

| | | | | | | | | | |
|----------|--|---|-----------------------------------|------------------------|------------------------|------------------------|---------------|---|---|
| | 5a | e.g. Helical- / Layer- / Disc- type / pancake coils | Type | Layer/Disc | Multi-start Layer | Disc | | Disc | <ul style="list-style-type: none"> • Winding type • Lead entry detail 2. Representative Coil assembly drawing reference |
| | 5b | e.g. Line lead entry (top, bottom, Center, Edge) | Line Lead entry | Top/Bottom | Top/Bottom | Top/Bottom | Center entry | | |
| 8 | Absorbed power at Short Circuit (= Rated Power/per unit short circuit impedance) <i>[The ratio shall be between 70 % to 130% of that rating of the reference transformer]</i> | | Sc. Tested Transformer | Max Voltage Tap | Min Voltage Tap | Nor Voltage Tap | Yes/No | Reference: 1. Short ckt test report inclusive of Routine test Impedance values | |
| | | | Rated MVA | 315 | 315 | 315 | | | |
| | | | Impedance measured after sc. test | 10.4% | 12.5% | 15.4% | | | |
| | | | Absorbed power (MVA) | 3028.85 | 2520.00 | 2045.45 | | | |

| | | | | | |
|----|--|--|---|--------|--|
| 9 | <p>Axial force and winding stresses occurring at short circuit as per IS table</p> <p><i>(Simulated as in Same Declared Program or same Calculation method used)</i></p> <p><i>[The axial forces and winding stresses occurring at SC shall not exceed 120% of that of reference transformer]</i></p> | | <p>As per Table given in IS 2026-5/IEC 60076-5.</p> <p>(A typical example with data of forces and stresses has been provided at the end of this Annexure-J.)</p> | Yes/No | <p>Reference:</p> <p>1. As per calculation made / results of the simulation software used (Name of software used :.....)</p> |
| 10 | <p>Same manufacturing process</p> | | <p>General Process reference to be provided</p> <p>Manufacturing process as per Standard common practice & QAP plan for the subject rating & type</p> | Yes/No | <p>Reference:</p> <p>1. *Standard QAP plan submitted</p> <p>2. Standard document for Manufacturing Practice (On site availability)</p> |

| | | | | | |
|----|---|--|---|---------------|---|
| 11 | Same clamping and winding support arrangement [Core Clamping principle, winding radial & axial support system, cleats & lead support arrangement] | | General conceptual description to be provided 1. Core clamping drawing with support arrangement and calculation of SC force withstand by clamping structure. 2. Winding drawing with axial and radial support details, lead exit details | Yes/No | Reference: 1. Clamping arrangement: Provide basic details 2. Winding bottom support structure and cleat & lead arrangement: Adequacy has been validated by the simulation software..... |
|----|---|--|---|---------------|---|

