

Specification: 240-62772907, SPECIFICATION FOR STATIONARY DIESEL GENERATORS Rev 4

ITEM	DESCRIPTION	SCHEDULE A	SCHEDULE A	SCHEDULE A	Unit	SCHEDULE B	Reference
	User to insert requirement	Category A	Category B	Category C			
		Station- or Unit DG Large units that could require multiple units in parallel or single units that need to supply load into the network for routine maintenance operation	Sub-station DG as second source of supply (Tx) Large units that could to supply load into the network for routine maintenance operation or supply current to dummy loads provided with the installation. Alternatively it must periodically supply the standing load of the designed system	Gx - outside plant installations, Building back-up supply Tx, Dx - sub-station or building back-up supplies			
		Synchronised or non-synchronised units Complex control systems often using external system PLC controllers Transfer load via external switchgear (plant reticulation) Extremely high level of reliability and availability due to criticality in generating plant Could be sacrificial component Extensive maintenance philosophy due to complexity Total System by-pass is possible via external switchgear High nr of analogue+digital I/Os	Non-synchronised units Complex control systems often using external system PLC controllers Transfer load via external switchgear (plant reticulation) or Internal ATS or External ATS High level of reliability and availability due to criticality in generating plant Extensive maintenance philosophy due to complexity Total System by-pass is possible via internal/external switchgear Limited nr of I/Os	Non-synchronised units Simple on-board control systems Transfer load via Internal/external ATS Non-sacrificial component, designed to achieve maximum life expectancy Simple maintenance philosophy because it is not complex unit, yet is essential in it's design in the plant No system bypass is required Limited nr of I/Os			
AB.0.1	Local Agent Representation required	Yes / No	Yes / No	Yes / No	Yes (Provide Details)		
AB.0.2	Number of Years local representative exists in South	Years	Years	Years	XXX		
AB.0.3	Supply Reference list with installations	Yes / No	Yes / No	Yes / No	Yes		
AB.0.4	Compliance with SANS (ISO) 9001:2008 required	Yes/No	Yes/No	Yes/No	Yes		
3	REQUIREMENTS						
3.1	General						
a)	Comply with requirements of SANS 8528	SANS 8528	SANS 8528	SANS 8528			
b)	Order of precedence for deviations	As specified	As specified	As specified			
c)	Vibrations and noise	SANS 60034 and BS 5514-5	SANS 60034 and BS 5514-5	SANS 60034 and BS 5514-5			
d)	Compliance to OHSAct	Yes - as specified	Yes - as specified	Yes - as specified			
3.2	Application Categories	Category A	Category B	Category C			
3.2.1	Application Category A	Information	Information	Information			
3.2.2	Application Category B	Information	Information	Information			
3.2.3	Application Category C	Information	Information	Information			
3.3	Application and operating philosophy						
a)	Application - sites	Information	Information	Information			
b)	Installation configuration	Fixed	Fixed	Fixed			
c)	Primary application	ESP	ESP	ESP			
d),e)	Synchronised generator	Yes	No	No			
3.4	Site Conditions						
a)	Site location - primary location	Land Use (Coastal and Inland)	Land Use (Coastal and Inland)	Land Use (Coastal and Inland)			
b)	Site location - other	Information	Information	Information			
c)	Location of generator	Inside (Indoors) Installation	Outside Installation with Protection	Outside Installation with Protection			
d)	Information						
e)	1) Minimum ambient temperature	-10	-10	-10	°C		
	2) Maximum ambient temperature	50	50	50	°C		
	3) Altitude	1750	1750	1750	m		
	4) Humidity	30 - 80	30 - 80	30 - 80	%		
	5) Air quality (dust or sand)	Dust	Dust	Dust			
	6) Marine environment	No	No	No			
	7) Shock and imposed vibration	No	No	No			
	8) Chemical pollution	No	No	No			
	9) Radiation	No	No	No			
	10) Cooling water/liquid	N/A	N/A	N/A			
	11) Earth tremors	N/A	N/A	N/A			
3.5	Reliability						
a)	Expected operating life	35	35	35	yrs		

b)	Expected operating life (Engine running hours at rated	15000	15000	15000	hrs	
