Electrical – Standard Specifications

DRY-TYPE, MEDIUM-VOLTAGE TRANSFORMERS

STANDARD SPECIFICATIONS

This standard specification is intended to be integrated into the project specifications. The Consultant shall write the specifications to meet the project needs in consultation with the Owner and in accordance with the attached design information section.

PART 1 – GENERAL

1.01 BASIS OF DESIGN

A. Specification covers dry type transformers, with primary voltage above 600 V, for use as shown on plans.

1.02 REFERENCE STANDARDS

A. ANSI C57.12.50 - Requirements for Dry-Type Distribution Transformers, 1-500 kVA 1-phase and 15-500 kVA 3-phase, with high voltage 601 - 34,500 V, low voltage 120-1000 V
B. ANSI C57.12.51 - Requirements for Ventilated Dry-Type Power Transformers 501 kVA and Larger, 3-Phase with High- Voltage 601 - 34,500 V, Low-Voltage 208Y/120 to 4160 V
C. ANSI C57.12.55 - Dry-Type Transformers in Unit Installations, Including Unit Substations - Conformance Standard
D. ANSI C57.12.70 - Terminal Markings and Connections for Distribution and Power Transformers
E. IEEE C57.12.01 - General Requirements for Dry-Type Distribution and Power Transformers Including Those with Solid Cast and/or Resin Encapsulated Windings
F. NEMA 5T20 - Dry Type Transformers for General Applications
G. UL 1561 - Dry Type General Purpose and Power Transformers

1.03 SUBMITTALS

A. Submit Shop Drawings for equipment provided under this Section.
B. Acoustical Sound and Vibration Test Data on manufactured unit.
    1. Test data sheets shall be submitted for review and approval by Owner and Architect/Engineer prior to shipment to job site.
C. Current Manufacturer's AEIC pre-qualification

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: ABB, General Electric, Square D, Siemens, Eaton
B. Approved equal

2.02 RATINGS AND STANDARDS COMPLIANCE

A. Show ratings and impedance of transformer on drawings. Where impedance is not specified elsewhere, provide 7% impedance for transformers in three transformer networks and 5.75% for non-networked transformers.
B. Ventilated dry type transformers shall comply with ANSI 57.12.51.

2.03 CONSTRUCTION

A. Transformer shall be cooled by natural air and forced air convection (AA/FA).
    1. Units shall include fans to increase kVA rating by 33%.
    2. Fan motors shall be 120 V with individual fusing.
    3. Temperature monitor and fan control unit includes:
        a. Temperature monitor with digital readout,
        b. GREEN- power on, YELLOW- fan on, RED- high temperature indicating lights,
        c. Audible high temperature alarm with alarm silence pushbutton,
        d. Maximum temperature memory with read and reset switch,
        e. Auto/manual fan control switch,
        f. System test switch,
        g. Auxiliary alarm contact for remote control and temperature monitoring,
        h. Acceptable manufacturer: Temptrol.
    4. Temperature sensing in each coil.
    5. Sequence of Operation
        a. Transformer operating below natural air convection cooling (M) rating
        b. GREEN light is activated
        c. Temperature rises to above natural air convection cooling (M) rating
        d. Relay is energized, fans and YELLOW light activate
        e. Temperature rises to higher set point, relay energizes and audible alarm, RED light, and circuit for remote alarms activates
    6. Control power shall be provided from control power transformer self-contained in equipment.
    7. Emergency Unit Substation transformers shall be pre-wired for future fan cooling, including RTD's or thermocouples embedded in the windings for temperature control.

2.04 INSULATION TYPE VPI

A. Electrical Insulation

1. Class H Insulation system shall be rated 22 degrees C.
2. Temperature rise based on a 3 degrees C ambient with a maximum 4 degrees C.
3. Insulation shall be inorganic materials such as porcelain, glass fiber, electrical grade glass polyester, or Nomex.
4. Coil assembly shall be Vacuum Pressure Impregnated (VPI) polyester.
5. Transformer shall be:
    a. Designed for temperature rise of 15o•c and shall be capable of operating at 33% above base nameplate kVA capacity continuously.
    b. Designed to meet sound level standards for dry-type transformers.
6. Basic Impulse Insulation Level: 95kV for 15kV; 60 BIL for 5Kv (emergency system); 30kV for 600V and below.

2.05 ENERGY EFFICIENCY

A. Minimum 98% efficiency or as required by Department of Energy minimum transformer efficiency requirements (CFR 43192 & DOE 78FR23335), whichever is greater.

2.06 CORE AND COIL

A. Coil:
    1. Windings shall be copper.

B. Core:
    1. Constructed of high grade, grain oriented, non-aging silicon steel.

2.07 TAPS

A. Taps:
    1. Rigidly support,
    2. Mark for connections,
    3. Accessible from front or back by panel removal,
    4. Four 2 Y. % full capacity taps; two above and two below rated voltage.

