Heywood BESS

275/33 kV Power Transformer
Technical Datasheet

16th May 2025

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Document Revision History						
RevNo.	**Date**	**Status**	**Eng Design**	**Eng Review**	**BEE App**	**Brief Description of Revision**
A	17/04/2025	Issued for Review	E. Connolly	R. McLean	F. Guillard	Issued for Review
B	16/05/2025	Final Issue	E. Connolly	R. McLean	F. Guillard	Final Issue

Reason For Issue
Final Issue

275/33 kV Power Transformer

Schedule 1 - Quantites & Project Specific Documents

Item	Description	Requirement	Vendor Data
A. Quantities			
1	160/80/80 MVA 275/33kV Power Transformer	2 off	
B. Project Specific Documents & Drawings			
1	J25-0479-ELE-SLD-0001 - Single Line Diagram	N/A	

Beyond Electrical Engineering

275/33 kV Power Transformer

Schedule 2 - Technical Requirements

Item	Description	Requirement	Vendor Data
A. Site Information			
1	Site	Heywood BESS	
2	Location	Heywood, Victoria	
3	Equipment Description	275/33 kV Power Transformer	
4	Equipment Manufacturer	Vendor to confirm	
5	OEM Model Number	Vendor to confirm	
6	Manufacture Location (Country)	Vendor to confirm	
7	Operating Environment	Outdoor	
8	Design life (equipment and finishes)	30 years	
9	Warranty Period	Minimum 24 months from delivery	
10	Overall Dimensions	Vendor to confirm	
11	Weight	Vendor to confirm	
B. Environmental Service Conditions			
1	All applicable requirements	Refer to Schedule 3	
C. General Details			
1	Tendered equipment complies in all respects with the project specification and technical specification for Power Transformers	Vendor to confirm	
2	Manufacturer lead time	Vendor to confirm	
3	Applicable standard	AS 60076	
4	Rated Power for applicable cooling regimes		
4.1	At Principal Tap:		
4.1.1	ONAN Cooling	Vendor to confirm	
4.1.2	ODAN Cooling	Vendor to confirm	
4.1.3	ONAF Cooling	Vendor to confirm	
4.1.4	ODAF Cooling	160/80/80 MVA	
4.2	At Minimum Buck Tap:		
4.2.1	ONAN Cooling	Vendor to confirm	
4.2.2	ODAN Cooling	Vendor to confirm	
4.2.3	ONAF Cooling	Vendor to confirm	
4.2.4	ODAF Cooling	Vendor to confirm	
4.3	At Maximum Boost Tap:		
4.3.1	ONAN Cooling	Vendor to confirm	
4.3.2	ODAN Cooling	Vendor to confirm	
4.3.3	ONAF Cooling	Vendor to confirm	
4.3.4	ODAF Cooling	Vendor to confirm	
4.4	Emergency (2 hour) rating from continuous operation at 0.6 times rated power for maximum cooling (ambient temperature = 50°C)		
4.4.1	At Principal Tap:	As Per IEC/AS Standard	
4.4.2	At Minimum Buck Tap:	As Per IEC/AS Standard	
4.4.3	At Maximum Boost Tap:	As Per IEC/AS Standard	
4.5	Emergency (10 minute) rating from continuous operation at 0.6 times rated power for maximum cooling (ambient temperature = 50°C)		
4.5.1	At Principal Tap:	As Per IEC/AS Standard	
4.5.2	At Minimum Buck Tap:	As Per IEC/AS Standard	
4.5.3	At Maximum Boost Tap:	As Per IEC/AS Standard	
5	Number of Phases	3	
6	Rated Frequency	50 Hz	
7	No-load Rated Voltage at Principal Tap		
7.1	HV Winding	275 kV	
7.2	LV Winding	33 kV	
8	Winding Connection		
8.1	HV Winding	Wye	
8.2	MV Windings	Delta	
8.3	IEC Vector Group	YNd11d11	
9	HV-MV Short Circuit Impedances		
9.1	Impedance	12.5% @ 160MVA	
9.2	Resistance	Vendor to confirm	
9.3	Reactance	Vendor to confirm	
9.4	Minimum Impedance	Vendor to confirm	
9.5	Tap Position for Minimum Impedance	Vendor to confirm	
9.6	Maximum Impedance	Vendor to confirm	

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Schedule 2 - Technical Requirements