*To be made part of short circuit test report document

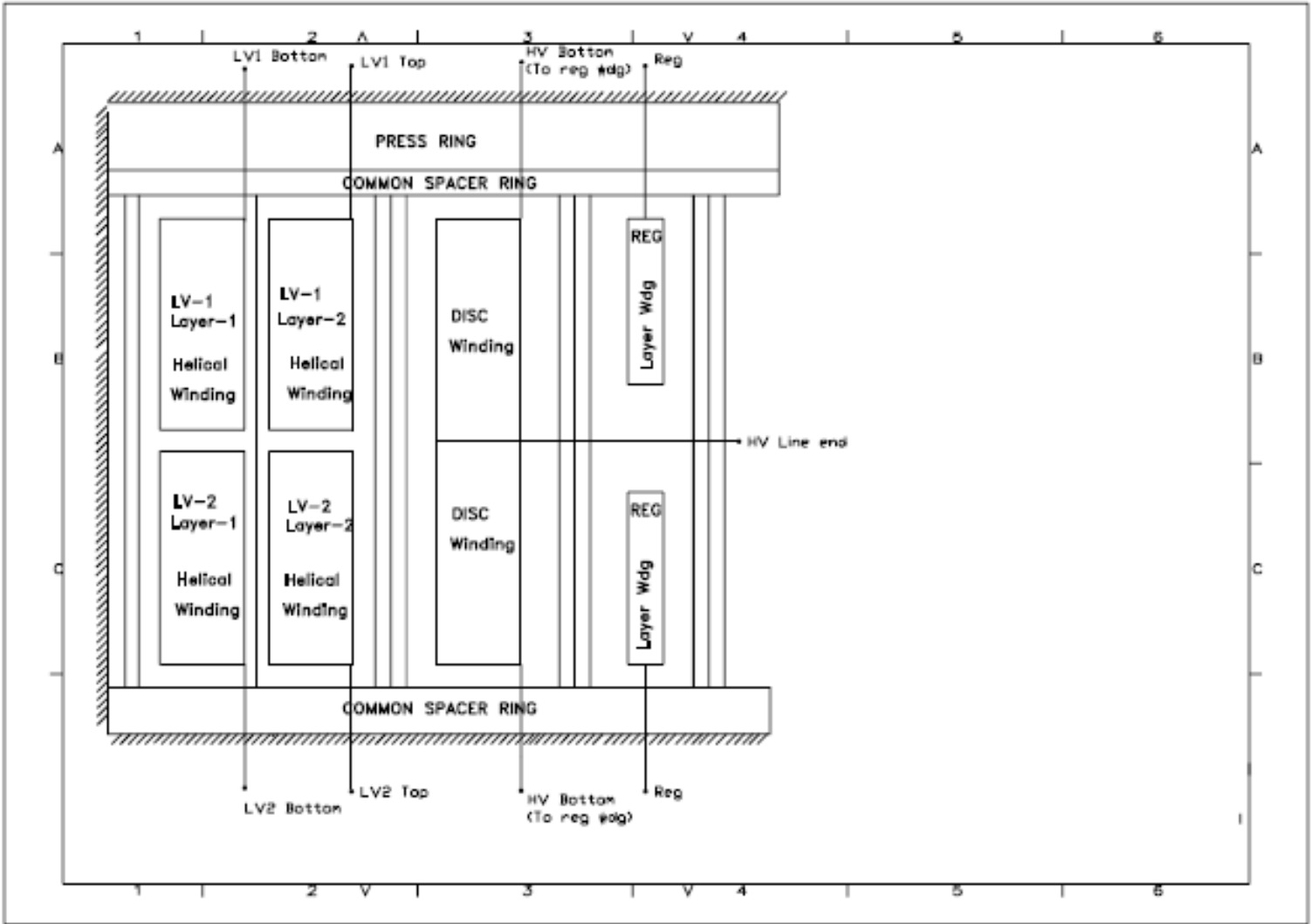
(For design to be similar every criteria specified above should match)

Result: The reference transformer was found/not found to be similar to the offered transformer. Design review of offered transformer can be carried out by comparison with reference transformer as per the process given in IEC 60076-5.

Manufacturer Signature

Purchaser's Signature

Representative Coil assembly reference Winding Arrangement



The detail comparison of technical parameters of typical offered & reference short circuit tested transformer is given below. The data is for reference and guidance purpose only.

| Technical parameter of Offered & Short circuit tested Transformer | | | |
|--|---|---|-------------------------------|
| Sr. No | Technical Parameters | Short Circuit Tested Unit Rating | Offered Transformer |
| 1.00 | Contract Ref. | | |
| 1.01 | Package & Substation | | |
| | | | |
| 2.00 | Rating | | |
| 2.01 | HV / LV | 315 MVA | 500 MVA |
| 2.02 | TV | 105 MVA | 167 MVA |
| 2.03 | Cooling | ONAN/ONAF/ODAF | ONAN/ONAF/ODAF |
| 2.04 | Rating at Different cooling | 189/252/315MVA (60%/80%/100%) | 300/400/500MVA (60%/80%/100%) |
| 2.05 | Voltage ratio | 400/220/33 kV | 400/220/33 kV |
| 2.06 | Voltage / Turn | 200 | 280 |
| 2.07 | Frequency | 50 Hz | 50 Hz |
| 2.08 | Phases | 3 | 3 |
| 2.09 | Max. Partial discharge at 1.58 Um/ $\sqrt{3}$ | <100 pC | <100 pC |
| 2.10 | Design of Power Frequency Level | 570 kVrms | 570 kVrms |
| 2.11 | Noise Level | 80 dB | 80 dB |

