolidate and catalogue all lubrication equipment at a dry, secure location.

2.4 Dust Extraction Plant

Relevant SIP Numbers: 41

Extent of Equipment Supply Identified:	92%
Extent of Equipment Installed:	40%

No drawings of the Dust Plant have been provided to Transnet or AB.

Although the plant was originally designed by TAFR, ownership of the intellectual property has transferred to a new company and they will be supporting AB throughout the Tippler 3 completion project.

Based on the direct site input and inspection of the equipment OEM during the Phase 1 inspections it has been confirmed that the Dust Extraction Plant is in generally good condition and conforming to manufacturing drawings.

The main structures of the two filter bag houses and the dust silo have been erected, but detail work here remains to manufacture and supply some missing items.

None of the ducting, compressed air systems, dust piping, mechanical and electrical equipment have been installed.

There are a number of equipment parts yet to be supplied to site including mechanical items, electrical devices, and piping. Some of these items require a further site survey by AB and the OEM to obtain as-built dimensions for manufacture. None of these items represent a potential delay to the installation programme with the exception of the Medium Voltage Variable Speed Fan Drive which is covered under the Electrical Section of this Report.

It was noted that an error made when the concrete floor slabs at +5.5m and +11.0m elevations were cast. This affects the apertures and offsets for the passage/routing for the dust extraction ducting to pass down to the Apron Feeders. As a result, the corresponding ducting sections on site are redundant and will require replacement.

Recommendations

All the Dust Extraction Plant Components should be fully located, catalogued and consolidated at either an on-site secure location/laydown area or taken off-site for secure storage and further refurbishment.

Supply new ducting section to accommodate error in cast concrete foundations as the most cost effective solution. Supplier has confirmed new ducting will not adversely affect the system performance.

Conduct site survey to determine as-built dimensions for Paddle Mixer feed tubing.

Remove bag filters from site to OEM for examination.

Pressure test and certify all pressurised equipment.

Address the condition and serviceability of the Medium Voltage Variable Speed Fan Drive on an urgent basis.

2.5 Electrical and Control Equipment

Low Voltage Equipment

All the electrical power, drive and control system panels have been located and are mounted on supporting steelwork in the Electrics Room and Control Room. The general installation is satisfactory although the arrangement of steel leg supports, to permit bottom entry of cabling is not sufficiently stiff and will require strengthening. This should be undertaken with the panels in-situ to avoid removal and re-installation of the panels. To date, there has been no cabling to the panels other than a single temporary low voltage power supply to the Low Voltage Distribution Board.

Internal inspection of each panel has also shown their condition to be satisfactory without indication of current or historical condensation. Although the condition of the panels is acceptable, it cannot be guaranteed that certain critical elements including the variable speed drives will correctly function at time of plant start up and commissioning. On site testing is not possible but a site inspection to make further determinations is possible. Recommendations will be made regarding the provision of additional spare back up drive units ready for use if required at time of start up. Refer to Sections 6 and 7 of this Report.

Medium Voltage Equipment

The Dust Extraction medium voltage Variable Speed Drive has been stored outside for an indeterminate period of time. Although it remained in its packing crate throughout this period, the hermetic sealing has degraded and split leaving the drive vulnerable to water ingress and the temperature fluctuations of the weather. This drive unit cannot be tested on site in advance of plant start up and commissioning and therefore other alternative testing, inspection or replacement needs to be considered.

It has been identified that the drive is a Siemens Generation 4 unit, which Siemens no longer produce, instead making the successor Generation 5. The two generations are significantly different physically, with input and output termination points being in different locations, making a future replacement of the Gen4 with a Gen5 very difficult, requiring a quantity of engineering and thus time consuming. Together with significantly long lead times for the replacement of the drive and complexities regarding the inspection of the existing Gen4 unit, these circumstances require a strategic decision to be made at the earliest date regarding refurbishment of the existing drive or procurement of a new drive. Refer to Sections 6 and 7 of this Report.

Condition of Motors

There are a large quantity of electrical motors across the plant, ranging from 0.37kW to 450kW (MV). Some of the smaller motors have been stored in a packing crate inside the Tippler building, but most of the larger motors are in their installed positions and unprotected. The large 450kW motor for the Dust Extraction plant, has been stored outside the Tippler building in its packing crate but the hermetic sealing has degraded and split, leaving the motor vulnerable to water ingress and the temperature fluctuations of the weather.

Recommendations

Design, manufacture and install reinforcements for electrical panel supports.

Supply a new generation 5 VFD for the Dust Extraction drive.

Due to the prolonged period of time the motors been idle and exposed, it is recommended that the main low voltage and medium voltage drive motors are inspected and refurbished by the original motor manufacturers - Siemens/WEG. This process can be effectively undertaken in conjunction with the mechanical drive inspection and refurbishment process.

2.6 Civils & Main Track Supports

2.6.1 Civil Works

The construction of the civil foundations and covering building for the complete Tippler 3 plant is not in the scope of this Report.

Based on inspection the holding down bolts for the Tippler Support Rollers and Dust Cowl Main Structure Arches have been cast out of position. The Tippler Support Rollers have been installed in their correct location despite the bolt mis-location. The mis-location of the Cowl Arches has caused clashes between to Arches and Panel Members. All other immediate interfaces between the TUS and BOP are within operational drawing requirements with the exception of the routing of one Dust Extraction Duct.

Of the equipment installed that connect directly with the civil works, some of the equipment has been grouted in position whereas other equipment remains un-grouted. Equipment correctly installed can be grouted in position. Any equipment grouted in the incorrect position will be re-grouted upon re-installation.

Recommendations

All future installation and remedial works that connect, interact with or require modifications to the civil works, will be conducted with reference to a qualified civil/structural engineer.

2.6.2 Main Rail Tracks – Transnet Drawing 1924701-4-120-N-DE-0001

The Main Tracks have not yet been laid in the Tippler building. Troughs have been cast in the concrete floor slab to receive the tracks, so that the Top of Main Line Rail (TOR) is nominally at a common elevation with the Tippler building Top of Concrete (TOC). The Track Support arrangement shown on the above drawing includes Rail Tie Members which span between the rails. No provision for these Tie Members has been included in the civil works. Slots will need to be formed to accommodate them during installation.

Complete manufacture and installation of the incoming and outgoing Main Rail Track Supports will be required.

3. GENERAL OBSERVATIONS & RECOMMENDATIONS

3.1.1 Bolts & Fixings

There has been a mixture of galvanised and black bolts used throughout the project.

Bolts of European origin were originally shipped to China to be used in the main structural joints of the TUS, but it has not been possible to determine if these bolts were actually used.

The project policy on bolting and continued use of existing bolts will be:

- A random 20% sample of the bolts in the main structural joints of the Tippler Cage and Train Positioner, together with critical precision bolts, will be checked for torque tightness and one nut and bolt assembly removed and tested for mechanical properties and chemical composition.
- No bolt that is sound and of the correct size and grade will be removed unless the structure to which it is attached to requires dismantling.
- Where fatigue susceptible structures and mechanical assemblies require assembly and reassembly, black bolts of the designed size and grade will be used and the Transnet paint repair procedure applied either locally or throughout the area, i.e. complete splice plates.
- Where light weight structures, access and handrailing require assembly and reassembly, galvanised bolts of the designed size and grade will be used.
- Where the mechanical and chemical composition testing described above shows a sub-standard item has been used, all bolts on the associated structure will be replaced using the designed size and grade.
- All bolt test results and torque tightening results will be referred to AB for review for confirmation of replacement policy.

3.1.2 Welding

The main areas of attention with regard to weld quality are the fatigue susceptible and primary load bearing structures of the TUS. Weld quality in these areas is imperative to the long, problem free life of the equipment.

The quality of the welding on the TUS structures as carried out at TZME, China is visually sub-standard across all structures. The extent of below standard welding could lead to fatigue related problems before the number of design life cycles is reached, but the implications and extent of work required make any kind of retrospective re-work unpractical. Any attempt to re-work welds would then require stress relieving as described in section 2.1, which then has implications on distortion of structures, re-alignment of the Tippler cage, surface preparation and protection.

It is recommended that a process of non-destructive testing is implemented at the outset of Phase 2 for all critical structural welds as indicated on the manufacturing drawings. Such a process should be planned without delay.

AB were provided with quality assurance pack documentation from the manufacturing process mainly in hard copy (pdf) during the course of the Phase 1 inspection and this did not allow sufficient time to review the content for compliance with design requirements. Some records were provided in soft copy and a general review of the folder relating to stress relieving records was empty. Refer to Section 7.

Welding on equipment such as ducting, access, bag house, dust silo, hoppers and chutes is of a commercial standard, but this is suitable to the structure types.

3.1.3 Surface Protection

The majority of the equipment external paintwork is in good condition giving consideration of the levels of exposure of the equipment during an 18 month period without cover. A plan of paint repair shall be agreed based on utilising Transnet’s surface treatment specification as a basis for remedial works. Special attention will be given to the repair processes necessary to eliminate corrosion identified at internal box section surfaces of the Tippler and Positioner and a paint specialist will be consulted.

4. CONSOLIDATION & CATALOGUING OF EQUIPMENT

The purpose of the Phase 1 Scoping process was to identify the extent and condition of the TUS and BOP equipment with the aim of estimating the timescales and costs of completing the installation and commissioning processes to be undertaken under Phase 2. The Scoping exercise has been effective in this regard but given that this process is largely complete it is important that the equipment locations are catalogued in detail and a plan devised for future relocation and safe storage in readiness for commencement of Phase 2. It is recommended that this process is commenced as soon as possible to ensure the equipment suffers no further degradation or mis-location.

5. EQUIPMENT REFURBISHMENT / REPLACEMENT

The Tippler 3 Train Unloading system was originally delivered to site in 2018, partially installed in 2019 and never used. To overcome the potential degradation of the equipment and issues relating to operating the equipment after a long delay to the operation, it is planned that the following inspection and refurbishment exercises are implemented:

5.1 On-Site Inspection and Refurbishment

This exercise relates to non-specialist equipment consisting of bearings and seals such as roller assemblies. Spare bearings and seals will be procured ready for installation with the originally fitted units inspected for damage and assessed for future use as spare parts.

5.2 Off-Site Inspection and Refurbishment

This exercise relates to specialist products including mechanical drives (gear reducers), electrical drives, drive motors which require the respective OEMs to dismantle and/or test the equipment under controlled conditions. Upon confirmation of the condition of the equipment by the OEM and confirmation of any potential warranty provision, it can be established whether full refurbishment is economical or whether replacement of the parts with full new warranty would provide the required economic assurance sought for reliable operation of the Train Unloading system at the time of start up and commissioning.

6. SPARE PARTS / STANDBY PARTS

Depending upon the outcome of the refurbishment versus replacement part process regarding the readiness for reliable operation of the equipment at start up, any decision regarding the choice replacement components and new equipment needs to consider the effect of lead times on the project programme, particularly of electrical and control equipment containing semi-conductors.

Concurrent with these decisions are considerations of what new equipment would usually be held as spare parts stock and thus be available for immediate replacement if original equipment failed at start up. It is understood that Transnet had already agreed a comprehensive spares parts holding (not ordered to date) and that a significant number of those parts would be suitable as standby parts. If these agreed spare parts were ordered in good time and taking account of current lead times, the requirement for additional standby parts may not be necessary other than in special instances such as the medium voltage Dust Extraction Fan Drive.

7. WARRANTY

It is Transnet’s objective to re-establish warranties of original equipment and the outcome of the Equipment Refurbishment/Replacement and Spare/Standby Parts evaluation will have a significant influence on how warranties can apply in the future. It will also have a direct bearing on how the Phase 2 prime contractor can evaluate their position regarding providing effective warranties. Whilst risks and warranty costs can be evaluated in respect of proprietary equipment, any warranty for manufactured components will depend on the extent and authenticity of manufacturing quality records. A review of the quality records would be required before a third party could fully consider providing a warranty of the manufactured items produced in China by TZME. It is proposed that a comprehensive review of quality records is conducted including a quality assurance expert and Transnet’s quality team who were involved in the manufacturing approvals process.

8. COSTING OF PHASE 2 – INSTALLATION & COMMISSIONING

8.1 Original Contract Costs vs Costs to Complete 2022

There are two particular aspects to completing the installation that are additional to, and exceed, the scope of the original project had it followed through to completion under the original contract with TAFR, i.e. activities that add to the cost of the project:

I. Refurbishment and/or replacement of elements of the equipment that have deteriorated, or likely to have deteriorated, and require particular inspection and confirmation of suitability for purpose.

II. Re-work due to incorrect installation and/or manufacture.

III. Engineering completion, documents and drawings.

Appendix B lists the Work Scope envisaged to complete the project and identifies which category and cost is associated and attributable to each work element.

With regard to i:

The cost of on-site refurbishment is less significant that of off-site refurbishment and inspection and the potential option of procuring new parts to avoid the risk of non-performance at the time of start up and commissioning. As outlined in Section 6 of this report, such procurement may not be cost prohibitive if provision of those parts had already been contemplated in the budget of spare parts stock.

With regard to ii:

These works are entirely additional to the originally scheduled works and under usual circumstances would have been identified and controlled at stages of manufacture and installation considerably in advance of the stages of installation that currently exist, i.e. they were entirely avoidable. This in particular relates to the Tippler being installed prior to thorough alignment checks and the tippler Dust cowl being installed thereafter.

With regard to iii:

The engineering and associated documents and drawings for the TUS is largely complete in accordance with industry standards. However, the package of drawings and documents provided to AB by Transnet, which it is understood to be the same package of data provided to Transnet by TAFR for the BOP, is of poor quality and deficient in content. Only hard copies of information are provided, not all are accompanied by bills of material, there is no structured index and no drawings or documents are provided in soft copy. As a result new engineering is required to be able to complete installation and commissioning and further engineering will be required to elevate the standard of engineering of the BOP to that of the TUS by way of a harmonisation exercise. The cost of completing this process, which is understood to be within the original contract scope, will be significant and will also have time implications for the installation process if not commenced as soon as possible. The scope of this work has not to date been fully defined or agreed by Transnet. Upon definition a pricing exercise can be undertaken.

9. PHASE 2 PROJECT PROGRAM

Two project programmes are included in Appendix F:

Baseline Program – Timescales based on commencing Phase 2 as a single contract.

Optimised Program - Timescales based on implementing an interim 'Enabling' contract.

Both programs have been complied based on close interactions with all relevant suppliers and contractors.

10. DESIGN ENGINEERING & EQUIPMENT INTELLECTUAL PROPERTY STATUS & AVAILABILITY

Train Unloading System (TUS)

The current status and future potential availability of intellectual property rights of design engineering and equipment supplied to the project is included in Appendix I.

At the current time, only rights to materials usually included Operating and Maintenance manuals have been secured in some but not all instances. No further rights have been secured, or apparently sought by Tenova. Transnet should proceed on the basis that no rights currently exist.

Ashton Bulk, Industrial Automation and Control and Advanced Actuators have expressed their readiness to negotiate the possibility of transferring ownership of such materials and IP rights for Transnet's unfettered future use for Tippler 3 as an element of Phase 2 of the project.

Transnet should also proceed on the basis that certain rights will not be available in any event since the policies of companies providing electrical components, hydraulic components etc such as Siemens, Dana, Bosch-Rexroth do not share intellectual property rights.

Balance of Plant (BOP)

The status of intellectual property rights relating to the BOP will be as negotiated between Transnet and Tenova at time of termination. It has been established by contacting some of the companies listed on Appendix I, that intellectual property rights were not sought or secured and will not be available from those companies.

11. SCOPE AND PRICING DEFINITION

Ashton Bulk approached the Phase 1 Scoping Exercise in accordance with the requirements of iCLM HQ 636 TPT - Part C3_Scope of Service. During the course of the Scoping Exercise further definition of the original scoping requirement and new requirements were advised to Ashton Bulk by various departments within Transnet.

These additional requirements are far reaching in terms of both supply, operation, warranty, risk offset and securing future access to the original designer's intellectual property over and above usual levels of provision, amongst other factors requested.

Each of these requirements have a significant influence on the costs of Phase 2 Installation and Commissioning process itself and also upon the future operation, maintenance, servicing, availability, reliability and protection of Transnet's Tippler 3 asset. It has been a primary consideration that Tippler 3 is operated and maintained in a manner that does not emulate the experience of Tippler 2.

At this time the Ashton Bulk's cost estimates necessarily take into account all of Transnet's departmental requests to date on an all encompassing basis in the absence of a detailed definition. Such definition will be required for Phase 2 pricing.

In addition to the works necessary to complete physical installation, refurbishment and engineering deficiencies include:

- Works additional to those included in the original contractor's scope of supply, i.e. remedial works including removal, re-alignment and preplacement of the Tippler.
- Potential new Knife Gate System.
- Provision for power supply for the works and running of the Tippler 3 system in the event external power supply is not available.
- The completion of the works is provided on a full 'turnkey' basis.
- A full warranty is provided (period and terms not specified) by a contractor that was not included in the original contract and associated risks.
- A full harmonisation of engineering drawings and documents be undertaken to include completion and correction of engineering materials provided by the previous contractor.
- Undertake/complete a full solid modelling process of the entire plant.
- Transfer of the original designers intellectual property right by way of licence or ownership.

Further:

- For a new contractor to both provide necessary standby cover and provide a full warranty, it will be necessary for a stock of spare parts and standby part to be procured and held. This to include the cost of long lead items that are considered to be at risk of non-performance/failure during start up and commissioning. The basis of these costs are the provisionally agreed costs of spare parts between Transnet and the previous contractors.
- It was specifically requested by Transnet that cost estimates should be based on their being no potential for Compensation Events, other than in exceptional circumstances, raised during Phase 2.
- During the course of the Scoping exercise Ashton Bulk were asked to provide our opinion of the current condition of Tippler 2 and the reasons why it is in a particularly poor condition for its age, including whether the levels of maintenance have contributed to the premature degradation of Tippler 2.

> Necessarily, a factor was included in the cost estimates for the avoidance of such degradation occurring with Tippler 3 and these costs would include specific servicing of the new T3 plant. For instance, any contractor undertaking the completion and warranting of this project to the extent Transnet have requested would require a two year service contract.

In view of the extent of works to be completed and necessary additional requirements outlined by Transnet, it is recommended that the full cost estimate included in Clause 8.2 of this document is used for funding allocation until such time the Phase 2 Installation and Commissioning is fully and firmly defined by Transnet.

PART C3: SCOPE OF WORK

Annexure B - 'Technical Specification: PLC/SCADA'

Document Reference	**Title**	**No of page**
	This cover page	1
C3.1	*Employer's* Works Information	
	Total number of pages	**51**

Document Control

Works Information Title	Tippler 3 Saldanha- Phase 2 Scope of Works		
Document Number		**Project Number**	N/A
Client	IOT Saldanha	**Client Contact**	

Rev	**Date**	**Revision Details/Status**	**Prepared by**	**Author**	**Verifier**	**Approver**

Current Revision	**Rev A**

Approval

Author signature		**Verifier signature**	
Name	W van Dyk	**Name**	Clarence King
Title	Principle Project Manager	**Title**	Project Director
Project Manager Signature		**Head of Projects Signature**	
Name		**Name**	
Title		**Signature**	
Approver signature			
Name			
Title			

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Tables

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1 Definitions and Abbreviations

1.1 Definitions

Table 1: Definitions

Employer	has the meaning defined in the Contract and includes their respective successors and assigns
Project Manager	means the Project Manager as described in the Contract
Site	means the Saldanha Port (final installed location of the Dual Wagon Tippler Facilities)
Contractor	means the *Contractor* engaged under the contract for the supply of the Dual Wagon Tippler Facility
Subcontractor	means a subcontractor or their subsidiary engaged by the *Contractor*
Dual Wagon Tippler Facility 3	Includes the Dual Wagon Tippler, Feed Hoppers and Chutes, Apron Feeders, Apron Feeder Level Structural Steel Floor and Dust Extraction Plant

1.2 Terminology

"**Shall**" is used to indicate that the *Contractor* is required to take action.

"**Should**" is used to indicate that the *Contractor* is advised to take action.

"**May**" is used to indicate that the *Contractor* is permitted to do something, or that the *Employer* reserves the right to do something, according to context.

"**Approved**" / "**Approval**", unless otherwise qualified, means normal, written agreement by *Employer* to a proposal by the *Contractor.*

1.3 Abbreviations

Table 2: Abbreviations

Term	Description
ISO	International Standards organization
EIC	Electrical, Instrumentation & Control
PLC	Programmable Logic Controller
VSD	Variable Speed Drive

2 Codes, Standards, Specifications and Regulations

2.1 General

2.1.1. The sequential order of precedence applicable to the use of the codes, standards, specifications and regulatory requirements for this project is as follows:

2.1.1.1. Regulatory Requirements.

2.1.1.2. Transnet Project Guidelines, Specifications and Standards.

2.1.1.3. International Standards.

2.1.2. In the event of an inconsistency, conflict or discrepancy between any of the standards, specifications and Regulations, the most stringent and safest requirement applicable to the project will prevail. Any inconsistencies critical to the design shall be brought to the attention of the Employer for resolution, prior to construction. The design shall comply with the latest revision of the following standards, plus any other applicable standards:

2.1.2.1. All equipment, components, design, materials, workmanship, services and works shall be covered by the applicable provisions of the latest editions of the relevant codes, standards, specifications and regulations, including but not limited to those listed in this Section.

2.2 International Standards

Current editions of the relevant International Standards Codes or Publications that shall apply include, but are not limited to, those listed in Table 5**Error! Reference source not found.**.

Table 3: International Standards

Code	Standard Title
IEC 61131-2	International Electrotechnical Commission Standard: Programmable Controllers - Equipment Requirements and Tests.
IEC 61131-3	International Electrotechnical Commission Standard: Programmable Controllers Part 3: Programming Languages – 1993
IEC 61131-5	International Electrotechnical Commission Standard: Programmable Controllers - Communications or Messaging Service Specification
IEC 61131-6	International Electrotechnical Commission Standard: Programmable Controllers - Functional Safety
IEC 61131-8	International Electrotechnical Commission Standard: Programmable Controllers - Guidelines for the Application and Implementation of Programming Languages
IEC 61400-25	International Electrotechnical Commission Standard: Principles and models for a communication environment supported by a client-server model

2.3 Project Location

The Saldanha port facilities are in the Port of Saldanha in the Western Cape region of South Africa.

2.4 Site Conditions

The equipment shall be suitable for installation within a harsh industrial environment as indicated in **Table 4.**

Table 4: Site Conditions

Condition	Description
Altitude	Sea Level
Air Temperature	45°C Maximum; -5°C Minimum

Condition	Description
Equipment Surface Temperature (from sun)	60°C Maximum
Relative Humidity	50% Minimum; 85% Maximum; 60% Average
Air Quality	Coastal salt- laden air with high concentration of iron ore dust
Air Pressure	101.3 kPa
Average Annual Rainfall	278 mm

3 Programmable logical controller hardware (PLC)

All equipment that is mentioned in the specification is the minimum requirement. Transnet Port Terminals Saldanha is a Siemens based site.

3.1 General requirements

3.1.1. The PLC's for the control and interlocking of tippler, tippler conveyor, dust plant and route equipment will be located in tippler electrical room. The PLC equipment will be housed in dust-proof cubicles and will be in an air-conditioned environment.

3.1.2. Interconnection between PLC cubicles and marshalling cabinets / junction boxes shall be via terminals.

3.1.3. PCS7 is our base line and PLC's must be compatible.

3.2 Technical requirements

3.2.1 Manufacture.

PCS7 is our base line and PLC's must be compatible. The field Station varies from S7 300 I/O to S7 200 I/O depending on the application. The Mainframe only houses the CPU, Power Supply for CPU and Communication cards. The distributed equipment is listed below in field Stations.

3.2.2 Mainframe.

- 416 CPU 6ES7416-3xl04-0AB0
- SITOP 6ES7407-0KR00-0AA0
- Ram Card 6ES7952-1JA01-0AA0
- Rack 6ES7400-1JA01-0AA0
- Back up battery 6ES7971-0BA00
- Rail 2000MM RAIL 6ES7390-1BC00-0AA0
- Optic link module OLM 6GK1502-3CB10
- ProfiBus plugs 6ES7972-0BB12-0XA0
- Pin front connecters 6ES7392-1AM00-0AA0
- Power supply SITOP 6EP1337-3BA00 / 6ES7307-1EA00-0AA0 Interface module 6ES7153-1AA03-0XB0

- High Speed Counter Card FM 350 6ES7 350-1AH03-0AE0.

Power Supply	220 VAC ± 15 %
Operating Temperature	0° C to 45° C ambient
Operating Humidity	Up to 90 % (non-condensating)
CPU	Microprocessor based
Programming Language	As per S7 PLC Software Specification.
Memory Type	Code – EPROM/FLASH PROM
Memory Size Timers / Counters	Data – CMOS RAM Expandable in blocks up to 32K Digital – 0,1 sec to 999 minutes Not less than 128 timers, 128 counters
Diagnostics	Self-diagnostics on memory processor and I/O's

3.2.3 Computer communications

Standard - H1 Siemens 10/100

3.2.3.1 Digital inputs.

Voltage Configuration	24VDC 16 per card 4 groups of 4-32 per card, 24 VDC Optocoupled, 1500 VAC
Isolation Response Time	Min 10 ms, max 25 mins
Terminal Arrangement	Screw Terminals to Accommodate 0,5 mm² wire
Status Monitoring	LED

3.2.3.2 Digital output.

Field Voltage	24V DC
Switching Current Isolation Configuration	Min. 1 AMP Optocoupler, 1500V
Terminal Arrangement	16/32 per card, 24 VDC Screw terminal to accommodate 0,5 mm² wire
Status Monitoring	LED

3.2.3.3 Analogue input.

Input Signal	4–20 mA/0-20mA/± 20mA
Type	Single ended, two wire & 4-wire
Resolution	12-bit
Isolation	Galvanic

Configuration	8 per card
Terminal Arrangement	Screw terminal to accommodate 0,5 mm² wire

3.2.3.4 Analogue outputs.

Out Put Signal	0-20 mA
Resolution	12-bit
Configuration	4 per card
Terminal Arrangement	Screw terminal to accommodate 0,5 mm² wire

3.2.3.5 I/O modules/general.

All terminations to cards will be removable without the necessity of disconnecting field wiring.

4 Programmable logic controller software design

4.1. This specification applies to all PLC software developed for the Siemens S7-1500 range of equipment. The specification is generic and where differences in functionality occur due to the variety of machines, these are detailed in the attached appendices.

4.2. The scope is applicable to the design, compilation, testing and commissioning of software modules, blocks, routines, sub-routines and data structures, which are to be loaded into the memory of a programmable logic controller.

4.3. This specification shall be read specifically in conjunction with SCADA Software Design to ensure that the PLC/SCADA interface is understood and complied to.

4.5 General requirements

4.5.1. All PLC software shall be designed in accordance with current technology, best modern engineering practices and shall comply with the requirements of this specification and the following specifications, standard, codes of practices and documents referred to herein;

4.5.2. IEC 1131-3 International Electrotechnical Commission Standard: Programmable Controllers Part 3: Programming Languages – 1993.

4.5.3. Where conflict exists between various specifications, standards and codes of practice the most stringent requirement shall apply.

4.6 Functional specification

4.6.1. The Contractor shall make himself/herself familiar with the functional requirements of the equipment to be controlled. This shall be in the form of a functional specification, or where this is not possible in its entirety, then functional clarification shall be carried out prior to commencement of work.

4.6.2. The functional specification and/or clarification shall be agreed with the Supervisor prior to commencement of software development.

4.7 Hardware configuration

4.7.1. The hardware configuration when using Siemens S7-1500, forms part of the total PLC software project. It shall be the responsibility of the Contractor to ensure that the configuration is correct and that all of the peripheral equipment connected and communicating with the PLC is accounted for in the hardware configuration.

4.7.2. The hardware configuration shall be agreed together with the Supervisor prior to commencement of any software programming.

4.8 Software language

4.8.1. The PLC software shall be written using the conventions of IEC 61131 – 3. The types of representations that will be allowed are as follows:

Table 5: Approved PLC Software Languages

4.3.1.1.1	Instruction list (IL, STL)
4.3.1.2	Function Block Diagram (FBD)
4.3.1.2	Sequential Flow Chart (SFC)
4.3.1.3	Structured Text (ST)

4.8.2. The use of Siemens Hi Graph shall be permitted where this simplifies the readability and functionality of the software. State diagrams with the transitions shall be adequately documented such that there is no ambiguity as to the process that is being executed.

4.8.3. The use of Siemens SCL (structured text) shall only be permitted where it significantly reduces the amount of program coding that it replaces.

4.8.4. The use of C++ high-level language will not be permitted.

4.9 Software documentation

4.9.1. Each and every network segment shall be designated with a meaningful header. Names shall not be duplicated even though the functions are similar. E.g. "Communications". The header shall be specific.

4.9.2. The use of network (segment) comments shall be used where complex logic exists or to describe the code if the functionality is not evident.

4.9.3. Free text comments and dialogue shall be used to describe part or parts of the program that cannot be easily detailed by the network header or comments, for example in a function block.

4.9.4. User defined data block words and instance data block words shall be commented. The description shall describe the word. Using the name only of the data word as its description shall not be allowed.

4.9.5. The software Contractor shall provide logic diagrams for all of the standard function blocks developed for Transnet Port Terminals Saldanha.

4.9.6. Function block numbering and naming shall follow a strict convention.

4.9.7. Symbolic (item) naming shall also adhere to Transnet Port Terminals Saldanha convention. Care must be taken if exporting and importing symbolic tables to ensure that the names and designations are completely transposable between the applications. Unused symbolic names and designations must be removed.

4.9.8. Where instance data blocks are associated with function blocks, the number of the data block shall be the same as the function block. Multiple instances shall be avoided in order to simplify the coding.

4.10 Software design

4.10.1. The software structure shall conform to the functional specification of the equipment. Functional areas, as defined by the Transnet Port Terminals Saldanha numbering and naming conventions shall form the basis of the program structure.

4.10.2. Cyclic program execution shall be implemented by the use of Organization blocks.

4.10.3. Interrupt processing shall be avoided unless absolutely necessary to fulfil functionality. The Contractor shall demonstrate the need to use interrupt processing prior to implementation.

4.10.4. Program logic shall be fail-safe and the convention of logic high for healthy shall be adopted. Under no circumstances shall a logic zero be used to initiate actions or sequences.

4.10.5. Parameterised function blocks shall have their input and output parameters logically grouped such that repetitive scrolling and paging when viewing the function on – line, is not necessary.

4.10.6. Where standard function blocks are used, and the functionality of a particular application does not require all of the parameters, then these parameters shall be suitably commented as not required.

4.10.7. A generic "First – up fault" function block shall be developed. Its purpose shall be to capture the initial cause of a failure such that the cause can be displayed and recorded. The fault shall remain in the fault state until acknowledged by the system.

4.10.8. The fault logic should be such that it is evaluated dynamically and therefore will continue to be processed after each acknowledgement. In this way fault conditions can be processed irrespective of their priority.

4.10.9. The Contractor shall provide a list of the parameterised faults together with the fault numbering and data block allocations.

4.10.10. Input /Output and I/O station numbering shall be consistent between equipment and machines. Functional areas of equipment and machines shall have I/O numbers allocated on a block basis. Sufficient numbers shall be allocated to allow for the most complex of machines with 20% spare capacity for future requirements.

4.10.11. Data transfer between the PLC and peripheral equipment (i.e. SCADA, TCS, etc.) shall be implemented using data words only. Direct access to input, output, and flag or marker area shall not be permitted. In the case of SCADA data, this shall be carried out using a single generic data block.

4.10.12. The power-on logic shall recover to a fail-safe, ready to start condition. It is the responsibility of the Contractor to ensure that equipment in the hardware configuration will allow the PLC to do this without compromising the integrity of the control system. After a power failure, recovery shall be automatic, and intervention shall not be necessary.

4.11 Software verification and approval testing

4.11.1. The Contractor shall verify the structure of the program with Transnet Port Terminals Saldanha representative and confirm the completion of the schedule of blocks.

4.11.2. The software shall be tested off-line using a simulation package to verify correct program functionality. The type of simulation package shall be agreed with Transnet Port Terminals Saldanha representative prior to testing.

4.11.3. The tests shall be carried out using the functional specification and the schedule of blocks.

4.11.4. The simulation testing shall be configured such that the equipment or machine process can be emulated using the simulation software to represent the process input and output environment. No interlocking shall be implemented in the simulation application. Apart from conventional sequence testing, various "what if" scenarios may be required to be tested to ensure correct software reaction. These tests shall be carried out at the discretion of the Supervisor but shall be documented by the Contractor.

4.11.5. The simulation testing shall be extended to include the SCADA integration. The Contractor shall supply a datagram listing detailing the data word allocations for this interface.

4.11.6. It is not practical to test the interface to Transnet Port Terminals Saldanha Terminal Control System in an off-line environment. As such, the testing at this stage will be limited to verifying the data block word and discrete bit allocations.

4.11.7. The Contractor is responsible to provide the approval test schedule, which will be signed off by the Supervisor on completion of the above tests.

4.12 Commissioning

4.12.1. Any testing, which could not be carried out during the software approval testing, shall be conducted during commissioning. Interfaces to Transnet Port Terminals Saldanha Terminal Control System shall be verified during this time. Cold and hot commissioning shall form part of the final approval tests.

4.12.2. The Supervisor shall witness the above tests and sign the approval test schedules.

4.12.3. On completion of final commissioning, the PLC software shall be loaded into non-volatile electrically erasable ROM media. The Contractor shall ensure that this software is not protected by password.

4.13 Drawings and documentation

4.13.1. The Contractor shall supply the complete Siemens project application and any additional or add – in modules or blocks, which were necessary to fulfil the Scope of Work. This includes third party modules such as GSD or configuration files and any applications that were developed to enable simulation testing. The above shall be provided on CD ROM media.

4.13.2. Software, which is necessary for the communications between the PLC and any other peripheral equipment, shall also be provided as part of the documentation package. This shall be supplied on the original media. The preference is a stand-alone once-

4.13.3. Documentation and programming manuals that are proprietary to the software shall be provided.

4.13.4. Software licenses applicable to any of the packages, modules, blocks, or required to execute the program functionality shall be provided. The Contractor shall be responsible to ensure that these are transferable to Transnet Port Terminals Saldanha.

4.13.5. This provision shall expressly constitute a term of any contract and as such subject to the Terms and Conditions of Purchase which shall apply.

5 Uninterruptable power supplies

This Specification covers the manufacture, supply, delivery and testing of uninterruptable power supplies to be used on all PLC controlled equipment

5.1 Design parameters

5.1.1 Input.

Voltage	220V AC ± 15%
Frequency	50Hz ± 4%
System	Single Phase and Neutral
– Protection Against transients with a peak value of 150-200 kV with a rising rate of 100 kV/Sec. – If this protection requires the use of an isolating transformer, details shall be provided.	

5.1.2 Output.

Voltage	220V AC ± 1%
Power Factor	0,8 to 1,0 (lagging)
Voltage Recovery	time with a 25%
Step Load	100ms (max)
Frequency	50Hz ± 0,5%
System	Single Phase
Rating	Suitably rated
Battery Standby	30 minutes

5.1.3 Load

5.1.3.1. The load shall comprise programmable logic controllers, computers, printers, programming equipment and monitors. This equipment can generate 3rd, 5th and 7th harmonic distortion. The UPS shall be so designed that these harmonics are not reflected at the output and that total harmonic distortion shall not exceed 5% at any load condition measured at the output of the UPS.

5.1.3.2. The above loads are designed to operate continuously but switching of single loads for maintenance can be expected.

5.1.3.3. The supply output from transformer, switchgear and protection circuit for the UPS needs to be suitably rated to allow worst case scenarios such as complete draining of UPS batteries. The in rush current needs to be accounted for.

5.2 No-break power supply

The equipment shall consist basically of:

- One set of batteries
- Battery charger
- Inverter
- Alarms and switching controls.

5.2.1 Battery specification

5.2.1.1. The batteries shall be of the sealed low-maintenance type.

5.2.1.2. It shall be preferred that the battery be housed in the same housing as the inverter and charger but if this is not practical then a separate battery cubicle is to be provided with its own double pole isolator.

5.2.1.3. All interconnections between batteries shall be such as to give the lowest volt drop and maximum corrosion resistance.

5.2.1.4. The battery output terminals shall be robust and adequately dimensioned for the output cable connections.

5.2.1.5. The minimum and maximum lifetime of the batteries shall be stated.

5.2.1.6. The number and capacity of cells or batteries shall be selected so as to provide, via the inverter, power for a period of not less than 30 minutes in the case of a mains failure.

5.2.2 Battery charger specification

5.2.2.1. The battery charger shall be of the constant voltage type, regulating to an accuracy of ±15%.

5.2.2.2. The battery charger shall have current limiting features, adjustable between 100% and 125% of full load output.

5.2.2.3. The voltage in the floating operating mode shall be such as to give maximum battery life and best charge conservation.

5.2.2.4. The battery charger shall be designed to recharge the battery, after a mains failure of the maximum time specified in paragraph 29.28.4.6 to 80% capacity within 10 hours, whilst also supplying the specified load.

5.2.2.5. The output(s) of the battery charger shall be connected in parallel to a set of batteries and a static inverter.

5.2.2.6. The battery charger shall be of the "soft start" type.

5.2.2.7. All heavy and large equipment, i.e., thyristors, capacitor banks etc., shall be easily accessible.

5.2.2.8. Facilities shall be provided for manually switching the charger to boost for deep charging facilities.

5.2.3 Inverter specification

5.2.3.1. The inverter shall have its own internal oscillator capable of maintaining the frequency within the limits specified.

5.2.3.2. The oscillator shall lock to mains if mains is available and run synchronous to the mains frequency.

5.2.3.3. In the event of a mains failure or out of specification, the oscillator shall be free running at a frequency of 50Hz ± 0,5%.

5.2.3.4. The output waveform shall be sinusoidal, and the maximum harmonic distortion shall be not greater than 5% at any load conditions within the rated capacity.

5.2.3.5. A static switch shall be provided which, in the event of inverter failure, automatically transfers the load to the mains. In synchronous mode such changeover shall be within 2m/secs. Should automatic synchronising fail, the unit shall have a manual facility to force the synchronisation.

5.2.3.6. The static bypass switch shall be inhibited when the inverter is not running synchronous to the mains.

5.2.3.7. The inverter shall be capable of withstanding an overload of approximately 15% for a period of 30 minutes.

5.2.3.8. The control circuitry shall conform to the electronic equipment specifications

5.2.3.9. All heavy equipment, i.e., transformers, shall be easily accessible.

5.2.4 Alarms and switching controls

5.2.4.1. All visual alarms shall be of the LED type. Red for fault condition, green for normal.

5.2.4.2. Local alarms that are to be displayed on the front panel are to include but not be limited to:

- Mains available/not available
- Battery charger available
- Inverter synchronised
- Load on mains
- Overload
- Inverter failure.

5.2.4.3. Remote alarms that are to be made available via a normally open contact closing under fault conditions are:

- Mains failure
- Battery charger failure
- Load on mains.

5.2.4.4. Indicator lamps shall burn continuously until the fault is cleared.

5.2.4.5. A muting push-button shall be provided for audible alarms.

5.2.5 Electronic equipment specification

5.2.5.1. Where electronic equipment is used in conjunction with electrical controls, such equipment shall be well screened and input-output protection against surge spikes up to 2kV at a rise time of less than 10msec shall be provided.

5.2.5.2. Where possible, electronic equipment shall be of modular construction on plug-in boards.

5.2.5.3. All connecting pins for current carrying contacts shall be gold plated.

5.2.5.4. All modules shall be clearly labelled in such a manner as to identify them against a circuit diagram reference.

5.2.5.5. The following technical information in addition to the circuit diagram shall be supplied.

- Set-up instructions
- PCB layouts
- Block diagrams
- Sequence of operations.

5.2.5.6. Potting or encapsulating of sub-assemblies shall be avoided.

5.2.5.7. Test points shall be provided where terminals are not provided.

5.2.5.8. PCB assemblies shall be protected from deposits of dust and moisture.

5.3 Construction

5.3.1. All steelworks shall be effectively treated against corrosion and painted in accordance with Transnet Corrosion Specification.

5.3.2. All cabinets shall be vermin proof.

5.3.3. Front access is required with cable access at the bottom.

5.3.4. Flexible wires shall be soldered directly onto terminals or shall have a crimped lug which is soldered onto a terminal or post.

5.3.5. Devices for retaining sub-assemblies, panels and cover-plates shall be of the captive type.

5.3.6. Self-tapping screws shall not be used.

5.3.7. Cooling fans are not preferred but if the equipment requires forced cooling, details shall be provided.

5.3.8. The heat generated by the equipment which has to be removed by external cooling, shall be stated in Watts.

5.4 Wiring

5.4.1. General purpose hook-up wire shall consist of stranded, tinned copper not less than 0,32mm² with thermo plastic insulation.

5.4.2. Shielded cables, single or multi-conductor, shall consist of stranded tinned copper not less than 0,16mm² for single conductors and not less than 0,32mm² for others.

5.4.3. All conductors and multi-conductor cables shall have insulation rated at 600V except for the following:

- Internal wiring on electronic panels shall have insulation adequate for the voltage on that wire. In no case shall insulation less than 300V be used.

5.4.4. Uninsulated conductors may be used where the method of securing insures adequate electrical clearance. (Such as busbars, resistors and capacitor leads, jumpers between adjacent terminals.)

5.4.5. All connections to terminals shall be readily accessible.

5.4.6. Internal wiring of electronic equipment shall be colour coded. The colour code shall be indicated on the circuit diagram.

5.4.7. All wiring that is not colour coded shall be numbered at both ends using ferrules. The numbering of such cabling shall be indicated on the circuit diagram.

6 SCADA software design

This specification covers the general and technical requirements for the design, supply and implementation of SCADA software for use at Transnet Port Terminals Saldanha.

6.1 General requirements

All SCADA software shall be designed in accordance with current technology, best modern engineering practices, and shall comply with the requirements of this specification and the following specifications, standards, codes of practices, and documents referred to herein.

6.2 Technical requirements

6.2.1 Duty.

SCADA systems are normally to be installed indoors in a suitable enclosure to provide either system status indication or supervisory control for Transnet Port Terminals operations and engineering maintenance personnel.

6.2.2 Type.

Transnet Port Terminals have adopted Win cc SCADA as the SCADA of choice unless specifically stated to the contrary.

6.3 Abbreviations & Acronyms

Table 6: SCADA abbreviations & acronyms

A or A	Description
A & Es	Alarms and Events
E	
ENG	Engineering

A or A	Description
F	
FGD	Functional Grouping Diagram
H	
HLS	Higher Level System
I	
I/L	Interlock
O	
OPS	Operations
P	
PLC	Programmable Logic Controller
T&P	
TPT	Transnet Port Terminals
S	
SCADA	Supervisory Control and Data Acquisition

6.3.1 Definitions

Table 7: SCADA definitions

Word	Definition
Developer	Refers to the person or company implementing or modifying the SCADA application
The Company	Refers to Transnet Port Terminals

6.3.2 Audience

6.3.2.1. This document is aimed at anybody who will be implementing a SCADA system or systems at the Contractor’s company.

6.3.2.2. Programmers of PLCs with which the SCADA exchanges data are also required to adhere to the PLC-SCADA interfacing.

6.3.2.3. Any other persons interfacing to the SCADA-PLC system should also consider the content of this document.

6.4 Design documents requirements

The design documents required before work on the SCADA can begin are specified here. All information contained in these documents should be used to ensure that the design meets the requirements of Transnet Port Terminals Saldanha.

Table 8: Design documents required on the SCADA

Description	Source
Process Description	Contractor-tippler Designer
Functional Grouping Diagram	Contractor-tippler Designer
Equipment & I/O List	Contractor-tippler Designer
SCADA-PLC Communications Data-Structure	Contractor-tippler Designer
• Specific Requirements: – Hardware & Networking Configuration – Operational, Engineering, Maintenance – Data Logging & Reporting – Higher Level System Interfacing – Access Levels Required for Different Screens etc.	Contractor-tippler Designer with inputs from The Company

6.4.1 Operational philosophy

6.4.1.1. The operational philosophy describes at a high level how the SCADA indicates process conditions and how it should interact with the various personnel.

6.4.1.2. The Operational Philosophy is arrived at by taking into account:

- The nature of the process or machine being controlled and whether it is manual, semi-automatic or fully automatic.

6.4.1.3. Personnel training levels.

6.4.1.4. The way that The Company's personnel perform their daily tasks with relation to the SCADA.

6.5 Personnel & training levels

This section lists all personnel who will be using the SCADA system. When designing the SCADA it is important that the personnel training levels and job descriptions be taken into account.

6.5.1 Operator.

- Has a minimum of Std 10
- Is literate
- Has little process or machine knowledge.

Tasks.

- Operation of the machine

- Is not required to investigate any faults. He notifies the supervisor of the problem by radio who then contacts a Millwright to rectify the problem
- Should be able to correct process problems with the help of the SCADA.

6.5.2 Millwright.

- Typically has an Electrical Diploma
- Mechanical & Electrical Knowledge
- PLC & Drives Knowledge.

Tasks.

- He is the 1st line of fault finding
- Can perform basic repairs i.e., Tripped Circuit Breakers, Fuses, Limit Switches etc;
- If he cannot diagnose and correct fault within 20 minutes we must call a Technician, or Mechanical / Engineering specialist.

6.5.3 Maintenance.

- Mechanical or Electrical Fitter.

Tasks.

- Electrical / Mechanical maintenance of the equipment.

6.5.4 Technicians.

- At least a Diploma (T3) or equivalent
- Varied levels of PLC & SCADA knowledge.

Tasks.

- Fault finding on breakdowns.
- PLC & SCADA maintenance and modifications.

6.6 Operations requirements

6.6.1. The operator should have a dynamic checklist for the start-up of the machine. The checklist will indicate which conditions / interlocks are OK and which are not. Detail reasons for the interlock not being healthy should be accessible from this screen. This functionality must enable him to bring the machine into operation quickly.

6.6.2. If the operator attempts to perform an operation and the operation is not possible or does not succeed, then this should be indicated to him by means of an unambiguous pop-up message stating the reason for the problem or failure.

6.6.3. Once running the operator's main screen will contain all information required for him to operate and monitor the machine. Any further detail required for operation will be contained on screens directly accessible from the main screen.

6.6.4. A short current alarm list is to be displayed on the main screen.

6.6.5. A screen containing operational performance information should be accessible from the main screen.

6.6.6. An annunciator screen should also be accessible from the main screen or displayed on a separate monitor.

6.6.7. The operator should not have access to any further screens that are not required for operations or could cause instability of the machine.

6.6.8. Operation should not be intuitive but clearly depicted.

6.6.9. The operator should have access to help screens and procedures on the operation of the machine.

6.7 Engineering requirement

6.7.1. This section lists the requirements of the Engineering Department who are concerned with the fault finding on the machine.

6.7.2. The following is required:

6.7.1.1. Technical Personnel should be able to access the full SCADA application by means of a log-on.

6.7.1.2. Access to detail machine screens for Interlocks overrides etc. by log-on.

6.7.1.3. Drill down from graphic overview of the machine. When tracing a fault, the drilldown should lead to the exact location of the fault.

6.7.1.4. The user should be intelligently routed to the problem area.

6.7.1.5. Historical Alarm, Event and Data Logging of specified variables.

6.7.1.6. Online access to documentation and help screens.

6.7.1.7. Access to Fault Fining Screens e.g Emergency Circuits.

6.7.1.8. Be able to disable pop-up messages.

6.7.3. The implementation of the engineering requirements should lead to SCADA design that enables the personnel to quickly diagnose any fault that might occur for which there is information available to the PLC, and therefore to the SCADA.

6.8 Maintenance requirement

This section lists the requirements of the Maintenance Department who are concerned with the maintenance of the machine. The following is required:

6.8.1. Should be able to access the maintenance functions by means of a log-on

6.8.2. Should be able to manually operate all equipment individually by means of a faceplate for each device

6.8.3. Any interlock preventing the device from starting should be available on a dynamic checklist available from the faceplate

6.8.4. All functions required for testing after maintenance should be available and these are specified under the machine's detail requirements

6.8.5. The functionality should enable the maintenance personnel to return the machine to a state that enables operations to begin.

6.8.6 Higher level system interface requirement

6.8.6.1. A higher-level system refers to any system that should receive data from the SCADA system. These systems are typically referred to as Level 3 and high systems in the automation pyramid.

6.8.6.2. The requirement is very machine specific but some general information is always required.

6.8.6.3. Typical data to be transmitted to HLS.

- Operational Performance Data.
- Downtime and Fault Information.

6.8.6.4. Typical data to be received from HLS.

- Operational Instructions.
- Operational and Machine Parameters.

6.8.6.5. Typical higher-level data that should be accessible on the SCADA.

- Long Term Historical Data.
- Electrical Drawings.
- General Procedural and Help Documents.

6.8.6.6. If there are any screens which display these interfaces and their status, they should be accessible to engineering personnel only.

6.9 Colour standards

6.9.1. The colour standards apply to all items displayed on the SCADA. Any colours used for dynamic displays are not to be used for colouring static real-world equipment.

6.9.2. Graphics, which are dynamic, meaning they can change state, should use the colours below to indicate their status.

Table 9: Dynamic graphics colours

Colour	Status Indication	Typical Use
Green	Healthy Ready to Start Safe Assigned to Route	Belt Alignment Switch, Pullcord Conveyor
Red	Running Active In-Use	Most Devices

Colour	Status Indication	Typical Use
	Danger	
Flashing Red	Alarm	Analogue Alarm
Magenta	Fault	Any fault
Blue	Local	When a device or function is in local
Cyan	Bad Data	When the indication is not reliable due to bad data

6.9.3. Graphics, which are static, meaning they do not change state, should use the colours below.

6.10 Standard screens, mimic hierarchy, menu structure and navigation

This section describes the standard screens, their layout and how the user navigates through them.

6.10.1 Main overview.

The main overview screen differs for the operations and engineering / maintenance departments. Both screens should have a group areas annunciator at the top of the screen, and if necessary, a menu bar at the bottom. The menu bar is only used when the group areas annunciator cannot contain the item due to space constraints.

6.10.2 Operations.

6.10.2.1. The operational overview contains only the operational data required for operation of the machine.

6.10.2.2. This could also be a graphical overview, provided that it is not too complex.

6.10.2.3. The screen should be kept simple and uncluttered.

6.10.3 Engineering / maintenance.

6.10.3.1. The Engineering / Maintenance overview is a graphical representation of the machine.

6.10.3.2. The user can then “jump” to the sub-area of the machine by clicking on it.

6.10.3.3. The sub-area of the machine should follow the same groupings as the Functional Grouping Diagram.

6.10.3.4. Problem areas are indicated by displaying a red flashing frame around them, on the Main Overview as well as on the sub-screens.

6.10.4 Group areas annunciator.

6.10.4.1. The group areas Annunciator is a screen, which occupies the top 10 % and full width of the viewing area and displays the overall status of all groups or areas of the machine.

6.10.4.2. The Functional Grouping Diagram should be used as a guideline for generating this screen. The devices or functions should be grouped so that no more than 8 groups are required.

6.10.4.3. If there is a problem in a particular group, then the black background behind each text should flash according to the colour standards. If the user is to click on the area, he must then be routed directly to the problem area.

6.10.5 Full annunciator screens.

6.10.5.1. The screen design is based upon the hardwired annunciator panels.

6.10.5.2. The status of a device is indicated by means of a red or green block which changes colour or flashes it's depending on the status.

6.10.5.3. The block also contains a short descriptive text.

6.10.5.4. An annunciator screen is made up of a number of these blocks, which are grouped according to the functions of the machine.

6.10.6 Dynamic checklists.

6.10.6.1. A dynamic checklist pop-up screen must be provided to indicate conditions (typically interlocks) that need to be satisfied in order to perform an operation.

6.10.6.2. The list must contain a description of each interlock with an OK indicator.

6.10.6.3. A green tick for OK and a red cross for Not OK should be used.

6.10.6.4. Making the text change with the state should also be used to make the checklist more helpful.

6.10.6.5. The conditions should be listed in decreasing priority.

6.10.6.6. The checklist's heading should include the operation or device name to which the checklist applies.

6.10.6.7. If the reason(s) for an interlock not being healthy is not obvious, then clicking on the particular interlock should route the user to the screen where he can see why the interlock is not healthy and perform the operation required to make the interlock healthy.

6.10.7 Faceplates.

6.10.7.1. Faceplates must be provided to display status information for a particular device or function.

6.10.7.2. The faceplate should list every function associated with the device and show the status of that function.

6.10.7.3. The status should be indicated by a digital indicator which is green when the status is active and off (grey) when inactive.

6.10.7.4. The faceplate should also contain all control buttons necessary for controlling the device or function, typically for mode changing, starting, and stopping.

6.10.7.5. The faceplate should, if necessary, contain one digital indicator for interlocks, or pre-start conditions, which, when "clicked", will display the devices or function's checklist.

6.10.8 Help screens.

6.10.8.1. Help screens must be provided to allow personnel to find faults and correct them.

6.10.8.2. Typically, the following headings are found on a help screen:

- General Information on New or Modified Equipment
- What To Do If …?
- How Do I …?.

6.10.8.3. The text should be stored in an open file format, the *.TXT, *.DOC or HTML formats would be acceptable.

6.10.8.4. The text for these documents should be obtained from a central repository if not in a central repository, then it must be available at the time, the facility should be there to easily move them to a central repository at a later stage.

6.10.9 Menu screens.

Menu screens must be made up of vertical groups of buttons which route the user to further screens.

6.10.9.1 Menu – For status screens.

Every status screen on the SCADA should be available from this menu.

6.10.9.2 Menu – For procedures, help and documentation.

All procedures help screens and documentation should be available from this menu.

6.11 Mimic hierarchy.

Operations and the Engineering / Maintenance Departments require different mimic hierarchies due to their different requirements.

6.11.1 Operations

The mimic hierarchy for operations personnel should be centred around operational information. Below is an example of a mimic hierarchy for operations personnel

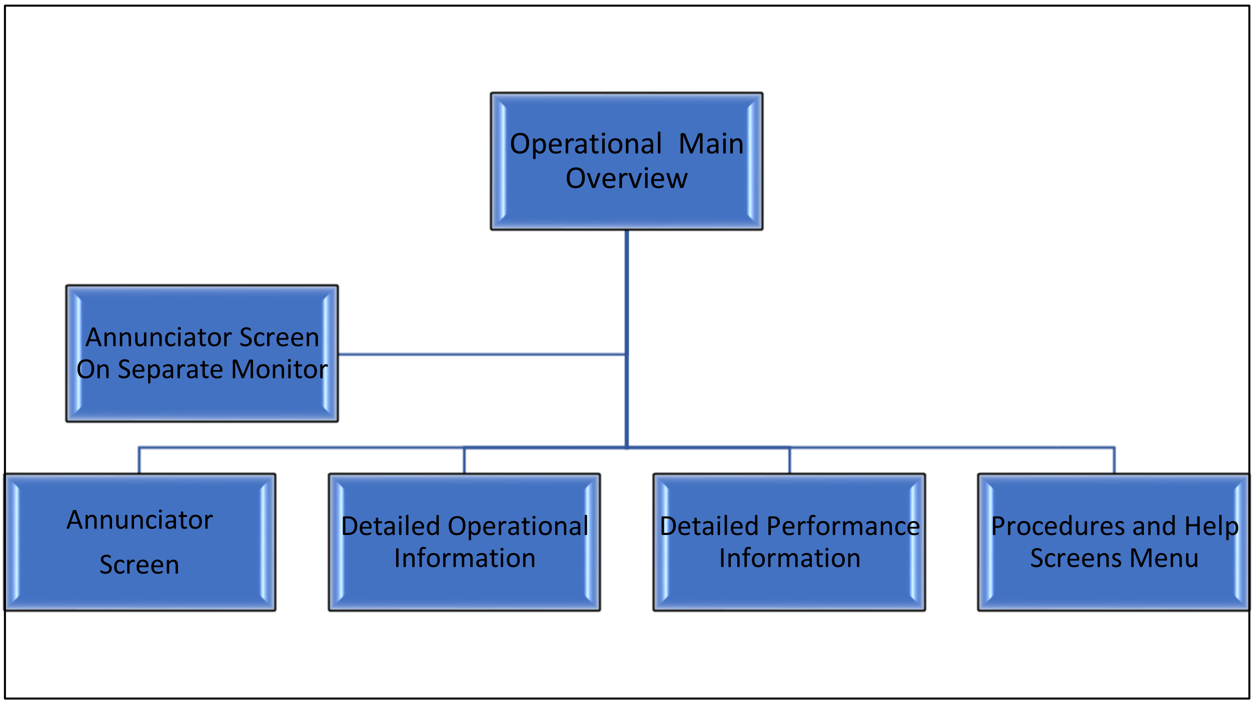

Figure 1: Mimic hierarchy for operations personnel

6.11.2 Engineering / maintenance

6.11.2.1. The Engineering / Maintenance mimic hierarchy should be centred on fault finding and maintenance.

6.11.2.2. The fault finding should be location based i.e. the user should be directed to the physical location of the problem.

6.11.2.3. The maintenance is also based on located and the user in this case should be able to find a device on the SCADA by knowing its physical location.

6.11.2.4. Below is an example of Engineering / Maintenance mimic hierarchy.

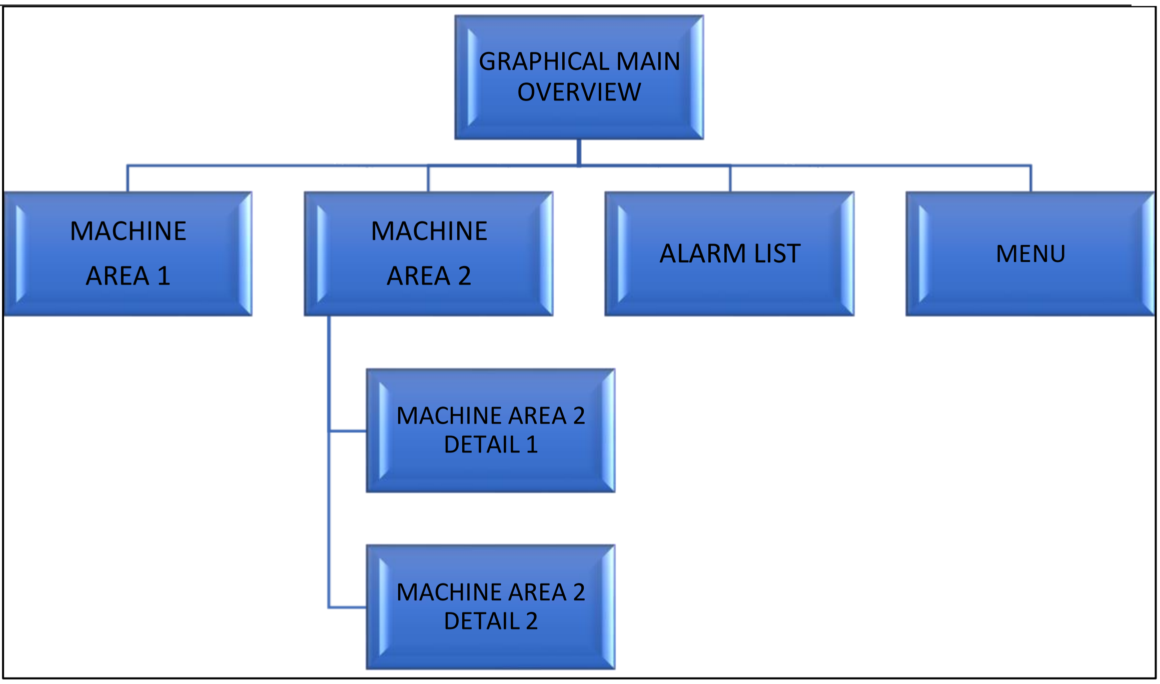

Figure 2: Engineering / Maintenance mimic hierarchy

6.11.2.5. The Functional Grouping Diagram should be used as a guideline to generate the mimic hierarchy.

6.12 Navigation

Navigation describes the way the user moves from one screen to the next. All navigation buttons which have common functionality should be located in the same place on the screen.

6.12.1. From the main overview.

6.12.1.1. From the Main Overview screen the user drills down to sub-screens. From any sub-screen the user should be able to return to the previous screen or to the Main Overview.

6.12.1.2. The buttons for these functions should always be located in the bottom right hand corner of the screen and should be clearly labelled.

6.12.2. From the group area annunciator.

6.12.2.1. The Group Areas Annunciator always remains at the top of the screen to indicate any problems in the other areas.

6.12.2.2. If there are no problems in a particular area and the user clicks on that area on the Annunciator, nothing should happen.

6.12.2.3. Only when there is a problem in that area i.e. the block is indicating a problem, is the user routed to a sub-screen where the problem can be seen.

6.12.2.4. When an engineer logs in the "problem only", routing is disabled, and the user is routed to the area even if no problem exists.

6.12.3. From pop-up screens.

6.12.3.1. Pop-up screens such as Checklists, Faceplates etc. appear on top and only cover a portion of the screen that is currently being viewed. These pop-ups should always have a button to close them again.

6.12.3.2. See the individual descriptions of the screens for further navigation details.

6.12.3.3. These screens must always appear at the same location, which is the centre of the screen.

6.13 Tag naming convention

6.13.1 Overview.

6.13.1.1. The Tag Naming Convention serves to uniquely and unambiguously identify and label all variables within the SCADA system.

6.13.1.2. It is also crucial that the naming used for the SCADA Tags ties up with the tag naming conventions used by other departments at The Company.

6.13.1.3. This ensures that all departments have a common point of reference when referring to equipment in the plant.

6.13.1.4. Further to identifying the equipment, each signal coming from or going to the equipment should be uniquely identified.

6.13.2 SCADA tag naming convention

Equipment Related Tagging.

6.13.3.1. The equipment related SCADA Tag Naming Convention uses a combination of:

- SAP Functional Location
- A Sub Section Identifier
- An Equipment Identifier
- A Signal Identifier
- An Optional Signal Modifier.

6.13.3.2. This forms a string of 32 characters, which must always be in capital letters.

6.13.3.3. The naming convention is formalised as follows:

AANNNN_AAAAAA		**-**	**AAAANNN**	**-**	**AAAANN**	**-**	**AA**
SAP Functional Location	Sub Section Identifier		Equipment identifier		Signal identifier		Signal Modifier

6.13.3 SAP functional location

6.13.4.1. The full SAP function location consists of a plant section e.g. Tippler and a sub section e.g. Ingo Grippers.

6.13.4.2. Only the plant section part is used as part of the Tag Convention. This part consists of three alphas and four numerics. For a Tippler this would be ____000x.

6.13.4.3. The SAP functional location should always be present in a Tag, even when the SCADA system being implemented is concerned with only one SAP functional location.

6.13.4 Sub section identifier

6.13.5.1. The sub section identifier consists of six (6) alphas. The six (6) alphas make u a unique string identifying a sub section of the functional location.

6.13.5.2. If a running number is required to identify many sub sections, then a running number can be used as the last alpha. If all alphas are not used, then the place holder _ (underscore) should replace them.

6.13.5.3. The table below gives some examples of the alpha part of the sub section identifier.

Table 10: Alpha Part Sub-Section Identifier

Alphas	**Description**
FIXSTA	Fixed Station
MCCSTA	MCC Station
POSTNR	Positioner
GRIPI	Grippers Ingo

6.13.5 Equipment identifier

6.13.6.1. The equipment identifier consists of four (4) alphas and a three (3) digit running number. The three (3) alphas describe the equipment type. If all alphas are not used, then the placeholder _ (underscore) should replace them.

6.13.6.2. The running number begins at 001 for each equipment type within the same functional location.

6.13.6.3. The table below gives some examples of the alpha part of an equipment identifier.

Table 11: Alpha Part Equipment Identifier

Alphas	**Description**
BAS	Belt Alignment Switch
CAM	CAM
CON	Conveyor
ZLS	Position Limit Switch
MOT	Motor
PMP	Pump
PB	Push-button
PCO	Pullcord
PLS	Pressure Limit Switch
TLS	Temperature Limit Switch
VLV	Valve
VSD	Variable Speed Drive

6.13.6 Signal identifier

6.13.7.1. The signal identifier consists of four (4) alphas and two (2) digit running number.

6.13.7.2. The four (4) alphas describe the signal type.

6.13.7.3. If all alphas are not used, then the placeholder _ (underscore) should replace them.

6.13.7.4. The running number begins at 01 for each signal type of a piece of equipment.

6.13.7.5. The table below gives some examples of the alpha part of a signal identifier.

Table 12: Alpha part of a signal identifier

Alphas	Description
II_	Current Indication
MCB	Main Circuit Breaker
OVL	Overload
PV_	Process Value
RFB	Running Feedback
SPT	Setpoint

6.13.7 Signal modifier

6.13.8.1. The signal identifier consists of two (2) alphas.

6.13.8.2. If all alphas are not used, then the placeholder _ (underscore) should replace them.

6.13.8.3. The signal modifier is used when the signal identifier does not provide the necessary detail to describe the signal fully and uniquely.

6.13.8.4. The table below gives some examples of the alpha part of a signal modifier.

Table 13: Alpha part of a signal modifier

Alphas	Description
HH	High High Limit
HI	High Limit
LL	Low Low Limit
LO	Low Limit
TI	Timer

6.13.8 Internal tagging

6.13.9.1. Internal tagging is concerned with the tagging of SCADA variables that are not directly related to equipment in the field.

6.13.9.2. These variables are either internal to the SCADA or generated by the PLC and read by the SCADA or vice versa.

6.13.9.3. Typical application of these tags is in defining the various phases of a sequence of events.

6.13.9.4. The naming convention is formalised as follows:

AANNNN_AAAAAA		-	AAAANNN	-	AAAANN	-	AA
SAP Functional Location	Sub Section Identifier		Equipment identifier		Signal identifier		Signal Modifier

6.13.9 SAP section identifier

The table below gives some examples of the alpha part of an internal sub section identifier.

Table 14: Alpha part of an internal sub section identifier

Alphas	Description
SYSTEM	Internal System Tags
SEQNCS	Sequences
TIMERS	Internal Timers

6.13.10 Function / equipment identifier

6.13.11.1. The function / equipment identifier consists of three (3) alphas and a two (2) digit running number.

6.13.11.2. The three (3) alphas describe the function type.

6.13.11.3. If all alphas are not used, then the placeholder _ (underscore) should replace them.

6.13.11.4. The running number begins at 01 for each function type within the same functional location.

6.13.11.5. The table below gives some examples of the alpha part of a function identifier.

Table 15: Alpha part function identifier

Alphas	Description
GRP	Group
PID	PID Control Loop
SEQ	Sequence

6.13.11 Signal identifier

6.13.12.1. The signal identifier consists of three (3) alphas and a one (1) digit running number.

6.13.12.2. The three (3) alphas describe the signal type.

6.13.12.3. If all alphas are not used, then the placeholder (underscore) should replace them.

6.13.12.4. Signal identifiers used for equipment tagging could also be used here.

6.13.12.5. The running number begins at 1 for each signal type of a function.

6.13.12.6. The table below gives some examples of the alpha part of a signal identifier.

Table 16: Alpha part signal identifier

Alphas	Description
ILK	Interlocked
PAS	Paused
PDC	PID Differential Constant
PIC	PID Integral Component
PPC	PID Proportional Constant
SNO	Step Number
SPD	Stopped
STG	Starting
TI	Timer

6.13.12 Signal modifier

6.13.13.1. The signal identifier consists of two (2) alphas.

6.13.13.2. If all alphas are not used, then the placeholder _ (underscore) should replace them.

6.13.13.3. The signal modifier is used when the signal identifier does not provide the necessary detail to describe the signal fully and uniquely.

6.13.13.4. The table below gives some examples of the alpha part of a signal modifier.

Table 17: Alpha part signal modifier

Alphas	Description
HH	High-High Limit
HI	High Limit
LL	Low-Low Limit
LO	Low Limit

6.14 Device symbols

Device symbols are to be used to represent dynamic real-world equipment. As a general rule these symbols will be displayed in the following colours:

Table 18: Device symbols colours

Colour	State
Orange	Default
Green	Healthy
Red	Activated
Flashing Magenta	Faulty

6.14.1 Plant equipment symbols

6.14.1.1 Pullcords

Symbol Colour- Body is green when healthy and flashing magenta when not healthy

- Dynamics

  None

6.14.1.2 Belt alignment switches

Symbol Colour- Body is green when healthy and flashing magenta when not healthy

- Dynamics

  None

6.14.1.3 Emergency-stop

Symbol Colour- Body is green when healthy and flashing magenta when not healthy

- Dynamics

  None

6.14.1.4 Flap detector

Symbol Colour- Body is green when healthy and flashing magenta when not healthy

- Dynamics

  None

6.14.1.5 Speed switch

Symbol Colour- Body is green when healthy, red when activated and flashing magenta when not healthy

- Dynamics

  None

6.15 Indicators, messages, and descriptive texts

6.15.1 Overview.

Up until this section no mention has been made of how the indicators and messages, which will appear on many of the standard screens as well as custom screens, should be displayed and animated. This section deals with the details of indicator and message displays namely:

- Appearance
- Colour
- Animation
- Location.

6.15.2 Indicators.

Two (2) types of indication are required: - digital and analogue.

6.15.2.1. Digital indicators are SCADA graphics that are typically not representative of the status of physical equipment but rather indications of the status or value of system or abstract variables.

6.15.2.2. Digital indicators do not use the device symbols.

6.15.2.3. A typical example of a digital indicator is the display technique used on the standard annunciator screens.

6.15.2.4. Analogue indicators display a continuous value which could be representative of physical equipment status or of an internal variable or status.

6.15.2.1 Digital indicators.

a. **On process graphical screens**.

Digital indicators should only be used on graphical process screens when there are no device symbols that could be used to display the status. They should not be used to indicate the status of real-world equipment, where device symbols are better suited.

b. **On process status screens**.

i. On process status screens, only indicators should be used e.g., Annunciator Panels and Faceplates.

ii. Typical discrete that require status indication are:

- System Status

- Sequence Status
- Sub System Status.

iii. On a process screen the equipment would typically be shown as it actually looks, using device symbols, and on a status screen only the status is shown, using indicators.

iv. The indicator must take the form of a rectangular block with a thick black border.

v. It should differentiate between changes in state by means of the fill colour.

vi. The colours used should adhere to the colour standards described above.

vii. A digital indicator can indicate more than two (2) states by means of multiple colours.

viii. An exception to these rectangular block indicators is the tick / cross indicator used on checklists.

6.15.2.2 Analogue indicators.

The following methods of displaying an analogue value are permitted:

a. **Text value readout**.

i. Text value readouts should typically be used when space is at a premium. This applies typically on graphical process screens.

ii. The value display should be contained in a recessed black background box with the text in white. If the analogue value is in alarm the background should be displayed in red. If the reading is unreliable or faulty the background should flash magenta. The units of the analogue value should be shown to the right of the recessed box.

b. **Bar graphs**.

Should be used on analogue value detail faceplates. The bar graph must have a scale on the left and the value should also be indicated as a text value readout underneath the bar graph. The bar graph fill colour must be green for healthy values and red for alarm values. The background of the bar graph should be black. If the reading is unreliable the background should flash magenta.

c. **Dials**.

i. Dials or meters should be used when the analogue value lends itself to being displayed in this way.

ii. Typical examples are:

- an angle measurement
- a current (ampere) measurement.

iii. As these indicators require huge amounts of screen space, they should be limited to detail screens and not main process screens, unless essential.

iv. The value should also be indicated as text value readout underneath the dial or meter. If the analogue value is in alarm, the background of the dial or meter should be displayed in red. If the reading is unreliable the background should flash magenta.

v. If the user is logged on as an Engineer, he/she should be able to click on the analogue display to call up the analogue detail display to adjust the analogue settings. The analogue settings available should be as follows:

- Low Low-Alarm Enable and Value
- Low Alarm Enable and Value
- High Alarm Enable and Value
- High High-Alarm Enable and Value
- Alarm Dead band
- Deviation Alarm Settings
- Rate of Change Alarm Settings.

