The Automation People
PROLIFIC
Prolific Systems & Technologies Pvt. Ltd.

Plot No. A-267, MIDC, Road No. 16A, Opp. ESIS Hospital, Wagle Industrial Estate, Thane (West) - 400 604

Date: 4/2/2016

CORE DETAILS

Design No. mahati

Step No.	SIDES Figure - I			CENTRE Figure - II				TOP & BOTTOM Figure - III			Stack
	B	L-1	Wt-1	L-2	X	Y	Wt-2	L-3	Z	Wt-3	
1	215	1015	94.30	800	112.0	102.0	40.86	1043	108.0	91.20	36
2	210	1005	55.93	795	110.0	100.0	24.27	1038	105.0	54.60	22
3	200	985	66.95	785	105.0	95.0	29.20	1028	100.0	66.30	28
4	185	955	62.91	770	98.0	88.0	27.63	1013	92.0	63.90	29
5	175	935	28.36	760	92.0	82.0	12.56	1003	88.0	29.20	14
6	165	915	24.50	750	88.0	78.0	10.88	993	82.0	25.70	13
7	155	895	19.21	740	82.0	72.0	8.61	983	78.0	20.50	11
8	145	875	14.51	730	78.0	68.0	6.52	973	72.0	15.70	9
9	130	845	16.99	715	70.0	60.0	7.72	958	65.0	18.90	12
10	120	825	10.31	705	65.0	55.0	4.71	948	60.0	11.70	8
11	100	785	11.48	685	55.0	45.0	5.31	928	50.0	13.50	11
12	90	765	4.63	675	50.0	40.0	2.16	918	45.0	5.50	5
13	80	745	3.24	665	45.0	35.0	1.52	908	40.0	3.90	4
14	65	715	3.86	650	38.0	28.0	1.83	893	32.0	4.80	6
15	55	695	1.07	640	32.0	22.0	0.51	883	28.0	1.40	2
	Weight (kg)		**418.25**	**Weight (kg)**			**184.29**	**Weight (kg)**		**426.80**	

Total Area (sq. mm)	34745	LL/WH (mm)	585	Grade	23ZDKH90
Total Weight (kg)	1029.34	CL/WW (mm)	414	Type	D Type (Flat Yoke)