Technical parameter of Offered & Short circuit tested Transformer

| Sr. No | Technical Parameters | Short Circuit Tested Unit Rating | Offered Transformer |
|--------|--|----------------------------------|-----------------------|
| 2.12 | Neutral (Solidly Earthed) | Solidly Earthed | Solidly Earthed |
| 2.13 | Service | Outdoor | Outdoor |
| 2.14 | Duty | Continuous | Continuous |
| 2.15 | Overload capacity | As per IEC 60076-7 | As per IEC 60076-7 |
| | | | |
| 3.00 | Impedance with Tolerance | | |
| 3.01 | HV - LV | | |
| 3.02 | Normal tap | Designed/Guaranteed/Measured | Designed/Guaranteed |
| 3.03 | Max Voltage tap | 12.10%/12.5% ± IEC Tol/12.4% | 12.4%/12.5% ± IEC Tol |
| 3.04 | Min Voltage tap | 9.8%/-/10.12% | 9.8%/10.3% ± IEC Tol |
| 3.05 | HV - TV | 16.8%/-/16.29% | 16.1%/15.4% ± IEC Tol |
| 3.06 | Normal tap | | |
| 3.07 | Max Voltage tap | 67%/60% Min/69.36% | 64%/60% Min |
| 3.08 | Min Voltage tap | 59%/-/60.81% | 56% |
| 3.09 | LV-TV | 79%/-/80.94% | 75% |
| | | | |
| 4.00 | Temp. rise over an ambient of 50 Deg C | | |
| 4.01 | Top Oil | 35 Deg C | 45 Deg C |

Technical parameter of Offered & Short circuit tested Transformer

| Sr. No | Technical Parameters | Short Circuit Tested Unit Rating | Offered Transformer |
|--------|--|--|--|
| 4.02 | Winding | 40 Deg C | 50 Deg C |
| 4.03 | Winding hot spot rise | 66 Deg C | 61 Deg C |
| 4.04 | Core hot spot rise | 61 Deg C | 55 Deg C |
| 5.00 | Guaranteed losses at Principle tap, rated voltage & frequency (Mentioned measured values in DSC tested unit) | Guaranteed/Measured/Designed | Designed/Guaranteed |
| 5.01 | Load Loss, kW | 444.5/425.78/429.39 | 495/500 |
| 5.02 | No Load loss, kW | 104.5/84.27/84.18 | 88.4/90 |
| 5.03 | Aux Loss, kW | 8.5/6.76/8.28 | 15/15 |
| 6.00 | System Fault Level (HV / IV / LV) | | |
| 6.01 | If System fault level is higher than SC tested T/F please submit calculation of short circuit impedance variation. | 50/40/-kA | 63/50/-kA |
| 7.00 | Winding connection (HV/IV/LV) | Auto Star/Delta | Auto Star/Delta |
| 8.00 | Insulation (HV/IV/LV) | Graded/Graded/Uniform | Graded/Graded/Uniform |
| 8.01 | HV (LI/LIC/SI/PF/AC) | 1300kVp/1430kVp/1050kVp/570kVrms /38kVrms | 1300kVp/1430kVp/1050kVp/570kVrms /38kVrms |
| 8.02 | IV (LI/LIC/SI/PF/AC) | 950kVp/1045kVp/750kVp/395kVrms/3 8kVrms | 950kVp/1045kVp/750kVp/395kVrms/3 8kVrms |