6.15.3 Messages.

Messages are defined as text strings which denote the status of a device/function or warn of the failure of a device/function. They can be dynamic or placed on a screen that appears dynamically. Messages should only be used when a device symbol or digital indicator would not suffice. All text should be configured according to section 0".

6.15.3.1 Windows based.

Dynamic text placed on windows should be displayed in a recessed white background box with the text in black. The background colour of the box should change to indicate state. The colour and text content should be indicative of the state and should adhere to the colour standards discussed above. The text content should be short and concise. Text should be used on detail screens mainly and only on main process screens when absolutely essential.

6.15.3.2 Pop-Up.

Pop-up text messages are presently used for critical failures and as an aid for starting up the machine. The operational philosophy determines when these should be used. The text should be red on a white background.

6.15.3.3 Static descriptive texts.

Static descriptive texts are defined as text that does not change dynamically, in either content or colour. The text serves purely a descriptive role. The text should be short, concise, and black in colour.

6.16 Alarms & events

6.16.1 Overview.

This section describes how Alarms and Events should be configured at the SCADA level. The prescribed method for handling alarms and events, however, also impacts on the way the PLC software is implemented.

6.16.2 Alarm & event philosophy.

6.16.2.1 Alarms.

An Alarm is defined as an abnormal condition, which requires the immediate attention of the operator so that he may take corrective action. They may also indicate system failures, which will result in the inoperability of the process. All Alarms should be immediately displayed and logged to history.

6.16.2.2 Events.

a. An Event is defined as a normal condition, which is mainly for operator or technical information. If the Event is important to the operator, then he should be notified immediately. If the Event is for technical personnel, then the operator should not be aware of the event. In both cases the Event should be logged to history.

b. The SCADA system should be notified of all Alarms and Events by the PLC. All Alarms, and in some cases Events, should be latched in the PLC to ensure that the SCADA does indeed receive and record them.

c. The result of the Alarm and Event implementation should be:

   i. Alarming which enables the operator to quickly identify faults

   ii. Alarming which enables the technical/electrical to quickly identify & rectify faults

   iii. An Alarm history, which enables technical/electrical personnel to successfully, analyses past faults

   iv. An Event system which informs the operator of important events which concern him

   v. An Event history, which enables technical/electrical personnel to successfully, analyse the operation and performance of the machine.

6.16.3 Analogue and trip alarming.

Analogue alarming is to be performed by the SCADA and the trip condition due to the analogue alarm in the PLC. The trip condition should also be alarmed on the SCADA. The analogue limits should be written to the PLC from the SCADA so that the PLC may perform these functions.

6.16.4 Alarm & event grouping & priority.

6.16.4.1 Grouping.

a. Alarms and Events should be grouped into logical areas. These areas should be based on the Sub Section Identifiers described in section Error! Reference source not found.", with the possibility of subgroups.

b. A system group should be created to cater for all system events i.e. Communications Failure. On larger systems it might be necessary to break down the system group into further subgroups.

6.16.4.2 Priority.

All Alarms and Events should be prioritised according to their severity and importance. The following prioritised list, in descending order, should be used as a guideline.

Table 19: Alarms and events priority group

Priority Grouping	Description
100	Messages
200	Alarms
300	Events

6.16.5 Operational alarms & event display.

a. Alarms and Events (A&Es) used for operation should list current conditions and be easily accessible from the main operational overview. The use of operational A&Es would typically be to indicate the completion, or the failure to complete, an operation. These A&Es typically apply only to process problems and not to equipment failures.

b. The Operational Alarm display should contain the following:

- Date and time of the condition
- Alarm Type
- Description
- Value.

c. The entries should be fixed width formatted so as to form columns under the headings.

d. The Colour of the entries should be according to the following list:

Table 20: Colours of Event Entries

Event Type & State	Colour
Alarm – Unacknowledged	Bright Magenta
Alarm – Acknowledged	Dark Magenta
Event	White

6.16.6 Technical alarms & events display

a. These "after the fact" A&E's enable the user to trace the source of an equipment failure. The implementation of a "first-up" A&E scheme is important to enable determination of the root-cause of the problem. The chronological order of A&E's is therefore important. This type of A&E scheme is best implemented by tight integration with the PLC software.

b. By applying the correct A&E scheme for the above, the analysis of A&E's becomes easy. Specifying any additional A&Es required for this purpose is a bit more difficult as it requires an intimate knowledge of the process or machine.

c. The Technical Alarm display should contain the following:

- Date and time of the event
- Alarm Type
- Group name
- Description
- Value.

d. The entries should be fixed width formatted so as to form columns under the headings. The user should be able to filter the alarms and events that are displayed according to group and priority, using a simple list selection technique.

e. The Colour of the event entry should be according to the following list:

Table 21: Colour of Event Type & State

Event Type & State	Colour
Alarm – Unacknowledged	Bright Magenta
Alarm – Acknowledged	Dark Magenta
Alarm – Reset	Green
Event	White

f. The background of the display should be black.

6.16.7 Alarm acknowledging.

a. Alarm acknowledging serves the purpose of making sure that the operator or user confirms that he has seen and attended to the alarm condition. It also serves to reset the latch in the PLC where applicable. The condition should first be reset in the field before the user can acknowledge and clear the alarm.

b. The user should only be allowed to acknowledge the alarm if he has the necessary privilege level.

6.17 Scripting or coding.

6.17.1. All scripting or custom coding should be kept to a minimum.

6.17.2. Where scripting is used it is to be clearly commented so that the purpose of the scripting is clear.

6.17.3. Where sub routines are used these are to be documented as part of the As Built documentation. This documentation should detail the following:

- Sub-routine name and description of function it performs
- Passed Parameter List with Data type and description
- Returned Values with Data Type and description
- Any affected variables or data and description of the affect.

6.17.4. Where the code calling structure is complex, it should be documented by means of a diagram.

6.18 Trends

6.18.1 Overview.

Trending should provide the operator with the necessary information to enable him to keep the process operating efficiently and within parameters. Trending should provide the technical personnel with the necessary information to enable them to monitor and analyse the performance of the relevant equipment and processes

6.18.2 Colour schemes.

The trend display should have a black background. The pen colour for each trend value can be chosen freely provided that it is easily visible on the background. Where printing of the trend is required, the background should be changed to white when printing.

6.18.3 History keeping.

History keeping periods and details will depend on the detail requirements. A minimum of 4 days is required.

6.18.4 Trend display and manipulation.

a. The following functions should be available on trend displays:

- Start and End Date and Time Adjustment by entry or by period
- Range Adjustment by Cursor
- Left and Right Panning
- Rubber Band Zooming, X & Y
- Updating Indication.

b. The following should be displayed on or next to the trend display:

- A legend containing the colour, tag and description of each pen
- The X scale and divisions
- The Y scale and divisions.

c. The trends should be printable by the click of a button.

d. The user should also be able to dump the trend data to a text file by the click of a button.

e. These options should both be password protected.

6.19 Security

6.19.1 Overview.

The SCADA should be operable without a user logged on, but with limited capability. All system and technical functions should require a technical person to log on.

6.19.2 Privilege levels.

The following privilege levels should be used:

Table 22: SCADA privilege levels

Level Group	Personnel Access	Functions Available
1	Guest	View Only
2	Operator	Operations / Control
3	Artisan	Operations / Control Detail Diagnostic Screens
4	Maintenance	Manual Functions
5	Technician	Full System Control
6	Administrator	Full System Control Administrative Functions

6.19.3 Single action logons.

Single action logons should be used wherever there is a need for a user to log on to perform a single operation and then for the system to automatically return to its previous logged on user e.g., to override an operational interlock.

6.19.4 Log on/off method.

It is intended that personnel will use a Smart Card to log onto the system. The user will remain logged on as long as his card is inserted. The normal user/password logon shall server as a backup to the card logon system in case of lost or forgotten cards. For the moment no logon will be required for levels 1 & 2 and further levels will use the standard user/password mechanism.

6.20 Scada to PLC communications

6.20.1 Overview.

SCADA to PLC communications structuring is important to optimise the communications channel. Proper structuring of the channel will result in faster update times and therefore raise the value, on a time basis, of all data obtained from the PLC. From the SCADA point of view the following types of data are communicated with the PLC:

6.20.1.1 Read up from the PLC:

- Digital Indications – Read up on display

- Digital Alarms & Events - Read up periodically
- Digitals for Logging - Read up periodically
- Analogues for indication - Read up on display
- Analogues for alarming, trending & logging - Read up periodically.

6.20.1.2 Written down to PLC:

- Digital Commands – Written on change
- Analogue Set points – Written on change.

6.20.2 Block and data areas

The following block and data area groupings are prescribed:

6.20.2.1 Input block.

Table 23: Input block area groupings

Group	Group Members
Fast Digital Input Area	• Digitals for Alarms • Digitals for Events • Digitals Used as Triggers • Logged Details • Any Other Digital That Is Continuously Polled By the SCADA
20% Spare	
Fast Analogue Input Area	• Analogues for historical trending/logging • Analogues with alarms
20% Spare	
Possible Block Break Due to Space Limitations	
Slow Digital Input Area	Digital Indicators Grouped According to Sub Section
20% Spare	
Slow Analogue Input Area	Analogue Indicators Grouped According To Sub Section
20% Spare	

6.20.2.2 Output block.

Table 24: Output block area groupings

Group	Group Members
Digital Output Area	Digital Commands
20% Spare	
Analogue Output Area	Analogue Set Points
20% Spare	

6.20.2.3. A further two block areas will be provided for SCADA implementations that require access to PLC inputs and outputs.

6.20.2.4. The input and output images should be marshalled directly into "data blocks" to be ready by SCADA.

6.20.2.5 Input image block.

Table 25: Input Image Block

Group	Group Members
Input Image	Digital Inputs
20% Spare	

6.20.2.6 Output image block.

Table 26: Output Image Block

Group	Group Members
Output Image	Digital Inputs
20% Spare	

6.20.3 Communications status monitoring

29.30.37.1. The operator should be notified immediately and clearly if there are any communications failures. All communications faults should be logged for technical personnel.

29.30.37.2. If degradation of the communications channel affects the validity of the data obtained via the channel, then all this data should be displayed as unreliable where, ever it is used.

6.21 Data logging and reports

6.21.1 Overview.

6.21.1.1. The Data logging requirement can be divided into two: -

- Logged data for use locally on the machine. For trends, alarms & events, production performance
- Logged data for use by a higher-level system. For Production performance, Stoppages, Analysis.

6.21.1.2. Data duplication should be avoided "at all costs".

6.21.1.3. The process being controlled will determine the requirements for data logging. It is the Developers responsibility to make up a list, where none exists, of all the values that could be logged. This list must then be submitted to The Company. The Company will then mark off, on the list, the values that are to be logged. Other specific requirements can be found in section 0".

6.21.2 Local vs higher level system data logging.

6.21.2.1. All history data required regularly by the operator should be logged locally. All history data that enables the technical staff to diagnose faults should be logged locally. If the higher-level system has a very high availability, then the data could be logged there.

6.21.2.2. All other data should be logged to, or by, a higher-level system if said system is available.

6.21.3 The data repository.

6.21.3.1. The Data Repository must be configured to automatically overwrite older data when either a specified time elapses or the hard drive storage space becomes depleted.

6.21.3.2. It must also be possible to back-up the data while the storage system is running. The data must be easily extractable using off-the-shelf open software.

6.21.3.3. An efficient and simple means of transferring the data to other computers should be made available.

6.21.4 Reporting.

6.21.4.1. Reports should be available from the two data repositories. Standard on-screen reports should be available to the operator so that he and his supervisor can evaluate his performance.

6.21.4.2. As a minimum, a shift report should be made available with all relevant parameters reported on.

6.22 Quality control

6.22.1 Overview.

It is crucial that Q.C. be conducted while the SCADA is in its development phase as well as after the SCADA has been commissioned. This will ensure that the SCADA meets and maintains the requirements of The Company.

6.22.2 Testing.

Testing should be performed in the development phase at regular intervals to ensure that:

- The SCADA is being implemented according to the Specification
- Any bugs or mistakes are corrected before commissioning
- The commissioning time is reduced.

6.22.3 System testing.

6.22.3.1. During development of the SCADA, the Developer should, at regular intervals, use process simulation to check the design of the SCADA application. The simulation should incorporate verification of the PLC software and its integration with the SCADA application as well. The simulation should therefore be applied at Input / Output level to the PLC. It should also simulate the real-world process as accurately as possible. All interlocks critical systems and abnormal conditions shall be tested.

6.22.3.2. The final testing before commissioning should comprehensively test all parts of the system. Only those tests, which can be performed on the actual equipment, shall be left for commissioning.

6.22.4 Witness testing.

6.22.4.1. Witness testing will be performed at intervals dictated by the project schedule. A representative of Transnet Port Terminals Saldanha will verify each and every part of the system design will attend these tests. The representative will then sign approval of the parts of the system or request the relevant changes to be made. The witness test documentation will consist of a checklist containing all parts of the system with the following indicated:

- Part Description
- Tick/Cross box
- Comment field.

6.22.4.2. The comment field will contain information on which the Developer should act.

6.22.4.3. Changes requested will be reviewed at the next Witness Test.

6.22.4.4. It is the developer's responsibility to ensure that the changes that are implemented do not cause other problems in the system.

6.22.4.5. A post-commissioning test will be conducted to review that any on-site modifications have not affected the systems accuracy or resilience to fault conditions.

6.23 Configuration management & change control

6.23.1 Supplied software.

6.23.1.1. The Developer shall supply The Company with three copies of the as built software & documentation as follows:

- Copies on CD – Software and Documentation
- Paper Copies - Documentation only.

6.23.1.2. All documents and software to be marked "As Built Rev 0.0".

6.23.1.3. All Standard Software and Licences required for the system are to be supplied to The Company in the original packaging with the standard documentation.

6.23.2 Directory structure.

6.23.2.1. The hard drive of the computer finally running the system should be divided into two (2) partitions, one for executable software and one for the application specific software.

6.23.2.2. The Directory structure of the installed application specific software should be as follows:

Table 27: Directory structure

Directory	Description
$ROOT$\DATA_APP\	All Application Specific Data Which Is Not Standard Software Data to Be Stored here
$ROOT$\DATA_APP\SCADA\	The SCADA Application
$ROOT$\DATA_APP\ALRMLOG\	The Historical Alarm Log Files
$ROOT$\DATA_APP\TRNDLOG\	The Historical Trend Log Files
$ROOT$\DATA_APP\DATALOG\	Other Logged Data
$ROOT$\DATA_APP\IOSERVER\	All I/O Server Related Data
$ROOT$\DATA_APP\DOCS	Any Online or Reference Documentation

6.23.2.3. All executable and associated software to be installed in the windows "Program Files" directory.

6.23.3 Copies & back-ups.

6.22.3.1. Keeping back-up copies must serve the following purposes: -

- Protecting the Company's intellectual property
- Enabling disaster recovery
- Being able to return to previous revisions should new modifications prove problematic?

6.22.3.2. The following back-ups are to be maintained:

- Master Copy - Off-site Zip Drive or CD's - Kept in fireproof Safe
- Back-up Copy- On-Site Zip Drive or CD's - Kept in fireproof Safe
- Working Copy – On-Site Zip Drive or CD's - In Application Managers Possession.

6.22.3.3. The Working Copy should always contain the latest live application. Each master copy should contain at least the three last major revisions with all minor revisions. The Master Copy and Back-up copy should be updated with the latest applications every month, in the case of minor revisions, or within a week of testing and implementation of a major revision.

6.22.3.4. The Working Copy should be the working master and could be stored on a file server, which is backed up daily, while modifications are being made. The directories on the server should be the same except for the root directory which should be the following-:

Table 28: Root directory information

Directory	Used For
\Working|	Latest Copy of Data Directory as Running Live for Quick Restore Capability
\Develop\	A Working Directory Containing the Application While Under Development
\Backups\Vers X_Y	Previous Revisions
\Docs\	Contains Revision Independent Documentation

6.23.4 Change Control.

6.23.4.1. Any modifications, no matter how small, made to the SCADA system design should be logged in the Revision Log and all Configuration Management functions performed and ticked off therein.

6.23.4.2. An up-to-date Revision Log should be stored in the \DOCS\ directory as stated in section 0". The Revision log should contain the following information: -

- Date of Implementation or Going "Live"
- New Revision Number
- Developer Name
- List of & Reasons for each modification
- Tick boxes

- Previous Revision Backed up
- New Revision Backed up on Server under \Working
- Development Directory Deleted
- Backed up to The Working copy
- Backed up to The Backup copy
- Backed up to The Master Copy.

6.23.4.3. This Revision log should be kept meticulously up to date.

6.24 Miscellaneous items

6.24.1 Fonts.

The only allowable font will be: -

- True Type Arial
- Size used should make text clearly legible
- When smaller fonts are required, Small Fonts should be used.

6.24.2 Multimedia.

Generally, no multimedia should be used unless stated otherwise in the detail requirements section.

6.24.3 Bullet-proofing.

The "Live" application should not allow the user to access the underlying Operating System. He should also not be allowed to perform any functions, which could render the system unstable. Should access to these kinds of functions is required due to a specific requirement then they should be protected by password. Other requirements:

- On reboot the user shall be logged on automatically
- The system will automatically boot into the correct runtime application
- No games will be installed
- The operator should not be able to interfere with the boot process.

6.25 Generated design documents summary.

The following As-Built documentation is to be supplied to Transnet Port Saldanha within 1 Month of Hand-over to Production:

Table 29: SCADA As-Built documentation

Document Type	Responsible Person
Security Levels and Privileges List	Developer
Alarm & Event Grouping & Priorities List	Developer
SCADA-PLC Communications Data-Structure	Developer
Higher Data Logging Structures or Flow	Developer

Document Type	Responsible Person
Operating & Maintenance Manuals	Developer
Complex Systems Documentation	Developer
Master User / Password List	Developer
Supplied Software List	Developer

6.26 Training

6.26.1 Operational.

6.26.1.1. The developer shall be obliged to give training to the Training Supervisor who will in turn train the operators. The Operating Manuals shall form the basis of this training.

6.26.1.2. The training shall make use of the simulation model used for testing. The developer shall ensure that at the end of the training period the Training Supervisor: -

- Knows the purpose and content of all operations screens
- Knows how to access all functions required to operate the machine
- Knows where to find the checklists and online help functions.

6.26.2 Technical.

6.26.2.1. The developer shall be obliged to give training to members of The Companies technical staff. The Operating and Maintenance Manuals shall form the basis of this training.

6.26.2.2. The training shall only deal with application specific topics and not with general software topics. The developer shall indicate to The Company, at commencement of the project, what standard software training does the technical staff in order for them to use and manage the system requires. The developer shall ensure that at the end of the training period the technical staff: -

- Know the system architecture
- Know the purpose of all screens on the SCADA
- Know where to look for faults in case of breakdowns
- Are able to restart the system in case of failure.

PART C3: SCOPE OF WORK

Annexure C - Technical Specification: Dust Extraction/Handling Plant

Document Reference	**Title**	**No of page**
	This cover page	1
C3.1	*Employer's* Works Information	
	Total number of pages	**26**

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Title		**Title**	
Project Manager Signature		**Head of Projects Signature**	
Name		**Name**	
Title		**Signature**	
Approver signature			
Name			
Title			

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Tables

1 Introduction

1.1 Purpose

1.1.1. This specification sets out the minimum technical requirements for quality and workmanship for all necessary engineering, design, management and co-ordination, supply of all drawings, manuals and documents, supply of materials plant and labour for the manufacture, construction, erection, testing and commissioning of the Dust Extraction and Collection System and all associated auxiliary equipment by a suitable Contractor.

1.1.2. This specification shall be read in conjunction with Document Number 1924701-2-211-M-SP-0003: Technical Specification for the design, manufacture, construction, erection, testing and commissioning of a Dual Wagon Tippler 3, Feed Hoppers, Apron Feeders and Dust House for the Port of Saldanha.

1.2 Equipment Scope of Supply

1.2.1. The scope of this specification comprises the design, supply, fabrication, shop assembly and testing, surface protection, packaging, delivery, installation, and commissioning of new Tippler Bag Houses as specified in the datasheet, including all necessary ancillary equipment in accordance with:

1.2.1.1. This specification

1.2.1.2. The equipment datasheet included in Annexure O of the Works Information

1.2.1.3. The Contractor Documentation Schedule list in Annexure A of the Works Information.

1.2.2. The Contractor shall provide the specified equipment in accordance with the intent and the provisions of this specification, and all other documents, codes, standards, and requirements referred to or included in this specification.

1.2.3. Obligations not expressly mentioned in the specifications, but which are necessary for the provision of complete operational equipment, ready to install and commission, shall be deemed to be included in the contract at no additional cost to the Employer.

1.2.4. The Contractor shall provide all resources, technology, processes, plant, equipment, materials and support facilities, necessary to provide the specified equipment to the Employer, including but not limited to, engineering, planning, supply of material, temporary work, warehousing, labour, supervision, fixed equipment and plant, infrastructure, emergency and first aid facilities, tools, miscellaneous materials, minor parts, communications, services and each and every item of expense, unless expressly excluded from the scope of supply in the provisions set out hereunder.

1.3 Scope of Equipment Supply Included

The scope of work shall include the design, supply of all materials, inspection, testing, and installation and commissioning of the following:

1.3.1. Complete dust collection equipment, including insertable bag dust collectors, exhaust fans, drives and rotary valves

1.3.2. Clean side ducting, silencers, and discharge fan

1.3.3. Compressed air systems, including compressors, driers, filters, air receivers, monitoring instrumentation and pneumatic controls

1.3.4. Access Platforms

1.3.5. Electric motors

1.3.6. Agglomerator or pug mill unit with water spray header for individually activated spray nozzles along with screw conveyor to the closest conveyor belt

1.3.7. Dirty side ducting, including clean outdoors, inspection doors, blast gates, dampers and duct saddle supports as specified in the drawings

1.3.8. Pressure drop calculations for the system

1.3.9. Lubrication lines run to an easily accessible location to allow for manual lubrication

1.3.10. Review of the design drawings to indicate all required maintenance access

1.3.11. Guards, in accordance with South African Standards

1.3.12. Condition monitoring requirements as required by the Employer

1.3.13. All necessary instrumentation, control, and safety devices for the safe and efficient operation of the dust collector equipment with all instrumentation wired to a junction box

1.3.14. Any control devices required to enable the remote control and condition monitoring from the Plant Process Control System (PCS)

1.3.15. Ancillary items normally supplied with the equipment and any specials tools or instructions required to adjust or to maintain the equipment

1.3.16. All items of material and equipment required for completion of the work such as all gaskets, nuts, bolts and washers

1.3.17. Surface protection

1.3.18. Specifications and supply of first-fill lubricants and schedule for lubrication

1.3.19. Schedule of consumables (i.e., air, water, lubricants, filter cloths, etc.)

1.3.20. Stainless steel nameplates affixed to all items of equipment that require identification in the field for operating and maintenance functions, including motors, instruments, switches, filters, and valves. The Employer will provide equipment numbers

1.3.21. Contractor participation in regular meetings with the Employer as required

1.3.22. Inspections, shop assembly, trial fit-up, testing and match marking, as applicable

1.3.23. Contractor documentation as specified in the Contractor Documentation Schedule as found in Annexure A of the Works Information

1.3.24. System functional description suitable for control system programming

1.3.25. Packaging suitable for transportation

1.3.26. Delivery, as nominated

1.3.27. Provision of commissioning spares

1.3.28. List of recommended operation spares for two (2) years and insurance spares

1.3.29. Provision of suitably qualified personnel to supervise the installation and commissioning

1.4 Scope of Equipment Supply Excluded

The scope of this work excludes:

1.4.1. Service piping outside the battery limits, which does not form an integral part of the dust collection installations

1.4.2. Power supply, control and instrument wiring outside of the battery limits, which do not form an integral part of the dust collection installations

1.4.3. Concrete Foundations, hold down bolts and grout

2 Definitions and Abbreviations

2.1 Definitions

Table 1: Definitions

Employer	has the meaning defined in the Contract and includes their respective successors and assigns
Project Manager	means the Project Manager as described in the Contract
Site	means the Saldanha Port (final installed location of the Dual Wagon Tippler Facilities)
Contractor	means the *Contractor* engaged under the contract for the supply of the Dual Wagon Tippler Facility
Subcontractor	means a subcontractor or their subsidiary engaged by the *Contractor*
Dual Wagon Tippler Facility 3	Includes the Dual Wagon Tippler, Feed Hoppers and Chutes, Apron Feeders, Apron Feeder Level Structural Steel Floor and Bag House (including agglomerators)

2.2 Terminology

"**Shall**" is used to indicate that the *Contractor* is required to take action.

"**Should**" is used to indicate that the *Contractor* is advised to take action.

"**May**" is used to indicate that the *Contractor* is permitted to do something, or that the *Employer* reserves the right to do something, according to context.

"**Approved**" / "**Approval**", unless otherwise qualified, means normal, written agreement by *Employer* to a proposal by the *Contractor.*

2.3 Abbreviations

Table 2: Abbreviations

Term	Description
ISO	International Standards organization
EIC	Electrical, Instrumentation & Control
FEA	Finite Element Analysis
PLC	Programmable Logic Controller
SWL	Safe Working Loads
VSD	Variable Speed Drive

3 Referenced Documents

Table 3: Referenced Documents

Document Number	Document Title
1924701-2-214-M-DS-0003	Bag House Data Sheet
1924701-C008-SCH-0001	Dust Collection (Bag House) *Contractor's* Documentation Schedule (CDS)

4 Engineering

4.1 Design

4.1.1 Units

The SI system of metric units shall be used for this Project.

4.1.2 Language

All data shall be in the English language.

4.1.3 Drawings

4.1.3.1. The Contractor shall submit ALL mechanical, structural, electrical and instrumentation drawings, for approval by the Employer.

4.1.3.2. The full list of documentation requirements is included in the Contractor Documentation Schedule (document 1924701-C008-SCH-0001) included under Annexure A of the accompanying Works Information document.

4.1.3.3. The Contractor shall maintain records and prepare "As-Constructed" documents (for all documents, drawings and Operation and Maintenance manuals etc.) on completion of the works. The "As Constructed" documents shall demonstrate compliance with project specifications and drawings. All mark ups shall be drafted with revised status and supplied to the Employer in both hard and electronic format.

4.1.3.4. The Contractors "As-Constructed" documents shall be signed by the Contractor and submitted to the Employer for approval as developed and at completion of the work. Software copies of the "As Constructed" documents will be accepted in Autocad 2004 (or later) to be loaded into Bentley MicroStation V8 software.

4.1.3.5. "As Constructed" drawings shall be submitted as per the requirements as set out in the "Contractor Documentation Submittal Requirements" (DOC-STD-0001) included under Annexure B of the accompanying Works Information document.

4.1.4 Calculations

Calculations shall be neat and legible and contain the following in the order as stated below: -

4.1.4.1. Summary of assumptions and conclusions

4.1.4.2. Table of contents

4.1.4.3. List of all associated drawings

4.1.4.4. List of all text and references used

4.1.4.5. Nomenclature.

4.1.4.6. Calculations shall include, but not be limited to, the following areas.

- Machine performance / capacity
- Maximum power demand
- Brake Performances
- Gear ratings and life
- Bearing life
- Structural analysis for strength, serviceability and stability
- Mechanical analysis
- Dynamic analysis
- Hydraulic system power, pressure loss and thermal loads
- Water system analysis
- Lubrication system design
- Electrical Fault levels
- Maximum demand and transformer loading
- Cable sizing
- Overload protection settings
- Contribution to system harmonics
- Electrical equipment selection criteria.

4.1.4.7. Calculations shall be prepared and checked by Engineers registered as Professional Members of the Engineering Council of South Africa (ECSA) or equivalent institution recognised by ECSA. Calculations shall not be prepared and checked by the same person. Checked calculations are required before the commencement of fabrication.

4.1.5 Structural Design Review

The Employer will conduct an independent review of the dust collection (bag house) structural design and fatigue analysis. The Contractor must make allowance for the supply of required documentation and the time required to facilitate a structural review. The review will include a review of FEA work performed by the Contractor. Feedback and results of the design review will be made available to the Contractor.

4.1.6 South African Electrical Compliance

Any equipment designed and fabricated/manufactured overseas shall have an electrical certificate of compliance to South African Regulations before it is delivered and operated in South Africa. The compliance certificate(s) shall fully cover High Voltage, Medium Voltage and Low Voltage. These certificates will be issued by an accredited South African Professional Engineer.

4.1.7 Employer QA Representative

The Contractors QA requirements will be as set out in the "General Quality Requirements for Contractors and Suppliers" (ACM-QM-STD-001) included under Annexure F of the accompanying Works Information document. The Employer may choose to appoint a QA/QC representative to monitor and report on some or all aspects of the production and fabrication processes. It is expected that full cooperation will be extended to the appointed QA/QC representative. Associated costs for this service will be borne by the Employer.

4.1.8 Contractor's Subcontractor Declaration

Where work is performed by a subcontractor of the Contractor they will be declared to the Employer. This will include any subcontractors operating on or at the Contractor's fabrication and assembly facility.

4.1.9 Hazardous Materials

The following materials shall not be used or installed:

- Asbestos in any form
- PCBs (poly-chlorinated biphenyls)
- Mercury
- Viton Seals
- Any paints containing lead or chromates (including in the tinters)

5 Codes, Standards, Specifications and Regulations

5.1 General

5.1.1. The sequential order of precedence applicable to the use of the codes, standards, specifications and regulatory requirements for this project is as follows:

5.1.1.1. Regulatory Requirements.

5.1.1.2. Transnet Project Guidelines, Specifications and Standards.

5.1.1.3. South African Standards.

5.1.1.4. International Standards.

5.1.2. In the event of an inconsistency, conflict or discrepancy between any of the standards, specifications and Regulations, the most stringent and safest requirement applicable to the project will prevail. Any inconsistencies critical to the design shall be brought to the attention of the Employer for resolution, prior to construction. The design shall comply with the latest revision of the following standards, plus any other applicable standards:

5.1.2.1. All equipment, components, design, materials, workmanship, services and works shall be covered by the applicable provisions of the latest editions of the relevant codes, standards, specifications and regulations, including but not limited to those listed in this Section.

5.1.2.2. Where there is no applicable South African standard, the latest appropriate ISO, British, German, American, Japanese, Australian or other approved standard shall apply. The use of non-South African Standards shall be approved by the Employer in writing.

5.2 Government Acts and Regulations

The *Contractor* shall be responsible for compliance of all *works* with Government Acts, By-laws, and Regulations, both State and Federal, including but not limited to the following:

5.2.1. Mine Health and Safety Act 29 of 1996

5.2.2. Occupational Health and Safety Act 85 of 1993

5.2.3. Minerals Act 50 of 1991

5.2.4. National Water Act 36 of 1998

5.2.5. Atmospheric Pollution Prevention Act 45 of 1965

5.2.6. Environmental Conservation Act 73 of 1989

5.2.7. Promotion of Access to Information Act 2 of 2000

5.2.8. National Road Traffic Act 93 of 1996

5.2.9. National Environmental Management Act 107 of 1998.

5.3 South African

The *Contractor* shall be responsible for compliance of all *works* with South African Standards, including but not limited to the following:

Table 4: South African Standards

Code	Standard Title
SABS 10142-1	Wiring Code
SANS 1222	Enclosures for Electrical Equipment
SANS 1507-4:2022	Electrical Cables
SANS 156:2007	MCB’s and MCCB’s
SANS 347	Categorization and Conformity Assessment Criteria for All Pressure Equipment

Code	Standard Title
SANS 357	Heat Treated Steels, Alloy Steels and Free-Cutting Steels
SANS 1465	Steel Castings
SABS 1200 H	Structural Steelwork
SANS 10044	Welding
SANS 10162	The Structural Use of Steel
Sans 121:2000; ISO 1461:1999	Hot Dip Galvanised Coatings on Fabricated Iron and Steel Articles
SANS 10160-1:2019	General Procedures and Loadings to be Adopted for Design of Buildings

5.4 International Standards

Current editions of the relevant International Standards Codes or Publications that shall apply include, but are not limited to, those listed in Table 5**Error! Reference source not found.**.

Table 5: International Standards

Code	Standard Title
ISO 281	Rolling bearings - Dynamic load ratings and rating life
ISO 281/1	Ball and Roller Bearings
BS 5227	AC Metal Enclosed Switchgear (Must be Lockable)
BS 162	Electrical Power Switchgear
IEC 60129	AC Disconnectors (Isolators) and Earthing Switches
IEC 60439	Factory-Built Assemblies of Low Voltage Switchgear and Controlgear
IEC 60947	Low Voltage Switchgear and Controlgear
IEC 60948	Switch Disconnectors
BS 6231	PVC Insulated Cables for Switchgear and Controlgear Wiring
BS 3858	Binding (Identification Sleeves for Cables and Wires
IEC 60034/SDEL-005	Electric Motors
BS 5304	Code of Practice for Safeguarding of Machinery
AGMA 6000	Specification for Measurement of Linear Vibration on Gear Units
ASTM A609/A609M	Standard Practice for Castings, Carbon, Low-Alloy, and Martensitic Stainless Steel, Ultrasonic Examination Thereof
ASTM E709	Standard Guide for Magnetic Particle Examination
BS EN 10204:2004	Metallic materials. Types of inspection documents
ISO 281	Roller bearings – Dynamic load rating and rating life
ISO 1940	Balance Quality Requirements of Rigid Rotors

5.5 Drawings and Drawing Standards

Drawings shall be in accordance with Transnet Capital Projects: Project Development and Execution: ENG-STD-0001, which will be made available on award of the contract. The drawings applicable to the supply of the dust collection system are listed under Section 5 of the Works Information.

5.6 Standard Specifications

The *Contractor* shall be responsible for compliance of all *works* with *Employer* standard specifications, including but not limited to the following: -

Table 6: Standard Transnet Specifications

Specification Number	Specification Title
SBH8/2/2	General electrical equipment
SBH8/2/3	Electrical motors and generators
SBH8/2/6	Lighting on equipment
SBH8/2/8	Testing & commissioning of electrical equipment
SBH8/2/9	Electronic equipment
SBH8/2/11	Medium voltage equipment for port equipment
SBH9/2/2	Hydraulic equipment
SBH9/2/4	Gearing, shafts, bearings, brakes, lubrication, vee-belts, keys and keyways
SBH9/2/6	Structural Steelwork
HE9/2/7	Compressed air systems
SBH9//2/8	Corrosion protection
SBH9/2/9	General requirements & conditions

6 Site Conditions

6.1 Project Location

The Saldanha port facilities are in the Port of Saldanha in the Western Cape region of South Africa. Saldanha is located approximately 100 km North of Cape Town.

6.2 Site Conditions

The equipment shall be suitable for installation within a harsh industrial environment as indicated in **Table 7**.

Table 7: Site Conditions

Condition	Description
Altitude	Sea Level
Air Temperature	45°C Maximum; -5°C Minimum

Condition	Description
Equipment Surface Temperature (from sun)	60°C Maximum
Relative Humidity	50% Minimum; 85% Maximum; 60% Average
Air Quality	Coastal salt- laden air with high concentration of iron ore dust
Air Pressure	101.3 kPa
Average Annual Rainfall	278 mm

6.2.1 Seismic Data

The designs of the Tippler Buildings conform to SANS 10160. The buildings consist of reinforced concrete wall and column framed structures with steel frame superstructures. The vault structures are founded on rock with side wall loading. The vaults have been designed to cater for shallow ground water tables. The buildings and superstructures are founded on piles. Seismic design considerations are as per SANS 10160-4:2011. The ground in contact with the Tippler Structures is classified as calcrete/sand and is Type 4 according to Table 1 in SANS 10160-4. The rock that is the main foundation medium is Type 1 as per Table 1 in SANS 10160-4 with Vs = 180 m/s. The Site is located in Zone 1 for seismic activity, i.e. natural seismic activity. The Tippler Buildings are considered to be Importance Class III as per Table 3 in SANS 10160-4.

6.2.2 Maximum Temperature and Thermal Rating

For the maximum ambient air temperature for design of all equipment including motors, gearboxes, and bearings refer to the equipment data sheets included under Annexure O of the Works Information.

7 Dust extraction plant

7.1. This specification describes the requirements for the dust collection, and handling system to be used in conjunction with the tippler house of the new wagon handling system in the Transnet Port Terminals Saldanha, South Africa.

7.2. The equipment offered shall be of well-known and reputable manufacture for which spares are freely available from local representatives. Should any doubt exist regarding this aspect, tenderers may submit alternate offers of equipment from which a selection may be made. Full information is to be provided at the time of tendering.

7.3. The equipment shall be designed for continuous operation in a harsh, hot, dusty and corrosive environment with a maximum ambient temperature of 50° Celsius. The equipment will be exposed to the elements and cleaned by high pressure hose down.

7.4. Allowance shall be made for installing, accessing and maintaining the systems using cranes, other than the permanent gantry crane installed within the Tippler building.
7.5. The equipment shall incorporate state of the art materials and best practices, in line with modern engineering concepts to ensure maximum serviceability of the equipment in operation.

7.6. The equipment shall be designed by the *Contractor, in accordance with* standard, heavy-duty applications, suitable for continuous operation at the rated capacity for the duty as specified in the Dust House Data Sheet (Annexure O of the Works Information). Preference shall be given to equipment of standard design having easily obtainable component spares.

7.7. Equipment designs shall facilitate ease of access for handling, transportation, installation, adjustment, control, maintenance and repair. The design of the equipment and components shall feature all conveniences for assembly, installation, operation and maintenance such as motor jacking bolts, lifting lugs (marked with SWL), *etc*.

7.8. Potentially dangerous items of equipment shall be protected with guards. Guards shall be designed to facilitate manual installation, maintenance and removal. The guards shall be planned into the design of the equipment and shall not constitute a hazard. Guards shall be designed to be removed by one person, hence limited to 20 kg. Guards shall be provided for personnel protection in accordance with the requirements of the Occupational Health and Safety Act No. 85 of 1993 and as per the standards referenced in **Table 4, Table 5** and **Table 6** in this technical specification.

7.9. First fill lubricants shall be of a type that is suitable for the application and equivalents can readily be sourced from major reputable suppliers. Selection shall be subject to approval by the *Employer*.

7.10. The equipment shall have a minimum number of separate, split sections, taking account of the limits in shipping weight, dimensional limitations at the intended fabrication location, on-Site storage space or the dimensions of the foundations and surrounding areas.

7.11. This specification sets out the some of the basic requirements for equipment to be used to achieve or improve on the limiting levels of dust release specified.

7.12. Any method of handling or reduction in handling of dust may be presented with applicable reference to emission levels, implementation sites with similar installations, and contact numbers, in the same or comparable material being handled.

7.13. A complete cartridge filter dust extraction unit with pulsed cleaning as well as a dust handling plant shall be provided.

7.14 Scope of supply

The dust extraction equipment and handling equipment must be supplied complete in all respects. To include, but not limited to:

7.14.1. Ductwork from Apron feeder/s and Tippler cowl, starting from suitable flanged connection.

7.14.2. All control valves to regulate air flows through ducts.

7.14.3. Dust drier.

7.14.4. Filtration units, collection silos and required conveyance system to transfer the dust to the skips and bags.

7.14.5. Discharge conveyor system.

7.14.6. Bagging facility and bag handling system.

7.14.7. Building enclosure and sheeting.

7.14.8. Access platforms, stairways, ladders etc as appropriate for all areas requiring maintenance.

7.14.9. Any necessary lifting devices for maintenance.

7.14.10. All support steelwork / structures for ducts, filters, conveyors, etc.

7.14.11. A complete main electrical panel supplying and controlling all associated 400V motors, control valves, control circuitry and instrumentation systems, etc. by means of a reputable PLC with suitable modules to interface directly with the Wagon Unloading Station PLC via Profibus (a separate three-phase supply will be provided to Supplier's requirement).

7.14.12. All associated motors (400V & 3.3kV).

7.14.13. All associated lighting and small power, its distribution and circuitry (a separate three-phase supply will be provided to Supplier's requirement).

7.14.14. Special Tools.

7.14.15. Documentation, as specified.

7.14.16. Manufacture, Assembly, Painting and Site Installation

7.14.17. Site testing and commissioning.

7.15 Applicable codes and standards

7.15.1. Special attention must be given to the control of dust which must satisfy the requirements of the Atmospheric Pollution Prevention Act 1965 (Act 45 of 1965) as amended by the Atmospheric Pollution Prevention Amendment Act 1973 (Act 17 of 1973).

7.15.2. The dust extraction and collection system must also satisfy any requirements imposed by the local authority for adjoining municipal areas.

7.15.3. Design shall be in accordance with applicable IEC and BS standards.

8 Dust control

8.1. A closely fitting shroud will be installed around the tippler cage with a number of suction pipes at the back or bottom of the shroud, sucking air and also any dust in the air, in from the sides of the Tippler drum.

8.2. The apron feeder/s will be totally enclosed, each enclosure being fitted with a suction pipe over the discharge point to the conveyor.

8.3. The extraction system must ensure that the escape of dust from the tippler drum and the apron feeders in the pit is within the following specified requirements.

8.4. The maximum dust released shall be less than 60 microgram per cubic metre at all dust generating points in the building and vault.

8.5. The stack emission shall be less than 20 micrograms per cubic metre of air released.

8.6. The system must be capable of handling the dust generated by a Tippler system throughput at rated capacities for 24-hours per day, 365 days a year. The production time of the system will relate to 35 train slots a week with train length of 228 wagons per train.

8.7. The system should be designed so as to minimise the dust escape from the tippler cowl to the building environment. However, the design and position of the duct intakes should be optimised to minimise the dust captured by the system, rather allowing the majority to settle back into the hopper.

8.8 Operation description

8.8.1. Commodity dust as per Clause 11.2 must be extracted from the tippler cowl and the Apron Feeder enclosure. The dust laden air must be passed through a filter where the dust is filtered out of the air stream and deposited into a hopper. Separate filters will be used to achieve the required duty.

8.8.2. On the clean air side fans will extract the air and expel into a stack. The filter hoppers will be emptied by screw conveyors which feed through double flap valves into a collection screw conveyor (SC-5-M) feeding into bags/skips.

8.8.3. An MCC will be situated in the tippler building electrics room; the MCC will contain all drives and soft starters as well as a separate compartment for the PLC.

8.8.4. Each motor shall be equipped with a rotation sensor and in addition each of the fan drives, shall also be equipped with a vibration sensor at each bearing and 5 PT 100 sensors. An emergency stop-start station must be situated next to each motor. All motor sensors as well as the emergency stop start stations must be linked and report back to the PLC.

8.8.5. Each of the filters must be equipped with a pressure differential sensor the sensors will give feedback to the PLC. The filters must have their own control system. The control system will regulate the pulsing of the filter but is not required to be adjustable from the PLC.

8.9 Ductwork

8.9.1. Dust hoods and ducts must be of stainless-steel grade 3CR12.

8.9.2. The ductwork shall be round-shaped as far as possible and arranged in the vertical, horizontal planes or with slopes of either 30°, 45° or 60° to the horizontal.

8.9.3. The duct shall be constructed by welding steel plate. The thickness of the plate shall be selected according to the diameter of the duct, but the minimum permissible thickness is 3mm. Large diameter ducts will be fitted with the stiffeners.

8.9.4. Due allowance must be made for erosive wear of the ductwork so that the life of the components used to form the ducts has acceptable time intervals between replacement.

8.9.5. Hinged and bolted inspection hatches shall be provided in suitable places so that cleaning of dust deposits in the duct is possible.

8.9.6. Sufficient manually operated regulation valves shall be provided for the dust collection and recovery system to facilitate flexible operation. Manual valves will be used for adjusting and balancing the air flow rates through branches in the ductwork.

8.9.7. Duct components will be joined together using bolted flanges with rubber gaskets.

8.9.8. Intervals between duct supports will not be greater than 3m. Vertical duct components will be equipped with at least 2 supports each.

8.9.9. Any dust enclosures or ducting must be so designed to allow an unobstructed passage of dust laden air. The inside must be free of protrusions where dust can lodge.

8.9.10. Ducting must be adequately secured to structures and be positioned to give clear access to drives and equipment, especially where maintenance access is required.

8.9.11. Ducting and structures are to be designed to aid ore and rainwater runoff and minimise build-up of deposits.

8.10 Screw conveyors/chutes/flap valves

8.10.1. Full details of proprietary equipment must be provided as part of the tender documentation.

8.10.2. Equipment must be able to withstand the highly abrasive material.

8.10.3. The rotary/flap discharge valves shall be air-tight and able to maintain the air pressure in the collector during dust discharge. The dust discharging capacity shall be matched to the capacity of the dust collector.

8.10.4. Sealed for life self-aligning bearings shall be used and be mounted such that easy replacement is possible.

8.11 Rotary Discharge Valves

The design of the rotary discharge valves shall incorporate the following:

8.11.1. Floating-shoe design with ceramic wipers and isolation gates

8.11.2. Cast iron housings with abrasion resisting rotors and outrigger ball or roller bearings

8.11.3. Direct coupled motorised drives

8.11.4. 5 m length discharge pipe.

8.12 Filter Bags

8.12.1. Calculations for the sizing and selection of area of filter media and Air to Cloth Ratio shall be prepared and submitted for approval.

8.12.2. Airflow shall be calculated based on the methods shown in the publication Industrial Ventilation: A Manual of Recommended Practice (26th *ed.*) by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers). All selection criteria shall be listed, for approval.

8.12.3. Wire Support Cages shall be fabricated from zinc-plated or electro-galvanised wire. Cages shall be constructed in three pieces, made of 4mm (minimum) diameter wire. Any fabricated component fittings on the cages shall also be zinc-plated or electro-galvanised.

8.12.4. Wire cages shall be straight and of uniform cross section and free from any weld spatter or sharp edges or protrusions so as not to cause damage to the filter cloth.

8.12.5. Venturi attachments, to enhance the pulse cleaning, shall be fitted and shall be specifically designed as an integral unit, matching the length and diameter of the filter bags. The dirty air inlet shall not point directly onto the filter bags.

8.12.6. Filter bags shall be pulse-cleaned by timed blasts of clean and dry, compressed air. The volumetric air requirement of each Dust Collector/filter unit and required air pressure shall be nominated. Reverse air systems shall be considered with approval from the *Employer.*

8.12.7. Filter bags shall be Polyester or Polypropylene. A full specification of the material offered shall be provided, including a representative sample of a completed filter bag/wire cage/pulse valve/blow pipe.

8.12.8. For top access Dust Collectors the SNAP-CUFF type attachment is preferred. Cell plate holes shall be punched, CNC plasma or CNC laser (preferred) cut to ensure accuracy. Oxy cut cell plates shall not be accepted.

8.12.9. Full details of the bag attachment shall be clearly detailed prior to purchase.

8.13 Pulse System

8.13.1. A compressed air pulse system shall be provided for cleaning the dust collector bags and all compressed air piping between the compressed air shutoff valve and the dust collector compressed air manifold shall be provided.

8.13.2. Cleaning of the filter bags shall be by timed pulses of compressed air controlled by solenoid valves. The differential pressure between the tube sheet and hopper shall be monitored and the cleaning pulse shall be applied as required to protect the bags from over-pressurisation. Pressure switches/gauges shall be provided to monitor and alarm dirty bag conditions.

8.13.3. All necessary equipment to clean the filter bags, including pulse air controller, diaphragm valves, solenoid valves and blow pipes complete with individual nozzles for each filter bag shall be installed.

8.13.4. The compressed air volume and required air pressure shall be specified prior to purchase.

8.13.5. The compressed air manifold shall be suitably sized to store sufficient compressed air for the cleaning cycle.

8.13.6. Any special requirements for pulse sequencing shall be highlighted prior to purchase.

8.13.7. The type and specification of all pulse valves shall be subject to approval by the *Employer*.

8.14 Discharge system

A conveyor discharge system to three alternative points together with any rotary valves, chutes, telescopic skirts, rapid connectors etc will be provided as follows:

8.14.1. To skip;

8.14.2. To a Bagging facility for road transport.

8.14.3. All depositing will be under the control of a single local operator. Dust emissions will be controlled at all discharge points to within the required levels.

8.14.4. Control of the choice of discharge route will be a management instruction from central control tower.

8.14.5. Designs must be such as to limit the risk of spillage and measures shall be installed to prevent emissions to atmosphere.

8.15 Filtration units

8.15.1. Modular cartridge filters designed for efficient separation of air and dust, provided with automatic system of pulsed filter cleaning.

8.15.2. A permanent, real time pressure monitoring system must be provided for monitoring of the pressures at loaded and filtered sides for comparisons. Adequate indication must be given to notify of inefficiency or no performance. Pressure difference monitoring systems must be provided for the whole system to determine clogging i.e. dust conveying pipes.

8.15.3. The filter media will be anti-static, non-inflammable and mildew proof.

8.16 Main fan

8.16.1. The fan(s) will be installed at the clean air side of the filters.

8.16.2. The fan shall have enough capacity to satisfy the requirement of dust collection system and to overcome the resistance to flow in the ducting, dust collector and stack.

8.16.3. The fan shall be of high efficiency, low noise, smooth operation, easy maintenance and durable.

8.16.4. Flexible joints will be used between the entrance / exit of the fan and the ductwork.

8.16.5. The fan will be equipped with a vibration & shock absorbing baseplate.

8.16.6. A water-proof safety guard will be provided for the moving parts fitted between the motor and the fan.

8.17 Exhaust Fans

8.17.7.1. The Dust Collector exhaust fan shall operate on the clean air side of the Dust Collector.

8.17.7.2. The Dust Collector exhaust fan shall be a single-width, single-inlet unit, designed for a single direct drive motor.

8.17.7.3. Flexible connections in outdoor locations shall be fitted with a weather and UV protective cover that shall be supported from one side of the connection.

8.17.7.4. The Dust Collector exhaust fan impeller shall be centrifugal type with backward inclined, laminar or aerofoil form of blade, incorporating internally reinforced blades with a solid leading edge. The hollow formed blades shall be dye checked and pressure tested to 70 kPa, with pressure taps being seal-welded prior to dynamic balancing.

8.17.7.5. The fan impeller shall be keyed to the shaft and positively located using a bolted keeper plate to prevent the impeller slipping along the shaft.

8.17.7.6. Fan shafts shall be supported in plummer block bearings.

8.17.7.7. Grease lubricated bearing seals shall be taconite grease-purged labyrinth type.

8.17.7.8. Fan bearings shall not to be guarded and shall be readily accessible for condition monitoring whilst in operation.

8.17.7.9. The Dust Collector exhaust fan casing shall be capable of being split, to allow the impeller/shaft assembly to be lifted clear for maintenance. Large access doors for fan internal inspection, and to allow high pressure water jet cleaning of both sides of the impeller and fan casing (when stationary) shall be provided together with a large drain socket.

8.17.7.10. Fans shall have flanged outlet and inlet flexible connections.

8.17.7.11. Fans shall be provided with a sound attenuator with suitable supports as necessary.

8.18 Exhaust stack

8.18.1. The stack will be designed to maximise discharge plume height, making due allowance for the height of local structures (i.e. the tippler building). It is to be structurally stable in all foreseen weather conditions.

8.18.2. A lightning arrester shall be provided on the exhaust stack according to the technical requirement for anti-lightning equipment.

8.18.3. Instrument test ports with bolted and gasketed covers will be provided to allow flow and dust density measurements during and after commissioning.

8.19 Compressed air supply

8.19.1. Dry compressed air will be piped to the vicinity of the equipment. Sizing of the compressor and associated lines will be for the Contractor to size, based on the air requirements of the filter plant.

8.19.2. The specified Free Air Delivery (FAD) shall be achieved under the most adverse combination of temperature and relative humidity at the Site.

8.19.3. The Contractor’s standard starting, load following and energy saving control systems and strategies shall be supplied with the compressors.

8.19.4. The compressor inlet air filter system shall be designed to remove all particulate matter that may cause damage or undue wear to the compressor. In addition, the system shall prevent the induction of water into the compressor from rain, equipment hose down or any other source. A filter restriction indicator, marked to indicate when the filter element requires cleaning, shall be provided on the compressor control panel. The air inlet filter may be combined with the air inlet silencer.

8.19.5. The desiccant/adsorption type of air dryer is preferred. Dryer and compressor instrumentation and protection systems shall be commensurate with the modular approach to the system.

8.19.6. High pressure air filters shall be supplied with flanged air inlet and outlet connections. The filter shall be the removable cartridge type, and the casing shall be provided with an automatic condensate drain trap.

8.19.7. Each air receiver shall be a pressure vessel, with mounting skirt or legs and supplied with:

8.19.7.1. 100 mm (nominal) diameter pressure gauge and gauge isolation ball valve

8.19.7.2. Safety relief valve (adjustable) with easing gear, sized in accordance with Regulations and shall as a minimum allow venting of the full output of a single compressor

8.19.7.3. Spare plugged ½" BSP shell connection

8.19.7.4. Two (2) inlet and two (2) outlet connections for air

8.19.7.5. Inspection port

8.19.7.6. Automatic condensate drain traps

8.19.7.7. Low pressure switch (if not included in pulse system manifold)

8.19.8. The air receivers shall be designed, fabricated, inspected, tested, approved, certified and stamped by the Statutory Authorities as a pressure vessel in accordance with South African Standards. Design calculations shall be provided by the Contractor.

8.19.9. All drain traps shall be provided with a manual isolation ball valve. All drain traps associated with the compressors, dryers and filters shall be to a standard approved by the Employer.

8.19.10. All moving parts accessible from either outside an acoustic enclosure or inside an acoustic enclosure, while doors are opened for maintenance access, shall be guarded. This applies in particular to cooling and air fans.

8.19.11. The compressor and after-cooler shall be cooled by the use of an air-blast oil cooler located within the acoustic enclosure.

8.19.12. The design of the compressor sub frame and base plate, if separate from the steel frame skid base for the entire module, shall be such that pockets of liquid or lubricant spillage do not accumulate. Oil containment frames shall be supplied.

8.19.13. Sub frames shall be provided with alignment jacking bolts to facilitate drive alignment.

8.19.14 Dryer

The dryer is to be sized to suit the maximum flow from the compressors, with compressors running under full load conditions.

8.19.15 Filters

The filters are to be sized to suit the maximum flow from the compressors, with the compressor running under full load conditions and with adequate provision to ensure satisfactory service life between maintenance intervals.

8.19.16 Condensate Oil Separator

The condensate oil separator is to be sized to suit the maximum condensate flow from the compressors, the plant air receiver (to be located adjacent to the compressors), the filters and the dryer on Site. In addition, one instrument air receiver will be located downstream of the dryer and any condensate from this will also be directed to the oil separator.

8.20 Explosion relief

Explosion relief panels are to be provided in all the enclosures, the ducting and silo. They must vent to atmosphere in positions which do not endanger personnel on access walkways. They must not vent into the building or an enclosed space.

8.21 Lubrication

8.21.1. All points requiring lubrication, such as bearings, pins, bushes, axles, etc., will have manual lubrication. Equipment with several grease nipples on one unit, or grease nipples which are difficult to access, will have a manual lubrication system arranged such that all greasing points are brought out to a common manifold of grouped nipples, which is easily accessible.

8.21.2. Lubrication pipes shall be stainless steel have a minimum inside diameter of 8mm.

8.21.3. Before the commencement of any test or operation the Contractor shall provide the initial fill of oil for all gearboxes and grease for components which require grease lubrication.

8.22 Maintenance access

8.22.1. All equipment must be designed to provide suitable access for required maintenance and changing of components in order to reduce time-to-repair.

8.22.2. All locations that require frequent inspections and maintenance shall be easily accessible by means of walkways and staircases. Vertical ladders will only be used for locations which are infrequently visited.

8.22.3. Handrails shall be of the preformed hot dipped galvanised steel stanchion type, bolted to structures or walkways.

8.22.4. Walkway grids shall be of the hot dipped galvanised, or approved fibre glass type, open mesh grid type where dust or product might settle because of spills, or of hot dipped galvanised chequered plate in other areas.

9 Civil and Structural

9.1. The design of the base support structures for the Dust Collector Systems shall be by the Employer, however, the Contractor shall provide all information necessary for the design of the footings and support structures. The Contractor shall provide certified design loads for unloaded and loaded conditions at the worst-case operating points.

9.2. All structural design, including loading conditions, shall be in line with the Structural Design Criteria nominated in Section 5.0.

9.3. Dust extraction ducting and ducting supports shall be designed for a partially or totally blocked condition, depending on duct diameter, as given in Table 8.

Table 8: Duct Loading Condition

Duct Diameter (mm)	**% Loaded**
D ≤ 700	100
700 < D < 1300	Varies Linearly From 100 to 50
D ≥1300	50

9.4. A maximum dust density of 2.4 t/m³ shall be used when calculating duct loadings. Wind loading shall also be taken into account.

9.5. A blocked dust ducting condition can only occur in horizontal ducting and therefore vertical ducting does not need to be considered for this loading condition. A blocked duct loading condition shall be considered in the same context as a blocked chute condition for determination of load factors and combinations.

9.6. The maximum support spacing shall be 4 m for ducting diameter ≤ 200 mm, and 6 m for larger ducts unless otherwise approved by the Employer. Structural analysis shall be done on all duct systems to determine minimum thickness of ducts (including effects due to inspection and clean-out doors) and minimum support distances.

9.7. Wherever possible ducts shall be supported from below using an under-saddle, with a flat bar strap over double- nutted -threaded tensioning rods.

9.8. In all cases duct supports shall involve the duct being securely cradled and located using an over or under strap with galvanised tensioning rods and double nutted.

9.9. Small section ducts up to 350 mm may be supported by hangers comprising two bolt minimum full circle clamps supported from the building with a rigid dropper of circular or square section tube or pipe. Support from hanger rods for ducts larger the 350 mm shall not be accepted.

9.10. All duct components shall be fully welded externally and weld penetration on the inside of the duct shall be minimised to reduce the tendency for material build-up. Flanges shall also be welded internally. Welding of the Duct Collector, ducting and supports shall conform to SANS 10044.

9.11. Drawings of the proposed duct supports showing type, location and loading shall be provided.

9.12. Gallows/knee brace type duct supports shall be the preferred method for secondary ducts extracting from conveyors. No interconnection between separate buildings shall be allowed due to the likelihood of differential settlement and transference of vibration between the structures.

9.13. Long ducts and duct supports for the dust extraction ducting spanning between the dust source collection hoods and the Dust Collector inlets shall cater for differential movement between the dust source structures and the Dust Collector support structure.

10 Electrical requirements

10.1. Associated electrical systems must be designed in accordance with the relevant specifications listed in Clause 11.2.

10.2. Provision shall be made to protect the equipment against mal-operation and possible damage to electronic equipment due to lightning surges and spikes on the supply, as well as possible direct lightning hits on the structure.

10.3. Electrical equipment shall have minimum enclosure protection levels as stated in Clause 28.3.2.

10.4. The size of all motors, other components and cables of the dust extraction system shall be determined by the Contractor.

10.5. Drives shall be designed for the following minimum ratings:

Table 9: Drive ratings

Mechanism	Duty	Cyclic factor	Starts/hour
Screw Conveyors	Continuous operation – Periodic duty (S6)	100%	12
Dust extraction drives	Continuous operation – Periodic duty (S6)	100%	12

10.6. All motors will be 400V 3-phase, rated below 132kW and started direct-on-line (DOL).

10.7. A main electrical panel shall be provided with separate sections for the following items associated with the dust extraction and collection equipment:

10.7.1. 400V motor controls.

10.7.2. Relays, controls circuits and the auxiliaries (control valves, etc).

10.7.3. The controlling PLC and instrumentation.

10.8. The Supplier is to advise on the size of a dedicated three-phase input supply to be provided for this main electrical panel.

10.9. The main electrical panel assembly shall:

10.9.1. Be fitted with 230V AC anti-condensation heaters.

10.9.2. Be located in the air-conditioned LV Switch room of the Tippler Electrics House.

10.9.3. Accommodate all the terminals necessary to interface with the Wagon Unloading Station.

10.10. The Supplier shall provide all lighting and small power sockets required in and around the dust extraction and collection system.

10.11. In order to maintain the dust extraction and collection system while the main electrical panel is de-energised, an additional panel shall be provided to supply all the associated lighting and small power socket circuits. This panel may be integrated with the main electrical panel.

10.12. The Supplier is to advise on the size of a dedicated three-phase input supply to be provided for this lighting and small power panel.

10.13. The electrical interfaces between the Wagon Unloading Station and the dust extraction and collection system are:

10.13.1. The 400V incoming power supply terminals at the main electrical panel.

10.13.2. The 400V incoming power supply terminals at the lighting and small power panel.

10.13.3. The control, signal and instrumentation terminals at the main electrical panel which connect to the Wagon Unloading Station.

10.14. All other equipment and cabling associated with the dust extraction and collection system are to be provided and installed by the Supplier.

10.15. Main fan motors shall be fitted with 230V AC anti-condensation heaters

10.16 Control system

10.16.1. The dust extraction and collection system shall incorporate and be controlled by a PLC unit. It shall use a combination of digital and analogue modules as necessary to meet the functional requirements of the equipment. This PLC shall communicate all necessary control signals and monitoring data via a Profibus link with the Wagon Unloading Station PLC.

10.16.2. The PLC and its associated circuitry shall be housed in a separate compartment of the main electrical panel.

10.16.3. The PLC shall control all aspects of the operation and monitoring of the equipment both in 'manual' and 'automatic' operation.

10.16.4. Solenoids, control and instrumentation supply voltages shall be 110V AC.

10.16.5. A local manual override facility must be provided to operate each individual filter cleaning cycling system during maintenance.

10.16.6. A permanent, real time pressure monitoring system must be provided for monitoring of the pressures at loaded and filtered sides for comparisons. Adequate indication must be given to notify of inefficiency or no performance. Pressure difference monitoring systems must be provided for the whole system to determine clogging i.e. dust conveying pipes.

10.16.7. The automatic start/stop sequence of the devices in the dust extraction and collection system shall be controlled by its own PLC, including actuation of the electrical valve used for reversed flow filter cleaning, main suction fan, rotary discharge valves and screw feeders.

10.16.8. The dust extraction and collection system shall incorporate the facility to switch the total system ON and OFF remotely from the Wagon Unloading Station PLC.

10.16.9. The Tenderer is to provide as soon as possible:

10.16.9.1. A schematic diagram of their proposed electrical system.

10.16.9.2. A list of the control and monitoring signals that will be interfaced to and from the Wagon Unloading Station control system.

10.17 Condition monitoring

10.17.1. Extraction fan motors (drive and non-drive end bearings) and any associated gearboxes (input and output shafts) are to be fitted with permanently installed vibration recording equipment.

10.17.2. Extraction fan motors shall be fitted with thermistors (type PT100) on their windings and bearings. Their temperatures will be recorded, and system tripping will be initialised when overheating occurs.

10.17.3. The requirements for mounting the condition monitoring sensors shall be confirmed by the Supplier of the Dust Extraction system to ensure their compatibility.

10.17.4. Fluid couplings (if fitted) shall be supplied with heat sensitive trip and fusible plugs in addition to contactless type monitoring equipment.

10.18 Noise

Noise levels shall be less than 80dBA 1 metre around any of the components.

End of Specification

PART C3: SCOPE OF WORK

Annexure D - Technical Specification: Mechanical/Electrical

Document Reference	Title	No of page
	This cover page	1
C3.1	*Employer's* Works Information	
	Total number of pages	**30**

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Approver signature			
Name			
Title			

Table of Contents

Tables

1 Definitions/Abbreviations

Table 1: Definitions and abbreviations

Acronym / Abbreviation	Description
BMH	Bulk Materials Handling
BoQ	Bill of Quantity
EPC	Engineering, Procurement and Construction
HAZOP	Hazard & Operability Analysis
HSS	Health, Safety and Security
HSSMP	Health, Safety and Security Management Plan
ITP's	Inspection and Test Plans
km	Kilometre
Mtpa	Million tonnes per annum
P & ID's	Piping and Instrumentation Diagrams
PFD's	Process Flow Diagrams
TFR	Transnet Freight Rail
TPT	Transnet Port Terminals
WBS	Work Breakdown Structure
Supervisor	Transnet Site Engineer

2 Standards

Standards shall be prioritized as stated below, the standard stated at the top having the highest priority should there be conflict.

2.1 Project Standards

The documentation listed in the tables below is used as a reference and/or guideline, with the purpose to enhance the interpretation of this document.

Table 2: Transnet specifications

Standard no.	Document Title
EEAM-Q-008	Corrosion Protection
EEAM-Q-009	Quality Management

2.2 National Standards

Table 3: National standards

Standard no.	Document title
SANS 094	The use of high strength friction grip bolts
SANS 10142-1	The Wiring of Premises – Part 1: Low-Voltage Installations
SANS 10142-2	The Wiring of Premises – Part 2: Medium-voltage Installations Above 1 Kv AC Not Exceeding 22 kV AC and Up to and Including 3000 Kw Installed Capacity

Standard no.	**Document title**
SANS 10198	The Selection, Handling of Installation of Electric Power Cables of Rating Not Exceeding 33 kV: Parts 1 to 14
SANS 135	ISO metric bolts, screws and nuts (hexagon and square)
SANS 136	ISO metric precision hexagon head bolts and screws, and hexagon nuts
SANS 1411	Materials of Insulated Electric Cables and Flexible Cords: Parts 1 to 7
SANS 1431	Weldable Structural Steel
SANS 1507	Electric Cables with Extruded Solid Dielectric Insulation for Fixed Installations (300/500 V To 1900/3300 V): Parts 1 to 6
SANS 1520	Flexible Electric Trailing Cables for Use in Mines – Part 1: Low-voltage (640/1100 V And 1900/3300 V) Cables: Parts 1 to 3
SANS 15708	Non-destructive testing - Radiation methods: Parts 1 and 2
SANS 1574	Electric Flexible Cables with Solid Extruded Dielectric Insulation: Parts 1 to 5
SANS 1804	Induction Motors: Parts 1 to 4
SANS 23279	Non-destructive testing of welds - Ultrasonic testing
SANS 3452	Non-destructive testing - Penetrant testing: Parts 1:to 4
SANS 763	Hot dip (galvanized) zinc coatings (other than on continuously zinc coated sheet and wire)
SANS 780	Distribution Transformers
SANS 9934	Non-destructive testing - Magnetic particle testing
SANS 62305-1:2011	Protection against lightning Part 1: General principles
SANS 62305-2:2011	Protection against lightning Part 2: Risk management
SANS 62305-3:2011	Protection against lightning Part 3: Physical damage to structures and life hazard
SANS 62305-4:2011	Protection against lightning Part 4: Electrical and electronic systems within structures
SANS 10313:2012	Protection against lightning - Physical damage to structures and life hazard
SANS 10199:2010	The design and installation of earth electrodes
SANS 1063:2011	Earth rods, couplers and connections
SANS 10200:1985	Neutral earthing in medium voltage industrial power systems
SANS 10292:2013	Earthing of low-voltage (LV) distribution systems
SANS 10142-1:2012	The wiring of premises Part 1: Low-voltage installations
SANS 10142-2:2009	The wiring of premises Part 2: Medium-voltage installations above 1 kV A.C. not exceeding 22 kV A.C. and up to and including 3 000 kW installed capacity

2.3 International Standards

Table 4: International standards

Standard no.	**Document title**
AFBMA	Anti-friction bearing manufacturers association (as applicable)
AGMA	American gear manufacturers association (as applicable)

Standard no.	Document title
ASME	American Society of Mechanical Engineers (As Applicable)
ASME B16.3	Flanges and Bolting for Pipes, Valves and Fittings.
ASTM	American Society of Testing and Materials (As Applicable)
AWS D1.1/D1.1M	Structural welding code – steel
BS 2634	Surface roughness comparison specimens
BS2573 part 1 1983	Rules for the design of cranes (structures).
BS2573 part 2 1980	Rules for the design of cranes (mechanisms);
BS 3790	Endless wedge belt and v-belt drives
BS 4235	Specification for Metric Keys and Keyways
BS 5228	Occupational noise management
BS 5499	Safety Signs for The Occupational Environment
BS 7608	Code of Practice for Fatigue Design and Assessment of Steel Structures
DIN 22101:2011-12	Continuous Conveyors- Belt conveyors for loose bulk materials
EN 10025	Hot-rolled steel flat products
EN 10025	Carbon steels & carbon manganese steels – hot rolled bars & semi-finished Products
EN 10025	Structural Steel – Hot-Rolled Plates, Floor Plates and Slabs
EN 10083	Carbon Steels and Carbon Manganese Steels – Cold Finished Bars
EN 10088	Wrought Alloy Steels – Stainless Steel Bars and Semi-Finished Products
EN 10220	Steel Tubes for Mechanical Purposes
EN 12882	Conveyor Belting of Elastomeric and Steel Cord Construction
EN 13414	Wire-Rope Slings
EN 14399	High Strength Steel Bolts with Associated Nuts and Washers for Structural Engineering
EN 15877	PVC Pipes and Fittings for Pressure Applications
EN 20286	ISO System of Limits and Fits
EN 2560	Covered Electrodes for Welding
EN 583	Non-Destructive Testing – Ultrasonic Testing of Carbon and Low Alloy Steel Plate – Test Methods and Quality Classifications
EN 60204	Electrical Installations – Surface Mines and Associated Processing Plant
EN 60439	Low-Voltage Switchgear and Control Gear Assemblies – Type-Tested and Partially Type-Tested Assemblies
EN 61386	Electrical Installations – Selection of Cables
EN ISO 3743	Acoustics – Determination of Sound Power Levels of Noise Sources
EN ISO 4783	Metric Screws Threads for Fasteners
EN10219	Structural Steel Hollow Sections
FEM Section II 2.131/2.132	Rules for the design of mobile equipment for continuous handling of bulk materials

Standard no.	Document title
FM Global	FM Global Fire Protection Approval Standards (As Applicable)
GB/T 1591	High Strength Low Alloy Structural Steel
GB/T 5782	Hexagon Head Bolts
GB/T 5783	Hexagon Head Bolts – Full Thread
IEC 60204	Safety of Machinery
IEC 61508	Functional Safety of Electrical/Electronic/Programmable Equipment
ISO 10816	Mechanical Vibration – Evaluation of Machine Vibrations By Measurements On Non-Rotating Parts
ISO 128	Technical Drawing
ISO 12944	Guide to The Protection of Structural Steel Against Atmospheric Corrosion By The Use Of Protective Coatings
ISO 14520	Gaseous fire-extinguishing systems - Physical properties and system design
ISO 1461	Hot Dip Galvanised Coating of Fabricated Iron and Steel Articles. Specification And Test Methods
ISO 2408	Steel Wire Ropes
ISO 2631	Evaluation of Human Exposure to Whole-Body Vibration
ISO 281	Rolling Bearings – Dynamic Load Ratings and Rating Life
ISO 4014	ISO Metric Hexagon Bolts and Screws – Product Grade A and B
ISO 4016	ISO Metric Hexagon Bolts and Screws – Product Grade C
ISO 4032	ISO Metric Hexagon Nuts Including Thin Nuts, Slotted Nuts and Castle Nuts.
ISO 4413	Hydraulic Fluid Power – General Requirements for Systems
ISO 4759	Tolerances for ISO Metric Bolts, Screws, Studs and Nuts—Product Grades A, B And C
ISO 5048:1989	Continuous Mechanical Handling Equipment – Belt Conveyors Calculation of Operating Power and Tensile Forces
ISO 5049-1:1994	Mobile Equipment for continuous handling of bulk materials – Part 1: Rules for the design of steel structures
ISO 717	Acoustics – Methods for The Determination of Noise Rating Numbers
ISO 898	Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel
ISO 9001:2015	Quality management systems - Requirements

3 General Requirements for Mechanical Installation

3.1 General

3.1.1. The Contractor shall be responsible for checking clearances around all equipment prior to its installation. Should any interference be evident, it shall be reported to the Project Manager in writing immediately.

3.1.2. Any portion of the work disclosed as defective through start-up testing due to improper installation shall be reported by the Contractor to the Project Manager immediately.

3.2 Contractor Responsibility

3.2.1. The Contractor shall pre-approve installation procedures proposed by the Installation Contractor and will be liable to any inappropriate installation procedure.

3.2.2. Contractor Representative shall inspect installation work and correct any inappropriate work. Installation work shall not proceed unless completed work has been approved by Contractor Representative and the Supervisor.

