

5.2.4.4.1 132/33 kV 80/120 MVA ONAN/ONAF Power transformer (for Bhasantek 132/33kV Substation)

Guaranteed Technical Particulars (GTP) for Auto/Power Transformer

Note:

1. The GTP shall be provided by the respective Vendor in their letterhead pad mentioning contractor/supplier Name, Users' name as PGCB and Consultant Name (if any) as per provision of contract between PGCB & Contractor. GTP must have Revision No. & date of submission. Responsible personnel of Manufacturer (Prepared by, checked by & Approved by, as appropriate) shall sign the GTP. The Project Manager/Design & Quality Control Personnel of Contractor shall also sign the GTP before submission to PGCB.
2. The items that require detail design of the offered transformer, may be kept unfilled mentioning "TBA" [To be announced] during detailed design. All other data shall be filled during bidding.

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	General			
1.1	Manufacturer		Insert	
1.2	Type		Power transformer three phase, oil immersed, with on-load tap changer, outdoor	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044	
			IEC 60076	
			IEC 60137	
			IEC 60214	
			IEC 60354	
			IEC 60529	
			IEC 60815	
			IEC 60947	
			NEMA TR-1	
			CENELEC EN 50216	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.6	Quality control		ISO 9001	
1.7	No. of Windings		Two	
1.8	Tertiary winding function		NA	
1.9	Thermal insulation class		A	
2	Ratings and properties			
2.1	Rating			
2.1.1	Voltage ratio (No Load)	kV/kV	132/33	
2.1.2	Rated Power HV-LV (ONAN / ONAF)	MVA	80/120	
2.1.3	Rated Power TV	MVA	NA	
2.1.4	Rated Ampacity (120 MVA)			
	HV	A		
	LV	A		
	TV	A	NA	
2.1.5	Percent Impedance			
	HV - LV, on the basis of rated power with on-load tap changer in plus (+) extreme tap position	%	13.63 ($\pm 5\%$)	
	HV - LV, on the basis of rated power with on-load tap changer in nominal tap position (tap position with 132kV rated voltage)	%	13.00 ($\pm 5\%$)	
	HV - LV, on the basis of rated power with on-load tap changer in minus (-) extreme tap position	%	12.65 ($\pm 5\%$)	
2.1.6	Percent Zero-Sequence Impedance			
	At 120MVA base, HV-LV	%	[not less than 90% of Z+]	
	At 70MVA base, HV-TV	%	NA	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	At 70MVA base, LV-TV	%	NA	
2.1.7	X/R ratio		[Insert]	
2.1.8	Rated Frequency	Hz	50	
2.1.9	Corresponding minimum Designed Frequency	Hz	48	
2.1.10	Induced Voltage			
	HV	kVrms	[Insert]	
	RV	kVrms	[Insert]	
	LV	kVrms	[Insert]	
	TV	kVrms	[Insert]	
2.1.11	Insulation level			
2.1.11.1	High voltage (HV)		LI 650 AC 275	
2.1.11.2	Low voltage (LV)		LI 170 AC 70	
2.1.11.3	Tertiary Voltage (TV)		NA	
2.1.11.4	Neutral Voltage (NV)		LI 170 AC 70	
2.1.11.5	Method of Neutral Earthing		Solidly Grounded -Yes	
2.1.11.6	The highest system voltage for equipment (effective value)			
	High voltage (HV)	kV	145	
	Low voltage (LV)	kV	36	
	Tertiary Voltage (TV)	kV	NA	
	Neutral Voltage (NV)	kV	36	
2.2	Guaranteed Loss & Evaluation of Loss			
2.2.1	No Load Loss			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.2.1.1	No-load losses with tap changer in nominal (principal) tap position at rated voltage and at rated frequency	kW	[Insert]	
2.2.1.2	No-load losses with tap changer in nominal (principal) tap position at 110 % rated voltage and at rated frequency	kW	[Insert]	
2.2.1.3	No-load losses with tap changer in nominal (principal) tap position at 90 % rated voltage and at rated frequency	kW	[Insert]	
2.2.1.4	Average of the above & No-Load Loss for Loss capitalization (N) [This value will be evaluated]	kW	[Insert]	
2.2.1.5	Loss Capitalization Unit	Tk/kW	600000	
2.2.1.6	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
2.2.2	On-load losses at 75°C			
2.2.2.1	On-load losses at 75°C and rated frequency, with tap changer in nominal tap position at rated tapping current (ONAF) of that tap position	kW	[Insert]	
2.2.2.2	On-load losses at 75°C and rated frequency, with tap changer in plus (+) extreme tap position at rated tapping current (ONAF) of that tap position	kW	[Insert]	
2.2.2.3	On-load losses at 75°C and rated frequency, with tap changer in minus (-) extreme tap position at rated tapping current (ONAF) of that tap position	kW	[Insert]	
2.2.2.4	Average of the above & On-load Loss for Loss capitalization (L) [This value will be evaluated]	kW	[Insert]	
2.2.2.5	Loss Capitalization Unit	Tk/kW	300000	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.2.2.6	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
2.2.3	Load Loss due to Ancillary Equipment [fans, pumps, heaters, etc.]	kW		
2.2.3.1	Capitalized valued of ancillary equipment load	Tk/kW	300000	
2.2.3.2	Tolerance to be applied to ancillary equipment load in % of the guaranteed value	%	20	
2.2.4	Per Phase loss			
	HV	kW	[Insert]	
	LV	kW	[Insert]	
	TV	kW	NA	
3	Design & Construction			
3.1	Cooling system			
3.1.1	Oil Flow through Windings/ windings group			
	Guided Oil Flow inside transformer	Yes/No.	Yes	
	Pattern of Oil Flow through Duct	Axial/Zig-Zag	[Insert]	
3.1.2	Pressure drop in side transformer			
	Radial Locations with respect to core		[Insert]	
	Axial Locations with respect to core		[Insert]	
3.1.3	Radiators & Coolers			
3.1.3.1	Radiator Location Attached to Tank or Separate		A	
3.1.3.2	HV side			
	No. of Radiator Bank	No.	[Insert]	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	No. of Fins/Plates in each Radiator	No.	[Insert]	
	No. of Cooler Fans	No.	[Insert]	
	No. of group of Cooler Fan	No.	[Insert]	
	Spare Fans in each group	No.	[Insert]	
	No. of Blower/Motor Driving a Fan	No.	01	
	Mounting of Fan in the radiator-HV side	Vertical/ Horizontal	[Insert]	
	No. of Plates/Fins covered by single cooler, thus, AF Cooling	No.	[Insert]	
	No. of Plates/Fins Not covered by single cooler, thus, AN Cooling	No.	[Insert]	
	No. of Pipes going out from Main Tank to Radiator Bank at Tank upper part (i.e. Hot Oil Pipes)	No.	[Insert]	
	No. of Pipes Coming in from Radiator Bank to Tank at Main Tank Lower part (i.e. Cold Oil Pipes)	No.	[Insert]	
	No. of Pipes collecting Hot Oil	No.	[Insert] (spare , n+1, shall be considered)	
	No. of Pipes collecting Cold Oil	No.	[Insert] (spare , n+1, shall be considered)	
3.1.3.3	LV side			
	No. of Radiator Bank	No.	[Insert]	
	No. of Fins/Plates in each Radiator	No.	[Insert]	
	No. of Cooler Fans	No.	[Insert]	
	No. of group of Cooler Fan	No.	[Insert]	
	Spare Fans in each group	No.	[Insert]	
	No. of Blower/Motor Driving a Fan	No.	01	
	Mounting of Fan in the radiator-HV side	Vertical/ Horizontal	[Insert]	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	No. of Plates/Fins covered by single cooler, thus, AF Cooling	No.	[Insert]	
	No. of Plates/Fins Not covered by single cooler, thus, AN Cooling	No.	[Insert]	
	No. of Pipes going out from Main Tank to Radiator Bank at Tank upper part (i.e. Hot Oil Pipes)	No.	[Insert]	
	No. of Pipes Coming in from Radiator Bank to Tank at Main Tank Lower part (i.e. Cold Oil Pipes)	No.	[Insert]	
	No. of Pipes collecting Hot Oil	No.	[Insert] (spare n+1, shall be considered)	
	No. of Pipes collecting Cold Oil	No.	[Insert] (spare, n+1, shall be considered)	
3.1.4	Oil Flow rate			
3.1.4.1	Oil Flow rate inside Transformer during ONAN Cooling			
	Highest Flow rate (Approx.)	m/s	[Insert]	
	Location at Transformer		[Insert]	
	Lowest Flow rate (Approx.)	m/s	[Insert]	
	Location at Transformer		[Insert]	
	Flow rate optimized to stop induced vibration at Core, Winding	Yes/No	Yes	
3.1.4.2	Oil Flow rate inside Transformer during ONAF Cooling			
	Highest Flow rate (Approx.)	m/s	[Insert]	
	Location at Transformer		[Insert]	
	Lowest Flow rate (Approx.)	m/s	[Insert]	
	Location at Transformer		[Insert]	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Flow rate optimized to stop induced vibration at Core, Winding	Yes/No	Yes	
3.1.5	Predicted Hot Spot Location			
	HV Side		Insert	
	LV side		Insert	
	TV side		NA	
3.1.6	Temperature Difference (D-Temp) between Inlet & Outlet of Radiator banks --- Design value	0C	[Insert]	
3.2	Temperature rise limits, at rated power, with complete cooling system in service and at lowest voltage tap			
3.2.1	Average Oil Temperature rise	°C		
3.2.2	Top oil	°C	≤ 50	
3.2.3	Average Winding Temperature rise	°C	≤ 55	
3.2.3.1	Hottest spot	°C	≤ 65	
3.2.3.2	Winding temperature rise at CMR under service conditions stated in Schedule of Technical Requirement	°C	[Insert]	
3.2.4	Maximum hot spot temperature rises in core at rated power	°C	[Insert]	
3.2.4.1	Internal Hot-spot Temperature (Amb. Temp. + Top oil rise + Core hot spot)	°C	130	
3.2.4.2	Surface Temperature (Amb. Temp. + Top oil rise + Core surface temp.)	°C	[Insert]	
3.2.5	Temperature gradient at specified rating			