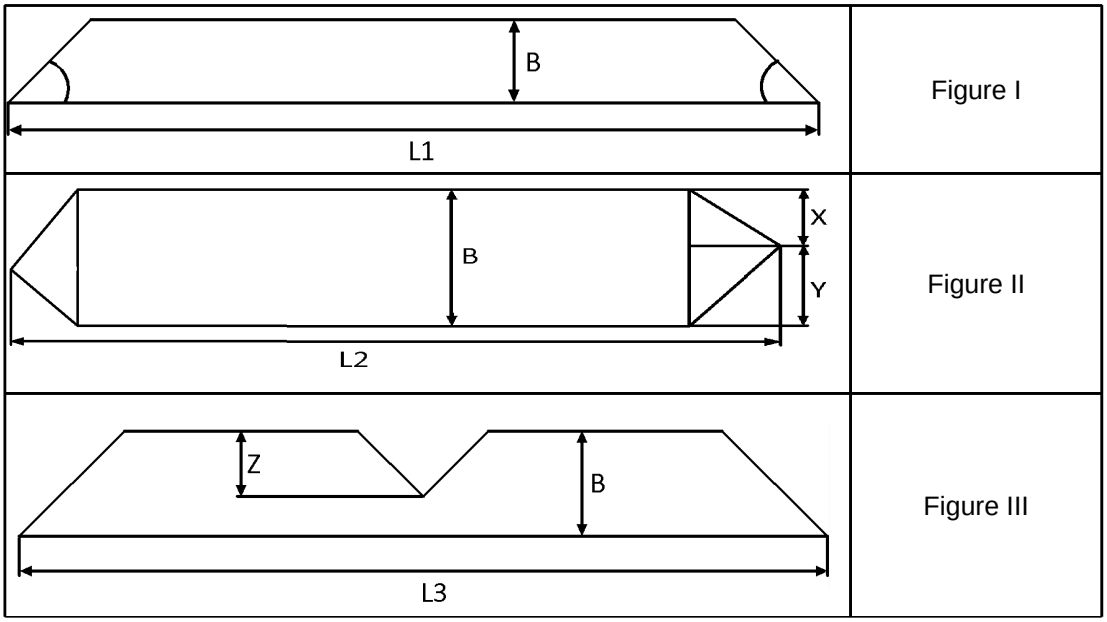
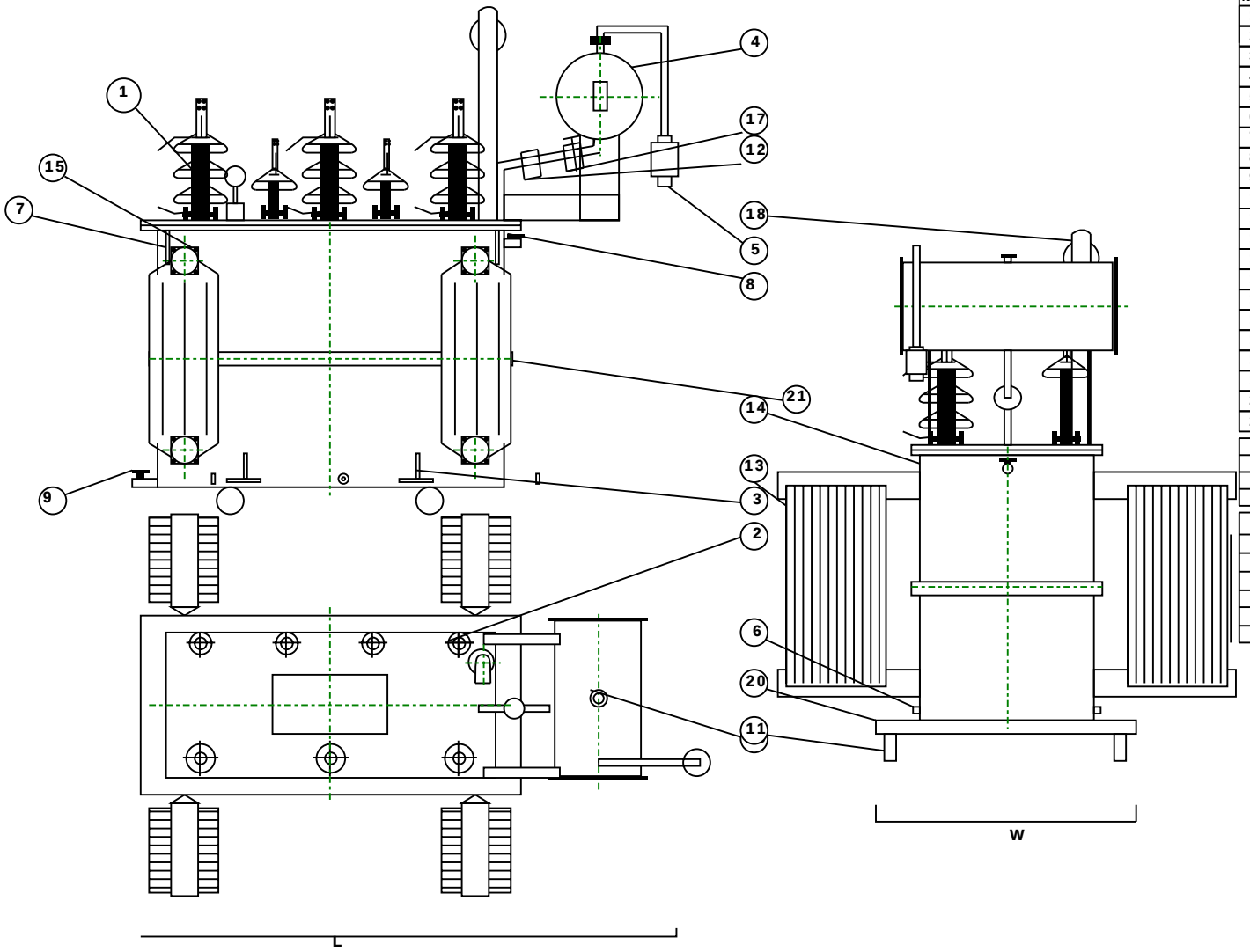


