AMENDMENT NO. 1 AUGUST 2016
TO
IS 1180 (PART 1) : 2014 OUTDOOR TYPE OIL IMMERSED DISTRIBUTION TRANSFORMERS UPTO AND INCLUDING 2 500 kVA, 33kV — SPECIFICATION

PART 1 MINERAL OIL IMMERSED

(*Fourth Revision*)

(*First cover page, English title*) — Substitute the following for the existing title:

'Outdoor/Indoor Type Oil Immersed Distribution Transformers Upto and Including 2 500 kVA, 33kV — Specification: Part 1 Mineral Oil Immersed (*Fourth Revision*)'

(*First cover page, Hindi title*) — Substitute the following for the existing title:

'बाह्य/आंतरिक-रंग तेल इम्मेर्सड वितरण ट्रांसफार्मर तक 2 500 kVA, 33 kV — विशिष्टि : भाग 1 मिनरल तेल-निमिज्जित (*चौथा पुनरीक्षण*)'

(*Page* 1, *Title*) — Substitute the following for the existing title:

'Outdoor/Indoor Type Oil Immersed Distribution Transformers Upto and Including 2 500 kVA, 33kV — Specification: Part 1 Mineral Oil Immersed (*Fourth Revision*)'

(*Page* 1, *clause* **1**, *line* 3) — Substitute 'outdoor/indoor type' for 'outdoor type'.

(*Page* 1, *clause* **1**) — Insert the following as Notes at the end:

NOTES

1 The following types of transformers are not covered under the scope of this standard:

a) Inverter duty transformers;
b) Traction transformers;
c) Instrument transformers;
d) Transformers for static converters;
e) Starting transformers;
f) Testing transformers;
g) Welding transformers;
h) Earthing transformers;
j) Mining transformers;
k) Transformers for solar, wind power application;
m) Transformers for railways (locomotive and other applications);
n) Furnace transformers;
p) Rectifier transformers; and
q) Dual ratio in primary/secondary windings transformers.

2 For Indoor Type Distribution Transformers, relevant provisions of Central Electricity Authority (CEA) Regulations, if any, shall be applicable.

(*Page* 1, *clause* **3.1**) — Substitute following in place of existing clause:

'**3.1 Distribution Transformer** — A distribution transformer is a transformer that provides the final voltage transformation by stepping voltages down within a distribution circuit or from a distribution circuit to an end user or application.

NOTE — The distribution circuit voltages are 3.3 kV, 6.6 kV, 11 kV, 22 kV and 33 kV in the country. The power supply for the end users is 415 volt, 3 Phase (240 volt, 1 phase), 50 Hz. Transformers with primary voltages of 3.3, 6.6, 11, 22 or 33 kV and secondary voltage of 433 volt, 3 Phase (and 250 volt single phase) are called Distribution Transformers. The maximum rating of these transformers for the purpose of this standard is considered up to 2 500 kVA, 3 Phase.'

Price Group 5

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(*Page* 1, *clause* **3.2**) — Substitute the following for the existing clause:

'**3.2 Non-Sealed Type Transformer** — A transformer which has a breather for breathing out and breathing in and/or a conservator with expansion and contraction of oil with temperature. The transformer tank body and cover are bolted/clamped/welded type. The tank can also be of corrugated construction.'

(*Page* 1, *clause* **4**) — Insert the following note under clause:

'NOTE— In case of indoor transformers and transformers installed in an enclosure, suitable ventilation, if required, shall be provided to maintain service conditions as per IS 2026 (Part 1).'

(*Page* 2, *clauses* **6.4** *and* **6.5**) — Substitute the following for the existing clauses:

'**6.4 Basic Insulation Level (BIL)**

Minimum basic insulation level shall be as given in Table 2.

Table 2 Minimum Basic Insulation Level
(*Clause* 6.4)

Sl No.	**Nominal System Voltage** (kV)	**Minimum BIL** (kVp)
(1)	(2)	(3)
i)	3.3	40
ii)	6.6	60
iii)	11	75
iv)	22	125
v)	33	170
NOTE— Insulation coordination of all relevant fittings and accessories corresponding to higher BIL values shall be ensured.		

6.5 No-Load Voltage Ratios

The no-load voltage ratios shall be as follows:

3 300/433-250, 6 600/433-250, 11 000/433-250, 22 000/433-250 and 33 000/433-250 V

NOTE — Secondary voltage may be selected as 415-240 V, subject to agreement between the user and the supplier.'