c)	Information	Yes - as specified	Yes - as specified	Yes - as specified		
3.6	Maintainability					
a)	Low maintenance	Yes	Yes	Yes		
b)	Ergonomics	Yes - as specified	Yes - as specified	Yes - as specified		
c)	Modular assemblies	Yes - as specified	Yes - as specified	Yes - as specified		
d)	Built-in test facilities	Yes - as specified	Yes - as specified	Yes - as specified		
e)	Component condition monitoring and alarming	Yes - as specified	Yes - as specified	Yes - as specified		
f)	Spares and parts availability	Yes - as specified	Yes - as specified	Yes - as specified		
g)	Warranty	2	2	2	yrs	
3.7	System definition					
	Single OEM Diesel Generator Set	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.1	Generator Rating					
3.7.1.1	General					
a)	Power Rating Category - SANS 8528-1	ESP	ESP	ESP		
b)	Performance Class	Class G3	Class G3	Class G3		
c)	Duty type (S1 if not specified)	S1	S1	S1		
d)	<i>Sizing input criteria:</i>					
1)	System voltage	400	400	400	V	
2)	Highest single phase load current (by measurement or	10	20	104	A	
3)	Power factor (by measurement or design)	0.8	0.8	0.8	Cosθ/pF	
4)	THD current distortion	<5	<5	<5	THD	
e)	Future expansion	10	10	10	%	
f)	Calculated minimum required output power/alternator	9.2	18.4	95.9	kVA	
		7.4	14.8	76.7	kW	
g)	Supplier recommended alternator size	Supplier to Specify	Supplier to Specify	Supplier to Specify	kVA	
		Supplier to Specify	Supplier to Specify	Supplier to Specify	kW	
	Supplier recommended engine size	Supplier to Specify	Supplier to Specify	Supplier to Specify	Hp	
h), j)	Ability to deliver full load	Yes - as specified	Yes - as specified	Yes - as specified		
i)	Start-up time	Specify	Specify	Specify	sec	
3.7.2	Diesel Engine	Info	Info	Info		
3.7.2.1	General					
a)	Diesel Engine Type	Diesel fuelled	Diesel fuelled	Diesel fuelled		
		Cold start	Cold start	Cold start		
		Water / Air cooled	Water / Air cooled	Water / Air cooled		
	Alternative cooling methodology - benefits and cost	Specify	Specify	Specify		
b)	Pre-heating	Yes	Yes	Yes		
	Pre-lubrication	Yes	No	No		
c)	Specific Fuel consumption - ISO 3046-2	Yes - as specified	Yes - as specified	Yes - as specified		
d)	Specific Oil consumption - ISO 3046-1	Yes - as specified	Yes - as specified	Yes - as specified		
e)	Auxiliary power requirements	Yes - as specified	Yes - as specified	Yes - as specified		
f)	De-rating in accordance with ISO 3046-1	As specified	As specified	As specified		
g)	De-rating graphs	As specified	As specified	As specified		
h)	Mounting type	Fully Resilient	Fully Resilient	Fully Resilient		
i)	DG single step load handling ability (≥ 50%)	Yes - as specified	Yes - as specified	Yes - as specified		
j)	DG single step load handling ability (110%)	Yes - as specified	Yes - as specified	Yes - as specified		
k), l)	Transient step-response values accepted	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.2.2	Governor					
a)	Mechanical/Electronic governor	Electronic	Electronic	Electronic / Mechanical		
b)	PI or PID	Proportional Integral Differential (PID)	Proportional Integral Differential (PID)	Proportional Integral Differential (PID)		
3.7.2.3	Speed - 1500 rpm preferred	Specify	Specify	Specify	rpm	
3.7.2.4	Emissions					
	Noise at 1 m	85	85	85	dbA	
3.7.3	Alternator					
3.7.3.1	General					
	Performance at different Power Factors	Yes - As specified	Yes - As specified	Yes - As specified		
3.7.3.2	Type					
a)	Brushless type	As specified	As specified	As specified		
		As specified	As specified	As specified		
b)	Duty Type	S1	S1	S1		
3.7.3.3	Excitation					
a)	Permanent magnet /AVR	Both are acceptable	Both are acceptable	Both are acceptable		
b)	Series current boost	Specify	Specify	Specify		
3.7.3.4	Heaters					

a=b)	Anti-condensation heaters	As specified	As specified	As specified		
c)	Heater Power requirements	Specify	Specify	Specify	W	
3.7.3.5	Power output					
a)	Short circuit rating	Specify	Specify	Specify	kA	
b)	Alternator efficiencies	Yes - as specified	Yes - as specified	Yes - as specified		
c)	Continuous current capabilities and the regulation					
3.7.3.6	Loading					
