CLARK PUBLIC UTILITIES

TECHNICAL SPECIFICATIONS

THREE-PHASE

PADMOUNTED TRANSFORMERS

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SPECIFICATIONS
PADMOUNTED THREE-PHASE
DISTRIBUTION TRANSFORMERS
12470 GRD Y/7200 VOLTS

SCOPE

This specification covers the requirements for new, three-phase, 60 HZ, self-cooled, liquid-immersed, padmounted, compartmental-type distribution transformers rated 2500 kVA and smaller, suitable for use on a 12.47 Grd Y/7.2kV distribution system. Transformers shall be loop-feed type.

The transformer core shall be grain-oriented silicon steel. Amorphous cores will not be accepted.

1.0 Reference Standards

1.1 Transformers supplied under this specification shall conform to the requirements of the latest editions, amendments, and supplements of the applicable parts of the following standards, characteristics, definitions, terminology except as otherwise specified herein:

IEEE C57.12.00	ANSI Z535
IEEE C57.12.34	ANSI C57.12.28
IEEE C57.12.70	IEEE C57.12.80
IEEE C57.12.90	IEEE C57.147
IEEE 386	NEMA TR-1
NEMA 260	

IEEE C57.12.34-2004 paragraph numbers and figure numbers have been retained to facilitate cross reference.

2.0 Ratings

2.1 Kilovolt-Ampere Ratings. The kVA ratings shall be as follows:

75	1000
150	1500
300	2000
500	2500
750	

2.2 Voltage Ratings and Tap Ratings

2.2.1 Voltage ratings shall be in accordance with Table 1 of ANSI C57.12.34-2004.

2.2.2 All transformers shall have four 2½% below nominal high voltage winding taps.

3.0 Tests

3.1 General. Except as specified in 3.2, tests shall be performed as specified in Section 8 of IEEE C57.12.00-2006 and in IEEE C57.12.90-2006.

3.2 Dielectric Tests. Dielectric tests shall be done in accordance with section 6 of IEEE C57.12.34-2004.

4.0 Construction

4.1 General. The padmounted compartmental-type transformers shall consist of the transformer tank with high and low-voltage cable terminating compartment. The transformer tank and compartment shall be assembled as an integral unit for mounting on a pad. There shall be no exposed screws, bolts, or other fastening devices which are externally removable. There shall be no openings through which foreign objects such as sticks, rods, or wires might contact live parts. There shall be means for padlocking the compartment door(s). The construction shall limit the entry of water (other than flood water) into the compartment so as not to impair the operation of the transformer.

4.1.1 A compartment containing the high and low-voltage compartments shall be as shown in Fig. 6 of IEEE C57.12.34-2004.

4.1.2 All compartment and transformer surfaces in contact with the pad shall be designed or treated to minimize corrosion.

4.1.3 Stainless steel hinges and pins shall be provided.

4.1.4 Transformer oil shall be non-PCB containing less than 1 ppm of PCB. Transformer nameplates to be stamped as follows:

NON-PCB/less than 1 ppm PCB when manufactured

Mineral oil or natural ester fluids which meet the requirements of IEEE C57.147, "IEEE Guide for Acceptance and Maintenance of Natural Ester Fluids in Transformers" are acceptable. All transformers may be retro-filled with mineral oil so they shall be designed for mineral oil.

4.2 Bushings and Terminals

4.2.1 The electrical characteristics of the completely assembled high-voltage connectors and the low-voltage termination shall be as given in Tables 3 and 4 of IEEE C57.12.34-2004. The phase-to-ground kV is 8.3. The BIL is 95. The 60 HZ, dry-one-minute withstand is 34kV. Bushing insert adapters are a part of these requirements.

4.2.2 The number, location, and arrangement of the high-voltage and low-voltage bushings and terminals shall be as shown in IEEE C57.12.34-2004 for Loop Feed transformers with dimensions matching Fig 5 (a), 6, and 12 (a).

4.2.3 High-voltage bushing wells and loadbreak inserts shall be provided for connection to the distribution system through separable insulated high-voltage connectors.

4.2.4 Terminal dimensions shall be as shown in IEEE C57.12.34-2004 Fig. 13(a) and (b) except that transformers rated 750 kVA to 2500 kVA shall have an 8-hole spade.

4.2.5 The low-voltage neutral shall be a fully insulated bushing. A ground pad shall be provided on the outer surface of the tank. A removable ground strap sized for the rating of the transformer shall be provided and connected between the neutral bushing and the ground pad.

4.2.6 For wye-wye connected units, the high-voltage neutral shall be connected to the low-voltage neutral internally with provision for opening this connection internally for testing.

4.3 High-Voltage and Low-Voltage Compartments.

4.3.1 The doors of the compartment shall be of sufficient size to provide adequate operating and working space when removed or open. The doors shall either be equipped for latching in the open position or designed for manual removal. Hinged doors shall be removable in the open position.

