

SECTION 26 20 00.10
GENERAL LIGHTING AND DISTRIBUTION TRANSFORMERS
PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dry-type distribution transformers with primary and secondary voltages of 600V and less and capacity ratings through 2000kVA.

Note: Paragraphs and words marked in [] are alternates. Select only one.

1.02 REFERENCES

- A. NFPA 70 - National Electrical Code
- B. NEMA ST20
- C. Underwriters Laboratory (UL) and Canadian Standard Association
 - a. UL 1561 – Dry-Type General Purpose and Power Transformers
 - b. CSA C22.2 No.47-M90 Air-Cooled Transformer (Dry Type)
- D. UL 250 Enclosure for Electrical Equipment
- E. 2005 Energy Act PUBLIC LAW 109-58—AUG. 8, 2005
Comply with all Rules from Department of Energy
 - a. 10 CFR 429
 - b. 10 CFR 431

- F. Natural Resources of Canada

1.03 SUBMITTALS

- A. Suppliers asking consideration as an approved equal shall submit complete, warranted performance data and physical dimensions for similar transformers. Data shall be submitted for each size specified, and shall be received by the consultant engineer no less than 10 days prior to the bid due date for consideration.
- B. Shall Include the following
 - a. Copy of ISO 9001:2000 Certification of manufacturing operation.
 - b. Copy of ISO 14001:2004 Certification of manufacturing operation.
 - c. Confirmation that transformer(s) are UL 1561 Listed with a K-9 Rating.
 - d. Construction Details including enclosure dimensions, kVA rating, primary & secondary nominal voltages, voltage tap, unit weight.
 - 1) Wire Access Points – showing Wire Bending Dimensions
 - 2) Location for Ground Lug Provisions – NEC *****
 - e. Basic Performance characteristics including insulation class, temperature rise, core and coil materials, impedances & audible noise level, unit weight, inrush data RMS.
 - f. Efficiency Data
 - g. No load and full load losses will be calculated per NEMA ST20 test methods.
 - h. Efficiency Curves
 - 1) Linear Loads
 - 2) Data per the non-linear load test program.

1.04 STANDARDS

- A. Transformers 1000kVA and smaller shall be listed by Underwriters Laboratories.
- B. Conform to the requirements of ANSI/NFPA 70.
- C. Transformers are to be manufactured and tested in accordance with NEMA ST20.

D. Efficiency – Per DOE 10 CFR 431.192 April 2013

Prior to January 1, 2016 Energy Conservation Standards for Low-Voltage Dry-Type Distribution Transformers				After January 1, 2016 Energy Conservation Standards for Low-Voltage Dry-Type Distribution Transformers			
Single phase		Three phase		Single phase		Three phase	
kVA	Efficiency (%)	kVA	Efficiency (%)	kVA	Efficiency (%) ¹	kVA	Efficiency (%) ¹
15	97.7	15	97.0	15	97.70	15	97.89
25	98.0	30	97.5	25	98.00	30	98.23
37.5	98.2	45	97.7	37.5	98.20	45	98.40
50	98.3	75	98.0	50	98.30	75	98.60
75	98.5	112.5	98.2	75	98.50	112.5	98.74
100	98.6	150	98.3	100	98.6	150	98.83
167	98.7	225	98.5	167	98.70	225	98.94
250	98.8	300	98.6	250	98.80	300	99.02
333	98.9	500	98.7	333	98.90	500	99.14
		750	98.8			750	99.23
		1000	98.9			1000	99.28

Note: All efficiency values are at 35 percent of nameplate-rated load, determined according to the DOE Test Method for Measuring the Energy Consumption of Distribution Transformers under Appendix A to Subpart K of 10 CFR part 431.

E. CSA 802.2-00 Minimum Efficiency Values for Dry Type Transformers

Energy Conservation Standards for Low-Voltage Dry-Type Distribution Transformers			
Single phase		Three phase	
kVA	Efficiency (%)	kVA	Efficiency (%)
15	97.7	15	97.0
25	98.0	30	97.5
37.5	98.2	45	97.7
50	98.3	75	98.0
75	98.5	112.5	98.2
100	98.6	150	98.3
167	98.7	225	98.5
250	98.8	300	98.6
333	98.9	500	98.7
		750	98.8
		1000	98.9

Note: All efficiency values are at 35 percent of nameplate-rated load.