Item	Description	Requirement	Vendor Data
9.7	Tap Position for Maximum Impedance	Vendor to confirm	
9.8	Maximum divergences of impedance from principal tap impedance in steps	Vendor to confirm	
10	Type of windings		
10.1	HV Winding	Vendor to confirm	
10.2	MV Winding	Vendor to confirm	
10.3	Winding Insulation Class	Class A	
11	Highest Voltage for equipment		
11.1	HV Winding	300 kV	
11.2	MV Winding	36 kV	
12	Rated Lightning Impulse Withstand Voltage		
12.1	HV Winding	1050 kVp	
12.2	MV Winding	200 kVp	
12.3	Neutral Winding	Vendor to confirm	
13	Rated Switching Impulse Withstand Voltage		
13.1	HV Winding	Vendor to confirm	
14	Rated Power Frequency Withstand Voltage		
14.1	HV Winding	460 kV	
14.2	MV Winding	70 kV	
14.3	Neutral Winding	Vendor to confirm	
15	Maximum partial discharge intensity measured during AC induced voltage withstand test	To AS60076:3	
15.1	at 1.1 x system highest voltage Um	Vendor to confirm	
15.2	at 1.3 Um	Vendor to confirm	
15.3	at 1.5 Um	Vendor to confirm	
16	Maximum temperature rise at rated power at Ambient 50°C		
16.1	Average winding	65°C	
16.2	Hot spot of windings	70°C	
16.3	Top oil	55°C	
16.4	Core	Vendor to confirm	
16.5	Tank	Vendor to confirm	
17	Overload capabilities according to IEC 60076-7	Yes	
18	HV/MV impedance voltage at rated 100% power and 75°C and tolerances (guaranteed value) :		
18.1	At Principal Tap:		
18.1.1	HV/MV	Vendor to confirm (%)	
18.2	At Minimum Tap:		
18.2.1	HV/MV	Vendor to confirm (%)	
18.3	At Maximum Tap:		
18.3.1	HV/MV	Vendor to confirm (%)	
19	Zero sequence impedance voltage (approx. value) at rated 100% power and 75°C, on principal tapping, assuming rated voltage (single phase) applied between line terminals and neutral		
19.1	Supply on HV with MV open circuit	Vendor to confirm (%)	
19.2	Supply on HV with MV short circuit	Vendor to confirm (%)	
19.3	Supply on MV with HV open circuit	Vendor to confirm (%)	
19.4	Supply on MV with HV short circuit	Vendor to confirm (%)	
21	No load losses at rated voltage and rated frequency on principal tap (guaranteed value)	Vendor to confirm (kW)	
22	Load losses at rated power and 75°C:		
22.1	On principal tapping		
22.1.1	HV/MV (guaranteed value)	Vendor to confirm (kW)	
22.2	On tapping for maximum loss:		
22.2.1	HV/MV	Vendor to confirm (kW)	
23	Tap position number	25	
24	Cooling plant losses	Vendor to confirm (kW)	
25	Guaranteed sound power level at 100% rated voltage and frequency:	To AS60076:3	
25.1	at no-load	Vendor to confirm (dB)	
25.2	at 4.26.1 plus cooling equipment	Vendor to confirm (dB)	
25.3	at 4.26.2 plus rated current	Vendor to confirm (dB)	
25.4	cooler bank only	Vendor to confirm (dB)	
26	Terminal Connection		
26.1	HV Terminal	Vendor to confirm	
26.2	MV Terminal	Vendor to confirm	
26.3	Neutral Terminal	Vendor to confirm	
27	Transformer Oil (To AS 60296)	Uninhibited	

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Schedule 2 - Technical Requirements