a)	Starting sequence and load schedules	As per User Requirement specification	As per User Requirement specification	As per User Requirement specification		
b)	Load types	Yes	Yes	Yes		
3.7.3.7	Voltage and frequency					
	Base Frequency	50	50	50	Hz	
	Continuous frequency operating range	48.5 to 51.5	48.5 to 51.5	48.5 to 51.5	Hz	
	Frequency deviation not more than 10 minute per	48 to 52	48 to 52	48 to 52	Hz	
	Frequency deviation not more than 1 minute per incident	47.5 to 52.5	47.5 to 52.5	47.5 to 52.5	Hz	
a)	Total Harmonic Distortion (THD) of HV side Voltage and % even harmonics	Specify	Specify	Specify	% / %	
	Adjustment Range on terminal voltage	±2.5	±2.5	±2.5	%	
	Adjustment range of terminal frequency	±1.5	±1.5	±1.5	%	
	Waveform deviation factor limit	<10	<10	<10	%	
	Total Harmonic Distortion relative to the fundamental	<5	<5	<5	%	
	Percentage of any one harmonic relative to the	<3	<3	<3	%	
b) - c)	Output performance	As specified	As specified	As specified		
3.7.3.8	Type of construction					
a)	Alternator cooling	Air-cooled	Air-cooled	Air-cooled		
b)	Alternator insulation class	Class H	Class H	Class H		
	Temperature rise	Heat rise curve B	Heat rise curve B	Heat rise curve B		
3.7.4	Control, monitoring, alarms, indications and switchgear					
3.7.4.1	General	Comply	Comply	Comply		
a)	Electrically fail safe	Comply	Comply	Comply		
b)	Powered from DC	Alarm and shutdown	Alarm and shutdown	Alarm and shutdown		
c)	Operate on Alarm-only and Alarm-Shut down	Comply	Comply	Comply		
d)	Time and date stamped	Comply	Comply	Comply		
3.7.4.2	Control panel controls	Refer to list	Refer to list	Refer to list		
a), b)	Local control functions	Yes - as specified	Yes - as specified	Yes - as specified		
c)	Control panel functions	Yes - as specified	Yes - as specified	Yes - as specified		
d)	auto-synchronizer	Yes - as specified	Yes - as specified	Yes - as specified		
e)	manual synchronizer	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.4.3	Control panel features	Yes - as specified	Yes - as specified	Yes - as specified		
a) 1)	Analogue Alternating Current (AC) Metering panel	Yes - as specified	Yes - as specified	Yes - as specified		
a) 2)	Adjustments	Yes - as specified	Yes - as specified	Yes - as specified		
a) 3)	Time/date stamped events	Yes - as specified	Yes - as specified	Yes - as specified		
a) 4)	Fault Present Indication - LED lamp	Yes - as specified	Yes - as specified	Yes - as specified		
a) 5)	Exersize switch	Yes - as specified	Yes - as specified	Yes - as specified		
a) 6)	Fault reset switch	Yes - as specified	Yes - as specified	Yes - as specified		
b) 1)	Emergency push button	Yes - as specified	Yes - as specified	Yes - as specified		
b) 2)	Mode selector switch	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.4.4	Remote Control System interface	Yes - as specified	Yes - as specified	Yes - as specified		
a)	Remote inputs	Yes - as specified	Yes - as specified	NA		
b)	Remote outputs	Yes - as specified	Yes - as specified	Yes - as specified		
c)	Analogue and digutal inputs and outputs	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.4.5	Diesel generator local control panel indications					
a)	Indications	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.4.6	Diesel generator annunciator alarms	Yes - as specified	Yes - as specified	Yes - as specified		
a)	Alarm list	Yes - as specified	Yes - as specified	Yes - as specified		
b)	GSM alarms	No	No	No		
3.7.3.9	Safety features					
a) 1)	Fail-safe engine stop solenoid	Digital HMI	Digital HMI	Digital HMI		
a) 2)	Emergency stop push-button on the engine	Yes	Yes	No		
a) 3)	Emergency stop push-button on the control panel	Yes	Yes	Yes		
a) 4)	Remote emergency shutdown capability	Yes	Yes	Yes		
a) 5)	Over speed protection	Yes	Yes	Yes		

a) 6)	DG No load rundown functionality	Yes	Yes	Yes		
3.7.4.8	Control system functionality	Yes - as specified	Yes - as specified	Yes - as specified		
a)	Emergency stop	Yes - as specified	Yes - as specified	Yes - as specified		
b)	Automatic Voltage Regulator (AVR)	Yes - as specified	Yes - as specified	Yes - as specified		
c)	Control philosophy	Yes	Yes	Yes		
3.7.4.9	Alarms and indications	Yes	Yes	Yes		
a)	Latch indication	Yes	Yes	Yes		