3.2.3. The Contractor shall be responsible for ensuring that the construction and installation techniques employed by the Installation Contractor(s) are appropriate and do not reduce the effectiveness of the design. Should any non-conformances be detected by the Contractor, he shall issue a report to the Project Manager describing the non-conformance and including a corrective action to rectify the non-conformance.

3.2.4. The Contractor shall issue Stop Work Order to stop any actions which are not in accordance with installation procedures given in the manual for installation, or which may endanger installation personnel safety, or which may damage or will lessen the Machine performance, reliability, availability, and service life.

3.3 Preparation Work

3.3.1 Off-Loading Of Machine and Equipment Components

3.3.1.1. In general, lifting crane shall be preferable for off-loading purpose.

3.3.1.2. Lifting of Machine components and equipment shall be via lifting lugs.

3.3.1.3. If forklift is to be used, the forks shall not directly touch the Machine and equipment components.

3.3.1.4. The Machine and equipment components shall be lifted up before being moved.

3.3.2 Transportation of Machine and Equipment

3.3.2.1. Machine components and equipment shall be adequately supported using wooden blocks, padded supports or similar means.

3.3.2.2. Components and equipment that are stacked shall be separated by wooden battens, mats or other padding material.

3.3.2.3. Each component and equipment shall be secured using nylon straps. If wire rope or chains are employed, coated surfaces of components shall be protected from contact with the securing ropes or chains.

3.3.2.4. Components and equipment shall be adequately protected from contact with each other during transportation.

3.3.3 Site Inspection of Components and Equipment

3.3.3.1. Upon receipt and offloading at site all items and equipment are to be fully inspected for transport and paint damage.

3.3.3.2. Any damaged surface treatment areas are to be fully repaired in accordance with Transnet Specification for Corrosion Protection **EEAM-Q-008**.

3.3.3.3. All damaged items and or areas are to be fully detailed in a Goods Received Inspection Report and issued to the Project Manager before any erection can commence.

3.3.4 Site Storage of Machine and Equipment

3.3.4.1. Machine and equipment components shall be stored on site in such a manner as to avoid corrosion or degradation of the components.

3.3.4.2. All components and equipment shall be stored under cover and above ground level.

3.3.4.3. Large components and equipment which are stored outdoors shall be supported on wooden blocks and ensure the components will always above the surface water.

3.3.4.4. All components and equipment stored outside shall be stored in a location such that the possibility of damage from vehicle or foot traffic is minimized.

3.3.4.5. Components and equipment which are stacked shall be separated from each other by wooden blocks or battens, or fabric or elastomer mats.

3.4 Mechanical Installation

3.4.1 General Installation

3.4.1.1 Lubrication.

3.4.2.1.1. The Contractor will ensure that all pivot pins and machined running surfaces are cleaned, then grease lubricated before / during assembly. Ensure all bearings, grease ways, lubrication pipes/hoses are primed with grease.

3.4.2.1.2. On no account should grease holes be left open during the installation. These are to be fitted with a removable sealing plug as appropriate prior to connection to lubrication systems or pipework.

3.4.2.1.3. The Contractor will ensure that all gear units and thruster brakes are filled with oil in accordance with the manufacturer’s instructions prior to operation.

3.4.1.2 Hydraulic Installation.

The Contractor will ensure that prior to the installation of any pipework, the Contractor will inspect each pipe to confirm that the bore of the pipe that has been supplied is in a pickled, oiled and capped condition. Should there be any evidence of contamination then the bore of the pipe is to be re-pickled and cleaned before installation.

3.4.1.3 Paintwork.

Any paintwork found to be damaged during transportation and installation is to be repaired in accordance with Transnet paint specification requirements.

3.4.1.4 Matchmarking.

3.4.2.4.1. The Contractor will ensure that all main structural joints and associated splice plates have been matchmarked in the workshops during the shop assembly process.

3.4.2.4.2. It is mandatory that all components are re-assembled with the same components as used in the shop assembly.

3.4.1.5 Alignment Of Holes.

All matching holes for fasteners or pins shall register with each other, so that the fastener can be inserted freely through the assembled member in a direction at right angles to the faces in contact. Drifting to align holes shall be so done that the metal is not distorted, and the holes are not enlarged. Holes that cannot be aligned without enlargement shall be cause for rejection unless enlargement by reaming is specifically approved. If enlarging of holes is approved in a specific case, cold galvanising, or painting in accordance with Transnet Corrosion Protection specification is to be applied and recorded.

3.4.1.6 Erection, Rigging and Slings.

3.4.2.6.1. Before any erection is commenced on site, the Contractor shall submit to the Project Manager, for his perusal and approval, full details of the erection procedure and methods of erection, together with a detailed daily programme covering a 3-week rolling horizon. All lifts required for the purpose of offloading, installation, assembly, etc of any item shall be undertaken by, or under the direct supervision of a competent person in terms of OHSAS 18001:2007.

3.4.2.6.2. All slings and shackles etc. used for lifting purposes, shall be stamped with the certified safe working load by their manufacturer or supplier. All lifting equipment shall be regularly inspected and replaced as required and a record book kept of same.

3.4.1.7 On-Site Welding.

3.4.2.7.1. Uncontrolled welding on site is not permitted. Should any welding be required on site, then the Contractor shall submit, to the Supervisor, a weld procedure for approval. This weld procedure shall contain, but not be limited to, the following:

- Specification to which welding, and welding procedure approval is to be carried out if **AWS D1.1/D1.1M:2010** is not used
- Details of materials and dimensions to be welded
- Details of consumables
- Details of any required preheat, weld preparation, and run sequence
- Details of welder qualifications
- Details of post weld heat treatment
- Details of any testing, physical or chemical which may be required by this specification

3.4.2.7.2. Any site welding shall be undertaken with due regard to any other items of equipment which might be damaged or burnt due to the welding process. Welding shall only be undertaken with the cables of welding machine forming the circuit. The structure of the machines shall not be used as a conductor in the circuit, as this causes stray currents which can cause unseen damage to equipment etc.

3.4.1.8 Fasteners.

3.4.2.8.1. Fitting-up bolts and drift pins shall not be used to bring improperly manufactured or fabricated parts or members into place, thus causing a strain on bolts, members, or parts. Any procedure required to rectify the above misalignment shall be to the approval of the Supervisor, but generally shall not affect the strength or appearance of the items concerned. Any approved rectification of galvanized steelwork shall, immediately following execution, be cold galvanized to prohibit oxidation of the parent metal. This shall be done in accordance with Transnet Corrosion Protection specification. The Contractor shall keep a clear record of any such rectification work which shall be available, at any time, for scrutiny by the Supervisor.

3.4.2.8.2. No flame cutting of holes is permitted.

3.4.2.8.3. All bolts shall be screwed tight, with at least two (2) clear threads and a maximum of five (5) threads projecting beyond the nut when tightened. A hardened steel flat washer shall be used under the bolt element being rotated when being tightened. Taper washers, to the correct angle, shall be provided and accurately aligned when bolts pass through the flanges of rolled sections.

3.4.1.9 High Strength Friction Grip Bolts.

The use of high strength friction grip bolts shall generally comply with the requirements of SANS 10094:2005 and shall be to Grade 8.8 as a minimum. The bolt connection shall comply with SANS 10094:2005. The surfaces of assembly shall, at the time of assembly, be free of grease, paint, other than prime coat as per specification M026, dirt, rust, scale, burrs or any other defects which would prevent mating of the parts or would interfere with the development of full friction between them. If, after final tightening of the bolts, a nut or bolt is slackened off for any reason, the bolt, nut, washers shall be discarded as scrap. Driving of bolts is not permitted. Bolts shall be tightened in accordance with Transnet Specification EEAM-Q-006 Structural Steel Work.

3.4.1.10 Correction.

Drift pins, jacking equipment, and the like shall not be used to bring improperly fabricated members into place. A moderate degree of reaming and cutting, however, may be employed to correct minor misfits only, if in the opinion of the Supervisor this will not be detrimental to the strength or appearance of the steelwork. No burning of holes in steelwork will be permitted without the written consent of the Supervisor. Welded connections for temporary bracing erection aids etc. shall be removed after having fulfilled their purpose, and the base material restored to its original surface finish. Any bare cutting faces are to be cold galvanized or painted and recorded, quoting drawing no. and describing the exact position.

3.4.1.11 Setting Out.

Immediately following completion of the civil works, and before the Contractor commences erection of steelwork on site, he shall check that the setting out and levels of the holding-down bolts, and the levels of concrete foundations, beam faces, columns, etc. are in accordance with the drawings provided by the Contractor and the Contractor shall report any discrepancies immediately to Transnet Port Terminals Saldanha representative.

3.4.1.12 Grouting.

3.4.2.12.1. Grouting shall be carried out in accordance with this specification. The following procedures shall be adhered to prior to grouting of any equipment.

3.4.2.12.2. The Supervisor must approve the alignments as carried out by the Contractor, thus satisfying himself that the correct procedures have been adopted. The Supervisor may check any alignment he feels necessary. The Supervisor will sign a grout release certificate to permit grouting to proceed.

3.4.2.12.3. Grouting or bedding shall be carried out by the Contractors Civil Contractor. The Contractor shall ensure that all grouting has been completed before loading is applied. The grout is to consist of an approved flowable non-shrink cementitious grout.

3.4.2.12.4. The Contractor shall ensure that no bedding or grouting is carried out until enough of the structure and equipment has been erected, and a sufficient number of bottom lengths, of other structural components that have been levelled, and are securely held by their permanent connections that have been fitted. Immediately before grouting, the space under the base plates and all pockets shall be cleared of all debris and shall be free of water.

3.4.1.13 Tolerances.

3.4.2.13.1. Alignment.

- Sub-soleplates, soleplates, machine bases, etc. which are mounted on concrete foundations shall be levelled, using precision level, with graduations indicating slopes of 1:6000 placed on suitable machined surfaces of these items.
- All levelling and alignment shall be within the manufacturer's recommended tolerances for the particular item of equipment. Alignment is subject to inspection by the Supervisor, and records of alignment measurements taken shall be kept in a form approved by the Project Manager.

3.4.2.13.2. Straightness.

A structural member after erection shall not deviate from straightness (or specified shape) by more than the following:

- For compression members and beams (other than purlins and sheeting rails): 1/1000 of the length between points that are to be laterally restraint.
- For other members: 1/500 of the overall length but not more than 25mm.

3.4.2.13.3. Length.

Table 5: Structural member straightness tolerances

Unless otherwise specified in the Specification.	**Permissible deviation in mm**
The permissible deviation of the length of a member from designated length.	+1 -2
For such members as trusses and lattice girders, these tolerances apply to the member as a whole. The lengths of component parts shall be such that the member can be properly assembled with a permissible deviation of	+1 -2

3.4.1.14 Accuracy of Erection.

Table 6: Erection tolerances

Unless otherwise specified in the Specification.	**Permissible deviation in mm**
Out of plum over any vertical height (H)	Lesser of 12mm or H/1000
Displacement of center line of columns in structures of more than one story in height from designated position.	For the Total Structure: Lesser of 12mm or H/1000

3.4.1.15 Location Of Holding-Down Bolts.

Table 7: Location of holding-down bolts tolerances

Unless otherwise specified in the Specification.	**Permissible deviation in mm**
The centre line of a holding-down bolt from its designated location in plan	±3
The top of the bolt from its designated elevation	±5

3.4.1.16 Column Bases.

Table 8: Column bases tolerances

Unless otherwise specified in the Specification.	**Permissible deviation in mm**
Designated level and plan position of column bases	±3

3.4.1.17 Level.

Table 9: Level tolerances

Unless otherwise specified in the Specification.	**Permissible deviation in mm**
Each storey	±2 per storey up to a maximum of ±30

3.4.1.18 Gantry Crane Rails.

Table 10: Gantry crane rail tolerances

Gantry crane rails shall be erected to the following tolerances:	**Permissible deviation in mm**
Deviation of gauge for span S:	
a. Less than or equal to 15m	±3
b. Greater than 15m	± [3+ (S-15)]/4
With a maximum of:	
a. Maximum differences in level between rails, measured at right angles to the gantry	5
b. Maximum difference in level over any 2m rail	1
c. Maximum horizontal deviation in plan from a straight line	5
Maximum horizontal deviation in plan at any point along the rail for:	
a. a 2m chord	1
b. a 15m chord	N/A

3.4.1.19 *Chutes, Skirts, and Liners.*

Erection of chutes, skirts and liners shall be in strict conformity with tolerances shown on the drawings. Unless otherwise stated on the drawings, tolerances shall be as follows:

Table 11: Chutes, Skirts and Liner Tolerances

Chutes and Liners	Permissible deviation in mm
– Surface tolerance	1 in 300, max. 10
– Location	± 10
– Steel Liner Gap	maximum 6
– Ceramic Tile Gap	maximum 4
– Chute wall horizontal distance either side of pulley centerline to be	equal within ± 5
Skirts	
– Skirt horizontal distance either side of belt centerline to be	equal within in ± 5
– Skirt tail end belt to skirt distance to be	60 ± 10

3.4.1.20 *Moving Head / Shuttle Carriages and Supporting Girders*

3.4.2.20.1. **Rails.**

Table 12: Rail gauge tolerances

Permissible deviation of gauge	±6
Maximum difference in level between rails measured at right angles to the rails	8
Maximum deviation in plan from a straight line	±5
Maximum horizontal off-set between rail and supporting girder web at any point	±3
Rail joints, if required, shall be aligned true and shall provide a smooth transfer of the wheel across the joint	

3.4.2.20.2. **Rail Supporting Girders.**

Notwithstanding the permissible steelwork tolerances stated elsewhere in this specification, moving head and shuttle rail supporting girders shall be fabricated and erected to a level of accuracy, which facilitates installation of rails to the tolerances as set forth above.

3.4.2.20.3. **Moving Head / Shuttle Carriages.**

Notwithstanding the permissible steelwork tolerances stated elsewhere in this specification, moving head and shuttle carriages shall be fabricated and erected to a level of accuracy, which facilitates installation of wheels and drives components to the tolerances as shown on the drawings and given in the component manufacturer's instructions.

3.4.1.21 *Other Tolerances.*

Other tolerances shall be as specified in AWS D1.1/D1.1M:2010.

3.4.1.22 Site Drilled Holes.

3.4.2.22.1. All holes required to be drilled on site shall be drilled as indicated on the relevant Contractor drawings and shall not be gas burned, punched, or enlarged with a hammer and punch unless approved by the Supervisor.

3.4.2.22.2. Holes to be drilled in compound members shall be drilled with one pass of the drill and through the required number of thicknesses. The components of compound members shall be securely fastened together prior to drilling by means of tack welding, bolting or clipping. Holes which are to be tapped shall be drilled to the correct tapping size as indicated on the appropriate drawing.

3.4.2.22.3. All matching holes for bolts shall register with each other so that a gauge 2mm less in diameter than the diameter of the hole will pass freely through the assembled members in a direction at right angles to such members.

3.4.2.22.4. The diameter of holes for bolts, other than fitted bolts, shall not be more than the following:

- M16; 2mm + 16mm = 18mm
- M20; 3mm + 20mm = 23mm
- M24; 4mm + 24mm = 28mm
- M30; 5mm + 30mm = 35mm
- M36; 6mm + 36mm = 42mm.

3.4.1.23 Steel Packs on Steelwork

3.4.2.23.1. Steel packs and shims shall be supplied by the Contractor and are to be of even thickness and shall be full faced where practicable.

3.4.2.23.2. The Contractor shall be wholly responsible for the supply and correct spacing of all packing plates under structures. The maximum number of packs shall be four unless approved otherwise by the Supervisor. All packing plates shall either be painted to Transnet Corrosion Specification or be of corrosion resistant material.

3.4.1.24 Steel Packs on Concrete

3.4.2.24.1. At all points on the concrete foundations, where steel packs are to be placed, the concrete face is to be clean and free from high spots. The packing plates next to the concrete are to be firmly bedded and levelled on a thin layer of good quality cement mortar. Steel packs shall be placed on each side of each holding down bolt, and shall be of a size, and so distributed, that there shall be no possibility of the baseplate and superimposed weights moving, whether grouted or not. A minimum of fifty percent of a column baseplate plan area shall be provided with steel packing unless otherwise approved by the Supervisor. No taper packing will be allowed.

3.4.2.24.2. The number of assorted steel packs are to be kept to a reasonable minimum and are to be clean and flat. The maximum number of assorted packs shall be four unless approved otherwise by the Supervisor. The Contractor shall be responsible for supplying the various sizes and thicknesses of packing plates for the Contract.

3.4.2.24.3. All packing plates shall either be painted to Transnet Corrosion Protection Specification or be of corrosion resistant material. The Contractor will ensure that the concrete has been properly scrabbled by the Civil sub-contractor prior to placing of any equipment requiring grouting.

3.4.1.25 Location of Equipment

The Contractor's attention is drawn to the fact that work may be carried out under all conditions of abnormal height, depth, restricted spaces, overhand and adverse environmental conditions. The Contractor shall, therefore, make a properly provisioned price for supplying, erecting, dismantling and relocation all scaffold frames and walkways, as the work may require. The use of drums and loose planks to form scaffolds will not be permitted on site. Adequate safety measure shall be taken to ensure adherence to relevant regulations and ensure a generally safe working environment.

3.4.1.26 Holding Down Bolts, Anchorages

3.4.2.26.1. Supply and fixing of holding down bolts and anchorages

3.4.2.26.2. The Contractor shall be required to supply, fix and build in certain holding down or through bolts, anchorages, ferrules, washers, sleeves, tubes, etc. in the concrete work for the erection of structural steelwork, machinery etc. For the purpose of providing room for the lateral adjustment of holding down bolts, anchorages, grouting sleeves, ferrules, etc. must be set true in accordance with the drawings and securely fixed in position to prevent displacement during concreting.

3.4.2.26.3. Where grouting tubes are to be built in around holding down bolts such grouting tubes must be securely fixed concentrically with the bolts and suitably protected to prevent the ingress of concrete.

3.4.2.26.4. Exposed threads of holding down bolts shall be adequately protected with grease, masking tape and / or sacking, and this protection shall be maintained in all portions of the Contract Works until erection of the relevant structural steelwork, mechanical or electrical plant / equipment commenced. All bolts, nuts and washers supplied under this Contract shall conform in all respects with the provisions of the relevant SANS specification. All bolts shall have metric threads and shall be supplied complete with all necessary nuts and washers. All bolts' anchorages, ferrules, washers, sleeves, tubes etc. shall be in accordance with Transnet Corrosion Protection Specification.

NOTE: The use of levelling nuts shall not be permitted.

3.4.1.27 Holes, Chases, Etc. and Building In

Where required, the Contractor shall form holes, chases, pockets, recesses, etc. through and in concrete for the reception of pipes, lugs, fixing bolts, angle kerbing and similar fixtures. All such pipes, fixtures, etc. must be set absolutely true in accordance with the drawings by means of accurately constructed templates securely fixed in position.

3.4.1.28 Temporary Fixings

3.4.2.28.1. Although it is an integral part of the design process, the maintenance of safety standards during erection is the responsibility of the Contractor who shall observe the recommendations given in OHSAS 18001:2007 and BS 5531:1988.

3.4.2.28.2. Adequate temporary bracing or stiffening shall be provided by the Contractor to protect the structure during erections from:

- The possibility of loss of stability or overstressing of the structure in its partially completed state; and
- The imposition of loadings (in particular those due to erection equipment or procedures) that are more severe than those which the completed structure is intended to sustain.

3.4.2.28.3. All temporary work provided for this purpose shall be left in position until such time as erection is sufficiently advanced for it to be no longer required.

3.4.2.28.4. The Contractor shall ensure that connections for temporary bracing, members, or cleats and additional holes used to facilitate handling or erection do not weaken the permanent structure or impair its serviceability.

4 General Requirements for Electrical Installation

4.1 General

4.1.1. The electrical equipment shall be suitable for the climatic, atmospheric and plant operating conditions prevailing on the site, and it is the Contractor's responsibility to ensure he is fully conversant with site conditions.

4.1.2. The make and type of equipment shall be as specified on drawings and schedules of quantities (Bills of Materials). Equipment not specified shall be to the approval of the Supervisor.

4.1.3. All equipment is to be painted in accordance with the Transnet Corrosion Protection Specification **EEAM-Q-008**.

4.1.4. Galvanizing of steelwork shall be required when called for on drawings or equipment schedules or in cases where this type of protection is called for by the Supervisor.

4.1.5. The hot-dip process shall be used. Galvanizing shall only be carried out after fabrication if the various components and shall be to Transnet Corrosion Protection Specification **EEAM-Q-008**.

4.1.6. Small areas of damaged coating can be repaired in situ by application of cold galvanizing paint after suitable priming, in accordance with Transnet Corrosion Protection Specification **EEAM-Q-008**.

4.1.7. Caddy clips or equivalent may be used for fixing conduit, tray supports and equipment. Welding of mounting brackets and fixings **will not be permitted**.

4.1.8. Explosive type tools such as Hilti shall not be used.

4.1.9. No holes shall be drilled in any structural member, nor shall any structural member be cut or altered in any way without the written approval of the Supervisor.

4.1.10. Holes required for mounting of equipment shall be drilled. No cutting or burning of holes will be permitted. Holes are to be painted before installation of bolts, and hole drilling and finishing shall conform to good engineering practices.

4.1.11. The Contractor shall make good any damage to the paintwork which occurs during erection and installation of the electrical system. This applies to paintwork on structures as well as on electrical and mechanical equipment. All repainting or touch-up shall be to Transnet Corrosion Protection Specification EEAM-Q-008.

4.2 Erection

4.2.1. Heavy equipment or groups of equipment shall be mounted on the floor or on well-constructed, well designed, and braced wall mounting frames to good engineering practices.

4.2.2. Small items of equipment shall be grouped on wall mounting racks or floor mounting frames subject to the Supervisor's approval. All cables and equipment are to be mounted so as not to restrict access. For example, on conveyor pan sections, cable racks must be above the return belt line and must not prevent access for idler mounting bolts, etc.

4.2.3. The mounting heights of equipment above the floor, unless shown otherwise on drawings, shall be:

4.2.3.1. 1500mm for electrical light switches

4.2.3.2. 300mm for 15 Amp socket outlets in offices

4.2.3.3. 1500mm for 15 Amp socket outlets elsewhere

4.2.3.4. 1500mm for isolating switches and motor control equipment

4.2.3.5. 1500mm for welding socket outlets

4.2.3.6. 500mm maximum to the top of distribution boards.

4.2.4. The positioning of local motor control gear shall, for reasons of safety and convenience, be placed so as to give the best view of the driven machinery. Local push-button stations, on-load isolators, etc., shall be mounted as close to the driven items as is practical, but in any event, shall not be mounted more than 3000mm from the driven item. If the Contractor is in doubt about the correct location, he shall obtain a binding directive from Transnet Port Terminals Saldanha representative.

4.2.5. All equipment is to be protected throughout the erection stage against the ingress of moisture, dust, dirt and foreign bodies and any other substance or effect which will cause the equipment to deteriorate or become unfit for service.

4.2.6. Equipment to be stored shall be given adequate covering. The Contractor shall be responsible for any damage or loss of goods handed over to him and he will be required to replace, free of charge, any damaged or lost items.

4.2.7. The Contractor shall be responsible for the cables on drums. The cables shall be taken from the drums to ensure minimum wastage. Cable ends shall be sealed immediately after cutting, this applies to the cable to be used as well as the part remaining on the drum. Installed lengths shall be measured gland to gland with 500mm extra allowed in the field and 2000mm at the MCC. Actual installed length shall be recorded in the column provided on the cable schedules.

4.2.8. The Contractor shall be responsible for the supply of all plant and test equipment necessary for the execution of the work specified and no additional claims will be recognized. All such plant, e.g., scaffolding, must be removed on completion of the relevant work. All plant must conform to the Machinery and Occupational Safety Act (Act No.6 of 1983). Proof of correct calibration of test equipment shall be required to be included on completed Test Certificates.

4.3 Cabling and Wiring

4.3.1. All conductors are to be of stranded annealed copper to SANS 1574:1992 & SANS 1507:1990 or equivalent specification the cable was manufactured in accordance with.

4.3.2. The maximum ambient temperature acceptable for vulcanized rubber and PVC insulated cables is 45°C and for impregnated paper insulated cables, 65°C.

4.3.3. The runs shall be selected to avoid exposure to drip or accumulation of liquids, high temperatures, direct sunlight, and possibility of mechanical damage to cables installed.

4.3.4. Fixed vertically installed cables shall be protected by steel pipes or covers or other Supervisor approved arrangements of minimum thickness 3mm to a minimum height of 300mm above floor level.

4.3.5. The cables to motors are to be protected to the top of the motor base plate with suitable "kick-plates" or pipes. All cable protection steelwork shall conform to Transnet Corrosion Protection Specification EEAM-Q-008.

4.3.6. The bending radii of cables shall be to SANS 10142-1:2012, or according to relevant information given in the specification the cable was manufactured to.

4.3.7. Conductors shall be arranged to avoid any appreciable mechanical stresses on terminals or conductors and crossing of conductor cores is not permitted.

4.3.8. PVC SWA cable glands shall be the captive cone type CCG BW Corrosion Guard with an outer sheath seal forming part of the gland. Each gland shall have a PVC gasket.

4.3.9. The protective covering sheath of PVC SWA cables shall be totally enclosed by the gland outer sheath seal arrangement. Flexible cable glands for (rubber/PVC cables) shall be of the CCG Posi Flex type with a PVC Gasket.

4.3.10. It may be necessary to terminate cables into a terminal box when installing lighting or where a field device has its own wiring different to the installation. CCG4 way or 3-way IP68 box complete with din rail and terminals and a see-through poly carbonate lid "adapt-a lid" shall be used.

4.3.11. Joints in flexible cords are prohibited. Terminations or joints in conductors other than in flexible cords shall be made in easily accessible positions and only approved connectors, terminal blocks, crimping lugs, or ferrules shall be used.

4.3.12. Soldered joints are only allowed in bar conductors and cores insulated with impregnated paper or other material which will make it possible to withstand the relatively high temperatures necessary for soldering.

4.3.13. A fixed outlet, supplying a portable appliance shall be readily accessible from the same room unless a flexible extension cable or cord is used with the portable socket outlet in that room.

4.3.14. 3-Core flexible cords are acceptable with cores coloured brown, blue and green/yellow striped. The colour identification is brown for the live, blue for the neutral and green/yellow for earth continuity. In all other cases black shall be used to distinguish the neutral or common. Core identification for joints in cables with identical number of cores is to be maintained throughout.

4.3.15. Clips, saddles, or clamps for securing of cables shall have smooth and rounded edges and shall not damage the cable sheath or serving. The type of saddle or clamp shall be approved by Transnet Port Terminals Saldanha before installation commences. PVC plastic strips shall be used for armoured cable. The type of strip used shall be approved by Transnet Port Terminals Saldanha. All types of clips, saddles, clamps, strip shall be impervious to damage of sunlight ultra-violet rays.

4.3.16. The maximum spacings of clips, saddles, or clamps for armoured cables for sizes up to and including 6mm² conductor area, are 400mm and 500mm for the heavier cables. Where cables are installed in positions where they are unlikely to be disturbed, the spacings for up to and including 6,0mm² conductor size may be increased to 500mm and 750mm for the heavier cables.

4.3.17. Unarmoured cables for up to and including 6mm² conductor area require a spacing not exceeding 300mm and 400mm for the heavier cables.

4.3.18. Unarmoured cables, other than aluminium sheathed cables, may not be plastered in or be run under floors or on walls with a rough surface. Rubber cables shall not be buried underground.

4.3.19. All PVC insulated tails shall be covered with either black heat shrink material or black PVC tape where they are installed in positions exposed to sunlight. Cable crutches shall be suitably protected against the ingress of water by means of PVC 'boots' or heat shrink material.

4.3.20. Holes for cables passing through a wall, partition or ceiling shall be made good with mortar, plaster, or similar non-inflammable material. Holes for cables passing through steelwork shall be bushed and the bushes flared at both ends to prevent abrasion of the cable serving, and the holes at both ends seals with a non-inflammable material.

4.3.21. Lighting and power cables shall not be run on the same tray or otherwise in parallel with 24V DC control and signal cables unless 300mm or further apart.

4.3.22. All cables shall be grouped and run according to the arrangements shown on the drawings with regard to spacing and clearances.

4.3.23. All Cables shall be marked for identification at each end as per relevant cable schedule. The markers shall be located at the cable glands and not be obscured in any way. Markers shall be stamped or slide-on stainless steel tags fastened to the cable with stainless steel straps as per PARTEX Type PKS or similar type approved by the Supervisor. Dynotape shall not be used.

4.3.24. Cables and cable-end seals shall be visually checked for possible damage.

4.3.25. A cable of which the condition is suspect shall be tested in the presence of Transnet Port Terminals Saldanha representative.

4.4 Cable Storage and Handling

4.4.1. All cable drums must be mounted up on cable drum jacks and the cable pulled directly off the top of the drum to prevent kinking in the cable. Under no circumstances must cables be unwound off a stationery drum laid on its side. Cable shall be pulled off the drum so that the rotation of the drum is opposite to the rolling direction indicator on the drum.

4.4.2. On continuous cable runs successive drums of cables must be checked to ensure that the correct core rotation is maintained throughout the run. Any length of cable found to have incorrect rotation shall be re-drummed and pulled in the correct direction, at the Contractor's expense.

4.4.3. Inspection of cable ends shall be undertaken to ensure rotation is correct and must take place prior to any backfilling of trenches. Should the Contractor ignore this instruction he will be responsible at his own expense to recover the cable, lift, re-drum, relay the cable and backfill of trenches.

4.4.4. A cable sock shall be attached to the cable end and a hemp rope or sisal rope attached to the cable sock, for pulling in the cable.

4.4.5. For cables in trenches, rollers shall be paced every 3 metres to allow the cable to be pulled in without sagging.

4.4.6. Cables shall be transported or moved around the site with the cable on the manufacturer's supplied cable drums and the cable drum shall be transported on a suitable cable drum trailer.

4.4.7. Cable drums shall be stored on a drained concrete surface, with the cable drums stored vertically and mounted on wooden supports to ensure cable drum is clear of the ground. The cable drums shall be stored neatly, and storage arrangement shall allow enough space between cable drums for ventilation purposes.

4.4.8. All cable jointing shall be done by suitably qualified artisans in accordance with the manufacturer's instructions. A 1000mm overlap shall be provided at each joint unless other instructions are specified on the drawings or by Transnet Port Terminals Saldanha representative.

4.4.9. Cores shall be joined by using solderless crimped connections. Approved hand crimping tools may be used for lugs up to 10mm² and hydraulic crimping tools utilising hexagon dies shall be used for lugs larger than 10mm².

4.4.10. Correctly sized lugs must be used. Enlarging of holes in lugs will not be permitted.

4.4.11. To prevent ingress of moisture, cables shall not enter a junction box or other equipment from the top.

4.4.12. All work must be completed in accordance with good electrical engineering practices and where necessary manufacturer's instructions for connecting of equipment shall be strictly observed.

4.5 Cables on Structures

4.5.1. Straps or saddles shall be used to clamp cables to brick concrete or steel structures.

4.5.2. Gridspan type cable trays shall be manufactured from 5mm steel and galvanised.

4.5.3. The cable racking and JB supports, and brackets shall be mild steel - treated as per Transnet Corrosion Protection Specification EEAM-Q-008.

4.5.4. The supports and brackets shall be bolted onto structures using galvanised mild steel bolts, nuts and washers.

4.5.5. The drilled holes shall be treated with zinc rich epoxy polyamide primer prior to fitting the bolts. Any mountings where bolting is not possible or practical and where welding must be done to a main structure, then such welding shall require the Contractors Mechanical Engineers prior approval. Proof of such approval shall be provided to the Supervisor before any work can commence.

4.5.6. The stainless-steel racking and JB's shall be bolted to the treated mild steel supports or brackets using stainless steel bolts, nuts and washers.

4.5.7. Where it is more practical for angle iron to be used, the minimum size of angle-iron shall be 20mm x 20mm and a maximum of 75mm x 75mm. Any deviation from the above size must be authorised by the Supervisor.

4.5.8. No more than three cables shall be placed on one angle iron. The cables shall not project beyond the square of the angle-iron.

4.5.9. Angle-iron or cable tray shall be supported at a minimum of every 1500mm when installed horizontally and every 3000mm in a vertical run.

4.5.10. Cable trays shall be provided if the number of cables to be supported exceeds three.

4.5.11. Cable trays and cable racking shall be mounted in the vertical plane to minimise collection of dust on the cables.

4.5.12. Angle-iron supports shall be provided where cable droppers or risers leave the main racks to feed individual items, and in all cases the cable rack or cable trays shall provide a continuous support for the cables.

4.5.13. Cable tray routes and positions shall be as per relevant Contractor drawings or as detailed by the Supervisor.

4.5.14. Exposure of cables to direct sunlight shall be avoided if at all possible.

4.5.15. Single core cables shall be laid in trefoil with aluminium banding every 1 000mm.

4.5.16. Insulok type cable ties shall be used to strap cables onto trays, racks, and supports. For cables larger than 50mm diameter, LK5 (540x133mm) straps shall be used. For cables less than 50mm diameter, T120R (388x7.8mm) straps shall be used.

4.5.17. Rubber cables shall be strapped every 300mm and SWA shall be strapped every 500mm.

4.5.18. Where cables of less than 25mm diameter are terminated, a coil providing 400mm slack, shall be left in the cable as close as is practical to the termination point.

4.5.19. Where cables of greater than 25mm diameter are terminated at field control devices and motors, a loop of 400mm slack shall be left in the cable as close as is practical to the termination point.

4.6 Cables in Ducts

4.6.1. Ducts shall be kept clean and dry and must be well sealed against seepage. The cable duct shall be completely covered by "chequer" plates or concrete slabs of adequate strength.

4.6.2. The cables shall be run in straight runs with crossings being avoided where possible and shall make a neat layout to the satisfaction of the Supervisor when completed and shall conform to the relevant cable layout drawings.

4.6.3. Cables supported and strapped onto racks are bound by the following, unless specified otherwise on drawings compiled by the Contractor or approved by the Transnet Project Manager.
4.6.4. The rack shall be attached to the side walls of the ducting as indicated on drawings such as for substation layouts or trenching layouts.

4.6.5. The tiers shall have a vertical pitch of 300mm or more. HV and LV power cables shall be laid on the upper tiers where possible.

4.6.6. The horizontal spacing between HV cables and between LV power cables shall be a minimum of the diameter of the largest cable in the group.

4.6.7. Gaps between cables shall be left clear. Control and signal cables may be laid touching one another.

4.6.8. Power control and signal cables shall be run on separate racks.

4.6.9. Where it is not possible to use separate racks, the clearance between signal cables and control or power cables shall be 300mm or better. Permission from the Supervisor must be obtained prior to running control and power cables on the same rack.

4.6.10. Power cables on racks shall not be double banked. Control cables may be double banked if required as indicated by the Contractor drawings or by the Supervisor.

4.7 Labelling

4.7.1. The Contractor shall supply labels for all devices, such as pull cords switches, speed switches, limit switches, etc and all local stations.

4.7.2. All labels shall be engraved on "Traffolyte" material unless otherwise stated.

4.7.3. A white-black-white material shall be used for designation labels and a red-white-red for warning labels.

4.7.4. The minimum thickness for labels shall be 1,5mm. The minimum height of letters to be 12mm.

4.7.5. The labels shall not discolour or distort in service.

4.7.6. Each device such as pull cord switches, speed switches, belt alignment switches, high level switches, etc. shall have a label engraved with the device number as designated on the

4.8 Wiring for Connecting of Boards and Equipment

4.8.1. Wiring for connecting of boards and equipment shall be brought to the terminal blocks and in cases where terminal blocks are not fitted direct to the equipment terminals.

4.8.2. The inner sheathing shall be stripped to the glands in so far as cables are involved.

4.8.3. Connections to junction box terminals shall be of the screw damping type. Connections to stud terminals shall be made by using crimped solderless lugs. Approved hand crimping tools may be used for lugs up to 10mm² and hydraulic crimping tools utilising hexagon dies shall be used for lugs larger than 10mm².

4.8.4. Correctly sized lugs must be used. Enlarging of holes in lugs will not be permitted.

4.8.5. Connections to unusual or special terminals shall be made with crimped solderless lugs of a type suitable for the application.

4.8.6. All wiring shall be individually terminated at terminal rails. One wire per lug, and one wire per terminal or contact.

4.8.7. The wiring inside of boards and equipment for connecting up shall be well planned and neatly arranged in the best possible manner without crossing of cores and it shall be possible to trace the individual wires without disconnecting or undoing the strapping or lacing.

4.8.8. Bunching of 4 current carrying conductors is permissible without using a de-rating factor.

4.8.9. The de-rating factor for over 4 current carrying conductors shall be approved by the Supervisor.

4.8.10. All wiring shall be marked except in special cases, which shall require the Supervisors' approval. Wire markers shall only be I/O related between the marshalling rack and the PLC I/O cards. The connecting-up shall be as per relevant drawings with the conductors marked with interlocking yellow PVC ferrules as per PARTEX Type PA or similar type approved by the Supervisor.

4.8.11. The markings for horizontal runs shall be from left to right facing them and for vertical runs from the bottom upwards.

4.8.12. Light fittings shall be fixed with galvanized steel or corrosion protected (to Transnet Corrosion Protection Specification EEAM-Q-008) brackets to building or steelwork.

4.8.13. Light fittings shall be installed with lamps of correct size and type fitted as indicated in the relevant drawings.

4.8.14. Connections between circuit conductors and accessories shall leave sufficient slack for the connecting up or replacing of some components.

4.8.15. This slack shall be taken up inside the fittings or connection boxes.

4.8.16. Light switches, socket, power and plug outlets shall be installed as indicated on the relevant drawings. Where it is not practical to mount the equipment as shown on the Contractors drawings, amended instructions will be issued by the Supervisor.

4.8.17. Multi-phase outlets shall be connected in the standard voltage phase rotation sequence.

4.8.18. A clearance of 2m or better shall be left between switches or socket outlets and water taps and pipes.

4.8.19. Power skirting shall be installed and connected according to the relevant drawings.

4.8.20. The channels for power and communication systems shall remain fully separated.

4.8.21. The different sections shall be electrically bonded.

4.9 Labelling

4.10.1. The Contractor shall supply labels for all devices, such as pull cords switches, speed switches, limit switches, etc and all local stations.

4.10.2. All labels shall be engraved on "Traffolyte" material unless otherwise stated.

4.10.3. A white-black-white material shall be used for designation labels and a red-white-red for warning labels.

4.10.4. The minimum thickness for labels shall be 1,5mm. The minimum height of letters to be 12mm.

4.10.5. The labels shall not discolour or distort in service.

4.10.6. Each device such as pull cord switches, speed switches, belt alignment switches, high level switches, etc. shall have a label engraved with the device number as designated on the equipment lists. For local control stations, the label shall contain the name of the equipment being controlled as well as the device number.

4.10.7. The labels shall be uniform in size and symbol height as far as practicable.

4.10.8. The labels shall be fixed with non-corrodible screws, adjacent to the device.

4.10.9. The following notices to the approval of the Supervisor shall be fixed outside each entrance to a sub-station or switch room. Each notice shall be inscribed on durable material in letters at least 32mm in height. Notices shall be in English and in such other languages or form as prescribed by the Machinery and Occupational Safety Act, No.6 of 1983:

4.10.10. "DANGER" in red letters, together with a red danger symbol (e.g. skull and crossbones), all on a white background.

4.10.11. Maximum voltage present in the sub-station or switch room (i.e. 3300V), in red letters on a white background.

4.10.12. Name of sub-station or switch room, in black letters on a white background.

4.10.13. A notice prohibiting unauthorised persons from handling or interfering with electrical apparatus.

4.10.14. A notice prohibiting unauthorised persons from entering and opening or interfering with installed electrical apparatus.

4.10.15. A notice containing directions as to the procedure in case of fire.

4.10.16. A notice containing directions for the treatment of persons suffering from electric shock.

4.10 Earthing and Bonding, Lighting, and Cathodic Protection

4.11.1. Metal parts of all electrical equipment, other than current carrying parts, are to be earthed.

4.11.2. Earthing conductors shall be of electrolytic copper and sized in accordance with SANS 10142-1:2012 or SANS 10313:2012 as applicable to duty. Lighting, general earthing, cathodic protection earth spikes to be of stainless-steel material.

4.11.3. All earth connections shall be of cadweld (thermite process), brazed or solderless pressure type connectors, except that earth connections to electrical plant and equipment shall be the latter type.
4.11.4. Main earthing conductors are not to be cut or joined. Branch tee-offs from the main earthing conductors are to be of the cadweld or brazed type.

4.11.5. All cable trays, racks, conduit, trunking, cable sheaths and armouring ducts, boxes and all other metal work connected with wiring (other than the current carrying parts) are to be bonded to earth.

4.11.6. Main earthing points shall be made of a suitable number of stainless-steel earth rods, driven to a suitable depth, or earth mats or plates shall be used. The maximum earth resistances per earthing point is 5Ω. The total earth loop impedance of any system shall not be more than 2Ω. An earth well consisting of a 300mm length of 300mm diameter asbestos cement pipe with a concrete cover shall be provided at each earth rod. Contractors shall perform tests and provide test certificate.

4.11.7. For lightning protection, it is necessary to earth the bases of metal structures at 2 opposite corners and at intervals of not more than 50m or as shown on the drawings.

4.11.8. Conveyor structures shall be earthed every 25m using 16mm stainless steel earth rods bonded to the structure with 70mm green PVC insulated copper cable.

4.11 Earthing of Cable Armouring

4.12.1. All cables provided with a metal sheath and/or armour shall be terminated at both ends into an approved gland for PILCSWA cable and mechanical compression type gland for PVC SWA PVC cable. The gland shall form a good electrical connection to the gland plate.

4.12.2. Special attention shall be paid to the earthing of all 11kV cable glands. A 70mm² bare electrolytic copper conductor shall be used to earth the cable gland effectively to the nearest part of the main earthing ring or earth bar.

4.12.3. All SWA cable shall have its armouring earthing at both ends via an earth tag on its gland and a half conductor size lugged earth wire to the nearest earth bar or stud, except in the case of insulated junction boxes with metal gland plates. In this case no earth tag is required.

4.12.4. Where an earthing conductor is exposed to possible mechanical damage, it shall be protected by means of a suitable conduit or pipe.

4.12.5. In general earth conductors shall be bare electrolytic copper except where PVC insulated earth conductors are specified on the drawings for certain applications. These include the neutral point of all lighting transformers and from the earthing bars of all 3,3kV and 400V switchgear to the main substation earthing bar.

4.12.6. Sizes of all earthing conductors shall conform to SANS 10142-1:2012.

4.12 Standards

4.13.1. Compliance with the latest amendments of the following codes and standards shall be considered a minimum requirement.

4.13.2. In the event of different requirements between codes and/or standards the most stringent code or standard shall apply.
4.13.3. SANS 10142-1:2012: The wiring of premises Part 1: Low-voltage installations.

4.13.4. OHSA:1993: Occupational Health and Safety Act (No. 85 of 1993).

4.13.5. Municipal By-Laws and special requirements of the Borough of Richards Bay.

4.13.6. Transnet Specification for Installation of Cables.

4.13.7. Telkom Regulations.

4.13.8. SANS 10313:2012: Protection of Structures against Lightning.

4.13.9. Transnet Safety Regulations.

4.13 Inspection and Testing

4.14.1. The complete electrical installation, including equipment fabricated on site or in the workshop of a sub-Contractor is subject to inspections and tests which shall be carried out in the presence of the Supervisor. Twenty-four hours' notice of these tests shall be given.

4.14.2. The electrical installation shall be to the approval of the Supervisor.

4.14.3. The Contractor or sub-Contractor shall provide, without additional charges, the necessary equipment for testing.

4.14.4. Distribution boards, motor starting equipment, etc, shall be inspected and tested on site after cabling and connecting up has been completed.

4.14.5. The test voltages shall be applied according to test requirements.

4.14.6. The cabling shall be tested with all equipment such as motors disconnected. Care must be taken to prevent flashing at the cable ends.

4.14.7. The electrical installation shall be fully insulation tested before commissioning.

4.14.8. The testing shall be done between the phases, phase and neutral, if applicable and phase and earth.

4.14.9. All electrical connections shall be checked.

4.14.10. The functionality of the whole installation shall be tested.

4.14.11. Earth continuity and effectiveness tests are to be performed.

4.14.12. Tests are required to establish that polarity of single pole switchgear in single phase circuits has been connected correctly.

4.14.13. Current transformer circuits are to be checked for connection, open circuit and earthing prior to any circuit energisation.

4.14.14. All metering, protection and overload relays shall be checked to verify correct functioning by means of injection tests where necessary.

4.14.15. The Contractor shall make all arrangements and pay all fees for any tests required to be carried out by the supply authorities.

4.14.16. All motors shall have the insulation resistance of the windings checked before commissioning, according to the motor manufacturer test requirements.

4.14.17. All inspection and testing are to be conducted in accordance with approved Project Quality Plan and detailed inspection and test plans and check lists.

4.14 Technical Requirements

4.16.1. All works shall be completed to accepted good engineering practices.

4.16.2. The provisions of this specification and the relevant specifications enclosed within the specification are to be fully complied with.

4.16.3. Where applicable, manufacturer's instructions for the installation of equipment are to be strictly adhered to.

4.15 Quality Assurance/Quality Control

4.17.1. All installation, erection, testing, and commissioning shall conform to good electrical engineering practice and to this specification.

4.17.2. In all matters relating to the installation of electrical equipment the Contractor will be responsible for the quality and correctness of workmanship and for the quality and suitability of materials of his supply, in accordance with Transnet Specifications.

4.17.3. Any section of the work or materials supplied which is considered to be unacceptable, shall be remade or replaced to the satisfaction of the Supervisor.

4.17.4. Strict observance must be followed with this specification particularly with respect to the testing, pre-commissioning, and commissioning checklists.

1.1. Documentation

The following documentation will be produced by the Contractor, and will be issued to the Transnet Project Manager for review and approval in principle:

12.4.1. Drawings, documents, and schedules.

12.4.2. Cable Schedules.

12.4.3. Cable termination details.

12.4.4. Cable routing details.

12.4.5. Supporting calculations for the selected power cables.

12.4.6. Supporting calculations for the selected protective devices.

12.4.7. Site installation schedule.

12.4.8. Operating & Maintenance Manuals as detailed in the individual specifications listed.

APPENDIX E

SQUAD CHECK FORM

TRANSNET

Location	**Saldanha**	Squad Check Number	**1924701.M003-SQ-1378**
Title	**Master Operating Philosophy Plant - (Tippler Unit/ Apron Feeders/ Dust Collection)**	Contract No.	**M003**
Project Name	**Installation of the 3rd Tippler at the Port of Saldanha**	Project No.	**1924701**
Document No.	**1924701.M003-MA-0005**	Revision	**0A**

Discipline	Reviewer's Name	Reviewer's Signature	Date	Mandatory	Optional	Approved	Approved with Comments	Rejected	Information
	Richard Shandu		19/04/2020	X			✓		

REVIEW STATUS (Assigned by Responsible Project Manager)

C 1	☐	APPROVED	C 3	☐	REJECTED
C 2	☒	APPROVED WITH COMMENTS (REVISE & SUBMIT)	C 4	☐	INFORMATION

SIGNED BY: RESPONSIBLE PROJECT MANAGER	Print Name	Sphamandla Mathonsi
	Signature	
	Date	20 April 2020

This review is only for general conformance with the design concept of the Project and general compliance with the information given in the contract documents

SQUAD CHECK COMMENT SHEET

	Project / Contract No.	Squad Check No.
	1924701-M003	1924701.M003-SQ-1378

Comments	Name of Discipline	Action Taken by Responsible PM
Update as indicated in the review comments on each page.		

SIGNED BY: RESPONSIBLE PROJECT MANAGER	Print Name	
	Signature	
	Date	

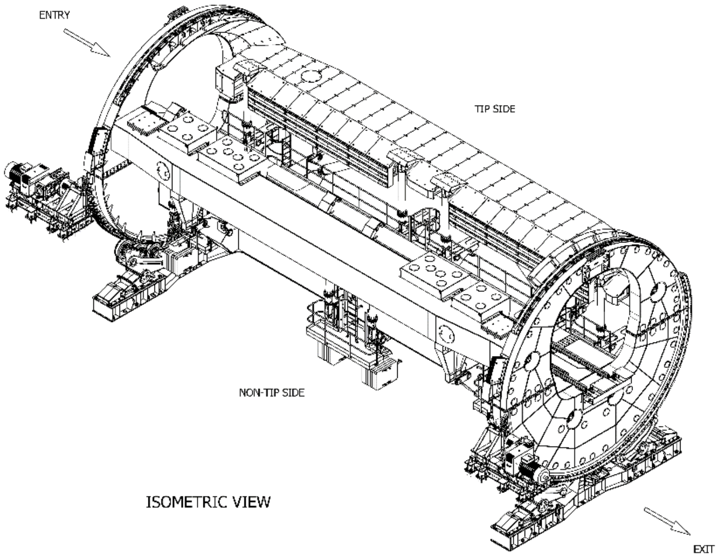
This comment sheet must always accompany the front cover sheet (Squad Check Form) once signed off

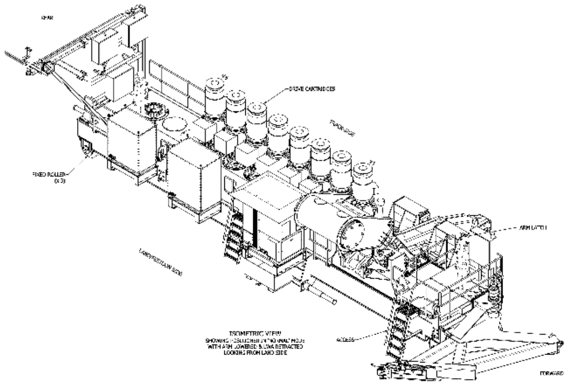
PROJECT-NAME	Tippler Saldanha				
PROJECT-No. CLIENT	1924701-M003	PROJECT-No.	AC0339		
DOC-No. CLIENT	1924701-M003--MA-0005	DOC-No.	**ENG-MAN-0913**	REV	A
DOCUMENT-TITLE	**Master Operating Philosophy Plant**				

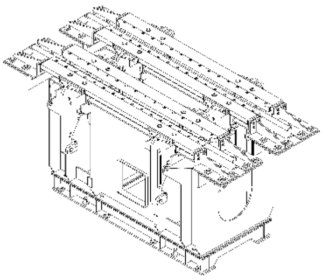
Master Operating Philosophy Plant

(Tippler Unit/ Apron Feeders/ Dust Collection)

(CONTROL PHILOSOPHY)







Rev.	Prepared		Checked		Approved		Reason for Revision
	Date	Name	Date	Name	Date	Name	
A	26.03.2020	D. Stark	26.03.20	S. Hussian	26.03.20	M. Wimble	

This copy is issued by an electronic data processing system and a signature is not required.
Original signed version is filed with the Quality Department

Product: **Wagon Tippler Unit**

Project: **AC0339 SALDANHA**

Seller: **TAKRAF GmbH**
Torgauer Straße 336
04347 Leipzig
Federal Republic of Germany

Buyer: **Transnet**

Contract No.: **1924701-M003**

Order No: **G0299**

Year of Construction: **2017/2018**

Table of Content:

Section END

1 GENERAL

1.1 General Description

This description provides the control philosophy for the operation of the Train Unloading system for the Tippler 3 plant at the port of Saldanha.

1.2 Train Unloading System Components

The system consist of the the following primary components:

One (1)	Tandem Unit Train Tippler Unloading System (Cage, Positioner, Grippers)
Five (5)	Hoppers
Five (5)	Apron Feeders
Five (5)	Knife Gates
One (1)	Dust Plant
Including (1)	Electrical Drive and Control System.

1.3 Subsequent – Control Philosophy Documents of the Main Units

To ensure ease of use, the following document structure has been setup. The purpose of this document is to describe the functionality of the various systems together. Because the subunits operate independently, the detail functionality and operations are described in their respective Control Philosophies as listed below.

- 1924701-M003--MA-0005 - Control Philosophy Tippler Positioner
- 1924701.M0003-LIS-0028 – Apron Feeder control philosophy
- 1924701.M0003-LIS-0026 - Dust System Control Philosophy
- 1924701.M0003-MA-0004 Apron feeder Knife Gates (Manually operated.)

1.4 Definitions - Abbreviations / Wording

Entry	Refers to the area of the unloading system where the full wagons approach the Tippler
Exit	Refers to the area of the unloading system where the empty wagons depart the Tippler
Main Arm	The element of Positioner that engages with the rake of wagons. Referenced as ‘Arm’ in this document to differentiate from the Last Wagon Arm (LWA)
MCR	Main Control Room
LCS	Local Control Station

LWA	Last Wagon Arm. A separate arm to the Positioner Arm which is used solely to push the last pair of wagons into the Tippler
PCS	Client's Plant Control System
Positioner	Mobile rail mounted device which hauls the rake of wagons and positions the wagons in the Tippler
Profibus	The open communications system used by Siemens
Rake	Refers to a length of wagons which excludes the locomotive
Tippler Plant	Refers to the M003 Project, including Tippler Unit, Hoppers, Apron Feeders, Dust Plant
Train	Refers to a combination of wagons and locomotive(s).
SCADA	Sequence Control and Data Acquisition
THD	Train Holding Device, i.e. Wheel Gripper
Wheel Gripper	A device designed to restrain the wagons to prevent movement of the rake/train and consequently prevent any forces from the train dynamics being transferred to the wagons on the Tippler during Tippler rotation
TUS	Train Unloading System. A system of separate components controlled to handle and empty a rake of wagons.
TCS	Train Unloading System - Control System
Unit Train Rotary Wagon Tippler	A type of Wagon Tippler where the rotation centre is aligned with the centre of the wagon rotary couplers to allow unit train handling
VSD	Variable Speed Drive

I/O -
LV -
STO -
ES -
PLC -
CCR -
CV - Conveyor

2 SPECIFICATION

The operation of the Tippler Plant is in accordance to the following

I. Regulatory requirements
II. South African Standards
III. Transnet Project Guidelines, specifications and Standards
IV. International Standards.

3 REFERENCE DRAWINGS & DOCUMENTS

Plant	49055178	Tippler unit & dust collection battery limit layout
Tippler Unit	49055206	Plant Arrangement Drawing
Tippler Unit	9112_D38	Electrical Equipment Schedule
Apron Feeder	B100-EAK-001	Apron Feeder Arrangement
Dust Plant	B100-JKA-001	Dust Plant Arrangement

3.1 Programmable Logic Controller (PLC)

The TUS handling plant, consisting of the main components listed in 1.2 above, is controlled by a dedicated PLC system.

Equipment mounted electrical components in the form of sensors, switches, etc, communicate with the PLC via input and output electrical signals to enable the PLC to control the function of all equipment (Tippler, Positioner, THDs) in the correct manner and sequence.

The Equipment operating functions are segregated in such a way that the software requirements are defined by a series of sequences, which are either free running, or event driven, as appropriate. A sequence in isolation provides the logic for the execution of a control system function, or mechanical operation and is a component part of the Equipment control system.

Any operation that the equipment is called upon to perform is accommodated using one or more sequences. Therefore, when an operator initiates an operation, a sequence is enabled which performs the selected operation, in so doing, several other sequences may be called upon.

3.2 Travel Limits & Monitoring

Normal positional limits of machine travel and motion of integral equipment/systems are controlled by suitably rated and enclosed absolute encoders and limit switches comprising proximity switches and laser sensors providing digital signaling to the PLC either directly or via remote I/O.

Tippler and Positioner speed feedback is provided to the PLC from incremental encoders connected directly to the VSD motors.

Hydraulic and lubrication systems incorporate the necessary amount of pressure, temperature, level and operational sensors which provide digital and analogue signaling to the PLC either directly or via remote I/O.

System alarms are provided for all exceptional events including overload and over travel signals, collision avoidance signals and any loss of signals.

Following investigation and remedy, alarms are cleared and ‘Auto’ control is reinstated from the point of interruption.

4 SAFETY CIRCUITS & INTERLOCKS

4.1 Safety

The following devices are hardwired:

- Emergency Stop Pushbuttons (Twist Reset)
- Operator’s Control Room Emergency Stop Pushbutton (Key Reset)
- ‘Lock Out’/’Lock In’ Pushbuttons (Tippler)
- Tippler & Positioner VSD,’s STO Lock Out Switches
- Tippler Over travel Limit Switches
- Positioner Over travel Limit Switches
- Motor Overloads, Circuit Breakers

4.2 Emergency Stop Relay ES1

This Emergency Stop sequence will immediately stop all equipment in the TUS in a controlled manner. Emergency Stop Pushbuttons located at Local Control Stations and other strategic locations. Operation of any of these devices will de-energise the Emergency Stop Relay ES1. For a full functional description of the Emergency Stop philosophy refer to the Emergency Stop and Over travel Circuit Diagram.

4.3 Motor Overloads, Circuit Breakers

Motor overloads, circuit breakers are hardwired into the associated contactor circuit. On receipt of a trip condition the associated contactor will be de-energized.

For a full functional description, refer to LV Starter Circuit Diagrams.

5 CONTROL MODES

All control modes of the Sub-units are via the PLC but with hard wired interlocking

- Automatic
  Controlled from the Control Room PLC. No manual intervention required.
- Local
  Controlled from the Local Control Station. Reduced interlocks.
- Semi-Auto
  Controlled from the Local Control Station. Individual cycles, e.g. one complete Tippler Tip cycle, one complete Positioner Forward cycle.

Modes and transfer of control are selected by the operators from the central control room SCADA display and LCS pushbuttons by a coordinated communication arrangement programmed into the PLC.
Refer to the control layout of each LCS.

5.1 Automatic (Main Control Room)

Following the train being located within the TUS area, all train moving operations by the system are required to be undertaken in the “Automatic” mode with strategic pauses for Tippler ‘Lock In’/’Lock Out’ and Locomotive uncoupling.

All pre-requisite signal checks are incorporated in the control system software such as Tippler at Rail Level, Tippler Clamps Raised, Positioner located at ‘Normal Forward’ limit, Positioner Arm Raised, Positioner LWA Retracted, Positioner at pre-determined travel locations, Entry side THDs Retracted, Hydraulic and Lubrication systems running and healthy.

5.2 Local (Local Control Stations - LCS)

For commissioning, maintenance and general setting up procedures the local operation and maintenance staff can have control of the individual machines from the associated LCS.
The Permission to control machines locally is provided to the Sub-units by the Plant operator upon request from the associated LCS pushbutton and with wireless communication between the local operator and control room operator.

After transferring control to the LCS, all ‘Local’ control functions provided at that LCS are then available to the local operator.

Once ‘Local’ control has been passed to a particular machine, i.e. Tippler, all other equipment (Positioner and THDs) or Apron Feeders or Dust plant are to be in a predetermined state/position prior to ‘Local’ control being selected and will be locked out whilst the Tippler is under commissioning or maintenance for the avoidance of collision and hazardous working conditions.

5.3 Semi-Auto Mode

5.3.1 Tippler

A ‘Semi-Auto’ mode of operation is available which permits the following operations:

Tippler	One complete Tip Cycle One complete Return Cycle
Positioner	One complete Forward Cycle One complete Return Cycle
THDs	One complete Engage and Retract Cycle

This function is beneficial for expediting the commissioning process by testing individual motions before undertaking full cycles and for setting the equipment back to work following maintenance and repair prior to full on load operation.

At the associated LCS the local operator requests permission for local control from the MCR operator in a similar manner to the process of requesting ‘Local’ control as described in Description Of Operations.

5.3.2 Apron Feeders

The Semi – Automatic Mode of operation is intended for use during commissioning and operator training.
All interlocks are fully functional but the operator starts each piece of equipment via the SCADA.
This allows the operator to step through the sequence manually.
This is different to the tippler, positioner and wheel grippers that have defined and limited movements that are initiated at the local control stations as well as at the SCADA.

5.3.3 Dust Plant

The Semi – Automatic Mode of operation is for use during commissioning and operator training.
All interlocks are fully functional but the operator starts each piece of equipment via the SCADA. This allows the operator to step through the sequence manually. This is different to the tippler, positioner and wheel grippers that have defined and limited movements initiated at the local control stations.

5.4 Maintenance Mode (LCS)

5.4.1 Tippler Unit

For commissioning, maintenance and general setting up procedures the local operation and maintenance staff can have control of the individual machines from the associated LCS. Permission to control machines locally is provided to the Tippler, Positioner Land and THD LCS by the MCR operator upon request from the associated LCS pushbutton and with wireless communication between the local operator and control room operator.

After transferring control to the LCS, all ‘Local’ control functions provided at that LCS are then available to the local operator.

In the case of the Positioner, having selected ‘Local’ at the Land LCS, the local operator is required to board the Positioner and select ‘Local’ at the Onboard LCS to enable ‘Local’ control to be fully implemented.

The controls at the LCS are fundamentally ‘push to run’ with all control interlocks for each individual function (Rotation/Travel Drive, Arm Raise/Lower, Latch Engage/Retract) operational.

In respect of Rotation and Travel Drives, selection of the ‘Overtravel’ option shall suspend normal travel interlocks so that the setting and testing of the over-travel limit switches can be tested and re-set without interruption.

Once ‘Local’ control has been passed to a particular machine, i.e. Tippler, all other equipment (Positioner and THDs) are to be in a predetermined state/position prior to ‘Local’ control being selected and will be locked out whilst the Tippler is under commissioning or maintenance for the avoidance of collision and hazardous working conditions.

5.4.2 Apron Feeder

The Local Mode will allow the testing of equipment individually after maintenance has been done without other equipment being online. Equipment is controlled directly from the local control stations and does not latch in this mode. Thus, as soon as the field start is released the motor shall stop. It shall only be possible to run the apron feeder in reverse at 50% speed for a maximum of 10 seconds at a time. Process interlocks are bypassed in this mode but safety interlocks are still in effect.

5.4.3 Dust Plant

The Local Mode will allow the testing of equipment individually after performing maintenance without other equipment being online. Control of equipment is directly via the local control stations and drives do not latch in this mode. Thus, as soon as the field start is released the motor shall stop. Process interlocks are bypassed in this mode but safety interlocks are still in effect.

5.4.4 Knife Gates

The primary function of the knife gates is to isolate an individual Apron Feeder so that it may be removed for maintenance. When it is decided that one apron feeder requires isolation for maintenance, the operator will shut down the tippler system. Each Apron feeder has its own knife gate installed between the Apron feeder and hopper. Using the push buttons on a local control station, the operator will close the knife gate. The apron feeder is then removed and the tippler system can be restarted. The tippler system will still operate at full nominal capacity with only four out of five apron feeders. Refer to 1924701.M003-LIS-0028 Apron feeder Control philosophy.

Knife gates are maintenance equipment and can only be utilized during maintenance. There are no interlocks between the knife gates and any of the other systems installed or operated on the plant.

6 SEQUENCE OF OPERATIONS

6.1 Overview of Operation Requirements

6.1.1 Startup

In Automatic mode, and under SCADA control, the TUS and ancillary equipment shall remain in a “Standby” condition until the *Start Sequence* is initiated. Once initiated, a start up sequence commences until all controlled devices are running, or in their correct state for continuous operation. For the system to be in a ready state, the following conditions need to be met with priority as listed below

1. **Dust plant signal healthy**
   The Train unloading system (TUS) requires a signal from the Dust extraction system that indicates the system is running.

2. **CV308 Signal Healthy (Priority and scope)**
   The TUS requires a signal from the CCR showing that CV308 is running.

3. **Apron feeder ready to Run Signal healthy**
   The TUS requires a signal from the Apron feeders that they are ready to run.

4. **Apron Feeder Hopper level**
   Once the optimum hopper level is achieved, i.e.~~2.5~~ tips, the Apron Feeders will start to evacuate material from the hoppers, provided that the CV308 signal is still healthy.

6.2 Automatic operation

Tippler Unit unloads the rake including the last wagon. All systems running in automatic mode.

To ensure that the hopper levels remain constant, the system is programmed to adjust the speed of the Apron feeders. The Apron feeders run at a constant speed. If the hopper level rises, the Apron feeders will be sped up automatically. The speed increased will be by a defined percentage. In a similar manner, if the hopper levels drop to a low level as determined by the system, the Apron feeders speed will be reduced by a defined percentage to increase, and thereafter maintain the hopper levels.

If the system encounters a blocked hopper pocket based on material blockage or due to an Apron Feeder failure the four (4) remaining Apron feeders will increase in speed to handle the designed throughput.

After last wagon pair unloading will be the Apron feeders continue to evacuate material from the hoppers, until all material has been removed.

Dust Extraction system will continue to evacuate any dust in the Tippler system, until the last wagon has been unloaded and the Apron feeders have evacuated all material from the hoppers.

6.3 Stopping Sequences

The automatic stopping sequence controlled by the SCADA system is developed for normal stops after the last wagon pair unloading has been completed as well as for stops due to equipment failures.

6.3.1 Normal stopping sequence

1. The TUS will receive a signal from Tippler Unit that the last two wagons have been unloaded and remain in the tippler cage.

2. The Apron feeders run until hopper is empty, then will stop.

3. Dust plant shutdown sequence initiated.

4. Based on completed stop of the Unloading Plant a signal will be sent to the CCR that CV308 can be stopped.
   Stopping of CV308 is controlled by the CCR based on conveyor unloading/ discharge requirements and not from the TUS control.

6.3.2 Apron Feeder / Hopper Failure stopping sequence

1. Tippler Unit receives a signal of hopper normal level height exceeded or Apron Feeder stop.

2. Tippler Unit completes the ongoing cycle of the Positioner and Tippler Cage (even unloading and return to rail track level) before stopping, Positioner Arm and Wheel Grippers will be engaged to prevent an uncontrolled rake.

3. Dust Plant stops as per its own procedure

4. Once the unloading plant has been stopped, a signal will be sent to the CCR.

6.3.3 Dust Plant Failure stopping sequence

1. Tippler Unit receives a signal of the Dust Plant stop.

2. Tippler Unit completes the ongoing cycle of the Positioner and Tippler Cage (even unloading and return to rail track level) before stopping, Positioner Arm and Wheel Grippers will be engaged to prevent an uncontrolled rake
3. Based on the completion of the Tippler Unit finished cycle, all Apron Feeders will be stopped.

4. Once the unloading plant has been stopped, a signal will be sent to the CCR.

END OF DOCUMENT

APPENDIX F

SQUAD CHECK FORM

TRANSNET

Location	**Saldanha**	Squad Check Number	**1924701.M003-SQ-1003**
Title	**Dust Extraction System - Control Philosophy**	Contract No.	**M003**
Project Name	**Installation of the 3rd Tippler at the Port of Saldanha**	Project No.	**1924701**
Document No.	**1924701.M003-LIS-0026**	Revision	**00**

Discipline	Reviewer's Name	Reviewer's Signature	Date	Mandatory	Optional	Approved	Approved with Comments	Rejected	Information
	Richard Shandu	RS	15/08/2019	X			✓		

REVIEW STATUS (Assigned by Responsible Project Manager)

C 1	☐	APPROVED	C 3	☐	REJECTED
C 2	☑	APPROVED WITH COMMENTS (REVISE & SUBMIT)	C 4	☐	INFORMATION

SIGNED BY: RESPONSIBLE PROJECT MANAGER	Print Name	Sphamandla Mathonsi
	Signature	
	Date	15 August 2019

This review is only for general conformance with the design concept of the Project and general compliance with the information given in the contract documents

TRANSNET

SQUAD CHECK COMMENT SHEET

Project / Contract No.	**Squad Check No.**
1924701-M003	1924701.M003-SQ-1003

Comments	**Name of Discipline**	**Action Taken by Responsible PM**
See comments in the red-lines within the document.		

SIGNED BY: **RESPONSIBLE PROJECT MANAGER**	**Print Name**	
	Signature	
	Date	

This comment sheet must always accompany the front cover sheet (Squad Check Form) once signed off

TRANSNET

TAKRAF
TENOVA

PROJECT-NAME	SALDANHA TIPPLER T3				
PROJECT-No CLIENT	1924701-M003	PROJECT-No	AC0339		
DOC-No. CLIENT	1924701.M0003-LIS-0026	DOC-No.	ENG-LIS-0198	REV	0
DOCUMENT-TITLE	Dust Extraction – Control Philosophy				

Dust Extraction System

Control Philosophy

Tippler T3 for Saldanha Iron Ore Terminal

Contract No.: 1924701-M003

Reviewed by: R. Shandu
Date: 22/07/2019

Rev.	Prepared (TAKRAF)		Checked (TAKRAF)		Approved (TAKRAF)		Approved (TGC)		Revision Status
	Date	Name	Date	Name	Date	Name	Date	Name	
A	22/06/2017	JB Bukenya	26/06/2017	W. Lampracht	26/06/2017	M. Thoresson			
B	08/05/2018	W Russell	08/05/2018	C van Niekerk	08/05/2018	W Lamprecht			
0									

Rev	Brief details of change
A	Generated
B	Updated as per client comments and tags changed as per client requirements
0	Updated as per client comments and P&ID revision

Table of Contents

1 Scope

Transnet is installing a new tippler, Tippler 3, at the Port of Saldanha. Tenova TAKRAF Africa has been contracted to supply and install the new tippler system complete with dual tandem tippler, wagon positioner, wheel grippers, apron feeders below the tippler to extract the iron ore onto a conveyor belt (supplied by others) and a dust extraction plant to extract the dust generated by the tippler and the apron feeders. This document describes the Functional Control Philosophy of the Dust Extraction Plant. It covers the overview of the system, the instrumentation, system interlocking, modes of control, and descriptions of operations.

This document shall be used by Engineering disciplines involved in the design, operation and maintenance of the Dust Extraction Plant.

The general philosophy proposed for the equipment below:

- Integrated control via Tippler S7 400 PLC where the equipment requires sequencing and interlocking, this includes alarming and trending
- Hard wired emergency stops and local isolators at each motorized component of the Dust Extraction Plant for personnel safety and equipment safety
- Local control stations for starting and stopping of drives locally for maintenance.

2 Reference documentation

This document must be read in conjunction with the following documents:

- 1924701-0-000-F-PF-0001-01–Dust extraction system process flow diagram
- 1924701-0-000-P-PI-0001-01–Dust extraction system piping and instrumentation
- 1924701-0-000-P-PI-0001-02–Dust extraction system piping and instrumentation
- 1924701-0-000-P-PI-0001-03–Dust extraction system piping and instrumentation
- 1924701-0-000-P-PI-0001-04–Dust extraction system piping and instrumentation
- 1924701-0-000-P-PI-0001-05–Dust extraction system piping and instrumentation
- 1924701-0-000-P-PI-0001-06–Dust extraction system piping and instrumentation
- 1924701-0-000-P-PI-0001-07–Dust extraction system piping and instrumentation
- 1924701.M003-MA-0001-01 & 02 – Train Unloading System - Description of Operations Part 1 & 2
- 1924701.M0003-LIS-0028 – Apron Feeder Control Philosophy

Ensure that the latest revision of these documents and drawings is used.

3 System Overview

The dust extraction system extracts the dust generated by the tipping of material from the Rail Wagons into the hoppers and at the transfer points on the reclaim conveyor underneath the feeders. There are two dust collectors fitted with bag filters that function in parallel. Ducting conveys the dust from the cowl over the tippler and the discharge chutes at the apron feeders to the dust collectors and a single fan draws the air through both sets of filters. The filters are cleaned using a reverse pulse cleaning system with compressed air.

Screw conveyors transfer the dust from the dust collectors to a pneumatic conveying system that transport the dust to a storage silo. A rotary vane feeder and double flap valve below each screw conveyor seals the pneumatic conveying system from the dust collectors and screw conveyors. Another rotary vane feeder controls the flow of dust from the storage silo and feeds the dust via a diverter chute to either a truck or a pug mill. The pug mill mixes the dust with water and it discharges onto the reclaim conveyor. ??

The major mechanical equipment for the dust extraction plant is the following:

?? = How is it currently done on-site?