Item	Description	Requirement	Vendor Data
27.1	Material Safety Datasheet to be provided	Yes	
27.2	PCB compounds shall not be used	No	
28	Number of Standby:	N+1	
28.1	Radiators / Coolers	Vendor to confirm	
28.2	Fans	Vendor to confirm	
28.3	Pumps	No. of Pumps = No. of Coolers	
29	Anti-corrosion protection of radiators or coolers	Hot Dipped Galvanised	
30	Radiators Tank Mounted or Separate	Vendor to confirm	
31	Transformer Tank Fittings		
31.1	Draining and filtering valves	Yes	
31.2	Valves for tank oil sampling	Yes	
31.3	Radiator isolation valves	Yes	
31.4	Pulling eyes for complete transformer	Yes	
31.5	Supports for hydraulic jacks	Yes	
31.6	Lifting lugs	Yes	
31.7	Tank earth terminals	Yes	
31.8	Core earth terminal box	Yes	
31.9	Inspection manholes	Yes	
31.10	Ladder	Yes	
31.11	Skids or wheels adjustable in two directions	No	
31.12	275kV Surge Arrestor Support	Yes, to suit	
31.13	33kV Surge Arrestor Support	Yes, to suit	
32	Transformer Accessories		
32.1	Oil preservation system with or without rubber bag	With	
32.2	Dehydrating breather standard or maintenance free	Maintenance free	
32.3	Oil level indicator of magnetic type	Yes	
32.4	Contact thermometer for the oil temperature	Yes on HV/MV side	
32.5	Winding temperature indicator	Yes	
32.6	Direct winding temperature measurement using fibre optic sensors	Yes	
32.7	Pressure relief device	Yes	
32.8	Rapid pressure relay	Yes	
32.9	Buchholz relay	Yes	
32.10	Buchholz relay gas sampling	Yes	
32.11	Non-return valve	Yes	
32.12	On-line gas monitor	Yes	
33	Supply Voltage for Transformer Auxiliaries	400/230 VAC +/- (Vendor to confirm tolerance)	
34	Control/Protection Voltage	110VDC +/- (Vendor to confirm tolerance)	
35	Current Transformer		
35.1	Winding Temperature Indicator CT	1	
35.1.1	Ratio	Vendor to confirm	
35.1.2	Output	Vendor to confirm (VA)	
35.1.3	Accuracy class	0.5	
35.1.4	Short time current rating	Vendor to confirm (kA/s)	
35.1.5	Thermal limit	Vendor to confirm (A)	
35.2	Line Drop Compensation CT		
35.2.1	Ratio	Vendor to confirm	
35.2.2	Output	Vendor to confirm (VA)	
35.2.3	Accuracy class	0.5	
35.2.4	Short time current rating	Vendor to confirm (kA/s)	
35.2.5	Thermal limit	Vendor to confirm (A)	
35.3	Protection Neutral CTs	1	
35.3.1	No. of CT cores.	2	
35.3.2	Accuracy class	0.5	
35.3.3	Transformation ratio and tapping	Vendor to confirm	
35.3.4	Maximum exciting current at the rated knee point e.m.f., Ie	Vendor to confirm	
35.3.5	Rated resistive burden Rb	Vendor to confirm	
35.3.6	Dimensioning factor, Kx	Vendor to confirm	
35.3.7	Thermal limit	Vendor to confirm (A)	
35.3.8	Short time current rating	Vendor to confirm (kA/s)	
35.3.9	Injection Test Point	Yes	
35.4	275kV Protection CTs (Not Required)		
35.4.1	Accuracy class	-	
35.4.2	Transformation ratio and tapping	-	
35.4.3	Maximum exciting current at the rated knee point e.m.f., Ie	-	
35.4.4	Rated resistive burden Rb	-	

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Schedule 2 - Technical Requirements