b)	Lamp/LED/Display	Yes	Yes	Yes		
c)	Reset button	Yes - as specified	Yes - as specified	Yes - as specified		
d)	Output contacts and event logs	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.4.10	Assemblies, Terminals, wiring and cabling	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.4.11	Automatic Transfer switches					
a)	ATS required?	No ATS required	No ATS required	Internal ATS		
b)1)-3)	ATS requirements	Yes - as specified	Yes - as specified	Yes - as specified		
c)	External Start/Stop signal	No	No	No		
3.7.4.12	Generator bypass switch					
a)	By-pass switch required?	Yes/No	Yes/No	Yes/No		
3.7.4.13	Automatic Synchronizing Systems					
a)-g)	Synchronizing functionality	Yes - as specified	No	No		
3.7.5	Auxiliaries					
3.7.5.1	Cooling and Heating					
a)	Radiator	Yes - as specified	Yes - as specified	Yes - as specified		
b)	Radiator shall be monitored for "low water level" alarm	Yes - as specified	Yes - as specified	Yes - as specified		
c)	Electric fan or mechanically coupled fan for canopy/room cooling	Mechanically coupled fan	Mechanically coupled fan	Mechanically coupled fan		
d)	Water jacket heaters water system isolation	Yes - as specified	Yes - as specified	Yes - as specified		
e)	Water jacket heaters electrical isolation	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.5.2	Starting					
a)	Starting method	Electric	Electric	Electric		
b)	Electric motor start philosophy	Method 2	Method 1	Method 1		
c)	Start failure	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.5.3	Batteries					
a)	Battery type	Nickle-Cadmium	Lead -acid/Nical-Cadmium	Lead-acid		
b) - c)	Battery performance	Yes - as specified	Yes - as specified	Yes - as specified		
d) - g)	Battery charging and system	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.5.4	Battery charger					
a)-d)	Performance	Yes - as specified	Yes - as specified	Yes - as specified		
e)	Battery loss monitor	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.6	Fuel system					
3.7.6.1	General					
a)	Day/Bulk Tank	Day tank only	Day tank only	Day tank only		
b)	Run time	12	12	12	hrs	
c)	Compliance to legislation	Yes - as specified	Yes - as specified	Yes - as specified		
d)	Fuel line materials	Yes - as specified	Yes - as specified	Yes - as specified		
e) g)	Water seperator and alarm	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.6.2	Fuel injection					
a)	Common rail injection?	Yes - as specified	Yes - as specified	Yes - as specified		
b)	Fuel system priming	Yes - as specified	Yes - as specified	Yes - as specified		
c)	Fuel system cooling	Yes - as specified	Yes - as specified	Yes - as specified		
d)	Fail-safe solenoid	Yes - as specified	Yes - as specified	Yes - as specified		
e)	Shutdown valve	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.6.3	Day Fuel Tank					
a)	Position	Yes - as specified	Yes - as specified	Yes - as specified		
b)	Construction	Yes - as specified	Yes - as specified	Yes - as specified		
c)	Run time	Yes - as specified	Yes - as specified	Yes - as specified		
d)-e)	Fuel level alarms and shutdown	Yes - as specified	Yes - as specified	Yes - as specified		
f)	Gravity feed from Bulk tank.	Yes - as specified	Yes - as specified	NA		
g)	Fail safe fuel transfer system	Yes - as specified	Yes - as specified	NA		
h)	Overfilling protection	Yes - as specified	Yes - as specified	NA		

i)	Construction	Yes - as specified	Yes - as specified	Yes - as specified		
j)	Inlet and valve	Yes - as specified	Yes - as specified	Yes - as specified		
k)	Overflow	Yes - as specified	Yes - as specified	Yes - as specified		
l)	Inspection hole	Yes - as specified	Yes - as specified	Yes - as specified		
m)	Limitation	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.6.4	Bulk Fuel Tank					
a)	Alarm levels	Yes - as specified	Yes - as specified	NA		
3.7.6.5	Diesel fuel	Yes - as specified	Yes - as specified	Yes - as specified		
3.6.7	Lubrication					
a) - b)	Oil pressure sensor and gauge	Yes - as specified	Yes - as specified	Yes - as specified		
c) - d)	Oil filter	Yes - as specified	Yes - as specified	Yes - as specified		
e)	Other bearing types	Yes - as specified	Yes - as specified	Yes - as specified		