Figure I

Figure II

Figure III



BILL OF MATERIAL

NO	DESCRIPTION	QTY.
1	HV BUSHING	3
2	LV BUSHING & NEUTRAL BUSHING	4
3	JAKING PAD	4
4	CONSERVATOR ASSLY WITH OIL FILLING CAP	1
5	SILICA JEL BREATHER	1
6	EARTHING TERMINAL	2
7	TANK LIFTING LUG	1
8	TOP FILTER VALVE	1
9	BOTTOM SAMPLING VALVE	1
10	R & D PLATE	1
11	ROLLER	1
12	BUCHHOZ RELAY	1
13	FLANGED RADIATORS	4
14	TRANSFORMER TANK	1
15	RADIATOR SHUT OFF VALVE	8
16	OIL FILLING HOLE (CONSERVATOR)	1
17	DRAIN VALVE (CONSERVATOR)	1
18	EXPLOSION VENT PIPE	1
19	THERMOMETER POCKET	3
20	BASE CHANNEL	2
21	STIFFENERS	1

OVERALL DIMENSIONS.

KVA	V/R	L	W	H
630	22/0.433 kV	1614	1446	2130

TRANSFORMER WEIGHT DETAILS (APPROX).

NO	DESCRIPTION	UNIT	VALUE
1	CORE AND WINDING	Kg	1749
2	TANK WITH FITTINGS	Kg	654
3	OIL	Kg	658
4	TOTAL FOR TRANSFORMER	Kg	3061
5	VOLUME OF OIL	Ltr	784

CUSTOMER :-	PROJECT :-	ITEM :-	ALL DIMENSIONS ARE IN MM	
			TITLE :-	SCALE :- NTS / QTY. :-
CONSULTANT :-	P.O. No. :-			DRG. No. :- / SHEET :-
	O.A. No. :-	THIS DRWAING AND DESIGN IS THE PROPERTY OF M/S. PROLIFIC SYSTEMS & TECHNOLOGIES PVT LTD. AND MUST NOT BE COPIED OR LENT WITHOUT THEIR PERMISSION IN WRITING		REV. :-
			The Automation People PROLIFIC	PROLIFIC SYSTEMS & TECHNOLOGIES PVT. LTD. PLOT NO. A-267, MIDC, ROAD NO. 16A, OPP. ESIS HOSPITAL, WAGLE INDUSTRIAL ESTATE, THANE (WEST) - 400 604
	REMARKS :-			

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Date : 02/04/2016

MANUFACTURER'S GUARANTEED TECHNICAL PARTICULARS OF TRANSFORMER ENERGY EFFICIENCY LEVEL 3 : 630 KVA (Cu) 22/0.415 KV

Sr.No	PARTICULARS	UNIT	AS OFFERED
1	Manufacturers Name		Prolific Systems & Technologies Pvt. Ltd.
2	Applicable standard		IS:2026 / 1180
3	Service		Outdoor, Continuously
4	Type (CRGO / Conventional)		CRGO / Conventional
5	Continuous Maximum Rating under peak ambient temp. of 50°C	KVA	630
6	Rated Voltage at Normal tap		
	(a) HV	Volt	22000
	(b) LV	Volt	415
7	Rated Current		
	(a) HV	Amp	16.534
	(b) LV	Amp	876.46
8	Rated frequency	Hz	50
9	No of Phases		Three
10	Method of connection		
	(a) HV		DELTA
	(b) LV		STAR
11	Vector Group		Dyn11
12	Method		
	(a) Method of cooling		ONAN
	(b) Transformer oil reference standard		IS: 335
13	Maximum temperature rise by the transformer when run at maximum ambient temp. of 50°C		
	(a) Of top oil by thermometer	°C	40
	(b) Of winding by resistance	°C	45
14	Hottest spot temperature, at rated current and voltage, calculated corresponding to the yearly weighted average ambient temp. of 32°C	°C	86.3
15	Max guaranteed No Load Loss at rated voltage and rated frequency	Watt	710
16	Max guaranteed Load Loss at rated voltage and rated frequency	Watt	4140
17	Total Losses at rated Current at 75 °C		
	i) At 50% loading	Watt	1745
	ii) At 100% loading	Watt	4850
18	Impedance at full load and at 75 °C	%	4.5
19	Resistance at full load and at 75 °C	%	0.657143
20	Reactance at full load	%	4.45
21	Efficiency at 75 °C		
	(a) At Unity power factor		
	(i) At 125% of full load	%	99.1
	(ii) At 100% of full load	%	99.24
	(iii) At 75% of full load	%	99.36
	(iv) At 50% of full load	%	99.45
	(v) At 25% of full load	%	99.39