Item	Description	Requirement	Vendor Data
35.4.5	Dimensioning factor, Kx	-	
35.4.6	Thermal limit	-	
35.4.7	Short time current rating	-	
35.4.8	IP ratings of marshalling and control cubicles	-	
35.4.9	Method of shipping transformer	-	
35.5	33kV Protection CTs (Not Required)		
35.5.1	Accuracy class	-	
35.5.2	Transformation ratio and tapping	-	
35.5.3	Maximum exciting current at the rated knee point e.m.f., Ie	-	
35.5.4	Rated resistive burden Rb	-	
35.5.5	Dimensioning factor, Kx	-	
35.5.6	Thermal limit	-	
35.5.7	Short time current rating	-	
35.5.8	IP ratings of marshalling and control cubicles	-	
35.5.9	Method of shipping transformer	-	
36	Painting and protective coating systems		
36.1	Method of surface preparation	Vendor to confirm	
36.2	Class of surface preparation	Vendor to confirm	
36.3	Are technical data sheets of painting and protective coating system included?	Vendor to confirm	
37	Total Oil Volume	Vendor to confirm	
D. Tap Changer			
1	Tap Changer Type	OLTC (On Load)	
2	Tap Changer Mounting inside or outside tank	Vendor to confirm - segerated Oil tank for OLTC	
3	Which winding is tapped	HV - 275kV	
4	Manufacturer	Vendor to confirm	
5	Country of Manufacture	Vendor to confirm	
6	Tap Changer Interrupter Type	Vacuum	
7	Tap Changer Equipment Type	Resistor Type	
8	Standard of Manufacture	IEC/AS	
9	Number of Tappings	21	
10	Rated Step Voltage	3.44 (kV)	
11	Tapping Range		
11.1	Plus (Maximum Tapping)	+15 (%)	
11.2	Plus (Minimum Tapping)	-15 (%)	
11.3	Tapping Step	1.25 (%)	
11.4	Number of Tap Steps	25	
11.5	Arrangement of Tappings (Taps, Linear, Coarse/Fine, Reversing)	Linear	
12	Current Ratings		
12.1	Rated Through Current	Vendor to confirm (A)	
12.2	Maximum Rated Through Current	Vendor to confirm (A)	
12.3	Six month cyclic overload capacity	Vendor to confirm (A)	
12.4	Two hour overload capacity	Vendor to confirm (A)	
12.5	Suitable for occassional overload of transformer to AS2374.7	Vendor to confirm	
12.6	Maximum overload capability of the tap-changer which still allows the tap-changer to change taps	Vendor to confirm (A)	
13	Voltage Ratings		
13.1	Phase-phase	300 kV	
13.2	Phase-earth	175 kV	
13.3	Lightning Impulse Withstand Voltage	1050 kVp	
14	Contacts & Switches		
14.1	Contact life (number of tap-change operations)	600000	
14.2	Replacement criteria (number of tap-change operations)	Vendor to confirm	
14.3	Before moving contact replacement	Vendor to confirm	
14.4	Number of operations on individual fixed contacts before replacement	Vendor to confirm	
14.5	Time taken to complete one operation	Vendor to confirm (s)	
14.6	Technical brochures/data provided	Yes	
15	OLTC Operating Motor		
15.1	Manufacturer	Vendor to confirm	
15.2	Type	Vendor to confirm	
15.3	Supply Voltage	400/230 VAC	
15.4	Power Rating	Vendor to confirm (W)	

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Schedule 2 - Technical Requirements

Item	Description	Requirement	Vendor Data
15.5	Number of Phases	Vendor to confirm	
E. Bushings			
1	Bushing - Phase HV		
1.1	Manufacturer	Vendor to confirm	
1.2	Type	Resin Impregnated Paper	
1.3	Mounting	Tank top	
1.4	Colour	Light Grey (N35 or similar)	
1.5	Rated Nominal Voltage	300 kV	
1.6	Prated Power Frequency Voltage Withstand	460 kV	
1.7	Rated Impulse Voltage Withstand	1050 kVp	
1.8	Rated Normal Current (To be not less than 130% of maximum FLC of Transformer - Refer AS 1265 Clause 4, Note 3)	Vendor to confirm	
1.9	Rated Short Circuit Current Rating per AS60137	Vendor to confirm	
1.10	Terminal Palm Number per AS 62271.301	Vendor to confirm	
1.11	Terminal Palm Material	Tinned Copper	
1.12	Pollution Level	IV	
1.13	Specific Creepage Distance (AS4436)	31 mm/kV	
1.14	Minimum Creepage length	8525 mm	
1.15	Minimum Creepage length protected	Vendor to confirm	
1.16	Minimum external taut-string metal to metal clearances:		
1.16.1	Phase to phase	As per IEC/AS Standard	
1.16.2	Phase to earth	As per IEC/AS Standard	
1.17	Minimum clearances above ground		
1.17.1	Any exposed live conducting parts	As per IEC/AS Standard	
1.17.2	Earth end of the bushing	As per IEC/AS Standard	
2	Bushing - Neutral HV		
2.1	Manufacturer	Vendor to confirm	
2.2	Type	Resin Impregnated Paper	
2.3	Mounting	Tank top	
2.4	Colour	Light Grey (N35 or similar)	
2.5	Rated Nominal Voltage	300 kV	
2.6	Prated Power Frequency Voltage Withstand	460 kV	
2.7	Rated Impulse Voltage Withstand	1050 kVp	
2.8	Rated Normal Current (To be not less than 130% of maximum FLC of Transformer - Refer AS 1265 Clause 4, Note 3)	Vendor to confirm	
2.9	Rated Short Circuit Current Rating per AS60137	50kA/1sec (TBC)	
2.10	Terminal Palm Number per AS 62271.301	Vendor to confirm	
2.11	Terminal Palm Material	Tinned Copper	
2.12	Pollution Level	IV	
2.13	Specific Creepage Distance (AS4436)	31 mm/kV	
2.14	Minimum Creepage length	8525 mm	
2.15	Minimum Creepage length protected	Vendor to confirm	
2.16	Minimum external taut-string metal to metal clearances:		
2.16.1	Phase to phase	As per IEC/AS Standard	
2.16.2	Phase to earth	As per IEC/AS Standard	
2.17	Minimum clearances above ground		
2.17.1	Any exposed live conducting parts	As per IEC/AS Standard	
2.17.2	Earth end of the bushing	As per IEC/AS Standard	
3	Bushing - Phase MV		
3.1	Manufacturer	Vendor to confirm	
3.2	Type	Resin Impregnated Paper	
3.3	Mounting	Tank top	
3.4	Colour	Light Grey (N35 or similar)	
3.5	Rated Nominal Voltage	36 kV	
3.6	Rated Power Frequency Voltage Withstand	70 kV	
3.7	Rated Impulse Voltage Withstand	200 kVp	
3.8	Rated Normal Current (To be not less than 130% of maximum FLC of Transformer - Refer AS 1265 Clause 4, Note 3)	Vendor to confirm	
3.9	Rated Short Circuit Current Rating per AS60137	Vendor to confirm	
3.10	Terminal Palm Number per AS 62271.301	Vendor to confirm	
3.11	Terminal Palm Material	Tinned Copper	
3.12	Pollution Level	IV	
3.13	Specific Creepage Distance	31 mm/kV	
3.14	Minimum Creepage length	1023 mm	