(*Page* 2, *clause* **6.7.3**) — Insert the following new clause:

'**6.7.4** Provision of any other tapping range and tapping step is subject to agreement between the user and the supplier.'

(*Page* 3, *Table* 3) — Substitute the following for the existing table:

Table 3 Maximum Total Losses Upto 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	
			50 % Load	100 % Load	50 % Load	100 % Load	50 % Load	100 % Load
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	6.3	4.0	53	245	48	225	42	205
ii)	10	4.5	72	270	65	240	58	215
iii)	16	4.5	150	480	135	440	120	400
iv)	20	4.5	175	575	160	525	145	485
v)	25	4.5	210	695	190	635	175	595
vi)	40	4.5	277	914	249	834	224	774
vii)	63	4.5	380	1 250	340	1 140	300	1 050
viii)	100	4.5	520	1 800	475	1 650	435	1 500
ix)	160	4.5	770	2 200	670	1 950	570	1 700
x)	200	4.5	890	2 700	780	2 300	670	2 100

(*Page* 3, *Table* 4) — Substitute the following for the existing table:

Table 4 Standard Ratings
(*Clause* 7.1)

Sl No.	**Nominal System Voltage**	**Standard Ratings** (kVA)
(1)	(2)	(3)
i)	Up to and including 11 kV	250, 315, 400, 500, 630, 800, 1 000, 1 250, 1 600, 2 000 and 2 500
ii)	Above 11 kV up to and including 22 kV	250, 315, 400, 500, 630, 800, 1 000, 1 250, 1 600, 2 000 and 2 500
iii)	Above 22 kV up to and including 33 kV	250, 315, 400, 500, 630, 800, 1 000, 1 250, 1 600, 2 000 and 2 500

(*Page* 3, *clause* **7.4**) — Substitute the following for the existing clause:

7.4 Basic Insulation Level (BIL)

Minimum basic insulation level shall be as given in Table 5.

Table 5 Minimum Basic Insulation Level
(*Clause* 7.4)

Sl No.	**Nominal System Voltage** (kV)	**Minimum BIL** (kVp)
(1)	(2)	(3)
i)	3.3	40
ii)	6.6	60
iii)	11	75
iv)	22	125
v)	33	170

NOTE — Insulation coordination of all relevant fittings and accessories corresponding to higher BIL values shall be ensured.

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(*Page* 4, *clause* **7.7.3**) — Substitute the following for the existing clause:

'**7.7.3** For ratings 500 kVA and above, on load tap changers may be provided for variation of HV voltage from +5 percent to –15 percent in steps of 2.5 percent.'

(*Page* 4, *clause* **7.7.3**) — Insert the following new clause:

'**7.7.4** Provision of any other tapping range and tapping step is subject to agreement between the user and the supplier.'

(*Page* 4, *Table* 6) — Substitute the following for the existing table:

Table 6 Maximum Total Losses Upto 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	
			50 % Load	100 % Load	50 % Load	100 % Load	50 % Load	100 % Load
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	250	4.50	1 050	3 150	980	2 930	920	2 700
ii)	315	4.50	1 100	3 275	1025	3 100	955	2 750
iii)	400	4.50	1 300	3 875	1 225	3 450	1 150	3 330
iv)	500	4.50	1 600	4 750	1 510	4 300	1 430	4 100
v)	630	4.50	2 000	5 855	1 860	5 300	1 745	4 850
vi)	800	5.00	2 459	7 300	2 287	6 402	2 147	5 837
vii)	1 000	5.00	3 000	9 000	2 790	7 700	2 620	7 000
viii)	1 250	5.00	3 600	10 750	3 300	9 200	3 220	8 400
ix)	1 600	6.25	4 500	13 500	4 200	11 800	3 970	11 300
x)	2 000	6.25	5 400	17 000	5 050	15 000	4 790	14 100
xi)	2 500	6.25	6 500	20 000	6 150	18 500	5 900	17 500

(*Page* 5, *Table* 7) — Substitute the following for the existing table:

Table 7 Standard Ratings
(*Clause* 8.1**)**

Sl No.	**Nominal System Voltage**	**Standard Ratings** (kVA)
(1)	(2)	(3)
i)	11 kV	5, 10, 16, 25, *50, *75 and *100
ii)	22 kV	10, 16, 25, *50, *75 and *100
iii)	33 kV	16, 25, *50, *75 and *100

NOTE — *Ratings are non-preferred.