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No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.6	Temperature rise of metallic parts			
	Tank walls	0C	[Insert]	
	Tie plate	0C	[Insert]	
	Top clamp	0C	[Insert]	
	Bottom clamp	0C	[Insert]	
3.3	Core Construction			
3.3.1	Type of Transformer Core (Shell or Core)		Core	
3.3.2	No. of Core Limb		03	
3.3.3	Core Material		CRGO Si steel	
3.3.3.1	Grade Designation		Insert	
3.3.3.2	Core Graining Method		Laser-beam or plasma jet irradiation	
3.3.3.3	Thickness of Sheet	mm	[Insert]	
3.3.3.4	Specific Loss at 1.7T,50Hz	W/kg	[Insert]	
3.3.3.5	Insulation material & Class		[Insert]	
3.3.4	Safe Working Temperature of Core	0C	[Insert]	
3.3.5	Whether step lap construction adopted		Yes	
3.3.6	Whether boltless construction adopted		Yes	
3.3.7	Core Material Make , Country		Insert	
3.3.8	Whether Core is pre-cut or cut at Factory		[Insert]	
3.3.9	Flux density at nominal voltage and frequency and at nominal ratio - (no load)			
a	Cores	T	[Insert]	
b	Yokes	T	[Insert]	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
c	Volts/turn	V	[Insert]	
3.3.10	Over flux withstand capability of the Transformer [flux density & time]			
a	Continuously 10% over voltage and frequency and at principal tap			
b	at 125% of rated Voltage	T, Min or s		
c	at 140% of rated Voltage	T, Min or s		
d	at 150% of rated Voltage	T, Min or s		
3.3.11	Magnetizing current (approx) at nominal ratio and			
a	at 0.90 x nominal voltage	% of FLA		
b	at 0.95 x nominal voltage	% of FLA		
c	at 1.0 x nominal voltage	% of FLA		
d	at 1.05 x nominal voltage	% of FLA		
e	at 1.1 x nominal voltage	% of FLA		
3.3.12	Power factor of magnetizing current at normal voltage ratio and frequency			
3.3.13	Oil Ducts among cores		Yes	
3.4	Winding Construction			
3.4.1	Materials of winding		Copper	
3.4.2	Make, country			
3.4.3	Conductor Used		CTC/others	
	HV		[Insert]	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	RV/ tap Winding			
	LV		[Insert]	
	TV		[Insert]	
3.4.4	Type of Conductor Used			
	HV		Disc	
	RV/ tap Winding		Insert	
	LV		Disc	
	TV		Helical/Disk	
3.4.5	Current density, Thermal			
	HV	A/mm2	[Insert]	
	RV/ tap Winding	A/mm2	[Insert]	
	LV	A/mm2	[Insert]	
	TV	A/mm2	[Insert]	
3.4.6	Current Density, Short circuit			
	HV	A/mm2	[Insert]	
	RV/ tap Winding	A/mm2	[Insert]	
	LV	A/mm2	[Insert]	
	TV	A/mm2	[Insert]	
3.4.7	Insulations at windings		Thermally Upgraded Paper	
3.4.7.1	Insulation Class		A	
3.4.7.2	Insulation Make ,Country			
3.4.7.3	Additional Insulations as Protection caps at windings			
	HV			
	LV			
	TV			
3.4.7.5	Oil Ducts among windings		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.4.7.6	Material of Pressboard		[Insert]	
3.4.7.7	Key Spacer		[Insert]	
3.4.8	Resistance /phase [Design Value with Tolerance]			
	HV	Ω	[Insert]	
	LV	Ω	[Insert]	
	TV	Ω	[Insert]	
3.4.9	Connection of three-phase windings (vector group IEC 60076)		Dyn1	
3.4.10	Tertiary winding connection (TV)		NA	
3.4.11	Geometric Location of windings with respect to core			
	TW		[Insert]	
	LW/ common winding		[Insert]	
	HV/ series winding		[Insert]	
	RW		[Insert]	
3.4.11	Winding Method at Factory		(Hor/Ver.)[Insert]	
3.4.12	Winding connections [crimped, Brazed or others]			
	Between Windings			
	Between Winding Layers/Disk			
	Between Main Winding & Tap Winding			
	Between Windings & Leads			
3.4.13	Clamping of Winding			
	The individual winding sets clamped separately from each other and separately from the core.		Yes	