Technical parameter of Offered & Short circuit tested Transformer

| Sr. No | Technical Parameters | Short Circuit Tested Unit Rating | Offered Transformer |
|-----------|---|--|--|
| 8.03 | LV (LI/LIC/AC) | 250kVp/275kVp/95kVrms | 250kVp/275kVp/95kVrms |
| 8.04 | N (LI/AC) | 170kVp/38kVrms | 170kVp/38kVrms |
| 9.00 | Bushing Ratings | | |
| 9.01 | HV | 420kV/2000A, OIP Condenser | 420kV/1250A, RIP Condenser |
| 9.02 | LV | 245kV/1250A, OIP Condenser | 245kV/2000A, RIP Condenser |
| 9.03 | TV | 72.5kV/3150A, OIP Condenser | 52kV/3150A, RIP Condenser |
| 9.04 | Neutral | 36kV/2000A, Oil Communicating | 36kV/2000A, Oil Communicating |
| 9.05 | Impulse level (HV/IV/LV/N) | 1425kVp/1050kVp/250kVp/170kVp | 1425kVp/1050kVp/250kVp/170kVp |
| 9.06 | Switching impulse level (HV/IV) | 1050kVp/850kVp | 1050kVp/850kVp |
| 9.07 | Power Frequency (Dry) (HV/IV/LV/N) | 695kVrms/505kVrms/105kVrms/77 kVrms | 695kVrms/505kVrms/105kVrms/77 kVrms |
| 10.0 0 | CORE | | |
| 10.0 1 | Flux Density at Rated Voltage | 1.722 T | 1.72 T |
| 10.0 2 | Core Construction [main limb / return limb] | 3 Main Limbs / 2 Return Limbs | 3 Main Limbs / 2 Return Limbs |
| 10.0 3 | Cross-section ratio - Main & Return limb Main limb & Yoke | 100% & 53% 100% & 53% | 100% & 53% 100% & 53% |

Technical parameter of Offered & Short circuit tested Transformer

| Sr. No | Technical Parameters | Short Circuit Tested Unit Rating | Offered Transformer |
|-----------|--|--|--|
| 10.0 4 | Core Diameter | 815 | 1015 |
| 10.0 5 | Window Height (top of Bottom yoke to bottom of top yoke) | 2500 | 2400 |
| 10.0 6 | Phase center /Phase - Return limb | 2315 / 1420 | 2610/1650 |
| 10.0 7 | Grade | HP Grade | HP Grade |
| 10.0 8 | Building factor | 1.17 | 1.18 |
| 10.0 9 | Weight | 67500 kgs Approx. | 108500 kgs Approx. |
| | | | |
| 11.0 0 | Winding | | |
| 11.0 1 | Winding arrangement sequence (Core - LV - Reg. - Common - Series) | Core - LV - Reg. - Common - Series | Core - LV - Reg. - Common - Series |
| 11.0 2 | Winding Type & Material | | |
| 11.0 3 | LV | Helical, Electrolytic Copper | Helical, Electrolytic Copper |
| 11.0 4 | REG | Multi Helical, Electrolytic Copper (Tap) | Multi Helical, Electrolytic Copper (Tap) |

Technical parameter of Offered & Short circuit tested Transformer

| Sr. No | Technical Parameters | Short Circuit Tested Unit Rating | Offered Transformer |
|-----------|--|---|---|
| 11.0 5 | IV | Disc, Electrolytic Copper | Disc, Electrolytic Copper |
| 11.0 6 | HV | Shielded disc, Electrolytic Copper | Shielded disc, Electrolytic Copper |
| 12.0 0 | Conductor Type / dimension / Insulation | | |
| 12.0 1 | LV | Epoxy Bonded CTC, 1.5 x 7.8//23, 0.5 PI | Epoxy Bonded CTC, 2 (1.3 x 5.4//31), 0.5 PI |
| 12.0 2 | REG | Epoxy Bonded CTC, 1.25 x 4.8//25, 1.5 PI (ZNO elements used) | Epoxy Bonded CTC, 1.36 x 6.5//27, 1.5 PI (ZNO elements used) |
| 12.0 3 | IV | Epoxy Bonded CTC, 1.4x 6.45//23, 1.1 PI | Epoxy Bonded CTC, 2 (1.1 x 6.4//25), 1.1 PI |
| 12.0 4 | HV | Epoxy Bonded CTC, 2 X (1.4 x 5.5//17), 1.5 PI | Epoxy Bonded CTC, 2 X (1.1 x 5.7//35), 1.5 PI |
| 13.0 0 | Proof Stress Value in Mpa | | |
| 13.0 1 | LV | 180 | 200 |
| 13.0 2 | REG | 160 | 200 |
| 13.0 3 | IV | 200 | 200 |

Technical parameter of Offered & Short circuit tested Transformer

| Sr. No | Technical Parameters | Short Circuit Tested Unit Rating | Offered Transformer |
|---------------|--|---|----------------------------|
| 13.0 4 | HV | 160 | 200 |
| 13.0 0 | ID / OD / Height | | |
| 13.0 1 | LV | 875/955/1900 | 1075/1160/1780 |
| 13.0 2 | REG | 1115/1155/1780 | 1320/1365/1700 |
| 13.0 3 | IV | 1305/1575/1950 | 1515/1845/1790 |
| 13.0 4 | HV | 1755/2100/1950 | 2069/2430/1790 |
| 14.0 0 | No of Turns (Max / Nor / Min) Voltage Tap | | |
| 14.0 1 | LV | 165 | 115 |
| 14.0 2 | REG | 112/0/112 | 80/0/80 |
| 14.0 3 | IV | 635 | 450 |
| 14.0 4 | HV | 520 | 368 |