(*Page* 5, *clause* **8.4**) — Substitute the following for the existing clause:

8.4 Basic Insulation Level (BIL)

Minimum basic insulation level shall be as given in Table 8.

Table 8 Minimum Basic Insulation Level
(*Clause* 8.4)

Sl No.	**Nominal System Voltage** (kV)	**Minimum BIL** (kVp)
(1)	(2)	(3)
i)	11	75
ii)	22	125
iii)	33	170

NOTE— Insulation coordination of all relevant fittings and accessories corresponding to higher BIL values shall be ensured.

(*Page* 5, *Table* 9) — Substitute the following for the existing table:

Table 9 Maximum Total Losses Upto 11kV Class Transformers
(*Clauses* 8.8.1.1, 8.8.1.2 *and* 8.8.1.3)

Sl No.	**Rating** (kVA)	**Impedance** (Percent)	**Maximum Total Loss** (W)					
			Energy Efficiency Level 1		Energy Efficiency Level 2		Energy Efficiency Level 3	
			50 % Load	100 % Load	50 % Load	100 % Load	50 % Load	100 % Load
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	5	2.50	40	115	35	95	30	75
ii)	10	4.00	70	190	60	170	55	150
iii)	16	4.00	95	265	82	224	63	190
iv)	25	4.00	125	340	110	300	95	260
v)	50	4.00	230	665	210	590	190	520
vi)	75	4.00	340	995	310	880	285	780
vii)	100	4.00	445	1 250	410	1 140	375	1 030

(*Page* 6, *clause* **10.1.2**) — Substitute the following for the existing clause:

‘**10.1.2** If required by the user, a suitable cable-end box may be provided on the high voltage and or low voltage side. Alternatively bus duct arrangement may be provided on low voltage side by agreement between the user and the supplier.

NOTE — Porcelain/ Epoxy/Silicon Rubber Bushing may also be used in the cable box subject to agreement between the user and the supplier.’

(*Page* 6, *clause* **10.1.5**, *informal table*) — Insert the following new notes at the end:

‘NOTES

1 For heavily polluted atmosphere, dimensions of bushings shall confirm to IS 8603.
2 Cast resin or polymer bushing can also be used with performance requirements as per IS 2099 and IS 7421.’

(*Page* 6, *clause* **10.2**, *lines* 3 *and* 9) — Substitute ‘1 kV *for* 1.1 kV’.

(*Page* 7, *clause* **13.3**) — Insert the following new note at the end of the clause:

‘NOTE — Dimensions of Rating Plate, Terminal Marking Plate and Combined Rating and Terminal Plate can be changed subject to agreement between the user and the supplier.’

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(*Page* 7, *clause* **14.1**) — Substitute the following for the existing clause:

'**14.1** The under-base of all three phase transformers upto 200 kVA ratings shall be provided with two channels of minimum size 75 mm × 40 mm as shown in Fig. 6 to make them suitable for fixing to a platform or plinth.'

(*Page* 7, *clause* **14.2**) — Substitute the following for the existing clause:

'**14.2** The under-base of all transformers beyond 200 kVA may be as per Fig. 7 to make them suitable for mounting on rollers.'

(*Page* 7, *clause* **15.1.1**) — Insert the following new note at the end of the clause:

'NOTE — Minimum thickness at the corrugations shall be 1.0 mm.'

(*Page* 11, *Fig.* 6) — Insert the following new note at the end of Fig. 6:

'NOTE — Any other mounting dimensions are subject to agreement between the user and the supplier.'

(*Page* 9, *clause* **16.1**, *line* 3) — Substitute the following for the existing clause:

'**16.1** Transformers of ratings 63 kVA and above with plain tank construction, the provision of conservator is mandatory. For sealed type transformers with or without inert gas cushion, conservator is not required.'

(*Page* 12, *Fig.* 7) — Substitute the following for the existing table in Fig. 7:

Rating (kVA)	***X***	***Y***
2 500	1 200	800
2 000	900	800
1 600	900	800
1 250	800	800
1 000	800	800
800	800	800
630	800	800
500	700	450
400	700	450
315	600	450
250	500	415

(*Page* 12, *Fig.* 7) — Substitute the following notes for the existing note:

'NOTES

1 Bidirectional rollers can also be used as per mutual agreement between the user and the supplier.

2 Any other mounting dimensions are subjected to agreement between the user and the supplier.'

(*Page* 12, *clause* **20.1**) — Substitute the following for the existing clause:

'The following standard fittings shall be provided:

a) Two earthing terminals with the earthing symbol ⏚;

b) Oil level gauge indicating oil level at minimum, 30°C and maximum operating temperature;

NOTES

1 Minimum and maximum positions correspond to the operating temperature of –5°C and 90°C respectively (for non-sealed type transformer).