4.3.2 The primary and secondary compartments shall be separated by a steel divider.

4.3.3 All threaded grounding nuts and grounding pads shall have the threads protected prior to painting.

4.3.4 All units shall be constructed on a four- or five-legged core.

4.3.5 kVA rating shall be yellow on green, 3 inches high, on the primary door near right-hand edge next to the handle.

4.4 Primary Compartment

4.4.1 All units shall have externally-bolted, universal bushing wells with removable studs.

Loadbreak bushing inserts shall be provided and installed.

4.4.2 All units shall be equipped with an external no-load tap changer in the primary compartment.

4.4.3 A sampler/drain valve (500 kVA and larger) or sampler/thief valve (300 kVA and smaller) shall be provided in the primary compartment.

4.4.4 All units shall have provisions for storing three spare replacement fuse links in a moisture proof container and three replacement links of the proper size shall be included.

4.4.5 There shall be a clear area around all primary bushings so that Cooper feed-through inserts can be installed when needed.

4.5. Secondary Compartment

4.5.1 Low voltage bushings on units 500 kVA and below shall have a minimum 750 inch-pounds of mechanical strength without causing oil leakage. Units 750 kVA and larger shall have a minimum 1200 inch-pounds of mechanical strength without causing oil leakage.

4.5.2 Bushings shall be replaceable without welding.

4.5.3 Bushing terminals shall be of one piece construction from the coil lead connection to the outer extremity.

4.5.4 Bushing supports are required on all units 750 kVA and larger. The supports must not interfere with the access to all eight holes in the spade.

4.5.5 The compartment shall contain the following features:

(1) Pressure-vacuum gauge provision.

(2) One-inch upper filter press connection

(3) Oil level plug

(4) Provision for top oil temperature gauge on 500 kVA and smaller.

(5) Top oil temperature gauge on 750 kVA and larger.

4.5.6 There shall be a minimum of (7) seven inches of space between the end of the low voltage bushing spade and the door.

4.6 Accessory Equipment. Accessory equipment covered in this standard shall be as given in Table 5 below:

TABLE 5

ACCESSORY EQUIPMENT

	75-500 kVA	750-1500 kVA
Tap changer handle in high-voltage compartment	X	X
Instruction nameplate inside low-voltage portion of compartment	X	X
1-inch drain valve with built-in sampling device	X*	X
1-inch drain plug	-*	-
1-inch upper filter press and filling plug (or cap)	X	X

***This differs from IEEE C57.12.34-2004

4.6.2 Terminal Marking and Angular Displacement. Terminal designations shall be as defined in IEEE C57.12.70-2000.

4.6.3 Nameplate

The nameplate shall contain the information specified in Section 5.12 of IEEE C57.12.00-2006 nameplate A for 500 kVA and below; nameplate C for 750 kVA and above. In addition to the requirements of Section 5.12, the following items will be added:

1.) The high-voltage BIL shall be included in nameplate A.
2.) Nameplates A and C will show total weight and gallons of oil.
3.) Nameplates A and C will show the maximum short circuit current. It shall be shown as "Max.L.V. 3 phase ISC=XXXX" where "XXXX" = the actual maximum Isc.
4.) Identification of terminal connections.

4.7 Tanks

4.7.1 Welded main cover construction shall be provided. Access to internal connections and for test purposes shall be provided by two hand holes.

5. Maximum Secondary Short-Circuit Current

5.1 The maximum values of symmetrical short circuit current shall not exceed those shown on the chart below. These values are based upon an infinite short circuit source at the high voltage bushings.

SHORT CIRCUIT CHART

MAXIMUM SHORT CIRCUIT CURRENTS
(In symmetrical kA-Three Phase)

kVA	208Y/120	Min %Z	480Y/277	Min %Z
75	10	2.08	14	0.64
150	22	1.89	14	1.23
300	42	1.98	25	1.44
500	65	2.14	30	2.01
750	65	3.20	30	3.01
1000	85	3.27	50	2.41
1500			50	3.61
2000			50	4.81
2500			55	5.46

6.0 Fuse Requirements

6.1 All units 1500 kVA and smaller shall be equipped with solely RTE/Cooper/Eaton flapper-valve Bay-O-Nets with 4000 series fuses and shall be equipped with internal solely RTE/Cooper/Eaton series 300 isolation links.

6.2 2000 and 2500 kVA units shall be provided solely with RTE/Cooper/Eaton High Ampere Overload Bay-O-Net load sensing fuses in series with solely RTE/Cooper/Eaton ELSP current-limiting backup fuses. All Bay-O-Nets will be equipped with flapper-valves. The Bay-O-Net will have silver plated contacts.