Technical parameter of Offered & Short circuit tested Transformer

| Sr. No | Technical Parameters | Short Circuit Tested Unit Rating | Offered Transformer |
|-----------|---|----------------------------------|---------------------|
| 15.0 0 | Winding weight | Bare Copper | Bare Copper |
| 15.0 1 | LV | 3440 kg | 4300 kg |
| 15.0 2 | REG | 2100 kg | 2300 kg |
| 15.0 3 | IV | 16450 kg | 20700 kg |
| 15.0 4 | HV | 22400 kg | 27500 kg |
| | | | |
| 16.0 0 | Current Density (Max / Nor / Min) Voltage Tap (A/mm²) | | |
| 16.0 1 | LV | 4.02 | 3.99 |
| 16.0 2 | REG | 2.85/3.14/3.49 | 2.81/3.1/3.44 |
| 16.0 3 | IV | 2.03/1.83/1.58 | 1.92/1.73/1.49 |
| 16.0 4 | HV | 1.62/1.78/1.98 | 1.54/1.7/1.89 |
| | | | |
| 17.0 0 | Loss at Max / Nor / Min Voltage Tap (kW) | | |

Technical parameter of Offered & Short circuit tested Transformer

| Sr. No | Technical Parameters | Short Circuit Tested Unit Rating | Offered Transformer |
|-----------|-----------------------------|----------------------------------|---------------------|
| 17.0 1 | I ² R | 385 / 344 / 415 | 441 / 394 / 471 |
| 17.0 2 | Stray | 39 / 45 / 56 | 47 / 54 / 117 |
| 17.0 3 | Eddy | 30 / 37 / 55 | 37 / 47 / 67 |
| 17.0 4 | Stray+Eddy | 69 / 82 / 111 | 84 / 101 / 184 |
| 17.0 5 | Total Load Loss | 454 / 426 / 526 | 525 / 495 / 655 |
| 17.0 6 | % (Stray+Eddy) of Load loss | 15.2 / 19.3 / 21 | 16 / 20.5 / 28 |
| 17.0 7 | Core loss | 84.5 | 88.4 |
| | | | |
| 18.0 0 | GAP (mm) | | |
| 18.0 1 | CORE - LV or CORE-TV | 30 | 30 |
| 18.0 2 | LV - REG | 80 | 80 |
| 18.0 3 | REG - IV | 75 | 75 |
| 18.0 4 | IV-HV | 90 | 112 |

Technical parameter of Offered & Short circuit tested Transformer

| Sr. No | Technical Parameters | Short Circuit Tested Unit Rating | Offered Transformer |
|-----------|---|----------------------------------|---------------------|
| 18.0 5 | PH - PH | 175 | 177 |
| 18.0 6 | PH - RETURN LIMB | 160 | 166 |
| | | | |
| 19.0 0 | Spacers / Circle (Nos. x Width) | | |
| 19.0 1 | LV | 24 x 35W | 36 X 30W |
| 19.0 2 | REG | 24 x 45W | 36 X 40W |
| 19.0 3 | IV | 36 X 40W | 36 X 45W |
| 19.0 4 | HV | 36 X 50W | 36 X 60W |
| 20.0 0 | Supporting Area ((No of spacer x width) *100/Mean dia) | | |
| 20.0 1 | LV | 29.20% | 31.0% |
| 20.0 2 | REG | 30.3% | 34.1% |
| 20.0 3 | IV | 32.0% | 31.0% |
| 20.0 4 | HV | 30.0% | 30.5% |

