

Title: **ROAD CROSSING OVERHEAD
LINES (STRAIN ONE SIDE AND
INTERMEDIATE ON THE OTHER
SIDE)**

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1. Introduction

The document was compiled to align with NRS 082 requirements in ensuring that equipment in the Eskom network is maintained, and to ensure that Occupational Health and Safety Act (OHSA) requirements are met.

This Task Manual is the revision of the document that was initially compiled and titled "Road Crossing Overhead Lines (Strain One Side And Intermediate On The Other Side)" to formalize the procedures of performing tasks. The document includes the latest updates in information, format, photos to make the document more user-friendly, the tasks identified when doing this maintenance for the safety of maintenance staff.

2. Supporting clauses

2.1 Scope

2.1.1 Purpose

The purpose of this Task Manual is to standardize maintenance tasks for "Road Crossing Overhead Lines (Strain One Side And Intermediate On The Other Side)".

2.1.2 Applicability

This document shall apply throughout Eskom and to contractors employed by the utility.

2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

- [1] ISO 9001 Quality Management Systems;
- [2] OHSA, Occupation Health and Safety Act 85 of 1993 and Regulations;
- [3] EPL_32-727, Safety, Health Environmental & Quality (SHEQ) policy;
- [4] EPC_32-520, Occupational Health & Safety Risk Assessment Procedure;
- [5] 240-114967625, Operating Regulations for High Voltage systems;
- [6] 240-62196227, Life Saving-Rules;
- [7] 240-78692652, Standard For Use And Maintenance Of Earthing Gear;
- [8] 240-120054284, Personal Protective Equipment Standard;
- [9] 240-86640998, Supervision of people in electrically hazardous locations;
- [10] 240-138196972, Routine Inspection And Maintenance Of Sub-transmission And Distribution Lines;
- [11] 240-133791951, Maintenance Inspection of Treated Wood Utility Poles Using the Non Destructive and Destructive Testing Method;
- [12] 240-70172585, Procedure for Vegetation Clearance and Maintenance within Overhead Power Line Servitudes and on Eskom Owned Land;
- [13] 240-80605256, Access to Farms (includes Strategy on dealing with game farms);
- [14] 240-77858652, Operating a Vehicle Mounted Crane;
- [15] 240-125121012, Usage Of Extension, Single, "A" Frame Ladders, Two Step Platform Or Pole Climbing Equipment;

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- [16] 240-77858900, Operating a Truck Mounted Crane With a Bucket Attached;
- [17] EPC_32-418, Working AT Heights;
- [18] 240-85844063, Making And Breaking, Or Replacement Of Jumpers Or Droppers On Overhead Lines And Substations; and
- [19] Manufacturer's manual.

2.2.2 Informative

- [20] 32-9, Definition of Eskom documents;
- [21] 32-644, Eskom documentation management standard;
- [22] 474-65, Operating Manual of the Steering Committee of Wires Technologies (SCOT);
- [23] 240-52380420, Steering Committee of Technologies (SCOT) Standards Development and Change Implementation Procedure;

2.3 Definitions

2.3.1 General

All definitions listed in recognised industry glossaries such as NRS 000, ORHVS and the IEV can be used wherever appropriate / applicable.

Definition	Description
Appointed operator	Means a person who is authorised to do operating and is deemed to be an authorised person in terms of these regulations. [ORHVS]
Authorise or Authorised	Refers to the giving of permission in writing to perform specific duties and responsibilities in terms of these regulations. Authorisation remains valid for a maximum period of three years which is based on divisional requirements [ORHVS]
Authorised person	Means a person, who has been authorised in terms of these regulations. N.B. Only persons who have satisfied the designated persons in terms of the Occupational Health and Safety Act (Act 85 of 1993) (General Machinery Regulation 2(1) that their knowledge is adequate to perform specific duties on specified plant and that their knowledge of these regulations is sufficient, may be authorised.
Fixed Earth	Equipment specific earth
Feeder jumpers:	Means insulated conductors used within the MV compartment to connect the two ring feeder cables
Operate or Operating	Means switching, linking, safety testing and earthing.
Transportation Permit	An exemption permit issued by a Provincial Roads Authority in terms of Article 81 of the National Road Traffic Act, authorising the transportation of an abnormal load or the movement of an abnormal vehicle or a combination of vehicles subject to such terms and conditions and the payment of such fees as may be imposed
Portable earth	This is a portable device used to connect isolated apparatus electrically directly to the general mass of earth in such a manner that it will ensure an immediate safe discharge of electrical energy at all times..
Portable Earthing Gear Set	This is a grouping of 3 individual portable earthing conductors with the same current rating and conductor length. [240-78692652]
Step potential	The difference in surface potential experienced by a person bridging a distance of 1 m with his/her feet without contacting any other earthed object.

