Technical Specification for
Three-Phase Dead Front Loop Feed
Pad Mounted Distribution Transformers

T - 30

COLLEGE PARK POWER
1886 Harvard Avenue
College Park, GA 30337

Telephone: (404) 669-3772
Fax: (404) 669-3798

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1.0 SCOPE AND APPLICATION

This specification is applicable for the mechanical and electrical requirements for three phase dead front pad-mounted, 60 Hertz, mineral-oil filled, self-cooled distribution transformers, in various kVA ratings for use on an underground electric distribution system.

2.0 COMPLIANCE WITH STANDARDS

All transformers shall be designed, manufactured and tested to meet all the requirements specified within the latest revision of the following documents. In the event that any of the referenced standards are shown to be contradictory, then the more stringent standard shall apply.

ANSI C57.12.00	"General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers."
ANSI C57.12.26	"Requirements for Transformers, Pad-Mounted, Compartmental-Type, Self-Cooled, Three- Phase Distribution Transformers for use with Separable Insulated High-Voltage Connectors; High Voltage, 24,940 GrdY/14,400 Volts and Below; 2500 kVA and Smaller."
ANSI C57.12.28	"Switchgear and Transformers, Pad Mounted Equipment Enclosure Integrity."
ANSI C57.12.90	"Test Code for Liquid-Immersed Distribution Power and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers."
ANSI/IEEE 386	"Separable Insulated Connectors for Power Distribution Systems above 600 V."

3.0 RATINGS

3.1 All ratings shall be based on not exceeding a 65EC. Winding temperature rise. The high voltage basic impulse insulation level (BIL) shall be 95 kV.

3.2 High Voltage: 12470 Grd Y / 7200 (except where specifically stated otherwise)

3.3 Low Voltage: 208/120, 480/277 as requested for quotation.

3.4 Size (kVA): 75, 112.5, 150, 225, 300, 500, 750, 1000, 1500, 2000, 2500 as requested for quotation.

3.5 Transformers connected wye-wye must have a four or five-legged core or must be of triplex design (3 single phase units in one tank).

4.0 DESIGN AND CONSTRUCTION

4.1 The pad-mounted compartmental type transformers shall consist of the transformer tank and high and low voltage terminating compartments. The transformer tank and high and low voltage terminating compartments shall be assembled as an integral unit, tamper resistant and weather resistant in accordance with the provisions of ANSI C57.12.28 for mounting on a pad.

4.2 Transformers shall be constructed in accordance with ANSI C57.12.26, latest revision, unless exception is taken by this specification.

4.3 The transformer shall comply with those specific dimensions specified in Figures 6(a), 7 and 8(a) of ANSI C57.12.26, latest revision.

4.4 Tank Construction, Accessories and Finish

4.4.1 The transformer tank shall comply with ANSI C57.12.26, latest revision and shall be of all welded steel construction. All welds on the exterior of the tank are to be full welds. Spot, tack or skip welds are not acceptable for attaching hinges, brackets, etc. There shall be no exposed screws, bolts or other fastening devices which are externally removable. The top shall be pitched to facilitate water run-off. If main tank cover is fully welded, a hand hole 24" x 36" shall be provided.

4.4.2 All surfaces that are in contact with the pad and the base sill shall be made of 400CB, 409 or 304L stainless steel. Stainless steel hardware shall be used to fasten stainless steel surfaces. Hinges shall be stainless steel.

4.4.3 Tank grounding provisions shall be as specified in ANSI C57.12.26 latest revision. One ground pad shall be provided in each compartment, consisting of a 1/2"-13 threaded boss, 7/16" deep. Each pad shall contain a bronze transformer tank ground connector suitable for AWG #8 solid - #2 stranded copper conductors, Penn Union HGSE-C1-SBH, Anderson GTCL-23A or approved equal.

4.4.4 The transformer shall be provided with permanently attached lifting provisions arranged on the tank to provide a distributed balanced lift in a vertical direction for the completely assembled transformer.

4.4.5 Construction of the unit shall be such that it can be lifted, skidded or slid into place on the mounting pad without disturbing the entrance cables.

4.4.6 Enclosure security shall conform to the requirements of Section 4 of ANSI C57.12.28 and be suitable for a Best Company padlock. Locking provisions shall be in accordance with Section 7 of ANSI C57.12.26 utilizing a 1/2" penta head captive bolt, with NC Class 2 threads, separate from the locking

device. The bolt shall be threaded into a blind hole. Aluminum handles and latches are not acceptable.

4.4.7 The base of the assembly shall be provided with a suitable sill to permit anchoring the unit on the pad from within the cable terminating compartments.

4.4.8 Two steel hold down cleats, slotted for 1/2" bolts, shall be provided for the front sill. Cleats shall be hot dip galvanized or stainless steel and secured for shipment to the ground pad inside the transformer cabinet.