Technical parameter of Offered & Short circuit tested Transformer

| Sr. No | Technical Parameters | Short Circuit Tested Unit Rating | Offered Transformer |
|-----------|---|----------------------------------|--|
| 21.0 0 | Top Ring Thickness & Material | 100 mm & Laminated Press Board | 130 mm & Laminated Press Board |
| 22.0 0 | Bottom Ring Thickness & Material | 80 mm & Laminated Press Board | 90 mm & Laminated Press Board |
| 23.0 0 | Oil Quantity during first filling | 100 kL | 115 kL |
| 24.0 0 | Tank Thickness | | |
| 24.0 1 | Side | 12 mm | 12 mm |
| 24.0 2 | Top | 25 mm | 25 mm |
| 24.0 3 | Bottom | 20 mm + Box Stiffener | 20 mm + Box Stiffener |
| 25.0 0 | Change of Solid Insulation & Oil duct for above GAP (Sr. No – 18.0) YES / NO | - | Similar/No change w.r.t short circuit tested unit. |
| 26.0 0 | Active Part arrangement (Core & Coil Assembly) Change YES / NO | - | Similar/No change w.r.t short circuit tested unit. |

Technical parameter of Offered & Short circuit tested Transformer

| Sr. No | Technical Parameters | Short Circuit Tested Unit Rating | Offered Transformer |
|---------------|---|---|---|
| 27.0 0 | Internal clearance in oil (Active part - Tank) Change (Yes / No) | - | Similar/No change w.r.t short circuit tested unit. |
| 28.0 0 | Cooling System (Radiator, Fans, Pumps) Change (Yes / No), If yes, submit detailed design calculation for supporting documents) | - | Same / Fans & pumps are suitably considered to dissipate total losses |

| Comparison Table - Forces & Electric Field Stress Summary | | | DOC No : _____ |
|--|---|---|--|
| | | | REV : _____ |
| Sr. No | Technical Parameters | 315MVA, 400/220/33 kV Short Circuit Tested | 500MVA, 400/220/33 kV Offered Transformer |
| 1.0 | NOA Ref No. | ----- | ----- |
| 1.1 | Package & Substation | ----- | ----- |
| 2.0 | Radial Forces (Actual / Permissible) (N/mm ² or Mpa) | | |
| 2.1 | LV | 57.05/180 Mpa | 47.5/200 Mpa |
| 2.2 | Regulating | 56.06/160 MPa | 75.16/200 Mpa |
| 2.3 | IV | 61.93/200 Mpa | 69.56/200 Mpa |
| 2.4 | HV | 86.14/160 Mpa | 100.25/200 Mpa |
| 3.0 | Axial Tilting Forces (Actual / Permissible) (kN) | | |
| 3.1 | LV | 3954/37207 kN | 485/105686 kN |
| 3.2 | Regulating | 296/6764 kN | 398/3164 kN |

| | | | |
|-----|---|-----------------------------|----------------|
| 3.3 | IV | 1436/129384 kN | 1819/111123 kN |
| 3.4 | HV | 1105/56222 kN | 2405/349302 kN |
| 4.0 | Axial Yoke Clamp Force in Winding (kN) | 1912 kN | 1723 kN |
| 5.0 | Compressive Force in Winding (Actual / Permissible) (kN) | | |
| 5.1 | LV | 3954/9845 kN | 485/1421 kN |
| 5.2 | Regulating | 296/432 kN | 398/796 kN |
| 5.3 | IV | 1436/2585 kN | 1819/4075 kN |
| 5.3 | HV | 1105/3591 kN | 2405/4642 kN |
| 6.0 | Tengential (Spiralling) Force in LV Winding (Actual / Permissible) (kN) | 310.36/979.24 | 18.29/61.6 |
| 7.0 | Dielectric Stresses (Actual / Permissible) (kV _{rms} /mm) | | |
| 7.1 | Oil Stress (Core - LV) | < 6.5 kV _{rms} /mm | |
| 7.2 | Oil Stress (LV - Regulating) | < 6.5 kV _{rms} /mm | |
| 7.3 | Oil Stress (Regulating- IV) | < 6.5 kV _{rms} /mm | |

| | | |
|------|------------------------------------|---|
| 7.4 | Oil Stress (IV- HV) | < 6.5 kV _{rms} /mm |
| 7.5 | Max Oil Stress Location & Value | IV - HV winding < 6.5 kV _{rms} /mm |
| 7.6 | Creep Stress in LV Winding | < 3 kV _{rms} /mm |
| 7.7 | Creep Stress in Regulating Winding | < 3 kV _{rms} /mm |
| 7.8 | Creep Stress in IV Winding | < 3 kV _{rms} /mm |
| 7.9 | Creep Stress in HV Winding | < 3 kV _{rms} /mm |
| 7.10 | Paper Stress | < 16 kV _{rms} /mm |
| 7.11 | Stress at Normal Service condition | Less than half of above values |

