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26 1200 – Medium Voltage Transformers

PART-1. GENERAL

1.01 Scope

A. This specification covers the electrical and mechanical characteristics of 45-10,000kVA Three-Phase Step- Down Pad-Mounted Distribution Transformers. KVA ratings for transformers with secondary voltages not exceeding 1,000-10,000 kVA.

B. Applicable References

1. All characteristics, definitions, and terminology, except as specifically covered in this specification, shall be in accordance with the latest revision of the following ANSI IEEE, NEMA, and Department of Energy standards:
 - a. C57.12.00 - IEEE Standard for Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
 - b. C57.12.28 - Pad-Mounted Equipment - Enclosure Integrity.
 - c. C57.12.34 -IEEE Standard Requirements for Pad-Mounted, Compartmental-Type, Self-cooled, Three-Phase Distribution Transformers (2500 kVA and Smaller) -High Voltage: 34500GrdYI19920 Volts and Below; Low-Voltage: 480 Volt 2500kVA and Smaller.
 - d. C57.12.90 -IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and IEEE Guide for Short-Circuit Testing of Distribution and Power Transformers.
 - e. C57.12.91 - Guide for Loading Mineral-Oil-Immersed Transformers.
 - f. NEMA TR 1-1993 (R2000) - Transformers, Regulators and Reactors, Table 0-2 Audible Sound Levels for Liquid-Immersed Power Transformers.
 - g. NEMA 260-1 996 (2004) - Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas.
 - h. 10 CFR Part 431 - Department of Energy - Energy Conservation Program for Commercial Equipment; Distribution Transformers Energy Conservation Standards; Final Rule.

C. Submittals

1. Data Submittal

- a. The following data shall be submitted:
 - 1) Percent Impedance
 - 2) Typical bid drawing

- 3) Approval drawing - drawings shall show final dimensions and features. When requested, approval drawings shall be provided per quoted lead time.
- 4) Record Drawing - drawings shall show final dimensions and features. When requested, record drawings shall be provided.

PART-2. PRODUCTS

2.01 Ratings

- A. The transformer shall be designed in accordance with this specification and the kVA rating shall be as indicated on the Drawings.
- B. The primary voltage, configuration, and the basic lightning impulse insulation level (BIL) shall be: loop feed, 41 60 Delta x 13200 Delta (dual primaries), 95 kV BIL.
- C. The secondary Voltage, configuration, and the basic insulation level (BIL) of the secondary voltage shall be 480Y/277V, 30 kV BIL.
- D. The transformer may be furnished with full capacity high-voltage taps. The tap changer shall be clearly labeled to reflect that the transformer must be de-energized before operating the tap changer as required in Section 4.3 of ANSIC57.12.34. The tap changer shall be operable on the higher Voltage only for transformers with dual voltage primaries. The unit shall have one of the following tap configurations:
 1. Two - 2 % taps above and below rated voltage (split taps).
- E. The average winding temperature rise above ambient temperature, when tested at the transformer rating, shall not exceed 65°C.
- F. The percent impedance voltage, as measured on the rated voltage connection, shall be per Table 2. For target impedances, the tolerance on the impedance shall be +/- 7.5% of nominal value for impedance values greater than 2.5%. The tolerance on the impedance shall be +1-10.0% for impedance values less than or equal to 2.5%.

2.02 Construction

- A. The core and coil shall be vacuum processed to ensure maximum penetration of insulating fluid into the coil insulation system. While under vacuum, the windings will be energized to heat the coils and drive out moisture, and the transformer will be filled with preheated filtered degassed insulating fluid. The core shall be manufactured from burr-free, grain-oriented silicon steel and shall be precisely stacked to eliminate gaps in the corner joints. The coil shall be insulated with B stage, epoxy coated, diamond pattern, insulating paper, which shall be thermally

cured under pressure to ensure proper bonding of conductor and paper. Coils shall be either aluminum or copper (eliminate a metal if one is required over the other).