F. Seismic Standards

- a. International Building Code (IBC), 2006 ICC Edition
- b. Tri-axial shake table test results conducted in accordance with the AC156 test protocol³ (Acceptance Criteria for Seismic Qualification Testing of Non-structural Components)

- G. International Standards Organization (ISO)
 - a. ISO 9001:2000 – Quality Management System
 - b. ISO 14001:2004 – Environmental Management System

1.05 PACKAGING FOR SHIPMENT

- A. Transformers shall be packaged for shipment using materials that will have the least environmental impact.
 - 1. Transformer Wrapping
 - a. Transformers shall be protected by Cardboard protective material – all plastic wraps will not be accepted.
 - 2. Transformer Shipping Base
 - 1) Transformers shall be shipped on a base that uses at least 50% less wood than traditional pallets.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Transformers shall be as manufactured by Square D Company or approved equal.
- B. Approved manufacturers shall be registered firms in accordance with ISO 9001:1994 SIC 3612 (US); which is the design and manufacture of low voltage dry type power, distribution and specialty transformers.

2.02 RATINGS INFORMATION

- A. All insulating materials are to exceed standards and be rated for 220°C UL component recognized insulation system.
- B. Transformers 15kVA and larger shall be 150°C temperature rise above 40°C ambient.
 - 1. Optional Temperature Rise 80°C Rise
- C. The maximum temperature of the top of the enclosure shall not exceed 50°C rise above a 40°C ambient.
- D. The transformer(s) shall be rated as indicated in the following schedule:
 - Identification Number(s)
 - kVA Rating
 - Voltages
 - Phase
 - Frequency

2.03 CONSTRUCTION

- A. Transformer coils shall be of the continuous wound construction and shall be impregnated with non-hygroscopic, thermosetting varnish
- B. All cores to be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating.
- C. The completed core and coil shall be bolted to the base of the enclosure but isolated by means of rubber vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure except for a flexible safety ground strap. Sound isolation systems requiring the complete removal of all fastening devices will not be acceptable.
- D. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.
- E. All terminals, including those for changing taps, must be readily accessible by removing a front cover plate.
- F. Taps shall have a 5% FCAN and 10% FCBN
 - a. 2.5% Steps On all voltages 350 V and above
 - 1) 15 to 225kVA
 - 2) 300kVA
 - (a) 150°C Rise
 - (b) 80°C Rise change to 5% FCBN instead of 10%
 - 3) 500 and 750kVA range change to 5% FCBN instead of 10%
 - 4) 1000kVA and greater per Manufacture Design
 - b. 5% Steps On all voltages below 350 V
 - 1) 15 to 225kVA
 - 2) 300kVA
 - (a) 150°C Rise
 - (b) 80°C Rise change to 5% FCBN instead of 10%
 - 3) 500 and 750kVA range change to 5% FCBN instead of 10%
 - 4) 1000kVA and greater per Manufacture Design
- G. Transformers shall have provisions for Bonding Neutral to Ground
- H. Transformers ventilated OPENS shall not be located in wire access areas defined on Drawings

I. Transformer access areas shall allow for NEC bending radius for the following cable ranges by kVA

kVA	Entering Bottom Access Point Wire Range Bending Space 480V / 600V	Entering Side Access Point Wire Range Bending Space 480V / 600V	Entering Bottom Access Point Wire Range Bending Space 208V / 240V	Entering Side Access Point Wire Range Bending Space 208V / 240V
15	(1) #14-#2AWG	(1) #14-#2/0 AWG	(1) #14-#2AWG	(1) #14-#2/0 AWG
30	(1) #14-#2AWG	(1) #14-#2/0 AWG	(1) #14-#3/0 AWG	(1) #14-250kcmil
45	(1) #14-#2/0 AWG	(1) #14-500kcmil	(1 or 2) #6-#4/0 AWG	(1) #6-500kcmil (2) #6 - 250kcmil
75	(1) #14-#4/0 AWG	(1) #14-500kcmil	(1 or 2) 1/0 - 500kcmil	(1 or 2) 1/0 - 500kcmil
112.5	(1 or 2) #6-#4/0 AWG	(1) #6-500kcmil (2) #6 - 250kcmil	(2) 2/0 - 500kcmil (3) 2/0 - 400kcmil	(2 or 3) 2/0 - 500kcmil
150	(1 or 2) #4 - 350kcmil	(1 or 2) #4 - 500kcmil	(2) 2/0 - 500kcmil (4) 2/0 - 250kcmil (3) 2/0 - 400kcmil	2, 3 or 4) 2/0 - 500kcmil
225	(1 or 2) 3/0 - 500kcmil	(1 or 2) 3/0 - 500kcmil	(4) 2/0 - 500kcmil	(4) 3/0 - 500kcmil
300	(2) 2/0 - 500kcmil (3) 2/0 - 400kcmil	(2 or 3) 2/0 - 500kcmil	(6) 2/0 - 500kcmil	(6) 3/0 - 600kcmil
500	(4) 2/0 - 500kcmil	(4) 3/0 - 500kcmil	(9) 2/0 - 500kcmil	(9) 3/0 - 600kcmil
750	(6) 2/0 - 500kcmil	(6) 3/0 - 600kcmil	(15) 2/0 - 500kcmil	(15) 3/0 - 600kcmil