6.3 Each Bay-O-Net shall have a drip shield below it to prevent oil from dripping onto elbow terminators and cables. The Bay-O-Nets shall be located so that they are readily removable with hotsticks without removing bolted-on parts.

KVA	PRIMARY	ISOLATION LINK
75	Fuse #358C05	#1861A02
150	Fuse #358C08	#1861A03
300	Fuse #358C10	#1861A05
500	Fuse #358C12	#1861A06
750	Fuse #358C12	#1861A06
1000	Fuse #358C14	#1861A07
1500	Fuse #353C17	#1861A05
kVA	Load Sensing Fuse Element	ELSP Current Limiting Fuse Elements
2000	4038361CO5CB	3544125M61M
2500	4038361CO5CB	3544175M51M

All fuses listed above are RTE/Cooper/Eaton. No substitutions of other brands of fuses are permitted.

7.0 SHIPPING PALLETS

7.1 All shipping pallets shall have the following general requirements.

7.2 The minimum clearance for lift truck forks shall be 3 inches.

7.3 Two-way access is acceptable.

7.4 Four-way access is preferred.

7.5 Pallet strength and design shall be adequate to contain the load for which it is intended.

7.6 Materials or equipment shall be secured to pallets with suitable bands, bolts, screws, or nails.

7.7 It shall be the responsibility of the vendor to deliver all transformers free from mechanical or electrical damage and/or damage to the paint system.

8.0 ANSI Z535 Safety Signs

Clark Public Utilities will provide its own custom "danger" and "warning" signs which will be placed on the transformers in the Clark Public Utilities' warehouse once they are received. The transformer manufacturer does not need to provide these signs.

9. 0 Maximum Losses

Losses shall not exceed the values shown in the following table. No-load (core) and load (copper) losses shall be independent of each other. No combining or averaging is acceptable.

3Ø Padmount Transformer
Maximum Losses

	208Y/120 Volts		480Y/277 Volts	
	No-load	Load	No-load	Load
kVA	(watts)	(watts)	(watts)	(watts)
75	255	665	260	670
150	420	1200	420	940
300	645	2025	720	1890
500	870	3395	865	2410
750	950	6100	975	4545
1000	1300	6995	1100	6300
1500			2000	8590
2000			2600	12,000
2500			3000	14,000

* No-load losses calculated at 20° C and load losses at 85° C

CPU does not specify efficiencies. It is expected that the transformer manufacturer will meet whatever the current DOE efficiencies are without exceeding the maximum losses as outlined in this section. NOTE: All loss values are based upon the maximum values from bid data for 1990 through 2005.

9.1 Transformers Bought by Contractors

Certified loss data on all transformers will be required from contractors during the installation inspection for review and approval before the facility will be accepted and energized.

Transformers which exceed maximum losses for each kVA as outlined in the table above will be subject to loss dollar penalties on losses over the maximum. Cost of losses will be $4,277/kW no-load (core) and $2,309/kW load (copper) for 3Ø units.

9.2 Transformers Purchased by Clark Public Utilities

Clark Public Utilities will evaluate losses on all bids and quotes. However, all designs must ***not*** exceed the maximum losses in the table above. Certified loss data on all transformers will be required for each shipment of transformers. Transformers which exceed the design losses quoted will be subject to loss dollar penalties. Cost of losses will be $4,277/kW no-load (core) and $2,309/kW load (copper) for 3Ø units.

BID DATA SHEET
PADMOUNT TRANSFORMER
THREE-PHASE

Distributor _____ Date _____
Manufacturer _____
Manufacturing Plant Location _____
Clark Stock Code Number _____ Bid Number _____

KVA	_____
High Voltage (IEEE Design)	_____KV
Low Voltage (IEEE Design)	_____Volts
High Voltage Taps	_____ AN _____BN
Impedance Voltage	_____%
Maximum L.V. Short Circuit Current	_____ KA
Maximum L.V. Short Circuit Current is at	L-L_____ or _____L-N
Short Circuit Impedance	_____%
RTE/Cooper/Eaton Bay-O-Net, Isolation Link & Fuses	_____Yes _____No
Total Weight	_____Pounds
Dimensions	
Height	_____ inches
Width	_____ inches
Depth	_____ inches
Oil	_____Gallons
H.V. Winding Metal	_____
L.V. Winding Metal	_____
Core Metal, Type (Grain oriented, only)	_____
Minimum Paint Thickness (Tank)	_____ Mils
No-load losses	_____watts
Load losses	_____watts
Total Losses	_____watts
Efficiency Rating (Informational Only)	_____ %

Minimum bottom and lower side coating (corrosion resistance) describe below:

A separate Bid Data Sheet *must be completed* for each KVA size and voltage rating.

This form must be completely filled in and included with all bid submittals at the time bids are due. Bid submittals without the Bid Data Sheet will be deemed non-responsive and will not be evaluated for award. Only Clark's Bid Data Sheets will be acceptable.