- B. The dielectric coolant shall be listed less-flammable fluid meeting the requirements of National Electrical Code Section 450-23 and the requirements of the National Electrical Safety Code (IEEE C2-2002), Section 15. The dielectric coolant shall be non-toxic*, non-bioaccumulating and be readily and completely biodegradable per EPA OPPTS 835.31 00. The base fluid shall be 100% derived from edible seed oils and food grade performance enhancing additives. The fluid shall not require genetically altered seeds for its base oil. The fluid shall result in zero mortality when tested on trout fry (Per OECD G.L. 203). The fluid shall be certified to comply with the US EPA Environmental Technology Verification (ETV) requirements, and tested for compatibility with transformer components. The fluid shall be Factory Mutual Approved, UL Classified Dielectric Medium (UL-EOUV) and UL Classified Transformer Fluid (UL-EOUV), Envrotermps FR 3 fluid.
- C. Tank and Cabinet Enclosure:
1. The high-voltage and low-voltage compartments, separated by a metal barrier, shall be located side-by-side on one side of the transformer tank. When viewed from the front, the low-voltage compartment shall be on the right. Each compartment shall have a door that is constructed so as to provide access to the high-voltage compartment only after the door to the low-voltage compartment has been opened. There shall be one or more additional fastening devices that must be removed before the high voltage door can be opened. Where the low-voltage compartment door is of a flat panel design, the compartment door shall have three-point latching with a handle provided for a locking device. Hinge pins and associated barrels shall be constructed of corrosion-resistant material, passivated AISI Type 304 or the equivalent.
 2. A recessed, captive, penta-head or hex-head bolt that meets the dimensions per ANSI C57 .12.28 shall secure all access doors.
 3. The compartment depth shall be in accordance with C57.12.34, unless additional depth is specified.
 4. The tank base must be designed to allow skidding or rolling in any direction. Lifting provisions shall consist of four lifting lugs welded to the tank.
 5. The tank shall be constructed to withstand 7 psi without permanent deformation, and 15 psi without rupture. The tank shall include a 15 psig pressure relief valve with a flow rate of minimum 35 SCFM.
 6. The exterior of the unit shall be painted Munsell 7GY3.2911.5 green
 7. The tank shall be complete with an anodized aluminum laser engraved nameplate. This nameplate shall meet Nameplate B per ANSI C57.12.00.

2.03 High Voltage Bushings and Terminals

- A. High voltage bushings will be installed in the high voltage termination compartment located on the front left of the transformer and requiring access via the low voltage termination compartment on the front right.
 - B. Bushing Style:
 1. 15/25/35 KV DEADFRONT, CURRENTS ABOVE 200 AMPS: The high voltage bushing shall be a 600A dead-break primary one-piece bushing externally removable, 30 rated, integral design. An optional 900 A bushing is available upon request.
 - C. Bushing Configuration
 1. 15/25 KV LOOP FEED DEADFRONT: The transformer shall be provided with six (6) high voltage bushings. ANSI C57.12.34 for loop feed configurations. The bushing heights shall be in accordance with Figure 3 minimum dimensions. ANSI C57.12.34.
- 2.04 Low Voltage Bushings and Terminals
- A. Bushing Style
 1. Voltages less than 700 Volts: The transformer shall be provided with tin-plated spade-type bushings for vertical takeoff. The spacing of the connection holes shall be 1.75" on center, per ANSI C57.12.34 figure 13a. The quantity of connection holes shall be 12, holes.
 2. Transformers 300 kVA and below, and 500 kVA with 480Y/1277 secondary will have two piece low voltage bushings with studs and screw on spades. Transformers 500 kVA with 208Y/120 secondary and all transformers above 500 kVA will have one-piece bushings.
 3. Standard I Maximum bushing hole quantities; kVA 750-1 500, 208Y/120V - 12 standard, 20 maximum.
 4. Bushing supports shall be provided for transformers requiring 10 or more connection holes. Bushing supports shall be affixed to the cabinet sidewalls; tank mounted supports mountings are not acceptable.
 - B. Bushing Configuration
 1. The transformer shall be provided with bushings in a staggered arrangement in accordance with Figure 1 1 a dimensions (Figure 12a dimensions may be specified when a larger termination compartment for greater working space is desired) of ANSI C57.12.34.
 2. Switching

- a. Primary Switching: The primary switching scheme provided with the transformer shall be one four position T-blade sectionalizing switch. Refer to Appendix I for the schematics of these switching options.
- b. Make-before-break option for four-position, sectionalizing switch: This switch option provides improved system reliability by eliminating momentary interruptions during switching operations.

2.05 Overcurrent Protection

- A. BAY-O-NET (The high-voltage overcurrent protection scheme provided with the transformer shall be an externally removable load break expulsion Bay-O-Net fuse assembly with a flapper valve to minimize oil spillage.