4.4.9 The tank finish shall be of high grade paints employing a controlled baking process that will insure a protective coating in accordance with the requirements of ANSI C57.12.28, paragraph 5, "Enclosure Coating System." The color shall be Munsell 7GY 3.9/1.5 olive green. Paint thickness on all exterior surfaces shall be a minimum of 2.5 mils. Interior tank coating shall be white or similar light color to enhance visibility during repair and maintenance

4.4.10 The transformer kVA rating shall be clearly and permanently marked in 2 inch yellow numerals centered on the cabinet door.

4.4.11 A permanently marked diagrammatic instruction nameplate shall be located inside the low voltage compartment and be in conformance with all provisions of ANSI C57.12.26, paragraph 7.4 latest revision. The metal (aluminum or copper) used in each winding shall be shown on the nameplate. The approximate total weight in pounds shall be shown on the nameplate. The nameplate shall include the month and year of manufacture. The transformer nameplate may contain the words "Mineral Oil Filled" or "Non-PCB Mineral Oil Filled" or similar statement.

4.4.12 The transformer shall be furnished with an oil drain valve, oil sampling device, an oil fill plug and an oil level gauge (Tedco Number M36E, Qualitrol 202-407-01or approved equivalent). All to be located in the low voltage compartment.

4.4.13 Tanks without cooling fins are preferred. If required, cooling fins shall be designed so that no sharp points or edges exist on any part of the fins or where they attach to the tank. Cooling fins shall have a 5" clearance from the ground. External corners and edges shall be rounded and smoother. Cooling fins shall be arranged to minimize their protrusion from the tank.

4.5 Bushings and Terminals

4.5.1 The high voltage bushing and low voltage terminal arrangement shall be as specified in ANSI C57.12.26 Figures 6(a), 7 and 8(a). The identification of the high voltage connector and low voltage terminal are required. The numbering shall be as shown on the equipment nameplate and shall comply with ANSI C57.12.26 latest revision.

4.5.2 The transformer shall be supplied with 8.3/14.4 kV class removable externally clamped stud bushing wells (Cooper 2603973B01 *or ABB or GE equivalent*) and 3 stud clamps with four bail tabs (Cooper 2026256A52). *ABB 3 stud clamp with bale holes may substitute.* Studs shall be provided in the wells. The transformer shall be supplied with 8.3/14.4 kV class replaceable load break type bushing inserts (Cooper 2604797B01M *or Elastimold or GE equivalent*).

4.5.3 The bushing wells shall be oriented so that the elbows can be operated with a hot stick.

4.5.4 The internal risers to externally clamped bushings shall allow replacement of the bushing wells from the exterior of the tank.

4.5.5 The transformer shall provide loop feed capability. The minimum current carrying capability of components for the loop primary cable system shall be 200 amperes (continuous) and 10,000 amperes symmetrical (momentary).

4.5.6 **For transformers 500 kVA and smaller**, the low voltage terminals shall be spade type in accordance with ANSI C57.12.26, Figure 9, latest revision. Low voltage bushings shall be epoxy (porcelain low voltage bushings are not permitted) with rotatable spade terminals constructed in a single piece and shall be externally clamped with leads of sufficient length to insure that all bushings can be changed without opening the tank. **Bolted type spades are not acceptable.** Low voltage terminals shall be arranged staggered as shown in ANSI C57.12.26, Figure 8 (a).

4.5.7 **For 750 kVA to 1500 kVA transformers**, the low voltage terminals shall be spade type in accordance with ANSI C57.12.26, Figure 9, latest revision. Low voltage bushings shall be epoxy or porcelain with rotatable spade terminals constructed in a single piece and shall be externally clamped with leads of sufficient length to insure that all bushings can be changed without opening the tank. **Bolted type spades are not acceptable.** Low voltage terminals shall be arranged staggered as shown in ANSI C57.12.26, Figure 8 (a).

4.5.8 **For 2000 and 2500 kVA transformers**, the low voltage terminals shall be spade type in accordance with ANSI C57.12.26, Figure 9, latest revision. Low voltage bushings shall be epoxy or porcelain with rotatable spade terminals constructed in a single piece and shall be externally clamped with leads of sufficient length to insure that all bushings can be changed without opening the tank. **Bolted type spades are not acceptable.** Low voltage terminals shall be arranged staggered as shown in ANSI C57.12.26, Figure 8 (a).

4.5.9 The low voltage bushings on units rated 500 kVA and larger shall be supported with an insulating material in a manner designed to counteract the

normal and customary downward forces resulting from the connection of multiple cables to the bushings.

