MAHENDRA TRANSFORMER (P) LTD.

F-10, South Side of G.T. Road, Industrial Area, Ghaziabad.

OPERATION AND MAINTANANCE MANUAL FOR DISTRIBUTION

Chapter-1
Brief technical data as prescribed in IS/BIS1180 is given below

(*Page* 2, *clause* **6.6**) — Insert following para at the end of clause:

'Alternatively [Dyn1, *see* IS 2026 (Part 1)] can also be specified. If system and application requirements demand different vector groups, the same can also be adopted.'

[*Page* 3, *Table* 3 (*see also Amendment Nos.* 1 *and* 3)] — Substitute the following for the existing table:

Table 3 Maximum Total Losses up to 11kV Class Transformers

(*Clauses* 6.8.1.1, 6.8.1.2, 6.8.1.3 *and* 6.8.2)

Sl No.	Rating (kVA)	Impedance (Percent)	Maximum Total Loss (W)									
			Energy Efficiency Level 1		*Energy Efficiency Level* 2		*Energy Efficiency Level* 3		*Energy Efficiency Level* 4		*Energy Efficiency Level* 5	
			50 Percent Load	100 Percent Load	50 Percent Load	100 Percent Load	50 Percent Load	100 Percent Load	50 Percent Load	100 Percent Load	50 percent Load	100 Percent Load
(1)	(2)	(3)	(4')	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
i)	16	4.5	135	440	120	400	108	364	97	331	87	301
ii)	25	4.5	190	635	175	595	158	541	142	493	128	448
iii)	63	4.5	340	1 140	300	1 050	270	956	243	870	219	791
iv)	100	4.5	475	1 650	435	1 500	392	1365	352	1 242	317	1 130
v)	160	4.5	670	1 950	570	1 700	513	1547	462	1 408	416	1 281
vi)	200	4.5	780	2 300	670	2 100	603	1911	543	1 739	488	1 582

NOTE — For non-preferred ratings of Table 1, maximum losses are subject to agreement between the user and the supplier.

(*Page* 4, *clause* **7.8.2**, *line* 2) — Substitute 'is' *for* 'shall be'.

[*Page* 4, *Table* 6 (*see also Amendment Nos.* 1 *and* 3)] — Substitute the following for the existing table:

Table 6 Maximum Total Losses up to 11kV Class Transformers

(*Clause* 7.8.1.1)

Sl No.	Rating (kVA)	Impedance (Percent)	Maximum Total Loss (W)									
			Energy Efficiency Level 1		*Energy Efficiency Level* 2		*Energy Efficiency Level* 3		*Energy Efficiency Level* 4		*Energy Efficiency Level* 5	
			50 Percent Load	100 Percent Load	50 Percent Load	100 Percent Load	50 Percent Load	100 Percent Load	50 Percent Load	100 Percent Load	50 Percent Load	100 Percent Load
(1)	(2)	(3)	(4')	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
i)	250	4.50	980	2 930	920	2 700	864	2 488	811	2293	761	2 113
ii)	315	4.50	1 025	3 100	955	2 750	890	2 440	829	2164	772	1 920
iii)	400	4.50	1 225	3 450	1 150	3 330	1080	3 214	1 013	3102	951	2 994
iv)	500	4.50	1 510	4 300	1 430	4 100	1354	3 909	1 282	3 727	1 215	3 554
v)	630	4.50	1 860	5 300	1 745	4 850	1 637	4 438	1 536	4 061	1 441	3 717
vi)	800	5.00	2 287	6 403	2 147	5 838	2 015	5 323	1 892	4 853	1 776	4 425
vii)	1 000	5.00	2 790	7 700	2 620	7 000	2 460	6 364	2 310	5 785	2 170	5 259
viii)	1 250	5.00	3 300	9 200	3 220	8 400	3 142	7 670	3 066	7 003	2 991	6 394
ix)	1 600	6.25	4 200	11 800	3 970	11 300	3 753	10 821	3 547	10 363	3 353	9 924
x)	2 000	6.25	5 050	15 000	4 790	14 100	4 543	13254	4 309	12 459	4 088	11 711
xi)	2 500	6.25	6 150	18 500	5 900	17 500	5 660	16 554	5 430	15 659	5 209	14 813

MANUAL

This part of manual gives you a complete understanding of transformer operation & maintenance from a user perspective. All the fitting & accessories namely HV/LV Bushing, Arcing Horn, Silicagel Breather, Dial thermometer have been described the upkeep of these fittings is significant to obtain optimum performance from the transformer.

GENERAL DESCRIPTION OF TRANSFORMER

Your new Power & Distribution Transformer is designed to serve you with superior performance and reliability conforming to IS: 2026 and 1180/2014 and your Specification.