- 450kW 3.3kV Dust Extraction Fan
- 2 x 22 kW Air Compressors
- 2 x Desiccant Air Dryer
- 2 x Bag Filters
- 2 x 3 kW 400v Screw Conveyors
- 2 x 0,37 kW 400v Rotary Vane Feeder
- 2 x Double Flap Valves
- 30 kW 400 V Blower
- Storage Silo
- 0,75 kW 400V Storage Silo Rotary Vane Feeder
- Manually operated Diverter Chute
- Manually operated Spout
- 3 kW 400 V Pug Mill

4 Modes of Operation

The system has three modes of operation, Automatic, Semi-Automatic and Manual. Automatic and Semi-Automatic are remote modes that are selected on the SCADA. Manual is a local mode requested via a local/remote selector switch on the local control station. An operator will go to the field and set the selector switch to the Manual mode. This generates a request on the SCADA and if the conditions are correct, the operator at the SCADA will grant the request. Indication lamps on the control station tell the field operator that Manual mode is active. Once local operation is complete, the field operator must return the selector switch to remote. The SCADA operator will then select either Automatic or Semi-Automatic. The exception to this is the diverter chute and dust storage rotary vane feeder. All three modes are requested at the local control station to enable truck loading but permission is still granted on the SCADA. ???

A. Automatic

The Automatic Mode of operation is the normal mode of operation for the plant. Control of the equipment is via PLC with operator intervention only required for global sequence starts and stops or in the event of a fault. The PLC will automatically start up and shut down all equipment as required.

B. Semi-Automatic

The Semi – Automatic Mode of operation is for use during commissioning and operator training. All interlocks are fully functional but the operator starts each piece of equipment via the SCADA.? This allows the operator to step through the sequence manually. This is different to the tippler, positioner and wheel grippers that have defined and limited movements initiated at the local control stations.

C. Local

The Local Mode will allow the testing of equipment individually after performing maintenance without other equipment being online. Control of equipment is directly via the local control stations and drives do not latch in this mode. Thus, as soon as the field start is released the motor shall stop. Process interlocks are bypassed in this mode but safety interlocks are still in effect.

For further details on the modes of control, please refer to 1924701.M003-MA-0001-02, Train Unloading System - Description of Operations Part 2

5 Abbreviations

AB	Air Blower	PIT	Pressure Transmitter with Display
AIT	Moisture Transmitter with Display	PLC	Programmable Logic Controller
CH	Chute	PT	Pressure Transmitter
CP	Compressor	SSL	Speed Switch Low
CV	Conveyor	TT	Temperature Transmitter
DOL	Direct On Line	VSD	Variable Speed Drive
DR	Dryer	VT	Vibration Transmitter
FA	Fan	XVC	Solenoid Valve Open
FE	Feeder	XVL	Solenoid Valve Left
FIT	Flow Transmitter with Display	XVO	Solenoid Valve Close
FV	Double Flap Valve	XVR	Solenoid Valve Right
HS	Hand Switch	YA	Event Alarm/Fault
HSS	Emergency Stop	YC	Controller
LSH	Level Switch High	YL	Indicator Light
LT	Level Transmitter	ZSC	Position Switch Close
ML	Mill	ZSL	Position Switch Left
MU	Motor Unit (VSD or DOL)	ZSO	Position switch Open
PDT	Pressure Differential Transmitter	ZSR	Position Switch Right

6 Instrument list

No.	Tag Number	Description	I/O Type	Function
Drawing: 1924701-0-000-P-PI-0001-02				
1	516-TT-001	DE Blower Motor Winding U-phase Temp Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
2	516-TT-002	DE Blower Motor Winding V-phase Temp Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
3	516-TT-003	DE Blower Motor Winding W-phase Temp Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
4	516-TT-004	DE Blower Motor Bearing DE Temp Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
5	516-TT-005	DE Blower Motor Bearing NDE Temp Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
6	502-HS-001	DE Blower Field Isolator	Digital Input	Indication
7	503-HS-002	DE Blower Mode Selector	Digital Input	Local/Remote Selector
8	504-YL-001	DE Blower Remote Indicator	Digital Output	Indication
9	505-YL-002	DE Blower Local Indicator	Digital Output	Indication
10	506-HS-003	DE Blower Jog Start	Digital Input	Start signal, non-latching
11	507-HSS-001	DE Blower E-Stop	Digital Input	Trip System
12	530-PDT-001	DE Dust Collector 1 Differential Pressure Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
13	530-YC-001	DE Dust Collector 1 Solenoid Controller	N/A	Local controller, I/O listed as instruments
14	530-LSH-001	DE Dust Collector 1 Level Switch	Digital Input	Trip on unhealthy
15	530-PT-001	DE Dust Collector 1 Air Supply Pressure Transmitter	Analogue Input	Indication, Alarm on High or Low
16	531-SSL-001	DE Screw Conveyor 1 Speed Switch	Digital Input	Alarm on unhealthy
17	533-ZSO-001	DE Dust Collector 1 Isolation Valve Open Limit	Digital Input	Indication
18	534-SSL-001	DE Rotary Vane Feeder 1 Speed Switch	Digital Input	Alarm on unhealthy
19	536-XVO-001	DE Double Flap Valve 1 Top Open Solenoid	Digital Output	Actuate Flap
20	536-XVC-001	DE Double Flap Valve 1 Top Close Solenoid	Digital Output	Actuate Flap
21	536-ZSO-001	DE Double Flap Valve 1 Top Open Limit	Digital Input	Indication
22	536-ZSC-001	DE Double Flap Valve 1 Top Closed Limit	Digital Input	Indication
23	536-XVO-002	DE Double Flap Valve 1 Bottom Open Solenoid	Digital Output	Actuate Flap

No.	Tag Number	Description	I/O Type	Function
24	536-XVC-002	DE Double Flap Valve 1 Bottom Close Solenoid	Digital Output	Actuate Flap
25	536-ZSO-002	DE Double Flap Valve 1 Bottom Open Limit	Digital Input	Indication
26	536-ZSC-002	DE Double Flap Valve 1 Bottom Closed Limit	Digital Input	Indication
27	541-HS-001	DE Screw Conveyor 1 Field Isolator	Digital Input	Indication
28	541-HS-002	DE Screw Conveyor 1 Mode Selector	Digital Input	Local/Remote Selector
29	541-YL-001	DE Screw Conveyor 1 Remote Indicator	Digital Output	Indication
30	542-YL-002	DE Screw Conveyor 1 Local Indicator	Digital Output	Indication
31	541-HS-003	DE Screw Conveyor 1 Jog Start	Digital Input	Start signal, non-latching
32	541-HSS-001	DE Screw Conveyor 1 E-Stop	Digital Input	Trip System
33	542-HS-001	DE Rotary Vane Feeder 1 Field Isolator	Digital Input	Indication
34	542-HS-002	DE Rotary Vane Feeder 1 Mode Selector	Digital Input	Local/Remote Selector
35	542-YL-001	DE Rotary Vane Feeder 1 Remote Indicator	Digital Output	Indication
36	542-YL-002	DE Rotary Vane Feeder 1 Local Indicator	Digital Output	Indication
37	542-HS-003	DE Rotary Vane Feeder 1 Jog Start	Digital Input	Start signal, non-latching
38	542-HSS-001	DE Rotary Vane Feeder 1 E-Stop	Digital Input	Trip System
Drawing: 1924701-0-000-P-PI-0001-03				
39	560-PDT-001	DE Dust Collector 2 Differential Pressure Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
40	560-YC-001	DE Dust Collector 2 Solenoid Controller	N/A	Local controller, I/O listed as instruments
41	560-LSH-001	DE Dust Collector 2 Level Switch	Digital Input	Trip on unhealthy
42	560-PT-001	DE Dust Collector 2 Air Supply Pressure Transmitter	Analogue Input	Indication, Alarm on High or Low
43	561-SSL-001	DE Screw Conveyor 2 Speed Switch	Digital Input	Alarm on unhealthy
44	563-ZSO-001	DE Dust Collector 2 Isolation Valve Open Limit	Digital Input	Indication
45	564-SSL-001	DE Rotary Vane Feeder 2 Speed Switch	Digital Input	Alarm on unhealthy
46	566-XVO-001	DE Double Flap Valve 2 Top Open Solenoid	Digital Output	Actuate Flap
47	566-XVC-001	DE Double Flap Valve 2 Top Close Solenoid	Digital Output	Actuate Flap
48	566-ZSO-001	DE Double Flap Valve 2 Top Open Limit	Digital Input	Indication
49	566-ZSC-001	DE Double Flap Valve 2 Top Closed Limit	Digital Input	Indication

No.	Tag Number	Description	I/O Type	Function
50	566-XVO-002	DE Double Flap Valve 2 Bottom Open Solenoid	Digital Output	Actuate Flap
51	566-XVC-002	DE Double Flap Valve 2 Bottom Close Solenoid	Digital Output	Actuate Flap
52	566-ZSO-002	DE Double Flap Valve 2 Bottom Open Limit	Digital Input	Indication
53	566-ZSC-002	DE Double Flap Valve 2 Bottom Closed Limit	Digital Input	Indication
54	571-HS-001	DE Screw Conveyor 2 Field Isolator	Digital Input	Indication
55	571-HS-002	DE Screw Conveyor 2 Mode Selector	Digital Input	Local/Remote Selector
56	571-YL-001	DE Screw Conveyor 2 Remote Indicator	Digital Output	Indication
57	571-YL-002	DE Screw Conveyor 2 Local Indicator	Digital Output	Indication
58	571-HS-003	DE Screw Conveyor 2 Jog Start	Digital Input	Start signal, non-latching
59	571-HSS-001	DE Screw Conveyor 2 E-Stop	Digital Input	Trip System
60	572-HS-001	DE Rotary Vane Feeder 2 Field Isolator	Digital Input	Indication
61	572-HS-002	DE Rotary Vane Feeder 2 Mode Selector	Digital Input	Local/Remote Selector
62	572-YL-001	DE Rotary Vane Feeder 2 Remote Indicator	Digital Output	Indication
63	572-YL-002	DE Rotary Vane Feeder 2 Local Indicator	Digital Output	Indication
64	572-HS-003	DE Rotary Vane Feeder 2 Jog Start	Digital Input	Start signal, non-latching
65	572-HSS-001	DE Rotary Vane Feeder 2 E-Stop	Digital Input	Trip System
Drawing: 1924701-0-000-P-PI-0001-04				
66	501-VT-001	DE Fan Bearing NDE Vibration Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
67	501-TT-001	DE Fan Bearing NDE Temp Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
68	501-TT-002	DE Fan Bearing DE Temp Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
69	502-TT-001	DE Fan Motor Winding U-phase Temp Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
70	502-TT-002	DE Fan Motor Winding V-phase Temp Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
71	502-TT-003	DE Fan Motor Winding W-phase Temp Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
72	502-TT-004	DE Fan Motor Bearing DE Temp Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
73	502-TT-005	DE Fan Motor Bearing NDE Temp Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
74	580-HS-002	DE Fan Mode Selector	Digital Input	Local/Remote Selector

No.	Tag Number	Description	I/O Type	Function
75	501-AIT-001	DE Dust Monitor	Analogue Input	Indication/Monitoring
76	501-YC-001	DE Dust Monitor Plant Running	Digital Output	Activate Dust Monitor
77	501-FIT-001	DE Flow Monitor	Analogue Input	Indication/Monitoring
78	501-YC-002	DE Flow Monitor Plant Running	Digital Output	Activate Flow Monitor
79	580-YL-001	DE Fan Remote Indicator	Digital Output	Indication
80	580-YL-002	DE Fan Local Indicator	Digital Output	Indication
81	580-HS-003	DE Fan Jog Start	Digital Input	Start signal, non-latching
82	580-HSS-001	DE Fan E-Stop	Digital Input	Trip System
Drawing: 1924701-0-000-P-PI-0001-05				
83	503-LT-001	DS Silo Level Transmitter	Analogue Input	Indication, Alarm on High, Trip on High High
84	511-XVO-001	DS Silo Vent Valve Open Solenoid	Digital Output	Actuate Valve
85	511-XVC-001	DS Silo Vent Valve Closed Solenoid	Digital Output	Actuate Valve
86	511-ZSO-001	DS Silo Vent Valve Open Limit	Digital Input	Indication
87	511-ZSC-001	DS Silo Vent Valve Closed Limit	Digital Input	Indication
88	504-ZSO-001	DS Silo Isolation Valve Open Limit	Digital Input	Indication
89	505-SSL-001	DS Rotary Vane Feeder Speed Switch	Digital Input	Alarm on unhealthy
90	507-XVL-001	DS Diverter Chute To Conveyor Solenoid	Digital Output	Actuate Diverter
91	507-XVR-001	DS Diverter Chute To Truck Solenoid	Digital Output	Actuate Diverter
92	507-ZSL-001	DS Diverter Chute To Conveyor Limit	Digital Input	Indication
93	507-ZSR-001	DS Diverter Chute To Truck Limit	Digital Input	Indication
94	507-LSH-001	DS Diverter Chute Material Level Switch	Digital Input	Indication
95	508-SSL-007	DS Pug Mill Speed Switch	Digital Input	Alarm on unhealthy
96	508-FIT-001	DS Water Supply Flow Transmitter	Analogue Input	Indication, Alarm on High or Low
97	510-XVO-001	DS Water Supply Valve Open Solenoid	Digital Output	Actuate Valve
98	510-XVC-001	DS Water Supply Valve Closed Solenoid	Digital Output	Actuate Valve
99	510-ZSO-001	DS Water Supply Valve Open Limit	Digital Input	Indication
100	510-ZSC-001	DS Water Supply Valve Closed Limit	Digital Input	Indication
101	571-HS-001	DS Rotary Vane Feeder Field Isolator	Digital Input	Indication
102	571-HS-002	DS Rotary Vane Feeder Mode Selector	Digital Input	Local/Remote Selector
103	571-YL-001	DS Rotary Vane Feeder Automatic Indicator	Digital Output	Indication
104	571-YL-002	DS Rotary Vane Feeder Semi-Automatic Indicator	Digital Output	Indication
105	571-YL-003	DS Rotary Vane Feeder Manual Indicator	Digital Output	Indication

No.	Tag Number	Description	I/O Type	Function
106	571-HS-003	DS Rotary Vane Feeder Start	Digital Input	Start signal, latching or non-latching
107	571-HS-004	DS Rotary Vane Feeder Stop	Digital Input	Stop Signal, low to stop when in Semi-Auto Mode
108	571-HS-005	DS Rotary Vane Feeder Diverter Chute To Pug Mill	Digital Input	Diverter Postion Button
109	571-HS-006	DS Rotary Vane Feeder Diverter Chute To Truck Loading	Digital Input	Diverter Postion Button
110	571-HSS-001	DS Rotary Vane Feeder E-Stop	Digital Input	Trip System
111	514-HS-001	DS Pug Mill Field Isolator	Digital Input	Indication
112	514-HS-002	DS Pug Mill Mode Selector	Digital Input	Local/Remote Selector
113	514-YL-001	DS Pug Mill Remote Indicator	Digital Output	Indication
114	514-YL-002	DS Pug Mill Local Indicator	Digital Output	Indication
115	514-HS-003	DS Pug Mill Jog Start	Digital Input	Start signal, non-latching
116	514-HSS-001	DS Pug Mill E-Stop	Digital Input	Trip System
Drawing: 1924701-0-000-P-PI-0001-06				
117	520-YC-001	DE Compressor 1 Controller	N/A	Local controller, I/O listed as instruments
118	520-YC-002	DE Compressor 1 Start/Stop	Digital Output	Start Signal, latching
119	520-YA-001	DE Compressor 1 Fault	Digital Input	Alarm on unhealthy
120	522-PIT-001	DE Air Receiver 1 Pressure Transmitter	Analogue Input	Indication, Alarm on High or Low, Trip on High High
121	522-YC-001	DE Air Receiver 1 Auto Drain Controller	N/A	Local controller, no PLC interface
122	528-YC-001	DE Desiccant Dryer 1 Controller	N/A	Local controller, no PLC interface
123	528-AIT-001	DE Desiccant Dryer 1 Moisture Analyser	Analogue Input	Indication, Alarm on High or Low
124	550-YC-001	DE Compressor 2 Controller	N/A	Local controller, I/O listed as instruments
125	550-YC-002	DE Compressor 2 Start/Stop	Digital Output	Start Signal, latching
126	550-YA-001	DE Compressor 2 Fault	Digital Input	Alarm on unhealthy
127	552-PIT-001	DE Air Receiver 2 Pressure Transmitter	Analogue Input	Indication, Alarm on High or Low, Trip on High High
128	552-YC-001	DE Air Receiver 2 Auto Drain Controller	N/A	Local controller, no PLC interface
129	558-YC-001	DE Desiccant Dryer 2 Controller	N/A	Local controller, no PLC interface

No.	Tag Number	Description	I/O Type	Function
130	558-AIT-001	DE Desiccant Dryer 2 Moisture Analyser	Analogue Input	Indication, Alarm on High or Low

7 Interlocks

There are three types of interlocks: start, process and safety Interlocks.

Start interlocks are required to be healthy in order to start a given piece of equipment but should the interlock become unhealthy while that piece of equipment is running it will be ignored.

Process interlocks are required to be healthy in order to start and run a given piece of equipment. Should the interlock become unhealthy during the operation of that piece of equipment, the piece of equipment will stop.

Safety interlocks are for the protection of equipment and people and will immediately shut down the equipment. Usually, this entails removing all power straight away but in some cases, it is safer to stop the equipment before removing power. Safety interlocks are reset in the field and acknowledged on the SCADA before equipment is restarted. For this plant, the e-stops are hardwired to a central safety relay that will trip the entire plant.

All the interlocks are described as either latching or not latching. An interlock that latches requires the operator to acknowledge the unhealthy state after the situation that caused the interlock to be unhealthy has been resolved. The system will consider the interlock unhealthy until it is acknowledge. An interlock that is not latching does not require acknowledgement, as soon as the situation has been resolved the interlock is healthy. It is recommended that the operator checks interlocked equipment before acknowledging the fault.

Figures given in the interlock tables below are for indication and will be confirmed during commissioning.

7.1 Start Interlocks

7.1.1 Dust Extraction Fan (214-FA-501)

Item No.	Tag Number	Description	Action	Latching
1	501-VT-001	DE Fan Bearing NDE Vibration Transmitter	Unhealthy (Temperature above 80˚C)	No
2	501-TT-001	DE Fan Bearing NDE Temp Transmitter	Unhealthy (Temperature above 80˚C)	No
3	501-TT-002	DE Fan Bearing DE Temp Transmitter	Unhealthy (Temperature above 80˚C)	No
4	502-TT-001	DE Fan Motor Winding U-phase Temp Transmitter	Unhealthy (Temperature above 80˚C)	No
5	502-TT-002	DE Fan Motor Winding V-phase Temp Transmitter	Unhealthy (Temperature above 80˚C)	No
6	502-TT-003	DE Fan Motor Winding W-phase Temp Transmitter	Unhealthy (Temperature above 80˚C)	No

Item No.	Tag Number	Description	Action	Latching
7	502-TT-004	DE Fan Motor Bearing DE Temp Transmitter	Unhealthy (Temperature above 80°C)	No
8	502-TT-005	DE Fan Motor Bearing NDE Temp Transmitter	Unhealthy (Temperature above 80°C)	No
9	533-ZSO-001	DE Dust Collector 1 Isolation Valve Open Limit	Unhealthy	No
10	563-ZSO-001	DE Dust Collector 2 Isolation Valve Open Limit	Unhealthy	No
11	504-ZSO-001	DS Silo Isolation Valve Open Limit	Unhealthy	No

7.1.2 Pneumatic Conveyor Blower (214-AB-515)

Item No.	Tag Number	Description	Action	Latching
1	516-TT-001	DE Blower Motor Winding U-phase Temp Transmitter	Unhealthy (Temperature above 80°C)	No
2	516-TT-002	DE Blower Motor Winding V-phase Temp Transmitter	Unhealthy (Temperature above 80°C)	No
3	516-TT-003	DE Blower Motor Winding W-phase Temp Transmitter	Unhealthy (Temperature above 80°C)	No
4	516-TT-004	DE Blower Motor Bearing DE Temp Transmitter	Unhealthy (Temperature above 80°C)	No
5	516-TT-005	DE Blower Motor Bearing NDE Temp Transmitter	Unhealthy (Temperature above 80°C)	No

7.2 Process Interlocks

7.2.1 Extraction Fan (214-FA-501)

Item No.	Tag Number	Description	Action	Latching
1	501-VT-001	DE Fan Bearing NDE Vibration Transmitter	Unhealthy (Vibration above $5mm/s^2$)	Yes
2	501-TT-001	DE Fan Bearing NDE Temp Transmitter	Unhealthy (Temperature above 100°C)	Yes
3	501-TT-002	DE Fan Bearing DE Temp Transmitter	Unhealthy (Temperature above 100°C)	Yes
4	502-TT-001	DE Fan Motor Winding U-phase Temp Transmitter	Unhealthy (Temperature above 100°C)	Yes

Item No.	Tag Number	Description	Action	Latching
5	502-TT-002	DE Fan Motor Winding V-phase Temp Transmitter	Unhealthy (Temperature above 100˚C)	Yes
6	502-TT-003	DE Fan Motor Winding W-phase Temp Transmitter	Unhealthy (Temperature above 100˚C)	Yes
7	502-TT-004	DE Fan Motor Bearing DE Temp Transmitter	Unhealthy (Temperature above 100˚C)	Yes
8	502-TT-005	DE Fan Motor Bearing NDE Temp Transmitter	Unhealthy (Temperature above 100˚C)	Yes
9	530-PDT-001	DE Dust Collector 1 Differential Pressure Transmitter	Unhealthy (DP above 115 kPA)	No
10	560-PDT-001	DE Dust Collector 2 Differential Pressure Transmitter	Unhealthy (DP above 115 kPA)	No
11	530-LSH-001	DE Dust Collector 1 Level Switch	Unhealthy	No
12	560-LSH-001	DE Dust Collector 2 Level Switch	Unhealthy	No

7.2.2 Pneumatic Conveyor Blower (214-AB-515)

Item No.	Tag Number	Description	Action	Latching
1	516-TT-001	DE Blower Motor Winding U-phase Temp Transmitter	Unhealthy (Temperature above 100˚C)	Yes
2	516-TT-002	DE Blower Motor Winding V-phase Temp Transmitter	Unhealthy (Temperature above 100˚C)	Yes
3	516-TT-003	DE Blower Motor Winding W-phase Temp Transmitter	Unhealthy (Temperature above 100˚C)	Yes
4	516-TT-004	DE Blower Motor Bearing DE Temp Transmitter	Unhealthy (Temperature above 100˚C)	Yes
6	516-TT-005	DE Blower Motor Bearing NDE Temp Transmitter	Unhealthy (Temperature above 100˚C)	Yes
7	503-LT-001	DS Silo Level Transmitter	Unhealthy (Level above 90%)	No
9	571-HS-001	DE Screw Conveyor 2 Field Isolator	Unhealthy	No

7.2.3 Screw Conveyor 1 (214-CV-531)

Item No.	Tag Number	Description	Action	Latching
1	531-SSL-001	DE Screw Conveyor 1 Speed Switch	Unhealthy (Less than 10 pulse/second after 5 seconds)	Yes
2	541-HS-001	DE Screw Conveyor 1 Field Isolator	Unhealthy	No
3	214-FE-534	Rotary Vane Feeder 1 Running	Unhealthy	No

7.2.4 Rotary Vane Feeder 1 (214-FE-534)

Item No.	Tag Number	Description	Action	Latching
1	534-SSL-001	DE Rotary Vane Feeder 2 Speed Switch	Unhealthy (Less than 10 pulse/second after 5 seconds)	Yes
2	542-HS-001	DE Rotary Vane Feeder 2 Field Isolator	Unhealthy	No
3	214-FV-536	Double Flap Valve 1 Running	Unhealthy	No

7.2.5 Double Flap Valve 1 (214-FV-536)

Item No.	Tag Number	Description	Action	Latching
1	214-AB-515	Pneumatic Conveyor Blower Running	Unhealthy	No

7.2.6 Screw Conveyor 2 (214-CV-561)

Item No.	Tag Number	Description	Action	Latching
1	561-SSL-001	DE Screw Conveyor 2 Speed Switch	Unhealthy (Less than 10 pulse/second after 5 seconds)	Yes
2	571-HS-001	DE Screw Conveyor 2 Field Isolator	Unhealthy	No
3	214-FE-564	Rotary Vane Feeder 2 Running	Unhealthy	No

7.2.7 Rotary Vane Feeder 2 (214-FE-564)

Item No.	Tag Number	Description	Action	Latching
1	564-SSL-001	DE Rotary Vane Feeder 2 Speed Switch	Unhealthy (Less than 10 pulse/second after 5 seconds)	Yes
2	572-HS-001	DE Rotary Vane Feeder 2 Field Isolator	Unhealthy	No
3	214-FV-566	Double Flap Valve 2 Running	Unhealthy	No

7.2.8 Double Flap Valve 2 (214-FV-566)

Item No.	Tag Number	Description	Action	Latching
1	214-AB-515	Pneumatic Conveyor Blower Running	Unhealthy	No

7.2.9 Storage Silo Rotary Vane Feeder (214-FE-505)

Item No.	Tag Number	Description	Action	Latching
1	505-SSL-001	DS Rotary Vane Feeder Speed Switch	Unhealthy (Less than 10 pulse/second after 5 seconds)	Yes
2	571-HS-001	DS Rotary Vane Feeder Field Isolator	Unhealthy	No
3	507-ZSL-001 507-ZSR-001	DS Diverter Chute To Conveyor Limit or DS Diverter Chute To Truck Limit	Unhealthy	No
4	507-ZSL-001 & 214-ML-508	DS Diverter Chute To Conveyor & DS Pug Mill not Running	Unhealthy	No
5	507-ZSR-001 & 507-LSH-001	DS Diverter Chute To Truck Limit & DS Diverter Chute Material Level Switch	Unhealthy	No
6	507-ZSR-001	DS Diverter Chute To Truck Limit & Feeder in Automatic Mode	Unhealthy	No

7.2.10 Pug Mill (214-ML-508)

Item No.	Tag Number	Description	Action	Latching
1	508-SSL-001	DS Pug Mill Speed Switch	Unhealthy (Less than 10 pulse/second after 5 seconds)	Yes

Item No.	Tag Number	Description	Action	Latching
2	514-HS-001	DS Pug Mill Field Isolator	Unhealthy	No
3	210-CV-308	CV308 Running	Unhealthy	No

7.3 Safety Interlocks

Item No.	Tag Number	Description	Action	Latching
1	507-HSS-001	DE Blower E-Stop	Unhealthy	Yes
2	541-HSS-001	DE Screw Conveyor 1 E-Stop	Unhealthy	Yes
3	542-HSS-001	DE Rotary Vane Feeder 1 E-Stop	Unhealthy	Yes
4	571-HSS-001	DE Screw Conveyor 2 E-Stop	Unhealthy	Yes
5	572-HSS-001	DE Rotary Vane Feeder 2 E-Stop	Unhealthy	Yes
6	580-HSS-001	DE Fan E-Stop	Unhealthy	Yes
7	571-HSS-001	DS Rotary Vane Feeder E-Stop	Unhealthy	Yes
8	514-HSS-001	DS Pug Mill E-Stop	Unhealthy	Yes

8 Control Philosophy

8.1 Start Up Sequence

When a start command is given, whether the system is in Automatic Mode or Semi-Automatic Mode, the sequence below will be followed. Should a piece of equipment be interlocked, the start-up sequence will be placed on hold and a warning will be displayed until the issue has been rectified, then start-up sequence will automatically resume. For example, a level switch high on the dust collectors will stop the dust extraction fan from starting. However, the pneumatic system will have been started already by the start-up sequence so the level will decrease. Once the level high interlock has cleared, the fan will start without intervention from the operator. If the system is in automatic mode, after a period of time period has lapsed the system will exit the start sequence and give a failed to start fault.

NB: In all modes, each piece of equipment must complete their start up cycle and return a running feedback (which is visible on the SCADA) before moving to the next step. For equipment fitted with speed switches this includes time for the equipment to get to speed and the speed switches be healthy.

1. Water to the pug mill is switched on by actuating 510-XVO-001 to open valve 214-AV-510. Feedback is received from the open limit switch 510-ZSO-001.
2. Flow transmitter 508-FIT-001 will indicate that the water is flowing.
3. A signal to 509-MU-001 starts the Pug Mill 214-ML-508; start-up is complete once speed switch 508-SSL-001 is healthy.

4. Check the Diverter Chute to Conveyor Limit 507-ZSL-001 is healthy, if not actuate solenoid 507-XVL-001 to move the chute and wait for the limit to make.
5. A signal to 506-MU-001 starts the Dust Storage Rotary Vane Feeder 210-FE-505; start-up is complete once speed switch 505-SSL-001 is healthy.
6. A signal to 509-MU-001 starts the Air Blower 214-AB-515
7. One of the Rotary Screw Compressors, 214-CP-520 or 214-CP-550 is started by sending a signal to 520-YC-002 or 550YC-002; the PLC will select the compressor that was not used for the previous cycle to alternate the compressors.
8. Once both pressure transmitters 522-PT-001 and 552-PT-001 mounted air receivers 214-AR-522 and 214-AR-552 respectively show a pressure of 620 kPa the compressed air system is healthy.
9. The pneumatic Double Flap Valves 214-FV-536 and 214-FV-566 will begin their open / close cycle as follows:
   a. Solenoids 536-XVC-001 & 2 and 566-XVC-001 & 2 shall be energised and the limits 536-ZSC-001 & 2 and 566-ZSC-001 & 2 must be made
   b. Solenoids 536-XVO-001 and 566-XVO-001 are energised, opening the two top flaps until the open limits 536-ZSO-001 and 566-ZSO-001 are received.
   c. Solenoids 536-XVC-001 and 566-XVC-001 then energised to close the top flaps.
   d. Once closed limits 536-ZSC-001 and 566-ZSC-001 are received, solenoids 536-XVO-002 and 566-XVO-002 are energised to open the bottom flaps.
   e. Once open limits 536-ZSO-001 and 566-ZSO-001 are received, solenoids 536-XVC-002 and 566-XVC-002 are energised to open the bottom flaps.
   f. When bottom flap closed limits 536-ZSC-002 and 566-ZSC-002 are made the cycle is complete and starts again
10. After a complete successful cycle of the Double Flap Valves, Dust Extraction Rotary Feeders 214-FE-534 and 214-FE-564 are started by sending a signal to 535-MU-001 and 565-MU-001. Start-up is complete for each feeder once speed switches 534-SSL-001 and 564-SSL-001 respectively are healthy.
11. Dust Extraction Screw Conveyors 214-CV-531 and 214- CV-561 are started by sending a signal to 532-MU-001 and 562-MU-001. Start-up is complete for each feeder once speed switches 531-SSL-001 and 561-SSL-001 respectively are healthy.
12. The last step is to start the dust extraction fan 214-FA-501 by sending a signal to 502-MU-001.

Should a piece of equipment becom~~ing~~e interlocked during operation, it will stop and an alarm will be displayed but the rest of plant that is not interlocked will continue to function. The stopping the dust extraction fan will stop both the tippler and the apron feeders. In the event of a high level from the dust storage silo, the operator must immediately investigate the issue and if they are unable to clear the silo via the pug mill the operator must request a truck and manually off load the silo to try prevent the dust extraction system shutting down.

8.2 Shut Down Sequence

The following conditions will trigger a controlled system shutdown.

- A global stop initiated by the operator when in automatic mode
- Individual stops initiated by the operator when in semi-automatic mode
- Tipping has stopped for more than 1 hour

The stopping sequence is the reverse of the starting sequence. Time must be given between steps for the equipment to come to a halt and material to clear. The Double Flap Valves must be stopped with solenoids 536-XVC-001 & 2 and 566-XVC-001 & 2 energised and limits 536-ZSC-001 & 2 and 566-ZSC-001 & 2 made. The last step will be to close the water supply valve 214-AV-510 and receive feedback from limit 510-ZSC-001

8.3 Manual Truck Loading

In the event of a problem with the Dust Storage Pug Mill or Conveyor 210-CV-308 the Dust Storage Silo 214-BN-503 can be emptied into a truck. The operator will request Semi-Automatic mode using the selector switch 513-HS-002 on the Dust Storage Rotary Vane Feeder LCS 214-IS-513. Once control is granted on the SCADA the operator can move the diverter chute to the truck loading position using the push button 513-HS-006 and manually lower the spout to the truck using the hand winch. The operator will then start the Dust Storage Rotary Vane Feeder 214-FE-505 with the push button 513-HS-003 and it will run until it is stopped by the operator using the push button 513-HS-004 or on receiving a level high signal from the level high switch 507-LSH-001 in the chute. The operator can then lift the chute and restart the Dust Storage Rotary Vane Feeder 214-FE-505 until the truck is full and the operator will switch the Dust Storage Rotary Vane Feeder 214-FE-505 back to Automatic Mode. The operator must ensure that he stops the rotary vane feeder while there is still sufficient space in the truck for the material that remains in the spout after the rotary vane feeder has been stopped.

8.4 Dust Monitor

The dust plant is fitted with a particulate analyser (501-AIT-001) and a flow meter (501-FIT-001). These two instruments are installed in the ducting between the bag filters and the fan. The PLC will use the readings from the two instruments to calculate the amount of dust per cubic meter of air passing that point. This reading will be clearly displayed on the SCADA. Should the amount of dust exceed acceptable limits a warning will be displayed and the operator must check the dust plant to find the cause. The dust plant is not interlocked with the dust monitoring and will continue to run as normal. The operator will be required to acknowledge the fault once the amount of dust is within acceptable limits once more.

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APPENDIX G

SQUAD CHECK FORM

Location	**Saldanha**	Squad Check Number	**1924701.M003-SQ-1376**
Title	**Apron Feeder System – Control Philosophy**	Contract No.	**M003**
Project Name	**Installation of the 3rd Tippler at the Port of Saldanha**	Project No.	**1924701**
Document No.	**1924701.M003-LIS-0028**	Revision	**02**

Discipline	Reviewer's Name	Reviewer's Signature	Date	Mandatory	Optional	Approved	Approved with Comments	Rejected	Information
	Richard Shandu		19/04/2020	X			✓		

REVIEW STATUS (Assigned by Responsible Project Manager)

C 1	☐	APPROVED	C 3	☐	REJECTED
C 2	☑	APPROVED WITH COMMENTS (REVISE & SUBMIT)	C 4	☐	INFORMATION

SIGNED BY: RESPONSIBLE PROJECT MANAGER	Print Name	Sphamandla Mathonsi
	Signature	
	Date	14 July 2020

This review is only for general conformance with the design concept of the Project and general compliance with the information given in the contract documents

TRANSNET

SQUAD CHECK COMMENT SHEET

Project / Contract No.	Squad Check No.
1924701-M003	1924701.M003-SQ-1376

Comments	Name of Discipline	Action Taken by Responsible PM
Address comments as indicated on each page in the document.		

SIGNED BY: RESPONSIBLE PROJECT MANAGER	**Print Name**	
	Signature	
	Date	

This comment sheet must always accompany the front cover sheet (Squad Check Form) once signed off

PROJECT-NAME	SALDANHA TIPPLER T3				
PROJECT-No. CLIENT	1924701-M003	PROJECT-No.	AC0339		
DOC-No. CLIENT	1924701.M003-LIS-0028	DOC-No.	ENG-LIS-0217	REV	2
DOCUMENT-TITLE	**Apron Feeder System – Control Philosophy**				

Apron Feeder System

Control Philosophy

Tippler T3 for Saldanha Iron Ore Terminal

Contract No.: 1924701-M003

Rev.	Prepared (TAKRAF)		Checked (TAKRAF)		Approved (TAKRAF)		Approved (TGC)		Revision Status
	Date	Name	Date	Name	Date	Name	Date	Name	
A	22/06/2017	JB Bukenya	26/06/2017	M.Malaza	07/08/2017	M. Thoresson			
B	11/04/2018	W Russell	11/04/2018	JB Bukenya	11/04/2018	P Drake			
0	03/10/2018	W Russell	03/10/2018	Gert Hill	03/10/2018	W Russell			
1	18/02/2019	W Russell	18/02/2019	M Malaza	18/02/2019	W Russell			
2	12/03/2020	S Hussain	12/03/2020	M Malaza	12/03/2020	P Drake			

Rev.	Brief details of change
A	Generated
B	Format updated and changes to the operating philosophy made
0	Updated to include comments from 90% design, issued for use
1	Updated to Include Clients comments
2	Updated to include operation of 5 x Knife Gates (This update is subject to approval of CE62 – 5 x Apron Feeder Knife Gates)

Table of Contents

1 Scope

Transnet is installing a new tippler, Tippler 3, at the Port of Saldanha. Tenova TAKRAF Africa has been contracted to supply and install the new tippler system complete with dual tandem tippler, wagon positioner, wheel grippers, apron feeders below the tippler to extract the iron ore onto a conveyor belt (supplied by others) and a dust extraction plant to extract the dust generated by the tippler and the apron feeders. This document describes the Functional Control Philosophy of the Apron Feeder System. It covers the overview of the system, the instrumentation, system interlocking, modes of control, and descriptions of operations. The Apron feeder system consists of the Apron Feeders and the hoppers that feed the Apron Feeders.

This document shall be used by Engineering disciplines involved in the design, operation and maintenance of the Apron Feeder facility.

The general philosophy proposed for the equipment below:

- Integrated control via Tippler S7 400 PLC where the equipment requires sequencing and interlocking, this includes alarming and trending
- Hard wired emergency stops and local isolators at each Apron Feeder for personnel safety and equipment safety
- Local control stations for starting and stopping of drives locally for maintenance.

Note: when the term tip or tipping is used, this refers to the tipping of two wagons at once. In other words, one tip results in two wagon loads of iron ore.

2 Reference documentation

This document must be read in conjunction with the following documents:

- 1924701-0-000-F-PF-0002-01 – Tippler System Process Flow Diagram
- 1924701-0-000-P-PI-0003-01 – Apron Feeder Overall P&ID
- 1924701-0-000-P-PI-0003-02 – Apron Feeder 1 P&ID
- 1924701-0-000-P-PI-0003-03 – Apron Feeder 2 P&ID
- 1924701-0-000-P-PI-0003-04 – Apron Feeder 3 P&ID
- 1924701-0-000-P-PI-0003-05 – Apron Feeder 4 P&ID
- 1924701-0-000-P-PI-0003-06 – Apron Feeder 5 P&ID
- 1924701.M003-MA-0001-01 & 02 – Train Unloading System - Description of Operations Part 1 & 2
- 1924701.M0003-LIS-0026 – Dust Extraction Control Philosophy
- 1924701-2-213-M-SP-0003 – Apron Feeder Technical Specification
- 1924701-2-214-M-DS-0003 – Apron Feeder Data Sheet

Ensure that the latest revision of these documents and drawings is used.

3 System Description

3.1 System Overview

The apron feeder system consists of the following:

- five hoppers
  - One hopper level high switch per hopper
  - One hopper level transmitter per hopper
- five apron feeders
  - 30 kW VSD controlled drive
  - automatic lubrication system
  - field isolator with local control buttons
  - speed switch
  - flashing light and siren
  - manual chain tensioning system
- five discharge chutes
  - blocked chute detector
- 5 x knife gates with mounting cylinders and a common hydraulic power pack

The hoppers receive the iron ore dumped from the wagons by the tippler. The tippler is a dual tandem tippler and the ore falls into all five hoppers simultaneously. Below each hopper is an apron feeder to extract the ore and between the hopper and the apron feeder is a place to mount the knife gate. The function of the knife gate is to isolate an apron feeder from the system. This allows the system to continue functioning after removing an apron feeder from the system. Each of the apron feeders has a discharge chute that feeds the iron ore onto the same conveyor. Further, each apron feeder is linked to a central dust extraction via ducting. This central dust extraction system also extracts dust from the tippler and is not covered in this document. Refer to the control philosophy for the dust extraction for more details. Finally, guarding is installed around the five apron feeders.

3.2 Process Requirements

- Apron Feeder Nominal Capacity – 1600 tph
- Apron Feeder Maximum Capacity – 2250 tph
- Nominal Plant Capacity – 8000 tph
- Maximum Plant Capacity – 10 000 tph
- Bulk Density Range – 2.3 to 3.0 t/m^3
- Maximum Feed Size – 25 to 27 mm
- Feed Moisture Content – 1.2 to 3.2 %

4 Modes of Operation

The system has three modes of operation, selected via selector switches on the RIO panel by the apron feeder. An operator will go to the field and set the required switch to the required mode. This generates a request on the SCADA and if the conditions are correct, the operator at the SCADA will grant the request. Indication lamps on the RIO panel tell the field operator which the mode is active.

A. Automatic
The Automatic Mode of operation is the normal mode of operation for the plant. Control of the equipment is by the PLC with operator intervention only required in the event of a fault. The PLC will automatically start up and shut down all equipment as required.

B. Semi-Automatic
The Semi – Automatic Mode of operation is intended for use during commissioning and operator training. All interlocks are fully functional but the operator starts each piece of equipment via the SCADA. This allows the operator to step through the sequence manually. This is different to the tippler, positioner and wheel grippers that have defined and limited movements that are initiated at the local control stations as well as at the SCADA.

C. Local
The Local Mode will allow the testing of equipment individually after maintenance has been done without other equipment being online. Equipment is controlled directly from the local control stations and does not latch in this mode. Thus, as soon as the field start is released the motor shall stop. It shall only be possible to run the apron feeder in reverse at 50% speed for a maximum of 10 seconds at a time. Process interlocks are bypassed in this mode but safety interlocks are still in effect.

For further details on the modes of control, please refer to 1924701.M003-MA-0001-02, Train Unloading System - Description of Operations Part 2

5 Abbreviations

CH	Chute	MU	Motor Unit (VSD or DOL)
CV	Conveyor	PLC	Programmable Logic Controller
DOL	Direct On Line	RIO	Remote Inputs & Outputs
FE	Feeder	SSL	Speed Switch Low
FS	Flow Switch	TT	Temperature Transmitter
HS	Hand Switch	VSD	Variable Speed Drive
HSS	Emergency Stop	YA	Event Alarm/Fault
LSH	Level Switch High	YC	Controller
LSL	Level Switch Low	YL	Indicator Light
LT	Level Transmitter	YS	Event Switch

6 Instrument List

No.	Tag Number	Description	Type	Function
Drawing: 1924701-0-000-P-PI-0003-01				
1	410-LSH-002	Hopper 1 Level Switch	Digital Input	Alarm, pause tipping cycle
2	420-LSH-002	Hopper 2 Level Switch	Digital Input	Alarm, pause tipping cycle
3	430-LSH-002	Hopper 3 Level Switch	Digital Input	Alarm, pause tipping cycle
4	440-LSH-002	Hopper 4 Level Switch	Digital Input	Alarm, pause tipping cycle
5	450-LSH-002	Hopper 5 Level Switch	Digital Input	Alarm, pause tipping cycle
6	410-LT-001	Hopper 1 Level Transmitter	Analogue Input	Indication, alarm on level high and pause tipping
7	420-LT-001	Hopper 2 Level Transmitter	Analogue Input	Indication, alarm on level high and pause tipping
8	430-LT-001	Hopper 3 Level Transmitter	Analogue Input	Indication, alarm on level high and pause tipping
9	440-LT-001	Hopper 4 Level Transmitter	Analogue Input	Indication, alarm on level high and pause tipping
10	450-LT-001	Hopper 5 Level Transmitter	Analogue Input	Indication, alarm on level high and pause tipping
Drawing: 1924701-0-000-P-PI-0003-02				
11	400-HSS-001	Apron feeder belt guard switch 1	Safety	System Trip
12	400-HSS-002	Apron feeder belt guard switch 2	Safety	System Trip
13	400-HSS-003	Apron feeder belt guard switch 3	Safety	System Trip
14	400-HSS-004	Apron feeder belt guard switch 4	Safety	System Trip
15	413-YC-001	Apron Feeder 1 Lubrication Unit Start	Digital Output	Run grease pump, latch on
16	413-LSL-001	Apron Feeder 1 Lubrication Grease Level Low	Digital Input	Alarm on unhealthy
17	410-FS-001	Apron Feeder 1 Grease Flow Switch 1	Digital Input	Alarm on unhealthy
18	410-FS-002	Apron Feeder 1 Grease Flow Switch 2	Digital Input	Alarm on unhealthy
19	410-FS-003	Apron Feeder 1 Grease Flow Switch 3	Digital Input	Alarm on unhealthy
20	410-FS-004	Apron Feeder 1 Grease Flow Switch 4	Digital Input	Alarm on unhealthy
21	410-SSL-001	Apron Feeder 1 Speed Switch	Digital Input	Alarm on unhealthy
22	410-YA-001	Apron Feeder 1 Sounder Beacon	Digital Output x 2	Indication in field
23	411-TT-001	Apron Feeder 1 Temp. Transmitter Motor Winding Red Phase	Analogue Input	Alarm when high, trip apron feeder when high high

No.	Tag Number	Description	Type	Function
24	411-TT-002	Apron Feeder 1 Temp. Transmitter Motor Winding White Phase	Analogue Input	Alarm when high, trip apron feeder when high high
25	411-TT-003	Apron Feeder 1 Temp. Transmitter Motor Winding Blue Phase	Analogue Input	Alarm when high, trip apron feeder when high high
26	411-TT-004	Apron Feeder 1 Temp. Transmitter Motor Drive End Bearing	Analogue Input	Alarm when high, trip apron feeder when high high
27	411-TT-005	Apron Feeder 1 Temp. Transmitter Motor Non Drive End Bearing	Analogue Input	Alarm when high, trip apron feeder when high high
28	414-HS-001	Apron Feeder 1 Field Isolator	Digital Input	Indication on SCADA
29	414-HSS-001	Apron Feeder 1 E-stop	Safety	Trip System
30	414-HS-002	Apron Feeder 1 Jog Forward	Digital Input	Start signal, non-latching
31	414-HS-003	Apron Feeder 1 Jog Reverse	Digital Input	Start signal, non-latching
32	410-LSH-001	Apron Feeder 1 Blocked Chute Detector	Digital Input	Trip apron feeder
Drawing: 1924701-0-000-P-PI-0003-03				
33	423-YC-001	Apron Feeder 2 Lubrication Unit Start	Digital Output	Run grease pump, latch on
34	423-LSL-001	Apron Feeder 2 Lubrication Grease Level Low	Digital Input	Alarm on unhealthy
35	420-FS-001	Apron Feeder 2 Grease Flow Switch 1	Digital Input	Alarm on unhealthy
36	420-FS-002	Apron Feeder 2 Grease Flow Switch 2	Digital Input	Alarm on unhealthy
37	420-FS-003	Apron Feeder 2 Grease Flow Switch 3	Digital Input	Alarm on unhealthy
38	420-FS-004	Apron Feeder 2 Grease Flow Switch 4	Digital Input	Alarm on unhealthy
39	420-SSL-001	Apron Feeder 2 Speed Switch	Digital Input	Alarm on unhealthy
40	420-YA-001	Apron Feeder 2 Sounder Beacon	Digital Output x 2	Indication in field
41	421-TT-001	Apron Feeder 2 Temp. Transmitter Motor Winding Red Phase	Analogue Input	Alarm when high, trip apron feeder when high high
42	421-TT-002	Apron Feeder 2 Temp. Transmitter Motor Winding White Phase	Analogue Input	Alarm when high, trip apron feeder when high high
43	421-TT-003	Apron Feeder 2 Temp. Transmitter Motor Winding Blue Phase	Analogue Input	Alarm when high, trip apron feeder when high high
44	421-TT-004	Apron Feeder 2 Temp. Transmitter Motor Drive End Bearing	Analogue Input	Alarm when high, trip apron feeder when high high
45	421-TT-005	Apron Feeder 2 Temp. Transmitter Motor Non Drive End Bearing	Analogue Input	Alarm when high, trip apron feeder when high high
46	424-HS-001	Apron Feeder 2 Field Isolator	Digital Input	Indication on SCADA
47	424-HSS-001	Apron Feeder 2 E-stop	Safety	Trip System

No.	Tag Number	Description	Type	Function
48	424-HS-002	Apron Feeder 2 Jog Forward	Digital Input	Start signal, non-latching
49	424-HS-003	Apron Feeder 2 Jog Reverse	Digital Input	Start signal, non-latching
50	420-LSH-001	Apron Feeder 2 Blocked Chute Detector	Digital Input	Trip apron feeder
Drawing: 1924701-0-000-P-PI-0003-04				
53	433-YC-001	Apron Feeder 3 Lubrication Unit Start	Digital Output	Run grease pump, latch on
54	433-LSL-001	Apron Feeder 3 Lubrication Grease Level Low	Digital Input	Alarm on unhealthy
55	430-FS-001	Apron Feeder 3 Grease Flow Switch 1	Digital Input	Alarm on unhealthy
56	430-FS-002	Apron Feeder 3 Grease Flow Switch 2	Digital Input	Alarm on unhealthy
57	430-FS-003	Apron Feeder 3 Grease Flow Switch 3	Digital Input	Alarm on unhealthy
58	430-FS-004	Apron Feeder 3 Grease Flow Switch 4	Digital Input	Alarm on unhealthy
59	430-SSL-001	Apron Feeder 3 Speed Switch	Digital Input	Alarm on unhealthy
60	430-YA-001	Apron Feeder 3 Sounder Beacon	Digital Output x 2	Indication in field
61	431-TT-001	Apron Feeder 3 Temp. Transmitter Motor Winding Red Phase	Analogue Input	Alarm when high, trip apron feeder when high high
62	431-TT-002	Apron Feeder 3 Temp. Transmitter Motor Winding White Phase	Analogue Input	Alarm when high, trip apron feeder when high high
63	431-TT-003	Apron Feeder 3 Temp. Transmitter Motor Winding Blue Phase	Analogue Input	Alarm when high, trip apron feeder when high high
64	431-TT-004	Apron Feeder 3 Temp. Transmitter Motor Drive End Bearing	Analogue Input	Alarm when high, trip apron feeder when high high
65	431-TT-005	Apron Feeder 3 Temp. Transmitter Motor Non Drive End Bearing	Analogue Input	Alarm when high, trip apron feeder when high high
66	434-HS-001	Apron Feeder 3 Field Isolator	Digital Input	Alarm on unhealthy
67	434-HSS-001	Apron Feeder 3 E-stop	Safety	Trip System
68	434-HS-002	Apron Feeder 3 Jog Forward	Digital Input	Start signal, non-latching
69	434-HS-003	Apron Feeder 3 Jog Reverse	Digital Input	Start signal, non-latching
70	430-LSH-001	Apron Feeder 3 Blocked Chute Detector	Digital Input	Trip apron feeder
Drawing: 1924701-0-000-P-PI-0003-05				
71	443-YC-001	Apron Feeder 4 Lubrication Unit Start	Digital Output	Run grease pump, latch on
72	443-LSL-001	Apron Feeder 4 Lubrication Grease Level Low	Digital Input	Alarm on unhealthy

No.	Tag Number	Description	Type	Function
73	440-FS-001	Apron Feeder 4 Grease Flow Switch 1	Digital Input	Alarm on unhealthy
74	440-FS-002	Apron Feeder 4 Grease Flow Switch 2	Digital Input	Alarm on unhealthy
75	440-FS-003	Apron Feeder 4 Grease Flow Switch 3	Digital Input	Alarm on unhealthy
76	440-FS-004	Apron Feeder 4 Grease Flow Switch 4	Digital Input	Alarm on unhealthy
77	440-SSL-001	Apron Feeder 4 Speed Switch	Digital Input	Alarm on unhealthy
78	440-YA-001	Apron Feeder 4 Sounder Beacon	Digital Output x 2	Indication in field
79	441-TT-001	Apron Feeder 4 Temp. Transmitter Motor Winding Red Phase	Analogue Input	Alarm when high, trip apron feeder when high high
80	441-TT-002	Apron Feeder 4 Temp. Transmitter Motor Winding White Phase	Analogue Input	Alarm when high, trip apron feeder when high high
81	441-TT-003	Apron Feeder 4 Temp. Transmitter Motor Winding Blue Phase	Analogue Input	Alarm when high, trip apron feeder when high high
82	441-TT-004	Apron Feeder 4 Temp. Transmitter Motor Drive End Bearing	Analogue Input	Alarm when high, trip apron feeder when high high
83	441-TT-005	Apron Feeder 4 Temp. Transmitter Motor Non Drive End Bearing	Analogue Input	Alarm when high, trip apron feeder when high high
84	444-HS-001	Apron Feeder 4 Field Isolator	Digital Input	Indication on SCADA
85	444-HSS-001	Apron Feeder 4 E-stop	Safety	Trip System
86	444-HS-002	Apron Feeder 4 Jog Forward	Digital Input	Start signal, non-latching
87	444-HS-003	Apron Feeder 4 Jog Reverse	Digital Input	Start signal, non-latching
88	440-LSH-001	Apron Feeder 4 Blocked Chute Detector	Digital Input	Trip apron feeder
Drawing: 1924701-0-000-P-PI-0003-06				
89	453-YC-001	Apron Feeder 5 Lubrication Unit Start	Digital Output	Run grease pump, latch on
90	453-LSL-001	Apron Feeder 5 Lubrication Grease Level Low	Digital Input	Alarm on unhealthy
91	450-FS-001	Apron Feeder 5 Grease Flow Switch 1	Digital Input	Alarm on unhealthy
92	450-FS-002	Apron Feeder 5 Grease Flow Switch 2	Digital Input	Alarm on unhealthy
93	450-FS-003	Apron Feeder 5 Grease Flow Switch 3	Digital Input	Alarm on unhealthy
94	450-FS-004	Apron Feeder 5 Grease Flow Switch 4	Digital Input	Alarm on unhealthy
95	450-SSL-001	Apron Feeder 5 Speed Switch	Digital Input	Alarm on unhealthy
96	450-YA-001	Apron Feeder 5 Sounder Beacon	Digital Output x 2	Indication in field

No.	Tag Number	Description	Type	Function
97	451-TT-001	Apron Feeder 5 Temp. Transmitter Motor Winding Red Phase	Analogue Input	Alarm when high, trip apron feeder when high high
98	451-TT-002	Apron Feeder 5 Temp. Transmitter Motor Winding White Phase	Analogue Input	Alarm when high, trip apron feeder when high high
99	451-TT-003	Apron Feeder 5 Temp. Transmitter Motor Winding Blue Phase	Analogue Input	Alarm when high, trip apron feeder when high high
100	451-TT-004	Apron Feeder 5 Temp. Transmitter Motor Drive End Bearing	Analogue Input	Alarm when high, trip apron feeder when high high
101	451-TT-005	Apron Feeder 5 Temp. Transmitter Motor Non Drive End Bearing	Analogue Input	Alarm when high, trip apron feeder when high high
102	454-HS-001	Apron Feeder 5 Field Isolator	Digital Input	Indication on SCADA
103	454-HSS-001	Apron Feeder 5 E-stop	Safety	Trip System
104	454-HS-002	Apron Feeder 5 Jog Forward	Digital Input	Start signal, non-latching
105	454-HS-003	Apron Feeder 5 Jog Reverse	Digital Input	Start signal, non-latching
106	450-LSH-001	Apron Feeder 5 Blocked Chute Detector	Digital Input	Trip apron feeder

7 Interlocks

There are three types of interlocks: start, process and safety Interlocks.

Start interlocks are required to be healthy in order to start a given piece of equipment but should the interlock become unhealthy while that piece of equipment is running it will be ignored.

Process interlocks are required to be healthy in order to start and run a given piece of equipment. Should the interlock become unhealthy during the operation of that piece of equipment, the piece of equipment will stop.

Safety interlocks are for the protection of equipment and people and will immediately shut down the equipment. Usually, this entails removing all power straight away but in some cases, it is safer to stop the equipment before removing power. Safety interlocks are reset in the field and acknowledged on the SCADA before equipment is restarted. For this plant, the e-stops and belt guard switches are hardwired to a central safety relay that will trip the entire plant.

All the interlocks are described as either latching or not latching. An interlock that latches requires the operator to acknowledge the unhealthy state after the situation that caused the interlock to be unhealthy has been resolved. The system will consider the interlock unhealthy until it is acknowledge. An interlock that is not latching does not require acknowledgement, as soon as the situation has been resolved the interlock is healthy. It is recommended that the operator checks interlocked equipment before acknowledging the fault.

Figures given in the interlock tables below are for indication and will be confirmed during commissioning.

7.1 Start Interlocks

7.1.1 Apron Feeder 1 (210-FE-410)

Item No.	Tag Number	Description	Action	Latching
1	411-TT-001	Apron Feeder 1 Temp. Transmitter Motor Winding Red Phase	Unhealthy (Temperature above 80˚C)	No
2	411-TT-002	Apron Feeder 1 Temp. Transmitter Motor Winding White Phase	Unhealthy (Temperature above 80˚C)	No
3	411-TT-003	Apron Feeder 1 Temp. Transmitter Motor Winding Blue Phase	Unhealthy (Temperature above 80˚C)	No
4	411-TT-004	Apron Feeder 1 Temp. Transmitter Motor Drive End Bearing	Unhealthy (Temperature above 80˚C)	No
5	411-TT-005	Apron Feeder 1 Temp. Transmitter Motor Non Drive End Bearing	Unhealthy (Temperature above 80˚C)	No
6	n/a	More than six starts in an hour	Unhealthy	No
7	n/a	Less than the minimum required tips performed during current cycle (applies only at the beginning of a cycle, not when there is a restart)	Unhealthy	No

7.1.2 Apron Feeder 2 (210-FE-420)

Item No.	Tag Number	Description	Action	Latching
1	421-TT-001	Apron Feeder 2 Temp. Transmitter Motor Winding Red Phase	Unhealthy (Temperature above 80˚C)	No
2	421-TT-002	Apron Feeder 2 Temp. Transmitter Motor Winding White Phase	Unhealthy (Temperature above 80˚C)	No
3	421-TT-003	Apron Feeder 2 Temp. Transmitter Motor Winding Blue Phase	Unhealthy (Temperature above 80˚C)	No
4	421-TT-004	Apron Feeder 2 Temp. Transmitter Motor Drive End Bearing	Unhealthy (Temperature above 80˚C)	No
5	421-TT-005	Apron Feeder 2 Temp. Transmitter Motor Non Drive End Bearing	Unhealthy (Temperature above 80˚C)	No
6	n/a	More than six starts in an hour	Unhealthy	No
7	n/a	Less than the minimum required tips performed during current cycle (applies only at the beginning of a cycle, not when there is a restart)	Unhealthy	No

7.1.3 Apron Feeder 3 (210-FE-430)

Item No.	Tag Number	Description	Action	Latching
1	431-TT-001	Apron Feeder 3 Temp. Transmitter Motor Winding Red Phase	Unhealthy (Temperature above 80˚C)	No
2	431-TT-002	Apron Feeder 3 Temp. Transmitter Motor Winding White Phase	Unhealthy (Temperature above 80˚C)	No
3	431-TT-003	Apron Feeder 3 Temp. Transmitter Motor Winding Blue Phase	Unhealthy (Temperature above 80˚C)	No
4	431-TT-004	Apron Feeder 3 Temp. Transmitter Motor Drive End Bearing	Unhealthy (Temperature above 80˚C)	No
5	431-TT-005	Apron Feeder 3 Temp. Transmitter Motor Non Drive End Bearing	Unhealthy (Temperature above 80˚C)	No
6	n/a	More than six starts in an hour	Unhealthy	No
7	n/a	Less than the minimum required tips performed during current cycle (applies only at the beginning of a cycle, not when there is a restart)	Unhealthy	No

7.1.4 Apron Feeder 4 (210-FE-440)

Item No.	Tag Number	Description	Action	Latching
1	441-TT-001	Apron Feeder 4 Temp. Transmitter Motor Winding Red Phase	Unhealthy (Temperature above 80˚C)	No
2	441-TT-002	Apron Feeder 4 Temp. Transmitter Motor Winding White Phase	Unhealthy (Temperature above 80˚C)	No
3	441-TT-003	Apron Feeder 4 Temp. Transmitter Motor Winding Blue Phase	Unhealthy (Temperature above 80˚C)	No
4	441-TT-004	Apron Feeder 4 Temp. Transmitter Motor Drive End Bearing	Unhealthy (Temperature above 80˚C)	No
5	441-TT-005	Apron Feeder 4 Temp. Transmitter Motor Non Drive End Bearing	Unhealthy (Temperature above 80˚C)	No
6	n/a	More than six starts in an hour	Unhealthy	No
7	n/a	Less than the minimum required tips performed during current cycle (applies only at the beginning of a cycle, not when there is a restart)	Unhealthy	No

7.1.5 Apron Feeder 5 (210-FE-450)

Item No.	Tag Number	Description	Action	Latching
1	451-TT-001	Apron Feeder 5 Temp. Transmitter Motor Winding Red Phase	Unhealthy (Temperature above 80˚C)	No
2	451-TT-002	Apron Feeder 5 Temp. Transmitter Motor Winding White Phase	Unhealthy (Temperature above 80˚C)	No
3	451-TT-003	Apron Feeder 5 Temp. Transmitter Motor Winding Blue Phase	Unhealthy (Temperature above 80˚C)	No
4	451-TT-004	Apron Feeder 5 Temp. Transmitter Motor Drive End Bearing	Unhealthy (Temperature above 80˚C)	No
5	451-TT-005	Apron Feeder 5 Temp. Transmitter Motor Non Drive End Bearing	Unhealthy (Temperature above 80˚C)	No
6	n/a	More than six starts in an hour	Unhealthy	No
7	n/a	Less than the minimum required tips performed during current cycle (applies only at the beginning of a cycle, not when there is a restart)	Unhealthy	No

7.2 Process Interlocks

7.2.1 Apron Feeder 1 (210-FE-410)

Item No.	Tag Number	Description	Action	Latching
1	410-SSL-001	Apron Feeder 1 Speed Switch	Unhealthy (Less than 10 pulse/second after 5 seconds)	Yes
2	411-TT-001	Apron Feeder 1 Temp. Transmitter Motor Winding Red Phase	Unhealthy (Temperature above 95˚C)	Yes
3	411-TT-002	Apron Feeder 1 Temp. Transmitter Motor Winding White Phase	Unhealthy (Temperature above 95˚C)	Yes
4	411-TT-003	Apron Feeder 1 Temp. Transmitter Motor Winding Blue Phase	Unhealthy (Temperature above 95˚C)	Yes
5	411-TT-004	Apron Feeder 1 Temp. Transmitter Motor Drive End Bearing	Unhealthy (Temperature above 95˚C)	Yes
6	411-TT-005	Apron Feeder 1 Temp. Transmitter Motor Non Drive End Bearing	Unhealthy (Temperature above 95˚C)	Yes
7	414-HS-001	Apron Feeder 1 Field Isolator	Unhealthy	No
8	410-LSH-001	Apron Feeder 1 Blocked Chute Detector	Unhealthy (after 3 seconds)	No

Item No.	Tag Number	Description	Action	Latching
9	410-LT-001	Hopper 1 Level Transmitter	Unhealthy (level < 15% during tipping cycle)	No
10	210-CV-308	Reclaim conveyor running	Unhealthy	No
11	214-FA-501	Dust Extraction plant running	Unhealthy	No

7.2.2 Apron Feeder 2 (210-FE-420)

Item No.	Tag Number	Description	Action	Latching
1	420-SSL-001	Apron Feeder 2 Speed Switch	Unhealthy (Less than 10 pulse/second after 5 seconds)	Yes
2	421-TT-001	Apron Feeder 2 Temp. Transmitter Motor Winding Red Phase	Unhealthy (Temperature above 95˚C)	Yes
3	421-TT-002	Apron Feeder 2 Temp. Transmitter Motor Winding White Phase	Unhealthy (Temperature above 95˚C)	Yes
4	421-TT-003	Apron Feeder 2 Temp. Transmitter Motor Winding Blue Phase	Unhealthy (Temperature above 95˚C)	Yes
5	421-TT-004	Apron Feeder 2 Temp. Transmitter Motor Drive End Bearing	Unhealthy (Temperature above 95˚C)	Yes
6	421-TT-005	Apron Feeder 2 Temp. Transmitter Motor Non Drive End Bearing	Unhealthy (Temperature above 95˚C)	Yes
7	424-HS-001	Apron Feeder 2 Field Isolator	Unhealthy	No
8	420-LSH-001	Apron Feeder 2 Blocked Chute Detector	Unhealthy (after 3 seconds)	No
9	420-LT-001	Hopper 1 Level Transmitter	Unhealthy (level < 15% during tipping cycle)	No
10	210-CV-308	Reclaim conveyor running	Unhealthy	No
11	214-FA-501	Dust Extraction plant running	Unhealthy	No

7.2.3 Apron Feeder 3 (210-FE-430)

Item No.	Tag Number	Description	Action	Latching
1	430-SSL-001	Apron Feeder 3 Speed Switch	Unhealthy (Less than 10 pulse/second after 5 seconds)	Yes
2	431-TT-001	Apron Feeder 3 Temp. Transmitter Motor Winding Red Phase	Unhealthy (Temperature above 95˚C)	Yes
3	431-TT-002	Apron Feeder 3 Temp. Transmitter Motor Winding White Phase	Unhealthy (Temperature above 95˚C)	Yes

Item No.	Tag Number	Description	Action	Latching
4	431-TT-003	Apron Feeder 3 Temp. Transmitter Motor Winding Blue Phase	Unhealthy (Temperature above 95˚C)	Yes
5	431-TT-004	Apron Feeder 3 Temp. Transmitter Motor Drive End Bearing	Unhealthy (Temperature above 95˚C)	Yes
6	431-TT-005	Apron Feeder 3 Temp. Transmitter Motor Non Drive End Bearing	Unhealthy (Temperature above 95˚C)	Yes
7	434-HS-001	Apron Feeder 3 Field Isolator	Unhealthy	No
8	430-LSH-001	Apron Feeder 3 Blocked Chute Detector	Unhealthy (after 3 seconds)	No
9	430-LT-001	Hopper 1 Level Transmitter	Unhealthy (level < 15% during tipping cycle)	No
10	210-CV-308	Reclaim conveyor running	Unhealthy	No
11	214-FA-501	Dust Extraction plant running	Unhealthy	No

7.2.4 Apron Feeder 4 (210-FE-440)

Item No.	Tag Number	Description	Action	Latching
1	440-SSL-001	Apron Feeder 4 Speed Switch	Unhealthy (Less than 10 pulse/second after 5 seconds)	Yes
2	441-TT-001	Apron Feeder 4 Temp. Transmitter Motor Winding Red Phase	Unhealthy (Temperature above 95˚C)	Yes
3	441-TT-002	Apron Feeder 4 Temp. Transmitter Motor Winding White Phase	Unhealthy (Temperature above 95˚C)	Yes
4	441-TT-003	Apron Feeder 4 Temp. Transmitter Motor Winding Blue Phase	Unhealthy (Temperature above 95˚C)	Yes
5	441-TT-004	Apron Feeder 4 Temp. Transmitter Motor Drive End Bearing	Unhealthy (Temperature above 95˚C)	Yes
6	441-TT-005	Apron Feeder 4 Temp. Transmitter Motor Non Drive End Bearing	Unhealthy (Temperature above 95˚C)	Yes
7	444-HS-001	Apron Feeder 4 Field Isolator	Unhealthy	No
8	440-LSH-001	Apron Feeder 4 Blocked Chute Detector	Unhealthy (after 3 seconds)	No
9	440-LT-001	Hopper 1 Level Transmitter	Unhealthy (level < 15% during tipping cycle)	No
10	210-CV-308	Reclaim conveyor running	Unhealthy	No
11	214-FA-501	Dust Extraction plant running	Unhealthy	No

7.2.5 Apron Feeder 5 (210-FE-450)

Item No.	Tag Number	Description	Action	Latching
1	450-SSL-001	Apron Feeder 5 Speed Switch	Unhealthy (Less than 10 pulse/second after 5 seconds)	Yes
2	451-TT-001	Apron Feeder 5 Temp. Transmitter Motor Winding Red Phase	Unhealthy (Temperature above 95˚C)	Yes
3	451-TT-002	Apron Feeder 5 Temp. Transmitter Motor Winding White Phase	Unhealthy (Temperature above 95˚C)	Yes
4	451-TT-003	Apron Feeder 5 Temp. Transmitter Motor Winding Blue Phase	Unhealthy (Temperature above 95˚C)	Yes
5	451-TT-004	Apron Feeder 5 Temp. Transmitter Motor Drive End Bearing	Unhealthy (Temperature above 95˚C)	Yes
6	451-TT-005	Apron Feeder 5 Temp. Transmitter Motor Non Drive End Bearing	Unhealthy (Temperature above 95˚C)	Yes
7	454-HS-001	Apron Feeder 5 Field Isolator	Unhealthy (Temperature above 95˚C)	Yes
8	450-LSH-001	Apron Feeder 5 Blocked Chute Detector	Unhealthy	No
9	450-LT-001	Hopper 1 Level Transmitter	Unhealthy (level < 15% during tipping cycle)	No
10	210-CV-308	Reclaim conveyor running	Unhealthy	No
11	214-FA-501	Dust Extraction plant running	Unhealthy	No

7.3 Safety Interlocks

Item No.	Tag Number	Description	Action	Latching
1	400-HSS-001	Apron feeder belt guard switch 1	Unhealthy	Yes
2	400-HSS-002	Apron feeder belt guard switch 2	Unhealthy	Yes
3	400-HSS-003	Apron feeder belt guard switch 3	Unhealthy	Yes
4	400-HSS-004	Apron feeder belt guard switch 4	Unhealthy	Yes
5	414-HSS-001	Apron Feeder 1 E-stop	Unhealthy	Yes
6	424-HSS-001	Apron Feeder 2 E-stop	Unhealthy	Yes
7	434-HSS-001	Apron Feeder 3 E-stop	Unhealthy	Yes
8	444-HSS-001	Apron Feeder 4 E-stop	Unhealthy	Yes
9	454-HSS-001	Apron Feeder 5 E-stop	Unhealthy	Yes

8 Control Philosophy

8.1 Motor Controllers and Feeders

8.1.1 Variable Speed Drives

The VSD’s used for the apron feeder drives are Siemen’s G120 units. These units have the Safe Torque Off, which will be used when the safety relay becomes unhealthy. Once the motor has come to a halt the power will be removed until the fault is reset. VSD’s will only have chokes fitted when cable lengths exceed 200 m. There are no dual drives in the apron feeder plant therefore no thermal motor overloads are required, motor protection will be via the VSD.

8.1.2 Direct On Line Starters

The DOL’s are controlled by Siemens Simocode Pro V units. Communication is via Profibus for status and control and the Simocode protects the motor from overload and earth fault. When the safety relay becomes unhealthy the 24 VDC supply used to pull in the contactor is cut off and the contactor will drop out.

8.1.3 Feeders

Feeders supply equipment that is self-contained with its own switchgear in a field-mounted panel or items that do not require remote control such as welding sockets and distribution board supplies. Feeders are equipped with a molded case circuit breakers and where relevant an earth leakage unit. There is no communication between the PLC and the feeder.

8.2 Centralized Lubrication System

The lubrication system consists of five units, one per apron feeder. Each unit consists of three major parts; a grease pump with integrated grease tank and level switch, distribution blocks and ultrasonic proximity switches. The grease pump pumps grease to the main distribution block that distributes equal amounts of grease to four sub distribution blocks, one mounted at each bearing. The distribution blocks at the bearings are fitted with the proximity sensors, which are the four flow switches indicated on each apron feeder, which monitor the flow of grease.

For each apron feeder, the pump needs to run for one cycle for every 8 hours of running. This will ensure that the grease in the grease tank is mixed and the grease in the bearings is refreshed with clean grease regularly. The PLC will have an accumulator to monitor the running time of each apron feeder. When 8 hours is reached the PLC will activate the pump until all the proximity flow switches on distribution blocks have pulsed once. If they have not all pulsed after 4 minutes the pump will be shut off and alarm displaced on the SCADA.

Faults that could cause the proximity switch not to make or break contact are:
- Blocked lubrication point
- Broken main line from grease pump to distribution block
- Contamination of lubricant in the lubrication system
- Grease pump not delivering lubricant
- Grease level too low

The level switch in the grease tank connects to the PLC. When the grease level is low, an alarm will display on the SCADA to notify the operator that a refill is required. If the alarm is raised during a grease cycle, the cycle will continue until it is completed but no further grease cycles will be carried out. Any fault or alarm displayed on the SCADA will be shown with a timer to indicate the time remaining until the next grease cycle.