| Comparison of forces and stresses of 500MVA,400/220/33kV,3-Phase Auto Transformer with SC tested 315MVA,400/220/33kV, 3-Phase Auto Transformer as per IEC-60076-5 | | | | | | | | | | | | | Doc. No: _____; Rev _____ | | | |
|--|------------------|-----------|-----------|----------|-------------|-----------|-----------|----------|----------------|-----------|-----------|----------|------------------------------|-----------|-----------|----------|
| Type of force/ Stress | Tertiary Winding | | | | Tap Winding | | | | Common Winding | | | | Series Winding | | | |
| | Actual | Reference | Allowable | Critical | Actual | Reference | Allowable | Critical | Actual | Reference | Allowable | Critical | Actual | Reference | Allowable | Critical |
| Mean hoop tensile stress on disc-, helical-, and layer type windings (Mpa) | Not Applicable | | | | 16.41 | 10.99 | 160 | - | 21.95 | 14.18 | 200 | - | 100.25 | 86.14 | 200 | - |
| Mean hoop compressive stress on disc, helical, single layer type windings (Mpa) | 47.5 | 57.05 | 160 | - | 75.16 | 56.06 | 160 | | 69.56 | 61.93 | 200 | | Not Applicable | | | |
| Equivalent mean hoop compressive stress on multi layer type windings (Mpa) | Not applicable | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|---|--------|--------|-------|---|----------------|-------|--------|----------------|---------|-------|----------------|---|--------|------|---------|---|
| Stress due to radial bending of conductors between axial sticks and spacers (Mpa) | 70.5 | 642 | 211.5 | - | 69.6 | 14.63 | 123.8 | - | 201.9 | 22.66 | 278.6 | - | | | | - |
| Stress due to axial bending of conductors between radial spacers (Mpa) | 305.44 | 1375 | 1460 | - | 177.8 | 134.8 | 1146.8 | - | 2574.08 | 1114 | 8597.4 | - | 2336.2 | 5160 | 11120.4 | - |
| Thrust force acting on the low voltage winding lead exists (kN) | 18.29 | 310.36 | 61.6 | - | Not Applicable | | | Not Applicable | | | Not Applicable | | | | | |
| Maximum axial compression force on each physical winding (kN) | 485 | 3954 | 1421 | - | 398 | 296 | 796 | - | 1819 | 1436 | 4075 | - | 2405 | 1105 | 4642 | - |

| | | | | | | | | | | | | | | | | |
|---|-------------|---------------|----|--------|------------|-------|----|------|-------------|-------------|----|--------|-------------|-------------|----|--------|
| Maximum axial compression force on winding compared to crit. Force for tilting (kN) | 485 | 3954 | - | 105686 | 398 | 296 | - | 3164 | 1819 | 1436 | - | 111123 | 2405 | 1105 | - | 349302 |
| Maximum end thrust force on physical winding : - UP (kN) - DOWN (kN) | 201/ 165 | 2429/ 3316 | - | - | 101/ 97 | 82/59 | - | - | 572/ 744 | 531/ 508 | - | - | 785/ 877 | 732/ 750 | - | - |
| Compressive stress on conductor paper Insulation and radial spacers (Mpa) | 11.25 | 20.1 | 80 | - | 17.66 | 16.77 | 80 | - | 8.78 | 12.56 | 80 | - | 10.55 | 5.78 | 80 | - |
| Compressive stress on end stack insulation structures and end ring (Mpa) | 4.66 | 12.35 | 80 | - | 4.48 | 4.64 | 80 | - | 2.76 | 4.63 | 80 | - | 3.44 | 3.83 | 80 | - |
| | | | | | | | | | | | | | | | | |

| | Actual | Reference | Allowable | Critical |
|--|----------------|----------------|----------------|----------------|
| Compressive stress on common press rings (Mpa) | 59.21 | 60.27 | 80 | - |
| Tensile stress on tie rods (Mpa) | Not Applicable | Not Applicable | Not Applicable | Not Applicable |
| Clamping force per limb (kN) | 1723 | 1912 | - | |