4.5.10 The low voltage neutral shall be a fully insulated bushing. Primary wye connections and secondary neutrals shall be internally connected to this spade with separate removable links or jumpers which are readily removable through hand holes. A ground pad shall be provided on the outer surface of the tank. A removable ground strap, suitably sized for the rating of the transformer shall be provided and connected between the low voltage neutral bushings and the ground pad.

4.6 Overcurrent Protection

4.6.1 The primary fuse shall be oil-immersed externally replaceable equivalent to Cooper bayonet type. For transformers 500 kVA and smaller, the fuse links shall be dual sensing Bay-O-Net equivalent to Cooper Number 358C in series with coordinated oil-immersed isolation links. For transformers larger than 500 kVA, the fuse links shall be current sensing Bay-O-Net equivalent to Cooper Number 353C in series with coordinated oil-immersed isolation links. Isolation links shall be equivalent to Cooper 1861A. See Table 1 for Cooper fuse designation. Equivalent ABB or General Electric fuse links and isolation links may substitute.

4.6.2 An information decal may be placed near the primary fuse if desired by the manufacturer. The wording shall be: "Caution, Read Bayonet (Fuse Holder) Instructions Before Operation."

4.6.3 A drip cup or drip shield angled toward the side panel and extending 4 to 5 inches from the transformer tank, shall be provided under the bayonet fuses. No oil should drip on top of the bushing/elbow assembly. *A drip cup (Central Moloney Part #70382457 or equivalent) to contain the oil is preferred.*

4.7 High and Low Voltage Compartment

4.7.1 The high and low voltage compartment shall comply with ANSI C57.12.26, Figure 7 latest revision.

4.7.2 A rigid steel partition shall be provided separating the high and low voltage compartments as designated in Figure 7 of ANSI C57.12.26 latest revision.

4.7.3 Doors shall be designed to prevent inadvertent dislodgement from the hinge. Compartment doors shall be equipped with latching in the open position. Hinge assemblies and pins shall be stainless steel. The door of the high voltage compartment shall be held closed by a captive stainless steel bolt which is accessible only after the low voltage door is opened.

4.8 Dielectric Oil

4.8.1 Transformers shall be furnished complete with oil which does not contain more than 1 ppm PCBs. A blue decal (approximately 2-1/2" x 3-1/2") with white letters shall be placed on the tank near the nameplate. The wording shall be "Filled with Non-PCB mineral oil" or "Filled with mineral oil that has less than one part per million PCB" or "Filled with Non-PCB mineral oil at time of manufacture, per 40 CFR 761 (May 31, 1979)." The transformer nameplate may contain the words "Mineral Oil Filled" or "Non-PCB Mineral Oil Filled."

4.8.2 The vendor shall certify that the liquid dielectric or any component of the liquid dielectric is not listed in the Federal Register, Vol. 45, No. 98, issued May 19, 1980, 40FR, Part 461, Appendix VIII, Subpart D - Identification and Listing of Hazardous Waste.

4.9 Impedance

The percent impedance (%IZ) as measured at rated voltage shall be as follows:

kVA Rating	Max. %IZ	Min. %IZ
75 – 500	5.0	1.4
750 – 2500	6.18	5.32

4.10 Tap Changer

Transformers shall be provided with an externally operated no load tap changer having two 2-½% steps above and two 2-½% steps below the rated voltage, in accordance with paragraph 6.2.1 of ANSI C57.12.20, latest revision. The tap changer shall be set at the factory to the neutral or nominal tap. The switch handle shall be non-corrosive with a fastening device to prevent inadvertent operation. Switches that must not be operated while energized shall have a warning sign to this effect near the switch.

4.11 Pressure Relief

The transformer shall be equipped with a replaceable pressure relief valve that complies with the requirements of ANSI C57.12.26, Section 7.5.2 latest revision, including the following:

4.11.1 The body of the valve shall be brass, bronze or stainless steel.

4.11.2 The venting port, on outward side of valve head seat, shall be protected to prevent entry of dust, moisture and insects before and after valve has actuated.

4.11.3 The device shall not have an indicating "pop-off" cover.

4.11.4 The device shall have a pull ring for manual or hot stick activation.

4.12 Safety Labels

Bilingual English/Spanish **WARNING** and **DANGER** labels shall be applied in accordance with NEMA standards Publication Number 260 latest revision and shall be attached to individual cabinets of pad mounted transformers as follows:

4.12.1 **WARNING** label shall be mounted on the outside of the high voltage compartment latched door and centered on the door two inches below the top.

4.12.2 **DANGER** label shall be mounted inside each compartment and centered on the face of the transformer directly below the bushings so it is visible when the door is in the open position.

5.0 QUALITY ASSURANCE

5.1 Transformers shall be tested in accordance with Paragraph 6 of ANSI C57.12.26, latest revision. Also, the impulse test as specified in ANSI C57.12.00 shall be made on all transformers.