MANUFACTURER'S GUARANTEED TECHNICAL PARTICULARS OF TRANSFORMER
ENERGY EFFICIENCY LEVEL 3 : 630 KVA (Cu) 22/0.415 KV

Sr.No	PARTICULARS	UNIT	AS OFFERED
	(b) At 0.8 power factor		
	(i) At 125% of full load	%	98.87
	(ii) At 100% of full load	%	99.05
	(iii) At 75% of full load	%	99.2
	(iv) At 50% of full load	%	99.31
	(v) At 25% of full load	%	99.24
22	Maximum efficiency	%	99.46
23	Load at which maximum efficiency occurs	%	41.41
24	Regulation at full load & at 75 °C	%	
	(a) At Unity power factor	%	0.76
	(b) At 0.8 power factor	%	3.25
25	Core material		CRGO
26	Max. flux density at rated voltage and rated frequency	Tesla	1.6
27	Percentage no load current at rated frequency (Without any positive tolerance)		
	(a) At rated voltage	%	2
	(b) At 112.5 rated voltage	%	4
28	Insulation level of transformer		
	(a) Impulse strength		
	HV	KVp	125
	LV	KVp	NA
	(b) Power frequency withstand voltage		
	HV	KVrms	50
	LV	KVrms	3
	(C) Induced over voltage withstand		
	Primary winding	KVrms @ Hz	44 @ 100
	Secondary winding	KVrms @ Hz	0.83 @ 100
29	Tank		
	(a) Type(construction)		Conventional(rectangular)
30	Terminal arrangements		
	(a) High voltage side		Bare bushing
	(b) Low voltage side		Bare bushing
31	HV Bushing details		
	(a) Rating of the bushing	kV / Amp	24 / 250
	(b) Type		Plain porcelain
	(c) impulse strength	KVp	125
	(d) Power frequency withstand voltage,dry and wet	kV	50
	(e) Reference Standard		IS : 3347 & IS : 2099
32	LV Bushing details		
	(a) Rating of the bushing	kV / Amp	1.1 / 1000
	(b) Type		Plain porcelain
	(c) Power frequency withstand voltage,dry and wet	kV	3
	(d) Reference Standard		IS : 3347 & IS : 2099
33	HV Coil constructional details :-		
	(a) Type of winding		Cross-over

MANUFACTURER'S GUARANTEED TECHNICAL PARTICULARS OF TRANSFORMER
ENERGY EFFICIENCY LEVEL 3 : 630 KVA (Cu) 22/0.415 KV

Sr.No	PARTICULARS	UNIT	AS OFFERED
	(b) No. of coil per phase		6
	(c) Conductor cross Section (min)	sq.mm	5.11
	(d) Bare conductor dia	mm	2.55
	(e) Covered conductor dia	mm	2.95
	(f) Phase current	Amp	9.55
	(g) Current density	A/sq.mm	1.87
	(h) Coil I.D	mm	320
	(i) Coil O.D	mm	400
	(j) Coil axial length	mm	507
	(k) Total no. of turns per phase	No	1928
	(l) Resistance per phase at 75 °C	ohms	9.07667
	(m) Weight of covered conductor per transformer	Kg	310.45
	(n) Inter layer insulation	mm	0
	(o) No.of vertical spacers per circle (in the annular gap between LV & HV)		8
34	LV Coil constructional details :-		
	(a) Type of winding		Layer
	(b) No. of Layer per phase		2
	(c) Conductor cross Section(min)	sq.mm	521.36
	(d) Bare conductor Size	mm	10.71 x 1.79
	(e) No.of conductor in parallel	mm	28
	(f) Covered conductor Size	mm	11.11 x 2.19
	(g) Phase current	Amp	876.46
	(h) Current density	sq.mm	1.68
	(i) Coil I.D	mm	226
	(j) Coil O.D	mm	292
	(k) Coil axial length	mm	567
	(l) Total no. of turns per phase	No	21
	(m) Resistance per phase at 75 °C	ohms	0.0007
	(n) Weight of covered conductor per transformer	Kg	264
	(o) Inter layer insulation	mm	2
	(p) No.of vertical spacers per circle		8
35	Type of Insulation		
	(a) Primary		TPC
	(b) Secondary		TPC
	(c) Insulation Class		A
36	Insulation materials		
	(a) Turn insulation HV		Craft paper
	(b) Turn insulation LV		Craft paper
	(c) Insulation core to LV		Pressed Compressed Board
	(d) Insulation HV to LV		Pressed Compressed Board
37	Minimum external clearances in air (with BMC s mounted)		
	(a) HV phase to phase	mm	330
	(b) HV phase to earth	mm	230
	(c) LV phase to phase	mm	75
	(d) LV phase to earth	mm	40