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Item	Description	Requirement	Vendor Data
3.15	Minimum Creepage length protected	Vendor to confirm	
3.16	Minimum external taut-string metal to metal clearances:		
3.16.1	Phase to phase	As per IEC/AS Standard	
3.16.2	Phase to earth	As per IEC/AS Standard	
3.17	Minimum clearances above ground		
3.17.1	Any exposed live conducting parts	As per IEC/AS Standard	
3.17.2	Earth end of the bushing	As per IEC/AS Standard	
3.18	Maximum Dynamic Operating Force -Horizontal Direction (Dynamic/Static) -Vertical Direction	 4000N 4000N	
F. Performance			
1	Core Construction		
1.1	Limbs: Banded / Bolted	Vendor to confirm	
1.2	Yokes: Banded / Bolted	Vendor to confirm	
1.3	Banding / Bolting material	Vendor to confirm	
1.4	Core bolt insulation (if applicable)	Vendor to confirm	
1.5	Number of limbs	Vendor to confirm	
1.6	Number of limbs wound	Vendor to confirm	
2	No-load current on principal tap		
2.1	at 100% excitation	Vendor to confirm (% of rated current)	
2.2	at 110% excitation	Vendor to confirm (% of rated current)	
3	Insulation of:		
3.1	Yoke clamps	Vendor to confirm	
3.2	Leg plates	Vendor to confirm	
3.3	Core laminations	Vendor to confirm	
4	Whether tank or other flux shields are incorporated	Vendor to confirm	
5	Flux density in magnetic circuit		
5.1	Maximum value at 100% rated voltage, rated frequency and principal tap		
5.1.1	Limb	Vendor to confirm	
5.1.2	Yoke	Vendor to confirm	
5.1.3	Shields	Vendor to confirm	
5.2	Maximum value at 110% rated voltage, rated frequency and principal tap		
5.2.1	Limb	Vendor to confirm	
5.2.2	Yoke	Vendor to confirm	
5.2.3	Shields	Vendor to confirm	
6	Winding type, e.g. interleaved disc, disc, helical etc.		
6.1	HV windings	Vendor to confirm	
6.2	MV windings	Vendor to confirm	
6.3	Tapping windings (as applicable)	Vendor to confirm	
6.4	Windings arrangement, i.e. core/…/…/…/…/	Vendor to confirm	
7	Presence of non-linear resistors?	Vendor to confirm	
8	Conductor Insulation		
8.1	HV windings	Vendor to confirm	
8.2	MV windings	Vendor to confirm	
8.3	Tapping windings	Vendor to confirm	
9	Oil circulation (i.e. natural/partially directed/directed):		
9.1	to windings		
9.1.1	HV windings	Vendor to confirm	
9.1.2	MV windings	Vendor to confirm	
9.1.3	Tapping windings	Vendor to confirm	
9.2	through windings		
9.2.1	HV windings	Vendor to confirm	
9.2.2	MV windings	Vendor to confirm	
9.2.3	Tapping windings	Vendor to confirm	
9.3	maximum oil velocity in windings, all pumps operating	Vendor to confirm	
10	Maximum current density in any winding at principal tap and rated power		
10.1	Winding	Vendor to confirm	
10.2	Current density	Vendor to confirm	
10.3	Current density in HV or MV winding under most onerous earth fault condition	Vendor to confirm	
11	Oil		
11.1	Manufacturer	Vendor to confirm	