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Definition	Description
Touch potential	The potential difference between the Grid Potential Rise (GPR) and the surface potential at the point where a person is standing, while at the same time having his/her hands in contact with earthed structure.
Work site	This is a place where workers are busy working (12m radius from the portable electrode). There can be more than one work sites on the same line.
Working earth	A supplementary portable earthing device used on apparatus in such a position that it is visible from and applied as close as possible to the point of work in such a manner that an equipotential zone is created. NOTE: This includes bonding/shunt conductors, induction earths and discharge earths.

2.3.2 Disclosure classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Description
ABC	Aerial Bundle Conductor
CMMS	Computer Maintenance Management System
EIA	Environmental Study (documentation) Available
IEC	International Electro technical Commission
IEV	International Electro technical Vocabulary
IPC	Insulation Piercing Clamps
OHSA	Occupational Health and Safety Act
ORHVS	Operating Regulations for High Voltage System
PCM	Process Control Manual
PTO	Principal Technical Officer
STO	Senior Technical Officer
TCIF	Technology Change Information Forum
TO	Technical Officer
TSU	Technical Service Unit
VMC	Vehicle Mounted Crane
WCO	Works-Coordinator

2.5 Roles and Responsibilities

2.5.1 Group Technology shall be responsible for:

- Ensuring that job plans and task lists are configured as per the maintenance Engineering Standard and available in the respective CMMS; and
- Ensuring that job plans and task lists reference the correct task manual.

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2.5.2 Training Department shall be responsible for:

- a) Where applicable ensure that the relevant training program is available to support the implementation of the task manual.

2.5.3 Plant Department (DX) / Performance and Works Planning Dept. (PWP) (TX) Managers shall be responsible for:

- a) Ensure that the CMMS is configured as per the requirement of the Maintenance Implementation Standard and maintenance (including defects and / or modification) is actioned as per the workflow process; and
- b) Ensuring that the correct maintenance feedback information is captured in the CMMS, analysed and appropriate action is taken.

2.5.4 Zone Management / Specialized Maintenance & Support (DX) / HV Plant / Secondary Plant Manager (TX) shall be responsible for:

- a) Ensure that maintenance is assigned to staff who are trained, authorized and found competent to perform maintenance on the specific equipment;
- b) Ensure that the equipment is maintained as per the Work Orders requirements; and
- c) Ensure that the maintenance feedback information is captured into the CMMS and relevant maintenance feedback documentation is attached for future maintenance analysis.

2.6 Process for monitoring

Document number	Document title
240-45920887	Process Control Manual (PCM) for Manage Maintenance Base.
240-52380420	Steering Committee of Technologies (SCOT) Standards Development and Change Implementation Procedure
240-95116172	Maintain Wires PCM

2.7 Related/supporting documents

Document number	Document title
240-145514226	Road Crossing Overhead Lines (Strain One Side And Intermediate On The Other Side) _ Observation / Risk Assessment

3. Requirements

3.1 Pre-Planning

Note 1: Do not take short cuts to save time.

Note 2: Identify the correct tools, equipment, material, etc, required for the task.

Note 3: Ensure that the correct craft is allocated to do the correct job / task and is acquainted with the area, environment and equipment.

- a) Confirm details of project contained in the Project Package: i.e. way-leaves have been granted, Hand over certificates available, Written permission from Local Authority, Land owners, Bill of materials, Drawings, Survey Sheet, Sag and Tension Chart, Scope of work and Environmental study (documentation) available (EIA)
- b) Assessment on site (where required) to determine whether there are Telkom lines, other pipes (water, gas, oil), a railway line or other power lines crossing the work site, or to determine the scope of work and resources (people, equipment, PPE, etc.) – cause of loss, upgrade/down grade, etc.
- c) Planning work and resources in accordance to the Work Order. Task specifications includes the following:
 - Traffic signs;
 - Red flags;
 - Road cones;
 - Amber rotating lights (Vehicles and on Workmen ahead traffic signs);
 - Reflective vests / bibs; and
 - Notifications of proposed work to:
 - Traffic;
 - Telkom if required;
 - Land owner/s for access as per 240-80605256;
 - Determine a strategy to control members of the public;
 - Confirm with traffic department if they will control the traffic at the work site; and
 - If traffic officers will be on site to control the traffic determine and document traffic control measures that will be implemented. Ensure that all parties involved sign the traffic control agreement

3.1.1 Previous Maintenance Information / Records

Additional work e.g. Modifications, defects etc.