The Transformers can be used for outdoor or indoor application

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1. Indoor transformer provided with cable box on primary and secondary both side, which facilitate to receive underground cables. This type of transformer can be used in both outdoor or indoor locations
2. Outdoor transformers are without cable boxes to directly receive cable/ connecting wire from overhead line. In this type transformer Cable box on LV side is provided on specific requirement of customer

GENERAL SPECIFICATION OF TRANSFORMER

11/. 433KV, copper wound double wound, 50 Hz, Core type, ONAN cooled, filled with first filling of fresh transformer oil as per ISS. 335, with upto date amendment.

Technical Details

Application : Outdoor/ Indoor, Refer to your Specification: -
Rating of transformer : As per your requirement

Primary : Input Voltage 3300 volts, 6600 volts, 11000 Volts, 22000volts, 33000 volts (depends upon Your requirement

Secondary	: Output Voltage 433 Volts, 416 volts, 415 volts or any other as per your requirement
Frequency	: 50 C/S, 60 C/S as per your requirements
No. of Phase	: Three
Connection	: H.V –Delta/Star as per your requirements L.V –Delta/Star, as per your requirements
Max. Tamp. Rise of	: (a) windings by resistance : ^{0}C - 45^{0}C (b) Top oil by thermometer : ^{0}C - 40^{0}C
Type of cooling	: Oil Natural Air Natural 'ONAN'. Filled with fresh transformer oil.
Class of insulation	: A
Tapping	: (i) Provided on H.V winding/Primary side, which allows you to increase or decrease voltage of secondary side. (ii) Off load externally /manually operated tap changer* (iii) Tapping ranges* Note:- Please refer to your technical specification regarding type of tap changer and range of tapping
H.V Terminal	3 nos. marked as Red, yellow & Blue for identification of phases. Outdoor bushings
L.V Terminal	4 nos. marked as Red, Yellow, and Blue & Neutral is mark as black.
Extra Neutral	Provided on top of LV Cable Box

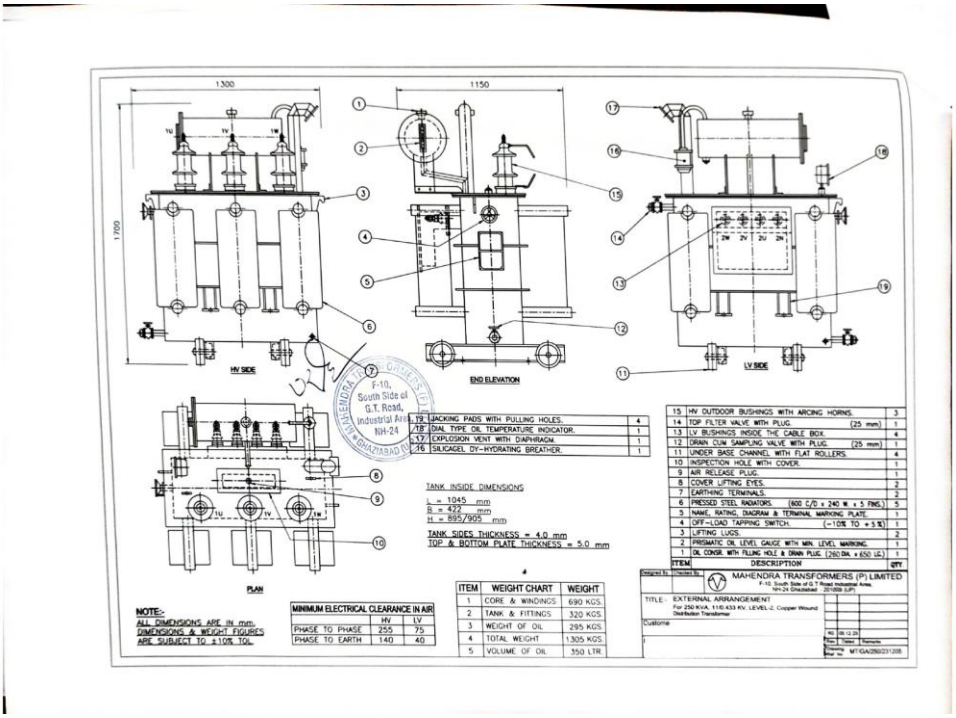
Chapter –2

INSTALLATION: - This manual however dose not cover installation/ erection procedure, yet some important points are given below, which are to be taken into consideration while commissioning

BEFOR INSTALATION CHECK FOLLOWING

- Dial type Thermometer provide loose, should be fixed in thermometer pocket. Refer OGA Drawing.
- Silicagel Breather provided loose should be fixed to the Breather pipe provide on conservator. Refer OGA DRG. .
- Terminals are marked with Red, Yellow, Blue paint for each phase.
- Neutral is painted Black.
- Before energizing make sure all the connections are tightened properly.
- Check oil level in conservator at minimum level.
- Check Earthing of transformer is properly done 2 nos. earthing terminal is provide at the bottom sidewall of transformer tank. Refer OGA DRG.
- Insure proper earthing by proper size of G.I. flat. Earthing terminal Refer OGA DRG.
- Neutral (Refer OGA DRG. is also to be earthed.