8.3 Knife Gate

The knife gate consists of three parts, five permanently installed frames, one between each hopper and apron feeder, a single removable cartridge containing the blade and fixed hydraulic power pack with two removable hydraulic cylinders. Hydraulic tubing from the power pack to each hopper is permanently installed with a short length of flexible hose at each mounting point to couple the cylinders to the power pack as required. The cylinder direction and pump control is done at a local control panel mounted at the hydraulic power pack.

When it is decided that an apron feeder requires isolation for maintenance, the operator will shut down the tippler system. Using the push buttons on the local control station, the operator will close the knife gate. Once the knife gate is closed, the apron feeder can be removed and the tippler system can be restarted. The tippler system will still run at nominal capacity with only four apron feeders.

Once the apron feeder is ready to be reinstalled, the tippler system is again shut down, the apron feeder reinstalled and the knife gate is opened using the hydraulic power pack once more.

8.4 Apron Feeders

8.4.1 Description of Operations

Before the apron feeders can run, the tippler must achieve three tips. This is to build up a bed of material on the apron feeders to reduce the wear from the iron ore. At the start of the tipping cycle, the operator will manually input the type of material and the number of wagons in the rake. If there are three or less wagons, the interlock requiring there to be three tips before starting the apron feeders will change to one tip. The speed of the apron feeders will be adjusted slightly to compensate for the different densities of the different materials. In order for the tippler to operate, the following conditions are required from the apron feeders:

- Conveyor CV308 to be running
- All apron feeder interlocks healthy, but any one apron feeder may be bypassed by a supervisor
- The respective apron feeder drives ready
- No active or un-acknowledged faults
- The hopper level high switches and level transmitters healthy
- Dust extraction plant running

Once the tippler has achieved three tips ~~or one tip if there are three or less wagons,~~ the beacons will start flashing the sirens will sound for fifteen seconds. After fifteen seconds, the sirens are switched off but the beacons will continue to flash. The apron feeders will now start. During start up, the pulses from the speed switch shall be ignored but after the apron feeders have reached the set speed according to the VSD feedback the PLC will monitor the number of pulses it receives to determine the actual speed of the apron feeder. Should the speed drop by more than 20% for more than 5 seconds the apron feeder drive will trip.

Startup complete occurs once the VSD's are at full speed and receiving run feedback and the speed switch is healthy. Should this not happen, the affected apron feeder will trip and the message "failure to start" displayed on the SCADA. With startup, the accumulator for the lubrication sequence will also begin.

While the system is running, the PLC will monitor the process interlocks and stop any or all of the apron feeders affected by an interlock becoming unhealthy. The tipping sequence will be suspended for the following two reasons: when two or more apron feeders have tripped or when a level high signal is received from a hopper level switch or hopper level transmitter.

In the event of an apron feeder chute blocking, an operator will go to the RIO panel mounted at the apron feeders. The operator will request local mode for the apron feeder using the selector switch and the SCADA operator will grant access. This will allow the Tippler to complete its current tipping cycle/rotation. Once the tippler is back in its normal position the tipping cycle will be paused. The operator at the apron feeder can then jog the apron feeder forwards and backwards using the local control station at the apron feeder to dislodge the material. Once the blockage is clear, the operator will return the apron feeder to automatic mode and the tipping cycle can be resumed.

The following conditions will trigger a controlled system shutdown.

- A global stop initiated by the operator when in automatic mode
- Individual stops initiated by the operator when in semi-automatic mode
- Tipping has stopped for more than 1 hour

During a global stop, the apron feeders must continue to run for a sufficient time to ensure the hoppers are empty. The apron feeders will not shut down until 2 minutes after all the hopper level transmitters are reading 0%. When the operator issues an individual stop to each feed, he must ensure the hoppers are empty. The VSD's will ramp the feeders down to a halt, then the run time accumulator for the grease system will store the number of hours the pan feeders have been running and the beacons switched off.

In the event of an uncontrolled stop of the apron feeders that ends the tipping cycle for whatever reason, the operator will need to put the apron feeders into semi-automatic mode and run them until they are clear of material. If the tipping cycle has not been ended, the operator will restart the system in automatic mode to carry on from the point that the tipping cycle had reached before the stop was initiated.

8.4.2 Speed Control

The apron feeders are VSD controlled and the speed of apron feeders is varied in the manner outlined below.

A. Automatic

When the system is in automatic mode, the nominal combined feed rate of the apron feeders is 8000 tph. The feed rate was determined by number of wagons that the tippler must process in an hour. If one apron feeder is removed from the system (disabled on the SCADA), the speed of the remaining four apron feeders will be adjusted to maintain a feed rate of 8000 tph.

The apron feeders will run at the nominal speed at the start of the tipping cycle. If the level in a hopper rises above the high set point given in the table below, the speed of the apron feeder for that hopper will be increased. If the material continues to rise, there are further speed increases until the level reaches 100 % and the tipping cycle is stopped altogether. The apron feeder speed is changed back to the nominal speed once the level in that hopper is back to the nominal level. If the tipping cycle has been suspend due a full hopper, the tipping cycle will automatically resume once the level in that hopper has dropped to 50% full.

Conversely, should the level in a hopper drop below the low set point given in the table below, the speed of the apron feeder for that hopper will be decreased. If the material continues to drop, there are further speed decrease until the level reaches 15 % and that apron feeder is stopped altogether. Again, the apron feeder speed is changed back to the nominal speed once the level in that hopper is back to the nominal level.

The table below gives the set points for the apron feeders. This table is a guideline and the final values will be determined during hot commissioning. It may be necessary to include an input on the SCADA in which the operator selects the type of ore being unloaded to account for the different densities. The speed percentages will be offset according to the density of the selected material. The material does in a single rate is the same, there will only be changes between the rakes.

Hoper Level		Apron Feeder feed rates		
		5 feeders		
Set point	%	Tons/hour	Speed (%)	Total t/h
High 2	80	1800	89	9900
High 1	75	1800	80	9000
Nominal	50	1620	72	8100
Low 1	25	1462.5	65	7312.5
Low 2	20	1350	60	6750
		4 feeders		
High 2	80	2250	100	9000
High 1	75	2137.5	95	8550
Nominal	50	2025	90	8100
Low 1	25	1822.5	81	7290
Low 2	20	1350	75	6750

B. Semi-Automatic

In semi-automatic the operator will be able to set the individual apron feeder speeds from 65% to 100%. However, the system will not allow the total feed rate to exceed 10 000 tons/hour.

C. Manual

In manual mode the operator will be able to set the individual apron feeder speeds from 5% to 100%. However, the apron feeder will only run while the push button at the local control station is pressed.

The operator must ensure that the conveyor belt is not flooded when running the apron feeders in semi-automatic or manual modes. The minimum speed is dictated by the cooling requirements for the motor. There is no forced cooling so the minimum speed for continuous operations is 60%. In semi-automatic mode the minimum speed has been set to 65% for added protection. It is important that the thermal protection for the motor is not bypassed, especially in manual mode.

APPENDIX H

SQUAD CHECK FORM

Location	**Saldanha**	Squad Check Number	**1924701.M003-SQ-1377**
Title	**Apron feeder Knife Gates – Control Philosophy**	Contract No.	**M003**
Project Name	**Installation of the 3rd Tippler at the Port of Saldanha**	Project No.	**1924701**
Document No.	**1924701.M003-MA-0004**	Revision	**0A**

Discipline	**Reviewer's Name**	**Reviewer's Signature**	**Date**	**Mandatory**	**Optional**	**Approved**	**Approved with Comments**	**Rejected**	**Information**
	Richard Shandu		19/04/2020	X			✓		

REVIEW STATUS (Assigned by Responsible Project Manager)

C 1	☐	APPROVED	C 3	☐	REJECTED
C 2	☒	APPROVED WITH COMMENTS (REVISE & SUBMIT)	C 4	☐	INFORMATION

SIGNED BY: RESPONSIBLE PROJECT MANAGER	Print Name	**Sphamandla Mathonsi**
	Signature	
	Date	20 April 2020

This review is only for general conformance with the design concept of the Project and general compliance with the information given in the contract documents

TRANSNET

SQUAD CHECK COMMENT SHEET

Project / Contract No.	Squad Check No.
1924701-M003	1924701.M003-SQ-1377

Comments	Name of Discipline	Action Taken by Responsible PM
Address comments as indicated on each page in the document.		

SIGNED BY: RESPONSIBLE PROJECT MANAGER	Print Name	
	Signature	
	Date	

This comment sheet must always accompany the front cover sheet (Squad Check Form) once signed off

PROJECT-NAME	SALDANHA TIPPLER T3				
PROJECT-No. CLIENT	1924701-M003	PROJECT-No.	AC0339		
DOC-No. CLIENT	1924701.M003-MA-0004	DOC-No.	ENG-MAN-1005	REV	0
DOCUMENT-TITLE	**Apron feeder Knife Gates – Control Philosophy**				

Apron Feeder Knife Gates

Control Philosophy

Tippler T3 for Saldanha Iron Ore Terminal

Contract No.: 1924701-M003

Rev.	Prepared (TAKRAF)		Checked (TAKRAF)		Approved (TAKRAF)		Approved (TGC)		Revision Status
	Date	Name	Date	Name	Date	Name	Date	Name	
A	01/04/2020	S Hussain	02/04/2020	P. Drake	03/04/2020	M. Wimble			
B									
0									

Rev.	Brief details of change
A	Initial version of Document. Content is subject to approval of CE62 – 5 x Apron Feeder Knife Gates.
B	
0	

Table of Contents

1 Scope

Transnet is installing a new tippler, Tippler 3, at the Port of Saldanha. Tenova TAKRAF Africa has been contracted to supply and install the new tippler system complete with dual tandem tippler, wagon positioner, wheel grippers, apron feeders below the tippler to extract the iron ore onto a conveyor belt (supplied by others) and a dust extraction plant to extract the dust generated by the tippler and the apron feeders. This document describes the Functional Control Philosophy of the Apron Feeder Knife Gates. It covers the overview of the system, the instrumentation, system interlocking, modes of control, and descriptions of operations.

This document shall be used by Engineering disciplines involved in the design, operation and maintenance of the Apron Feeder Knife Gates.

The general philosophy proposed for the equipment below:

- Local control stations for starting and stopping of drives locally for maintenance.

2 Reference documentation

This document must be read in conjunction with the following documents:

- OT3882.1/A3/001-01–Knife Gate hydraulic circuit
- 1924701.M003-MA-0001-01 & 02 – Train Unloading System - Description of Operations Part 1 & 2
- 1924701.M003-LIS-0028 – Apron Feeder Control Philosophy

Ensure that the latest revision of these documents and drawings is used.

3 System Overview

The primary function of the knife gates is to isolate an individual Apron Feeder so that it may be removed for maintenance. When it is decided that one apron feeder requires isolation for maintenance, the operator will shut down the tippler system. Each Apron feeder has its own knife gate installed between the Apron feeder and hopper. Using the push buttons on a local control station, the operator will close the knife gate. The apron feeder is then removed and the tippler system can be restarted. The tippler system will still operate at full nominal capacity with only four out of five apron feeders. ***Refer to 1924701.M003-LIS-0028 Apron feeder CP***

Once the apron feeder is ready to be reinstalled, the tippler system is again shut down, the apron feeder reinstalled and the knife gate opened to allow the hopper to discharge onto the Apron feeder.

4 Modes of Operation

The system operates only in a Manual mode and is hydraulically driven. Manual is a local mode on the local control station. An operator will go to the field and energise the system.

It is the responsibility of the person performing the manual isolation to liaise with operations and ensure that the plant is shut down and that the necessary permits are in place before any knife gate is either closed or opened.

A. Local

Control of the knife gate is done only via a local control station consisting of a gate selector switch, an open push button, close push button and local ~~e~~-stop. The open and close functions are jog functions only. The E-stop is not linked to the global emergency circuit and will only trip the knife gate actuators. All control is done locally and there are no interlocks with the main plant

The local isolator on the hydraulic unit must be switched off and locked out when not in operation.

5 Abbreviations

DOL	Direct On Line
HY	Hydraulic Power Pack
HSS	Emergency Stop
LSL	Level Switch Low Low
MT	Motor Unit (VSD or DOL)
PDS	Pressure Differential Switch high
PI	Pressure Indicator
PS	Pressure Switch
TT	Temperature Transmitter
XVC	Solenoid Valve Open
XVO	Solenoid Valve Close
YA	Event Alarm/Fault
YC	Controller
YL	Indicator Light
ZSC	Position Switch Close
ZSO	Position switch Open

6 Instruments

No.	Tag Number	Description	Function	Action
1	401-LSLL-001	Oil low low level switch	Oil low level trip and indication	Add oil
2	401-TSHH-001	Oil High High temperature switch	Oil high temperature trip and indication	Allow system to cool down
3	401-PDSH-001	Oil differential pressure (Filter blocked) switch	Filter blocked indication	Clean or replace filter
4	401-PSH-001	Oil Pressure switch high	Stops pump and indicate high pressure	To be reset when pressure
14	401-ZSO-001	Gate 1 Open Limit Switch	Control panel indication	Open Status
15	401-ZCS-001	Gate 1 Closed Limit Switch	Control panel indication	Closed Status
16	401-ZSO-002	Gate 2 Open Limit Switch	Control panel indication	Open Status
17	401-ZCS-002	Gate 2 Closed Limit Switch	Control panel indication	Closed Status
18	401-ZSO-003	Gate 3 Open Limit Switch	Control panel indication	Open Status
19	401-ZCS-003	Gate 3 Closed Limit Switch	Control panel indication	Closed Status
20	401-ZSO-004	Gate 4 Open Limit Switch	Control panel indication	Open Status
21	401-ZCS-004	Gate 4 Closed Limit Switch	Control panel indication	Closed Status
22	401-ZSO-005	Gate 5 Open Limit Switch	Control panel indication	Open Status
23	401-ZCS-005	Gate 5 Closed Limit Switch	Control panel indication	Closed Status
24	401-XVO-001	Gate 1 Open Solenoid	Extend Cylinder	Move gate to open position
25	401-XVC-001	Gate 1 Closed Solenoid	Retract Cylinder	Move gate to closed position
26	401-XVO-002	Gate 2 Open Solenoid	Extend Cylinder	Move gate to open position
27	401-XVC-002	Gate 2 Closed Solenoid	Retract Cylinder	Move gate to closed position

No.	Tag Number	Description	Function	Action
28	401-XVO-003	Gate 3 Open Solenoid	Extend Cylinder	Move gate to open position
29	401-XVC-003	Gate 3 Closed Solenoid	Retract Cylinder	Move gate to closed position
30	401-XVO-004	Gate 4 Open Solenoid	Extend Cylinder	Move gate to open position
31	401-XVC-004	Gate 4 Closed Solenoid	Retract Cylinder	Move gate to closed position
32	401-XVO-005	Gate 5 Open Solenoid	Extend Cylinder	Move gate to open position
33	401-XVC-005	Gate 5 Closed Solenoid	Retract Cylinder	Move gate to closed position
34	401-XV-006	Load / Unload solenoid	Enable oil flow	Load control

7 Interlocks

There are three types of interlocks: start, process and safety Interlocks.

Start interlocks are required to be healthy in order to start a given piece of equipment but should the interlock become unhealthy while that piece of equipment is running it will be ignored.

Process interlocks are required to be healthy in order to start and run a given piece of equipment. Should the interlock become unhealthy during the operation of that piece of equipment, the piece of equipment will stop.

Safety interlocks are for the protection of equipment and people and will immediately shut down the equipment. Usually, this entails removing all power straight away but in some cases, it is safer to stop the equipment before removing power. Safety interlocks are reset in the field and acknowledged on the SCADA before equipment is restarted. For this plant, the ~~e~~-stops are hardwired to a central safety relay that will trip the entire plant.

All the interlocks are described as either latching or not latching. An interlock that latches requires the operator to acknowledge the unhealthy state after the situation that caused the interlock to be unhealthy has been resolved. The system will consider the interlock unhealthy until it is ~~acknowledge.~~ An interlock that is not latching does not require acknowledgement, as soon as the situation has been resolved the interlock is healthy. It is recommended that the operator checks interlocked equipment before acknowledging the fault.

Figures given in the interlock tables below are for indication and will be confirmed during commissioning.

7.1 Start Interlocks

7.1.1 Hydraulic Power Pack (2-210-HY-401)

Item No.	Tag Number	Description	Action	Latching
1	401-LSLL-001	HPP Oil level switch low	Unhealthy (Oil level below 300mm)	No
2	401-TSHH-001	HPP Oil temperature Transmitter	Unhealthy (Temperature above 50˚C)	No
3	401-PSH-001	HPP Oil Pressure switch	Unhealthy (Pressure above 16 MPa)	Yes

7.2 Process Interlocks

7.2.1 Hydraulic Power Pack (2-210-HY-401)

Item No.	Tag Number	Description	Action	Latching
1	401-LSLL-001	HPP Oil level switch low	Unhealthy (Oil level below 300mm)	No
2	401-TSHH-001	HPP Oil temperature Transmitter	Unhealthy (Temperature above 50˚C)	No
4	401-PSH-001	HPP Oil Pressure switch	Unhealthy (Pressure above 16 MPa)	Yes

7.3 Safety Interlocks

Item No.	Tag Number	Description	Action	Latching
1	2-210-HY-401-S1	Panel emergency stop	Unhealthy	Yes
2	210-HS-401-S1	Pendant emergency stop		Yes

8 Control Philosophy

8.1 Operating Sequence

The knife gates are fully manual with no process interlocks and are hydraulically operated. The local isolator on the hydraulic unit must be switched off and locked out when not in operation.

It is the responsibility of the person performing the manual isolation to ~~laisse~~ with operations and ensure that the plant is shut down and that the necessary permits are in place before any knife gate is either closed or opened.

The knife gates are fully manual with no process interlocks and are hydraulically operated.

The local start station is equipped with local emergency stop and control buttons. It also has the facility to be controlled via a remote pendant station.

Local Start Station control functions (located on the hydraulic unit)

Function	**Colour**	**Function**	**Reference**
Emergency Stop	Red	System Shutdown	-S1
Stop Pushbutton	Red	Stop Hydraulic Pump	-S2
Start Pushbutton	Green	Start Hydraulic Pump	-S3
Reset Pushbutton	Green	Reset High Pressure Trip	-S4
Open Pushbutton	Green	Opens Knife Gate Selected	-S5
Close Pushbutton	Green	Closes Knife Gate Selected	-S6
Selector Switch	Black	Select Knife Gate 1 to 5	-S7

Local Pendant control functions

Function	**Colour**	**Function**	**Reference**
Emergency Stop	Red	System Shutdown	-S1
Open Pushbutton	Green	Opens Knife Gate Selected	-S5
Close Pushbutton	Green	Closes Knife Gate Selected	-S6

8.2 System interlocks

- 401-LSLL-001 Low Low oil level – lamp - pump will not start
- 401-TSHH-001 High oil temperature – lamp - pump will not start
- 401-PDSH-001 Filter blocked – lamp - alarm only – replace filter element
- 401-PSH-001 High oil pressure – lamp - pump will not run – check for blockage in chute - can be reset by push button

8.3 Preliminary checks

- Visual check tank oil level
- Check that main electrical power is on at the panel and that the healthy indication light is on
- Check that all alarm lights are off
- Pump stopped indication is on

8.4 Start hydraulic pump

- Start pump – the pump running light will now be on and gates are ready to be operated

8.5 Gate ~~of~~ operation

- Select the gate to be operated (example GATE 1)
- Press respective push button (GATE 1) to open
- GATE 1 will open and upon full stroke, the limit switch will illuminate the relevant lamp, which will advise the operator to release the pushbutton.
- Press respective push button (GATE 1) to close
- GATE 1 will close and upon full stroke, the limit switch will illuminate the relevant lamp, which will advise the operator to release the pushbutton.
- Repeat as necessary for gates 2, 3, 4 or 5
- Press EMERGENCY STOP in emergency situation

8.6 Solenoid operation

The pump load/unload solenoid is energized simultaneously with any one of the 10-off directional solenoids, whenever the push button open gate or close gate is pressed. The solenoids are in pairs for open/close of the gates 1, 2, 3, 4 & 5.
Should the pushbutton be released, the solenoid coils will become de-energised and the gate will remain in its ‘parked’ position

On illumination of the respective fully open or fully closed lamp, the pushbutton must be released immediately, which in turn de-energises the solenoid coils of both the directional control valve and the pump loading valve

8.7 Over pressure

Should the over pressure switch 401-PSH-001 be activated during normal operation of any of the 5-off gates, the pump/motor will automatically stop. This could be an indication of a possible chute blockage, requiring investigation. Upon completion of clearing the chute blockage, the high pressure reset button can be pressed/re-set and normal operation continued.

8.8 Settings:

401-LSLL-001 Low - low oil level – 350mm from top of tank
401-TSHH-001 High temperature – 50 deg. C
401-PSH-001 Over pressure – 160 bar (or pressure determined during hot commissioning)

9 Equipment Description and Function

The following describes the actions taken when the cylinders are in operation. Oil is drawn from the reservoir through the suction line into the fixed displacement H.P. gear pump (2-210-PP-401). This pump is driven by an 11 kW electric motor (2-210-MT-401) which is coupled via a bellhousing and torsional flexible-coupling to the pump.

Oil is pumped from the reservoir by means of the gear pump (2-210-PP-401) to the gate cylinders, passing through the following equipment:

- Flexible hose
- Non return valve
- Load holding valve [401-XV-006] set to xx MPa which holds the cylinders in any position and ensures that the gate will not move unless the solenoid is energised.
- Pressure relief valve [PRV01]1, which serves to limit the pressure in this portion of the system to.
- Directional control valves which are solenoid operated and directs oil to either end of the cylinders engaging it to extend or retract. Energising the solenoids [XVC], the cylinder will move to close the gate and energising [XVO], the cylinder will move open the gate
- Pressure compensated flow divider which regulates the flow from the load holding valve to the cylinders to ensure that each cylinder receives the correct amount of oil so that the cylinders move together.

This combination is mounted next to the reservoir on a common base frame.

The pressure switch [401-PSH-001] is connected to the system through Test point 1 (TP1). This switch is activated at maximum pressure of 16 MPa and serves as a protection for the cylinders and power pack.

A temperature switch [401-TSHH-001] located in the reservoir will send signal to control system to trip the system if the temperature of oil in the reservoir ~~raises~~ above 50°C.

Oil returning to the reservoir is filtered by the return line filter [FIL1]. Therefore, no oil entering the reservoir will be unfiltered.

An electrical clogging indicator [401-PDSH-001] will indicate to the maintenance personnel once the filter has been clogged. The filter should be changed with in the next possible service interval. The Filter is clogged at an oil temperature above 25°C when the delta pressure of 200 KPa, is measured across the filter element (401-PDSH-001).

A level switch [401-LSLL-001] has been mounted atop the of the reservoir. Should the oil level drop below the pre-set value of 300mm below the top of tank, the system will trip immediately.

END OF DOCUMENT.

APPENDIX I

Technical Specification: Dual Wagon Tipplers, Feed Hoppers, Apron Feeders and Dust House for the Port of Saldanha

Document Number 1924701-2-211-M-SP-0003

TRANSNET
SALDANHA IRON ORE EXPANSION (PHASE 1D) – TIPPLER
DUAL WAGON TIPPLER FACILITY TECHNICAL SPECIFICATION

Document Details

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Revision	Revision Date	Details	Authorised	
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Table of Contents

1.0 Introduction

1.1 Overview

Transnet is undertaking a major programme of projects in Cape Town, Saldanha and Postmasburg to upgrade and expand the capacity of their infrastructure, as part of Transnet's Market Demand Strategy. The Scope of this project is to increase the materials handling capacity at Saldanha Port primarily by the addition of Tippler 3 and associated conveyors and rail infrastructure.

1.2 Purpose

This specification sets out the minimum technical requirements for quality and workmanship for all necessary engineering, design, management and co-ordination, supply of all drawings, manuals and documents, supply of materials plant and labour for the manufacture, construction, erection, testing and commissioning of a **Dual Wagon Tippler Facilities, Feed Hoppers, Apron Feeders, Dust House** and all associated auxiliary equipment by a suitable *Contractor*. This specification shall be read in conjunction with the following particular specifications.

- Technical Specification : Apron Feeder : Document Number 1924701-2-213-M-SP-0003
- Technical Specification : Dust Collection (Bag House) : Document Number 1924701-2-214-M-SP-0003

The Saldanha Bulk Terminal Iron ore handling facilities have a current throughput of 58Mtpa and currently operate 2 Dual Wagon Tipplers as part of the unloading circuit. Transnet has engaged AECOM to undertake the EPCM delivery of an expansion project. Included within the scope of this project is a new third dual wagon tippler (Tippler 3). A conveyor network will connect the new tipplers to the existing material handling system.

2.0 Definitions, Terminology and Abbreviations

2.1 Definitions

Employer	has the meaning defined in the Contract and includes their respective successors and assigns
Project Manager	means the Project Manager as described in the Contract
Site	means the Saldanha Port (final installed location of the Dual Wagon Tippler Facilities)
Contractor	means the *Contractor* engaged under the contract for the supply of the Dual Wagon Tippler Facility
Subcontractor	means a subcontractor or their subsidiary engaged by the *Contractor*
Dual Wagon Tippler Facility 3	Includes the Dual Wagon Tippler, Feed Hoppers and Chutes, Apron Feeders, Apron Feeder Level Structural Steel Floor and Bag House (including agglomerators)

2.2 Terminology

"Shall" is used to indicate that the *Contractor* is required to take action.

"Should" is used to indicate that the *Contractor* is advised to take action.

"May" is used to indicate that the *Contractor* is permitted to do something, or that the *Employer* reserves the right to do something, according to context.

"Approved" / "Approval", unless otherwise qualified, means normal, written agreement by *Employer* to a proposal by the *Contractor*.

2.3 Abbreviations

Table 1: Common Terms and Abbreviations

Term	Definition
CCTV	Closed Circuit Television
COR	Continuous Operating Rate
DC	Direct Current
DCS	Distributed Control System
DFT	Dry Film Thickness
DOL	Direct-On-Line
DSO	Direct Ship Ore
ECI	Early Contractor Involvement
FAT	Factory Acceptance Testing
FBH	Flat Bottom Hold
FEA	Finite Element Analysis
FEM	European Federation of Material Handling
HDPE	High Density Polyethylene
HMI	Human Machine Interface
HV	High Voltage (Greater than 44kV AC up to 132kV AC)
I/O	Input Output – PLC
ILAC	International Laboratory Accreditation Cooperation
ITP	Inspection Testing Procedures
LCS	Local Control Station
LV	Low Voltage (Nominal voltage levels up to and including 1000V AC)
MV	Medium Voltage (Greater than 1000V AC and less than 44kV AC)
MCC	Motor Control Centre
MDR	Manufacturer’s Data Report
Mtpa	Million tonnes per annum (metric)
NACE	National Association of Corrosion Engineers
NDT	Non-Destructive Testing
PC	Personal Computer
PCBs	Poly-Chlorinated Biphenyls
PID	Proportional, Integral and Derivative (for control systems)
PLC	Programmable Logic Controller
PQR	Procedure Qualification Records
RTD	Resistive Thermal Device
SAT	Site Acceptance Testing
SMF	Synthetic Mineral Fibres
SMS	Stockpile Management System
SWLL	Safe Working Load Limit

Term	Definition
TB	Tension Bearing (bolts)
TF	Tension Friction (bolts)
Tph	tonnes per hour (metric)
UPS	Uninterruptible Power Supply
VESDA	Very Early Smoke Detection and Alarms
VSD	Variable Speed Drive
WPS	Welding Procedure Specifications

3.0 Referenced Documents

Table 2: Reference Documents

Document Number	Document Title
1924701-2-211-M-DS-0003	Dual Wagon Tippler Data Sheet
1924701-C008-SCH-0001	Dual Wagon Tippler *Contractor's* Documentation Schedule (CDS)

4.0 Engineering

4.1 Design

4.1.1 Units

The SI system of metric units shall be used for this Project.

4.1.2 Language

All data shall be in the English language.

4.1.3 Drawings

The *Contractor* shall submit ALL mechanical, structural, electrical and instrumentation drawings, for approval by the *Employer*.

The full list of documentation requirements is included in the *Contractor* Documentation Schedule (document 1924701-C008-SCH-0001), included under Annexure A of the accompanying Works Information document.

The *Contractor* shall maintain records and prepare "As-Constructed" documents for all documents, drawings and Operation and Maintenance manuals etc. on completion of the *works*. The "As Constructed" documents shall demonstrate compliance with project specifications and drawings. All mark-ups shall be drafted with the revision status clearly indicated and supplied to the *Employer* in both hard and electronic format.

The *Contractors* "As-Constructed" documents shall be signed by the *Contractor* and submitted to the *Employer* for approval as developed and at completion of the work. Software copies of the "As Constructed" documents will be accepted in Autocad 2004 (or later) to be loaded into Bentley MicroStation V8 software.

"As Constructed" drawings shall be submitted as per the requirements as set out in the "*Contractor* Documentation Submittal Requirements" (DOC-STD-0001) included under Annexure B of the accompanying Works Information document.

4.1.4 Calculations

Calculations shall be neat and legible and contain the following, in the order as stated below:-

- Summary of assumptions and conclusions
- Table of contents
- List of all associated drawings
- List of all text and references used
- Nomenclature
- Calculations shall include, but not be limited to, the following areas:
    - Machine performance / capacity
    - Maximum power demand
    - Brake Performance
    - Gear rating and life
    - Bearing life
    - Structural analysis for strength, serviceability and stability
    - Mechanical analysis
    - Dynamic analysis
    - Hydraulic system power, pressure loss and thermal loads
    - Water system analysis
    - Lubrication system design
    - Ore car coupling forces modelling during unloading
    - Electrical Fault levels
    - Maximum demand and transformer loading
    - Cable sizing
    - Overload protection settings
    - Contribution to system harmonics
    - Electrical equipment selection criteria

Calculations shall be prepared and checked by Engineers registered as Professional Members of the Engineering Council of South Africa or equivalent institution recognised by ECSA. Calculations shall not be prepared and checked by the same person. Checked calculations are required before the commencement of fabrication.

4.1.5 Structural Design Review

The *Employer* will conduct an independent review of the cell, train holding devices and positioner's structural design and fatigue analysis. The *Contractor* must make allowance for the supply of required documentation and the time required to facilitate a structural review. The review will include a review of FEA work performed by the *Contractor*. Feedback and results of the design review will be made available to the *Contractor*.

4.1.6 South African Electrical Compliance

Any equipment designed and fabricated/manufactured overseas shall have an electrical certificate of compliance to South African Regulations before it is delivered (and operated) in South Africa. The compliance certificate(s) shall fully cover High Voltage, Medium Voltage and Low Voltage. These certificates will be issued by an accredited South African Professional Engineer.

4.1.7 *Employer* QA Representative

The *Contractors* QA requirements will be as set out in the "General Quality Requirements for *Contractors* and Suppliers" (ACM-QM-STD-001) included under Annexure F of the accompanying Works Information document.

The *Employer* may choose to appoint a QA/QC representative to monitor and report on some or all aspects of the production and fabrication processes. It is expected that full cooperation will be extended to the appointed QA/QC representative. Associated costs for this service will be borne by the *Employer*.

4.1.8 *Contractor's* Subcontractor Declaration

Where work is performed by a subcontractor of the *Contractor* they will be declared to the *Employer*. This will include any subcontractors operating on or at the *Contractor's* fabrication and assembly facility.

4.1.9 Hazardous Materials

The following materials shall not be used or installed:-

- Asbestos in any form
- PCBs (poly-chlorinated biphenyls)
- Mercury
- Viton Seals
- Any paints containing lead or chromates (including in the tinters)

5.0 Codes, Standards, Specifications and Regulatory Requirements

5.1 General

The sequential order of precedence applicable to the use of the codes, standards, specifications and regulatory requirements for this project is as follows:

i. Regulatory Requirements.

ii. Transnet Project Guidelines, Specifications and Standards.

iii. South African Standards.

iv. International Standards.

In the event of an inconsistency, conflict or discrepancy between any of the standards, specifications and regulations, the most stringent and safest requirement applicable to the project will prevail. Any inconsistencies critical to the design shall be brought to the attention of the *Employer* for resolution, prior to construction. The design shall comply with the latest revision of the following standards, plus any other applicable standards:

5.2 Government Acts and Regulations

The *Contractor* shall be responsible for compliance of all *works* with Government Acts, By-laws and Regulations, both State and Federal, including but not limited to the following (including all amendments):

- Mine Health and Safety Act 29 of 1996
- Occupational Health and Safety Act 85 of 1993
- Minerals Act 50 of 1991
- National Water Act 36 of 1998
- Atmospheric Pollution Prevention Act 45 of 1965
- Environmental Conservation Act 73 of 1989
- Promotion of Access to Information Act 2 of 2000
- National Road Traffic Act 93 of 1996
- National Environmental Management Act 107 of 1998

5.3 South African Standards

The *Contractor* shall be responsible for compliance of all *works* with South African Standards, including but not limited to the following:

Table 3: South African Standards (excluding Electrical and Control)

Code	Standard Title
SANS 3452	Non-destructive testing - Penetrant testing: Parts 1:to 4
SANS 15708	Non-destructive testing - Radiation methods: Parts 1 and 2
SANS 23279	Non-destructive testing of welds - Ultrasonic testing
SANS 9934	Non-destructive testing - Magnetic particle testing
SANS 763	Hot dip (galvanized) zinc coatings (other than on continuously zinc coated sheet and wire)
SABS 094	The use of high strength friction grip bolts
SABS 135	ISO metric bolts, screws and nuts (hexagon and square)
SABS 136	ISO metric precision hexagon head bolts and screws, and hexagon nuts

Table 4: South African Standards – Electrical and Control

Code	Standard Title
SANS 780	Distribution Transformers
SANS 1411	Materials Of Insulated Electric Cables And Flexible Cords: Parts 1 to 7
SANS 1507	Electric Cables With Extruded Solid Dielectric Insulation For Fixed Installations (300/500 V To 1900/3300 V): Parts 1 to 6
SANS 1520	Flexible Electric Trailing Cables For Use In Mines – Part 1: Low-voltage (640/1100 V And 1900/3300 V) Cables: Parts 1 to 3
SANS 1574	Electric Flexible Cables With Solid Extruded Dielectric Insulation: Parts 1 to 5
SANS 1804	Induction Motors: Parts 1 to 4
SANS 10142-1	The Wiring Of Premises – Part 1: Low-Voltage Installations
SANS 10142-2	The Wiring Of Premises – Part 2: Medium-voltage Installations Above 1 Kv AC Not Exceeding 22 Kv AC And Up To And Including 3000 Kw Installed Capacity
SANS 10198	The Selection, Handling And Installation Of Electric Power Cables Of Rating Not Exceeding 33 Kv: Parts 1 to 14

5.4 International Standards and Guides

The *Contractor* shall be responsible for compliance of all *works* with International Standards and Guides, including but not limited to the following:-

Table 5: International Standards and Guides

Code	Standard Title
AFBMA	Anti-Friction Bearing Manufacturers Association (As Applicable)
AGMA	American Gear Manufacturers Association (As Applicable)
ASME	American Society Of Mechanical Engineers (As Applicable)
ASME B16.3	Flanges And Bolting For Pipes, Valves And Fittings.
ASTM	American Society Of Testing And Materials (As Applicable)
AWS D1.1/D1.1M	Structural Welding Code – Steel
BS 2634	Surface Roughness Comparison Specimens
BS 3790	Endless Wedge Belt And V-Belt Drives

Code	Standard Title
BS 4235	Specification For Metric Keys And Keyways
BS 5228	Occupational Noise Management
BS 5499	Safety Signs For The Occupational Environment
BS 7608	Code Of Practice For Fatigue Design And Assessment Of Steel Structures
EN 10025	Carbon Steels & Carbon Manganese Steels – Hot Rolled Bars & Semi-Finished Products
EN 10025	Structural Steel – Hot-Rolled Plates, Floor Plates And Slabs
EN 10025	Hot-Rolled Steel Flat Products
EN 10083	Carbon Steels And Carbon Manganese Steels – Cold Finished Bars
EN 10088	Wrought Alloy Steels – Stainless Steel Bars And Semi-Finished Products
EN10219	Structural Steel Hollow Sections
EN 10220	Steel Tubes For Mechanical Purposes
EN 12882	Conveyor Belting Of Elastomeric And Steel Cord Construction
EN 13414	Wire-Rope Slings
EN 14399	High Strength Steel Bolts With Associated Nuts And Washers For Structural Engineering
EN 15877	PVC Pipes And Fittings For Pressure Applications
EN 20286	ISO System Of Limits And Fits
EN 2560	Covered Electrodes For Welding
EN 583	Non-Destructive Testing – Ultrasonic Testing Of Carbon And Low Alloy Steel Plate – Test Methods And Quality Classifications
EN 60204	Electrical Installations – Surface Mines And Associated Processing Plant
EN 60439	Low-Voltage Switchgear And Control Gear Assemblies – Type-Tested And Partially Type-Tested Assemblies
EN 61386	Electrical Installations – Selection Of Cables
EN ISO 3743	Acoustics – Determination Of Sound Power Levels Of Noise Sources
EN ISO 4783	Metric Screws Threads For Fasteners
FEM Section II 2.131/2.132	Rules For The Design Of Mobile Equipment For Continuous Handling Of Bulk Materials
FM Global	FM Global Fire Protection Approval Standards (As Applicable)
GB/T 1591	High Strength Low Alloy Structural Steel
GB/T 5782	Hexagon Head Bolts
GB/T 5783	Hexagon Head Bolts – Full Thread
IEC 60204	Safety Of Machinery
IEC 61508	Functional Safety Of Electrical/Electronic/Programmable Equipment
ISO 10816	Mechanical Vibration – Evaluation Of Machine Vibrations By Measurements On Non-Rotating Parts
ISO 128	Technical Drawing
ISO 12944	Guide To The Protection Of Structural Steel Against Atmospheric Corrosion By The Use Of Protective Coatings
ISO 1461	Hot Dip Galvanised Coating Of Fabricated Iron And Steel Articles. Specification And Test Methods
ISO 2408	Steel Wire Ropes

Code	Standard Title
ISO 2631	Evaluation Of Human Exposure To Whole-Body Vibration
ISO 281	Rolling Bearings – Dynamic Load Ratings And Rating Life
ISO 4014	ISO Metric Hexagon Bolts And Screws – Product Grade A And B
ISO 4016	ISO Metric Hexagon Bolts And Screws – Product Grade C
ISO 4032	ISO Metric Hexagon Nuts Including Thin Nuts, Slotted Nuts And Castle Nuts.
ISO 4413	Hydraulic Fluid Power – General Requirements For Systems
ISO 4759	Tolerances For ISO Metric Bolts, Screws, Studs And Nuts—Product Grades A, B And C
ISO 5048	Continuous Mechanical Handling Equipment – Belt Conveyors Calculation Of Operating Power And Tensile Forces
ISO 5049	Equipment for continuous handling of bulk materials – Part 1: Rules for the design of steel structures
ISO 717	Acoustics – Methods For The Determination Of Noise Rating Numbers
ISO 898	Mechanical Properties Of Fasteners Made Of Carbon Steel And Alloy Steel
ISO 14520	Gaseous fire-extinguishing systems - Physical properties and system design

5.5 Drawings and Drawing Standards

Drawings shall be in accordance with Transnet Capital Projects: Project Development and Execution: ENG-STD-0001, which will be made available on award of the contract. The drawings applicable to the supply of the dual wagon tippler have been included in the “Works Information” - document under Section 6.

5.6 Standard Specifications

The *Contractor* shall be responsible for compliance of all *works* with *Employer* standard specifications, including but not limited to the following:-

Table 6: Standard Transnet Specifications

Specification Number	Specification Title
SBH8/2/2	General electrical equipment
SBH8/2/3	Electrical motors and generators
SBH8/2/6	Lighting on equipment
SBH8/2/8	Testing & commissioning of electrical equipment
SBH8/2/9	Electronic equipment
SBH8/2/11	Medium voltage equipment for port equipment
SBH9/2/2	Hydraulic equipment
SBH9/2/4	Gearing, shafts, bearings, brakes, lubrication, vee-belts, keys and keyways
SBH9/2/6	Structural Steelwork
SBH9/2/7	Compressed air systems
SBH9/2/8	Corrosion protection
SBH9/2/9	General requirements & conditions

6.0 Site Conditions

6.1 Project Location

The Saldanha port facilities are in the Port of Saldanha in the Western Cape region of South Africa. Saldanha is located approximately 100 km North of Cape Town.

6.2 Site Conditions

The equipment shall be suitable for installation within a harsh industrial environment as indicated in **Table 7**.

Table 7: Site Conditions

Condition	Description
Altitude	Sea Level
Air Temperature	45°C Maximum; -5°C Minimum
Equipment Surface Temperature (from sun)	60°C Maximum
Relative Humidity	50% Minimum; 85% Maximum; 60% Average
Air Quality	Coastal salt- laden air with high concentration of iron ore dust
Air Pressure	101.3 kPa
Average Annual Rainfall	278 mm

6.2.1 Seismic Data

The Tippler 3 and 4 Building designs are according to SANS 10160. The buildings will consist of a reinforced concrete walls and column framed structures with steel superstructures. The structures will be founded on rock. Side wall loading makes allowance for shallow ground water tables. Seismic design considerations are as per SANS 10160-4:2011. The soils in contact with the Tippler Structures are classified as calcrete/sand and are Type 4 according to Table 1 in SANS 10160-4. The rock that will be the main foundation mediums are Type 1 as per Table 1 in SANS 10160-4 with Vs = 180 m/s. The Site is located in Zone 1 for seismic activity, i.e. natural seismic activity. The Tippler Buildings are considered to be Importance Class III as per Table 3 in SANS 10160-4.

The Tippler 1 Building design is according to SANS 10160. The building consists of a reinforced concrete wall and column framed structure with steel frame superstructure. The vault structure is founded on rock. The vault and side wall loading makes allowance for shallow ground water tables. The building and superstructure are founded on piles. Seismic design considerations are as per SANS 10160-4:2011. The soil in contact with the Tippler Structure is classified as calcrete/sand and is Type 4 according to Table 1 in SANS 10160-4. The rock that is the main foundation medium is Type 1 as per Table 1 in SANS 10160-4 with Vs = 180 m/s. The Site is located in Zone 1 for seismic activity, i.e. natural seismic activity. The Tippler Building is considered to be Importance Class III as per Table 3 in SANS 10160-4.

6.2.2 Maximum Temperature and Thermal Rating

For the maximum ambient air temperature for design of all equipment including motors, gearboxes, and bearings refer to the equipment data sheets as referenced in Section 3.0.

7.0 Material Properties

7.1 Product Properties

The Dual Wagon Tipper Facility shall be designed for the iron ore properties specified in the Equipment Data Sheets as referenced in Section 3.0.

7.2 Wear Materials

Areas of the Dual Wagon Tippler rotary cell and hoppers exposed to the product shall be lined with bolt-on ceramic liners. The number of bolt holes for bolt on liners shall be minimised. The gaps between the liners are to be filled with an approved trowel-applied ceramic grout. Bolt holes are to be based on the existing centre patterns to allow retrofit with other wear liner plate material if required.

8.0 Design Criteria

8.1 General

The Dual Wagon Tippler Facility shall be designed to handle iron ore (both lumps and fines). The Dual Wagon Tippler shall unload iron ore wagons to achieve an overall average out-loading tonnage rate of **8000Tph** measured over the duration of a train rake of **140 wagons**.

8.2 Design Features

The Dual Wagon Tippler shall be a single cell design, tipping two cars simultaneously. Ore cars are coupled in pairs via non-rotating draw bars. The control system shall ensure that the fixed drawbar is always presented to the middle of the dumper facility. Single point isolation shall be provided for Dumper Rotate and Positioner drives.

The Dual Wagon Tippler facility shall be designed to unload ore cars as specified in Section 8.8 of this document. The Dual Wagon Tippler cell envelope shall be designed to permit “drive through” clearance for Diesel (43D) and Electrical (E15 – not under power) locomotives.

The Positioner shall be capable of positioning trains of up to 140 (typically 114) fully laden cars and one (1) locomotive through the Dual Wagon Tippler. The Positioner shall be of a rack and pinion configuration.

Trains of ore cars are presented to the Dual Wagon Tippler by means of a locomotive(s). The locomotive(s) pass through the dumper cell, drawing a new rake of loaded cars into the dumper. The first two cars are positioned in the dumping position by the locomotive. The entry side positioner arm shall be able to engage with the train automatically at this position. The locomotive/s may be removed from the train after the first two cars are positioned in the dumper.

The unloading of the train is completed using the positioner. No index cars will be fitted to the train. A single point, full isolation system shall be provided to ensure safe operation whilst train movements / operations are occurring. Ore from each car shall be dumped into the surge hopper.

An allowance for overfilling of wagons is to be made as follows:

- 2% material per wagon for tippler design
- 2.5% material in rake of wagons for positioner and train holding device design

8.3 Throughput and Cycle Time

The system shall be designed for an average 90 second cycle between consecutive dual wagons dumping ore from the train rake. Nominal throughput shall be as specified in the “Dual Wagon Tippler Data Sheet” (1924701-2-211-M-DS-0003) as referenced in Section 3.0.

8.4 Design Approach

The *Contractor’s* tender submission shall include layout and machine loads (static and dynamic) data, which will be utilised by the *Employer* to complete tender designs for interdependent structural and mechanical components.

The *Contractor's* tender submission shall nominate the intended design methodology for structural and mechanical components.

The *Contractor's* tender submission shall also nominate the proposed design methodology for prediction of train behaviour and loading to minimise train forces throughout the loading cycle, taking account of the proposed track layout.

The *Contractor* shall nominate the limiting parameters utilised during tender submission and shall also nominate the requirements for track design input in the tender submission of engineering schedules.

The Dual Wagon Tippler shall be designed in accordance with the requirements of FEM (De Federation Europeenne De La Manutention) 2.131/2.132 (SECTION II) of 1992. Alternatively ISO 5049/1 Mobile equipment for continuous handling of bulk materials - Part 1: Rules for the design of steel structure may be used.

Finite Element Analysis (FEA) shall be used for all structural components including:-

- Trunnion Rollers
- Trunnion Bogie
- End Rings
- Cell Structure
- Positioners and Drive Assembly
- Critical areas including pivots and areas of stress concentration
- Tipper machine structures shall be modelled using a combination of shell and solid elements. Use of thin shells vs thick shells shall be explicitly indicated

All structural designs shall be independently verified by an approved third party verification organisation and their design verification reports will be provided, in addition to the design documentation supplied by the *Contractor*.

8.5 Design Life, Availability and Reliability

The Dual Wagon Tippler Facilities mechanical and structural components shall be designed for operating 24 hours per day, 365 days per year. The Service life of the equipment has been stipulated in the data sheets and the *Contractor* shall provide design life for the various components as required in the data sheet.

The equipment design life requirements, availability and reliability shall be as indicated in Table 8.

Table 8: Design Lifer Requirements, Availability and Reliability

Criteria	Requirement
Days/year	365
Hours/day	24
Operating hours/year	6800
Availability	>95%
Reliability	>98%

The *Contractor* warrants that the design, fabrication, supply and installation of goods is based on achieving a minimum operational availability of 95% on annual average until the defects date.

The calculation of availability excludes occurrences which are not attributable to the *Contractor* such as but not limited to operator damage or unqualified maintenance as well as unusual/non-specified loaded wagons, but includes all scheduled maintenance and proportionate unscheduled maintenance (repairs).

In order to ensure the above mentioned availability, the *Employer* shall make sure that all spare parts as mentioned in the supplier's spare parts list are available at the operation site at the Completion Date. Should the operational availability not be achieved due to *Employer's* failure to provide such spare parts, *Contractor* shall not be liable for such non-achievement.

Should the operational availability of 95% not be achieved due to reasons attributable to the *Contractor* then the *Contractor* shall take all reasonable steps necessary to increase the mean time between failures (MTBF) and reduce the mean time to repair (MTTR) to ensure that an availability of 95% is achieved.

Technical Statement

The Tippler and auxiliary equipment will be designed for heavy duty use and in accordance with the submitted project specifications.

The layout reflects all proven standards in the industry for such type of equipment and incorporates our latest design developments.

The mechanical equipment will be designed incorporating the necessary safety factors and a bearing lifetime of minimum 60 000 hours.

Access and easy replacement of the units will be addressed during engineering.

Structural design of tippler cage is proven and will exceed the specification where 4 Million cycle fatigue life is requested.

During operation the equipment requires detailed inspection and maintenance as is described and requested in the maintenance manual to meet the specified availability and reliability percentage per annum.

The detailed inspection of the equipment during operation and between train arrivals unloading will be the base and the key to recognize in an early stage any upcoming problems and schedule repair work.

Spare parts for all indicated mechanical and electrical parts need to be in stock at the operating site, as the expedited procurement could take 2 to 16 weeks.

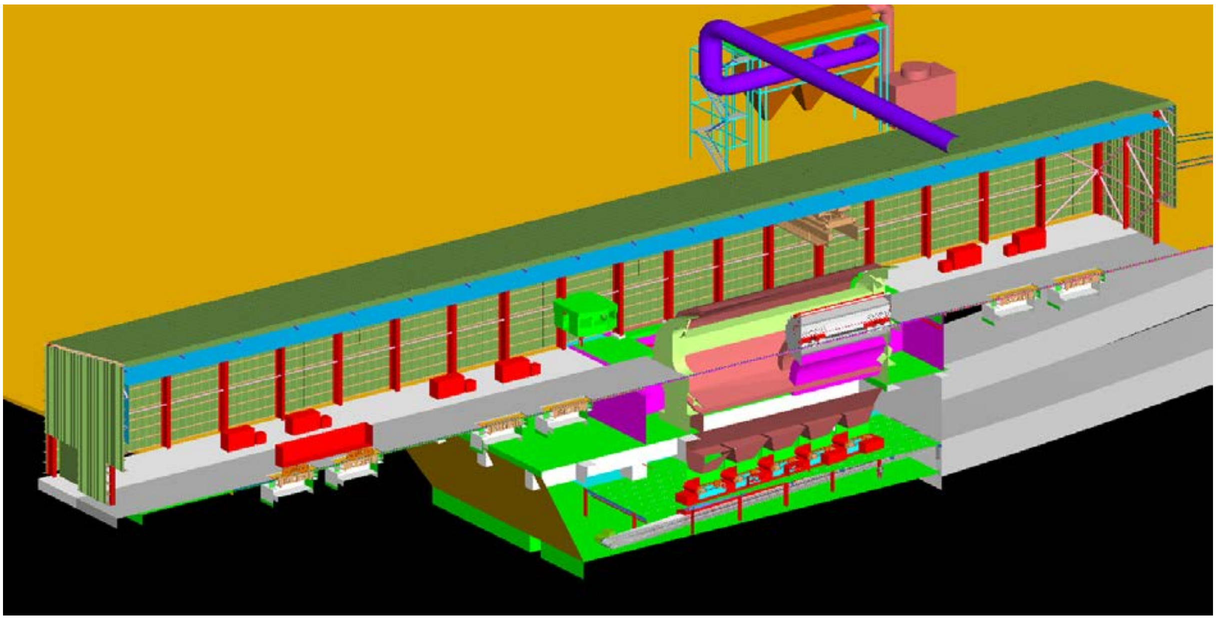
As currently planned no service contract or consulting agreement will be signed between the end user and the supplier.

The supplier will not have the chance to influence maintenance and decisions taken in a planned or unplanned maintenance window which affects the availability and reliability directly.

During repair work, planning tasks and optimization thereof is the key to match the required availability and reliability.

8.6 Dual Wagon Tippler Facility Layout

Figure 1: Dual Wagon Tippler Facility Layout



Also refer to the drawings as referenced under Section 5 of the Works Information.

8.7 Train Presentation to the Dual Wagon Tippler

Trains of loaded ore cars will be presented to the Dual Wagon Tippler with locomotives at the head of the train. A new train approaching the Dual Wagon Tippler stops short of the Dual Wagon Tippler awaiting authorisation. The Dual Wagon Tippler operator shall select ‘Locomotive Permit’ on the control system to indicate to rail personnel that the Dual Wagon Tippler (system) is ready for presentation of a new train of ore cars. Rail personnel then activate the Drive Through Interlock field switch (single point isolation), which in turn activates the green light above the rail to allow the locomotive driver to proceed.

The locomotive proceeds to drive through the cell at creep speed and stops with the first two ore cars positioned in the dumper. The Positioner is then engaged after the first dump cycle. The locomotive is then decoupled.

8.8 Train and Ore Car Specification

The Dual Wagon Tippler shall be capable of unloading ore wagons that have a maximum wagon (gross) load of 120 ton per wagon. This is to be based on an ore car design as detailed in the “Dual Wagon Tippler Data Sheet” (1924701-2-211-M-DS-0003) and the ore having sufficient density to fill the volume of the car and to load the axles to maximum capacity.

The Dual Wagon Tippler shall be capable of allowing the train locomotives to pass through the Dual Wagon Tippler. The *Contractor* shall specify the required clearances. The minimum acceptable clearances shall be to suit the ore wagons and locomotives as specified in the “Dual Wagon Tippler Data Sheet” (1924701-2-211-M-DS-0003).

8.9 Noise Levels

Noise levels shall comply with the statutory requirements for noise emissions and the occupational health and safety of operating personnel.

Equipment noise levels including drives and gear boxes, shall be measured as a whole and the noise level measurement shall be less than 85 db(A) measure at 1 metre whilst the Dual Wagon Tippler Facility is operating. Sound and vibration will be measured during operation and the levels documented.

9.0 Mechanical Requirements

9.1 General

The Dual Wagon Tippler shall hold and fully support the car throughout the tipping cycle and not cause damage to the car or couplings.

9.2 Equipment Selection

The Dual Wagon Tippler Facility shall incorporate only equipment of established proven design for the intended application.

The procedure for selection of mechanical components shall make provision for the *Employer* to standardise components with existing equipment in use on Tippler 2, as well as with current spares holdings. The procedure shall comprise the following steps:-

- The *Contractor* shall submit details of the proposed selection of mechanical components
- The *Employer* will advise the *Contractor* on required changes to the make and model of equipment and/or components
- The *Contractor* shall advise the *Employer* on the commercial and schedule impacts arising from the proposed changes, supported with backup documentation
- The *Employer* will confirm which changes are necessary to provide the required levels of standardisation and will instruct the *Contractor* accordingly
- The mechanical and electrical/electronic components applicable for standardisation include:

a. Drive systems, including gearbox, couplings and brake.

b. Mechanical components, such as trunnions, pins, wheels, rack segments.

c. Lubrication systems, including pumps, injectors and valves.

d. Hydraulic systems, including filters, cylinders, valves and pumps.

e. SCADA system to be WONDERWARE, servers, network switches, patch panels etc.

f. LV switchgear, cables, DB Boards etc..

9.3 Load Classifications

The operating load classifications shall be specified for mechanisms and mechanical components for each of the following categories:

- Positioners
- Dual Wagon Tippler cell
- Support trunnions
- Driving pinions girth gears and rack
- Clamping devices

The design standards shall be used to establish:

- Design load combinations
- Strength loads
- Fatigue and reversing loads
- Fatigue load spectra
- Fatigue load cycles
- Checking for strength
- Checking for fatigue

9.4 Dual Wagon Tippler

The Dual Wagon Tippler shall be designed as a single rotary cell. The centre of rotation of the tippler shall not require the wagons to be decoupled for tipping. For reference purposes, the seated position of the cell, suitable for the through passage of rolling stock, shall be the “zero degree” position.

The tip angle used during normal operation is detailed in the “Dual Wagon Tippler Data Sheet” (1924701-2-211-M-DS-0003). The cell shall however be capable of rotation to the 180º position for maintenance purposes.

The Dual Wagon Tippler shall have the ability to tip full, empty and partially loaded wagons.

Provision shall be made in the design to control a derailed car(s) so that, if entered into the dumper, it must not fall off anywhere into the structure.

The balance position shall be selected such that the Dual Wagon Tippler does not ‘run-away’ if the brakes are lifted while the cell is at the zero degree position.

The Dual Wagon Tippler Cell rotation drive shall comprise variable speed motors equipped with a disk brake and pinion arrangement.

9.4.1 Drum drive system

The drum drive shall consist of two units (one on each side) consisting of an AC motor , disk brake, torque resilient coupling, reducer and pinion mounted on fabricated and machined bed plates for maximum stability.

The drive shall be installed above ground level outside the pit to be easily accessible for maintenance.

The bed plates shall be installed on the existing galvanized mounting bolts for adjustment of levels etc. and the plates shall be grouted after initial levelling.

The components shall be designed with a service factor of 2 and a minimum service life of 50 000 hours.

A spring-applied calliper disk brake shall be fitted on the high speed side of the reducer. The brake shall be sized so that the drum can be restrained and held in position by engaging only one set of brakes.

Each drive pinion shall be supported by means of pillow blocks on a structural frame and coupled to the gearbox by means of a resilient type coupling. Jacking pads and bolts must be provided for pinion to rack clearance adjustment. It shall be possible to remove the pinion without disturbing the gearbox and motor. Pinions shall be heat treated to give the expected service life.

The rack gears shall be sectional cast, austempered and shot peened, ductile iron, bolted to the structure. An additional gear rack segment shall be provided at each end to prevent the pinion from possibly running out of the rack. The segments shall be heat treated to give the expected service life.

Lubrication of the rack and pinion shall be by means of a fully automatic piston pump type system.

A locking gear shall be provided to lock the drum at the side where a pinion might be removed for repairs.

The cell drive system shall have accurate feedback of cell position and drive motor speed which must be relayed to the control room

Provision shall be included to prevent cell over travel and disengagement of the cell drive gears in the event of uncontrolled rotation in either direction.

A positive mechanical isolation system shall be provided for the dumper cell to allow work on the drive system. Attention shall be paid to the method of releasing the isolation system under load after work on the drive has been performed.

The method for lifting the tippler cell for support roller assembly maintenance shall be via jacking (jacks to be provided) from the trunnion floor level.

9.4.2 Blocking System

The blocking system to support the ore wagon whilst tipping shall extend the full length of the dumper cell, and be chamfered on leading and trailing edges to allow for leaning cars.

The clearance between the blocking system and the nominal position of the side-walls of the ore cars shall be set at 25 mm, but provision shall be made to adjust this setting in the range ±25 mm without affecting the structural integrity of the system.

Blocking beam pads on the non-tip side shall align with a vertical rib of the ore wagon when the wagon is located in the tip position.

The blocking beam shall be provided with replaceable wear material in high wear areas (e.g. positions where side posts of ore car body contact the blocking beam).

9.4.3 Clamping System

Ore wagon clamps for Tippler 3 shall be designed to suit the nominated ore wagons, engaging on the top sill in the nominated location and will be of the gravity actuated type clamping system.

The clamp system shall minimise exposure of the “tip side” clamps to the ore stream. Plain spherical bearings are preferred for all pivot pins in the car clamp mechanisms. Bearings shall be conservatively sized to keep bearing pressures low. Bearings shall be appropriately sealed for the service conditions.

The counterweight gravity clamps shall have "failure" indication/sensing.

9.4.4 Final Drive to Tippler Cell

Final drive to the dumper cell shall be via rack and pinion gearing.

Rack segments shall be machined from cast steel ‘Tee’ section, with provision of a machined spigot to accurately locate the gear teeth, and shall be bolted to the mounting face to counteract separating forces of the gearing.

Control of the dumper cell rotation speed shall be provided via variable speed drives, of appropriate size. All drives shall be fitted with position encoders to permit accurate control. The cell drive system shall have accurate feedback of cell position and drive motor speed.

The drive mounting system shall provide adjustment to enable gear backlash to be set.

9.4.5 Cell Drive Pinions

The cell drive pinion shall be mounted onto a simply supported shaft such that any pinion forces other than torque are not transferred to the drive motor. The pinion is to be mounted on the pinion shaft between two self-aligning roller bearings. The bearings shall be mounted into purpose manufactured bearing cartridge assemblies.

The bearing cartridge assemblies are to be supported in line-bored split supports welded to and forming an integral part of the drive base.

It is the intention that the pinion, shaft, bearing cartridge assemblies and driven coupling half be changed out as a complete sub-assembly without any further shim adjustment in the field.

Lubrication of the pinion shaft bearing shall be by the automatic lubrication system. Each cartridge assembly shall be fitted with lubrication points, one for each labyrinth seal and one for the bearing.

9.4.6 Cell Drive – Drive Bases

The drive shall be a parallel shaft design mounted on a machined baseplate fixed with existing holding down bolts to the concrete. The pinion support shaft shall connect to the pinion shaft with a flexible coupling. The pinion shaft shall be capable of removal and replacement without altering the alignment of the drive or pinion shaft.

Lifting lugs shall be provided to ensure ease of installation and maintenance.

9.4.7 Wagon Rails

Running rail shall be of the UIC-60 type to match the main railroad track. Running rails on the platen beam of the Dual Wagon Tippler cell shall be secured by means of Pandrol® clips or an approved equivalent proprietary forged steel clip, i.e. no cast clips shall be allowed. Rails shall be located in a longitudinal direction with blocks bolted to each rail. The rail mounting and securing arrangement shall be designed for ease of replacement.

9.4.8 End Ring Rails and Trunnions

Rolling rails shall be clamped to the end rings with proprietary rail clips and bolt up against a machined landing surface. The ring rail bolting surfaces shall be machined true and square to the centre of rotation of the Dual Wagon Tippler cell.

The mating surfaces between rolling rail and machined end ring shall be arranged to minimise stresses within the fixing bolt connection. Special attention shall be paid to the rail rolling process to ensure that the rail foot is flat. Rolling rails shall be crane rail with a flat head. Crowned head rail shall not be used.

Rail must be selected to ensure it has a wear life of at least 10 years with the Dual Wagon Tippler operating at 30 Mtpa throughput.

The design shall include measures to prevent the build-up of ore around end rings, trunnion rollers and equaliser support frames.

Shedder plates shall be provided on the Dual Wagon Tippler cell to ensure that all ore is directed into the dump hopper. Attention shall be given to the shedder plate around the end rings.

All components which are likely to wear shall be fitted with suitably attached replaceable liners. Provision shall be made in the design to allow adjustment of critical components to allow for wear and long term use of the machine.

Enclosed ring gears shall be supplied with flanged waste lubricant troughs that may be retracted and cleaned from accessible locations.

9.4.9 Cell Over-Travel Arrester System

The cell shall be prevented from over travelling with an appropriately sized hydraulic buffer system.

9.5 Positioner

The Positioner shall index trains of up to 140 (typically 114) wagons and two (2) locomotives in free drive mode through the Dual Wagon Tippler, a wagon pair at a time in automatic or semi-auto control modes. The Positioner shall have a clearance envelope to allow the through passage of ore cars and locomotives.

The Positioner shall be positioned on the entry side of the Dual Wagon Tippler, supported on rails parallel to the rail track.

Size and quantity of drives shall be selected to suit the cycle times and duty cycle specified in the “Dual Wagon Tippler Data Sheet” (1924701-2-211-M-DS-0003). The final number of drives shall be agreed with the *Employer* upon completion of train dynamics assessment.

The Positioner rails and the rack shall be arranged so as to minimise the risk of damage due to dust and/or spillage build-up.

9.5.1 Positioner Engagement System

The positioner shall engage the train of ore wagons through a retractable arm supported between side plates.

The arm shall engage onto the ore car drawbar without excessive free play when engaged. The side of the arm head shall bear against the striker face on the ore cars.

A simple electromechanical arrangement for extending and retracting the arm is preferred and horizontal and vertical adjustment shall be provided for the positioner support rollers.

9.5.2 Positioner Drive

The positioner shall be driven by multiple variable speed AC electromechanical drives operating in parallel.

The Positioner shall have accurate feedback of its position and load at any instant. The drive control system shall ensure even load sharing between the drives and drive modules shall be arranged for ease of change out as a complete unit.

The Positioner drive system shall be able to hold the train at any position in its travel in the event of a power failure, plus incorporate over load protection to prevent damage to the drive systems.

9.5.3 Positioner Guide and Support Rollers

Guide rollers shall be adjustable independently to allow alignment of the positioner relative to the main line rail tracks and for compensation of wear on guide rail(s), rollers, rack and pinions.

Bearings shall be provided with Taconite type seal arrangements. Bearings and seal purge shall be connected to the automatic lubrication system.

9.5.4 Positioner Support Rails

The positioner support rails shall be crane rail section with flat head. Crowned head rail shall not be used. Rail sections shall be secured by proprietary clips, Pandrol® or approved equivalent of forged steel only, for ease of installation, alignment and replacement.

9.5.5 Positioner Segmented Gear Rack

The positioner gear rack shall be cast steel segmented type design. The exact length of the segments, both individual and overall, shall suit the existing positioner’s configuration design.

The gear rack shall have machine cut teeth with a machined mounting face. The gear rack segments are to be machined to ensure interchangeability.

The rack segments shall be bolted onto the existing machined mounting face on the longitudinal “spine bar”. Provision shall be made to facilitate accurate set-out, adjustment and alignment of the rack.

9.5.6 Positioner Pinions

The pinions shall have machine cut teeth. Lubrication of the pinions and rack shall be via an automatic lubrication system.

9.5.7 End-of-Travel Buffers

End-of-travel buffers shall be provided to prevent over travel of the positioner in the event of uncontrolled movement in either direction.

Design of arresters for the end of the positioner advance stroke shall allow for impact of the positioner whilst engaged with a train of maximum length, travelling at half max indexing speed without the effects of braking.

Arresters at the return end of the positioner travel shall be sized to handle impact of the Positioner alone travelling at maximum return velocity;

The layout of the new positioner and end stop buffers shall be as per the existing positioner and end stop buffers, where access is maintained between the positioner end stop foundations and the entry end ring of the Dual

Wagon Tippler cell. Positioner travel shall include a slow-down zone after the final limits and before contact with buffers at either end of its travel.

9.5.8 Support System – Positioner Cables and Services

The cable festoon support system shall be heavy duty type, suitable for the harsh environment. The system shall be provided to support electrical and control cabling and any other services required to be run from fixed points on land to the positioner.

Provision shall be made for detection of over-tensioning of the cables and other services and shall be interlocked with positioner operation.

The cable support system shall ensure that the minimum bending radius is maintained in both directions of positioner travel.

9.6 Train Holding Devices

Wheel grippers that clamp the sides of the ore car wheel rims shall be used as train holding devices. The train holding devices shall be capable of holding the nominated ore cars and unpowered locomotives, once they are stationary.

The quantity and type of train holding devices shall be appropriate for the maximum loads generated by all configurations of ore car trains. When retracted the train holding devices shall allow the through passage of all ore cars and locomotives (retract to below top of rail level).

9.6.1 Wheel Grippers

Wheel grippers shall clamp both sides of both wheels on one axle of an ore car. Wheel grippers shall be applied after the train has been indexed to the correct location and stopped by the positioner. Grippers shall not be used to decelerate the ore car train.

The preferred gripper facing pad material shall be wear resistant steel such as Hardox or approved equivalent. Wheel grippers shall retract below the top of the main line rail. The uppermost surface of the gripper bar shall not project more than 75 mm above the top of the main line rail (in new condition).

Each wheel gripper shall be capable of independent operation and shall be able to be isolated without affecting the operation of other grippers.

9.6.2 Stationary Holding Arm

A land mounted holding arm will be located at the entry end of the Tippler, on the opposite side of the main rail track from the positioner. The holding arm will locate over the rotary coupler between 2nd and 3rd wagons from the Tippler after arm engagement checks have been confirmed by photocells. The pivoted arm will be raised and lowered by a hydraulic cylinder. A faculty will be built into the arm to allow small amounts of lateral movement sufficient to relieve any load on the arm prior to disengaging.

The construction of the arm will be a heavy duty box set mounted on a heavy duty support bracket, which will be bolted to the concrete foundations.

9.7 Foundation Loads

The *Contractor* shall provide loadings for:

- Trunnion bogie
- Cell drive unit
- Positioner mounting points
- Positioner end of travel buffer loads
- Wheel gripper mounting points
- Stationary holding arm

Appropriate loading components shall be identified in an X, Y and Z axis system. The loading shall be un-factored and allowances for additional dynamic loads shall be clearly and separately identified.

The *Contractor* shall indicate the accuracy of the stated loadings and a target accuracy of ± 5% or better is required at tender stage.

Should the loads increase by greater than 8% from those nominated at tender; all cost for failure to comply shall be at the *Contractor's* expense.

The maximum loads imposed by the Dual Wagon Tippler for the loaded and unloaded conditions shall be detailed and set out in the General Assembly Drawings.

9.8 Access and Maintainability

The Dual Wagon Tippler Facility design shall carefully consider access to, and maintainability of all components.

These elements of design shall be incorporated in the formal concept and final design reviews, and shall form part of the *Contractor's* quality system.

Platforms, walkways, stairs, and handrails shall be in accordance with SANS 10400, SANS 10160, SANS 10162, Occupational Health and Safety Act No. 85 of 1993, Construction Regulation 2013.

Access shall be provided to carry out maintenance and inspection activities on all equipment including, but not limited to drives, bearings, pivots, lubrication points, chutes and electrical equipment. Specific attention is to be paid to vertical access for removal of equipment for maintenance activities where overhead crane or mobile crane assistance is required.

Stairways are to be provided in lieu of ladders utilising geometry of rise 190 mm (200 mm maximum) and going 270 mm (250 mm minimum), tread widths of 275 mm minimum and each upper step overhang the adjacent lower step by 25 mm if no solid riser is provided. For fire escape routes solid risers must be provided.

Access shall be provided as follows:

- Main walkway and stair widths shall be minimum 1,100 mm between stringers/handrails, all others shall be minimum 900 mm
- Minimum headroom shall be 2,400 mm measured vertically from step pitch line
- Handrails shall be 1,000 mm high above walking surface level. Approved proprietary handrailing and stanchions may be used e.g. Mentis product
- Kickflats shall be provided continuous on all platforms and landings 100 mm high above walking surface level
- Only fully hot dipped galvanized and approved, proprietary floor grating or checker plate shall be used

Removable walkway sections are to be avoided (where applicable). Where a walkway is required to be removable for maintenance purposes, additional removable handrails shall be provided to seal off the temporary openings.

Access openings shall be provided to allow inspection of the internals of fabricated box sections. The access openings shall be a minimum size of 600 mm diameter. These are to have gaskets or gasket compound and de-oxygenating compound shall be placed prior to final sealing on erection or prior to transport as appropriate. Entry into the box sections is considered as a confined space entry and provision shall be made for forced ventilation of these openings.

All machines shall be designed to maximise the ease of maintenance activities.

The maintenance activity, personnel safety, access, equipment selection and reliability shall be considered as an integral part of the design process.

The design process shall include detailed reviews of all significant maintenance activities to ensure they are readily accomplished. It is expected that the design review for each machine will take place when approximately 15% and subsequently 60% of the design drawings are complete.

Should the review identify areas where re-design is required to ensure maintainability, all costs of rework shall be borne by the *Contractor.*

9.9 Guarding

Guards shall be provided for personnel protection in accordance with the requirements of the Occupational Health and Safety Act No. 85 of 1993 and as per the standards referenced in Table 3, Table 5 and Table 6, in this Technical Specification.

All safety guards shall be provided with two labels as follow:-

- DANGER ISOLATE EQUIPMENT BEFORE REMOVING GUARD
- APPROXIMATE MASS OF GUARD XX kg (when above 10 kg)

The maximum mass of any one guard shall be 20 kg and the maximum size of any one guard shall be 2 m^2.

9.10 Standardisation

Standardisation of parts shall be maximised wherever the potential exists for savings to the *Employer* in either capital cost or reduced operating costs.

9.11 Gearing

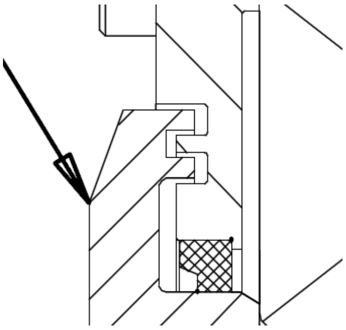
Gearboxes shall be thermally rated for continuous operation with an ambient temperature of 50ºC and a maximum oil sump temperature of 90ºC.