J. Terminals shall be size to handle cables for the following wire range

kVA	480 / 600 V		208 / 240 V	
	Terminal Mechanical Lugs	Terminal Compression Lugs NEMA TWO HOLE	Terminal Mechanical Lugs	Terminal Compression Lugs NEMA TWO HOLE
15	2/0-14 AWG	(1) #12-10 AWG (1) #8-#1/0 AWG	2/0-14 AWG	(1) #8-#1/0 AWG
30	2/0-14 AWG	(1) #8-#1/0 AWG	350 kcmil-6 AWG	(1) #8-#1/0 AWG (1) #4-300kcmil (1) 250kcmil-350kcmil
45	2/0-14 AWG 350 kcmil-6 AWG	(1) #8-#1/0 AWG (1) #4-300kcmil	350 kcmil-6 AWG (1) 600 kcmil-4 AWG or (2) Equal 250 kcmil-1/0 AWG	(1) 250kcmil-350kcmil (1) #2/0-500kcmil (2) #4-300kcmil
75	2/0-14 AWG 350 kcmil-6 AWG	(1) #8-#1/0 AWG (1) #4-300kcmil (1) 250kcmil-350kcmil	(1) 600 kcmil-4 AWG or (2) Equal 250 kcmil-1/0 AWG	(2) #2/0-500kcmil (1) 400kcmil-600kcmil (AL) (2) #4-300kcmil (2) 250kcmil-350kcmil
112.5	350 kcmil-6 AWG (1) 600 kcmil-4 AWG or (2) Equal 250 kcmil-1/0 AWG	(1) 250kcmil-350kcmil (1) #2/0-500kcmil (2) #4-300kcmil	(2) 350 kcmil-6 AWG (2) 600 kcmil-2 AWG	(3) 250kcmil-350kcmil (3) #4-300kcmil (2) 400kcmil-600kcmil(AL)
150	(1) 600 kcmil-4 AWG or (2) Equal 250 kcmil-1/0 AWG	(1) 250kcmil-350kcmil (2) #4-300kcmil	(3) 350 kcmil-6 AWG (2) 600 kcmil-2 AWG	(3) #2/0-500kcmil (3) #4-300kcmil (3) 400kcmil-600kcmil(AL) (4) 250kcmil-350kcmil
225	(1) 600 kcmil-2 AWG (2) 600 kcmil-2 AWG	(2) #2/0-500kcmil (2) 400kcmil-600kcmil (AL) (2) #4-300kcmil	(3) 600 kcmil-2 AWG	(4) #4-300kcmil (4) #2/0-500kcmil
300	(2) 600 kcmil-2 AWG	(3) 250kcmil-350kcmil (3) #2/0-500kcmil (3) 400kcmil-600kcmil(AL)	(4) 600 kcmil-2 AWG	(6) #2/0-500kcmil (6) 400kcmil-600kcmil(AL)
500	(3) 600 kcmil-2 AWG	(4) #4-300kcmil (4) #2/0-500kcmil	(6) 600 kcmil-2 AWG	(9) #2/0-500kcmil (9) 400kcmil-600kcmil(AL)
750	(4) 600 kcmil-2 AWG	(6) #2/0-500kcmil (6) 400kcmil-600kcmil(AL)	(9) 600 kcmil-2 AWG	(15) #2/0-500kcmil (15) 400kcmil-600kcmil(AL)

K. The transformer enclosures shall be ventilated and be fabricated of heavy gauge, sheet steel construction. The entire enclosure shall be finished utilizing a continuous process consisting of degreasing, cleaning and phosphatizing, followed by electrostatic deposition of polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces. The coating shall be UL recognized for outdoor use. The coating color shall be ANSI 49.

- a. Minimum Clearance from Rear and Sides ½”
- b. Units 75kVA and smaller shall have KITS to convert to wall mounted
- c. Units 150kVA and small shall have provisions to be Trapeze Mounted
- d. All enclosures shall have KIT to convert from Type 2 to Type 3R

2.04 SOUND LEVELS

A. Sound levels shall be warranted by the manufacturer not to exceed the following:

15 to 50KVA - 39dB; 51 to 150kVA - 44dB; 151 to 300kVA - 49dB; 301 to 500kVA - 54dB; 501 to 700kVA - 56dB; 701 to 1000kVA - 58dB; 1001 to 1500kVA - 59dB; 1501 to 2000kVA- 60dB

Note: Lower sound levels may be desirable for critical areas such as hospitals, schools or office areas. Contact your local Square D representative for specific recommendations.

2.05 OPTIONAL ACCESSORIES

- A. [Provide weathershields for units ID#_____750kVA max.]
- B. [Provide wall mounting brackets for units ID#_____75kVA max.]
- C. [Provide ceiling mounting brackets for units ID#_____150kVA max.]

PART 3 EXECUTION

3.01 INSTALLATION

- A. Not used

END OF SECTION