- Cable end should be crimped with Lugs of Proper size. As per the size of terminals, provided
- Arcing Horns to be fitted to HV Bushings as per OGA. Drawing.
- Fuses of the proper Sizes to be provided between HV Terminals & input supply
- Check BDV of oil and insulation resistance.
- Connection terminals for alarm and trip contacts of Buchholz relay, OTI, WTI, MOG, PRV are available in marshalling box, so the alarm and trip system can be connected there. (This is an optional feature and provided on specific requirement only) .
- Run transformer on No load for 2 to 2.5 Hours & put load after such time.



Chapter-3

GENERAL PREVENTIVE MAINTENANCE PROCEDURE

1. Avoid unbalancing load: - This may damage your transformer check unbalancing by clamp tester
2. Avoid over loading; - This may also damage your transformer check the load at frequent intervals of fifteen days by clamp tester.
3. Gaskets should be checked time to time and if leakage is observed the gasket should be replaced.
4. Top up the oil, as and when required, maintain oil at the minimum level marked on oil level gauge.
5. Filter Transformer oil in every 5 years.
6. Replace Silica gel if it is pink in color.(fill oil up to the mark in silica gel breather in its transparent cup provided at bottom of silica gel breather
7. Visual check of all input – output connections for tightness, if found loose tight these.

8. Check if the load of the LV cable is rest upon the terminals? if so give proper support to cable to avoid its load on terminals., it can loose the terminals of transformer resulting oil leakage and damages of terminals. Check for proper grounding for neutral and earthing.
9. Always keep transformer properly painted.
10. Observe regularly the temperature of oil of transformer with the help of provided/ fitted oil temperature indicator. If it rises beyond the limits mentioned in name plate, shut down transformer and call for proper checking. If OTI with alarm and trip contacts is provided (on specific requirement) the system will shut down transformer automatically if temperature rises beyond the prescribed limit
11. Observe regularly the temperature of winding of transformer with the help of provided/ fitted winding temperature indicator. If it rises beyond the limits mentioned in name plate, shut down transformer and call for proper checking. (This is an optional accessory and provided when specifically asked for). If WTI with alarm and trip contacts is provided (on specific requirement) the system will shut down transformer automatically if temperature rises beyond the prescribed limit.
12. Due to any reason if gas is formed in transformer buchholz relay (if provided on specific requirement) will operate and transformer will shut down immediately.
13. Due to any reason, if any internal pressure is built up inside the transformer the PRV will operate and transformer will be shut down automatically. (This is an optional accessory and provided when specifically asked for

PREVENTIVE MAINTENANCE SCHEDULE

The work of maintenance consists of routine inspection, testing cleaning and adjustments & which are carried on a transformer in service to avoid its break down. A rigid system of inspection and preventive maintenance will ensure long-life, trouble-free service and low maintenance cost. The amount of attention and maintenance vary with service conditions and load cycle of transformer.

Records should be kept for each transformer giving details of all inspection & tests and other maintenance made and of unusual occurrences.

Chapter-4

Item No.	FITTINGS AND ACCESSORIES	Qty.	DRG
1	Oil conservator with Oil filling hole and drain plug	1 no.	G.A.
2	Plain oil level gauge with minimum marking (MOG with alarm and trip contacts on specific requirement)	1 no.	G.A.
3	Buchholz relay Shut off valve between conservator and tank on specific requirement	1 no	GA
4.	Lifting lugs	2 nos.	G.A
5	Top Filter valve With Plug	1 no.	G.A.
	Off Load Tap Changer Switch (to control outgoing voltage (as per your specified range) OR On load tap changer with RTCC and AVR (On specific requirement) Switch (to control outgoing voltage (as per your specified range) OR Without tap)	1 no.	G.A.
6	Name, Rating Diagram & Terminal marking plate	1 no.	G.A.
7	Earthing Terminals	2 no.	G.A.
8	Explosion vent with Diaphragm or PRV (on specific requirement)	1 no.	G.A.
9	Cover lifting Eyes	2 nos.	G.A.
10	HV Outdoor Bushing with Arcing Horn	3 nos.	G.A.
11	Silica gel De-hydrating Breather	1 no.	G.A.
12	Pressed steel radiators	Set	GA
13	Inspections Hole with cover (for OCTC only)	1 no.	GA
14	Thermometer pocket	1 no.	G.A
15	LV bushings	4nos.	G.A.
16	Under base channel 2 nos. with Unidirectional/ Bidirectional (on specific requirement) flat Rollers	4 nos. rollers	G.A.
17	Drain/ sampling Valve with plug	1 no.	G.A.
	Air Release plug	1 no.	G.A.
18	Jacking pads	4 nos.	GA