2 Only minimum position corresponding to the operating temperature of 30°C (for sealed type transformers).

c) Air release device (for non-sealed type transformers);

d) Rating and terminal marking plates;

e) Dehydrating breather shall be provided for non-sealed type transformers;

f) Drain-*cum*-sampling valve preferably steel with plug for three phase transformers (for ratings above 500 kVA);

NOTE — Valve size shall be as per agreement between the user and the supplier.

g) Thermometer pocket with cap;

h) Oil/Nitrogen/Air filling hole having (1¼″ nominal size thread) with cover (for sealed type transformers without conservator);

j) Lifting lugs for the complete transformer as well as for core and winding assembly;

k) Pressure relief device or explosion vent [for sealed type transformers (for all ratings) and non-sealed type transformers (for ratings above 200 kVA)];

m) One filter valve on the upper side of the tank (for transformers above 200 kVA);

n) HV side neutral grounding strip (where one of the HV bushing terminal is connected to earth);

p) LV earthing arrangement for single phase transformers;

q) Buchholz relay for transformers above 1 000 kVA; and

r) Arcing horns for HT side (one number per phase).'

[*Page* 13, *clause* **20.2**(b)] — Substitute the following for the existing entry:

'b) Filter valve for transformers up to 200 kVA;

NOTE — Valve size shall be as per agreement between the user and the supplier.'

[*Page* 13, *clause* **20.2**(c)] — Substitute the following for the existing entry:

'c) Suitable rating lightning arrestors for HT side (one number per phase);'

[*Page* 13, *clause* **20.2**(m)] — Substitute the following for the existing entry:

'm) Pressure relief device or explosion vent (upto 200 kVA for non-sealed type transformers);'

[*Page* 13, *clause* **20.2**(n)] — Substitute the following for the existing entry:

'n) Protection relay for sealed type transformers for internal parameters that is pressure, temperature, oil level and gas detection;'

[*Page* 13, *clause* **20.2** (p)] — Insert the following new entries at the end:

'q) Unidirectional flat rollers (for transformers above 200 kVA);

r) Drain-*cum*-sampling valve preferably steel with plug for three phase transformers (for transformers upto 500 kVA); and

NOTE — Valve size shall be as per agreement between the user and the supplier.

s) Self protection/disconnection devices subject to agreement between the user and the supplier:

1) Thermo-magnetic circuit breaker as self protection device on secondary side as per IS/IEC 60947-2 : 2003; and
2) Expulsion fuse as disconnection device on primary side as per IS 9385 (Part 2) : 1980.

NOTE— Additional requirements for transformers with self protection/disconnection devices are under preparation.'

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[*Page* 13, *clause* **21.2**(g)] — Insert the following new Note:

'NOTE — For single phase transformer with 11/√3 or 22 / √3 or 33/√3 kilo volts and with 1.0 kV neutral bushing, this test shall be conducted at test voltage of neutral (3 kV rms for one minute).'

[*Page* 14, *clause* **21.3**(b), *Note*] — Delete

[*Page* 14, *clause* **21.4**(c)] — Substitute the following for the existing entry:

'c) No load current at 112.5 percent voltage (*see* **6.9.2, 7.9.2** and **8.9.2**);'

(*Page* 14, *clause* **21.5.1.1**) — Substitute the following for the existing clause:

'**21.5.1.1** *Pressure test* (*type test)*

For non-sealed and sealed type transformers, the transformer tank shall be subjected to air pressure of 80 kPa for 30 min (25 kPa for 30 min for corrugated tanks) and vacuum of 250 mm of mercury for 30 min. There should be no air leakage at any point.

The permanent deflection of flat plates, after pressure/vacuum has been released, shall not exceed the values given below:

Length of Plate	*Deflection*
Up to 750 mm	5.0 mm
751 mm to 1 250 mm	6.5 mm
1 251 mm to 1 750 mm	8.0 mm

NOTE — Permanent deflection is not applicable for corrugations.'