3.1.2 Spares and Materials

Material and Spares shall be in accordance with the design handover / scope of work package / Minor reticulation design package.

3.1.3 Tools and equipment

- a) Standard tool set;
- b) Aerial Device;
- c) Torque wrench;
- d) Lifting device;
- e) Crimping tool & Dies;
- f) Generator;
- g) Dynamometer;
- h) Run out wheels;
- i) Measuring stick (height measurement);

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- j) Aviation balls;
- k) Pilot wire/rope;
- l) Flexible swivel woven wire socks;
- m) Come-along clamps / wire grip device;
- n) Hydraulic cutter and crimpers;
- o) Travelling earth;
- p) Stringing and tensioner machine; and
- q) Sag and tensioning chart.

3.1.4 Personal protective equipment

All personal protective equipment shall be in accordance with 240-44175132 the additional requirements from the on-site assessment of the equipment installation arc flash energy rating. All PPE shall be approved and comply with the identified arc flash energy rating.

3.2 Safety and preparation

- a) Risk assessment and signing of permit and worker's register shall be done in accordance to EPC_32-520 and 240-114967625 before the commencement of work and approved safe work procedures shall be practiced / followed.
- b) Environmental hazards shall be removed in accordance with EPL_32-727.

Note 1: Work may only commence once the instruction has been given by person supervising the task.

Note 2: Ensure that the line / apparatus have been handed over before commencing with work preparation.

Note 3: All steps as identified in the analysis of physical material handling are applicable.

Note 4: All work has to be executed under direct supervision of a responsible person in terms of standards or procedures (close proximity).

Note 5: Work activities on the line below energised HV line must be done in accordance with regulation 5.3.6.

Note 6: All hazards as identified in the analysis of HV Operating are applicable.

Note 7: When the line is still under construction and/or has not yet been connected to the network, ensure that the authorised person applies working earths on all conductors

Note 8: Where there are Telkom lines, railway lines or other power lines crossing the work site, ensure that support structures for the conductors are erected prior to work commencement.

Note 9: Ensure vehicles, equipment and people next to road side are in a safe position.

Note 10: Ensure road signs are correctly placed and the traffic department is informed.

- c) Park vehicles as far from the road side as possible.
- d) Ensure that all rotating amber lights on the vehicles are switched on.
- e) Ensure that all people are wearing their reflective vests / bibs
- f) Liaise with Traffic Officers on site to confirm traffic control agreement
- g) Place the traffic signs at work sites:
 - National Roads:
 - "Stop/Go" signs and persons with red flags are to be placed 60 meters on either side of work site (Persons with red flags are only required if traffic is not controlled by traffic officers).
 - "Men at work" signs are to be placed 120 meters on either **side of the work site**.
 - 60 km/h signs are to be placed 180 meters on either side of the work site.

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- 80 km/h signs are to be placed 300 meters on either side of the work site.
- 100 km/h signs are to be placed 450 meters on either side of the work site.
- 120 km/h signs are to be placed 550 meters on either side of the work site.
- Workmen ahead signs, fitted with a rotating amber light are to be placed 560 meters on either side of the work site
- Provincial Roads or dual carriage roads:
 - “Stop/Go” signs and persons with red flags are to be placed 60 meters on either side of work site
 - (Persons with red flags are only required if traffic is not controlled by traffic officers).
 - “Men at work” signs are to be 120 meters on either side of the work site.
 - 60 km/h signs are to be placed 180 meters on either side of the work site.
 - 80 km/h signs are to be placed 300 meters on either side of the work site.
 - 100 km/h signs are to be placed 450 meters on either side of the work site.
 - Workmen ahead signs, fitted with a rotating amber light are to be placed 460 meters on either side of the work site

Note 11: Test / Inspect poles for rot/damage or vandalism in accordance with the approved standards / procedures, (refer to 240-133791951 for testing methods).

h) Check the stays (where applicable) on the structures on both sides of the road for the correct tension

i) Off load and lay out tools, equipment and material.

Note 12: When the line is connected to the network, ensure that plant is isolated safety, tested and earthed where required in accordance with ORHVS

3.3 Routine Inspection

This section should contain all the routine inspection activities (on line) that should be carried out on the relevant line, the overhead lines inspection activities are covered in 240-138196972.

3.4 Procedure

Note 1: Ensure good visibility with additional lights/lighting where necessary.