2.08 ENCLOSURES

A. Transformer enclosure shall:
    1. Be constructed of 12 ga sheet steel,
    2. Be equipped with removable panels for access to core and coils,
    3. Include front and rear panels with ventilated grills,
    4. Include rubber isolation pads to isolate core from case; there shall be no metal-to-metal contact,
    5. Base suitable for skidding in all directions.

B. Finish:
    1. Transformer enclosure and rails shall be finished with manufacturer's standard finish,

2. Outdoor transformers shall have outdoor paint finish.

C. Ventilation Openings - Louvered or fine mesh screened. Ventilation openings shall be constructed to prevent any foreign object intrusion. Punched holes are unacceptable to guard against insertion of foreign objects.

2.09 NAMEPLATE

A. Nameplates shall be:

1. Secured to transformer enclosure with screws,
2. Diagrammatic nameplate listing all information as required by NEMA standards.

B. Transformer:

1. Transformer shall have nameplate with:

a. Manufacturer's name and drawing number,
b. Transformer identification tag as indicated on drawings,
c. Electrical connection diagram,
d. Primary and secondary voltage rating,
e. kVA rating,
f. Basic Impulse Level.

C. Doors:

1. Provide external doors and hinged bolted panels with "Caution - High Voltage - Keep Out" signs.

D. Submit identification to Owner/Architect/Engineer for approval.

2.10 ACCESSORIES

A. Transformer shall include:

1. Provisions for lifting and jacking,
2. Removable panel for access for de-energized tap changing,
3. Two ground pads using Salisbury ground ball studs,
4. A continuous 1/4" x 2" ground bus for connection to adjacent compartment's switchgear.

2.11 TERMINAL COMPARTMENTS

A. Transformer shall include HV terminal compartment and LV terminal compartment.

1. Air filled primary terminal chamber shall have adequately sized stress cone terminations of 3 to 6 single conductors, as indicated.

B. Connections between:

1. Primary device and transformer shall be Bus.
2. Transformer and secondary shall be Bus.

3. Connections between the transformer and the switchgear shall be provided by the switchgear manufacturer.

C. Secondary neutral connection shall be brought out for bonding to ground bar.

1. Provide fully insulated secondary neutral bushing (externally groundable) to permit the use at a neutral conductor or CT or GF sensing.

D. Provide removable link between neutral point and ground bar.
E. Distribution class surge arresters, rated at 15kV, located in HV terminal chamber.
F. Terminal markings shall be provided on the transformer terminals and shall clearly identify each terminal when doors or covers are opened.

1. Transformers will have high voltage (primary) terminal markings:

a. "H1" to "N' Phase
b. "H2" to "C" Phase
c. "H3" to "B" Phase

2. Low voltage switchgear normally connected to the building power service transformers will be constructed in accordance with industry standards and will have their buses identified "1", "2", "3", "N". Transformers will have low voltage (secondary) terminal markings "X1", "X2", "X3", "XO" from left to right or top to bottom when facing the low voltage terminals and the switchgear shall be as follows:

a. "X1" to "1" (BUS)
b. "X2" to "2" (BUS)
c. "X3" to "3" (BUS)

3. Noted: transformer connections as indicated above results in a rotation sequence at the low voltage switchgear of "1", "2", "3".

2.12 QUALITY ASSURANCE

A. Transformers to be of the highest quality manufactured by a firm that has manufactured such apparatus for at least 25 years.

2.13 VIBRATION ISOLATION

A. Mounting type - Unit DNP (Double Neoprene Pad): Neoprene pad isolators shall be formed by two layers of 1/4-inch to 5/6-inch thick ribbed or waffled neoprene, separated by a stainless steel or aluminum plates. These layers shall be permanently adhered together.

1. Neoprene shall be 40 to 50 durometer. The pads shall be sized so that they will be loaded within the manufacturer's recommended range.
2. Provide steel top plate equal to the size of the pad. This is provided to transfer the weight of the supported unit to the pads.
3. Acceptable manufacturers: Amber/Booth

a. Korfund Dynamics
b. Mason Industries

c. Peabody Noise Control
d. Vibration Mountings Control
e. Kinetics Noise Control

B. Provide vibration control devices, materials, and related items. Perform all work as specified in this section to provide complete vibration isolation systems in proper working order.

1. Coordinate the size, location, and special requirements of vibration isolation equipment and systems with other trades. Coordinate plan dimensions with size of housekeeping pads.
2. Size isolators to meet the specified loading requirements.
3. Should equipment cause excessive noise or vibrations, the Contractor shall be responsible for remedial work required reducing noise and vibration levels. "Excessive" is defined as exceeding the manufacturer's specifications for the unit in question.
4. Upon completion of the work, the Owner's Representative shall inspect the installation and shall inform the installing contractor of any further work that must be completed. Make all adjustments as directed. This work shall be done before vibration isolation systems are accepted.