The design and rating of all gearing shall be in accordance with American Gear Manufacturer's Association (AGMA) standards and documents. Gearbox service factor, bearing life and thermal rating requirements shall be suitable for a design operating life of 60,000 Dual Wagon Tippler Facility operating hours. Gearbox selection shall be based on AGMA design. Rating calculations shall be based on normal operation of the machines under full load, and shall include for the number of starts and torque reversals.

As a minimum all gearboxes shall have:

- A dust tight dip stick, clearly marked with the correct oil level
- A replaceable element type breather of adequate capacity and suitable for operation in a dust laden atmosphere
- An accessible plugged oil drain point of suitable diameter. It is preferred that this drain point be BSP tapped with a minimum size of 1"
    - A magnetic sump plug
- Labyrinth/taconite seals to supplement rubber oil seals as per the sketch below

Labyrinth/taconite seal



Basic ratings of gear sets shall be in accordance with AGMA specifications:

- ANSI/AGMA 2001-C95 (Spur and helical gearing)
- ANSI/AGMA 2003-B97 (Bevel gearing)

Attention is drawn to Clause 16.2 of AGMA 2001 regarding reduction of allowable bending stress number to 70% of values listed in the standard for reversing drives.

Noise emissions shall be minimised as far as practically possible. Tender submissions for speed reducers shall include a statement regarding the expected noise emissions.

Gear rating calculations for both open gearing and reducers shall be submitted for review and approval. A declaration of all factors used in the rating calculations shall also be included.

9.11.1 Gearing Factors Design

The following service factor shall be applied to the design of all open gearing and the selection of all reducers. Service factor shall be applied to demand loads.

Service factor = 2

Gear and reducer basic ratings shall be adjusted for the number of load cycles (life factor, stress cycle factor) in accordance with AGMA 6114 and AGMA 6013 as appropriate. The value of the factor shall not exceed unity. The number of cycles shall be based on the life requirements as specified in the “Dual Wagon Tippler Data Sheet” (1924701-2-211-M-DS-0003).

The reliability factor for all gearing and reducers shall be 1.0.

9.11.2 Gear Reducers

Reducers shall comply with ANSI/AGMA 6013-A06 (Enclosed drives).

The thermal power rating for reducers shall exceed the demand power of the equipment under the most onerous combination of conditions. Allowance may be made for cyclic operation of drives. For drives that experience cycles of varying demand, allowance shall be based on repeated cycles of the highest mean demand power.

The use of forced cooling, i.e. external oil cooling or fans, shall require the approval of the *Employer.*

Splash lubrication shall be employed in all reducers. The use of forced lubrication shall require approval from the *Employer.*

Reducers shall be provided with a quick connect coupling for lubrication filling and draining. A Stauff SDB93 desiccant breather filter shall be provided on all reducers.

Worm and wheel reducers are only permitted for small ancillary drives of less than 3kW and only when integral with proprietary equipment.

9.11.3 Rack and Pinion Gearing

The final drive gear rack and pinion(s) on both the dumper cell and Positioner shall be designed in accordance with the American Gear Manufacturer’s Association document, ANSI/AGMA 6114-A06.

Racks shall be segmented for ease of manufacture and replacement. Rack segments shall have machine cut teeth and mounting surfaces to ensure correct alignment. Pinions shall have ground teeth.

Minimum Quality Number (to AGMA 2000):

- pinion(s) Qv = 8

- rack / ring gear Qv = 6

The design of the mounting arrangement for rack segments shall pay particular attention to the accurate positioning of rack tooth pitch and alignment. Positioning shall be repeatable and rack segments shall be interchangeable. The mounting arrangement shall be capable of accepting all loads imposed by the pinion(s), tangential and separating forces.

Gearing for the Dual Wagon Tippler cell shall be designed to accommodate any skewing of the gears due to deflection of the dumper structure.

9.12 Bearings

Bearings shall be heavy duty type, selected to provide a minimum L10 life of 100,000 hours (calculated in accordance with ISO 281-1) unless otherwise noted.

Bearings and housings shall be of standard types and sizes readily available in South Africa.

Bearings shall be re-greasable and shall be provided with adequate labyrinth and grease purged seals. Where bearings are fitted to the dead end of a shaft, a steel blanking plate shall be fitted.

Calculation of bearing loads shall include allowance for horizontal forces at the wheel periphery.

Ring support roller bearings must be designed to avoid brinelling damage to surfaces as loading will be largely static during ore car movements.

9.13 Lubrication

A schedule of lubrication requirements for all bearings, grease purged seals, and open gearing shall be supplied. The schedule shall include the equipment manufacturer’s preferred lubricant (for run-in and normal operation).

Automatic lubrication shall be provided for all grease lubrication points on the dumper, Positioner and train holding devices that require frequent replenishment of lubrication.

For points requiring infrequent replenishment of lubrication (e.g. greater than three months between lubrication), consideration shall be given to the provision of manual lubrication. The system for manual lubrication shall be discussed and agreed with the *Employer.*

The automatic lubrication systems can be sub-divided into grease lubrication (for bearings, seals and slides) and gear lubrication (for open gearing). The design of open gear lubrication systems must endeavour to minimise the spillage of lubrication from the applied surfaces as far as possible.

All gearboxes and hydraulic power units shall be either fitted with bladders to prevent air entering the units or fitted with 3 µm desiccant breathers depending on the airflow requirements.

9.13.1 Automatic Lubrication

The automatic lubrication systems shall be dual line type. The system shall provide adjustment for lubricant delivery at individual points. The distribution blocks shall be mounted in positions that are accessible from normal maintenance positions whilst the machine is operating.

9.13.2 Automatic Lubrication – Dual Wagon Tippler Cell

The pump, control cabinet and reservoir for the Dual Wagon Tippler cell automatic grease lubrication system shall be land mounted and accessible at all times. Equipment on-board the Dual Wagon Tippler cell shall be serviced via a grease line run through the cell catenary system.

The gear lubrication system shall be fully land based. The pump, control panels, reservoir and preferably the delivery nozzles shall be safely accessible whilst the dumper is operating.

9.13.3 Automatic Lubrication – Positioners

It is intended that the pumps, control panels, and reservoirs for the automatic lubrication systems for the positioners are mounted on-board the positioner. This applies to both grease and gear lubrication systems.

9.13.4 Manual Lubrication

Lubrication points that only require infrequent lubrication and are thus not connected to the automatic systems shall be ‘piped’ to central panel(s).

All grease nipples shall be 1/8" BSP Tecalemit H29 or approved equivalent. Grease points shall be accessible from walkways and platforms and shall not require the removal of guards. Inaccessible points shall have extension lines run to an accessible point. Each grease point and line from remote points shall be identified by labels or tags.

Each manual grease point and line shall be appropriately labelled.

9.13.5 Pump Systems

Automatic lubrication shall be electrically powered, PLC controlled dual line Tecalemit system or approved equivalent.

The grease reservoir and pump unit shall be located to provide safe and easy access during machine operation.

Reservoir size shall be selected according to grease consumption rates based upon a refilling frequency of approximately two months.

Refilling of the reservoir shall be carried out from the ground level by mobile lube truck. Reservoir level indication shall be provided at the point of filling on the ground level. The filling coupling shall be a 3/4” Aeroquip “snap on” fitting.

Lubricant flow monitoring shall be included for each zone of the lubrication system. Details of the proposed system shall be provided at tender.

Reservoir level shall be monitored and provided with a low level alarm. The level and alarm status shall be monitored and alarmed within the control system.

All external panels and enclosures shall be designed and constructed in accordance with the requirements of Transnet specifications SBH8/2/11 and SBH9/2/8.

9.13.6 Piping and Fittings

All rigid piping shall be stainless steel complying with BS 3605 Part 1 in accordance with the requirements of Transnet specification SBH9/2/2 and suitably sized to meet the duty as required.

Steel braided hydraulic hoses shall be used to connect fixed pipelines where relative movement between the fixed pipelines may occur. All flexible hoses shall be secured to prevent rubbing between the hoses and be in accordance with the requirements of Transnet specification SBH9/2/2.

All piping shall be adequately supported at hose connections, adjacent to bends and at intervals not exceeding 40 times the pipe outside diameter.

9.14 Hydraulic Equipment

As a minimum, all hydraulic equipment shall comply with the requirements of Transnet specificationSBH9/2/2.

9.14.1 Hydraulic Power Equipment

Hydraulic equipment must be suitably robust for the harsh dust laden marine environment where it is to be used. Hydraulic equipment specified must ensure that fluid cleanliness and permissible temperatures are maintained within the system. Where coolers are specified, they must have sufficient cooling capacity to operate in a semi-clogged state. The cooler must be robust enough to withstand high pressure wash-down.

Hydraulic equipment must be designed for ease of fault finding and system setup. Where manifold blocks are used they must be equipped with test-points (mini-mess type) with port identification symbols machined into the manifold block.

9.14.2 Hydraulic Power Packs

The hydraulic power units shall be housed in a fully enclosed weather proof steel cabinet of rigid and robust design. All faces of the cabinet shall be fitted with lockable and hinged covers and doors, which shall be easily removed. The hinge material shall have due regard to low usage rates and corrosive conditions caused by iron ore and saline water.

Ventilation shall include air filtration using easily replaceable washable air filters. Noise levels shall comply with the requirements of the project specification. The housing shall include acoustic insulation as required to comply with this noise emission level.

All hydraulic systems shall be of the self-bunded design. Hydraulic fluid reservoir shall have 110% containment. The whole unit shall, as a minimum, be provided with a drip tray/oil pan under the unit fitted with a drainage outlet and ball valve for drainage purposes. The drainage outlet shall be valved and piped to discharge at ground level.

All equipment that requires inspection and/or maintenance activities shall be accessible via access doors or removable cover plates without the need to dismantle or remove the housing.

Hydraulic pumps shall be variable displacement axial piston type.

Filtration shall be less than 3 micron absolute.

The frequency of filter element change out shall not be less than 3 months.

Filters shall be fitted with a differential pressure gauge across the element.

Each hydraulic system shall be provided with means of identification of all equipment and valving.

Equipment numbering shall be in accordance with the project specification, with the following minimum requirements for equipment identification:

- Flow diagram for each system, identifying all equipment and valves numbers
- Plant / equipment layout drawing for each system, identifying all equipment and valve numbers
- All equipment and valves shall be identified by equipment number, mounted on the valve or equipment

Refilling of the reservoir shall be carried out from the ground level. Reservoir level indication shall be provided at the point of filling on the ground level. Filling and oil top-up shall be undertaken through a filtration system.

The fixed end of the filling coupling shall match the connection type specified by the *Employer.* Hydraulic reservoir tank(s) shall be fitted with a hydraulic reservoir filter to accommodate thermal expansion and air movement in the tanks. The reservoir filter shall be silica gel type, sized to accommodate the full usage and thermal movement.

All hydraulic assemblies shall be fitted with quick-connect couplings suitably sized for connection to a kidney filtering system. The coupling lines shall be fitted with lockable isolation valves and secure dust caps to prevent ingress of dust. The filtering feed and return lines shall be extended from the tanks to a nominated point within 1.2 m of a vehicle access point.

The hydraulic power units shall be complete, with electrical enclosure housing all motor controls and protection, PLC and all input & output modules and HMI. PLC shall be compliant with plant specs and have functionality to connect to the system network. A complete alarm and fault recording system will be included in the PLC and HMI to enable fault finding on the unit.

9.14.3 Hydraulic Piping

Hydraulic piping, installation, support, cleaning, flushing, testing and commissioning shall be in accordance with the piping and hydraulic equipment technical specifications. Piping shall be stainless steel seamless tubing of suitable wall thickness to suit operating pressures.

The number of flanged or screwed connections shall be minimised.

All lines shall be hard piped, as far as this is possible. Steel braided flexible hoses shall be used only where relative movement exists. All flexible hoses shall be secured to prevent rubbing between the hoses. All bend radii must be within the manufacturer's specification.

All piping shall be adequately supported at hose connections, adjacent to bends and at intervals equivalent to instrument tubing standards, but not less than 40 times the pipe outside diameter.

9.15 Dust Extraction Unit

See Dust Extraction Unit Technical Specification and Data Sheet attached in Annexures N and O of the Works Information respectively.

9.16 Hopper Liners

For Tippler 3 the geometric form of the hopper and bins and the required flow type for the bins has been determined by the *Employer*, based on previous operational experiences with Tippler 2's hopper and bins. The hopper and bins have been so designed that build-up of ore in individual bins shall not occur with an apron feeder being out of operation. The sliding contact area of the ore with the hopper has also been minimised. The *Employer* will work closely with the *Contractor* to ensure that the optimum hopper and bin design has been selected. Once optimal hopper and bin design has been agreed between the *Employer* and the *Contractor*, then supply and installation of the hoppers and bins will be affected by the *Contractor*.

A minimum of five bins and feeders will be provided with easily replaceable ceramic (or equivalent) wear liners.

9.17 Apron Feeders

See Apron Feeder Technical Specification and Data Sheet attached in Annexures L and M of the Works Information respectively.

9.18 Apron Feeder Level Floor

The apron feeder support is a steel structure, supported by columns from the vault floor and side walls similar to the 3D models shown below. The *Employer* will work closely with the *Contractor* to ensure that the optimum apron feeder level support design has been selected. Only once the optimal apron feeder level support design has been agreed between the *Employer* and the *Contractor*, can the further detailed designs, fabrication and installation be completed by the *Contractor*.

9.19 Operator's Room

An operator's room will be provided (by others). The operator's room will have the following features:-

- The location of the room will be such that the operator has a clear view of the Dual Wagon Tippler and incoming Positioner operation

- Fixed Station operator controls for manual operation of the Dual Wagon Tippler shall be a PC based workstation, to be supplied by the *Contractor*. These controls shall be suitable for fitting in the operator's room without obstructing the clear view of the Dual Wagon Tippler and Positioner operation
- Windows will be provided and located to eliminate blind spots. Windows will be made from laminated safety glass
- Sufficient space will be allowed around the operator's chair for two observers

Figure 2: Apron Feeder Level Structural Steel Support – Side View

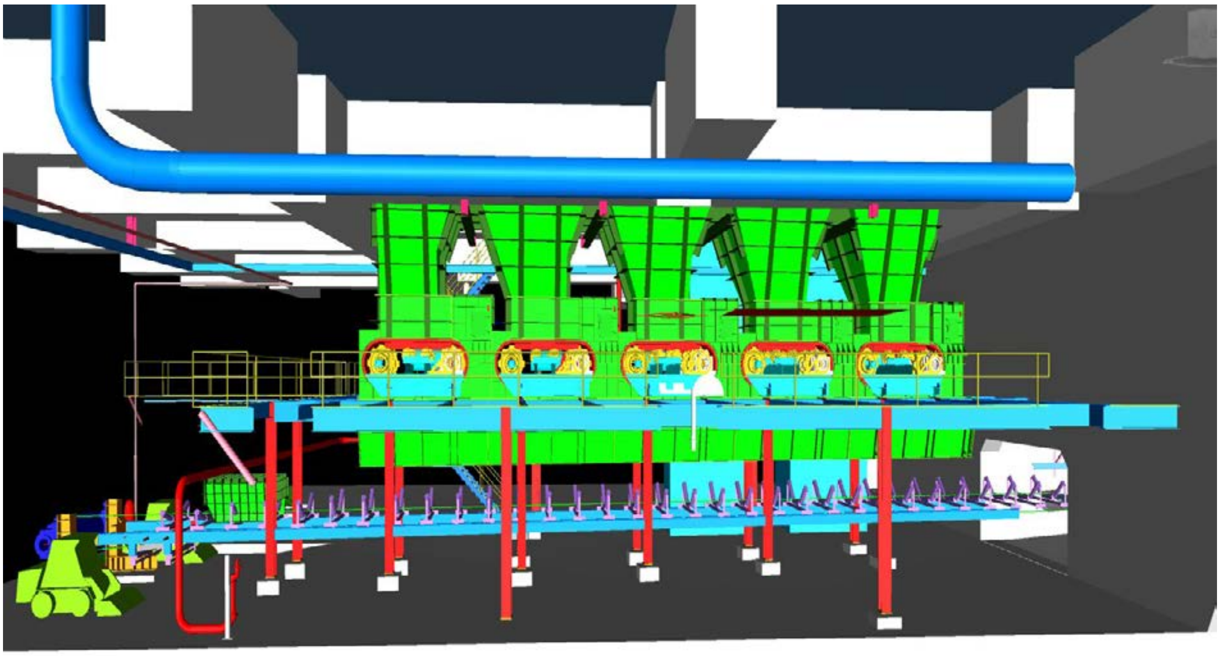


Figure 3: Apron Feeder Level Structural Steel Floor – Rear View 1

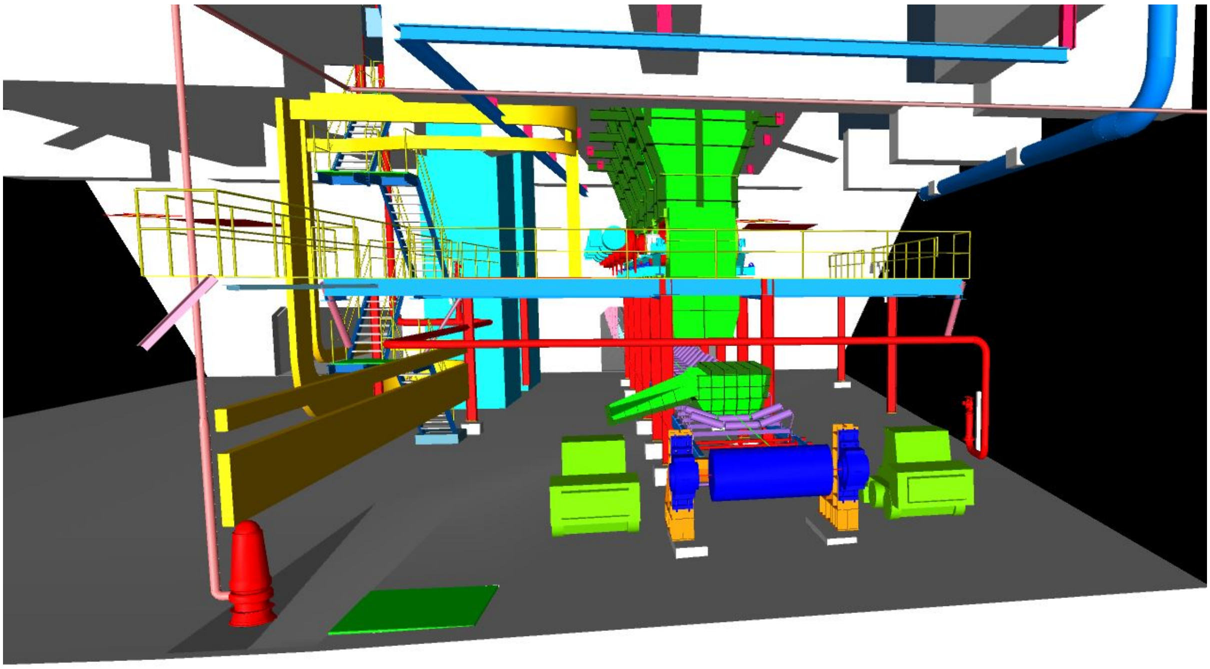


Figure 4: Apron Feeder Level Structural Steel Floor – Rear View 2

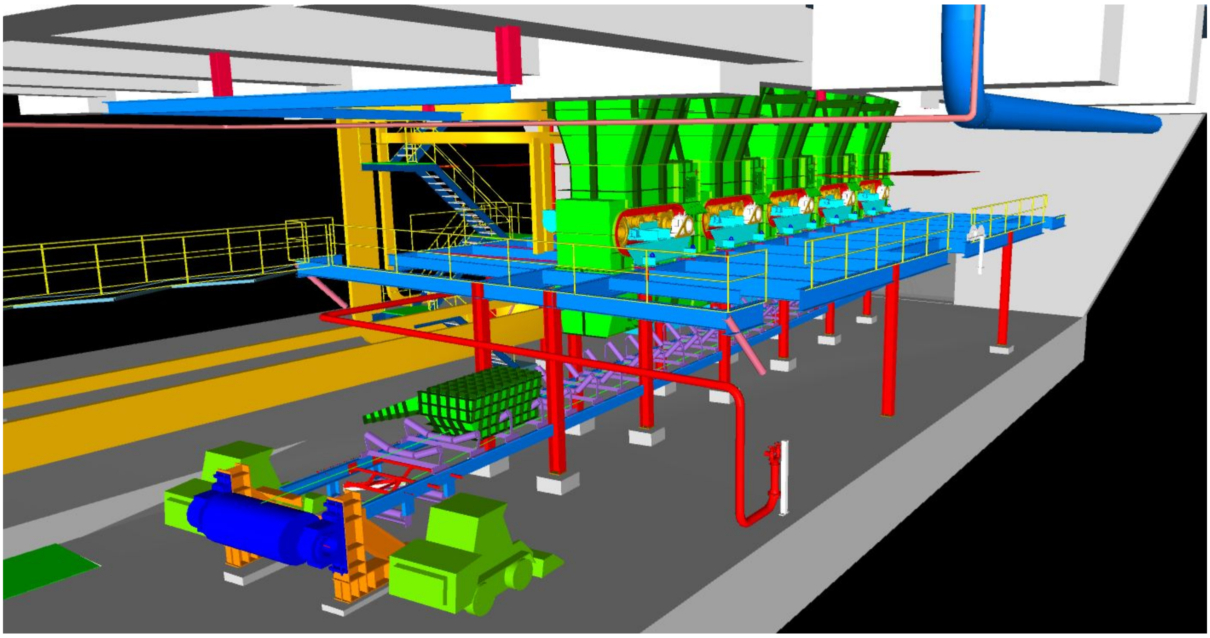
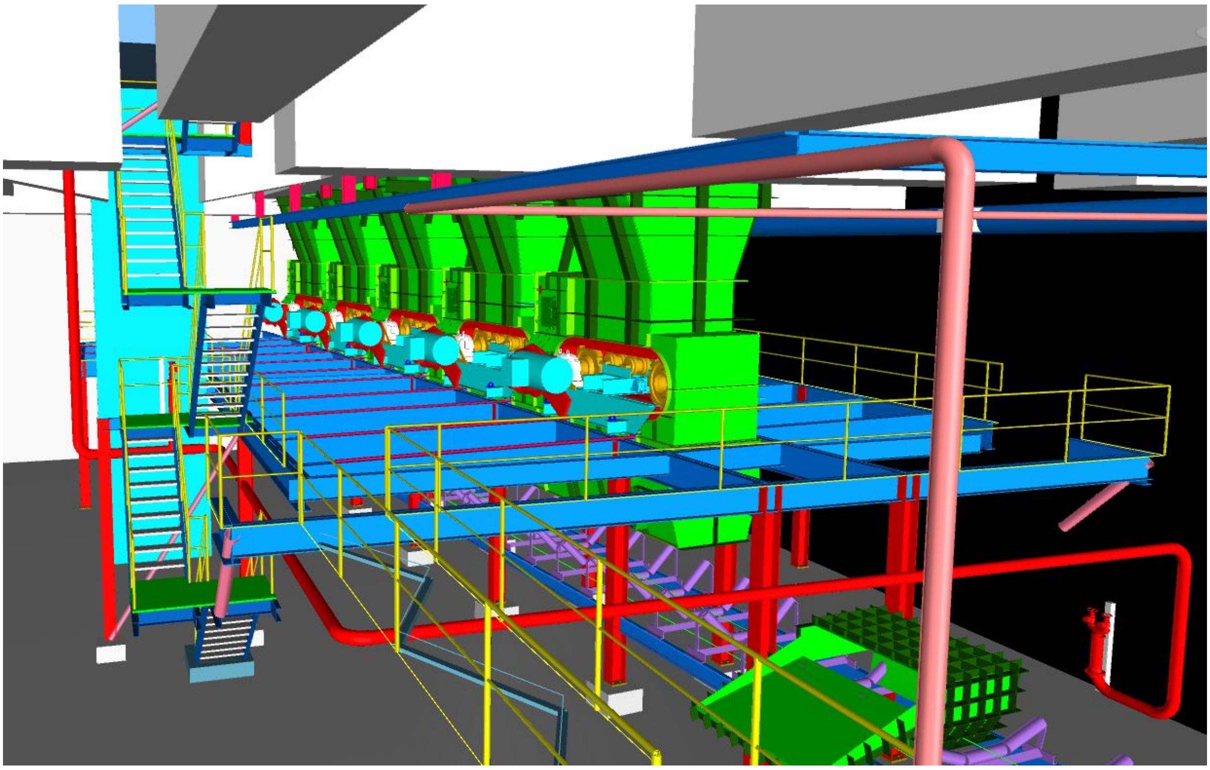


Figure 5: Apron Feeder Level Structural Steel Floor – Front View



- The Room will be totally enclosed and weather-proof. Dust-sealing and air-conditioning will be fitted
- Operator access to the room will be via stairs
- The operator’s room shall house the *Contractor* provided SCADA system

10.0 Structural Requirements

10.1 Introduction

This section of the specification covers the design requirements for the structural elements of the Dual Wagon Tippler facilities, including the specified loads imposed on the machine and the load combinations to be considered for the limit state and serviceability designs.

10.2 General

The structural design, fabrication and erection shall comply with the standards nominated in Section 5.0 of this specification.

10.3 Structural Design and Fabrication

Structures shall be of robust, heavy duty design. They shall have clean lines, free of ledges, pockets, crevices and the like which can harbour dirt and moisture. Spaces between members which are inaccessible or difficult to reach shall be avoided or sealed off by plating. Internal members that cannot be inspected during service shall not be used.

The selection of structural steel members in the design shall be such that they are either South African sections, or sections of an alternative international standard approved by the *Employer.* The alternative sections and plates must match the general size and dimensions of sections and plates available in South Africa for example universal beam and universal column sections and plates of thickness 5 mm, 6 mm, 8 mm, 10 mm, 12 mm, 16 mm, 20 mm, 25 mm, 30 mm, 40 mm. Prior approval shall be obtained from the *Employer* should thicker plates be considered.

All materials shall be new and comply with the relevant South African, international standard or equivalent standard approved by the *Employer*. Material test certificates for all structural steel shall be handed to the *Employer* for review and approval. If required by the *Employer*, the *Contractor* shall also provide sufficient historic test data to certify that material properties as reported are credible and can be used as a basis for determining load and resistance factors commensurate with the South African Design Codes.

All structural plate and sections that form part of the machine structure shall be traceable to the heat and batch number. As cutting progresses, these shall be transferred to each individual part of the fabrication. Hard stamping of the individual components is required to ensure 100% traceability.

FEA software used for the analysis and section capacity design modules must be in accordance with generally accepted international norms and standards.

Areas of high stress concentration shall be indicated on the relevant drawings, so that these can be readily identified for future maintenance and inspections of the machines.

10.4 Design Loads

Structural design loads and load combinations shall be in accordance with SANS 10160. Additional loads of type snow, ice, and hail are not applicable.

Structural design loads for material build-up within chutes shall assume a maximum material build-up angle of 75º to the horizontal and a bulk density for structural loading as nominated in the “Dual Wagon Tippler Data Sheet” (1924701-2-211-M-DS-0003).

10.4.1 Wagon Nominal Loads

Nominal mass for wagons shall be as specified in the “Dual Wagon Tippler Data Sheet” (1924701-2-211-M-DS-0003).

Due allowance shall also be made for non-uniform distribution of car load between the bogies and wheels due to loading and leaning of the ore cars. The maximum variation in load distribution due to non-uniform loading shall be 5%.

10.4.2 Overloaded Ore Cars

Maximum overload mass for ore cars shall be taken as 10% over the nominal loading values. Cognisance shall be taken of the movement of the centre of gravity of loaded wagon under overload conditions.

For this strength case condition, no account need be taken of non-uniform loading.

10.4.3 Locomotive Drive Through

The Dual Wagon Tippler shall be designed to accommodate the through passage of Diesel and Electrical Locomotives as specified in the “Dual Wagon Tippler Data Sheet” (1924701-2-211-M-DS-0003).

10.4.4 Ore Retention in Wagon

The Dual Wagon Tippler design shall allow for occasional retention of 10% of the ore mass in the wagon, based on the ore car payload as specified in the “Dual Wagon Tippler Data Sheet” (1924701-2-211-M-DS-0003).

10.4.5 Positioner and Train Holding Devices

The selection of positioner power shall account for the most onerous case of train dynamics.

10.4.6 Coupler Force Limits

Positioner drives force/speed profile shall be arranged to reduce the coupler forces and fatigue damage and meet the required unloading cycles. The Positioner shall operate such that there are no longitudinal forces on the ore car couplings being rotated during the dumping cycle.

10.4.7 Design Cycle

The loading/unloading cycle time shall be **90 seconds**. The Dual Wagon Tippler control system shall provide for the optimisation of the Indexing operations and minimising the resultant fatigue loads on the Indexer arm, in-train and wheel gripper/locks. Each cycle shall include for unloading a pair of cars, as well as all train securing and indexing.

10.4.8 Leaning and/or Bowed Cars

The lateral position of the top sill of ore cars can vary from the nominal position relative to the centreline of the track. The range of lean of ore cars is ± 75 mm.

The facilities shall accommodate leaning cars within this range. The cell and blocking system shall be provided with a lead-in chamfer to assist the passage of leaning cars through the cell. The positioner shall be adequately powered to cope with the additional force required.

Consideration shall be given to the case where the leading part of the ore car may be in contact with any part of the cell structure prior to the external stiffeners being engaged with the blocking beams.

10.4.9 Axial Forces on the Dual Wagon Tippler Cell

During the tip cycle, it is expected that the ore car wheels will slide across the running rails.

Experience shows that this repeated movement results in wearing and forming of depressions in the head of the rails.

The movement (with respect to Dual Wagon Tippler cell axis) of each ore car wheelset across the worn rail depression results in the axial forces being transmitted to the Dual Wagon Tippler cell and Positioner.

Vertical loads on the Dual Wagon Tippler cell and support rollers are amplified under this circumstance. Adequate allowance shall be included in the design for these forces.

10.4.10 Maintenance and Erection Loads

The Dual Wagon Tippler Facilities shall be designed for the additional loads resulting from erection and maintenance activities. The design loads for maintenance activities shall be clearly identified on the machines and detailed in the maintenance manual.

All loads resulting from shipping and transport, erection and maintenance activities shall be considered as an integral part of the equipment design. The equipment design shall consider wind loading during construction/erection.

10.5 Special Loads

Special loads shall be identified in accordance with SANS 10160. The design shall also consider the loads resulting from the following, (These are to be nominated by the *Contractor)*:

- No protection offered by electrical protective devices
- Fully choked hopper blocking Dual Wagon Tippler motion
- Maintenance activities to be carried out to Dual Wagon Tippler Facilities
- Ore car derailment loads and recovery strategies
- Wet ore hang up in ore cars
- Over rotation of cell

10.6 Strength Assessment

The preferred method for determination of permissible stress for strength, buckling and serviceability shall be in accordance with SANS 10162.

10.7 Fatigue

The method for determination of fatigue strength and permissible stress ranges shall be in accordance with SANS 10162.

All parts of the structures within the Dual Wagon Tippler Facility shall be designed to withstand a minimum of four million (4×10^6) dump operations, under normal operating conditions, without fatigue failure.

A dump cycle for the Dual Wagon Tippler is defined as the complete Dual Wagon Tippler cell tip and return, release of train holding devices, Positioner advance and reapplication of train holding devices. (Positioner return is concurrent with cell tip and return).

10.8 Material Requirements

All materials shall be new and comply with the relevant standards.

The *Contractor* shall obtain material test certificates for all structural steel used.

The use of materials having an ultimate tensile strength of more than 550 MPa or a yield strength greater than 450 MPa are not to be used without the express written permission of the *Employer.*

All structural plate and sections that form part of the machine structure shall be stamped to identify the heat and batch number. As cutting progresses these numbers shall be transferred to each individual part of the fabrication and hardstamped for traceability.

10.9 Welding

All welding shall be carried out in accordance with the requirements of Transnet Specification SBH9/2/6.

All welding shall be carried out under the supervision of a welding supervisor employed by the *Contractor.* The welders and welding supervisor shall be qualified for the designated welding procedure in accordance with the requirements of Transnet Specification SBH9/2/6.

Small, heavily loaded structures, such as the bogie trunnions, shall be stress-relieved after welding and prior to machining.

The American Welding Standard AWS D1.1 will be considered by the *Employer*.

10.10 Inspection and Testing of Welds

All non-destructive testing associated with fabrication shall be carried out in accordance with the codes and requirements as stipulated in Transnet Specification SBH9/2/6.

All non-destructive testing shall be carried out by an approved testing laboratory registered with the National Association of Testing Authorities of South Africa or another *Employer* approved authority. Where fabrication will be conducted outside of South Africa, the testing Authority, the applicable standards, the testing personnel, facilities and methods shall be subject to approval by the *Employer.*

The test procedures to be used are:

- Visual inspection
- Radiographic testing
- Ultrasonic testing
- Magnetic particle testing

The minimum requirements for non-destructive examination of welds shall be as follows:-

- All welds shall be subjected to 100% visual inspection
- All full-penetration butt welds shall be subjected to 100% magnetic particle and either ultrasonic or radiographic examination
- All partial-penetration butt welds, corner welds and fillet welds shall be subjected to 10% magnetic particle and either ultrasonic or radiographic examination
- All FP category and critical welds nominated by the designer shall be subjected to 100% magnetic particle and either ultrasonic or radiographic examination

Where less than 100% examination is specified, the nominated percentage of weld type to be examined shall be agreed with the *Employer* to ensure that a representative sample of each weld type is examined.

All welds that fail to meet the acceptance limits as required by the nominated standard shall be rejected, removed or repaired and re-tested. Re-testing shall cover 100% of all the repaired welds, using the same examination methods as adopted for the specific portion of the work.

Traceability of structural welding shall be maintained throughout the fabrication process and includes full records of weld number (referenced to weld map), Welder ID, welding procedure qualification and welder qualification documentation, date, consumable types and batch numbers. This information will be cross referenced to any in-process inspections (such as weld prep, preheat), inspection records and / or NDT reports.

The *Contractor* bears full responsibility for the design of all machines, including the selection of materials and welding procedures.

10.11 **Lifting**

10.11.1 Transport and Erection Lifting

Properly designed pad eyes shall be provided at suitable lifting points on all major structural components to ensure safe lifting and to facilitate correct orientation during transportation and erection.

Lifting point loads shall take into account variations in centre of gravity, contingencies for mass, wind, lifting dynamic factors and lateral load due to off vertical slings. These shall be stamped with their design Safe Working Load Limit (SWLL).

10.11.2 Maintenance Lifting

The *Contractor* shall undertake a review to identify all maintenance activities that cannot be undertaken using mobile crainage. Where these are identified, a means of conducting the activity shall be provided, either using special tools or by having specific lifting devices permanently installed on the machines.

All crawl beams and lifting devices/points shall include SWLL signage and the *Contractor* shall obtain all necessary certification, licences and approvals for any lifting devices requiring registration.

Stainless steel labels shall be fixed to large items of equipment indicating the gross weight.

Where applicable, the *Contractor* shall advise on the number, locations and loads at the maintenance jacking points.

10.12 **Bolted Joints**

All bolts, washers and nuts shall comply with the relevant South African Standards and shall either be Grade 316 stainless steel for bolts, nuts and washers or shall be hot dipped galvanised. The minimum bolt size and specification shall be M20 Grade 8.8 / TB, unless noted otherwise.

Substitution of bolts that have not been manufactured to South African standards may be permissible, provided that due regard has been taken of allowable stresses, in accordance with the relevant structural codes and material properties of the bolts. Appropriate quality control and testing shall be applied to batches of bolts. Due regard shall also be given to dimensional tolerances and surface finishes, which could cause the bolt to fail prematurely.

10.12.1 Commercial and Precision Bolts

Commercial bolts may be used for field connections for cold-formed girts and purlins, stair treads, handrails, doors and window framing. The length of bolts shall be selected so that the threaded portion of the bolt shall project through the nut for a minimum of three (3) threads when fully tightened and so that the nut can be fully tightened without reaching the end of the thread. Where prevention of loosening of the nuts is required, Nylock® nuts or approved equivalent shall be used. All bolts shall be supplied with two washers.

10.12.2 High Strength Bolts

High strength bolted connections shall be bearing-type, unless otherwise shown.

All High Strength Friction Grip Bolts (HSFG) bolts shall be supplied to SABS 1282 – 1982.

All bolts indicated on the Drawings as 8.8S or 10.9S shall be tightened using either:

- Direct-tension indication method
- ‘Turn of Nut’ method, specified in SABS 0162: Part 1

Bolts installed by the direct-tension indication method shall be tightened in accordance with SABS 0162: Part 1.

The *Contractor’s* proposed methods for bolt tightening shall be submitted to the *Employer* for approval.

The tensioning of HSFG bolts using torque wrenches is not permitted, unless approved in writing by the *Employer*.

The length of bolts shall be selected so that the threaded portion of the bolt shall project through the nut a minimum three (3) threads when fully tightened and so that the nut can be fully tightened without reaching the end of the thread.

One flat round hardened steel washer shall be used under the nut for each bolted connection except that if the bolt is turned during tightening then two washers shall be used, one under the nut and one under the bolt head.

Unless otherwise specified, bolts used on bevelled surfaces shall be provided with bevelled washers, which shall provide full bearing to the head and the nut.

10.12.3 Testing of Structural Bolts

The *Contractor* shall undertake the following testing methodology to verify compliance on a statistical basis with the relevant ISO Standards for physical properties of structural grade fasteners. The testing shall cover all structural grade bolts, nuts and washers.

Testing shall be performed to the following requirements:

- All testing shall be carried out in an approved facility
- The frequency of testing shall be 1 per 1000 units per batch. Where smaller quantities are involved, one unit per batch shall be tested. Where smaller quantities of different grades are involved (ie., Gr 8.8, Gr 10.9, Gr 12.9 etc.), one unit per grade shall be tested
- All bolts shall be traceable to a batch number
- Hardness testing in accordance with ISO 898 is acceptable in lieu of tensile testing only when testing is conducted at the mid-radius position of the shank, one diameter back from the end of the bolt. The Vickers test (HV) shall be the accepted method for hardness testing

- Using the above method, where the hardness values fall outside the specified range, tensile and wedge testing shall be carried out on samples from the same batch. If this is not possible, the entire batch shall be rejected, physically identified, quarantined and shall not be used

11.0 Corrosion Protection

All structural, mechanical and fabricated items shall have surface protective coatings suitable for a marine coastal environment. This applies to all surfaces, except fully enclosed and permanently sealed sections.

Corrosion protection shall be in accordance with the requirements as set out in Transnet Specification SBS9/2/8.

The use of hot-dip galvanised coatings may be considered for some fabricated items and secondary steelwork where, due to the geometry of the specific item, galvanising may be more cost-effective.

Corrosion protection by means of hot dipped galvanizing shall be in accordance with SANS 763 as specified in Transnet Specification SBS9/2/8.

The design of the Dual Wagon Tippler Facilities shall use features that reduce corrosion and material traps. Horizontal surfaces shall be avoided where possible. Exposed horizontal surfaces greater than 500 mm in width shall be graded to an outlet or discharge point.

All surfaces shall be painted unless functionality prohibits doing so. Components manufactured from stainless steel need not be painted unless otherwise specified. A surface passivating treatment shall be applied following the welding of stainless steel components and equipment.

All pipelines shall be identified by colour in accordance with South African Standards and shall have identifying labels stating the pipeline service and direction of flow at strategic locations and adjacent to each valve. This excludes minor lube lines and the like, where the contents are identifiable to trained personnel.

Drainage and mounting holes shall be painted after drilling and prior to installation of bolts.

Following transport and erection on Site, damaged surfaces shall be cleaned and touched-up in accordance with the requirement of the respective paint system.

All fully-enclosed, sealed and fabricated box sections shall not be painted internally and shall be pressure tested at 25 kPa (g) for 30 minutes prior to protective coating to ensure the section is completely sealed. A de-oxygenating compound shall be inserted appropriate to the box section volume prior to final sealing.

The coating inspectors shall be NACE qualified, or equivalent as approved by the *Employer.*

12.0 Fire Protection

Fire protection within the Dual Wagon Tippler not specifically supplied by the Tippler *Contractor* as part of his *works*, shall be provided by others. It is however expected that any components, equipment or cabling supplied with the Dual Wagon Tippler Facility conform to the requirements listed below.

The adopted approach to be applied to the protection of the Dual Wagon Tippler Facility from fire is to minimise the need for fire protection by using:

- Non-combustible building materials. This applies to the switch room and any control room or operator's cabin, including insulation materials provided by the *Contractor*.
- Standard photoelectric smoke detection shall be installed in the switch room, to be supplied by others.
- Gaseous fire protection shall be installed to discharge into switch boards and cabinets containing PLC/DCS components and communications equipment. This is to be supplied by *Contracto*r only for equipment that is within the *Contractor's* scope of work.
- Hydraulic power units with an oil volume in excess of 200 litres shall have an automatic interlock installed to shut down the pack on heat detection. The hydraulic packs shall be enclosed with an installed heat detector in the upper part of the cabinet to initiate a shutdown in the event of temperatures above 150ºC. This shall be supplied by the *Contractor*.
- Transformers shall have a 2-hour fire rated wall, to be installed between the transformer and the switch/MCC room. The bund of the transformer should be drained to ground through a flame trap ("S" bend in the pipe). This will be supplied by others.

- Seal cable penetrations, with approved fire stopping materials of equal or greater fire rating than the surrounding floor/wall, shall be provided by the *Contractor* for all equipment that is within the *Contractor's* scope of work.
- Grouped electrical cables under the switch rooms shall be protected by applying approved cable coating. This shall be provided by the *Contractor* for all equipment that is within the *Contractor's* scope of work.

12.1 Alarming and Monitoring

All fire detection and active protection systems shall be connected via a fire alarm panel into the Site fire alarm system.

12.2 Equipment Specification

The fire protection systems shall be designed and installed in accordance with the relevant Standards. These shall include:

- Portable fire extinguishers in accordance with SANS 1910, located adjacent to critical electrical and hydraulic equipment, to be provided by others.
- Fire-retardant cable coating and fire stopping at cable penetrations in accordance with FM Global requirements, to be provided by the *Contractor* for all equipment that is within the *Contractor's* scope of work.

- Cabinet gaseous fire protection in accordance with ISO 14520. The gas system shall be suitable for personnel remaining within the room during discharge (FM200 or approved equivalent). This shall be provided by the *Contractor* only for equipment that is within the *Contractor's* scope of work.

13.0 Electrical, Instrument and Control Requirements

13.1 General

The electrical design, supply, installation and commissioning of the Dual Wagon Tippler Facility shall comply with the requirements of the relevant codes, standards, specifications and statutory requirements as specified in Section 5.0 of this document.

The machine shall be designed for reliable, safe operation and for low maintenance.

The electrical services associated with the Dual Wagon Tippler Facility shall include all design, documentation, equipment supply, installation, pre-commissioning, commissioning and services necessary to provide a fully operational Dual Wagon Tippler Facility.

The electrical *works* shall include, but not be limited to, the design, supply and commissioning of the following:-

- Main LV DB board, electrical switchgear and motor control centres (MCC), including any variable speed drives
- Supply and install the busbar from the transformer LV side to the main DB board
- Monitoring and Control equipment, including PLCs, networking software for communication to Site control network etc.
- SCADA software compatible with Site systems, license and industrial computer
- Server(s) and network switch as required
- Electrical field devices and instrumentation, including all materials for mounting them
- Design of all cabling, including flexible cables and support systems, from the switch - and server room to all applicable equipment
- IP ratings of equipment to be minimum IP 54, unless otherwise specified
- Field instruments shall be sealed to IP66 standard
- As a minimum, all electrical equipment and cubicles shall be designed to IP65
- All cubicles shall be SS316

- Electric motors shall have a minimum degree of protection of IP55

The *Contractor* will be required to liaise and proactively interact with all other parties to obtain all necessary information to ensure the successful completion and operation of the electrical and electronic infrastructure of the Dual Wagon Tippler Facility, and also to ensure that it is fully and seamlessly integrated with all other electric and electronic systems of the Site as required and vice versa. Reference is made to the figure overleaf.

13.2 Power Supply

The power supply for the Dual Wagon Tippler Facility shall be 400V, 3 phase, 4 wire, 50Hz with neutral solidly earthed. The *Contractor* shall install the busbar from the transformer LV side to the tippler DB board, which will double as the main DB board, and must provide for all electrical equipment covered in the scope of work.

13.2.1 Harmonic Generation and Power Factor

The Dual Wagon Tippler Facility designs shall minimize harmonic distortion in the power supply arising from the electric and electronic installed equipment and ensure that the power factor shall be at the best possible level.

13.2.2 Local Voltage Dips, Surges and Flicker

For the purpose of these requirements, the point of common coupling shall be 400V single point connection where the maximum fault level shall be that of the maximum transformer fault level rating.

13.3 Voltage Levels

The following voltage levels shall be used:

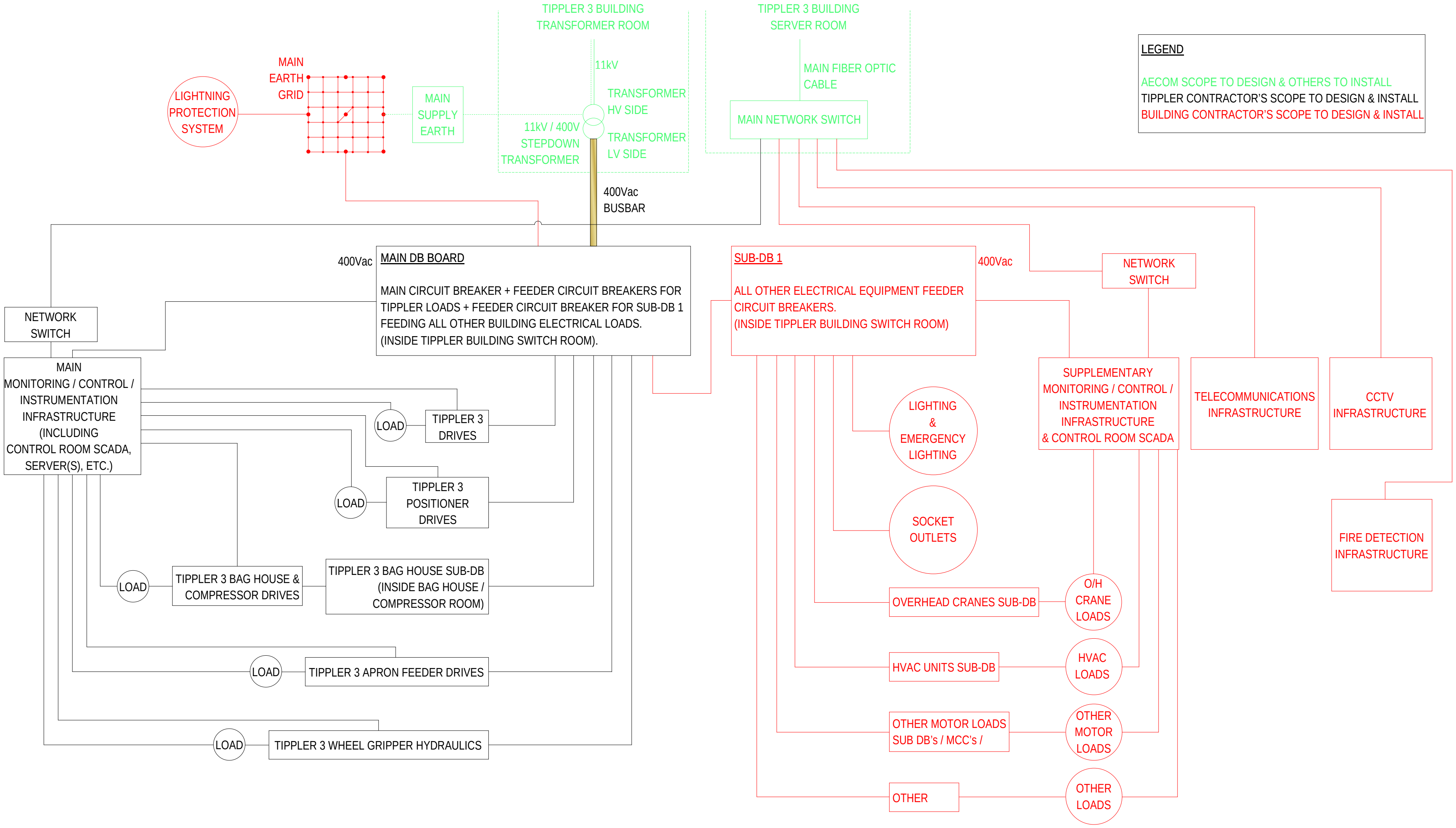
- The LV supply shall be 400 V AC, three phase, 50Hz, solidly earthed
- The UPS voltage shall be 230V AC single phase (or 400V AC three phase) 50Hz, solidly earthed
- Main switchgear trip supplies 110V AC, negatively earthed
- The on-board control voltage shall be 24 V DC, negative earthed. All control power supplies shall be supplied by an uninterruptible power supply UPS

13.4 Switch and Server Rooms

The switch and server rooms shall comply with the documentation listed in Section 5.0, including the project specification. Additional requirements specific to the Dual Wagon Tippler Facility are as follows:

- Cables shall be bottom entry, glanded through the bottom of electrical and electronic panels. Top entry cabling shall only be approved on special circumstance whereby suitable proof must be provided to support the design decision
- The panels will be elevated approximately 1,000 mm above ground level for bottom entry cabling
- Equipment within the rooms shall be prewired as far as possible and fully tested within the factory to the maximum extent possible
- All electrical/electronic equipment metal enclosures, including all mounting equipment, shall be 316 stainless steel (includes any bolts/nuts etc.). Painting of the metal parts shall be in accordance with the client’s standards

BLOCK DIAGRAM TO ESTABLISH TIPPLER 3 BUILDING ELECTRICAL & MONITORING / CONTROL / INSTRUMENTATION BATTERY LIMITS



The switch and server rooms shall be respectively supplied with, but not limited to the following:

- Uninterruptible power supply (UPS) : by *Contractor*, only for equipment that is within the *Contractor's* scope of work
- Fire detection equipment : by *Contractor*, only for equipment that is within the *Contractor's* scope of work
- Fire suppression equipment : by *Contractor*, only for equipment that is within the *Contractor's* scope of work
- Fire alarm panel and connection to the Site fire alarm system : by *Contractor*, only for equipment that is within the *Contractor's* scope of work
- Pressurisation/Air conditioners vents : by others
- Normal and emergency lighting : by others
- Socket Outlets (Normal and dedicated as required) : by others
- Main Server(s) and main network switch : by others
- Data outlets : by others
- Telephone outlets (if applicable) : by others

The *Contractor* shall design, supply and install the following Dual Wagon Tippler Facility electrical equipment in the switchroom:

- Main LV DB Board including switchgear and main busbars from transformer secondary side
- All monitoring, control, instrumentation and communications equipment
- Motor control centre(s) and Variable Speed Drive(s)

13.5 Switchboards

All switchboards shall be supplied in accordance with the documentation listed in Section 5.0. The *Contractor* shall note the following:

- The main DB board shall be rated to the maximum fault level rating of the transformer. Cascading shall be implemented on the switchgear in order to reduce downstream switchgear and sub-DB board fault level rating requirements
- Where ACB circuit breakers are utilised in the switchboards, they shall be fully withdrawable
- Statutory and client specific required electrical and mechanical interlocks shall be installed for the switchboards and between the switchboards and other respective equipment e.g. Sub-DBs, MCCs, Variable Speed Drives etc. as needed
- All switchboards (main and sub types) shall be equipped with suitable main meters, including for large power circuits, with communications back to the monitoring and control infrastructure
- The meters shall, as a minimum, be able to measure voltage, amperage, power factor and harmonic distortion

13.6 Variable Speed Drives

All variable speed drives shall be in accordance with the documentation listed in Section 5.0. A VSD controller shall be provided for each Dual Wagon Tippler cell motor, each positioner drive motor and each Apron Feeder drive motor.

Regenerative braking shall be utilised as the primary means of decelerating the ore car train. If filters are used, they shall be active filters, not passive filters with capacitors. All VSDs shall be air-forced cooled with suitable filters if required. No water cooled units shall be accepted.

13.7 Electrical Motors

All motors shall be provided in accordance with the documentation listed in Section 5.0. Motor RTD's, thermistors, anti-condensation heaters and vibration monitoring devices shall be provided where required.

13.8 Earthing

The Dual Wagon Tippler facilities shall be earthed in accordance with the documentation listed in Section 5.0, with specific attention to be taken of the requirements of Transnet Specification SBH8/2/11. The earthing system for the Tipper buildings will be installed by others. The Contractor shall link the earthing for all electrical equipment supplied by the *Contractor* to this earthing system.

Trailing cables onto the package shall incorporate pilot cores and an earth continuity system shall be provided to trip the upstream supply in the event of cable breakage. The *Contractor* shall ensure the steel frame of the package is electrically continuous across all structural joints, with earth bonds provided where necessary.

Earth bosses shall be provided for the termination of earth cables onto structural steelwork. The design shall prevent earth or welding currents passing through equipment bearings.

13.9 Electrical Junction Boxes and Enclosures

The *Contractor* shall supply and install all junction boxes on the package in accordance with the documentation listed in Section 5.0.

Factory cabling on transportable modules shall be maximised as far as practically possible, and where practical shall terminate into junction boxes on the module.

13.10 Monitoring/Control and Communications Systems

The *Contractor* shall provide a complete monitoring/control and communication system to allow full manual and automatic operation of the Dual Wagon Tippler Facility in accordance with the client’s requirements. This shall include the integration of any applicable field devices and instruments.

The associated infrastructure shall be located as needed in the Tippler buildings, with the main equipment such as server(s), network switch etc. to be located inside the server room.

The monitoring/control and communications systems shall be designed, installed, factory tested and commissioned in accordance with the documentation listed in Section 5.0.

The *Contractor* shall ensure that all Control System Engineers involved in the *works* are competent in the specific equipment and software used as part of the Contract.

13.11 Anti-Collision System

An anti-collision system shall be provided by the *Contractor* to prevent collisions between the positioner and rolling stock in accordance with the machine control system requirements documents and the following requirements:-

- A primary optical encoder for the position sensing control systems shall activate a visible alarm in the operator’s cabin and reduce the drive speed to creep if it is within an adjustable collision zone
- A back-up ultrasonic sensing control system shall stop the drive so as to prevent a collision if the optical encoder control system fails in any way
- All systems shall be “fail safe” and shall be implemented through the PLC system

13.12 Local Control and Emergency Stop Stations

Local control stations shall be provided adjacent to all motors for maintenance purposes. Groups of drives performing the same mechanical function shall have a single control station. Where a group of drives occur, then sufficient “E-stops” shall be provided to allow operational personnel to stop the machine without incurring personal injury.

Emergency stop facilities shall be provided. Activation of the emergency stop pushbutton shall stop all items of plant as quickly as possible. This shall, as a minimum, include the following:

- Locations in accordance with statutory regulations
- Emergency stop pushbuttons incorporated into all local control stations

- Emergency stop stations at all other areas where personnel could be trapped or caught due to the driven movement of equipment
- Emergency stop station in the operator's cabin

A complete power shutdown (when machine is unattended) shall result in all machine controls being disabled, all motions to cease and all brakes to be applied. Power supply to the PLC system, control interface equipment, SCADA equipment and other critical equipment shall remain active. The following devices shall initiate an emergency stop condition for the Dual Wagon Tippler:

- Drive over-travel limit switches
- Ore car Positioner arm collision detected
- Positioner force out of range
- Emergency stop switches
- Blocked chute switches or downstream feed system fault
- Local control isolators
- Drive motor fault
- Drive gearbox fault

13.13 Sirens and Visual Indicators

Sirens and visual warning indicators shall be provided to warn personnel prior to the start-up of mechanical equipment.

13.14 Field Instrumentation and Devices

13.14.1 Instrument Selection

Instrumentation shall include, but not be limited, to:

- Local start and emergency stop stations, mounted adjacent to each electrical drive
- Local control panels located adjacent to the Dual Wagon Tippler cell and train holding devices
- Emergency stop located adjacent to the positioners and at the positioner access point
- Safety devices necessary to protect personnel and equipment
- Audible alarms and flashing lights
- Fire detection sensors shall be provided by the *Contractor* for all equipment within the *Contractor's* scope of work
- Anti-collision devices and sensors
- Temperature monitoring
- Level detectors
- A rolling stock detection system to detect rolling stock other than ore cars within the Dual Wagon Tippler cell and the Positioner operating area
- Absolute position encoder systems for Dual Wagon Tippler cell and Positioners position monitoring. The encoders shall provide a continuous absolute rotational position signal. Proximity and/or limit switches shall be provided to reset the encoder for each cycle
- A train spotted switch. The intent of the train spotted switch is to confirm that the ore cars are in the correct position for tipping. It is not related to presentation of trains to dumper by the locos
- Block chute detectors

Equipment to be mounted on-board the positioners shall be capable of handling the vibration and shock experienced. Wherever possible, equipment sensitive to vibration and shock shall be located off the machine.

General limits, detection and field devices shall include, but not be limited to, the following:

- Dual Wagon Tippler cell limit switches
- Position of brakes
- Car sensing switches
- Clamp monitoring sensors
- Instrumentation associated with the hydraulic power unit for the moving side beam

Positioners:

- Arm retracted
- Arm extended
- Gap between ore cars
- Forward travel limit
- Reverse travel limit
- Over travel limits
- Catenary cable over-tension switch
- Warning horn

Wheel Locks:

- Lock engaged switch
- Lock open switch

Wheel Grippers:

- Gripper closed switch
- Gripper open switch

All instrumentation shall be provided in accordance with the documentation listed in Section 5.0.

13.14.2 Instrument Integration and Installation

The instrument installation shall comply with the requirements of the documents listed in Section 5.0 of this document. The *Contractor* shall also take note of the following:-

- Instruments without critical safety functions shall be wired to Field Marshalling I/O Panels mounted locally to the equipment
- Instruments used for safety critical functions shall be hardwired back to the switch and/or server rooms as required
- Where such instruments are wired in series as part of an interlock (e.g. pull-wire switches), separate contacts from the instrument shall be wired into the Field Marshalling I/O panel to permit individual alarming of each instrument in the series interlock
- Instruments shall be positioned to avoid mechanical damage during operation (including spillage and other causes of impact). Where necessary, they shall be installed in a stainless steel enclosure for added protection
- Where access is not available to main bearings to conduct vibration analysis, remote accelerometers shall be provided to enable condition monitoring to be conducted safely

13.14.3 Instrument Tubing & Accessories

Instrument tubing shall comply with the Project General Installation Standards and the Control and Instrument Design Criteria as referenced in table 5. The *Contractor* shall note:

- All instrument tubing and accessories shall be described on instrument lookup drawings
- Specification requirements for 316 stainless steel instrument tubing
- Specification requirements for instrument air tubing
- Flexible connections shall be provided onto all equipment subject to vibration

13.15 Condition Monitoring

All equipment shall be fitted with appropriate sensors for condition monitoring. Sensors shall, where practical, be located in positions that take account of the protection of the sensors from product spillage, water, dust and operator movements. Preference shall be given to robust sensors that provide accurate detection of major failure modes and common failures associated with major equipment.

13.16 Field Marshalling I/O Panels

Field Marshalling I/O Panel shall be used to collect local I/O to minimise Site cable installation and cabling installed on trolley / catenary systems. The enclosures shall:

- Where practical, be located on each transportable module to allow full pre-wiring of the module in the factory
- Incorporate a sunshield / rain hood
- Contain equipment rated for the expected internal temperatures
- Incorporate a circuit breaker for isolation of incoming 230V UPS supplies

Whilst it is preferred to wire instruments direct to a Field Marshalling I/O Panel, there may be instances where Junction Boxes are required.

13.17 Cables

The *Contractor* shall supply and install all LV, control, instrument and communications cabling which forms part of the “on-board” cabling. Where possible these cables will be terminated at both ends.

All cables shall comply with the requirements as listed in Section 5.0. Note that:

- All VSD cabling shall be fully screened in accordance with the specification
- All cables installed through mobile cable support systems shall be flexible
- Optical fibre cable shall be used for all communication cabling

Where cables run between different transportable modules, they shall be disconnected and coiled safely for transport. Junction boxes shall be provided where appropriate to minimize the length of cable coiled in one location.

The *Contractor* shall provide mobile cable support systems for all flexible cables.

The *Contractor* shall provide junction boxes at the edge of the package to allow easy Site connection of cables from the junction boxes/field marshalling panels to the switch and server rooms receptively. The *Contractor* shall develop a separate cable schedule for those cables running between local equipment and the package junction boxes/field marshalling panels and between the junction boxes/IO panels and the switch/server room equipment. These cables will be installed on suitable cable management/support systems.

All cables shall be of the fire resistant, self-extinguishing, low toxic emission type. Where this is not practical, suitable cable fire-stopping methods shall be applied. Furthermore, where cables traverse between building rooms and the like, suitable fire-stop methods shall also be implemented, irrespective whether or not the actual cables are of the fire resistant, self-extinguishing type.

For entry into panels and switch/server rooms, hose proof glands with a 2 hour fire rating from panels into and out of switch and server rooms shall be used.

13.18 Cable Supports

The *Contractor* shall design, supply and install all cable supports within the defined scope of work. Cable management systems shall be 316 stainless steel, painted or galvanised in accordance with the client’s standards. Where cable management systems do not require to be steel, in other words conduit or trunking, PVC type may be used.

Any potential flammable material such as PVC/plastic material used on the cable management/support systems shall be of the fire resistant, self-extinguishing type. Furthermore, where cable support systems traverse between building rooms and the like, suitable fire stop methods shall also be implemented, irrespective whether or not the actual cable support systems are of the fire resistant, self-extinguishing type.

In particular, heavy duty cable ladder shall be used where multiple cables are to be installed, and conduit (metal or PVC as determined) shall be used where additional support/protection is required between the cable ladder and the field equipment.

The *Contractor* shall provide all mobile cable support systems (such as catenary systems) between stationary and moving structures, such as the Dual Wagon Tippler Cell and positioner.

Cable supports used for transfer of cables to moving sections shall:

- Have all moving parts permanently lubricated and sealed
- Where necessary, have sliding surfaces protected by material that reduces and is capable of withstanding, friction. This material must be installed in a manner that will facilitate future replacement
- Be provided with suitable access to allow maintenance or cable replacement
- Minimise the flexing and tensioning on cables

Unless otherwise agreed, catenary cable systems shall comply with the following:

- Catenary systems shall utilise trolleys supported on a beam track. The trolleys shall be selected with consideration given to load capacity and life of the rollers
- The beam track shall support a sunshade for the cables
- Towing ropes shall be used in the catenary system. The rope length shall be shorter than the length of the cable loop so that the trolleys are pulled along by the towing ropes and not by the cables
- A system of detecting a trolley or cable jam shall be incorporated in the catenary system, which shall immediately disconnect driving power to the positioner

13.19 Equipment Numbering and Labelling

All equipment shall be allocated numbers in accordance with the Project Numbering System and labelled accordingly.

13.20 Factory Acceptance Testing

A complete set of Factory Acceptance Tests (FATs) shall be performed by the *Contractor.* The FAT shall be witnessed by the *Employer.* The FAT shall include all system and sub system functions and all field I/O. It shall also include the HMI screen displays. The FAT shall include all communication links with equipment supplied by 3rd parties and the overall plant-wide control system.

The *Contractor* shall provide a full set of FAT procedures and test sheets for approval by the *Employer* at least 4 weeks prior to the FAT. The FAT procedures shall test all functions described in the functional specification.

The equipment shall not be transported to Site until the FAT has been completed and signed off by the Employer. All FAT procedures shall be witnessed by the *Employer* and all tests shall be documented and signed by the *Contractor.*

14.0 Identification

Each component shall be fitted with a nameplate. Information on the nameplates shall be in English and shall be engraved, with paint-filled lettering, using a minimum letter height of 6 mm and depth of 1 mm.

The nameplate material shall be stainless steel and shall include:

- Supplier’s name
- Model number
- Serial number
- Date of manufacture
- Design power (kW)
- Total mass (kg)
- Any other relevant information

15.0 Operational Requirements

15.1 Operating Modes

The Dual Wagon Tippler Facility shall have two modes of operation, eg. normal and maintenance. The Dual Wagon Tippler Facility shall be fail-safe when changing operating mode. The Dual Wagon Tippler Facility shall be capable of operating on a continuous basis, day or night.

15.2 Normal Operating Mode

Normal operating mode shall be the usual mode of operation when unloading trains. All drives and functions shall be available to the operator. The Stacker's protection systems and interlocks shall be active and local starts of equipment shall be inactive. Provision for control of the Dual Wagon Tippler Facility and inloading circuit from the ship loader operator's circuit is required for direct loading operations.

The Dual Wagon Tippler Facility shall operate in Auto or Semi-Auto mode, as selected in SCADA by the Operator. The philosophy for the control modes will be agreed with the *Employer* upon inception of the works. The following descriptions are preliminary.

15.2.1 Auto

The operator shall be able to start and operate the Dual Wagon Tippler Facility from the SCADA terminal in the control room. In the Auto mode the machine shall be fully automatic and controlled and monitored from the SCADA screen. All machine protection, interlocks and sequencing shall be operational in Auto mode.

15.2.2 Semi-Auto

The operator shall be able to operate the Dual Wagon Tippler Facility from the control room. The operator shall be able to operate the Dual Wagon Tippler Facility in single steps of the automatic sequence from the SCADA station. All machine protection, interlocks and sequencing shall be operational in Semi-Auto mode.

15.2.3 Drive Status

Local/Remote shall be used to determine the state of an individual drive or equipment. When selected to Local, that particular drive or equipment may be operated locally in the field. When selected to Remote that drive may now be controlled via the SCADA screen in either Auto or Semi-Auto modes. In Remote mode, only Stop buttons on Local control stations shall be recognised by the control system.

Local Control Stations (LCS) shall be provided for all drives to allow an operator to start and operate a drive for maintenance or test purposes. Only hard-wired safety interlocks shall remain operative.

15.3 Maintenance Operating Mode

Maintenance mode shall be used to permit starting and operation of discrete equipment groups from local control stations (LCS's). All local protection functions shall be operative. Sequence interlocking shall be inoperative. Start commands from the operator's room shall be disabled.

16.0 Assembly and Construction

16.1 Off-Site Assembly and Testing

Where identified, all equipment faults shall be corrected or faulty equipment replaced prior to shipment to the Saldanha Port Terminal.

The Dual Wagon Tippler Facilities shall be shop-assembled and tested prior to delivery to Site in as large components as practically possible, to reduce Site erection time. The *Contractor* shall, at the earliest possible date, propose the level of pre-assembly via sketches, showing the pre-assembled sections, for approval by the *Employer*. .

As a minimum, the following components are expected to be in an advanced state of assembly and testing prior to Site delivery:-

- Dual Wagon Tippler cell
- Drive assemblies, each consisting of motor and brakes
- Trunnion assemblies
- Positioners
- Train holding devices
- Hydraulic assemblies
- Switchroom equipment
- Instruments, cabling, junction boxes, control stations and Field Marshalling I/O panels within transportable modules
- Apron Feeders
- Bag House

All assembled components shall be checked for alignment, fit, fabrication, and dimensions. Sub-assemblies shall be shipped complete, except where it is impractical to do so. Component parts, sub-assemblies, equipment and structures shall be match marked and tagged for ready identification during erection off Site.

All sub-assembly drives and motorised units shall be run to ensure that they are in proper operating condition.

Control system off Site tests shall include functional and interface tests. The Dual Wagon Tippler Facilities shall have maximum off Site assembly to suit the unloading facilities available at the port, as agreed with the *Employer.*

Factory acceptance testing shall be carried out in accordance with the requirements as set out in this document. The factory testing of the Electrical, Instrument and Control equipment shall include:

- Factory testing of the control system
- All statutory testing of electrical cabling and equipment
- Continuity testing to prove electrical continuity of the package structure for the purposes of earthing and lightning protection
- Operation of all field equipment to prove correct wiring and function
- Calibration of instrumentation
- Switchgear and associated control system functional testing
- Primary and secondary injection of all on-board protection relays
- Factory run tests on all motors
- Control system testing

The results of all testing shall be recorded and supplied as part of the *Contractor's* Documentation Requirements (CDR).

16.2 On-Site Assembly and Testing

The Dual Wagon Tippler Facilities shall be assembled and pre-commissioned in the least number and largest possible size of units, taking account of the capacity of the rigging and unloading facilities available at the port, the spatial limitations on Site and the amount of remaining erection work that would have to be completed on Site.

The *Contractor* shall include the detailed erection sequences in the Construction Methodology.

17.0 Commissioning, Testing and Training

Throughout the duration of the Contract, the *Contractor* shall provide the *Employer* with free and unencumbered access to its premises and Site at all times, for the purpose of carrying out inspections, monitoring and testing. Notwithstanding any prior inspections that may have taken place, any portion of the *works* for which defects are subsequently identified and noted may be rejected, at the sole discretion of the *Employer*.

All electrical tests, in particular those of cable, protection and major equipment shall be entered into the electrical log book prior to energisation.

17.1 Commissioning

It is the *Employer* and the *Contractor's* responsibility to ensure that commissioning is achieved and complies with all relevant industry and international standards, statutory regulations and the specifications, whether they are specifically listed herein or whether they may be reasonably inferred to be required in order to undertake the *works*.

The commissioning plan and procedures are to be approved by the *Employer* prior to the commencement of commissioning, this includes the off-Site commissioning.

The stages of commissioning are:

- Commissioning Stage 1 – Mechanical Completion
- Commissioning Stage 2 – Function Testing – No Load Commissioning
- Commissioning Stage 3 – System Commissioning
- Facility Turn over
- Commissioning Stage 4 – Start up and Ramp up
- Operation and Performance Testing

The *Contractor* shall prepare and submit for approval a detailed Commissioning Procedure Manual.

The procedure shall include for testing of components and systems as outlined in the Commissioning Procedures and shall also include safety measures to be implemented during the commissioning stages in respect to Othersor operations personnel. The procedure shall be in accordance with the *Employer's* Health and Safety Plan and commissioning procedures.

17.2 Stage 1 – Mechanical Completion

Pre-Commissioning shall be completed before energising the Dual Wagon Tippler Facility. The objective is to prove that the construction work is complete and the equipment is ready for testing. The checks shall include, but not be limited to, the following:

- Preparing as-constructed mark-up drawings
- Completion of Field Inspection Checklists and ITP's, which are then approved by the *Employer*
- Checking that all structures, mechanisms and equipment have been installed correctly and are in the right location, alignment and orientation
- Pressure testing of piping and systems, as required
- Checking, flushing and first-filling of systems
- All covers and guards fitted
- Ensuring that the equipment as constructed conforms to project specifications and drawings
- Ensuring that all labels, name plates, and signs are correctly placed
- Ensuring that cables are correctly installed and terminated
- Ensuring that all instruments are correctly installed and calibrated and that all Loop Tests have been successfully completed
- Ensuring that all fasteners as installed meet the project specification and are correctly tensioned
- Ensuring hydraulic and electric circuits are correct and labelled
- Ensuring all rubbish, scaffolding, tools and any other items have been removed, as required

Electrical tests and checks shall be in accordance with relevant standards, shall be fully documented, and as a minimum shall include the following:

- Insulation resistance testing of cables and switchgear
- Earth continuity and resistance tests

The operation of the PLC and all PLC inputs and outputs, including field devices, shall be checked and tested. In addition, PLC communications and pilot core interlocking systems shall be tested.

17.3 Stage 2 – Function Testing

No-load commissioning involves all checks and tests after the electrical supply to the machine has been energised and prior to load commissioning with ore. No-load commissioning is intended to prove that all mechanical equipment is functional and adjusted as required and the control logic *works* correctly, by operating the machine without process material. The *works* will typically include motor rotation checking, control loop checking, running and adjusting equipment alignment, empty running of all mechanical equipment, sequence testing of PLC code, setting and proving the operation of safety devices, limit switches and interlocks, and the like.