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Schedule 2 - Technical Requirements

Item	Description	Requirement	Vendor Data
11.2	Type designation	Vendor to confirm	
11.3	Applicable standard	Vendor to confirm	
12	Type of tank:		
12.1	cover or bell type	Vendor to confirm	
12.2	cover connection: bolted or welded	Vendor to confirm	
13	Minimum thickness of transformer tank:		
13.1	Sides	Vendor to confirm	
13.2	Bottom	Vendor to confirm	
13.3	Cover	Vendor to confirm	
14	Thickness of radiator plates	Vendor to confirm	
15	Colour of finishing paint	N42 Stormy Grey or similar	
16	Overall Dimensions		
16.1	Maximum height from floor level	Vendor to confirm	
16.2	Maximum length of transformer	Vendor to confirm	
16.3	Maximum width of transformer	Vendor to confirm	
16.4	Minimum height to crane hook for lifting active part out of tank, including allowance for slings	Vendor to confirm	
16.5	Minimum height above transformer cover for lifting of OLTC diverter switch insert	Vendor to confirm	
16.6	Maximum dimensions for transport		
16.6.1	height	Vendor to confirm	
16.6.2	length	Vendor to confirm	
16.6.3	width	Vendor to confirm	
17	Masses		
17.1	Mass of transformer and coolers, complete with necessary equipment and filled with oil	Vendor to confirm	
17.2	Mass of transformer dry active part	Vendor to confirm	
17.3	Total mass of copper in windings	Vendor to confirm	
17.4	Total mass of cellulose insulation	Vendor to confirm	
17.5	Mass of active iron in core	Vendor to confirm	
17.6	Mass of tank empty	Vendor to confirm	
17.7	Mass of coolers complete with oil	Vendor to confirm	
17.8	Maximum mass for transport	Vendor to confirm	
17.9	Mass of main tank, erected and filled with oil	Vendor to confirm	
17.1	Mass of complete oil	Vendor to confirm	
17.11	Maximum mass of one bushing	Vendor to confirm	
G. Materials Details			
1	Manufacturer	Vendor to confirm	
2	Country of manufacture	Vendor to confirm	
3	Place of manufacture	Vendor to confirm	
4	Model number	Vendor to confirm	
5	With which standard specification/s will the plant comply?	IEC 60076/ AS/NZS 60076	
6	Is the transformer capable of operating in parallel with one or more transformers of similar design?	Vendor to confirm	
7	Type of transformer (shell or core)	Core	
8	Core		
8.1	Manufacturer of electrical steel	CRGO Type	
8.2	Total mass of electrical steel	Vendor to confirm	
8.3	Core mounting (in tank, lid underhung)	In Tank	
9	HV winding		
9.1	Type (disc, helical, spiral, etc.)	Vendor to confirm	
9.2	Total mass of conductor	Vendor to confirm	
9.3	Length of mean turn	Vendor to confirm	
9.4	Number of effective turns on principal tapping	Vendor to confirm	
9.5	Type of insulation (uniform/non-uniform)	Vendor to confirm	
9.6	Conductor insulation material	Insulation Paper	
9.7	Insulation class	Class A	
9.8	Thickness of insulation	Vendor to confirm	
10	MV winding		
10.1	Type (disc, helical, spiral, etc.)	Vendor to confirm	
10.2	Total mass of conductor	Vendor to confirm	
10.3	Length of mean turn	Vendor to confirm	
10.4	Number of effective turns on principal tapping	Vendor to confirm	
10.5	Type of insulation (uniform/non-uniform)	Vendor to confirm	
10.6	Conductor insulation material	Insulation Paper	
10.7	Insulation class	Class A	