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No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Core		Insert	
3.4.14	Guaranteed Tangent delta of winding		Insert	
3.4.15	Guaranteed PD level		pC	
3.4.16	Curing of Active Part			
	Highest temperature	°C	Insert	
	Duration	Hrs	Insert	
	Average temperature	°C	Insert	
	Duration	Hrs	Insert	
	Total duration	Hrs	Insert	
3.4.17	Active Part Compression during Pressure, (approx)	mm		
3.5	Sound / Noise			
	At No load , rated frequency , 100% rated voltage	dB	[Insert]	
	At No load , rated frequency , 105% rated voltage	dB	[Insert]	
	At load , rated frequency , 100% rated voltage	dB	[Insert]	
	At load , rated frequency , 105% rated voltage	dB	[Insert]	
	Guaranteed during Testing	dB	[Insert]	
	Audible noise level (acc. to NEMA TR1), at 105 % of rated voltage, at maximum power and with complete cooling system in service	dB	[Insert]	
	Radio Interference Voltage at 0.5 MHz as specified in IEC 60694	μV	2500 max	
3.6	Short Circuit			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.6.1	Current through windings for Terminal Fault			
	HV	kArms		
	LV	kArms		
	TV	kArms		
3.6.2	Pre-fault voltage	p.u.	1.05	
3.6.3	Withstand Duration	s	2	
3.6.4	Similar Design Transformer (as per IEC 60076-5, Annex A) type test reference			
	Testing Authority		STL Lab, insert Name	
	certificate reference			
	Contact address of test Lab			
	Validity of test certificate			
3.6.5	Force			
	Axial Force	kN	[Insert]	
	Free Buckling Force	kN	[Insert]	
	Compression Force	kN	[Insert]	
	Designed Safety Margin		[Insert]	
3.6.7	Offered & Reference Similar Design transformer Short Circuit Force relationship		Within 110%	
3.6.8	Temperature during SC			
	HV Winding [Actual]	OC	[Insert]	
	LV Winding [Actual]	OC	[Insert]	
	RV Winding [Actual]	OC	[Insert]	
	TV Winding [Actual]		[Insert]	
3.6.9	Maximum Circulating Current in Delta tertiary for L-G fault at TV terminal	kA	[Insert]	