The *Contractor* shall submit a procedure for aligning moving mechanical equipment and supervise the alignment and mechanical survey. The *Contractor* shall be required to approve and sign-off on final alignment results.

All drives, circuits and controls shall be checked and tested in local mode, with the drive main fuses initially removed. All trip functions, safety devices and interlocking shall be proven as reliable, including pull wire switches, overloads, earth leakage, whilst checking the contactor operation. All associated alarms and indications shall be proved.

The HMI shall be fully commissioned and checked as part of the drive testing. Testing and commissioning of mechanical plants and piping shall be in accordance with the *Employer's* specifications.

No-load commissioning will be carried out progressively and commissioning of any particular item shall not commence until pre-commissioning of that item has been successfully completed. The lubricant supply to all points shall be proved prior to initial start-up.

17.4 Commissioning Stage 3 (System Commissioning)

When the above procedures have been completed for each drive and function, the procedure shall be repeated in maintenance and normal modes, including proving of all communications, interlocking, alarming and commands in conjunction with the land-based systems provided by others. The *Contractor* shall complete the testing and commissioning reports and submit to the *Employer* for approval.

The *Contractor* shall check the operation of all drives and machine functions in all modes and methods of operation. The checks shall include:

- Listening for abnormal noise
- Temperature rise
- Equipment speeds
- Lubrication and hydraulic systems
- All mechanical devices
- Relief valve settings
- Positioner acceleration and deceleration
- Brake systems

Results from the completed checks shall be recorded and marked up on check sheets, drawings and operation and maintenance manuals.

All checks shall be repeated in all operating modes as appropriate. The settings and adjustments on the machine, and its dynamic responses, shall be checked to confirm that they are within acceptable limits and in accordance with the design.

On completion of these checks, the machine shall undergo trials using the *Employer* operating and maintenance personnel under the supervision of the *Contractor.* All alarms, safety and protection devices shall be demonstrated in this period.

Stage 4 commissioning shall not commence until all PLC programming and adjustments have been carried out and all machine protection devices, such as relief valves, limit switches and the like, have been set to the values described in the commissioning manual.

The *Contractor* shall endeavour to remove all bridges before load commissioning commences. Where bridges are required to remain, these shall be recorded in a bridge register, which includes reasons why and when the bridges are to be removed.

17.5 Commissioning Stage 4 (Start Up and Ramp Up)

Commissioning Stage 4 (Start-up and Ramp up) comprise the activities, tests and measurements necessary to introduce product. It is a multi-discipline and multi-system activity. The *Employer* shall arrange for the required train, ore product and operational personnel for the test.

Stage 4 commissioning involves all checks and tests to finally set the machine for long term operation with product after the completion of no-load commissioning.

The load commissioning will be based on an overall plant commissioning program coordinated by the *Employer.*

The machine shall be run up to design tonnage under the supervision of the *Contractor*, as required by the *Employer.* The machine will be operated during load commissioning by *Employer* personnel.

The *Contractor's* commissioning manual shall describe all load commissioning required by the *Contractor* to check that the machine is capable of operating up to the maximum specified capacity.

After sufficient commissioning and operator's training, the performance test shall be carried out by unloading a train at the Continuous Operating Rate (COR).

17.6 Operation and Performance Testing

17.6.1 Guaranteed Nominal Design Rating

The performance testing shall entail the continuous operation of the Dual Wagon Tippler Facility under normal operating condition at the specified cycle times for a minimum of ten (10) full wagon rake lengths (total number of ore wagons in one (1) rake shall be between 114 and 140).

During the performance testing, no further adjustments shall be performed. During the Dual Wagon Tippler Facility testing, the reliability and availability performance shall be as nominated in the Technical Specification (Section 8.5) and with a nominal dumping rate of a pair of ore cars and minimum discharge rate as specified in the "Dual Wagon Tippler Data Sheet".

The *Contractor* shall also provide performance guarantees for the availability and reliability of the machine, durability and design life for all machine components, including the structure and corrosion protection coatings.

The *Contractor* shall indicate available options for modification or upgrading for the machine in the event the machine fails to meet the guaranteed performance.

17.6.2 Abnormal Test Conditions

In case the test conditions deviate from the pre-specified conditions, a reduced Mean Operating Rate shall be mutually agreed upon between both parties for an agreed, limited period of time, within which the contracted rate will be achieved.

17.6.3 Abortion of Tests

A performance test, which is aborted due to reasons attributable to the Dual Wagon Tippler Facility, shall be considered unsuccessful. A performance test which is aborted due to reasons not attributable to the Dual Wagon Tippler Facility may be considered successful, if the data collected until abortion of the test, indicate that the test could have been successfully completed, provided a minimum of 70,000 tonnes (i.e. minimum 5 full trains) throughput has been achieved at the required rates.

17.6.4 Repetition of Tests

If a test has been failed, the *Contractor* shall carry out modifications to improve the output, and repeat the test.

17.6.5 Emergency Stop Test Procedure

The emergency stop test procedure shall be split into 2 separate tests:-

Test 1: To be performed with positioner pushing a full ore car train.

Test 2: To be performed with Dual Wagon Tippler cell at 90 degrees, unloading full ore cars.

Following resetting of the system, the Dual Wagon Tippler Facility shall be restarted to demonstrate the capability to restart from these positions.

17.6.6 Power Failure Test Procedure

As per the emergency stop test procedure, but with the main power supply contactor opened, the *Contractor* shall demonstrate that the Tippler systems have the capabilities to safely stop operations and then restart when power is restored.

17.7 Reporting

All testing necessary to safely commission and prove the Dual Wagon Tippler Facility performance shall be reported on inspection and test report forms.

If sheets do not exist then the *Contractor's* standard inspection and test forms may be used, subject to approval by the *Employer.* All pre-energisation test sheets shall be submitted to the *Employer* at least 48 hours prior to the first energisation of the Dual Wagon Tippler Facilities power supply. Once the inspections and tests are completed, the report forms shall be submitted to the *Employer* as soon as practicable but not later than seven days after the test or check, for acceptance by the *Employer.*

Inspection and test report forms shall include details of the tester, including *Employer* and *Contractor's* representatives. A report, suitably indexed and numbered, shall be compiled, which shall include the inspection and test reports for each item of equipment. The data section of the report shall record actual, as tested machine performance and shall, where appropriate, include the relevant acceptance criteria. The *Contractor* is responsible for recording and producing fully documented records during commissioning.

17.8 Training

The *Contractor* shall include training for operations personnel, engineers and maintenance personnel. One full - time training officer, nominated by the *Employer*, shall also be trained at all required levels for all relevant disciplines. Training of the *Employer* Operators shall be conducted on Site during the commissioning period and shall include classroom and on-machine instruction and conclude with written classroom and on-machine competency tests. The training shall include explanation of the damage that may result if the machine is incorrectly operated and / or maintained.

During pre-commissioning and no-load commissioning, the *Employer's* personnel shall be trained to a level that is sufficient to enable the *Employer's* personnel to operate the machine during load testing and performance testing under the *Contractor's* supervision. Complete sets of Training Manuals shall be provided.

Upon completion of load testing, the trainer shall assess the *Employer* Operators and advise on their competency to operate the machines for ongoing operations.

18.0 Packing, Handling, Transport and Storage of New Tippler Facility Equipment

The *Contractor* shall include for secure packaging, suitable for ocean freight, road transport and outdoor storage as applicable.

18.1 Handling and Storage

All equipment shall be handled and stored without overstress or deformation. It shall be stored clear of the ground in a manner that will avoid collection of water and damage to surface coatings.

18.2 Delivery to Site

Damaged materials, equipment or components shall be replaced, unless the *Contractor* is given the *Employer's* written consent to repair and erect them.

Care shall be taken when delivering, off-loading, and stacking of steel, materials or equipment to avoid damaging the protective coatings applied at the workshop. The *Contractor* shall be required to make good all damaged areas to a quality consistent with the specified coating. Coating repair procedures shall be submitted and approved by the *Employer* prior to execution of such work.

Responsibility for all steelwork, materials and equipment shall remain with the *Contractor* until erected, inspected and accepted by the *Employer.*

19.0 Spares and Maintenance Tools

To the extent that this is possible and practical, component and equipment selection shall be carried out to maximise interchangeability of components. The selection shall be based upon the *Employer's* preferred equipment.

19.1 Special Maintenance Tools

Special Maintenance tools are defined as tools that are not readily available from tool suppliers and must be engineered to conduct the specific task. The need for special tools is to be identified during the design and preparation of the maintenance procedures.

Where specialist maintenance tools are required in the first 12 months of operation, these are to be identified in the Installation Operation and Maintenance manual. The *Contractor* shall supply these tools.

Where specialist maintenance tools are required, but not expected to be required within the first 12 months of operation, the *Contractor* shall advise the *Employer* that such a tool is required. The *Employer* will then advise which of the following options are to be adopted:

- *Contractor* to supply the Special Tools
- *Contractor* to supply fabrication drawings and calculations for the Special Tools
- *Contractor* to provide a functional description of the tools design requirements so it can be made in the future

19.2 Spares

The *Employer* production targets require the achievement of high levels of equipment performance. This necessitates an appropriate spares philosophy. The spares will be broken down into:-

Start-Up and Commissioning Spares

Those spares required during the commissioning process, including first fills. These are to include items likely to fail during commissioning.

Consumables

Those spares and consumables utilised as part of the normal operations and maintenance processes which are an operating expenditure. These items will be stocked on Site and procurement and stocking levels will be managed by the *Employer.*

Insurance

Capital spares held, which are not anticipated to be used but are available to mitigate a failure of equipment as the alternative repair/replacement time would be unacceptable.

Rotatable

Items of equipment which are replaced then overhauled separately from the facility rather than rebuilt in-situ, before being returned to stock.

Demand Items

Demand items are catalogued in the inventory system at nil stock and ordered from the vendors once the item is required. The spares philosophy is to reduce the risk for the initial operation by appropriate holding of spares.

To reduce the initial project capital the number of rotatable spares provided will be minimised with the rotatable spares holdings being increased in subsequent years of operation.

The *Contractor* shall provide recommended lists of critical spares and costing allocated into the above categories. The *Contractor* shall provide the spares recommendations with sufficient time for the items to be ordered so that they arrive on Site prior to being required, allowing for a 4 week spares review period by the *Employer.*

19.3 Spare Parts Data

Data shall be submitted with a maintenance manual and typical sectional drawings with item part numbers. Spare Parts data shall be also provided in electronic format. *Contractor* shall submit complete details and maintenance and operating manuals of items purchased from subcontractors. Identical parts shall show identical part number. *Contractor* shall retain copies of all design and spare parts documentation for future reference.

19.3.1 Packing, marking and labelling of spare parts

Each part shall be properly tagged with a weatherproof label, showing:

- The article number as specified in the Contract
- Manufacturer's unique part number
- Description of the part
- Expiry date for parts having a limited shelf life

Small items with the same part numbers shall be tagged and packed together in a plastic bag or box, and the tag shall also be shown on the outside of the bag or box.

APPENDIX J

AECOM

TRANSNET

Contract Number: M003
Package Title: Dual Wagon Tippler 3 Data Sheet
Document Number: 1924701-2-211-M-DS-0003

Revision	Description	Date	Prepared By	Review By	Approved By
A	Internal Review	2014/05/09	Mark Mc Hugh		-
0	Issued for Use	2015/11/19	Mark Mc Hugh	23/11/15	

Definitions

AD	After Dispatched
ARAD	After Receipt of Approval Drawings
ARO	After Receipt of Order
AW	After Award
CF	Certified Final
D	On Delivery
E	Electronic
FA	For Approval
I	Included in IOM
IOM	Installation & Operation Manual
M	Included in MDR
MDR	Manufacturer's Data Report
P	Print/Hard Copy
PTD	Prior to Delivery
W	Week

Notes – unless otherwise noted

1. CF Data/Documents due 2 weeks after receipt of FA Data/Documents by Vendor
2. MDR Data/Documents due 2 weeks after shipping
3. IOM Data/Documents due 4 weeks before shipping
4. *= Additional 2 copies of these Data/Documents to be shipped with equipment/materials

Rev	Item	Description	Units	Data by Principal
Data by Principal				
GENERAL				
	P1.01	Equipment Type	Text	Dual Wagon Tippler
	P1.02	Number of Wagons per Tip	Text	2
	P1.03	Cell Arrangement	Text	Drive through, single cell
	P1.04	Design Rotation Angle	Deg	160 (operational)
	P1.05	Centre of Cell Rotation	Text	Coupler Centre Line
	P1.06	Wagon Clamp Location	Text	Top of wagon side sill above bogie centre line
	P1.07	Anti-Rotation Lock	Yes/No	Yes
	P1.08	Indexer Arm type	Text	Retractable sliding
	P1.09	Indexer engagement point	Text	Drawbar
	P1.10	Indexer last car arm	Text	Yes, pivoted
	P1.11	Wheel grippers	Yes/No	Yes, one set Ingo, one set outgo
		Duty		
	P1.12	Method of Operation	Text	Continuous
	P1.13	Service Life	Years	25
	P1.14	Service Life Cycles	No.	4 000 000
	P1.15	Location	Text	Port of Saldanha, Western Cape Province, South Africa
	P1.16	Material Type	Text	Iron Ore lump and fines product
	P1.17	Throughput – Peak Design	tph	10000
	P1.18	Throughput – Nominal	tph	8000
	P1.19	Througput - Tip cycles times	secs	90
	P1.20	Throughput – Per annum	Mtpa	30
	P1.21	Availability (Minimum)	%	95
		Locomotive Type 1		Contractor must verify the information provided below
	P1.22	Locomotive Type	Text	Transnet Class 34D
	P1.23	Width	m	See attched Transnet drg. for 34D loco
	P1.24	Length	m	See attched Transnet drg. for 34D loco
	P1.25	Maximum Weight	Tonnes	113
	P1.26	Maximum Axle Load	Tonnes	18.85
	P1.27	Starting TE	kN	380
	P1.28	Continuous TE speed	km/hr	See attched Transnet drg. for 34D loco
	P1.29	Locomotive to travel through tippler	Yes/No	Yes

Rev	Item	Description	Units	Data by Principal
		Locomotive Type 2		Contractor must verify the information provided below
	P1.30	Locomotive Type	Text	Transnet Class 43D
	P1.31	Width	m	See attched Transnet drg. for 43D loco
	P1.32	Length	m	See attched Transnet drg. for 43D loco
	P1.33	Maximum Weight	Tonnes	130
	P1.34	Maximum Axle Load	Tonnes	21.63
	P1.35	Starting TE	kN	548
	P1.36	Continuous TE speed	km/hr	See attched Transnet drg. for 43D loco
	P1.37	Locomotive to travel through tippler	Yes/No	Yes
		Locomotive Type 3		Contractor must verify the information provided below
	P1.38	Locomotive Type	Text	Transnet Class 15E
	P1.39	Width	m	See attched Transnet drg. for 15E loco
	P1.40	Length	m	See attched Transnet drg. for 15E loco
	P1.41	Maximum Weight	Tonnes	180
	P1.42	Maximum Axle Load	Tonnes	30
	P1.43	Starting TE	kN	588
	P1.44	Continuous TE speed	km/hr	See attched Transnet drg. for 15E loco
	P1.45	Locomotive to travel through tippler	Yes/No	Yes
		Wagon Type 1 (Primary Wagon Type)		Contractor must verify the information provided below
	P1.46	Wagons per rake	No.	140
	P1.47	Wagon Type	Text	Transnet CR-13 iron ore wagon
	P1.48	Coupling Type	Text	Alternate Rotary Coupling - Rigid Drawbar wagon pairs
	P1.49	Wagon Capacity	Tonnes	100
	P1.50	Wagon Tare Weight	Tonnes	20
	P1.51	Maximum Gross Weight (Loaded)	Tonnes	120
	P1.52	Wagon Width	mm	See attched Transnet drg. for CR-13 Wagon
	P1.53	Wagon Height	mm	See attched Transnet drg. for CR-13 Wagon
	P1.54	Wagon Length (between coupling lines)	mm	See attched Transnet drg. for CR-13 Wagon
	P1.55	Maximum Axle Load	Tonnes	30
		Wagon Type 2		Contractor must verify the information provided below
	P1.56	Wagons per rake	No.	140
	P1.57	Wagon Type	Text	Transnet CR-14 iron ore wagon

Rev	Item	Description	Units	Data by Principal
	P1.58	Coupling Type	Text	Alternate Rotary Coupling - Rigid Drawbar wagon pairs
	P1.59	Wagon Capacity	Tonnes	100
	P1.60	Wagon Tare Weight	Tonnes	20
	P1.61	Maximum Gross Weight (Loaded)	Tonnes	120
	P1.62	Wagon Width	mm	See attched Transnet drg. for CR-14 Wagon
	P1.63	Wagon Height (Empty/Loaded)	mm	See attched Transnet drg. for CR-14 Wagon
	P1.64	Wagon Length (between coupling lines)	mm	See attched Transnet drg. for CR-14 Wagon
	P1.65	Maximum Axle Load	Tonnes	30
		Rail Track		
	P1.66	Rail Type	Text	Narrow Gauge
	P1.67	Rail Gauge	mm	1067
	P1.68	Maximum Allowable Axle Load	Tonnes	30 Ton
	P1.69	Minimum Vertical Curve Radius	m	0
	P1.70	Maximum Vertical Gradient on approaching	%	1 : 800
	P1.71	Maximum Vertical Gradient on Release	%	1 : 800
	P1.72	Minimum Horizontal Radius Curvature on Approach	m	500
	P1.73	Minimum Horizontal Radius Curvature on Release	m	500
MATERIAL DATA				
		Iron Ore Lump		
	P2.01	Bulk Density	kg/m^3	2300
	P2.02	Moisture Content	%	1.2% average
	P2.03	Angle of Repose	Deg	33° to 35°
	P2.04	Particle size	mm	-25+8
		Iron Ore Fines		
	P2.05	Bulk Density	kg/m^3	3000
	P2.06	Moisture Content	%	3.2% average
	P2.07	Angle of Repose	Deg	35°-38°
	P2.08	Particle size	mm	-5+0.2
		DRS Ore		
	P2.09	Bulk Density	kg/m^3	2450
	P2.10	Moisture Content	%	1.3% average
	P2.11	Angle of Repose	Deg	33° to 35°
	P2.12	Particle size	mm	-27+13

Rev	Item	Description	Units	Data by Principal
		C/Sinter		
	P2.13	Bulk Density	kg/m^3	2650
	P2.14	Moisture Content	%	2.1% average
	P2.15	Angle of Repose	Deg	34º-37º
	P2.16	Material Compressive Strength Range	Mpa	600 to 1000
	P2.17	Particle size	mm	-8+5
SITE CONDITIONS				
	P3.01	Latitude	Text	33.0433º S
	P3.02	Longitude	Text	17.9963º E
	P3.03	Altitude	Text	Sea level
	P3.04	Ambient Temperatures (Min / Max)	Deg C	13.6 / 31.4 (Based on Year 2010)
	P3.06	Max Temperature - Shade	Deg C	45
	P3.07	Min Temperature	Deg C	-5
	P3.08	Mean Rainfall	mm/yr	278
	P3.10	Mean Relative Humidity (min/max/average)	%	50% 85% 60%
	P3.11	In-Service Wind Speed	Km/h	80
	P3.12	Out of Service Wind Speed (Storm)	Km/h	140 max over 20 meters
	P3.13	Environment	Text	Harsh Marine, Coastal salt laden air
	P3.14	Climate	Text	Dry Mediterranean
ELECTRICAL SUPPLY				
	P4.01	Voltage	V	400
	P4.02	Frequency	Hz	50
	P4.03	Phase	Text	3
		Data by Vendor		
GENERAL				
	S1.01	Supplier	Text	Tenova Takraf
	S1.02	Manufacturer	Text	Tenova Takraf
	S1.03	Country of Manufacture	Text	PRC - Europe
	S1.04	Model	Text	Tandem Unit Train Unloading System
	S1.05	Design Life	Years	20 minimum
	S1.06	Design Maximum Rotation	Deg	180
	S1.07	Design Back Tip Rotation	Deg	-5
	S1.08	Design Cycle Time	s	System 81.8 - Design / Tippler 30

Rev	Item	Description	Units	Data by Principal
	S1.09	Number of Cycles per Hour	No.	40 - Rated / 44 - Design
	S1.10	Design Unloading Capacity – Max	tph	8800
	S1.11	Absorbed Power - Min	kW	TBC
	S1.12	Absorbed Power - Norm	kW	595 - Positioner Hauling
	S1.13	Absorbed Power – Max	kW	TBC
STRUCTURAL STEEL				
	S2.01	Country of Origin (Steel Sections)	Text	PRC - Specialist Sections from Europe
	S2.02	Country of Origin (Fabrication)	Text	PRC
WAGON TIPPLER PERFORMANCE PARAMETERS				
	S3.01	Average cycle time during design case train unloading	s	86 - System / 30 - Tippler
	S3.02	Minimum cycle time during design case train unloading	s	81.8 - System / 30 - Tippler
	S3.03	Maximum cycle time during design case train unloading	s	90 - System / 30 - Tippler
	S3.04	Design case average throughput	tph	8800
	S3.05	Minimum rated cycle time	s	81.8
	S3.06	Maximum rated cycle time	s	90
	S3.07	Maximum rated average throughput	tph	8000
	S3.08	Rotation Speed (Max)	rad/sec	0.24
	S3.09	Cell length	mm	21.465
	S3.10	Allowable range of cell rotation	deg	180
	S3.11	Method of Anti-rotation locking	text	Gear Segment Intergral with Drive Units
	S3.12	Capability for future installation of wagon vibration mechanisms	Yes/no	Yes
	S3.13	Cell Tare Weight	Tonne	247.5 (excluding Ballast)
	S3.14	Design unfactored thrust allowance from locomotives	kN	Maz. Loco Mass x 0.25 = 319
DESIGN DATA				
	S4.01	Structural strength design code	Text	BS2573 Pt 1
	S4.02	Fatigue strength welding code	Text	BS2573 Pt 1
	S4.03	Welding code - structural welds	Text	DIN / ASTM / AWS D1.1-D1.1M
	S4.04	Welding code - fatigue purpose welds	Text	DIN / ASTM / AWS
	S4.05	Design cycles for fatigue purposes	Text	4 x 10^6
	S4.06	Structural material designation	Text	GB 700-88 Grade Q235
	S4.07	Foundation design loads provided	Yes/No	Yes
	S4.08	FEA structural and fatigue design	Yes/No	Yes

Rev	Item	Description	Units	Data by Principal
	S4.09	3D modelling	Yes/No	Yes
	S4.10	In-Train forces simulation programming for indexing system loads. (non-linear modelling)	Yes/No	Yes
AVAILABILITY				
	S5.01	Guaranteed Reliability (downtime due to unplanned maintenance as measured over a 12 month rolling period)	%	>98
	S5.02	Guaranteed availability (downtime due to planned maintenance as measured over a 12 month rolling period)	%	>98
	S5.03	Planned maintenance schedule included	Yes/No	Yes // 17 times x 5 hours + 8 times x 10 hours
END RING				
	S6.01	End ring diameter (nominal to outside of rail)	mm	9.450
	S6.02	End ring centres (rail-rail dimension)	mm	20.500
	S6.03	End ring rail attachment method	Text	Bespoke Rail Clips, Shear Plates and End Stops
	S6.04	End ring rail specification	Text	Crane Rail - A120 (100kg/m) DIN 536/1 Gr. 90+VA
	S6.05	End ring rolling stock opening clearance standard	Text	D365M Structure Gauge for Wagon Tipplers
	S6.06	End ring seal type	Text	Rubber Skirt to Dust Cowl
	S6.07	End ring spill deflection shedder plates	yes/no	Yes
	S6.08	Wearing surface (ore contact) lining materials	Text	Hardox 400
ROTATING CRADLE / GIRDER FRAME / PLATTEN				
	S7.01	Cradle frame description	Text	Pin Jointed - 'J' Frame - Refer to Mech Description of Equip
	S7.02	Access for internal inspection provided	Yes/No	Yes
	S7.03	Counter weight in frame	Yes/No	Yes - Cradle Rear Beam
	S7.04	If Yes, the weight of counterweight	kg	35.000
	S7.05	Wagon supported by girder during rotation	Yes/No	Yes
	S7.06	Girder material/lining details at wagon support locations	Text	GB 700-88 Grade Q235
	S7.07	Girder in material flow path during rotation	Yes/No	No
	S7.08	Abrasion/impact resistant lining material on material flow path surfaces	Text	Hardox 400
	S7.09	Platten design (fixed/floating)	Text	Floating - Pin Jointed
	S7.10	Rail material	Text	Standard SA Rail (as Entry Track)
	S7.11	Access provided along rear girder	Yes/No	Yes - Local to Wagon Clamps
	S7.12	Access provided along front girder	Yes/No	Yes
	S7.13	General Arrangement drawings supplied	Yes/No	Yes

Rev	Item	Description	Units	Data by Principal
	S7.14	Over rotation protection provided	Yes/No	Yes
	S7.15	Over rotation protection type	Text	Yes
	S7.16	Loop cables/hoses included	Yes/No	Only for Clamp Limit Switches
	S7.17	Loop cables/hoses mast structure included	Yes/No	Yes
	S7.18	Loop cables/hoses mechanism/type	Text	
WAGON TIPPLER WHEEL TRUNNIONS				
	S8.01	Configuration	dual/quad	Quad
	S8.02	Trunnion Roller Diameter	mm	800
	S8.03	Trunnion Roller width	mm	220 Overall / 138 Between Flanges
	S8.04	Trunnion Roller Mass	kg	959 including Bearings and Covers
	S8.05	Number of Trunnion Bogies	number	8
	S8.06	Trunnion Bogie Mass	kg	2450 including 2 Roller Assemblies
	S8.07	Trunnion Roller material	Text	GB 3077-88 Grade 42 Cr Mo
	S8.08	Trunnion Roller hardness	Brinell	248-302
	S8.09	Trunnion bearing L10 life	hours	>50000
	S8.10	Trunnion shaft diameter	mm	185
	S8.11	Trunnion shaft material	Text	GB 3077-88 Grade 42 Cr Mo
	S8.12	Sill Beam	Yes/no	Yes
	S8.13	Trunnion flanged? (Ingo/outgo)	Yes/no	Ingo
	S8.14	Method of trunnion alignment	Text	Surveyed based on Extensive Datum Markings
	S8.15	Trunnions provided with automatic lubrication system	Yes/No	Yes
WAGON TIPPLER CLAMPING MECHANISM				
	S9.01	Clamping method (hydraulic/gravity) -gravity preferred	Text	Gravity
	S9.02	Clamping system capable of securing the Ore wagon in the event that the whole Ore wagon load does not dislodge from the Ore wagon	Yes/No	No - 10% Material Retention as per Clause 10.4.4 of Design Loads in Technical Specification.
	S9.03	Number of clamps	Text	8
	S9.04	Clamp centres	mm	Refer to Proposal Drawing
	S9.05	Clamping surface width	mm	>200mm
	S9.06	Nominal unfactored design clamping load	KN	12te per Clamp
	S9.07	Method of compensation for wagon height variation	Text	Spring and Cushioning Pad Combination
	S9.08	Clamp travel	mm	Angular

Rev	Item	Description	Units	Data by Principal
	S9.09	Designed to hold fully loaded wagon in tipped position	Yes/No	No - 10% Material Retention as per Clause 10.4.4 of Design Loads in Technical Specification.
	S9.10	Spring compensation	Yes/No	Yes
	S9.11	Control/design measures to prevent impact damage from trains/wagons	Text	Shjock Absorbing to Prevent Damage to Wagons
	S9.12	Pivot pin bushing/bearing type	Text	Spherical Plain Bearings - Sealed for Life
	S9.13	Pivot pin bushing/bearing seal type	Text	Intergral with Bearings
	S9.14	Total Gripper Assembly Mass	kg	18000 excluding Counter Weights
WAGON TIPPLER ROTATION DRIVES				
	S10.01	Number of drives	No.	2
	S10.02	Cell rotation drive/s capable of righting an ore wagon with a full hung up wagon load	Yes/No	No - 10% Material Retention as per Clause 10.4.4 of Design Loads in Technical Specification.
	S10.03	Electric motor power	kW	132
	S10.04	Motor service factor	Text	Service Factor Applies to Gear Box.
	S10.05	Variable speed drives	Yes/No	Yes
	S10.06	Reducer type (parallel shaft /bevel helical)	Text	Helical / Parallel Shaft
	S10.07	Rack and Pinion drive mechanism	Yes/No	Yes
	S10.08	Brake unit rating	N.m	150% Full Load Motor Torque Minimum
	S10.09	Brake unit calliper quantity per brake	No.	2
	S10.10	Brake unit on one side capable of restraining full wagon and cell rotation	Yes/No	Yes
	S10.11	Brake callipers run by dedicated powerpacks	Yes/No	No - Ellectrically Released
	S10.12	Reducer reduction ratio	ratio	31.4:1
	S10.13	Final reduction ratio	ratio	21.2:1
	S10.14	Cardan shaft connection between rotation drives?	Yes/No	No - Synchronised by VSD
	S10.15	Allowable number of starts under full load	per hour	80
	S10.16	Allowable number of stops under full load	per hour	80
	S10.17	Drive arrangement drawing with loads supplied	Yes/No	Yes
	S10.18	Guarding provided	Yes/No	Yes
		Cell Rotation Drives Electric Motors		
	S10.15	Manufacturer	Text	Siemens
	S10.16	Country of Manufacture	Text	Czech Republic
	S10.17	Manufacturers Type No.	Text	1LG6280-4PM90

Rev	Item	Description	Units	Data by Principal
	S10.18	Frame Size	Text	280S
	S10.19	Basic Standard to which motor complies	Text	IEC 60034-1 IEC 60085
	S10.20	Motor mounting method	IM	IMB3
	S10.21	Motor cooling method	IC	IC411
	S10.22	Motor protection classification	IP	IP55
	S10.23	Terminal box IP rating	IP	IP55
	S10.24	Continuous maximum rating	KW	75
	S10.25	Rated voltage	V	400
	S10.26	Number of poles	Text	4
		Gear Reducer		
	S10.68	Manufacturer	Text	Brevini PLV
	S10.69	Country of Manufacture	Text	Germany
	S10.70	Type	Text	Parallel Axis
	S10.71	Model Number	Text	PD35-R11-V11-31.5
	S10.72	Reduction Ratio	No.	32.1:1
	S10.73	Mass	kg	1015
	S10.74	Mass moment of Inertia (J) (@ HS)	kgm²	0.089
	S10.75	Power rating (mechanical)	kW	301
	S10.76	Power rating (thermal)	kW	197
	S10.77	Torque rating at output shaft cts operation (at operating speed)	Nm	62500
	S10.78	Maximum torque rating at output shaft	Nm	114000
	S10.79	Service Factor - Mechanical (AGMA)	Text	2.28 DIN
	S10.80	Service Factor - Thermal (AGMA)	Text	
	S10.81	Seal type	Text	Taconite
	S10.82	Lubrication - oil specification	Text	Synthetic Oil ISO VG 220
	S10.83	Minimum operating temperature (oil temperature)	degC	-20
	S10.84	Maximum operating temperature (oil temperature)	degC	95
	S10.85	Maximum reducer surface temperature	degC	
		Brake		
	S10.137	Manufacturer	Text	Sibre
	S10.138	Country of Manufacture	Text	Germany
	S10.139	Type	Text	Disc Brake

Rev	Item	Description	Units	Data by Principal
	S10.140	Actuation method (Electric thruster, hydraulic)	Text	Electric Thruster
		High Speed Coupling		
	S10.155	Manufacturer	Text	Sibre
	S10.156	Country of Manufacture	Text	Germany
	S10.157	Type	Text	TBC
	S10.158	Model Number	Text	AFC-AS-65-450
	S10.159	Materials of construction	Text	TBC
	S10.160	Rated power at operating speed	kW	TBC
	S10.161	Rated Torque	Nm	1880
	S10.162	Mass moment of Inertia (J)	kgm^2	TBC
	S10.163	Mass	kg	TBC
	S10.164	Method of attachment to shafts	Text	key
		Low Speed Flexible coupling		
	S10.165	Manufacturer	Text	KTR - Gearex
	S10.166	Country of Manufacture	Text	TBC
	S10.167	Type	Text	Gear coupling
	S10.168	Model Number	Text	FA50
	S10.169	Materials of construction	Text	TBC
	S10.170	Rated power at operating speed	kW	TBC
	S10.171	Rated Torque	Nm	51000
	S10.172	Mass moment of Inertia (J)	kgm^2	TBC
	S10.173	Mass	kg	114
	S10.174	Method of attachment to shafts	Text	key
		Cardan shaft coupling (if reqd)		
	S10.175	Manufacturer	Text	N/A
	S10.176	Country of Manufacture	Text	N/A
	S10.177	Type	Text	N/A
	S10.178	Model Number	Text	N/A
	S10.179	Materials of construction	Text	N/A
	S10.180	Rated power at operating speed	kW	N/A
	S10.181	Rated Torque	Nm	N/A
	S10.182	Mass moment of Inertia (J)	kgm^2	N/A
	S10.183	Mass	kg	N/A

Rev	Item	Description	Units	Data by Principal
	S10.184	Method of attachment to shafts	Text	N/A
		Cardan Shaft/s		
	S10.185	Description	Text	N/A
	S10.186	Diameter	mm	N/A
	S10.187	Length	mm	N/A
	S10.188	Material	Text	N/A
	S10.189	Intermediate support required?	Yes/No	N/A
		Tippler Cell Rack and Pinion		
	S10.190	Pinion face width	mm	250
	S10.191	Pinion material	mm	GB 3077-88 Grade 42 Cr Mo
	S10.192	Pinion hardness	Brinell	248-302
	S10.193	Pinion pitch diameter	mm	458
	S10.194	Pinion tooth module	mm	80mm Circular Pitch
	S10.195	Gearing service factor	Text	1.5 Nominal
	S10.196	Pinion shaft size at bearings	Text	220
	S10.197	Rack face width	mm	220
	S10.198	Rack hardness	Brinell	207-270
	S10.199	Rack material	mm	Cast Steel JB/ZQ4297-86 Grade ZG35CrMnSi
	S10.200	Rack base	Text	T Section
	S10.201	Rack attachment method	Text	Fitted Bolts and High Strenght Friction Bolts
	S10.202	Lubrication method	Text	Automatic
	S10.203	Lubricant type	Text	TBC
POSITIONER				
		Positioner General		
	S11.01	Positioning speed (indexing)	m/s	0.6
	S11.02	Positioning speed (returning)	m/s	1.8
	S11.03	Last wagon positioner arm	Yes/No	Yes
	S11.04	Number of drives	No.	8
	S11.05	Number of redundant drives to still achieve target cycle time	No.	1
	S11.06	Positioner tractive force at full load motor torque	N	98100
	S11.07	Positioner Individual drive motor power	kW	90
	S11.08	Positioner total on board moving mass	kg	70000 approx.

Rev	Item	Description	Units	Data by Principal
		Positioner Linear Drive Mechanisms		
	S11.09	Electric motor power	kW	90
	S11.10	Motor service factor	Text	Service Factor Applies to Gear Box.
	S11.12	Variable speed drives	Yes/No	Yes
	S11.13	Reducer type (planetary/parallel shaft)	Text	Planetary
	S11.14	Rack and Pinion drive mechanism	Yes/No	Yes
	S11.15	Brake unit	Yes/No	Yes
	S11.16	Reducer reduction ratio	ratio	25.7:1
	S11.17	Guarding provided	Yes/No	Yes
		Positioner Electric motors		
	S11.18	Manufacturer	Text	Siemens
	S11.19	Country of Manufacture	Text	Czech Republic
	S11.20	Manufacturers Type No.	Text	1LG6310-6PM90
	S11.21	Frame Size	Text	315S
	S11.22	Basic Standard to which motor complies	Text	IEC 60034-1 IEC 60085
	S11.22	Motor mounting method	IM	IMB3
	S11.23	Motor cooling method	IC	IC411
	S11.24	Motor protection classification	IP	IP55
	S11.25	Terminal box IP rating	IP	IP55
	S11.26	Continuous maximum rating	KW	75
	S11.27	Rated voltage	V	400
	S11.28	Number of poles	Text	6
	S11.29	Speed at rated output	rpm	1000
		Positioner Gear Reducers		
	S11.70	Manufacturer	Text	Brevini Power Transmission
	S11.71	Country of Manufacture	Text	Italy
	S11.72	Type	Text	Planetary
	S11.73	Model Number	Text	SLS6002DC/MP../S-45CR1
	S11.74	Reduction Ratio	No.	25:1
	S11.75	Mass	kg	approx 1600
	S11.76	Mass moment of Inertia (J) (@ HS)	kgm^2	0.0457
	S11.77	Power rating (mechanical)	kW	208
	S11.78	Power rating (thermal)	kW	110

Rev	Item	Description	Units	Data by Principal
	S11.79	Torque rating at output shaft cts operation (at operating speed)	Nm	64000
	S11.80	Maximum torque rating at output shaft	Nm	1400000
	S11.81	Service Factor - Mechanical (AGMA)	Text	2.3 DIN
	S11.82	Service Factor - Thermal (AGMA)	Text	1.22 DIN
	S11.83	Seal type	Text	Taconite
	S11.84	Lubrication - oil specification	Text	Synthetic Oil ISO VG 220
	S11.85	Minimum operating temperature (oil temperature)	degC	-20 if Synthetic
	S11.86	Maximum operating temperature (oil temperature)	degC	95
	S11.87	Maximum reducer surface temperature	degC	
		Brake		
	S11.141	Manufacturer	Text	Coremo
	S11.142	Country of Manufacture	Text	Italy
	S11.143	Type	Text	D-E5.7kN
	S11.144	Actuation method (Electric thruster, hydraulic)	Text	Electric
		Torque limiting coupling		
	S11.159	Manufacturer	Text	Autogard
	S11.160	Country of Manufacture	Text	UK
	S11.161	Type	Text	400 Series
	S11.162	Model Number	Text	416-5 SR Synchronous Reset
	S11.163	Materials of construction	Text	Steel
	S11.164	Rated power at operating speed	kW	
	S11.165	Rated Torque	Nm	225 - 2540
	S11.166	Mass moment of Inertia (J)	kgm²	0.108 - 0.427
	S11.167	Mass	kg	63
	S11.168	Method of attachment to shafts	Text	key
		Rack and Pinion		
	S11.172	Pinion face width	mm	210
	S11.173	Pinion material	mm	GB 3077-88 Grade 42 Cr Mo
	S11.174	Pinion hardness	Brinell	248-302
	S11.175	Pinion pitch diameter	mm	378.79
	S11.176	Pinion teeth module	mm	70mm Circular Pitch
	S11.177	Pinion shaft cartridge lower bearing diameter	mm	Supplier Information - TBC

Rev	Item	Description	Units	Data by Principal
	S11.178	Pinion shaft cartridge upper bearing diameter	mm	Supplier Information - TBC
	S11.179	Pinion to shaft attachment method (spline/key/shrink)	Text	Spline
	S11.180	Pinion cartridge shaft material	Text	GB 3077-88 Grade 42 Cr Mo
	S11.181	Gearing service factor	Text	1.5 Nominal
	S11.182	Rack face width	mm	190
	S11.183	Rack hardness	Brinell	207-270
	S11.184	Rack material	Text	Cast Steel JB/ZQ4297-86 Grade ZG35CrMnSi
	S11.185	Rack base	Text	L Section
	S11.186	Rack attachment method	Text	Fitted Bolts and High Strenght Friction Bolts
	S11.187	Lubrication method	Text	Automatic
	S11.188	Lubricant type	Text	TBC
	S11.189	Excess Lubricant catchment system	Text	TBC
POSITIONER CARRIAGE				
	S12.01	Carriage construction (description)	Text	Fabricated Box Section
	S12.02	Stair access	Yes/No	Yes
		Vertical Support Wheels/track		
	S12.03	Quantity	Text	4
	S12.04	Load compensation for equalised 4 point loading	Yes/No	Yes
	S12.05	Wheels Diameter	mm	600 Minimum
	S12.06	Width	mm	140
	S12.07	Wheel material	mm	GB 3077-88 Grade 42 Cr Mo
	S12.08	Wheel hardness	Brinell	248-302
	S12.09	Bearing type	Text	Spherical Roller
	S12.10	Bearing L10 life	Text	>50000 Hours
	S12.11	Shaft diameter	mm	110
	S12.12	Shaft material	mm	GB 3077-88 Grade 42 Cr Mo
	S12.13	Support track material	Text	Standard Crane Rail
	S12.14	Support tracking mounting	Text	Embedded Plate
	S12.15	support track centres	mm	2000
	S12.16	Support track length	mm	44000
	S12.17	Track alignment method	Text	Surveyed based on Extensive Datum Markings / Jig
		Horizontal/Guide Wheels		
	S12.18	Quantity	Text	4

Rev	Item	Description	Units	Data by Principal
	S12.19	Type	Text	Cartridge
	S12.20	Diameter	mm	600 Minimum
	S12.21	width	mm	60
	S12.22	Wheel material	Text	GB 3077-88 Grade 42 Cr Mo
	S12.23	Wheel hardness	Brinell	248-302
	S12.24	Bearing type	Text	Spherical Roller
	S12.25	Bearing L10 life	Text	>50000 Hours
	S12.26	Shaft diameter	mm	150
	S12.27	Shaft material	Text	GB 3077-88 Grade 42 Cr Mo
	S12.28	Support track material	Text	GB 3077-88 Grade Q235
	S12.29	Support track centres	mm	N/A
	S12.30	Support tracking mounting	Text	Embedded Stools
	S12.31	Adjustment method	Text	Eccentric Adjustment
POSITIONER ARMS				
		Main arm		
	S13.01	Type	Text	Luffing - Main Offer / Extending - Alternative
	S13.02	Extension/retraction mechanism	Text	Self Contained Electro-Hydraulic Actuator
	S13.03	Mass	kg	7500 approx.
	S13.04	Arm material - cast/welded	Text	Welded - GB 700-88 Grade Q235
	S13.05	Arm design life cycles	No.	4 x 10^6
	S13.06	Drawbar Gripper - replaceable insert	Yes/No	Yes
	S13.07	Arm extension time	s	7.5
	S13.08	Arm retraction time	s	7.5
		Last wagon arm		
	S13.14	Type	Text	Luffing - Main Offer / Extending - Alternative
	S13.15	Lowering mechanism	Text	Intergral with Main Arm
	S13.16	Mass	kg	1500 approx.
	S13.17	Design Service factor	Text	TBC
BUFFER/EMERGENCY STOPS				
	S14.01	Number of buffers (hauling direction)	Text	2
	S14.02	Number of buffers (return direction)	Text	2
	S14.03	Buffer type	Text	Pneumatic
	S14.04	Buffer mounting (onboard or static)	Text	Onboard

Rev	Item	Description	Units	Data by Principal
	S14.05	Total energy absorption (hauling direction)	J	TBC Based on Final Train Hauling Calculations
	S14.06	Total energy absorption (return direction)	J	TBC Based on Final Operating Velocity & Positioner Design Mass
WHEEL GRIPPERS GENERAL				
	S15.01	Number and layout of grippers	Text	3 Sets (Bogies) Entry Side / 1 Set (Bogie) Exit Side
	S15.02	Method of actuation (Hydraulic/electric)	Text	Self Contained Electro-Hydraulic Actuator
	S15.03	Separate Hydraulic power pack	Yes/No	No
	S15.04	Holding Capacity	kN	200 per Unit Minimum
	S15.05	Wagon Clamps Type (description)	Text	Pivoting Lever
	S15.06	No. of cylinders per gripper	Text	2
	S15.07	Cylinder size (Bore x rod x stroke)	Text	80 Bore / 45 Rod Nominal
	S15.08	Replaceable wearing pad surface?	Yes/No	Yes
	S15.09	Pivot pin bushing/bearing type	Text	Bronze
	S15.10	Pivot pin bushing/bearing seal type	Text	TBC
	S15.11	Total Gripper Assembly Mass	kg	8250
PROTECTIVE COATINGS				
	S16.01	Paint Manufacturer	Text	tbd
	S16.02	Surface Preparation	Text	per spec
	S16.03	Prime Coat, Material Selection	Text	per spec
	S16.04	Prime Coat, Dry Film Thickness (DFT)	µ	per spec
	S16.05	Intermediate Coat, Material Selection	Text	per spec
	S16.06	Intermediate Coat, Dry Film Thickness (DFT)	µ	per spec
	S16.07	Finish Coat, Material Selection	Text	per spec
	S16.08	Finished Coat, Dry Film Thickness (DFT)	µ	per spec
INSTRUMENTATION				
	S18.01	Instrument list provided (with manufacturer and model number)	Yes	Yes
PLC				
	S19.01	Make and Model	Text	Siemens
	S19.02	I/O List provided	Yes	List I/O quantity dig and analogue etc.
Electrical				
	S20.01	Load list provided	Yes	Yes

APPENDIX K

Technical Specification: Apron Feeder

Document Number 1924701-2-213-M-SP-0003

Document Details

Ref (SA)	1924701-2-213-M-SP-0003
Date	9 May 2014
Prepared by (SA)	Mark Mc Hugh

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Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
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Table of Contents

1.0 Introduction

1.1 Overview

Transnet is undertaking a major programme of projects in Cape Town, Saldanha and Postmasburg to upgrade and expand the capacity of their infrastructure, as part of Transnet's Market Demand Strategy. The Scope of this project is to increase the materials handling capacity at Saldanha Port primarily by the addition of Tippler 3 and associated conveyors and infrastructure.

1.2 Purpose

This specification sets out the minimum technical requirements for quality and workmanship for all necessary engineering, design, management and co-ordination, supply of all drawings, manuals and documents, supply of materials plant and labour for the manufacture, construction, erection, testing and commissioning of the **Apron Feeders** and all associated auxiliary equipment by a suitable *Contractor*.

This specification shall be read in conjunction with Document Number 1924701-2-211-M-SP-0003: Technical Specification for the design, manufacture, construction, erection, testing and commissioning of a Dual Wagon Tippler 3, Feed Hoppers, Apron Feeders and Dust House for the Port of Saldanha.

The Saldanha Bulk Terminal Iron ore handling facilities have a current throughput of 58Mtpa and currently operate 2 Dual Wagon Tipplers as part of the unloading circuit. Transnet has engaged AECOM to undertake the EPCM delivery of an expansion project. Included within the scope of this project is a new third dual wagon tippler (Tippler 3). A conveyor network will connect the new tipplers to the existing material handling system.

1.3 Equipment Scope of Supply

The scope of this specification comprises the design, supply, fabrication, shop assembly and testing, surface protection, packaging, delivery, installation and commissioning of the new Tippler Apron Feeders as specified in the datasheet, and shall include all necessary ancillary equipment in accordance with:

- This specification
- The equipment datasheets in Annexure M
- The supplier data requirements list in Annexure A

The *Contractor* shall provide the specified equipment in accordance with the intent and the provisions of this specification and all other documents, codes, standards, and requirements referred to or included in this specification.

Obligations not expressly mentioned in the specifications, but which are necessary for the satisfactory provision of complete operational equipment for the Tipplers, as installed and fully commissioned, shall be deemed to be included in the contract at no additional cost to the *Employer.*

The *Contractor* shall provide all resources, technology, processes, plant, equipment, materials and support facilities that are necessary to provide the specified equipment to the *Employer*, including but not limited to, engineering, planning, supply of material, temporary work, warehousing, labour, supervision, fixed equipment and plant, infrastructure, emergency and first aid facilities, tools, miscellaneous materials, minor parts, communications, services and each and every item of expense, unless expressly excluded from the scope of supply in the provisions set out hereunder.

1.4 Scope of Equipment Supply Included

The equipment scope of supply shall include the design, supply of all materials, inspection, testing, and installation and commissioning of the new apron feeders, complete with (but not limited to):

- Complete apron feeder assembly with electromechanical drive, main frame carrying roller supports, pans, chains, carrying return rollers, segmented and reversible sprockets, tail wheels, bearings, bearing housings, impact rails, shafts, seals and chain tension devices, chain tension guides and support legs
- All necessary drive guards and safety guards, fully supported off the main frame
- All the Apron Feeder feed and discharge chutes
- Skirt support beams at the drive end of primary apron feeders, with holes to bolt in skirt supports

- Automatic, centralised, integral grease lubrication system including valves, instruments, grease piping, fittings and master and slave divider blocks for connection to grease supply pump
- Manual hydraulic jacking equipment for chain tensioning, including lock nuts, located on the main frame
- Unloading at site and assembly into the plant
- All necessary instrumentation, control and safety devices for the safe and efficient operation of the apron feeder with all instrumentation wired to a junction box

1.5 Scope of Equipment Supply Excluded

The scope of supply excludes:

- Concrete support structure below the apron feeder support legs
- Fixed piping between the connection on the lubrication system and the remote filling point
- Concrete foundations and anchor bolts
- All motor starters, power, control and instrumentation cabling that are unrelated to the equipment supplied by the Contractor, as described in the specifications

1.6 Equipment Supply Terminal Limits

The terminal limits shall be in accordance with Section 2.2.2 of the Site Information.

2.0 Definitions and Abbreviations

2.1 Definitions

Table 1: Definitions

Employer	has the meaning defined in the Contract and includes their respective successors and assigns
Project Manager	means the Project Manager as described in the Contract
Site	means the Saldanha Port (final installed location of the Dual Wagon Tippler Facilities)
Contractor	means the *Contractor* engaged under the contract for the supply of the Dual Wagon Tippler Facility
Sub-Contractor	means a Sub-Contractor or their subsidiary engaged by the *Contractor*
Dual Wagon Tippler Facility 3	Includes the Dual Wagon Tippler, Feed Hoppers and Chutes, Apron Feeders, Apron Feeder Level Structural Steel Floor and Bag House (including agglomerators)

2.2 Terminology

“Shall” is used to indicate that the *Contractor* is required to take action.

“Should” is used to indicate that the *Contractor* is advised to take action.

“May” is used to indicate that the *Contractor* is permitted to do something, or that the *Employer* reserves the right to do something, according to context.

“Approved” / “Approval”, unless otherwise qualified, means normal, written agreement by *Employer* to a proposal by the *Contractor*.

2.3 Abbreviations

Table 2: Abbreviations

Term	Description
ISO	International Standards Organisation
EIC	Electrical, Instrumentation & Control
FEA	Finite Element Analysis
PLC	Programmable Logic Controller

3.0 Reference Documents

Table 3: Reference Documents

Document Number	Document Title
1924701-2-214-M-DS-0003	Apron Feeder Data Sheet
1924701-C008-SCH-0001	Apron Feeder *Contractor's* Documentation Schedule (CDS)

4.0 Engineering

4.1 Design

4.1.1 Units

The SI system of metric units shall be used for this Project.

4.1.2 Language

All data shall be in the English language.

4.1.3 Drawings

The *Contractor* shall submit ALL mechanical, structural, electrical and instrumentation drawings, for approval by the *Employer*.

The full list of documentation requirements is included in the *Contractor* Documentation Schedule (document 1924701-C008-SCH-0001) included under Annexure A of the accompanying Works Information document.

The *Contractor* shall maintain records and prepare “As-Constructed” documents (for all documents, drawings and Operation and Maintenance manuals etc.) on completion of the *works*. The “As Constructed” documents shall demonstrate compliance with project specifications and drawings. All mark ups shall be drafted with revised status and supplied to the *Employer* in both hard and electronic format.

The *Contractors* “As-Constructed” documents shall be signed by the *Contractor* and submitted to the *Employer* for approval as developed and at completion of the work. Software copies of the “As Constructed” documents will be accepted in Autocad 2004 (or later) to be loaded into Bentley MicroStation V8 software.

“As Constructed” drawings shall be submitted as per the requirements as set out in the “*Contractor* Documentation Submittal Requirements” (DOC-STD-0001) included under Annexure B of the accompanying Works Information document.

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4.1.4 Calculations

Calculations shall be neat and legible and contain the following in the order as stated below:

- Summary of assumptions and conclusions
- Table of contents

- List of all associated drawings
- List of all text and references used
- Nomenclature
- Calculations shall include but not be limited to the following areas
- Machine performance / capacity
- Maximum power demand
- Brake Performances
- Gear ratings and life
- Bearing life
- Structural analysis for strength, serviceability and stability
- Mechanical analysis
- Dynamic analysis
- Hydraulic system power, pressure loss and thermal loads
- Water system analysis
- Lubrication system design
- Electrical Fault levels
- Maximum demand and transformer loading
- Cable sizing
- Overload protection settings
- Contribution to system harmonics
- Electrical equipment selection criteria

Calculations shall be prepared and checked by Engineers registered as Professional Members of the Engineering Council of South Africa (ECSA) or equivalent institution recognised by ECSA. Calculations shall not be prepared and checked by the same person. Checked calculations are required before the commencement of fabrication.

4.1.5 Structural Design Review

The *Employer* will conduct an independent review of the apron feeder's structural design and fatigue analysis. The *Contractor* must make allowance for the supply of required documentation and the time required to facilitate a structural review. The review will include a review of FEA work performed by the *Contractor*. Feedback and results of the design review will be made available to the *Contractor*.

4.1.6 South African Electrical Compliance

Any equipment designed and fabricated/manufactured overseas shall have an electrical certificate of compliance to South African Regulations before it is delivered and operated in South Africa. The compliance certificate(s) shall fully cover High Voltage, Medium Voltage and Low Voltage. These certificates will be issued by an accredited South African Professional Engineer.

4.1.7 *Employer* QA Representative

The *Contractor's* QA requirements will be as set out in the "General Quality Requirements for *Contractors* and Suppliers" (ACM-QM-STD-001) included under Annexure F of the accompanying Works Information document.

The *Employer* may choose to appoint a QA/QC representative to monitor and report on some or all aspects of the production and fabrication processes. It is expected that full cooperation will be extended to the appointed QA/QC representative. Associated costs for this service will be borne by the *Employer*.

4.1.8 *Contractor's* Subcontractor Declaration

Where work is performed by a subcontractor of the *Contractor* they will be declared to the *Employer*. This will include any subcontractors operating on or at the *Contractor's* fabrication and assembly facility.

4.1.9 Hazardous Materials

The following materials shall not be used or installed:-

- Asbestos in any form
- PCBs (poly-chlorinated biphenyls)
- Mercury
- Viton Seals
- Any paints containing lead or chromates (including in the tinters)

5.0 Codes, Standards, Specifications and Regulations

5.1 General

The sequential order of precedence applicable to the use of the codes, standards, specifications and regulatory requirements for this project is as follows:

i. Regulatory Requirements.

ii. Transnet Project Guidelines, Specifications and Standards.

iii. South African Standards.

iv. International Standards.

In the event of an inconsistency, conflict or discrepancy between any of the standards, specifications and regulations, the most stringent and safest requirement applicable to the project will prevail. Any inconsistencies critical to the design shall be brought to the attention of the *Employer* for resolution, prior to construction. The design shall comply with the latest revision of the following standards, plus any other applicable standards:

5.2 Government Acts and Regulations

The *Contractor* shall be responsible for compliance of all *works* with Government Acts, By-laws and Regulations, both State and Federal, including but not limited to the following (including all amendments):

- Mine Health and Safety Act 29 of 1996
- Occupational Health and Safety Act 85 of 1993
- Minerals Act 50 of 1991
- National Water Act 36 of 1998
- Atmospheric Pollution Prevention Act 45 of 1965
- Environmental Conservation Act 73 of 1989
- Promotion of Access to Information Act 2 of 2000
- National Road Traffic Act 93 of 1996
- National Environmental Management Act 107 of 1998

5.3 South African Standards

The *Contractor* shall be responsible for compliance of all *works* with South African Standards, including but not limited to the following:

Table 4: South African Standards

Standard Number	Title
SANS 357	Heat Treated Steels, Alloy Steels and Free-Cutting Steels
SANS 1465	Steel Castings
SANS 4413	Hydraulic Fluid Power – General Rules and Safety Requirements for Systems and Components
SANS 10044	Welding
SANS 10160	Basis of Structural Design for Buildings and Industrial Structures
SANS 60204	Safety of Machinery – Electrical Equipment of Machines
CMA	Conveyor Manufacturers Association of SA Limited Guideline – Safety Around Belt Conveyors

5.4 International Standards

Current editions of the relevant International Standards Codes or Publications that shall apply include, but are not limited to, those listed in Table 5.

Table 5: International Standards

Standard Number	Title
AGMA 2003-C10	Rating the Pitting Resistance and Bending Strength of Generated Straight Bevel, Zero Bevel and Spiral Bevel Gear Teeth
AGMA 2001-D04	EN-Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth
AGMA 6000	Specification for Measurement of Linear Vibration on Gear Units
ASTM A609/A609M	Standard Practice for Castings, Carbon, Low-Alloy, and Martensitic Stainless Steel, Ultrasonic Examination Thereof
ASTM E709	Standard Guide for Magnetic Particle Examination
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B36.10	Welded and Seamless Wrought Steel Pipe
ASME B36.19M	Stainless Steel Pipe
BS EN 10204:2004	Metallic materials. Types of inspection documents
ISO 281	Roller bearings – Dynamic load rating and rating life
ISO 4406	Cleanliness Level Standards
ISO/TR 14179	Gears – Thermal Capacity

5.5 Drawings and Drawing Standards

Drawings shall be in accordance with Transnet Capital Projects: Project Development and Execution: ENG-STD-0001, which will be made available on award of the contract. The drawings applicable to the supply of the apron feeders are listed under Section 5 of the Works Information.

5.6 Standard Specifications

The *Contractor* shall be responsible for compliance of all *works* with *Employer* standard specifications, including but not limited to the following:-

Table 6: Standard Transnet Specifications

Specification Number	Specification Title
SBH8/2/2	General electrical equipment
SBH8/2/3	Electrical motors and generators
SBH8/2/6	Lighting on equipment
SBH8/2/8	Testing & commissioning of electrical equipment
SBH8/2/9	Electronic equipment
SBH8/2/11	Medium voltage equipment for port equipment
SBH9/2/2	Hydraulic equipment
SBH9/2/4	Gearing, shafts, bearings, brakes, lubrication, vee-belts, keys and keyways
SBH9/2/6	Structural Steelwork
SBH9//2/8	Corrosion protection
SBH9/2/9	General requirements & conditions

6.0 Site Conditions

6.1 Project Location

The Saldanha port facilities are in the Port of Saldanha in the Western Cape region of South Africa. Saldanha is located approximately 100 km North of Cape Town.

6.2 Site Conditions

The equipment shall be suitable for installation within a harsh industrial environment as indicated in **Table 7**.

Table 7: Site Conditions

Condition	Description
Altitude	Sea Level
Air Temperature	45°C Maximum; -5°C Minimum
Equipment Surface Temperature (from sun)	60°C Maximum
Relative Humidity	50% Minimum; 85% Maximum; 60% Average
Air Quality	Coastal salt- laden air with high concentration of iron ore dust
Air Pressure	101.3 kPa
Average Annual Rainfall	278 mm

6.2.1 Seismic Data

The designs of the Tippler Buildings conform to SANS 10160. The buildings consist of reinforced concrete wall and column framed structures with steel frame superstructures. The vault structures are founded on rock with side wall loading. The vaults have been designed to cater for shallow ground water tables. The buildings and superstructures are founded on piles. Seismic design considerations are as per SANS 10160-4:2011. The ground in contact with the Tippler Structures is classified as calcrete/sand and is Type 4 according to Table 1 in SANS 10160-4. The rock that is the main foundation medium is Type 1 as per Table 1 in SANS 10160-4 with Vs = 180 m/s. The Site is located in Zone 1 for seismic activity, i.e. natural seismic activity. The Tippler Buildings are considered to be Importance Class III as per Table 3 in SANS 10160-4.

6.2.2 Maximum Temperature and Thermal Rating

For the maximum ambient air temperature for design of all equipment including motors, gearboxes, and bearings refer to the equipment data sheets included under Annexure M of the Works Information.

7.0 Technical Requirements

7.1 General

The equipment shall be designed by the *Contractor, in accordance with* standard, heavy-duty applications, suitable for continuous operation at the rated capacity for the duty as specified in the Apron Feeder Data Sheet included under Annexure M in the Works Information.

The equipment shall be designed for continuous operation in a hot and dusty environment, with a minimum design life of 20 years. The equipment shall be designed for start-up under normal and choked conditions.

The equipment will be exposed to the elements and cleaned by high-pressure hose down.

All materials, equipment, components and accessories shall be new, suitable for the service and the requirements of this specification and the standards, codes and documents referenced herein.

The equipment shall have a minimum number of separate, split sections, taking account of the limits in shipping weight, dimensional limitations at the intended fabrication location, on-Site storage space and the dimensions of the new Tippler 3 vault.

All components requiring regular replacement, inspection and adjustment shall be readily accessible with minimum dismantling.

Mechanical equipment shall be designed and manufactured with provision made for condition monitoring, which shall include, but not be limited to, studs for vibration monitoring of rotating equipment, valves for oil samples in piping and inspection ports in equipment.

All piping shall be designed, fabricated and tested in accordance with ASME B31.3 or *Employer* approved equivalent. All piping shall be cleaned by pickling after fabrication. All piping shall be sealed to prevent contamination during transport and installation.

Preventative and routine maintenance, including lubrication, condition monitoring and adjustments, shall require the minimum time possible.

The use of tapped holds shall require approval by the *Employer*. Bolts or screws assembled into tapped holes shall have an approved thread locking compound applied to them.

First fill lubricants shall be of a type that is suitable for the application and equivalents can readily be sourced from major reputable suppliers. Selection shall be subject to approval by the *Employer*.

7.2 Mechanical

The equipment shall be designed to eliminate potential corrosion due to accumulated iron ore at steelwork connections and penetration of moisture into and between steelwork components. Steel ledges prone to build up of fines shall be sealed with angled shedder plates.

Feeder pull-out and run loads shall be the highest loads calculated using Supplier methodology and TUNRA calculations. Where possible, the speed of the apron feeder shall be based on TUNRA predicted depth and minimum bulk density. Feeder power shall be based on the maximum bulk density and pan speed, and be supported by TUNRA calculations.

7.2.1 Drive Assembly

The drive unit shall be preferably electro-mechanically driven.

The maximum output torque of the electro-mechanical drive shall be limited to 150% of the full load torque required by the apron feeder.

All components in the drive train shall be designed for a minimum of 200% of the full load torque required by the apron feeder.

It must be possible to adjust the individual feeder rate to between 50% and 125% of the design rate.

Drive safety factors shall be based on the full load torque required by the apron feeder.

The apron feeder speed will be modulated according to an external speed reference signal.

The apron feeder shall be capable of starting and accelerating to its rated speed under maximum material depth and initial fill conditions, i.e. no arched stress field in the hopper.

The apron feeder shall be capable of inching in either direction using a variable speed drive. Reverse inching will be used only during maintenance and infrequently under load conditions.

All motor driven equipment shall be permanently marked with arrows to indicate the required direction of rotation of the drive motor.

The electro-mechanical drive shall be shaft mounted on the head shaft using a frictional keyless shaft-hub connection device.

Bearings shall incorporate taconite seals. L_{10} life shall be a minimum of 100,000 hours.

The tail shaft shall be provided with an M20 tapped hole at one end for tachometer connection and include provision and sealing for projections through the bearing end cap.

Guards shall be provided for all shaft extensions projecting through a bearing housing.

Drive torque arm to be integral to the apron feeder and all forces to be managed within the apron feeder main frame.

7.2.2 Sprockets

The design shall allow all sprocket segments to be changed without breaking the chains.

Chain sprockets shall be replaceable in type, comprising of no less than three pieces, and bolted to sprocket hubs by high strength bolts. Sprocket hubs shall be integral with shafts or attached using compression friction devices. Sprockets shall incorporate a hunting tooth and reversible segments for double life.

7.2.3 Chains and Tension Adjustment

Two strands of Caterpillar crawler tractor chain or *Employer* approved equivalent shall be used to support the feeder pans.

Feeder chains shall be of sealed and lubricated track (SALT) type with I-Loc master links having a minimum safety factor of 1.5 on maximum chain pull calculated for worst case pull out conditions.

Not less than 2 split master links shall be incorporated in each chain strand. The *Contractor* shall specify the number of chain links required to achieve this.

A hydraulic take-up shall be provided on the tail shaft for tensioning of the chains. The take-up shall:

- Include heavy duty nuts and lock nuts, or similar, for locking the tail shaft in position
- Be such that it prevents unequal tensioning of the chains

The hydraulic pumps for the take-up shall be hand operated, permanently mounted and inclined so that oil accumulates towards the discharge end of the pump. Hydraulic jacking equipment shall be fitted with pressure gauges calibrated in kPa.

7.2.4 Rollers

Support rollers shall be of the lubricated sealed-for-life type.

Rollers shall be readily removable without breaking the chains.

Carry rollers shall be replaceable in-situ without the need to jack pans higher than 10 mm or to empty the apron feeder. Return rollers shall incorporate a replaceable wear collar and be fitted with handles to facilitate replacement.

Guards for carry rollers shall run along the entire length of the feeder.

7.2.5 Pans

Pans shall be individually replaceable in-situ without disturbing the remainder of the apron.

Pan designs shall be such that the fit between overlapping areas and the pan height minimises spillage but allows sufficient clearance to prevent cramping of pans, *i.e.* self-cleaning.

Longitudinal impact strips shall be mounted on the main frame to minimise deflection of the pans. The impact strips shall be hardened head rail and include shim adjustment for clearance to underside of pans.

The pans shall be ribbed on the underside for strength.

Feeder pans shall be cast from manganese steel to ISO 13521 GX120Mn13 as a minimum.

Every sixth pan shall incorporate a wear indicator close to the skirts.

Pans shall be secured to chains with Caterpillar flame hardened head, square nut earthmoving track bolts and nuts or *Employer* approved equivalent.

Pan contact surfaces with chains shall be machined.

Chain fixing holes and seats shall be drilled and faced and chain mounted pads shall be machined.

7.2.6 Automatic Grease Lubrication System

The apron feeders shall be equipped with an automatic centralised grease lubrication system specifically designed for the operating environment defined in the Site Datasheet.

The centralised grease lubrication system, as a minimum, shall:

- Include a reservoir, level instrumentation and pump mounted in an enclosure
- Include a flanged inlet including valves to enable connection to a DN50 rigid pipeline for remote grease filling by a lube truck
- Deliver grease, via steel tubing and divider blocks mounted on the feeder frame, to bearings and seals on the head and tail shafts
- Include a dedicated control unit with provision for feedback to the plant control system

Lubrication blocks and pipes shall be supplied with the connection point for the automatic lubrication system at the head end, non-drive side.

Fixed pipes shall be a minimum diameter of 10 mm stainless steel and secured with Stauff pipe clamps or equivalent for ease of removal and replacement.

Durable flexible hoses shall be supplied for connection from divider blocks to bearings where required.

Where applicable, a single lubrication system shall be used to service both feeder and dribble conveyor.

7.3 Surface Protection

Reference shall be made to Section 11 of the Technical Specification for Feed Hoppers, Apron Feeders and Dust House (Doc No 1924701-2-211-M-SP-0003), which shall be deemed to apply to the Apron Feeders.

The equipment called for herein shall be factory finished and painted in accordance with the *Contractor's* standard procedures, provided that the *Contractor's* standard finish is appropriate to the Site conditions and meets the specifications as referenced above. High-gloss finishes and chrome-plating, which affect use of thermography equipment, shall not be used.

Machined surfaces shall not be painted and shall be protected by a coating of rust preventive grease or similar material during shipping and storage. The preventive coating shall be easily removable in the field with solvents and without the need for wire brushing or other mechanical removal methods. Standard colours shall be submitted with the proposal for the *Employer's* selection and approval.

Guards shall be provided for personnel protection in accordance with the requirements of the Occupational Health and Safety Act No. 85 of 1993 and as per the standards referenced in Table 4, Table 5 and Table 6, as contained in this specification.

7.4 Electrical

The equipment shall be supplied as standalone units and shall be supplied complete with all necessary instrumentation and electrical equipment to provide adequate functionality. The equipment shall be fully operational on the connection of the single power supply. The *Contractor* shall provide all other necessary equipment for the proper operation of the system including but not limited to:

- Local start / stop for motors
- Lanyard switches
- Wiring to junction boxes
- Emergency stops
- Junction boxes
- Cubicles and enclosures as required

The *Contractor* shall provide a detailed logic description, in the *Employer's* standard format, of the equipment operation and interlocks, which is to be integrated by others to with the remote Saldanha Port PLC. The *Employer's* standard format will be made available on the award of the contract.

As a minimum, all electrical equipment and cubicles shall be designed to IP65. Electric motors shall have a minimum degree of protection of IP55.

7.4.1 Power Supply

All electrical equipment, especially the earthing equipment, shall have suitable corrosive protection and associated IP ratings for marine conditions. All internal fixing and mounting materials shall be 316 Stainless

Steel with external fixing materials to be 316 Stainless Steel, either hot dipped galvanised or painted as applicable, both in accordance with the *Employer's* standards. Bolts and nuts only to be 316 Stainless Steel. Power supply shall be as stated in the datasheets.

7.4.2 Control

Control shall be by 24V DC for field device circuits and programmable controller inputs and outputs.

All control of the equipment will be from a remote PLC system. Wiring from the equipment control panel to the remote Saldanha Port PLC system will be by others. Local control will only be used for maintenance and troubleshooting.

The *Contractor* shall provide a logic description, in the *Employer's* standard format, of the entire equipment system operation and interlocks, for use by others to configure the remote Saldanha Port PLC. The *Employer* shall subsequently attend the Factory Acceptance Test (FAT) at the *Contractor's* premises to witness and sign off the FAT. The *Employer's* standard format will be made available on award of the contract.

The *Contractor* shall provide a suitable control panel for the equipment which shall include as a minimum:

- Terminal strips for the *Contractor* provided field instrumentation
- All stop / start push buttons for local operations
- All fault and diagnostic lights and/or annunciator panel for local troubleshooting

7.4.3 Instrumentation

External field mounted instruments requiring routine calibration or inspection shall be provided with rain/sun shields to provide additional weather protection.

Field instruments shall be sealed to IP66 standard.

All instrumentation and control shall be designed to be failsafe.

The *Contractor's* scope shall include all protective devices such as pull wire switches, under-speed proximity switches, pressure, temperature and vibration switches and any remote analogue instrumentation which are necessary to continuously operate the apron feeder at optimum conditions.

Pull wire switches and pull wires shall be supplied lengthwise on both sides of the feeder as per the requirements of *Conveyor Manufacturers Association of SA Limited Guideline – Safety Around Belt Conveyors.*

The *Contractor's* scope shall include all necessary sensing elements for the interlocking and automatic control of the apron feeder, dribble conveyor and lubrication system. In addition the *Contractor* shall provide a detailed control strategy and connection details for all sensing elements.

7.4.4 Cables

The power supply cables to the equipment mentioned under this scope will be designed, supplied and installed by the *Contractor*.

All other cable integral with the equipment shall be supplied and installed by the *Contracto*r. The *Contractor* shall pre-wire all power, control and instrument cabling to suitable panels, to the largest extent possible, so that the equipment and panel are mounted on a common skid and can be transported as a complete unit.

7.4.5 Motors

The *Contractor* shall indicate the starter type recommended for the drive motor to minimise current draw during start-up and to achieve practical run up period. The start current should be limited to 150% of the full load current but shall not exceed 200% of the full load current.

7.4.6 Cubicles and Enclosures

All cubicles shall be SS316 and shall have a degree of protection as specified for IP65 equipment. All cabling shall be bottom entry, unless otherwise specified, via a removable non-ferrous gland plate.

7.4.7 Equipment Protection

All necessary sensing elements for the protection of the equipment shall be supplied and installed by the *Contractor.*

8.0 Fabrication and Assembly

The apron feeder assembly shall be fabricated and assembled as per the Codes, Regulations and Standards listed in Section 5.0.

9.0 Identification

Each component shall be fitted with a nameplate. Information on the nameplates shall be in English and shall be engraved, with paint-filled lettering, using a minimum letter height of 6 mm and depth of 1 mm.