(*Page* 14, *clause* **21.5.2.1**) — Substitute the following for the existing clause:

'**21.5.2.1** *Pressure test* (*type test)*

For non-sealed and sealed type transformers, the transformer tank subjected to air pressure of 80 kPa for 30 min (25kPa for 30 min for corrugated tanks) and vacuum of 500 mm of mercury for 30 min. There should be no air leakage at any point. The permanent deflection of flat plate, after pressure/ vacuum has been released, shall not exceed the values given below:

Length of Plate	*Deflection*
Up to 750 mm	5.0 mm
751 mm to 1 250 mm	6.5 mm
1 251 mm to 1 750 mm	8.0 mm
Above 1 751 mm	9.0 mm

NOTE — Permanent deflection is not applicable for corrugations.'

(*Page* 15, *Annex* A) — Delete following entries:

13730 Specification for particular types of winding wires:

(Part 0/ Sec 3) : 2012 General requirements, Section 3Enameled round copper wire

(Part 17) : 1996 Polyvinyl acetal enameled rectangular copper wire, Class 105

(Part 27) : 1996 Paper covered rectangular copper wire

(*Page* 15, *Annex* A) — Insert the following new entries at the appropriate places:

'IS 8603 : 2008 Dimensions for porcelain transformers bushings for use in heavily polluted atmospheres 12/17.5kV, 24kV and 36kV

IS 9385 (Part 2) : 1980 High voltage fuses: Part 2 Expulsion and similar fuses

13730 Specification for particular types of winding wires:

(Part 0/Sec 1) : 2012 Part 0 General requirements, Section 1 Enamelled round copper wire (*first revision*)

(Part 0/Sec 2) : 2011 Part 0 General requirements, Section 2 Enamelled rectangular copper wire (*first revision*)

(Part 0/Sec 3) : 2012 Part 0 General requirements, Section 3 Enamelled round aluminium wire (*first revision*)

(Part 17) : 1996 Polyvinyl acetal enameled rectangular copper wire, Class 105

(Part 27) : 1996 Paper covered rectangular copper wire

IS/IEC 60947-2 : 2003 Low-voltage switchgear and controlgear — Part 2 : Circuit breakers'

(*Page* 18, *Annex* D) — Insert following new Annex E:

ANNEX E

ADDITIONAL INFORMATION ON LEAKAGE TEST

[*Clauses* 21.2 (j), 21.5.1.3, 21.5.2.3 *and* 21.5.3.3]

E-1 CALCULATION OF GAUGE PRESSURE DURING OIL LEAKAGE TEST FROM NORMAL STATIC HEAD

Hydrostatic pressure in oil is given by:

$$p = \rho g h$$

where

p = pressure at a point (Pa);
ρ = density of oil (kg/m^3) (as per IS 335, the density can be taken as 890 kg/m^3);
g = acceleration due to gravity (9.81 m/s^2); and
h = height of oil column at a particular point (m) (measured from top).

E-2 As per **21.5.1.3, 21.5.2.3** and **21.5.3.3**, the amount of pressure application during the leakage test on assembled transformer for non-sealed and sealed type transformers with all fittings including bushing in position is summarized below:

a) *Tank with corrugations* — Pressure equivalent to twice the normal head measured/calculated at base of tank
for 8 h (for 3 phase transformer) and 6 h (for 1 phase transformers); and

b) *Tank without corrugations* — 15 kPa measured at top of the tank for 6 h for both 3 phase and 1 phase transformer.

E-3 If position of pressure gauge is not specified. Based on facility available, the pressure gauge can be mounted near the base of the tank or near the top cover (or on the cover):

a) The depth of static head at bottom gauge position shall be the height from highest oil level to base of tank;
b) The depth of static head at top of the tank shall be the height from highest oil level in conservator up to tank top gauge location; and

c) In case the conservator is not provided, (for example single phase transformers and small 3 phase transformer below 63 kVA) and pressure gauge is mounted on cover of tank, a pressure equivalent to one static head (tank height in this case) shall be applied since as per requirement test pressure is equivalent to twice the static head.

E-4 SAMPLE CALCULATION OF PRESSURE FOR A TRANSFORMER HAVING OIL LEVEL OF 1000 mm

Density of *T/F* oil, $\rho = 0.89$ gr/cc = 890 kg/m^3

Oil level in the *T/F*, h = 1 000 mm = 1 m

Hence, normal head pressure = (890 × 9.81 × 1) Pa = 8 730.9 Pa ≈ 8.7 kPa

Twice the normal head pressure = 2 × 8.7 kPa = 17.4 kPa

Hence, pressure to be measured in the gauge is,

a) 17.4 kPa, if gauge is fixed at base of tank; and
b) 8.7 kPa, if gauge is fixed at top

(ETD 16)

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