f)	Oil drain pump	Yes - as specified	Yes - as specified	No		
g)	Oil priming pump	Yes - as specified	Yes - as specified	No		
h)	Oil label	Yes - as specified	Yes - as specified	Yes - as specified		
i)	Auxiliary oil cooler/heater	Yes - as specified	Yes - as specified	No		
j)	Crank case breather exhaust	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.8	Aspiration and cooling air intake					
a)	Dry type air filter	Yes - as specified	Yes - as specified	Yes - as specified		
b) - c)	Minimize intake of dust, vermin, etc.	Yes - as specified	Yes - as specified	Yes - as specified		
d)	Water drainage possible	Yes - as specified	Yes - as specified	Yes - as specified		
e)	Easy maintenance	Yes - as specified	Yes - as specified	Yes - as specified		
f)	Differential pressure high alarm	Yes - as specified	Yes - as specified	Yes - as specified		
g)	Minimise intake of exhaust gasses and hot air	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.9	Earthing					
3.7.9.1	General					
a)	Earth Fault protection	Yes - as specified	Yes - as specified	Yes - as specified		
	Earth fault current (% of full load current)	10	10	10	%	
	Time delay	2	2	2	sec	
b)	Earth conductors	Specify	Specify	Specify	mm ²	
c)	Indipendant earthing	Yes - as specified	Yes - as specified	Yes - as specified		
d)	Earth Mat provision	Yes - as specified	Yes - as specified	Yes - as specified		
c)	Earthing philosophy	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.9.2	Generator neutral earthing					
a)-b)	Information	Information	Information	Information		
c)	Neutral earthing method	Solid earthing	Solid earthing	Solid earthing		
d)	Generator earth fault protection	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.9.3	Earth and bonding of components					
a-c)	Earth conductor	Yes - as specified	Yes - as specified	Yes - as specified		
d)	Battery negative earthing	Yes - as specified	Yes - as specified	Yes - as specified		
e)	DG frame earthed	Yes - as specified	Yes - as specified	Yes - as specified		
f)	Electrolytic corrosion prevention	Yes - as specified	Yes - as specified	Yes - as specified		
g)	Tank earthed	Yes - as specified	Yes - as specified	Yes - as specified		
h)	Junction boxes	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.9.4	Enclosures					
a)	Enclosure IP rating	IP 54				
b)	Enclosure colour	SANS 60529				
b-f)	Doors and bonding	Yes - as specified	Yes - as specified	Yes - as specified		
g-h)	Earth connections	Yes - as specified	Yes - as specified	Yes - as specified		
i - j)	Gland plates	Yes - as specified	Yes - as specified	Yes - as specified		
k-m)	Bonding	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.10	Mechanical build					
3.7.10.1	Coupling	Specify	Specify	Specify		
3.7.10.2	Base frames	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.10.3	Vibration damping	Specify	Specify	Specify		
3.7.10.4	Exhaust system					
a) - g)	Design and positioning	Yes - as specified	Yes - as specified	Yes - as specified		
h) - k)	Material	Yes - as specified	Yes - as specified	Yes - as specified		
l) - v)	Joints, welding, lagging, construction	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.10.5	Building fire detection and protection					

a)	Risk analysis	Yes	Yes	Yes		
b)	Detection and protection	No	No	No		
3.7.10.6	Outdoor canopy	Yes	Yes	Yes		
a)	Canopy required?	Yes/No	Yes/No	Yes/No		
a-e)	Construction	Yes	Yes	Yes		
	Material type?	Mild steel epoxy coated	Mild steel epoxy coated	Mild steel epoxy coated		
3.7.10.7	Acoustic canopy					
a)	Sound damping	Yes/No	Yes/No	Yes/No		
b)	Sound damping material	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.10.8	Control panel					
a)	Construction	Yes - as specified	Yes - as specified	Yes - as specified		
b)	Doors	Yes - as specified	Yes - as specified	Yes - as specified		
c)-m)	Sub-component construction	Yes - as specified	Yes - as specified	Yes - as specified		
n)	Control transformers	Yes - as specified	Yes - as specified	Yes - as specified		
o)-p)	Wiring	Yes - as specified	Yes - as specified	Yes - as specified		
q)	Bonding	Yes - as specified	Yes - as specified	Yes - as specified		