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No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.6.9.1	Winding withstand capacity of this current	Min or s		
3.7	Dielectric Design			
3.7.1	Impulse Voltage at HV (LI)			
	Maximum applied voltage at critical points	kV	[Insert]	
	Permissible Voltage	kV	[Insert]	
	Safety Factor	kV	[Insert]	
	Transferred surge at LV	kV	[Insert]	
	Transferred surge at TV	kV	[Insert]	
	ZnO Block to limit distributed impulse [tap Winding/other]		No	
3.7.2	Impulse Voltage at HV (SI)		NA	
	Maximum applied voltage at critical points	kV	[Insert]	
	Permissible Voltage	kV	[Insert]	
	Safety Factor	kV	[Insert]	
	Transferred surge at LV	kV	[Insert]	
	Transferred surge at TV	kV	[Insert]	
	ZnO Block to limit distributed impulse [tap Winding/other]		No	
3.7.3	Impulse Voltage at LV (LI)			
	Maximum applied voltage at critical points	kV	[Insert]	
	Permissible Voltage	kV	[Insert]	
	Safety Factor	kV	[Insert]	
	Transferred surge at HV	kV	[Insert]	
	Transferred surge at TV	kV	[Insert]	
	ZnO Block to limit distributed impulse		No.	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.7.4	Impulse Voltage at LV (LI)		NA	
	Maximum applied voltage at critical points	kV		
	Permissible Voltage	kV	[Insert]	
	Safety Factor	kV	[Insert]	
	Transferred surge at HV	kV	[Insert]	
	Transferred surge at LV	kV	[Insert]	
	ZnO Block to limit distributed impulse		No.	
3.8	Tap changer			
3.8.1	Manufacturer		MR (EU), ABB (EU)	
3.8.1.1	Country of origin		Insert	
3.8.2	Switching technology		Vacuum	
3.8.3	Model designation		Insert	
3.8.4	Type of tap changing		On-load	
3.8.5	Electrical location of Tap winding		HV / Series Winding	
3.8.5.1	Geometric Location of Tap winding		[Insert]	
3.8.6	Type of voltage regulation		Constant Flux Variable Voltage (C.F.V.V.)	
3.8.7	Tapping range	% V	-15% to +10%	
3.8.7.1	Tapping step/Size of each tapping step	%	1.25	
3.8.8	Short circuit current - time	kA-s		
3.8.8.1	Rated current	A		
3.8.9	OLTC diverter switch		Separate oil filled Compartment	
3.8.10	Breathing of OLTC		Separate conservator	
3.8.11	OLTC Oil guided to Radiator for cooling		No	
3.8.12	OLTC tap change principle type		Resistance/Reactance type	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.8.13	MVA Rating of Transformer due to OLTC operation		Rated power 120MVA, all taps	
3.8.14	Rated Voltage (No. load) due to OLTC operation	kV/kV	(132 - 12 x 1.25 %) / 33 to (132 + 8 x 1.25 %) / 33	
3.8.15	Percent Impedance design due to Tap Changing		Constant Impedance	
3.8.16	OLTC Motor			
3.8.16.1	Rating	50Hz, kW		
	AC voltage	V		
	Power	kW		
	Inrush	A		
3.8.16.2	Cabinet		Yes	
3.8.16.3	Handle		Insert	
	Tap position indicator		Digital code matrix (BCD)	
	Auxiliary supply		3x400 V / 230 V, 50 Hz	
3.9	Earthing			
3.9.1	Neutral [with double connection], with copper conductor	sqmm		
3.9.2	Core , taken out		Yes	
3.9.3	Clamp		Yes	
3.9.4	Tank Body		Yes	
3.9.5	Cubicles		Yes	
3.9.6	Radiators, if separately mount /connected		Yes	
3.9.7	Others		[Insert]	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.10	Valves & Manholes			
3.10.1	Type of valves used			
3.10.2	Valve schedule attached		Yes	
3.10.3	Spare Manhole for inspection & future use		Yes, insert number & size	
3.11	Layout			
11.1	Primary winding bushings		Longitudinal axis	
11.2	Secondary winding bushings		Longitudinal axis (opposite to HV)	
11.3	Tertiary winding bushings		As per Specification	
11.4	Conservator tank		As per Specification	
11.5	Tap changer		To be defined in design stage	
11.6	Control cabinet		To be defined in design stage	
11.7	Coolers		To be defined in design stage	
13	Dehydrating breather			
13.1	Type of dehydrating breather		Insert	
13.2	Dehumidifying agent	kg	Insert	
3.14	Transformer Tank			
14.1	Type of design		Welded/Bolted	
14.2	Thickness of transformer tank:			
	• Sides	mm	Insert	
	• Bottom	mm	Insert	
	• Top	mm	Insert	
14.3	Material of the autotransformer tank		Insert	
14.4	Corrosion protection of the tank		YES	
14.5	Vacuum withstand of the complete tank with cooler	mbar	1	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14.6	Over-pressure withstand of the complete autotransformer	bar	0.3	
14.7	Painting Color		Insert	
3.15	Conservator			
15.1	Type		With diaphragm	
15.2	Number of compartments	pcs.	Insert	
15.3	Oil level indicators with alarm for minimum oil level	pcs.	Insert	
15.4	Membrane provided inside the conservator for "breathing" of the transformer		Yes	
	Winding Temperature			
4	Oil for Transformer & Tap-Changer			
4.1	Manufacturer, Country		Insert	
4.2	Type		Mineral	
4.3	Type Designation			
4.4	Standard		IEC 60296	
4.5	Minimum flash point	°C	Insert	
4.6	Viscosity at 20°C	mm ² /s	Insert	
4.7	Minimum dielectric strength	kV/cm	Insert	
5	Bushing			
	Standard		IEC 60137	
5.1	HV bushing (145 kV)			
5.1.1	Make/Country		ABB (Sweden/ Switzerland), Trench (France/USA), HSP (Germany), GE (Italy)	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.1.2	Model		Insert	
5.1.3	Quantity		3	
5.1.4	Class	kV	145/650/275	
5.1.5	Housing		Composite SiR	
5.1.6	test tap	Yes		
5.1.7	The max. test voltage of the tap for 1 minute.	at 50 Hz, kV AC	2 kV	
5.1.8	Rated current	A	≥ 800	
5.1.8.1	Rated short circuit current (2 s)	kA rms	40	
5.1.9	Minimum creepage distance	mm/kV	≥ 31	
5.1.10	USCD, Unified Specific Creepage Distance	mm/kV	Insert	
5.1.11	Creepage factor , Cf [According to IEC 60815]		<3.2	
5.1.11.1	profile factor, P.F.		<1.1	
5.1.12	Min. flashover distance	mm		
5.1.13	Cantilever test load	kN	Insert	
5.1.14	Housing shed type	Alternate		
5.1.15	Air Vent		Yes	
5.1.16	Allowable mounting angle [with Vertical]	0 [deg]	Insert	
5.1.16.1	Mounted Angle [with Vertical] in this transformer	0 [deg]	Insert	
5.1.17	Total Length	mm		
5.1.18	Outer diameter	mm		
5.1.19	CT Pocket Length for BCT	mm	400 or as per design	
5.1.20	Oil quantity [for OIP type]	kg		
5.1.21	Mounting Flange made of corrosion free aluminium alloy	Yes		