MANUFACTURER'S GUARANTEED TECHNICAL PARTICULARS OF TRANSFORMER
ENERGY EFFICIENCY LEVEL 3 : 630 KVA (Cu) 22/0.415 KV

Sr.No	PARTICULARS	UNIT	AS OFFERED
38	Minimum internal clearances (in oil)		
	(a) Between HT outside surface and tank inside (non bushing side)	mm	25
	(b) Between HT outside surface and tank inside (HV & LV bushing side)	mm	40
	(c) Between HV winding and yokes (end insulation)	mm	40
	(d) LV winding and yokes	mm	4
	(e) From top of yoke to inside of top cover of tank (With gasket)	mm	97
	(f) LT/HT coil annular gap (bare conductor)	mm	14
	(g) Radial clearance between core & LV coil (Bare conductor)	mm	5.0
	(h) Phase to phase clearance between Limbs (HV Conductors),with a minimum of 2 No.s x 1 mm Press board covering the tie rods	mm	14
	(i) Minimum thickness of locking Spacers between HV coil section (including 1 mm ring of press board)	mm	9
	(j) Maximum clearance of core channels from tank walls at each end		
	(i)HV Side	mm	60
	(ii)LV Side	mm	60
39	Tank details		
	(a) Clear inside tank dimensions		
	(i)Length	mm	1308
	(ii)Breadth	mm	520
	(iii)Height	mm	1160
	(b) Tank sheet thickness		
	(i)Sides	mm	3
	(ii)Top	mm	5
	(iii)Bottom	mm	5
	(c) Tank stiffener details		
	(i)No.of stiffener around the tank	Nos	2
	(ii)Size		50 x 10
40	Cooling radiator details		
	(a) No of radiator		4
	(b) No. of Fins Per Radiator		7
	(c) Radiator Size		300 X 900
41	Size of core frame channels :	mm	125 X 65
42	Tie rod details	mm-No	16 - 8
43	Core stud details	mm-No	16 - 8
44	Core coil assembly base supports(2 Nos.)	mm	1256 X 65 X 125
45	Transformer weight details (Approx)		
	(a) Core And Winding	Kg	1749
	(b) Tank with fittings	Kg	654
	(c) Oil	Kg	658
	(d) Total for transformer	Kg	3061
	(e) Volume of Oil (minimum quantity for first filling)	Ltr	784
	(f) Window Height	mm	585
	(g) Limb Centre	mm	414
46	Overall dimensions (Approx)		
	(a) Length	mm	1614

MANUFACTURER'S GUARANTEED TECHNICAL PARTICULARS OF TRANSFORMER
ENERGY EFFICIENCY LEVEL 3 : 630 KVA (Cu) 22/0.415 KV

Sr.No	PARTICULARS	UNIT	AS OFFERED
	(b) Breadth	mm	1446
	(c) Height	mm	2130
47	Paint shade		light gray-631
48	Whether the bidder is an ISO: 9001 / 9002 certified company ?		Yes

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Date : 02/04/2016

INSULATION ARRANGEMENT

Design No. mahati

Top & Bottom Clearances:

Clearance Type (mm)	Common Block (mm)	Winding Block (mm)	Permawood Ring (mm)	Total Clearance (Sq. mm)
Top	10	30	0	40
Bottom	10	30	0	40

Cylinders:

Cylinders Type	Inner Dia \(mm\)	Cylinder Thickness (mm)	Outer Dia \(mm\)	Height (mm)	No. of cylinders (No)	Material	Surface Area Coil (Sq.mm)
LV Cylinder	221	1.5	224	580	2	Press Phan	26854.67
HV Cylinder	315	2.5	320	565	2	Press Phan	45244.8

Wedges :

Winding	Type	Width (mm)	Length (mm)	No of Wedges (No)	Total Wedges (No)	Thickness (mm)
Above LV	Plain	8	565	7	7	4
HV	Dovetail	8	565	7	7	4

Spacers :

Winding	Width (mm)	Radial (mm)	Wedges Below Winding (mm)	Duct Above Winding (mm)	Length (mm)	Thickness (mm)	Spacer Area (Sq.mm)	Per Surface Area (Sq.mm)
HV	0	40	4	4	48	9	0	0

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Date : 02/04/2016

SHORT CIRCUIT FORCE, THERMAL, OVERLOAD AND NOISE LEVEL CALCULATIONS

Design No. mahati

Dynamic Short Circuit Force Calculation :

Hoop Stress for HV (kg/cm²)	421.15
Hoop Stress for LV(kg/cm²)	273.57

Thermal Ability to Withstand Short Circuit Force Calculation :

Time (Sec.)	3
Temperature Rise of Short Circuit for LV (°C)	127.76
Temperature Rise of Short Circuit for HV (°C)	135.59

Hot Spot Temperature Calculation :

Hot Spot Temp Over Average Ambient Temperature of 32 °C	86.3

Inrush Current Calculation

Inrush Current (Amps)	119.73
Inrush Current In Terms Of Line Current (Times)	7.24

Overload and Noise Calculation :

Initial Top Oil Rise (°C)	1.25
Ratio of Over Load/Rated Load	39
Duration of Overload (Sec)	100
Ultimate Top Oil Rise After Overload(°C)	123.63
Noise Level (db)	53.99

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Date : 02/04/2016

TANK, RADIATOR AND CONSERVATOR

Design No. mahati

Tank Details :

Total Length (mm)	Total Height (mm)	Total Width (mm)
1308	1160	520

Radiator Details :

Radiator Width (mm)	Center Distance (mm)	Distance between Radiator (mm)	Radiators (no)	Finns / Radiators (no)
300	900	375	4	7

Conservator Details :

Conservator Diameter (mm)	Conservator Length (mtr)	Oil in Conservator (Litre)
290	0.9083	20.4

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TRANSFORMER BASIC INFORMATION

Design No. mahati

Transformer Type	DT	Ref. Standard	IS	Design Date	02/04/2016
Rating	630 kVA	Vector Group	Dyn11	Impedance (Normal Tap)	4.5 %
HV	22000 V	Phase	Three	Tolerance on Impedance	±10 %
LV	415 V	Winding Type	Two Winding	Flux Density	1.5 Tesla
Cooling		Frequency	50 Hz	Core Building Factor	1.2
Cooling Type	kVA				
ONAN	630				
Oil Temp. Rise	40 °c	Tapping On	HV		
Ambient Temp.	50 °c	Tapping Range	-	Tapping Type	-
Winding Temp. Rise	45 °c	Step Value	-	Core Loss	0.59 W/Kg
Core Type	D Type (Flat Yoke)	Grade	23ZDKH90	Thickness	0.23 mm
Tank Type	Radiator type with conservator				
Losses (W)		Tolerance (%, ±)		Class of Insulation	A
No Load Loss	Load Loss	No Load Loss	Load Loss	Regulating Coil	-
710	4140	5	5	Conductor Material	Copper
Current Density (Amp/mm², Max.)		Gradient (°c)			
LV	HV	Regulating	LV	HV	Regulating
2	2	-	20	20	-

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Date : 02/04/2016

WINDING DETAILS (COPPER WOUND)

Design No. mahati

DESCRIPTION		Cooling Type	ONAN	Vector Group	Dyn11
Rating (KVA)	630	HV Voltage	22000	LV Voltage	415
HV Current(A)	16.54	LV Current(A)	876.46	Taps (%)	0 to 0