3.7.10.9	Generator controller	Yes - as specified	Yes - as specified	Yes - as specified		
a)	mechanical and electrical interference	Yes - as specified	Yes - as specified	Yes - as specified		
b)	No memory loss	Yes - as specified	Yes - as specified	Yes - as specified		
c)	Response in control	Yes - as specified	Yes - as specified	Yes - as specified		
d)	Override in emergency	Yes/No	Yes/No	No		
e)	Software configuration files	Yes - as specified	Yes - as specified	Yes - as specified		
3.8	Marking, labelling and packaging					
3.8.1	General	Yes - as specified	Yes - as specified	Yes - as specified		
3.8.2	Marking	Yes - as specified	Yes - as specified	Yes - as specified		
3.8.3	Labelling	Yes - as specified	Yes - as specified	Yes - as specified		
3.8.3.1	Labels	Yes - as specified	Yes - as specified	Yes - as specified		
3.8.3.2	Rating plates	Yes - as specified	Yes - as specified	Yes - as specified		
3.8.4	Packaging and shipping	Yes - as specified	Yes - as specified	Yes - as specified		
3.9	Documentation	Yes - as specified	Yes - as specified	Yes - as specified		
3.10	Civil requirements					
a)	Is a plinth required?	Yes/No	Yes/No	Yes/No		
b)	Is a bunt wall required	Yes/No	Yes/No	Yes/No		
c)	Plinth and bunt wall specification available	Specify	Specify	Specify		
4	Tests					
4.1	Responsibility for testing	Yes - as specified	Yes - as specified	Yes - as specified		
4.2	Type tests	SANS 8528	SANS 8528	SANS 8528		
a)-c)	Compliance	Yes - as specified	Yes - as specified	Yes - as specified		
d)	Test load selected according to performance class	Yes - as specified	Yes - as specified	Yes - as specified		
4.3	Insulation resistance testing	Yes	Yes	Yes		
a)-b)	Information	Yes - as specified.	Yes - as specified.	Yes - as specified.		
c) 1)	2 kV (rms) applied for 1 min - AC circuits	Yes - as specified	Yes - as specified	Yes - as specified		
c) 2)	DC test voltage of 500 V applied for 2 min - Test 1	Yes - as specified	Yes - as specified	Yes - as specified		
c) 3)	DC test voltage of 500 V applied for 2 min - Test 2	Yes - as specified	Yes - as specified	Yes - as specified		
c) 4)	1 kV (rms) applied for 1 min - DC circuits	Yes - as specified	Yes - as specified	Yes - as specified		
4.4	Factory acceptance tests					
a) 1)	Full functional test of all control and operating systems	Yes - as specified	Yes - as specified	Yes - as specified		
a) 2)	Full load test - 70 min	Yes - as specified	Yes - as specified	Yes - as specified		
b)1)-5)	Readings to be taken during load test	Yes - as specified	Yes - as specified	Yes - as specified		
c)	Overload test	Yes - as specified	Yes - as specified	Yes - as specified		
d)	Single load step - \geq 50% of continuous kW rating	Yes - as specified	Yes - as specified	Yes - as specified		
e)	Single load step - \geq 110% of most severe single step	Yes - as specified	Yes - as specified	Yes - as specified		
f)	Documentation to be provided	Yes - as specified	Yes - as specified	Yes - as specified		
f)	Specified performance documentation	Yes - as specified	Yes - as specified	Yes - as specified		
g)	Test results at specified altitude [1900m]	Yes - as specified	Yes - as specified	Yes - as specified		
h)1)	Battery discharge test	Yes - as specified	Yes - as specified	Yes - as specified		
h)2)	Battery charger test	Yes - as specified	Yes - as specified	Yes - as specified		
4.5	Site acceptance tests					
a) 1)	Full functional test of all control and operating systems	Yes - as specified	Yes - as specified	Yes - as specified		
a) 2)	Site load test - 20 min	Yes - as specified	Yes - as specified	Yes - as specified		

b)1-5)	Readings to be taken during load test	Yes - as specified	Yes - as specified	Yes - as specified			
5	Spares holding and availability						
a)	Spares availability	Yes - as specified	Yes - as specified	Yes - as specified			
b)	Spares list	Yes - as specified	Yes - as specified	Yes - as specified			
6	Additional requirements						
a)	Maintenance training costing	Yes - as specified	Yes - as specified	Yes - as specified			
b)	Suitable sized dummy load	Yes/No	Yes/No	Yes/No			
c)	GSM module costing	Yes/No	Yes/No	Yes/No			
d)	Rubber hoses and belt	Yes - as specified	Yes - as specified	Yes - as specified			