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.1.21.1	No. of Hole	No.		
5.1.21.2	Diameter of each hole	mm		
5.1.21.3	Distance between hole	mm		
5.1.21.4	Fixing nut-bolt Material	AL or SS		
5.1.21.5	Earthing holes M12	No.		
5.1.22	End-shielding		Yes	
5.1.23	Al-casted head [with oil expansion chamber and oil level Indicator--- for OIP]			
5.1.24	Top Terminal Suitable for	AL		
5.1.25	dissipation factor			
5.1.26	Partial discharge	pC	0.5% or lower	
5.1.27	Insulation Class	F/1550 C		
5.1.28	Total Weight	kg	[Insert]	
5.2	LV bushings (36 kV)			
5.2.1	Make/Country		ABB (Sweden/ Switzerland), Trench (France/USA), HSP (Germany), GE (Italy)	
5.2.2	Model		[Insert]	
5.2.3	Quantity		3	
5.2.4	Class	kV	36/170/70	
5.2.5	Manufacturer		Insert	
5.2.6	Type		Insert	
5.2.7	Model		Insert	
5.2.8	Rated current	A	≥ 2500	
5.2.8.1	Rated short circuit current (2 s)	kA rms	31.5	
5.2.9	Minimum creepage distance	mm/kV	≥ 31	

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No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.2.10	USCD, Unified Specific Creepage Distance	mm/kV	Insert	
5.2.11	Creepage factor , Cf [According to IEC 60815]		<3.2	
5.2.11.1	profile factor, P.F.		<1.1	
5.2.12	Min. flashover distance	mm		
5.2.13	Cantilever test load	kN		
5.2.14	Housing shed type	Alternate		
5.2.15	Air Vent	Yes		
5.2.16	Allowable mounting angle [with Vertical]	0 [deg]		
5.2.16.1	Mounted Angle [with Vertical] in this transformer	0 [deg]		
5.2.17	Total Length	mm		
5.2.18	Outer diameter	mm		
5.2.19	CT Pocket Length for BCT	mm	400 or as per design	
5.2.20	Oil quantity [for OIP type]	kg		
5.2.21	Mounting Flange made of corrosion free aluminium alloy	Yes		
5.2.21.1	No. of Hole			
5.2.21.2	Diameter of each hole			
5.2.21.3	Distance between hole			
5.2.21.4	Fixing nut-bolt Material	AL or SS		
5.2.21.5	Earthing holes M12	No.		
5.2.22	End-shielding		Yes [if required by design]	
5.2.23	Al-casted head [with oil expansion chamber and oil level Indicator--- for OIP]		Yes	
5.2.24	Top Terminal Suitable for	AL		

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No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.2.25	dissipation factor			
5.2.26	Partial discharge	pC	0.5% or lower	
5.2.27	Insulation Class	F/1550 C		
5.2.28	Total Weight	kg		
5.3	TV bushings (36 kV)		NA	
5.3.1	Quantity			
5.3.2	Class	kV		
5.3.3	Manufacturer			
5.3.4	Type			
5.3.5	Rated current	A		
5.3.6	Minimum creepage distance	mm/kV	≥ 31	
5.3.7	Partial discharge	pc	Insert	
5.3.8	Insulation Class	F/1550 C		
5.3.9	Outer diameter	mm		
5.3.10	CT Pocket Length for BCT	mm		
5.3.11	Total Weight	kg		
5.4	NV bushings (36 kV)			
5.4.1	Quantity		1	
5.4.2	Class	kV	36/170/70	
5.4.3	Manufacturer		ABB (Sweden/ Switzerland), Trench (France/USA), HSP (Germany), GE (Italy)	
5.4.4	Type		Insert	
5.4.5	Rated current	A	≥ 1250	
5.4.5.1	Rated short circuit current (2 s)	kA rms	31.5	
5.4.6	Minimum creepage distance	mm/kV	≥ 31	
5.4.7	Partial discharge	pC	0.5% or lower	
5.4.8	Insulation Class	F/1550 C		