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Item	Description	Requirement	Vendor Data
10.8	Thickness of insulation	Vendor to confirm	
11	Current density allowed for in windings		
11.1	HV winding	Vendor to confirm (A/mm2)	
11.2	MV winding	Vendor to confirm (A/mm2)	
12	Insulating oil to be used in the transformer		
12.1	Brand and type	Mineral Oil (Option price for K-type oil)	
12.2	To be supplied with the transformer Installation	Yes	
12.3	Is Product Technical Data Sheet included?	Yes	
12.4	Is Material Safety Data Sheet included?	Yes	
12.5	Quantity required to fill the transformer to cold oil level (10°C)	Vendor to confirm	
12.6	Main tank	Vendor to confirm	
12.7	OLTC tank	Vendor to confirm	
12.8	Main conservator	Vendor to confirm	
12.9	OLTC conservator	Vendor to confirm	
12.10	Radiators	Vendor to confirm	
12.11	Total quantity to be supplied with Transformer	Vendor to confirm	
13	Method of cooling		
13.1	Radiator mounting	Vendor to confirm	
13.2	Fans	Vendor to confirm	
13.3	Oil pumps	Vendor to confirm	
13.4	Manufacturer and type of fans where used	Vendor to confirm	
13.5	Number of fans	Vendor to confirm	
14	Fan motor details		
14.1	Number of phases	Vendor to confirm	
14.2	Volume of air displaced by each fan	Vendor to confirm	
14.3	Air flow direction (horizontal, vertical)	Vendor to confirm	
15	Manufacturer and type of pumps where used	Vendor to confirm	
16	Manufacturer and type of pumps motor where used if separate to pump	Vendor to confirm	
17	Pump details		
17.1	Number of phases	Vendor to confirm	
17.2	Output rating of each pump motor	Vendor to confirm	
17.3	Volume of oil displaced by each pump	Vendor to confirm	
17.4	Head developed by each pump	Vendor to confirm	
17.5	What steps are taken to prevent operation of the oil surge protection relay when the pumps are started?	Vendor to confirm	
17.6	Starting torque limit	Vendor to confirm	
17.7	Acceleration time to full speed	Vendor to confirm	
H. Alarms			
1	Alarm Requirements		
1.1	Gas and oil actuated gas alarm	Alarm	
1.2	Gas relay gas alarm	Alarm	
1.3	AC control power source failure	Alarm	
1.4	DC control power source failure	Alarm	
1.5	Oil high temperature	Alarm	
1.6	Windings high temperature	Alarm	
1.7	Transformer / Conservator low oil level	Alarm	
1.8	Common Alarm	Alarm	
1.9	Transformer pressure relief device	Pressure Relief Device	
1.10	Diverter switch surge or diverter switch pressure relief device	Pressure Relief Device	
1.11	Tap change drive motor fail	Alarm	
1.12	Tap-change time exceeds set limit	Alarm	
1.13	OLTC Manual/Auto selection status indication	Visual	
1.14	Tap change progress	SCADA Signal	
1.15	OLTC Common Alarm Signal	Alarm	
1.16	OLTC Commom Fault Signal	Alarm	
1.17	Tap Position Indication	SCADA Signal	
1.18	Conservator fitted with Oil Level Indicator	Visual	
1.19	Buchholz Relay	Alarm	
I. Testing			
1	Routine tests according IEC 60076-1	Yes	
2	Type tests:		
2.1	Temperature-rise type test (IEC 60076-2)	Yes	
2.2	Dielectric type tests (IEC 60076-3)	Yes	

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Schedule 2 - Technical Requirements

Item	Description	Requirement	Vendor Data
2.3	Determination of sound level (IEC60076-10) for each specified sound level	Yes	
2.4	Measurement of the power taken by the fan and liquid pump motors	Yes	
3	Special tests(depending on voltage level, some of them could be routine tests acc. to IEC 60076-1):		
3.1	Dielectric special tests (IEC 60076-3)	Yes	
3.2	Determination of capacitances windings-to-earth, and between windings	Yes	
3.3	Measurement of dissipation factor (tan δ) of the insulation system capacitances	Yes	
3.4	Determination of transient voltage transfer characteristics (IEC 60076-3 Annex B)	Yes	
3.5	Measurement of zero-sequence impedance(s) on three-phase transformers	Yes	
3.6	Short-circuit withstand test (IEC 60076-5)	Yes	
3.7	Measurement of d.c. insulation resistance	Yes	
3.8	Vacuum deflection test on liquid immersed transformers	Yes	
3.9	Pressure deflection test on liquid immersed transformers	Yes	
3.10	Vacuum tightness test on site on liquid immersed transformers	Yes	
3.11	Measurement of Frequency Response (Frequency Response Analysis)	Yes	
3.12	Check of external coating (ISO 2178 and ISO 2409 or as specified)	Yes	
3.13	Measurement of dissolved gasses in dielectric liquid	Yes	
4	Witness Testing to be provided to the Principal	Yes	
5	The contractor shall ensure that the following site tests are carried out:		
5.1	winding resistance measurement on all taps and all windings	Yes	
5.2	voltage ratio measurement, all taps	Yes	
5.3	voltage vector relationship, all taps	Yes	
5.4	Insulation resistance of all windings at 2.5 kV dc	Yes	
5.5	Dielectric Dissipation Factor (DDF) tests of all winding configurations	Yes	
5.6	Operation of fans and/or pump(s) in automatic and manual mode.	Yes	
5.7	Overpressure test for 24 hours before setting to work the pressure relief device.	Yes	
5.8	Oil dielectric test and test for water content	Yes	
6	Quality Assurance:		
6.1	Manufacturer quality assurance acc. to ISO 9001	Yes	
6.2	Manufacturer Quality Manuals submitted with offer	Yes	
6.3	Manufacturer a sample of Quality Inspection and Test Plan with offer	Yes	
7	Informative transformer general arrangement drawing showing overall dimensions and transport	Yes	