5.2 The transformer design shall be tested for short circuit withstands capability in accordance with ANSI C57.12.90 latest revision**.**

6.0 CERTIFIED TEST REPORTS AND DATA REQUIRED

6.1 The vendor shall provide, upon request as part of the bid, an outline drawing showing physical dimensions, total transformer weight, location of accessories and nameplate and connection diagram.

6.2 The vendor shall provide a certified test report for all transformers in a given order, indicating the actual loss data for each unit delivered. Within 30 days of transformer shipment, the certified test reports shall be mailed directly to:

College Park Power
Attn: Director
1886 Harvard Avenue
College Park, GA 30337

7.0 EQUIVALENT FIRST COST (EFC) EVALUATION

7.1 The vendor shall state all exceptions to this specification. If no exceptions are taken, vendor shall so state.

7.2 Equivalent First Cost (EFC) will be calculated and evaluated for all bids received. The method used to determine the EFC is documented in A Method for Economic Evaluation of Distribution Transformers, published by the Edison Electric Institute, April 1981.

7.3 The EFC shall be determined with the following formula:

EFC ($) = [4.81 x NLL (watts)] + [2.10 x LL (watts)] + Purchase Price

where NLL= No Load (core) Losses and LL = Load (winding) Losses.

7.4 All bidders shall supply No Load, Load and Total losses reported in watts on the form provided in the bid documents. No load losses shall be reported at 20°C. The value for load losses shall be corrected to 85EC.

7.5 Quoted losses shall be the guaranteed average of all transformers in a specific order of a given size and type. The losses of an individual unit in the shipment shall not exceed the tolerances specified in Table 19, ANSI C57.12.00 - 10% No Load, 6% Total Load. Units exceeding these limits shall not be shipped to College Park Power. If any such unit is found to have been shipped, College Park Power will request full credit based upon the purchase price of the unit.

8.0 PENALTY FOR NON-CONFORMING TRANSFORMERS

8.1 Should any transformer fail to conform to the specifications in any way, then, at the option of College Park Power, the vendor shall replace the non-conforming transformer with a suitable transformer and bear all associated costs; or have the initial bid price reduced by a penalty charge calculated in accordance with Section 8.2 below.

8.2 Calculation of the penalty charge in dollars per unit shall be the "Equivalent First Cost of Actual Losses" less the "Equivalent First Cost of Quoted Losses."

8.3 In the event that a given order does not exceed the average losses as quoted, but any individual transformer exceeds the tolerances as specified in Section 7.4, then the penalty charge shall be deducted from the bid price of that unit.

8.4 In the event the average losses for a given transformer order exceeds the quoted average, then the penalty charge shall be calculated in accordance with Section 9.2 based on the difference of the actual average losses and the quoted average losses and shall be deducted from each unit in the order.

8.5 In no case will the penalty charge exceed the bid price of the non-conforming unit.

9.0 PACKAGING AND SHIPPING

Each transformer shall be fastened to skids or to a two-way entry, disposable pallet of the vendor's own design. This pallet must be of such dimension as to provide two inch (2") clearance of the transformer at its widest outside measurements, on all four sides. Skids or pallet must provide a minimum of 2-1/4 inches of fork under clearance.

10.0 WARRANTY

10.1 The vendor shall guarantee the transformers for a minimum period of 18 months from shipment or 12 months from installation that all equipment covered by this agreement is to be free from defects in material and workmanship. Any defective

units discovered or identified during this period shall be replaced or repaired by the vendor at no cost to College Park Power. Vendors are encouraged to provide extended warranties for the entire transformer or for specific parts and/or performance (i.e., additional warranty on paint finish.)

10.2 Any material repaired or replaced under the terms of the above guarantee shall itself be covered by those terms as if it were a new product.

10.3 The vendor shall state the expected service life and failure mode of the product in its intended application. This should also include documentation explaining how expected service life was determined.

10.4 Any transformers that fail after the warranty, but before the expected service life, may be subjected to an engineering failure analysis to determine the cause of failure. This analysis will be performed by the vendor and College Park Power engineers. The vendor shall, if requested, supply the required resources for the analysis at no cost to College Park Power.

TABLES AND FIGURES

Table 1

Three Phase Pad-mounted Transformers Fuse and Isolation Link Sizes
(Cooper Part Numbers Indicated)

kVA RATING	PRIMARY FUSE	ISOLATION LINK
75	4000358C03	3001861A01M
112.5	4000358C05	3001861A02M
150	4000358C05	3001861A02M
225	4000358C08	3001861A03M
300	4000358C08	3001861A03M
500	4000358C10	3001861A05M
750	4000353C12	3001861A03M
1000	4000353C14	3001861A05M
1500	4000353C16	3001861A05M
2000	4000353C17	3001861A05M
2500	4000353C__	30018__A05M