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.4.9	Outer diameter	mm		
5.4.10	CT Pocket Length for BCT	mm	400 or as per design	
5.4.11	Total Weight	kg		
6	Weights			
6.1	Total weight of transformer, ready for service	kg	Insert	
6.2	Shipping Weight of Transformer [Without Oil]	kg	Insert	
6.3	Weight of Core	kg	Insert	
6.4	Weight of Winding	kg	Insert	
6.5	Weight of Active Parts	kg	Insert	
6.6	Weight of oil in Main tank	kg	Insert	
6.7	Weight of oil in radiator & Main tank Conservator	kg	Insert	
6.8	Weight of oil in OLTC tank & OLTC Conservator	kg	Insert	
6.9	Total Weight of oil in Transformer	kg	Insert	
7	Dimensions & Layout drawing			
7.1	Outer dimensions:			
	Length	mm	Insert	
	Width	mm	Insert	
	Height without Bushing	mm	Insert	
	Maximum Height with Bushing	mm	Insert	
7.3	Informative dimensional sketch		To be enclosed with bid	
8	NA			
9	Auxiliary power supply			
9.1	Motors		3x400 V / 50 Hz	
9.2	Heaters		230 V / 50 Hz	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
9.3	Control voltage		110 V DC	
9.4	Oil pump (if any)		3x400 V / 50 Hz	
10	Current transformer incorporated into the power transformer			
10.1	CT in HV bushings, for protection and WTI		In all phases, 3cores Characteristics shall be defined in design stage.	
10.2	CT in MV bushings, for protection, WTI and Tap Changer		In all phases, 4 cores characteristics shall be defined in design stage	
10.3	CT in TV bushings, for protection and WTI		NA	
10.4	CT in neutral bushing, for protection		In all phases, 2 cores Characteristics shall be defined in design stage	
11	Miscellaneous Item			
11.1	AVR Relay		Shall be from OLTC Manufacturer	
11.2	Bucholtz relay, Make		insert	
11.3	Control Cable , Make		insert	
11.4	OTI Make		insert	
11.5	WTI Make		insert	
11.6	Remote Transformer Panel with all accessories, Make		Yes, insert	
11.7	Marshalling Cubicle with all accessories, Make		Yes, insert	
11.8	Cooling Cabinet with all accessories, Make		Yes, insert	
11.9	Material (Cooling & Marshalling Cabinet)		Insert	
11.10	No. of PRD in Main Tank		Min 3	

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No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
11.11	No. of PRD in OLTC		Insert	
11.12	Oil Surge Relay			
11.13	WTI [Normal & Fiber Optic]		Yes, insert number	
11.14	OTI		Yes, insert number	
11.15	Gasket Material		Nitrile Rubber	
11.16	Nut-Bolt, Make		Insert	
11.17	Nut-Bolt, Material		SS	
11.18	LA Make		Insert	
12	Operating conditions			
12.1	At the altitude (above sea level)	m	≤ 1000	
12.2	Maximum ambient temperature	°C	45	
12.3	Average daily temperature	°C	35	
12.4	Average annual temperature	°C	30	
12.5	Minimum ambient temperature	°C	-2	
	Overall compliance with the requirements (yes/no)			

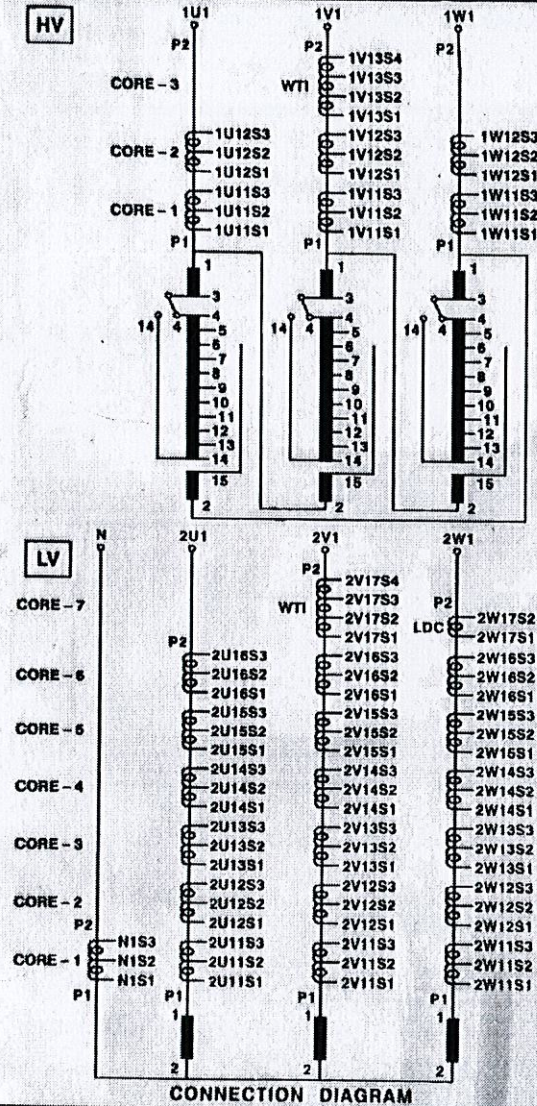
N.B. : For better understanding picture of the name plate of the existing 132/33 kV 80/120 MVA ONAN/ONAF Power transformer of Bhasantek 132/33kV Substation is attached herewith.