PAINTING PROCEDURE

| PAINTING | Surface preparation | Primer coat | Intermediate undercoat | Finish coat | Total Dry Film Thickness (DFT) | Colour shade |
|--|--|--|--|--|--------------------------------|---|
| External surfaces: Main tank, pipes, conservator tank, oil storage tank & Driving Mechanism (DM) Box etc. () | Shot Blast cleaning Sa 2 ½* | Epoxy base Zinc primer (30-40µm) | Epoxy high build Micaceous iron oxide (HB MIO) (75µm) | Aliphatic polyurethane (PU) (Minimum 50µm) | Minimum 155µm | RAL 7035 |
| Internal surfaces: Main tank, pipes (above 80 NB#), conservator tank, oil storage tank & DM Box etc. () | Shot Blast cleaning Sa 2 ½* | Hot oil resistant, non-corrosive paint, low viscosity varnish or epoxy | -- | -- | Minimum 30µm | Glossy white for paint |
| Radiator (external surfaces) | Chemical / Shot Blast cleaning Sa 2 ½* | Epoxy base Zinc primer (30-40µm) | Epoxy base Zinc primer (30-40µm) | PU paint (Minimum 50µm) | Minimum 100µm | Matching shade of tank/ different shade aesthetically matching to tank |
| Manufacturer may also offer Radiators with hot dip galvanised (in place of painting) with minimum thickness of 40µm (min) | | | | | | |

| | | | | | | |
|--|---|--|----|---|--|---|
| Radiator and pipes up to 80 NB (Internal surfaces) | Chemical cleaning, if required | Hot oil proof, low viscosity varnish or Hot oil resistant, non-corrosive Paint | -- | -- | -- | -- |
| Digital RTCC Panel | Seven tank process as per IS:3618 & IS:6005 | Zinc chromate primer (two coats) | -- | EPOXY paint with PU top coat or POWDER coated | Minimum 80µm / for powder coated minimum 100µm | RAL 7035 shade for exterior and Glossy white for interior |
| Control cabinet / Marshalling Box - No painting is required. | | | | | | |

Note:

*indicates Sa 2 ½ as per Swedish Standard SIS 055900 of ISO 8501 Part-1.

#NB: Nominal Bore

Annexure-L

I. UNUSED INHIBITED HIGH GRADE INSULATING OIL PARAMETERS

| Sl. No. | Property | Test Method | Limits |
|-----------------------------|--|--|---|
| A Function | | | |
| 1a. | Kinematic Viscosity at 40 °C | IS 1448 Part 25 or ISO 3104 or ASTM D7042 | 12 mm ² /s (Max.) |
| 1b. | Kinematic Viscosity at -30 °C | | 1800 mm ² /s (Max.) |
| 2. | Appearance | A representative sample of the oil shall be examined in a 100 mm thick layer, at ambient temperature | The oil shall be clear and bright, transparent and free from suspended matter or sediment |
| 3. | Pour point | IS 1448 Part 10/Sec 2 or ISO 3016 | -40 °C (Max.) |
| 4. | Water content a) for bulk supply b) for delivery in drums | IEC 60814 | 30 mg/kg (Max.) 40 mg/kg (Max.) |
| 5. | Electric strength (breakdown voltage) | IS 6792 or IEC 60156 | Minimum 30 kV (new unfiltered oil) / 70 kV (after treatment) |
| 6. | Density at 20 °C | IS 1448 Part 16 or ISO 12185 or ISO 3675 or ASTM D7042 | 895 kg/m ³ (Max.) |
| 7. | Dielectric dissipation factor (tan delta) at 90 °C | IS 16086 or IEC 60247 or IEC 61620 | 0.0025 (Max.) |
| 8. | Negative impulse testing KVp @ 25 °C | ASTM D3300 | 145 (Min.) |
| 9. | Carbon type composition (% of Aromatic, Paraffins and Naphthenic compounds) | IEC 60590 and IS 13155 or ASTM D2140 | Maximum Aromatic : 4 to12 % Paraffins : <50% & balance shall be Naphthenic compounds. |
| B Refining/Stability | | | |
| 1. | Colour | ISO 2049 | L0.5 (less than 0.5) |