Inputs	Unit	LV	HV
Type of winding		Layer	CO
Winding direction		R-L	L-R
Minimum turns	No	-	1928
Normal turns	No	21	1928
Maximum turns	No	-	1928
Rated Phase current	Amp	876.46	9.55
Discs / Layers/ Coils	No	2	6
Coils of Disc/ Foil	No	-	-
Turns per Coil	No	-	321.33
Layers	No	-	13
Turn per Disc / Turn per Layers	No	10.5	25
Insulation between Discs/ Layers (Axial)	mm	0	9
Ducts	No	1	0
Size of each duct	mm	2	0
Type of conductor		Rectangular	Round
Medium Super Enamalled	No	-	-
Conductor radially	No	7	1
Conductor axially	No	4	1
Total conductors	No	28	1
Bare conductor width/ conductor diameter	mm	10.71	2.55
Bare conductor thickness	mm	1.79	-
Paper covering over conductor (both side)	mm	0.4	0.4
Insulated conductor thickness	mm	2.19	2.95
Diameter compensation of insulation	mm	-	-
Radial thickness of winding	mm	33	40
Radial clearance between Core-LV/ LV-HV/ HV-Reg	mm	4	14
Inside diameter	mm	226	320
Outside diameter	mm	292	400
Height of total Disc	mm	567	462
Insulation gap between HV and tap section (Axially)	mm	-	-
Height of insulation	mm	-	45
Insulation for Gap between coils	mm	-	-
Extra packing	mm	0	0
Over all axial length of Winding	mm	567	507
Top clearance	mm	10	40
Bottom clearance	mm	10	40

Leg Length/WH	mm	585	Core Diameter	mm	218
Center Length/WW	mm	414	Phase to phase clearance	mm	14

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Tech. Parameter	Guar.	Design
Gradient LV	-	8.4879
Gradient HV	-	11.7832
No Load Loss (W)	710	712.3
Load Loss (W)	4140	4346.89
Total Loss (W)	-	5059.19
%R	-	0.69
%X	-	4.44
%Z	-	4.49

Resistance in Ohms at 75 ºC	
LV (Ohms)	0.0021
HV (Ohms)	27.23

Losses @ 50 & 100 % Load	
50 % Load	1799.02 (W)
100 % Load	5059.19 (W)

Ambient	Temp. Rise (°C)	
Temp.(°C)	Winding	Oil
50	45	40

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Date : 02/04/2016

BILL OF MATERIAL

Design No. mahati

Winding Section

Sr. No	Item Code	Material	Item Description	Specification	Quantity	Unit	Unit Cost (Rs)	Total Cost (Rs)	Remark
1	1	Copper	LV Conductor	1.79 X 10.71	256.00	kg	500.00	128000.00	
2	1	Copper	HV Conductor	diameter 2.55	298.00	kg	510.00	151980.00	
3	6	Press Phan		----	5.51	kg	100.00	551.00	
4	15	PCB	Insulation		55.40	kg	100.00	5540.00	

Total Cost (Rs) 286071.00

Core Section

Sr. No	Item Code	Material	Item Description	Specification	Quantity	Unit	Unit Cost (Rs)	Total Cost (Rs)	Remark
1	3	M. S.	Frame Parts	1256 X 65 X 125	105.00	kg	70.00	7350.00	
2	4	Lamination	23ZDKH90	thickness 0.23 mm	1029.00	kg	200.00	205800.00	

Total Cost (Rs) 213150.00

Tank Section

Sr. No	Item Code	Material	Item Description	Specification	Quantity	Unit	Unit Cost (Rs)	Total Cost (Rs)	Remark
1	3	M. S.	Tank	1308 X 520 X 1160	315.00	kg	70.00	22050.00	
2	5	Radiator		----	178.00	kg	110.00	19580.00	
3	8	Oil	Tank	----	567.00	kg	70.00	39690.00	
4	8	Oil	Radiator	----	71.00	kg	70.00	4970.00	
5	8	Oil	Conservator	----	20.40	kg	70.00	1428.00	

Total Cost (Rs) 87718.00

Other Section

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Sr. No	Item Code	Material	Item Description	Specification	Quantity	Unit	Unit Cost (Rs)	Total Cost (Rs)	Remark
1	17	Stiffners,Pipes,Bushings Assembly	Other		174.00	kg	70.00	12180.00	

Total Cost (Rs)	12180.00
Grand Total Cost (Rs)	599119.00