2.06 Over Voltage Protection

- A. The overvoltage protection scheme provided with the transformer shall protect the high-voltage or low voltage winding.
- B. DEAD-FRONT BUSHINGS: Externally mounted, Distribution Class M.O.V.E. Dead-front elbow arresters shall be supplied. M.O.V.E. arresters are for installation on 200 A rated dead-front bushing interfaces only. If transformer bushings are rated 600 A or 900 A, BT-TAP elbow connectors, T-OP II elbow connectors, or 600 A bushing adapters, each with a load-reducing tap plug for arrester connection, are required.

2.07 Labeling

- A. A temporary bar code label shall be attached to the exterior of the transformer in accordance with ANSI CS7.12.34.

2.08 Finish Performance Requirements

- A. The tank coating shall meet all requirements in ANSI CS7.12.28 including:
 1. Salt Spray
 2. Crosshatch adhesion
 3. Humidity
 4. Impact
 5. Oil resistance
 6. Ultraviolet accelerated weathering
 7. Abrasion resistance - taber abraser
- B. The enclosure integrity of the tank and cabinet shall meet the requirements for tamper resistance set forth in ANSI CS7.12.28 including but not limited to the pry test, pull test, and wire probe test.

2.09 Production Testing

A. All units shall be tested for the following:

1. No-Load (85°C or 20°C) losses at rated current
2. Total (85°C) losses at rated current
3. Percent Impedance (85°C) at rated current
4. Excitation current (100% voltage) test
5. Winding resistance measurement tests
6. Ratio tests using all tap settings
7. Polarity and phase relation tests
8. Induced potential tests
9. Full wave and reduced wave impulse test

B. Minimally, transformers shall conform to efficiency levels for liquid immersed distribution transformers, as specified in Table 1.1 of the Department of Energy ruling. "10 CFR Part 431 Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule; October 12, 2007." Manufacturer shall comply with the intent of all regulations set forth in noted ruling. This efficiency standard does not apply to step-up transformers.

C. In addition, the manufacturer shall provide certification upon request for all design and other tests listed in C57.12.00, including verification that the design has passed short circuit criteria per ANSI C57.12.00 and C57.12.90.

D. In the event of proposal bid evaluated with guaranteed losses due to a loss evaluation (see section 10.0), manufacturer shall conform to guaranteed average losses as specified in ANSI C57.12.00. The no-load losses of a transformer shall not exceed the specified no-load losses by more than 10%, and the total losses of a transformer shall not exceed the specified total losses by more than 6%.

2.10 Approved Manufacturers

A. Cooper Power Systems

2.11 Accessories

A. The following accessories and options shall be provided:

1. Bolted main tank cover (1 000 kVA & below)
2. Welded main tank cover with bolted handhole (1 500 kVA & above)
3. 1.0" upper fill plug
4. 1.0" drain plug in LV compartment (500 kVA & below)
5. 1.0" drain valve with sampling device in LV compartment (750 kVA & above)
6. Automatic pressure relief valve

7. Metal drip shield (when bayonets specified)
8. Ground provisions per C57.12.34 section 9.1 1.
9. Meet NEMA TR-1 sound levels
10. Liquid level gauge
11. Dial-type thermometer gauge
12. Pressure vacuum gauge
13. 1.0" drain valve w/ sampling device in (LV or HV) compartment (500 kVA & below)
14. Upper fill valve
15. Pressure vacuum bleeder
16. Fault indicator provisions
17. Ground connectors
18. Danger high voltage warning signs
19. FM Global (FM) Approved transformer (to comply with NEC 450-23 listing restrictions for installations on, near, or inside of buildings)
20. Combination UL Listed & Classified transformer (to comply with NEC 450-23 listing restrictions for installations on, near, or inside of buildings) per UL XPLH
21. UL Listed transformer (certifying compliance with ANSI standards only) per UL XPLH

PART-3. EXECUTION

3.01 Shipping

- A. Transformers, 1000 kVA and below, shall be palletized. Transformers, 1500 kVA and larger, shall be loaded and unloaded with overhead cranes, so a pallet is not to be provided for these transformers.

3.02 Service

- A. The manufacturer of the transformer shall have regional service centers located within 2 hours flight time of all contiguous 48 states. Service personnel shall be factory trained in commissioning and routine service of quoted transformers.
- B. Description of positions:
 1. Feed from A & B
 2. Feed from A only
 3. Feed from B only
 4. Open - the loop is closed and the transformer is de-energized



This section of the NIU Design and Construction Standards establishes minimum requirements only. It should not be used as a complete specification.