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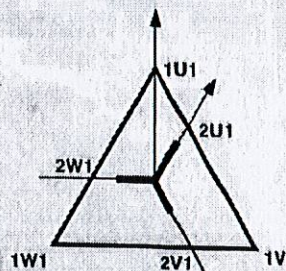
SL

DOUBLE WOUND TRANSFORMER

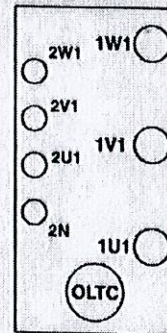
MVA		120	TYPE OF COOLING	ONAN/ONAF
KV (NO LOAD)	HV	132	RATING MVA	80 / 120
KV (NO LOAD)	LV	33	MAXIMUM AMBIENT TEMP.	50 °C
AMPERES	HV	524.9	GUARANTEED TEMP. RISE OIL	50 °C
AMPERES	LV	2099.5	GUARANTEED TEMP. RISE WDG.	55 °C
PHASES		3	CONNECTION SYMBOL	Dyn1
FREQUENCY		50	UNTANKING MASS	62500 kg
MAKER'S W.O. NO.		ET09958	TOTAL OIL	30500 / 34900 kg/ltr
MAKER'S SERIAL NO.		ET09958/1	TOTAL MASS	127800 kg
DIAGRAM DRG. NO.		T62B057410H	HEAVIEST PACKAGE WITH OIL	105400 kg
YEAR OF MANUFACTURE		2011	HEAVIEST PACKAGE WITHOUT OIL	80400 kg
INSULATION LEVEL	HV LINE: LI 650 AC 275/LV LINE AND NEUTRAL: LI 170 AC 70			
CONTRACT NO.	4503177595			
PURCHASER	Siemens A/c PGCB Bangladesh			



HV ACROSS 1U1 1V1 1W1			LV ACROSS 2U1 2V1 2W1		
SWITCH POSN NO.	HV VOLTS	HV AMPS	IN EACH PHASE OLTC CONNECTS	% IMPEDANCE VOLTS AT 75 °C ON 120 MVA BASE	
1	145200	477.1	15 - 14	13.73 %	
2	143550	482.8	15 - 13		
3	141900	488.2	15 - 12		
4	140250	494.0	15 - 11		
5	138600	499.9	15 - 10		
6	136950	505.9	15 - 9		
7	135300	512.1	15 - 8		
8	133650	518.4	15 - 7		
9	132000	524.9	15 - 6	13.11 %	
10	130350	531.5	15 - 5		
11A	128700	538.3	15 - 4		
11B	128700	538.3	15 - 3		
11C	128700	538.3	15 - 14		
12	127050	545.3	15 - 13		
13	125400	552.5	15 - 12		
14	123750	559.9	15 - 11		
15	122100	567.4	15 - 10		
16	120450	575.2	15 - 9		
17	118800	583.2	15 - 8		
18	117150	591.4	15 - 7		
19	115500	599.8	15 - 6		
20	113850	608.5	15 - 5		
21	112200	617.5	15 - 4	12.78 %	



VECTOR DIAGRAM Dyn1



PLAN VIEW

- NOTES: 1) TANK AND CONSERVATOR IS DESIGNED TO WITHSTAND FULL VACUUM.
2) TRANSFORMER IS CONNECTED TO ON LOAD TAP CHANGER.
3) REFER INSTRUCTION MANUAL BEFORE ERECTION AND APPLYING VACUUM.

LOCATION	RATIO	BURDEN VA	CLASS	Rct(max) OHMS	Iex(max) @Vk mA	Vk (min) VOLTS	CONNECTION	PURPOSE
1U1,1V1,1W1(CORE1)	1000 - 800 / 1 A	30	PX	4.2 - 3.3	50 - 100	1000 - 500		51 / 51 N
1U1,1V1,1W1(CORE1)	1000 - 800 / 1 A	30	PX	4.2 - 3.3	50 - 100	1000 - 500		87T2
1V1 (CORE1)	524.9 / 1.9, 2.0, 2.2 A	15	5					WTI
2U1,2V1,2W1(CORE1)	2500 - 1000 / 1 A	30	PX	10.5 - 4.2	50 - 100	1000 - 500	1V13S1 - 1V13S	51 / 51 N
2U1,2V1,2W1(CORE2)	2500 - 1000 / 1 A	30	0.2					ENERGY METER
2U1,2V1,2W1(CORE3)	2500 - 1000 / 1 A	30	0.5					METER CKT
2U1,2V1,2W1(CORE4)	2500 - 1000 / 1 A	30	PX	10.5 - 4.2	50 - 100	1000 - 500		SP
2U1,2V1,2W1(CORE5)	2500 - 1000 / 1 A	30	PX	10.5 - 4.2	50 - 100	1000 - 500		REF
2U1,2V1,2W1(CORE6)	2500 - 1000 / 1 A	30	PX	10.5 - 4.2	50 - 100	1000 - 500		57T2
2W1 (CORE7)	2099.5 / 1 A	7.5	5					LDC CT
2V1 (CORE7)	2099.5 / 2.0, 2.1, 2.3 A	15	5					WTI
LV NEUTRAL N(CORE1)	2500 - 1000 / 1 A	30	PX	10.5 - 4.2	50 - 100	1000 - 500	2V17S1 - 2V17S	REF

ET09958
T62B057410H

Crompton Greaves Lt
TRANSFORMER DIVISION
KANJURMARG, MUMBAI.