19	WTI, OTI, MOG, PRV with alarm and trip contacts with marshalling box (on specific requirement)		

Chapter – 5

TAP SWITCH OPERATION PROCEDURE

1. Shut Off Transformer before Operating off circuit tap changer
2. **To operate off circuit manually operated tap switch PLEASE ENSURE THAT TAP SWICH HANDLE LOCKING SHAFT IS FITTED PROPERLY INTO THE HOLE PROVIDED JUST BELOW THE TAP SWITCH HANDLE WITH POSITION MARKING**

3. Shut down not required for operating on load tap changer, from remote panel.

Chapter-6

UNTANKING PROCEDURE

(1) Keep ready following tools:- Spanner- 3/8 X ½ & Box wrench 2 set,
(2) Remove Silicagel breather.
(3) Open connections of WTI, OTI, MOG, PRV if provided)
(4) Open plug from oil filling hole on top of conservator.
(5) Drain out transformer oil from filter drain valve.
(6) Remove brass nut, caps from HV terminals, slide bare HV rod inside of HV bushing. Open LV Terminals also if these are cover mounted.
(7) Remove nut & bolts of top cover.
(8) Set de-clamps of lifting chain pulley/crane to the lifting eyes of the top cover
(9) Lift slightly top cover plate and pull gently HV rods from HV pocket from inside of top cover plate, so that HV leads are not broken.
(10) Remove 4 nos. M.S. nuts provided out side base of tap switch handle, than pull out tap switch handle gently from tank body.

(11) Remove locking nut and bolts, which are jointing core coil assembly to inside wall of the tank.
(12) Remove brass nuts from inside of LV terminal and pull out the copper jumpers.
(13) Fix de-clamps into the both core coil lifting lugs diagonally provided, on the top channel of core coil assembly and gently lift the core coil assembly from the tank.

IMPORTANT:

Keep close watch on all side of core coil assembly as it lifted, to see that coils are not touched with the tank body.

Chapter-7

ISS REFERENCES

IS: 2026	Part (I, II, III, IV, V) Power Transformers
IS 1180/2014	Refer amendments 1 to 4
IS: 6600	Guide for loading oil immersed Transformer
IS: 335	New Insulating Transformer oil
IS: 1866	Code practice for maintenance and supervision of insulating oil in service.
IS: 3347	Part I Section 1 & 2 Dimension of porcelain parts & metal parts for transformer bushing (1.1 KV). Part III Section 1 & 2 Dimension of porcelain parts & metal parts for transformer bushing (17.5 KV).
IS: 2099	Porcelain Transformer bushing for AC Volts above 1000 Volts
IS: 3639	Fitting & accessories of transformers
IS: 3401	Silicagel used in Silicagel Breather

Chapter 8

TROUBLE SHOOTING

Sl. no.	Fault	Possible cause	Repair/Remedy
1.	Input HV Voltage is correct but out put voltage fluctuate	(i) Loose connection of LV terminal. (ii) Defect of LV cable/ line.	(i) Tight the connections. (ii) Replace the cable. Remark: Use single core cable for separate phases.
2.	Excessive over heating	Over loading	Check load, if over loading is there, reduce the load
3.	Smock or spark coming from terminals.	Loose connections or damage of the connectors.	Remove old connectors/ lugs by new one.
4.	Low/high voltage from output terminal.	(i) HV incoming voltage may be high or low, than specified Volts. (ii) Incorrect tap switch position.	Adjust Tap switch to the position,.
5.	Shoot up of temperature, abnormal sound in transformer.	Internal short circuit .	Shut Down transformer immediately & Call After Sale Service cell to check transformer.

While every care is being taken in manufacturing the transformer at our works, even than in case of any trouble regarding transformer, do not hesitate to contact us:

Mahendra Transformers Pvt. Ltd.
F-10 South Side of G.T.Road Industrial Area
Near National Highway No.24
Ghaziabad-201009
Email: mahendratransformers@gmail.com

0120-4561635

While writing to us please always quotes the followings which will enable us to take immediate action:

1. Capacity of transformer.
2. Serial no.
3. Year of manufacturing.
4. Location of transformer installed.
5. Sale invoice no.
6. Nature of trouble.
7. Contact person name address and contact no

PLEASE HELP US TO SERVE YOU BETTER