J. Manfacturer List			
1	Alarm Requirements		
1.1	Transformer	Vendor to confirm	
1.2	OLTC Equipment	Vendor to confirm	
1.3	HV Bushings	Vendor to confirm	
1.4	MV Bushings	Vendor to confirm	
1.5	Neutral Bushing	Vendor to confirm	
1.6	Insulating cylinders	Vendor to confirm	
1.7	Core plate material	Vendor to confirm	
1.8	Winding conductor	Vendor to confirm	
1.9	Transformer tank	Vendor to confirm	
1.10	Radiators	Vendor to confirm	
1.11	Air cooled oil coolers	Vendor to confirm	
1.12	Oil	Vendor to confirm	
1.13	Oil valves	Vendor to confirm	
1.14	Oil pumps	Vendor to confirm	
1.15	Oil flow indicators	Vendor to confirm	
1.16	Fans	Vendor to confirm	

Beyond Electrical Engineering

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Schedule 2 - Technical Requirements

Item	Description	Requirement	Vendor Data
1.17	Gaskets for oil tight joints	Vendor to confirm	
1.18	Pressure relief device	Vendor to confirm	
1.19	Oil level indicators	Vendor to confirm	
1.20	Dehydrating breather	Vendor to confirm	
1.21	Gas and oil actuated relay(s)	Vendor to confirm	
1.17	Control cabinet	Vendor to confirm	
1.18	Temperature indicating devices	Vendor to confirm	
1.19	Material for anti-vibration mountings	Vendor to confirm	
1.20	Current transformers	Vendor to confirm	
1.21	Monitoring devices (to specify)	Vendor to confirm	
K. Delivery & Installation			
1	Delivery Terms	DDP (Delivery Duty Paid)	
2	Delivery Location	Heywood, Victoria	
3	Installation	Required	
4	On-Site Training	To be provided	
L. Documents			
1	Design documentation & drawings	Required (with native drawing files provided at IFC)	
2	O&M Manuals	Required	
3	Test Certficates and Reports	Required	
4	Maintenance Requirements Schedule	Required	
5	Recommended spare parts list	Required	

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Schedule 3 - Environment Conditions

Item	Description	Requirement	Vendor Data
A. Elevation			
1	Elevation	<1000m	
B. Temperature and Humidity			
1	Maximum Design Ambient Air Temperature	50°C	
2	Minimum Design Ambient Air Temperature	-5°C	
3	Maximum Rate of Change of Temperature	Fluctuations of up to 20°C within a period of 20 minutes	
4	Minimum Relative Humidity	To suit local conditions Average: 80%	
C. Solar Radiation & Rainfall			
1	Solar Radiation	1250 W/m^2	
2	Mean Annual Rainfall	To suit local conditions - Australian Rainfall and Runoff – A Guide to Flood Estimation	
3	Highest Monthly Rainfall	To suit local conditions - Australian Rainfall and Runoff – A Guide to Flood Estimation	
D. Pollution Level & Creepage Distance (AS4436)			
1	Pollution Level	Level IV - as per IEC 60815/AS 4436	
2	Creepage	31 mm/kV	
3	Corrosion Category	C2	
E. Wind & Seismic (AS1170)			
1	Wind loading category to AS1170.2: a) region b) Ultimate wind speed c) Terrain category d) Ultimate wind pressures	 a) A1 b) 162 km/h c) 2 d) 1750 Pa	
2	Seismic category to AS1170.4: a) Importance Level	a) 3	