DOUBLE WOUND TRANSFORMER

MVA
kV (NO LOAD)
kV (NO LOAD)
AMPERES
AMPERES
PHASES
FREQUENCY
MAKER'S W.O. NO.
MAKER'S SERIAL NO.
DIAGRAM DRG. NO.
YEAR OF MANUFACTURE
INSULATION LEVEL
CONTRACT NO.
PURCHASER

120
132
33
524.9
2099.5
3
50
ET09958
ET09958 / 2
T62B057410H
2011

TYPE OF COOLING
RATING MVA
MAXIMUM AMBIENT TEMP.
GUARANTEED TEMP. RISE OIL
GUARANTEED TEMP. RISE WDG.
CONNECTION SYMBOL
UNTANKING MASS
TOTAL OIL
TOTAL MASS
HEAVIEST PACKAGE WITH OIL
HEAVIEST PACKAGE WITHOUT OIL

°C
°C
°C
kg
kg/lt
kg
kg
kg

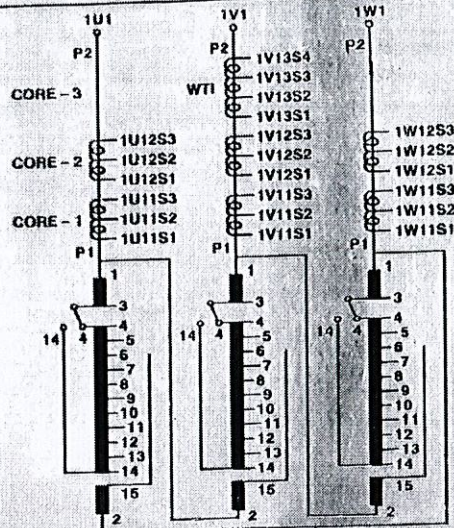
ONAN / ONAF
80 / 120
50
50
55
Dyn1
62500
30500 / 34900
127800
105400
80400

HV LINE: LI 650 AC 275 / LV LINE AND NEUTRAL: LI 170 AC 70

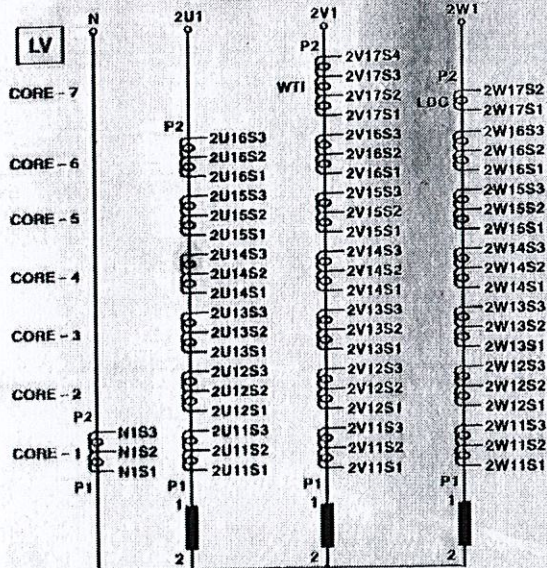
4503177595

Siemens A/c PGCB Bangladesh

HV



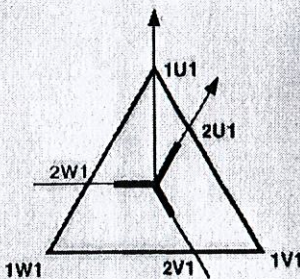
LV



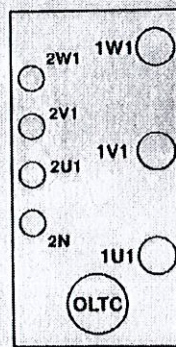
CONNECTION DIAGRAM

HV ACROSS 1U1 1V1 1W1 LV ACROSS 2U1 2V1 2W1

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7	135300	512.1	15 - 8	
8	133650	518.4	15 - 7	
9	132000	524.9	15 - 6	12.99 %
10	130350	531.5	15 - 5	
11A	128700	538.3	15 - 4	
11B	128700	538.3	15 - 3	
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14	123750	559.9	15 - 11	
15	122100	567.4	15 - 10	
16	120450	575.2	15 - 9	
17	118800	583.2	15 - 8	
18	117150	591.4	15 - 7	
19	115500	599.8	15 - 6	
20	113850	608.5	15 - 5	
21	112200	617.5	15 - 4	12.65 %



VECTOR DIAGRAM Dyn1



PLAN VIEW

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LOCATION	RATIO	BURDEN VA	CLASS	Rct(max) OHMS	Iex(max) @Vk mA	Vk (min) VOLTS	CONNECTION	PURPOSE
1U1,1V1,1W1(CORE1)	1000 - 600 / 1 A	30	PX	4.2 - 3.3	50 - 100	1000 - 500	—	51 / 51 N
1U1,1V1,1W1(CORE1)	1000 - 800 / 1 A	30	PX	4.2 - 3.3	50 - 100	1000 - 500	—	87T2
1V1 (CORE1)	524.9 / 1.3, 2.0, 2.2 A	15	5	—	—	—	1V13S1 - 1V13S	WTI
2U1,2V1,2W1(CORE1)	2500 - 1000 / 1 A	30	PX	10.5 - 4.2	50 - 100	1000 - 600	—	51 / 51 N
2U1,2V1,2W1(CORE2)	2500 - 1000 / 1 A	30	02	—	—	—	—	ENERGY METER
2U1,2V1,2W1(CORE3)	2500 - 1000 / 1 A	30	0.5	—	—	—	—	METER CKT
2U1,2V1,2W1(CORE4)	2500 - 1000 / 1 A	30	PX	10.5 - 4.2	50 - 100	1000 - 600	—	SP
2U1,2V1,2W1(CORE5)	2500 - 1000 / 1 A	30	PX	10.5 - 4.2	50 - 100	1000 - 600	—	REF
2U1,2V1,2W1(CORE6)	2500 - 1000 / 1 A	30	PX	10.5 - 4.2	50 - 100	1000 - 600	—	87T2
2W1 (CORE7)	2099.5 / 1 A	7.5	5	—	—	—	—	LDC CT
2V1 (CORE7)	2099.5 / 2.0, 2.2 A	15	5	—	—	—	2V17S1 - 2V17S	WTI
LV NEUTRAL N(CORE1)	2500 - 1000 / 1 A	30	PX	10.5 - 4.2	50 - 100	1000 - 600	—	REF

ET09958
T62B057410H

Crompton Greaves Ltd.
TRANSFORMER DIVISION