Note 2: Failure to minimise the identified critical risks could result in injuries to personnel or damage equipment.

Note 3: Ensure that appropriate PPE and safety equipment are identified, inspected and worn/used during execution of the task.

Risk assessment and task analysis shall be done in accordance to EPL_34-727 before the commencement of work, an on-site risk assessment shall continuously be carried out and approved safe work procedures shall be practiced / followed by:

- Identifying hazards;
- Minimizing identified hazards and / or
- Removing identified hazards.

Note 4: If cranes with man-bucket/cradle are used in conjunction with this task all the steps as identified in the task analysis of operating a vehicle mounted crane with a bucket attached or aerial device is applicable.

3.4.1 Equipment Transportation

- a) Ensure that equipment is transported as per relevant Task Analysis, Task Manual or procedure to worksite.

3.4.2 Fitting of hardware and equipment

Note 1: All hazards and risks as identified in for work with/on extension/single ladders (240-125121012) task are applicable.

Note 2: All hazards and risks as identified in for operate a vehicle mounted crane (240-77858652 / 240-77858900) task are applicable.

Note 3: Ensure that no work is carried out from an un-safe position or in such haste that quality of work is compromised.

Note 4: Ensure that the correct PPE and safety equipment are used at all times while performing the task.

- a) Position and secure ladder as per 240-125121012 or aerial device / VMC with bucket as per 240-77858652 / 240-77858900
- b) Place tools and equipment in the pouch.
- c) Climb-up the ladder or raise aerial device to working position – using fall arrest system according to requirements
- d) Secure snatch block and rope to lift tools and equipment.
- e) Fit hardware to the structures (Depending on the configuration this may vary):
- On non-tensioning side structure only insulators is to be fitted.
 - On tensioning side structure insulators, straining clamps, etc are to be fitted.
- f) Fit lifting gear and conductor running wheels to the structure on the side to which the conductor will be pulled in. (Depending on the configuration and length of the line, more conductor running wheels may be required).

3.4.3 Conductor laying –out Method

3.4.3.1 Preparing conductors on one side of the road

Note 1: Ensure that no work is carried out from an un-safe position or in such haste that quality of work is compromised

- a) Run out conductors.
- b) Ensure that the length of the conductor required is correct.
- c) Ascend to working position.
- d) Pull up conductors through the conductor-running wheels onto the intermediate pole.
- e) Make off the conductors on ground level.
- f) Attach conductor onto non-tension side.
- g) Descend to ground level.

3.4.3.2 Pulling the conductors over the road

Note 1: Traffic must be adequately controlled when working close or on the road

Note 2: When tensioning, remember to fit a dynamometer onto the conductors to attain the correct sagging starting with centre phase.

Note 3: When connecting or disconnecting a jumper ensure that equipotential earthing is applied as per 240-85844063.

Note 4: Strain assembly methods:

- a) Stop traffic from both sides of the work site.
- b) Take the conductor ends to the structure on the other side of the road.

-
- c) Climb ladder/raise aerial device to working position using fall arrest system according to requirements.
 - d) Pull out the slack of the conductors.
 - e) Secure the conductor to the pulling device with a conductor grip.
 - f) Tension the conductors to correct requirements using dynamometer to attain the correct sagging as per specifications.
 - g) Check the tension on the stays and ensure that the poles are plumb.
 - h) Check sagging and ground clearances in accordance to surveyor's profile.
 - i) Make off the conductor by using either the strain clamp or compression dead-end.
 - j) Bind-in conductors on the intermediate pole.
 - k) Allow traffic to proceed.
 - l) Remove conductor running pulleys and lifting gear and lower to ground level.
 - m) Remove tools and equipment from site

3.4.4 Tensioning Method

3.4.4.1 Preparation for stringing and tensioning with a tensioning and stringing machines

- a) Ensure that the erected structures are in accordance to applicable specification
- b) Provide suitable access for platform and trestles, cable jacks and stringing gear.
- c) Provide suitable access for running out conductors and pilot cables.
- d) Ensure appropriate crimper and correct dies are on site.
- e) Position the road signs and assign the trained traffic controller where necessary;
- f) Position the running block.
- g) Inspect the equipment before the commencement of work.

3.4.4.2 Running and tensioning conductors

Note 1: Where stringing work is carried out over a period of time ensure that the structures are inspected before commencing with work.

- a) Setup the drum, tensioner and puller stations and ensure that the earth of the machines is connected to the electrode.

Note 2: Where stringing work is carried out over a period of time ensure that the structures are inspected before commencing with work.