The nameplate material shall be stainless steel and shall include:

- Supplier's name
- Model number
- Serial number
- Date of manufacture
- Design power (kW)
- Total mass (kg)
- Any other relevant information

10.0 Acceptance, Testing and Commissioning

10.1 *Contractor's* Workshop Testing

The *Employer* shall have unhindered access to the *Contractor's* workshops and Site at all times while work is in progress and the *Contractor* shall provide proper facilities for access and inspection purposes.

After fabrication and machining, the equipment shall be completely shop assembled to ensure proper fit of all parts, including guards.

The equipment shall be supplied with the following:

- All safety signage fitting
- All equipment numbering and nameplate fitting

10.2 Installation and Maintenance Procedures

The *Contractor* shall supply assembly, installation and maintenance procedures for all equipment components. These shall include the procedures for testing and commissioning.

10.3 Commissioning

The provisions of Section 16 of the Technical Specification for Feed Hoppers, Apron Feeders and Dust House (Doc No 1924701-2-211-M-SP-0003) shall apply.

11.0 Packing and Delivery

11.1 Packing

The following conditions apply to packing of equipment for delivery to Site:

- The equipment shall be packed to prevent damage during loading, transport and outdoor storage, and to allow for easy handling
- The Supplier shall submit for approval, the packing features used to avoid brinelling of bearings
- All threaded holes shall be closed with set-screws. Threads shall be coated with a molybdenum disulphide anti-seize compound such as “Never-Seez” or equivalent. Plastic covers and caps shall not be used

11.2 Delivery to Site

The *Contractor* shall prepare and submit a transportation plan showing the delivery method from the point of manufacture to Site.

11.3 Handling and Storage

All equipment shall be handled and stored without overstress or deformation. The equipment shall be stored clear of the ground in such a manner so as to avoid collection of water and damage to surface coatings.

12.0 Spares and Maintenance Tools

The provisions of Section 18 of the Technical Specification for Feed Hoppers, Apron Feeders and Dust House (Doc No 1924701-2-211-M-SP-0003) shall apply.

APPENDIX L

Contract Number: M003
Package Title: Tippler 3 Apron Feeders Data Sheet
Document Number: 1924701-2-213-M-DS-0003

Revision	Description	Date	Prepared By	Review By	Approved By
OA	Issued for Internal Review	5/9/2014	Mark Mc Hugh		-
00	Issued for Use	11/19/2015	Mark Mc Hugh		
01	Issued for Use	12/9/2015	Mark Mc Hugh		

Definitions

AD	After Dispatched
ARAD	After Receipt of Approval Drawings
ARO	After Receipt of Order
AW	After Award
CF	Certified Final
D	On Delivery
E	Electronic
FA	For Approval
I	Included in IOM
IOM	Installation & Operation Manual
M	Included in MDR
MDR	Manufacturer's Data Report
P	Print/Hard Copy
PTD	Prior to Delivery
W	Week

Notes – unless otherwise noted

1. CF Data/Documents due 2 weeks after receipt of FA Data/Documents by Vendor
2. MDR Data/Documents due 2 weeks after shipping
3. IOM Data/Documents due 4 weeks before shipping
4. *= Additional 2 copies of these Data/Documents to be shipped with equipment/materials

Rev	Item	Description	Units	Data by Principal
		Data by Principal		
		General		
	P1.01	Equipment Number	-	TBA
	P1.02	Equipment Name	-	Apron Feeder
	P1.03	Quantity	-	5
	P1.04	Operating Duty	hrs/annum	7000
	P1.05	Method of Operation	-	Continuous
	P1.06	Dribble Conveyor Required	Y/N	No
		Material Details		
	P2.01	Material Type	-	Hematite Iron Ore Lump and Fines
	P2.02	Crushed Bulk Density - Mass Calculations	t/m^3	2.7
	P2.03	Crushed Bulk Density - Volume Calculations	t/m^3	2.3
	P2.04	Angle of Repose	°	36
	P2.05	Feed Size - F_{50}, F_{80}, F_{95}, F_{100} (Max)	mm	25 to 27
	P2.06	Unconfined Compressive Strength - Average	MPa	800
	P2.07	Feed Moisture Content - Nominal	%	2
	P2.08	Feed Moisture Content - Maximum	%	3.2
	P2.09	Effective Angle of Internal Friction (δ)	°	55
		Feeder Details		
	P3.09	Capacity - Nominal	tph	1600
	P3.10	Capacity - Maximum	tph	2,000
	P3.11	Skirt Length (Le)	mm	2,260
	P3.12	Shaft Centres (L)	mm	2260
	P3.13	Slope (θ)	°	0
		Hopper & Bin Details (If Applicable)		
	P4.13	Hopper Flow Type	-	Mass Flow
	P4.14	Height of Material in Contact with Wall (H)	mm	4000
	P4.15	Height of Hopper (Zg)	mm	4000
	P4.16	Surcharge Head (Hs)	mm	2000
	P4.17	Height of Clearance (yc)	mm	200
	P4.18	Width of Bin (D)	mm	3500
	P4.19	Discharge Material Height (Hd)	mm	1100

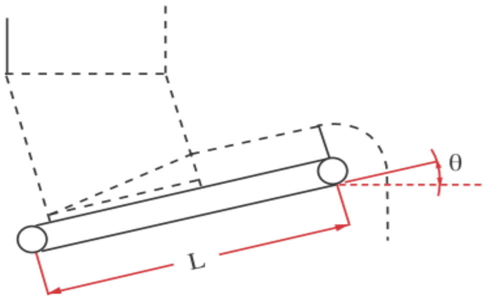
	P5.03	Number and Mounting of Hydraulic Drives	-	Electro mechanical drives preferred
	P5.04	Hydraulic Pump Details	-	Electro mechanical drives preferred
	P5.05	Filter Type	Simplex/Duplex	Electro mechanical drives preferred
	P5.06	Hydraulic Hose Length Required (Total)	mm	Electro mechanical drives preferred
		Electrical Details		
	P6.01	Input Voltage	V/Ph	400V/3
	P6.02	Control Voltage	V	24V DC
		Site Conditions		
	P7.01	Latitude	°	33.0433º S
	P7.02	Longitude	°	17.9963º E
	P7.03	Altitude	-	Sea level
	P7.04	Ambient Temperatures (Min / Max)	° C	13.6 / 31.4 (Based on Year 2010)
	P7.05	Max Temperature - Shade	° C	45
	P7.06	Min Temperature	° C	-5
	P7.07	Mean Rainfall	mm/yr	278
	P7.08	Mean Relative Humidity (min/max/average)	%	50% 85% 60%
	P7.09	Mean Wind Speed (9am/3pm)	km/h	Not applicable as Apron Feeders will operate in an enclosed conrete vault
	P7.10	Wind	-	Not applicable as Apron Feeders will operate in an enclosed conrete vault
	P7.11	Environment	-	Harsh Marine, Coastal salt laden air
	P7.12	Climate	-	Dry Mediterranean
Data by Vendor				
		General		
	S1.01	Manufacturer	-	TENOVA TAKRAF AFRICA
	S1.02	Model Number	-	1830 mm x 2272 mm, Model D4
	S1.03	Discharge Bed Depth	mm	1100
	S1.04	Speed Range (Min, Max)	m/s	0.115 - 0.1394
	S1.05	Operating Head Shaft Torque (Min, Max)	kNm	41.97 - 52.63
	S1.06	Starting Head Shaft Torque (Min, Max)	kNm	61.72 - 77.38
	S1.07	Pan Width Inside Flights	mm	1830
	S1.08	Skirt Discharge Inside Width	mm	1750
	S1.09	Skirt Slope from Vertical	°	0
	S1.10	Skirt Length	mm	1200
	S1.11	Feeder Angle of Inclination	°	0
	S1.12	Pull Out Force	kN	225 (MAX)
		Shafts		
		Drive Shaft		
	S2.01	Material	-	BS970 709 M40 (EN19)
	S2.02	Hardness	BHN	160 - 210
	S2.03	Diameter at Sprocket Hubs	mm	185
	S2.04	Diameter at Bearings	mm	180
		Tail Shaft		
	S2.05	Material	-	BS970 709 M40 (EN19)
	S2.06	Hardness	BHN	160 - 210
	S2.07	Diameter at Sprocket Hubs	mm	155
	S2.08	Diameter at Bearings	mm	150
	S2.09	Main Bearings L_{10} Life	Hrs	>100000
	S2.10	Main Bearings Seal Type	-	TACONITE
		Chain		
	S3.01	Manufacturer	-	ITR (CATERPILLAR EQUIVALENT)
	S3.02	Type/Model Number	-	D4
	S3.03	Lubrication	-	SALT
	S3.04	Number of Standard Links Each Side	-	38
	S3.05	Number of Master Links Each Side	-	2 (TWO)
	S3.06	Operating Chain Tension - Maximum	kN	76.5
	S3.07	Allowable Peak Chain Tension - Standard Link	kN	844
	S3.08	Chain Breaking Tension - Standard Link	kN	769
	S3.09	Master Link Derating Factor	-	0.9
	S3.10	Operating Chain Safety Factor	-	9.93
	S3.11	Start Up Chain Safety Factor	-	6.75
		Sprocket		
	S4.01	Drive Sprocket		ITR (CATERPILLAR EQUIVALENT)
	S4.02	PCD	-	688 mm
	S4.03	Thickness of Tooth	mm	57
	S4.04	Number of Teeth	-	25
	S4.05	Number of Sprocket Segments	-	5
	S4.06	Shaft Attachment	-	BIBIKON LOCKING ELEMENTS
	S4.07	Tail Wheel		TENOVA DESIGN
	S4.08	Diameter	mm	628
	S4.09	Number of Segments	-	N/A

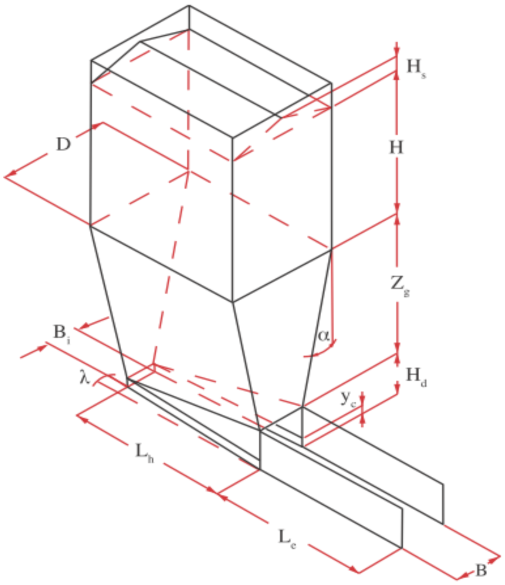
	S4.10	Attachment Method	-	BIBIKON LOCKING ELEMENTS
		Carry and Return Rollers		
	S5.01	Manufacturer	-	ITR (CATERPILLAR EQUIVALENT)
	S5.02	Model Number	-	25/DE4 / 38/315
	S5.03	Number of Carry Rollers	-	10
	S5.04	Number of Return Rollers	-	4
	S5.05	Lubrication	-	SEALED - LIFETIME LUBRICATION
	S5.06	Bearing Life	Hrs	>100000
	S5.07	Bearing Size/Model	-	TAPERED ROLLER / TBA
		Pans		
	S6.01	Material	-	MANGENESE STEEL
	S6.02	Thickness	mm	30
	S6.03	Number of Pans	-	38
	S6.04	Pan Stiffening Rib Height	mm	27
	S6.05	Chain Attachment Details	-	BOLTED - TRACK BOLTS AND NUTS
	S6.06	Number of Impact Rails	-	ONE
	S6.07	Feeder Length Required for Replacement	mm	500
		Drive Motor		
	S7.01	Manufacturer	-	ZEST
	S7.02	Model/Type	-	WEG
	S7.03	Size	kW	30
	S7.04	Voltage/Phases	V/Ph	400 / 3 Ph
	S7.05	Frame	-	200L
	S7.06	Speed	rpm	1475
	S7.07	Start Torque at Recommended Start Current Limit	Nm	TBA
	S7.08	Feeder Start Torque Requirements	Nm	TBA
	S7.09	Recommended Start Type	-	DOL
	S7.10	Time to Reach Full Speed with Recommended Starter & Current	s	TBA
	S7.11	Pull Out Torque	Nm	475
	S7.12	Full Load Current	A	64.8
	S7.13	Minimum Time Delay Between Starts	s	TBA
	S7.14	Rotating Mass Inertia	kgm²	TBA
	S7.15	Feeder Power Draw at Design/Maximum Capacity	kW	21
	S7.16	Terminal Box IP Rating	-	IP55
	S7.17	Terminal Box Size	-	STANDARD
	S7.18	Number of Terminal Boxes	-	ONE
	S7.19	RTDs Type/Quantity - Windings	-	N/A
	S7.20	RTDs Type/Quantity - Drive Bearings	-	RESISTORS
	S7.21	RTDs Type/Quantity - Non-Drive Bearings	-	RESISTORS
	S7.22	Shaft Grounding Brushes in Design	Y/N	TBA
	S7.23	Maximum Number of Starts (Cold)	/hr	TBA
	S7.24	Maximum Number of Starts (Running Temp)	/hr	TBA
	S7.25	Insulation Type	-	F
		Couplings		
	S8.01	High Speed		N/A
	S8.02	Manufacturer	-	N/A
	S8.03	Model	-	N/A
	S8.04	Service Factor	-	N/A
	S8.05	Low Speed		N/A
	S8.06	Manufacturer	-	N/A
	S8.07	Model	-	N/A
	S8.08	Service Factor	-	N/A
		Gearbox (If Required)		
	S9.01	Design Standard	-	ISO6336
	S9.02	Manufacturer	-	BREVINI
	S9.03	Model	-	SC8504
	S9.04	Mounting	-	SHAFT
	S9.05	Reduction Ratio	:1	388
	S9.06	Efficiency	%	95
	S9.07	AGMA Rating - Durability	-	TBA
	S9.08	AGMA Rating - Strength	-	TBA
	S9.09	Main Bearings L_{10} Life	Hrs	150539
	S9.10	Main Bearings Seal Type	-	RUBBER SINGLE LIP
	S9.11	Number of Stages	-	4
		Drive Shaft		
	S10.01	Material Specification	-	BS970 709 M40 (EN19)
	S10.02	Diameter at Sprocket Hub	mm	185
	S10.03	Bearing Designation	-	SNL 3140

	S10.04	Bearing L10 Life	Hrs	>100000
		Tail Shaft (If Applicable)		
	S11.01	Material Specification	-	BS970 709 M40 (EN19)
	S11.02	Diameter at Sprocket Hub	mm	155
	S11.03	Bearing Designation	-	SNL 3134
	S11.04	Bearing L10 Life	Hrs	>100000
		Hydraulic System		
	S12.01	Required	Y/N	N/A
	S12.02	Power Pack - Motor Size	kW	N/A
	S12.03	Maximum Pressure	kPa	N/A
	S12.04	Accumulator Capacity	m^3	N/A
	S12.05	Oil Capacity	L	N/A
	S12.06	Oil Specification	-	N/A
		Oil Cooling System		
	S12.07	Required	Y/N	N
	S12.08	Details of System	-	N/A
	S12.09	Cooling Capacity	kW	N/A
	S12.10	Number of Fans	-	N/A
	S12.11	Installed Power Requirements	kW	N/A
	S12.12	Absorbed Power Requirements	kW	N/A
		Lubrication System		
	S13.01	Manufacturer	-	LINCOLN LUBRICATION SA
	S13.02	Control Philosophy	-	PROGRESSIVE - PLC CONTROLLER
	S13.03	Lube Pump		PISTON PUMP
	S13.04	Type/Manufacturer	-	LINCOLN
	S13.05	Flowrate	L/s	VARIABLE (0 - 250 cm^3/hr)
	S13.06	Pressure	kPa	350
	S13.07	Motor Size	kW	0.09
		Oil Filter		
	S13.08	Type/Manufacturer	-	N/A
	S13.09	Automatic Duty/Standby	-	N/A
	S13.10	Opening Size	-	N/A
	S13.11	Expected Life	Hrs	N/A
	S13.12	Oil Capacity	L	N/A
	S13.13	Oil Specification	-	N/A
	S13.14	Grease Reservoir Capacity	Days	30 KG
		Lubrication Heater System		
	S13.15	Required	Y/N	NO
	S13.16	Heating Capacity Required	kW	N/A
	S13.17	Power Requirements	kW	N/A
		Electrical and Instrumentation		
	S14.01	Control Panel	-	REMOTE
	S14.02	Enclosure IP Rating	-	IP65
	S14.03	Power (Volts/Amps)	-	400V / 3 Ph
	S14.04	Details of Instrumentation	-	TBA
		Mass of Components		
	S15.01	Apron Feeder Pan (1 Only)	kg	94
	S15.02	Feeder Assembly (Excluding Drive)	kg	7077
	S15.03	Drive Assembly	kg	1055
	S15.04	Hydraulic Power Pack (If Applicable)	kg	N/A

Key Dimensions

Bin/Hopper





APPENDIX M

Technical Specification: Dust Collection (Bag House)

Document Number 1924701-2-214-M-SP-0003

Document Details

Ref (SA)	1924701-2-214-M-SP-0003
Date	9 May 2014
Prepared by (SA)	Mark Mc Hugh

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
OA	9 May 2014	Issued for Tender	Mark Mc Hugh – Lead Mechanical Engineer	-
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Contents

1.0 Introduction

1.1 Overview

Transnet is undertaking a major programme of projects in Cape Town, Saldanha and Postmasburg to upgrade and expand the capacity of their infrastructure, as part of Transnet's Market Demand Strategy. The Scope of this project is to increase the materials handling capacity at Saldanha Port primarily by the addition of Tippler 3 and associated conveyors and rail infrastructure.

1.2 Purpose

This specification sets out the minimum technical requirements for quality and workmanship for all necessary engineering, design, management and co-ordination, supply of all drawings, manuals and documents, supply of materials plant and labour for the manufacture, construction, erection, testing and commissioning of the **Dust Collection Systems** and all associated auxiliary equipment by a suitable *Contractor*.

This specification shall be read in conjunction with Document Number 1924701-2-211-M-SP-0003: Technical Specification for the design, manufacture, construction, erection, testing and commissioning of a Dual Wagon Tippler 3, Feed Hoppers, Apron Feeders and Dust House for the Port of Saldanha.

The Saldanha Bulk Terminal Iron ore handling facilities have a current throughput of 58Mtpa and currently operate 2 Dual Wagon Tipplers as part of the unloading circuit. Transnet has engaged AECOM to undertake the EPCM delivery of an expansion project. Included within the scope of this project is a new third dual wagon tippler (Tippler 3). A conveyor network will connect the new tipplers to the existing material handling system.

1.3 Equipment Scope of Supply

The scope of this specification comprises the design, supply, fabrication, shop assembly and testing, surface protection, packaging, delivery, installation and commissioning of new Tippler Bag Houses as specified in the datasheet, including all necessary ancillary equipment in accordance with:

- This specification
- The equipment datasheet included in Annexure O of the Works Information
- The *Contractor* Documentation Schedule list in Annexure A of the Works Information

The *Contractor* shall provide the specified equipment in accordance with the intent and the provisions of this specification and all other documents, codes, standards, and requirements referred to or included in this specification.

Obligations not expressly mentioned in the specifications, but which are necessary for the provision of complete operational equipment, ready to install and commission, shall be deemed to be included in the contract at no additional cost to the *Employer.*

The *Contractor* shall provide all resources, technology, processes, plant, equipment, materials and support facilities, necessary to provide the specified equipment to the *Employer,* including but not limited to, engineering, planning, supply of material, temporary work, warehousing, labour, supervision, fixed equipment and plant, infrastructure, emergency and first aid facilities, tools, miscellaneous materials, minor parts, communications, services and each and every item of expense, unless expressly excluded from the scope of supply in the provisions set out hereunder.

1.4 Scope of Equipment Supply Included

The scope of work shall include the design, supply of all materials, inspection, testing, and installation and commissioning of the following:

- Complete dust collection equipment, including insertable bag dust collectors, exhaust fans, drives and rotary valves
- Clean side ducting, silencers and discharge fan
- Compressed air systems, including compressors, driers, filters, air receivers, monitoring instrumentation and pneumatic controls
- Access Platforms
- Electric motors

- Agglomerator or pug mill unit with water spray header for individually activated spray nozzles along with screw conveyor to the closest conveyor belt
- Dirty side ducting, including clean out doors, inspection doors, blast gates, dampers and duct saddle supports as specified in the drawings
- Pressure drop calculations for the system
- Lubrication lines run to an easily accessible location to allow for manual lubrication
- Review of the design drawings to indicate all required maintenance access
- Guards, in accordance with South African Standards
- Condition monitoring requirements as required by the *Employer*
- All necessary instrumentation, control and safety devices for the safe and efficient operation of the dust collector equipment with all instrumentation wired to a junction box
- Any control devices required to enable the remote control and condition monitoring from the Plant Process Control System (PCS)
- Ancillary items normally supplied with the equipment and any specials tools or instructions required to adjust or to maintain the equipment
- All items of material and equipment required for completion of the work such as all gaskets, nuts, bolts and washers
- Surface protection
- Specifications and supply of first-fill lubricants and schedule for lubrication
- Schedule of consumables (*i.e.* air, water, lubricants, filter cloths, *etc.*)
- Stainless steel nameplates affixed to all items of equipment that require identification in the field for operating and maintenance functions, including motors, instruments, switches, filters and valves. The Employer will provide equipment numbers
- *Contractor* participation in regular meetings with the *Employer* as required
- Inspections, shop assembly, trial fit-up, testing and match marking, as applicable
- *Contractor* documentation as specified in the *Contractor* Documentation Schedule as found in Annexure A of the Works Information
- System functional description suitable for control system programming
- Packaging suitable for transportation
- Delivery, as nominated
- Provision of commissioning spares
- List of recommended operation spares for two (2) years and insurance spares
- Provision of suitably qualified personnel to supervise the installation and commissioning

1.5 Scope of Equipment Supply Excluded

The scope of this work excludes:

- Service piping outside the battery limits, which does not form an integral part of the dust collection installations
- Power supply, control and instrument wiring outside of the battery limits, which do not form an integral part of the dust collection installations
- Concrete Foundations, hold down bolts and grout

2.0 Definitions and Abbreviations

2.1 Definitions

Table 1: Definitions

Employer	has the meaning defined in the Contract and includes their respective successors and assigns
Project Manager	means the Project Manager as described in the Contract
Site	means the Saldanha Port (final installed location of the Dual Wagon Tippler Facilities)
Contractor	means the *Contractor* engaged under the contract for the supply of the Dual Wagon Tippler Facility
Subcontractor	means a subcontractor or their subsidiary engaged by the *Contractor*
Dual Wagon **Tippler Facility 3**	Includes the Dual Wagon Tippler, Feed Hoppers and Chutes, Apron Feeders, Apron Feeder Level Structural Steel Floor and Bag House (including agglomerators)

2.2 Terminology

“Shall” is used to indicate that the *Contractor* is required to take action.

“Should” is used to indicate that the *Contractor* is advised to take action.

“May” is used to indicate that the *Contractor* is permitted to do something, or that the *Employer* reserves the right to do something, according to context.

“Approved” / “Approval”, unless otherwise qualified, means normal, written agreement by *Employer* to a proposal by the *Contractor.*

2.3 Abbreviations

Table 2: Abbreviations

Term	Description
ISO	International Standards organization
EIC	Electrical, Instrumentation & Control
FEA	Finite Element Analysis
PLC	Programmable Logic Controller
SWL	Safe Working Loads
VSD	Variable Speed Drive

3.0 Referenced Documents

Table 3: Referenced Documents

Document Number	Document Title
1924701-2-214-M-DS-0003	Bag House Data Sheet
1924701-C008-SCH-0001	Dust Collection (Bag House) *Contractor's* Documentation Schedule (CDS)

4.0 Engineering

4.1 Design

4.1.1 Units

The SI system of metric units shall be used for this Project.

4.1.2 Language

All data shall be in the English language.

4.1.3 Drawings

The *Contractor* shall submit ALL mechanical, structural, electrical and instrumentation drawings, for approval by the *Employer*.

The full list of documentation requirements is included in the *Contractor* Documentation Schedule (document 1924701-C008-SCH-0001) included under Annexure A of the accompanying Works Information document.

The *Contractor* shall maintain records and prepare “As-Constructed” documents (for all documents, drawings and Operation and Maintenance manuals etc.) on completion of the *works*. The “As Constructed” documents shall demonstrate compliance with project specifications and drawings. All mark ups shall be drafted with revised status and supplied to the *Employer* in both hard and electronic format.

The *Contractors* “As-Constructed” documents shall be signed by the *Contractor* and submitted to the *Employer* for approval as developed and at completion of the work. Software copies of the “As Constructed” documents will be accepted in Autocad 2004 (or later) to be loaded into Bentley MicroStation V8 software.

“As Constructed” drawings shall be submitted as per the requirements as set out in the “*Contractor* Documentation Submittal Requirements” (DOC-STD-0001) included under Annexure B of the accompanying Works Information document.

4.1.4 Calculations

Calculations shall be neat and legible and contain the following in the order as stated below:-

- Summary of assumptions and conclusions
- Table of contents
- List of all associated drawings
- List of all text and references used
- Nomenclature
- Calculations shall include, but not be limited to, the following areas.
    - Machine performance / capacity
    - Maximum power demand
    - Brake Performances
    - Gear ratings and life
    - Bearing life
    - Structural analysis for strength, serviceability and stability
    - Mechanical analysis

  - Dynamic analysis
  - Hydraulic system power, pressure loss and thermal loads
  - Water system analysis
  - Lubrication system design
  - Electrical Fault levels
  - Maximum demand and transformer loading
  - Cable sizing
  - Overload protection settings
  - Contribution to system harmonics
  - Electrical equipment selection criteria

Calculations shall be prepared and checked by Engineers registered as Professional Members of the Engineering Council of South Africa (ECSA) or equivalent institution recognised by ECSA. Calculations shall not be prepared and checked by the same person. Checked calculations are required before the commencement of fabrication.

4.1.5 Structural Design Review

The *Employer* will conduct an independent review of the dust collection (bag house) structural design and fatigue analysis. The *Contractor* must make allowance for the supply of required documentation and the time required to facilitate a structural review. The review will include a review of FEA work performed by the *Contractor*. Feedback and results of the design review will be made available to the *Contractor*.

4.1.6 South African Electrical Compliance

Any equipment designed and fabricated/manufactured overseas shall have an electrical certificate of compliance to South African Regulations before it is delivered and operated in South Africa. The compliance certificate(s) shall fully cover High Voltage, Medium Voltage and Low Voltage. These certificates will be issued by an accredited South African Professional Engineer.

4.1.7 *Employer* QA Representative

The *Contractors* QA requirements will be as set out in the “General Quality Requirements for *Contractors* and Suppliers” (ACM-QM-STD-001) included under Annexure F of the accompanying Works Information document. The *Employer* may choose to appoint a QA/QC representative to monitor and report on some or all aspects of the production and fabrication processes. It is expected that full cooperation will be extended to the appointed QA/QC representative. Associated costs for this service will be borne by the *Employer*.

4.1.8 *Contractor’s* Subcontractor Declaration

Where work is performed by a subcontractor of the *Contractor* they will be declared to the *Employer*. This will include any subcontractors operating on or at the *Contractor’s* fabrication and assembly facility.

4.1.9 Hazardous Materials

The following materials shall not be used or installed:

- Asbestos in any form
- PCBs (poly-chlorinated biphenyls)
- Mercury
- Viton Seals
- Any paints containing lead or chromates (including in the tinters)

5.0 Codes, Standards, Specifications and Regulations

5.1 General

The sequential order of precedence applicable to the use of the codes, standards, specifications and regulatory requirements for this project is as follows:

i. Regulatory Requirements.

ii. Transnet Project Guidelines, Specifications and Standards.

iii. South African Standards.

iv. International Standards.

In the event of an inconsistency, conflict or discrepancy between any of the standards, specifications and Regulations, the most stringent and safest requirement applicable to the project will prevail. Any inconsistencies critical to the design shall be brought to the attention of the *Employer* for resolution, prior to construction. The design shall comply with the latest revision of the following standards, plus any other applicable standards:

All equipment, components, design, materials, workmanship, services and *works* shall be covered by the applicable provisions of the latest editions of the relevant codes, standards, specifications and regulations, including but not limited to those listed in this Section.

Where there is no applicable South African standard, the latest appropriate ISO, British, German, American, Japanese, Australian or other approved standard shall apply. The use of non-South African Standards shall be approved by the *Employer* in writing.

5.2 Government Acts and Regulations

The *Contractor* shall be responsible for compliance of all *works* with Government Acts, By-laws and Regulations, both State and Federal, including but not limited to the following:

- Mine Health and Safety Act 29 of 1996
- Occupational Health and Safety Act 85 of 1993
- Minerals Act 50 of 1991
- National Water Act 36 of 1998
- Atmospheric Pollution Prevention Act 45 of 1965
- Environmental Conservation Act 73 of 1989
- Promotion of Access to Information Act 2 of 2000
- National Road Traffic Act 93 of 1996
- National Environmental Management Act 107 of 1998

5.3 South African

The *Contractor* shall be responsible for compliance of all *works* with South African Standards, including but not limited to the following:

Table 4: South African Standards

Code	Standard Title
SABS 142	Wiring Code
SABS 1222	Enclosures for Electrical Equipment
SABS 1507	Electrical Cables
SABS 156	MCBs and MCCBs
SANS 347	Categorization and Conformity Assessment Criteria for All Pressure Equipment

Code	Standard Title
SANS 357	Heat Treated Steels, Alloy Steels and Free-Cutting Steels
SANS 1465	Steel Castings
SABS 1200 H	Structural Steelwork
SANS 10044	Welding
SABS 0162	The Structural Use of Steel
SABS ISO 1461	Hot Dip Galvanised Coatings on Fabricated Iron and Steel Articles
SABS 10160	General Procedures and Loadings to be Adopted for Design of Buildings

5.4 International Standards

Current editions of the relevant International Standards Codes or Publications that shall apply include, but are not limited to, those listed in **Error! Reference source not found.**.

Table 5: International Standards

Code	Standard Title
ISO 281	Rolling bearings - Dynamic load ratings and rating life
ISO 281/1	Ball and Roller Bearings
BS 5227	AC Metal Enclosed Switchgear (Must be Lockable)
BS 162	Electrical Power Switchgear
IEC 60129	AC Disconnectors (Isolators) and Earthing Switches
IEC 60439	Factory-Built Assemblies of Low Voltage Switchgear and Controlgear
IEC 60947	Low Voltage Switchgear and Controlgear
IEC 60948	Switch Disconnectors
BS 6231	PVC Insulated Cables for Switchgear and Controlgear Wiring
BS 3858	Binding (Identification Sleeves for Cables and Wires
IEC 60034/SDEL-005	Electric Motors
BS 5304	Code of Practice for Safeguarding of Machinery
AGMA 6000	Specification for Measurement of Linear Vibration on Gear Units
ASTM A609/A609M	Standard Practice for Castings, Carbon, Low-Alloy, and Martensitic Stainless Steel, Ultrasonic Examination Thereof
ASTM E709	Standard Guide for Magnetic Particle Examination
BS EN 10204:2004	Metallic materials. Types of inspection documents
ISO 281	Roller bearings – Dynamic load rating and rating life
ISO 1940	Balance Quality Requirements of Rigid Rotors

5.5 Drawings and Drawing Standards

Drawings shall be in accordance with Transnet Capital Projects: Project Development and Execution: ENG-STD-0001, which will be made available on award of the contract. The drawings applicable to the supply of the dust collection system are listed under Section 5 of the Works Information.

5.6 Standard Specifications

The *Contractor* shall be responsible for compliance of all *works* with *Employer* standard specifications, including but not limited to the following:-

Table 6: Standard Transnet Specifications

Specification Number	Specification Title
SBH8/2/2	General electrical equipment
SBH8/2/3	Electrical motors and generators
SBH8/2/6	Lighting on equipment
SBH8/2/8	Testing & commissioning of electrical equipment
SBH8/2/9	Electronic equipment
SBH8/2/11	Medium voltage equipment for port equipment
SBH9/2/2	Hydraulic equipment
SBH9/2/4	Gearing, shafts, bearings, brakes, lubrication, vee-belts, keys and keyways
SBH9/2/6	Structural Steelwork
HE9/2/7	Compressed air systems
SBH9//2/8	Corrosion protection
SBH9/2/9	General requirements & conditions

6.0 Site Conditions

6.1 Project Location

The Saldanha port facilities are in the Port of Saldanha in the Western Cape region of South Africa. Saldanha is located approximately 100 km North of Cape Town.

6.2 Site Conditions

The equipment shall be suitable for installation within a harsh industrial environment as indicated in **Table 7**.

Table 7: Site Conditions

Condition	Description
Altitude	Sea Level
Air Temperature	45°C Maximum; -5°C Minimum
Equipment Surface Temperature (from sun)	60°C Maximum
Relative Humidity	50% Minimum; 85% Maximum; 60% Average
Air Quality	Coastal salt- laden air with high concentration of iron ore dust

Condition	Description
Air Pressure	101.3 kPa
Average Annual Rainfall	278 mm

6.2.1 Seismic Data

The designs of the Tippler Buildings conform to SANS 10160. The buildings consist of reinforced concrete wall and column framed structures with steel frame superstructures. The vault structures are founded on rock with side wall loading. The vaults have been designed to cater for shallow ground water tables. The buildings and superstructures are founded on piles. Seismic design considerations are as per SANS 10160-4:2011. The ground in contact with the Tippler Structures is classified as calcrete/sand and is Type 4 according to Table 1 in SANS 10160-4. The rock that is the main foundation medium is Type 1 as per Table 1 in SANS 10160-4 with Vs = 180 m/s. The Site is located in Zone 1 for seismic activity, i.e. natural seismic activity. The Tippler Buildings are considered to be Importance Class III as per Table 3 in SANS 10160-4.

6.2.2 Maximum Temperature and Thermal Rating

For the maximum ambient air temperature for design of all equipment including motors, gearboxes, and bearings refer to the equipment data sheets included under Annexure O of the Works Information.

7.0 Technical Requirements

7.1 General

The *Contractor* is to undertake the detail design of each dust collection system.

The equipment shall be designed for continuous operation in a harsh, hot, dusty and corrosive environment with a maximum ambient temperature of 50 degrees Celsius. The equipment will be exposed to the elements and cleaned by high pressure hose down.

Allowance shall be made for installing, accessing and maintaining the systems using cranes, other than the permanent gantry crane installed within the Tippler building.

The equipment shall incorporate state of the art materials and best practices, in line with modern engineering concepts to ensure maximum serviceability of the equipment in operation.

The equipment shall be designed by the *Contractor, in accordance with* standard, heavy-duty applications, suitable for continuous operation at the rated capacity for the duty as specified in the Dust House Data Sheet (Annexure O of the Works Information). Preference shall be given to equipment of standard design having easily obtainable component spares.

Equipment designs shall facilitate ease of access for handling, transportation, installation, adjustment, control, maintenance and repair. The design of the equipment and components shall feature all conveniences for assembly, installation, operation and maintenance such as motor jacking bolts, lifting lugs (marked with SWL), *etc*.

Potentially dangerous items of equipment shall be protected with guards. Guards shall be designed to facilitate manual installation, maintenance and removal. The guards shall be planned into the design of the equipment and shall not constitute a hazard. Guards shall be designed to be removed by one person, hence limited to 20 kg. Guards shall be provided for personnel protection in accordance with the requirements of the Occupational Health and Safety Act No. 85 of 1993 and as per the standards referenced in Table 4, Table 5 and Table 6 in this technical specification.

First fill lubricants shall be of a type that is suitable for the application and equivalents can readily be sourced from major reputable suppliers. Selection shall be subject to approval by the *Employer*.

The equipment shall have a minimum number of separate, split sections, taking account of the limits in shipping weight, dimensional limitations at the intended fabrication location, on-Site storage space or the dimensions of the foundations and surrounding areas.

7.2 Mechanical

The Dust Collectors shall be a complete dust collection system. The following requirements shall apply to all Dust Collectors supplied under this specification:

7.2.1 Dry Bag House Type Dust Collector

The bag house dust collector designs shall incorporate the following:

- Easily accessible hinged access doors and, as a minimum, capable of operating within the range of 85 – 110% of the airflow nominated in the Data Sheets
- Reverse pulse fabric filters supported on rigid internal wire cages for the full length of the bag
- Designed such that the bags and cages can be safely and easily replaced
- Include additional bags to allow blanking of damaged bags
- Walk-in type clean side plenums
- Connecting ducting from bag house to fan
- Stiffened housings to prevent drumming and designed to prevent the accumulation of dust and/or moisture
- Warp-free design bag mounting plates with precision cut openings
- Means for safely and easily raising and lowering replacement bags
- Discharge hoppers, designed for two thirds full dust loading and provided with high loading level alarm, access doors and clean out doors
- Reverse-pulse air filtering and drying systems, arranged for in service changeover of the filters (where applicable)
- Support structure(s), walkways, access platforms, stairways and hand railing. Ladders will not be permitted

The *Contractor* shall provide all additional instruments and devices required to provide a safe, efficient overall operation that ensures equipment and personnel protection.

Dust entry into dust collectors shall be into the hopper of the filter, suitably positioned so as to allow pre-separation of dust particles and moisture from the conveying airflow. The use of blast panels or the like shall not be accepted.

The Dust Collector shall be installed complete with all structural support steelwork as indicated on the drawings, including all access platforms and safety hand railing. Any special requirements for access or maintenance platforms shall be clearly outlined in the initial quotation.

The Dust Collector body shall be fabricated from steel sheet or plate with rolled steel flat bar sections on edge and externally welded to provide a rigid and airtight enclosure. External stiffeners are preferred due to the likelihood of possible build-up of foreign substances, which could lead to blockages within the Dust Collector.

The Dust Collector shall preferably be a single piece, fully welded construction. Where physical size dictates, modular construction may be accepted, provided that the final assembly is fully weather proof, air-tight and capable of withstanding the specified design peak fan static positive and vacuum pressures.

Special attention shall be taken to ensure that all external welds are continuous to prevent any ingress of rain water, which would accelerate rust and have a detrimental effect on the product.

The Dust Collector body shall be constructed from a minimum of 5 mm plate and the dust hoppers beneath the dust collector body from 6 mm plate.

The Dust Collector body shall be stiffened externally with evenly spaced vertical supports, which shall be fully welded. Horizontal stiffeners, where approved, shall be suitably declined so as to prevent build-up of material or rainwater.

Dust Collector casings shall be airtight to withstand the design peak fan static positive and vacuum pressures as specified on the equipment data sheet.

All calculations relating to structural integrity of the Dust Collector vessel shall be provided. Overall design shall be subject to approval.

The Dust Collector shall have top access with maintenance doors fitted to a minimum 1% slope to the roof, to shed rainwater. There shall be no areas where rainwater could accumulate. Full safety hand railing and kick plates shall also be provided, with allowance made for drainage below kick plates with no more than 10 mm clearance.

Trafficable areas of the roof of the Dust Collector, including clean side access panels shall, as a safety feature, be fabricated from non-slip floor plate. Access panels shall have internal stiffeners and hinge bars, as external stiffeners are considered to be a personnel safety hazard.

All filter bag access panels shall be hinged and fitted with 40% compressible closed cell neoprene seals to ensure a complete airtight seal.

Quick-action door fasteners shall be used and shall be fitted with alloy wing-style fixings of fabricated or cast construction. Plain steel fittings shall not be used. 316 Grade Stainless Steel shall be used for all threaded door fastener spindles.

Door fasteners shall be positioned so as not to create a safety trip hazard at access points to stairs or landings.

No specialised tools shall be required to open access panels.

Sealants used in the jointing shall be non-hardening and shall be suitable for use in the stated environmental conditions without detriment or breakdown due to ultraviolet light or weathering.

7.2.2 Rotary Discharge Valves

The design of the rotary discharge valves shall incorporate the following:

- Floating-shoe design with ceramic wipers and isolation gates
- Cast iron housings with abrasion resisting rotors and outrigger ball or roller bearings
- Direct coupled motorised drives
- 5 m length discharge pipe

7.2.3 Filter Bags

Calculations for the sizing and selection of area of filter media and Air to Cloth Ratio shall be prepared and submitted for approval.

Airflow shall be calculated based on the methods shown in the publication Industrial Ventilation: A Manual of Recommended Practice (26th *ed.*) by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers). All selection criteria shall be listed, for approval.

Wire Support Cages shall be fabricated from zinc-plated or electro-galvanised wire. Cages shall be constructed in three pieces, made of 4mm (minimum) diameter wire. Any fabricated component fittings on the cages shall also be zinc-plated or electro-galvanised.

Wire cages shall be straight and of uniform cross section and free from any weld spatter or sharp edges or protrusions so as not to cause damage to the filter cloth.

Venturi attachments, to enhance the pulse cleaning, shall be fitted and shall be specifically designed as an integral unit, matching the length and diameter of the filter bags. The dirty air inlet shall not point directly onto the filter bags.

Filter bags shall be pulse-cleaned by timed blasts of clean and dry, compressed air. The volumetric air requirement of each Dust Collector/filter unit and required air pressure shall be nominated. Reverse air systems shall be considered with approval from the *Employer.*

Filter bags shall be Polyester or Polypropylene. A full specification of the material offered shall be provided, including a representative sample of a completed filter bag/wire cage/pulse valve/blow pipe.

For top access Dust Collectors the SNAP-CUFF type attachment is preferred. Cell plate holes shall be punched, CNC plasma or CNC laser (preferred) cut to ensure accuracy. Oxy cut cell plates shall not be accepted.

Full details of the bag attachment shall be clearly detailed prior to purchase.

7.2.4 Pulse System

A compressed air pulse system shall be provided for cleaning the dust collector bags and all compressed air piping between the compressed air shutoff valve and the dust collector compressed air manifold shall be provided.

Cleaning of the filter bags shall be by timed pulses of compressed air controlled by solenoid valves. The differential pressure between the tube sheet and hopper shall be monitored and the cleaning pulse shall be applied as required to protect the bags from over-pressurisation. Pressure switches/gauges shall be provided to monitor and alarm dirty bag conditions.

All necessary equipment to clean the filter bags, including pulse air controller, diaphragm valves, solenoid valves and blow pipes complete with individual nozzles for each filter bag shall be installed.

The compressed air volume and required air pressure shall be specified prior to purchase.

The compressed air manifold shall be suitably sized to store sufficient compressed air for the cleaning cycle.

Any special requirements for pulse sequencing shall be highlighted prior to purchase.

The type and specification of all pulse valves shall be subject to approval by the *Employer*.

7.2.5 Rotary Valves

The final type, configuration and specification of rotary valves shall be subject to approval by the *Employer*.

Any variation to this specification shall be nominated prior to purchase.

Drawings of the valves offered shall be required, showing cross sectional elevation and full specification of all component parts, materials and recommended spare parts.

The non-drive end of the shaft of the rotary valve shall be fitted with under-speed detection equipment.

7.2.6 Exhaust Fans

The Dust Collector exhaust fan shall operate on the clean air side of the Dust Collector.

The Dust Collector exhaust fan shall be a single-width, single-inlet unit, designed for a single direct drive motor.

Flexible connections in outdoor locations shall be fitted with a weather and UV protective cover that shall be supported from one side of the connection.

The Dust Collector exhaust fan impeller shall be centrifugal type with backward inclined, laminar or aerofoil form of blade, incorporating internally reinforced blades with a solid leading edge. The hollow formed blades shall be dye checked and pressure tested to 70 kPa, with pressure taps being seal-welded prior to dynamic balancing.

The fan impeller shall be keyed to the shaft and positively located using a bolted keeper plate to prevent the impeller slipping along the shaft.

Fan shafts shall be supported in plummer block bearings.

Grease lubricated bearing seals shall be taconite grease-purged labyrinth type.

Fan bearings shall not to be guarded and shall be readily accessible for condition monitoring whilst in operation.

The Dust Collector exhaust fan casing shall be capable of being split, to allow the impeller/shaft assembly to be lifted clear for maintenance. Large access doors for fan internal inspection, and to allow high pressure water jet cleaning of both sides of the impeller and fan casing (when stationary) shall be provided together with a large drain socket.

Fans shall have flanged outlet and inlet flexible connections.

Fans shall be provided with a sound attenuator with suitable supports as necessary.

7.2.7 Dust Disposal

The dust disposal system comprises a screw-type transfer conveyor, which intermittently receives dust from the dust collector hopper rotary valves and delivers it to a dust weigh hopper. The weigh hopper shall be batch filled up to a set point mass of dust before discharging into an agglomerator type paddle mixer or pug mill for mixing with water to produce a bony mix of bulk solids.

The dust transfer system up to the agglomerator shall be fully sealed to prevent the escape of dust.

The transfer conveyor in the Car Dumper and conveyors generally in other areas shall have full length skirts and dust covers. The discharge chutes from the dust collector rotary valves to the transfer conveyor and the transfer conveyor to the weigh hopper shall be fully sealed with the connection between the transfer conveyor discharge and the weigh hopper inlet having a flexible connection to enable accurate weighing of dust in the weigh hopper. The transfer conveyor inlet chute shall be vented back to a dust collector hopper to prevent over pressurisation of the system.

The agglomerators shall be equipped with a water control valve, flow meter and water spray bar for addition of a metered quantity of raw water to achieve consistent batch slurry densities. After a set mixing time, the agglomerator shall discharge the bony mix of iron-ore solids to the conveyor feed chute, which discharges directly onto the conveyors.

A control sequence for the slurry batch-mixing system and the set-points for control of the dust disposal system shall be provided, which shall be implemented in the plant process control system.

7.2.8 Compressed Air Equipment

The specified Free Air Delivery (FAD) shall be achieved under the most adverse combination of temperature and relative humidity at the Site.

The *Contractor's* standard starting, load following and energy saving control systems and strategies shall be supplied with the compressors.

The compressor inlet air filter system shall be designed to remove all particulate matter that may cause damage or undue wear to the compressor. In addition the system shall prevent the induction of water into the compressor from rain, equipment hose down or any other source. A filter restriction indicator, marked to indicate when the filter element requires cleaning, shall be provided on the compressor control panel. The air inlet filter may be combined with the air inlet silencer.

The desiccant/adsorption type of air dryer is preferred. Dryer and compressor instrumentation and protection systems shall be commensurate with the modular approach to the system.

High pressure air filters shall be supplied with flanged air inlet and outlet connections. The filter shall be the removable cartridge type, and the casing shall be provided with an automatic condensate drain trap.

Each air receiver shall be a pressure vessel, with mounting skirt or legs and supplied with:

- 100 mm (nominal) diameter pressure gauge and gauge isolation ball valve
- Safety relief valve (adjustable) with easing gear, sized in accordance with Regulations and shall as a minimum allow venting of the full output of a single compressor
- Spare plugged ½" BSP shell connection
- Two (2) inlet and two (2) outlet connections for air
- Inspection port
- Automatic condensate drain traps
- Low pressure switch (if not included in pulse system manifold)

The air receivers shall be designed, fabricated, inspected, tested, approved, certified and stamped by the Statutory Authorities as a pressure vessel in accordance with South African Standards. Design calculations shall be provided by the *Contractor.*

All drain traps shall be provided with a manual isolation ball valve. All drain traps associated with the compressors, dryers and filters shall be to a standard approved by the *Employer*.

All moving parts accessible from either outside an acoustic enclosure or inside an acoustic enclosure, while doors are opened for maintenance access, shall be guarded. This applies in particular to cooling and air fans.

The compressor and after-cooler shall be cooled by the use of an air-blast oil cooler located within the acoustic enclosure.

The design of the compressor sub frame and base plate, if separate from the steel frame skid base for the entire module, shall be such that pockets of liquid or lubricant spillage do not accumulate. Oil containment frames shall be supplied.

Sub frames shall be provided with alignment jacking bolts to facilitate drive alignment.

7.2.9 Dryer

The dryer is to be sized to suit the maximum flow from the compressors, with compressors running under full load conditions.

7.2.10 Filters

The filters are to be sized to suit the maximum flow from the compressors, with the compressor running under full load conditions and with adequate provision to ensure satisfactory service life between maintenance intervals.

7.2.11 Condensate Oil Separator

The condensate oil separator is to be sized to suit the maximum condensate flow from the compressors, the plant air receiver (to be located adjacent to the compressors), the filters and the dryer on Site. In addition, one instrument air receiver will be located downstream of the dryer and any condensate from this will also be directed to the oil separator.

7.2.12 Safety and Security Guards

Guards shall be provided for personnel protection in accordance with the statutory regulations and mechanical equipment specification.

7.2.13 Ductwork

Duct losses may be calculated using either the Velocity Pressure Method or the Equivalent Length Method.

Calculations shall identify all assumptions that are made and a credible basis for making such assumptions. The calculations shall be provided to the *Employer* for approval.

Long, straight sections of the run-of-duct between the dust source and the Dust Collector shall require approximately 5 % of “Green” together with a loose flange for Site fit-up.

Lobster-back bends shall have maximum 15° segments and be fully welded externally. Maximum out of square or out of line shall not exceed ± 1° and all bends shall be flanged.

Adequate access is required to all bends for regular maintenance.

Ducting shall be fitted with a loose flange or similar, approved fitting at every change of direction to facilitate fit-up.

Ducting shall be of fully welded construction with minimum 3 mm thickness grade 250 steel for straight lengths and 5 mm thickness abrasion resisting steel for bends. Duct thicknesses are dependent upon duct diameter and pressure and shall be determined using structural analysis with the above used as a guideline only. Individual straight lengths shall not exceed 5 m between flanges and every second length shall be provided with one clean out door on the bottom of the duct and one inspection door on the top of the duct.

Ducts of round or rectangular section ≥ 350 mm shall be provided with clean out / inspection ports fitted at approximate 10 m centres. These shall be located immediately after any major change in direction.

Inspection openings shall be located where possible on the top of the duct and midway between clean out openings. Smaller ducts shall include break sections that can be removed clear of connecting duct.

Doors shall be hinged, secured with quick action peg and pin fixings and sealed with a rubber gasket. Clean out doors shall be mounted in the lowest section of the duct.

The doors shall be manufactured by reusing the segment of duct as the door and reinforcing the perimeter with a flat bar flange welded externally.

Branch ducts should enter a header on the side or on the top and shall not enter at or near elbows or opposite each other.

All branch ducts shall enter the main line duct at a cone. Cones shall have a maximum included angle of 30°. Branch ducts shall enter the cone at an angle between 30° and 45°. The intersection point for the entire line of the branch shall be set back from the large end of the cone by 100 mm minimum. All duct fittings (cones and bends) shall be flanged. Flanges shall be cut from minimum 6 mm plate on round or rectangular ducts of up to 350 mm diameter. Rolled equal angles of minimum 6 mm thickness may be fitted on larger ducts. Drilling shall be in increments of 8, 16 or 32 holes.

Bends shall be minimum 2D (2 x Duct Diameter), preferably 3D, unless notified otherwise.

All bends and one straight duct diameter length shall be fabricated from Bisalloy Bisplate 400 (or approved equivalent) and fitted with lifting lugs and flanges.

Damper (blast) gates shall be provided with drilled plates to fix the plate and show its operating position. Damper gates shall be provided on all branches not closer than 10 diameters to the header. Damper gates shall be fitted adjacent to each extraction hood and shall be of the slide or guillotine type with a means of locking the gate at the adjusted position. All component parts subjected to airborne high abrasion shall be manufactured from Bisalloy Bisplate 400 (or approved equivalent).

Velocity traverse test points (comprising a DN25 half socket with screwed plug) shall be located in each branch duct and between entries on the header and both sides of the fan, for the purpose of performing a Pitot Tube Traverse. These points shall be located in a convenient and accessible position, approximately 6 – 8 duct diameters upstream of the hood or branch cone being tested.

Air velocity within ducts should remain in the region of 20-25 m/s, with hood entrance velocities of 1 m/s nominal (2 m/s maximum).

Total flow rate required for each duct leg shall be provided by the *Contractor*

8.0 Civil and Structural

The design of the base support structures for the Dust Collector Systems shall be by the *Employer*, however, the *Contractor* shall provide all information necessary for the design of the footings and support structures. The *Contractor* shall provide certified design loads for unloaded and loaded conditions at the worst case operating points.

All structural design, including loading conditions, shall be in line with the Structural Design Criteria nominated in Section 5.0.

Dust extraction ducting and ducting supports shall be designed for a partially or totally blocked condition, depending on duct diameter, as given in Table 8.

Table 8: Duct Loading Condition

Duct Diameter (mm)	% Loaded
D ≤ 700	100
700 < D < 1300	Varies Linearly From 100 to 50
D ≥1300	50

A maximum dust density of 2.4 t/m³ shall be used when calculating duct loadings. Wind loading shall also be taken into account.

A blocked dust ducting condition can only occur in horizontal ducting and therefore vertical ducting does not need to be considered for this loading condition. A blocked duct loading condition shall be considered in the same context as a blocked chute condition for determination of load factors and combinations.

The maximum support spacing shall be 4 m for ducting diameter ≤ 200 mm, and 6 m for larger ducts unless otherwise approved by the *Employer*. Structural analysis shall be done on all duct systems to determine minimum thickness of ducts (including effects due to inspection and clean-out doors) and minimum support distances.

Wherever possible ducts shall be supported from below using an under-saddle, with a flat bar strap over double-nutted -threaded tensioning rods.

In all cases duct supports shall involve the duct being securely cradled and located using an over or under strap with galvanised tensioning rods and double nutted.

Small section ducts up to 350 mm may be supported by hangers comprising two bolt minimum full circle clamps supported from the building with a rigid dropper of circular or square section tube or pipe. Support from hanger rods for ducts larger the 350 mm shall not be accepted..

All duct components shall be fully welded externally and weld penetration on the inside of the duct shall be minimised to reduce the tendency for material build-up. Flanges shall also be welded internally. Welding of the Duct Collector, ducting and supports shall conform to SANS 10044.

Drawings of the proposed duct supports showing type, location and loading shall be provided.

Gallows/knee brace type duct supports shall be the preferred method for secondary ducts extracting from conveyors. No interconnection between separate buildings shall be allowed due to the likelihood of differential settlement and transference of vibration between the structures.

Long ducts and duct supports for the dust extraction ducting spanning between the dust source collection hoods and the Dust Collector inlets shall cater for differential movement between the dust source structures and the Dust Collector support structure.

9.0 Electrical

The dust collection systems shall be designed as stand-alone units incorporating all necessary instrumentation and electrical equipment to provide adequate functionality. The dust collection system shall be fully operational on the connection of a single power supply. The system shall include all other necessary equipment for the proper operation of the system, including but not limited to:

- Wiring
- Junction boxes
- Cubicles and enclosures as required

The supply to each system shall be a single 400V (allowable voltage drop 5%), 3 phase, 4 wire, 50Hz supply from a star-connected source. The star point will be solidly earthed. The dust collectors shall be fully operational on the connection of the single power supply.

Instrumentation shall be 24V DC for field device circuits and programmable controller inputs and outputs and 230V AC single phase, 50Hz for contactor coils.

External field mounted instruments requiring routine calibration or inspection shall be provided with rain/sun shields to provide additional weather protection. All necessary sensing elements for the protection of the dust collectors and associated equipment shall be supplied and installed by the *Contractor*. Field instruments shall be sealed to IP66 standard.

As a minimum, all electrical equipment and cubicles shall be designed to IP65. Cubicles shall have bottom cable entry with removable aluminium gland plates. Electric motors shall have a minimum degree of protection of IP55. The *Contractor* shall provide a detailed logic description, in the *Employer's* standard format, of the entire dust collection system operation and interlocks. These will be integrated by others with the remote Saldanha Port PLC. The *Employer's* standard format will be made available on award of the contract.

Low voltage motors shall be 400V / 3 phase / 50Hz.

All the motor details, including motor power rating, speed, degree of protection and any special requirements relating to frame, belt loading on shaft, starting torque or speed range and control, shall be approved prior to purchase. Any additional information required for the design and specification of motor starters, VSD's and cabling shall also be included.

Fan motors shall be selected for "limit load" operation over the specified flow range.

All motor driven equipment shall be permanently marked with arrows to indicate the required direction of rotation of the drive motor. Direction of rotation marking shall not be made with adhesive labels.

Under-speed detection shall be provided on each rotary valve on the non-driven end, consisting of a star wheel and proximity switch. Sufficient tabs or teeth shall be provided on the star wheel to allow speed detection into the plant PLC. Approved alternative methods of speed detection may be offered.

Level switches shall be provided to signal high level (fault) in dust hoppers. Low level switches are not required as an empty hopper is not considered a problem.

High Level switches shall be positioned not higher than 50% of the vertical height of the dust collector hopper, shall preferably be paddle-type or tuning fork switches and shall be subject to approval by the *Employer*.

Pulse Compressed Air pressure shall be monitored by an approved pressure switch, located in each dust collector Pulse Air supply line.

The condition of the filter bags shall be monitored by a "Dwyer" Magnehelic differential pressure gauge or approved equivalent. The gauge shall be fitted with a 4-20mA analogue output, with high and low set points, to interface with the plant control system.

Pressure tappings for the differential pressure gauge shall be fitted to both sides of the Dust Collector tube plate, and shall be provided with a cleaning pulse generated by the Filter Bag Pulse Cleaning mechanism.

Differential pressure gauges and sensors shall be mounted at a height of 1500–1600 mm above an everyday trafficked walkway so as to be easily and readily viewable by operation staff. These shall be piped to the pressure tappings using 6-8 mm diameter nylon tubing via the nearest electric cable tray.

The gauge and sensors shall be protected physically and from UV within a robust sheet metal enclosure incorporating a hinged shield over the watch glass. The gauge direction shall be aligned to the Site South to help prevent UV/weathering degradation of the gauge watch-glass. This enclosure shall also contain the Solid State Sequential Pulse Timer required to control the bag-house cleaning cycle.

10.0 Fabrication and Assembly

The dust collection assembly shall be fabricated and assembly as per the Codes, Regulations and Standards mentioned in Section 5.

11.0 Identification

The dust collection assemblies shall be provided with a stainless steel nameplate fitted in plain view, which shall list the following information:

- Manufacturer's name
- Equipment designation
- Serial number or model number
- Contract or purchase order number
- Date of manufacture
- Total mass
- Unit size or important information (*e.g.* capacities, power rating *etc.*)

12.0 Acceptance, Testing and Commissioning

12.1 General

The *Employer* or designated inspection agent shall have unhindered access to the work at any time while it is in progress and the *Contractor* shall provide proper facilities for such access and inspection.

The equipment shall be completely shop assembled to ensure proper fit of all parts, including guards.

The equipment shall be supplied with the following:

- All safety signage fittings
- All equipment numbering and nameplate fittings

Unless transport restrictions dictate, items shall be transported fully assembled. The *Contractor* shall advise, in the Tender submission, which items are able to be shipped fully assembled.

Where major components are fabricated in separate facilities, templates shall be manufactured and shipped to each factory to verify critical fit-up dimensions.

All items shall be clearly and indelibly match-marked in the factory prior to shipment.

Bearings shall be fitted prior to shipment and a rigorous packaging procedure shall be followed to prevent brinelling. The *Contractor* shall assist the Client in commissioning and bringing on to line the *works* as directed by the *Employer* to achieve Practical Completion.

12.2 Commissioning

The provisions of Section 16 of the Technical Specification for Feed Hoppers, Apron Feeders and Dust House (Doc No 1924701-2-211-M-SP-0003) shall apply.

13.0 Packaging and Delivery

The *Contractor* shall provide secure packaging, suitable for ocean freight, road transport and outdoor storage, as applicable.

13.1 Handling and Storage

All equipment shall be handled and stored without overstress or deformation. It shall be stored clear of the ground to avoid collection of water and damage to surface coatings.

13.2 Delivery to Site

Damaged materials or equipment for components shall be replaced unless the *Contractor* is given the *Employer's* written consent to repair and erect them.

Care shall be taken when delivering, off-loading, stacking of steel, materials or equipment to avoid damaging the protective coatings applied at the workshop. The *Contractor* shall be required to make good all damaged areas to a quality consistent with the specified coating.

Responsibility for all steelwork, materials and equipment shall remain with the *Contractor* until erected, inspected and accepted by the *Employer.*

14.0 Spares and Maintenance Tools

The provisions of Section 18 of the Technical Specification for Feed Hoppers, Apron Feeders and Dust House (Doc No 1924701-2-211-M-SP-001) shall apply.

APPENDIX N

AECOM

TRANSNET

Contract Number: M003
Package Title: Dust Collection (Baghouse) Data Sheet
Document Number: 1924701-2-214-M-DS-0003

Revision	Description	Date	Prepared By	Review By	Approved By
A	Internal Review	2014/05/09	M Mc Hugh		-
0	Issued for Use	2015/11/19	M Mc Hugh	23/11/1	

Definitions

AD	After Dispatched
ARAD	After Receipt of Approval Drawings
ARO	After Receipt of Order
AW	After Award
CF	Certified Final
D	On Delivery
E	Electronic
FA	For Approval
I	Included in IOM
IOM	Installation & Operation Manual
M	Included in MDR
MDR	Manufacturer's Data Report
P	Print/Hard Copy
PTD	Prior to Delivery
W	Week

Notes – unless otherwise noted

1. CF Data/Documents due 2 weeks after receipt of FA Data/Documents by Vendor
2. MDR Data/Documents due 2 weeks after shipping
3. IOM Data/Documents due 4 weeks before shipping
4. *= Additional 2 copies of these Data/Documents to be shipped with equipment/materials

Rev	Item	Description	Units	Data by Principal
Data by Principal				
GENERAL				
	S1.01	Equipment Description	-	Tippler 3 Dust Collector
	S1.02	Dust Collector Equipment Number	-	2214-DC01
	S1.03	Fan Equipment Number	-	2214-DC01-FN01
	S1.04	Rotary Valve Equipment Number	-	2214-DC01-RV01
	S1.05	Air Compressor Equipment Number	-	2214-DC01-CO01
	S1.06	Installation Type (Indoor/Outdoor/Roof)	-	Outdoor
		Duty Requirements		
	S2.01	Process Description	-	Car Dumper Extraction, Iron Ore
	S2.02	Duty Cycle	-	Continuous
	S2.03	Total Flowrate	Am^3/hr	354000
	S2.05	Particle Size Analysis	µm (d$_{40}$)	20
	S2.06	Design Dust Particle Size	µm	1
	S2.07	Dust Particle S.G. & Bulk Density	-	4.4/2.7
	S2.08	Moisture Content Range	%	2.5
	S2.09	Dust Loading	g/m^3	5
	S2.10	Conveying Air Speed (Minimum)	m/s	20
	S2.11	Maximum Emissions	mg/m^3	50
		Dust Design Flow Rates		
		Car Dumper Side		
	S3.01	Hood A1	Am^3/hr	51340
	S3.02	Hood A2	Am^3/hr	51340
	S3.03	Hood A3	Am^3/hr	51340
	S3.04	Hood A4	Am^3/hr	51340
	S3.05	Hood A5	Am^3/hr	51340
	S3.06	Hood A6	Am^3/hr	51340
	S3.07	Header A1+A2	Am^3/hr	102680
	S3.08	Header A1+A2+A3	Am^3/hr	154020
	S3.09	Header A1+A2+A3+A4	Am^3/hr	205360
	S3.10	Header A1+A2+A3+A4+A5	Am^3/hr	256700
	S3.11	Header A1+A2+A3+A4+A5+A6	Am^3/hr	308040
		Conveyor Side		Transnet CR-14 iron Ore Wagon

Rev	Item	Description	Units	Data by Principal
	S3.16	AF Discharge B1	Am^3/hr	9200
	S3.17	AF Discharge B2	Am^3/hr	9200
	S3.18	AF Discharge B3	Am^3/hr	9200
	S3.19	AF Discharge B4	Am^3/hr	9200
	S3.20	AF Discharge B5	Am^3/hr	9200
	S3.21	Header B1+B2	Am^3/hr	18400
	S3.22	Header B1+B2+B3	Am^3/hr	27600
	S3.23	Header B1+B2+B3+B4	Am^3/hr	36800
	S3.24	Header B1+B2+B3+B4+B5	Am^3/hr	46000
SITE CONDITIONS				
	P3.01	Latitude	Text	33.0433º S
	P3.02	Longitude	Text	17.9963º E
	P3.03	Altitude	Text	Sea level
	P3.04	Ambient Temperatures (Min / Max)	Deg C	13.6 / 31.4 (Based on Year 2010)
	P3.06	Max Temperature - Shade	Deg C	45
	P3.07	Min Temperature	Deg C	-5
	P3.08	Mean Rainfall	mm/yr	278
	P3.10	Mean Relative Humidity (min/max/average)	%	50% 85% 60%
	P3.11	In Service Wind Speed	Km/h	80 maximum
	P3.12	Out of Service Wind Speed (Storm)	Km/h	130 (max) up to 20 m & 150 (max) over 20 m
	P3.13	Environment	Text	Harsh Marine, Coastal salt laden air
	P3.14	Climate	Text	Dry Mediterranean
ELECTRICAL SUPPLY				
	P4.01	Voltage	V	400
	P4.02	Frequency	Hz	50
	P4.03	Phase	Text	3
		Data by Vendor		
GENERAL				
	S1.01	Manufacturer	Text	**TENOVA**
	S1.02	Model No.	Text	2x594-WS-6000-BE
	S1.03	Design Capacity	Am^3/h	98.34
	S1.04	Design Inlet Static Pressure	kPa	1.75Kpa
	S1.05	Pressure Drop Across Dust Collector	kPa	1.5Kpa

Rev	Item	Description	Units	Data by Principal
	S1.06	Collection Efficiency @ 1 µm	%	99.90%
	S1.07	Total Cloth Area	m²	3021
	S1.08	Bag Cleaning - Revese Pulse or Other (Specify)	-	REVERSE PULSE
	S1.09	Reverse Pulse Air Required	m³/h @Kpa	180@500
	S1.10	Bag Fabric Type	Text	PTFE/POLYESTER NEEDLEFELT 550g/m²
	S1.11	Bag Configuration	Text	HANGING VERTICALLY 18 PER ROW
	S1.12	Number of Bags Fitted	Text	1188
	S1.13	Number of Blanked Ports (Additional Bags)	Text	NONE
	S1.14	Material of Construction	Text	3MM & 5MMM MILD STEEL PLATE
	S1.15	Air Inlet Size	mm x mm	6X1100MM
	S1.16	Hopper Volume	m³	2 X 47m³
	S1.17	Surface Treatment - Application, Coating Material & Thickness (µm)	-	TRANSNET CORROSSION PROTECTION SYSTEM EEA-Q-008
ROTARY VALVES				
	S2.01	Manufacturer	Text	**BULKMATIC**
	S2.02	Model No.	Text	RV - 0300 - M
	S2.03	Throughput	kg/h	8000
	S2.04	Inlet Flange Size	mm	300MM
	S2.05	Voltage	V/ph	400
	S2.06	Drive Make/Model	Text	SEW C/W WEG MOTOR
	S2.07	Drive Rating	kW	0.55
AIR FILTERS				
	S4.01	Manufacturer/Model	Text	JEMACO CDF 290 RA/CDF 290 RB/CDF 290 RF
	S4.02	Pressure Drop Clean Dry/Clean Wet	kPa	0.07BAR/0.07BAR/0.07BAR
	S4.03	Residual Water Content @ Rated Capacity	ppm	N/A
	S4.04	Residual Oil Content @ Rated Capacity	ppm	0.01/0.1@4.63m³/min
	S4.05	Air Inlet And Outlet Connection Size/drilling	mm	25NB INLET & OUTLET
AIR RECEIVER				
	S5.01	Manufacturer/Model	Text	**INGERSOL RAND**
	S5.02	Size	m³	2.1
	S5.03	Pressure Rating	kPa	700
	S5.04	Design Code	Text	R6A-7BAR
	S5.05	Automatic Drain Manufacturer	Text	KAESER

Rev	Item	Description	Units	Data by Principal
	S5.06	Automatic Drain Model/type	Text	ECO DRAIN AUTOMATIC CONDENSATE DRAIN
	S5.07	Pressure Relief Valve Manufacturer	Text	INGERSOL RAND
	S5.08	Pressure Relief Valve Model	Text	
	S5.09	Relief Pressure Setting	kPa	
AIR COMPRESSOR				
	S6.01	Manufacturer/Model	Text	**INGERSOL RAND**
	S6.02	Dust Collector Compressed Air Flow Required	FAD m^3/h	3
	S6.03	Air Compressor Rated Flow @ Operating Pressure	FAD m^3/h	3.6@700
	S6.04	Operating Pressure	kPag	700
	S6.05	Maximum Pressure	kPag	900
	S6.06	Voltage	V/ph	400
	S6.07	Drive Make/Model	Text	WEG
	S6.08	Drive Rating	kW	18
AIR DRYER				
	S7.01	Manufacturer/Model	Text	JEMACO PSK 160-40
	S7.02	Drier Type	Text	DESCICANT
	S7.03	Air Pressure Drop At Rated Flow	kPa	0.98 BAR
	S7.04	Air Inlet And Outlet Connection Size/drilling	mm	25 NB
	S7.05	Discharge Air Quality	Text	MINUS 40 DEGREES CELCIUS @ 7 BAR
	S7.06	Voltage	V/ph	220
	S7.07	Drive Make/Model	Text	N/A
	S7.08	Drive Rating	kW	N/A
FAN				
	S8.01	Manufacturer	Text	TROJAN
	S8.02	Model No.	Text	BC85 SIZE 2340C/1.0
	S8.03	Duty	A m^3/h @ kPa	98.34 @ 3.25Kpa
	S8.04	Speed at Duty Point	rpm	740
	S8.05	Power at Duty Point	kW	390
	S8.06	Fan Efficiency	%	81%
	S8.07	Casing - Material & Thickness	mm	MILD STEEL 6, 8 AND 10MM
	S8.08	Rotor - Type/Diameter	mm	2340MM
	S8.09	Bearing Designation & L_{10} life	Hrs	22230EKC3<100000hrs
	S8.10	Shaft - Material & Diameter	mm	135MM DIA BS970 080M40 (EN8)

Rev	Item	Description	Units	Data by Principal
	S8.11	Shaft Critical Speed	rpm	1385rpm
DRIVE DETAILS (DIRECT \ V-BELT)				
	S9.01	Belt Drive	Yes/No	NO
	S9.02	Drive Pulley, PCD x Belt Section	Text	N/A
	S9.03	Driven Pulley, PCD x Belt Section	Text	N/A
	S9.04	Belts - Number and Section	Text	N/A
	S9.05	Direct Coupled	Yes/No	YES
	S9.06	Coupling Type	Text	Bibby Wescar Rotofluid
	S9.07	Manufacturer	Text	VOIGT
	S9.08	Model	Text	Alfa 95P SCF K3 AB9
MOTORS				
	S10.01	Manufacturer	Text	WEG
	S10.02	Voltage	V/ph	3.3KVA
	S10.03	Frame Size	Text	400JH
	S10.04	No. of Poles	Text	8
	S10.05	Locked Rotor Current	A	612A
	S10.06	Full Load Current	A	102A
	S10.07	Full Load Torque	Nm	590 kg fm
	S10.08	Speed	rpm	740
	S10.09	Rated Power	kW	450
	S10.10	Motor Terminal Box and Cable Gland Size	mm	RWG3 2 X 3"
	S10.11	Enclosure IP Rating	IP	IP55 TEFC
	S10.12	Insulation Class	Text	F
	S10.13	Service Factor	Text	1.00 S1
DUCTING				
	S11.01	Bends - Material & Thickness	mm	VRN 400 5MM
	S11.02	Clean Out/Inspection Doors Included	Yes/No	YES
	S11.03	Ducting Supports Included	Yes/No	YES
	S11.04	Discharge Stack Height	m	FAN DISCHARGE HIGHT 8M
	S11.05	Silencer - Model No. & Material	Text	N/A
SHIPPING DIMENSIONS				
	S12.01	Baghouse (LxWxH)	m	2X7750X4500X15200
	S12.02	Fan (LxWxH)	m	5600X4500

Rev	Item	Description	Units	Data by Principal
MASSES				
	S13.01	Bag House and Support Structure	kg	63600
	S13.02	Fan Assembly	kg	14000kg
	S13.03	Ducting and Supports	kg	32500