- b) Connect the travelling earth to the spike.
- c) Pull the conductor / pilot cable through the running / travelling earth.
- d) Run out the conductor or pilot cable.
- e) Tension the conductor using the approved methods and sagging charts.
- f) Mark and make-off the conductors.

3.4.5 Task wrap up.

Note 1: Dispose redundant material in accordance with statutory and organisational requirements.

- a) Remove all equipment, tools, redundant material and all people from site.
- b) Complete all relevant documentation – works order and risk assessment documentation.

- c) Restore the site as per EPC32-727.
- d) Close and lock gates
- e) Verify the Signing off of Clearance section of permit workers register and hand to Authorised Person

Note 2: Check and ensure that the number of working earths removed is equal to the one recorded when task commenced: could result in one earth being left on line

Note 3: Ensure that all member of the team has signed off workers register/ clearing permit to ensure that everyone is accounted for and understand that the task is complete and treat the equipment as live.

3.4.6 Test and Measurements

Not Applicable

3.5 Modifications

Not Applicable

4. Forms and Records

The maintenance feedback sheet prescribed in annexure A must be populated and form part of the feedback to the Works Coordinator.

The Work Order must be populated with maintenance feedback and the relevant maintenance feedback documentation and attached to the Work Order.

Information highlighted on the maintenance feedback form must captured in the WO as per JP or Task List requirements

5. Authorization

This document has been seen and accepted by:

Name and surname	Designation
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6. Revisions

This revision 0 of Task Manual DMN_ 240-145514226 supersedes all the revisions this document.

Date	Rev	Compiler	Remarks
July 2019	1	D Ntombela	The first revision of the document published as 240-145514226 Reviewed the document and formatted into the new format.
Feb 2013	1	Fanie De Bruin	Reviewed the document and formatted into the new format.
Sept 2009	0	Fanie De Bruin	Original issue DMN 34-314

7. Development team

The following people were involved in the development of this document

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8. Acknowledgements

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Tools equipment:				6. Carry out the task as per task manual 240-145514226			
Used correctly							
In good and safe condition							
Test instrument calibrated							
Toolbox Talk:							
Task manuals used							
Complete Worker's register							
Risk Assessment been done							
Valid work permits available							
Could observed practices / conditions lead to:							
1. Injury:				2. Illness (fumes, gas, etc.)			
Risk of getting caught by				3. Costs (delays)			
Risk of striking against/get struck by				4. Poor quality (non-conformance)			
Risk of fall from same level							
Risk of fall from different level							
Risk of slip, trips and falls							
Risk of electrocution							

4.	NON COMPLIANCE PRACTICE OBSERVATION							
		Yes	No	N/A		Yes	No	N/A
	1. Working at unsafe speed				7.Failure to warn			
	2. Using unsafe equipment				8. Taking chances			
	3. Using equipment unsafely				9. Failure to identify hazards			
	4. Unsafe loading, placing & lifting				10.Failure to secure lock-out			

	5. Taking unsafe position				11. Safety signs ignored			
	6. Safety rules ignored							
	NOTE: ALL OBSERVED CLASS HAZARDS SHALL REQUIRE IMMEDIATE INTERVENTION							
5.	OBSERVED DEVIATIONS / NON-CONFORMANCES							
6.	RISK BEHAVIOURS							
7.	PROPOSED CONTROLS							
	Compile a procedure for this task		Issue a standing instruction					
	Revise present procedure		Change work methods					
	Retraining of employees		Professional referral					
	Engineering revision		Coaching					
8.	ANALYSIS							
	IAC – inadequate capability		ABU – abuse or misuse / equip / drugs or alcohol		MAIN – inadequate maintenance			
	KNO – lack of knowledge		NAT – natural factors		EQU – inadequate equipment			
	SKI – lack of skill		LEA – inadequate leadership		STA – inadequate work / train Standards			
	STR – stress		ENG – inadequate engineering		WEA – wear & tear			
	MOT – improper motivation		PUR – inadequate purchasing		CON – inadequate control			

9.	DISCUSSION BETWEEN SUPERVISOR/OBSERVER AND EMPLOYEE	
	1. EMPLOYEE EXPLANATION FOR RISK BEHAVIOUR:	
	2. AGREEMENT TO CHANGE AT RISK BEHAVIOUR:	
10.	FOLLOW-UP ACTIONS	WHEN / WHO

Signatures	Dates
Person being Observed: _____	_____
Signature (Task Observer): _____	_____
<i>If deviations were found</i>	
Chairperson Safety Committee: _____	_____