

Type DT-3

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Product Description

Note: The following pages provide listings for most standard transformer ratings and catalog numbers. For other ratings or catalog numbers not shown, or for special enclosure types (including stainless steel), refer to Eaton.

Types DS-3, DT-3

- Ventilated, NEMA 2 enclosure standard
- Suitable for indoor applications, outdoors when weathershields are also installed
- Upright mounting only
- 220°C insulation system
- 150°C rise standard; 115°C or 80°C rise optional
- Available in single-phase ratings 15–167 kVA, 600 volts primary (DS-3)
- Available in three-phase ratings 15–1500 kVA and up to 600 volts primary (DT-3)

Application Description

NEMA TP-1-2002 compliant energy-efficient transformers are specifically designed to meet the energy efficiency standards set forth in NEMA Standards publication, TP-1-2002, “Guide for Determining Energy Efficiency for Distribution Transformers.” Surveys have shown that the average loading of low voltage dry-type distribution transformers, over a 24-hour period, is approximately 35%. NEMA TP-1 compliant transformers are optimized to offer maximum efficiency at 35% of nameplate rating.

The range of products covered by NEMA TP-1-2002 are:

NEMA TP-1-2002 Product Range

Rating	Voltage Class	Voltage
	Primary voltage	34.5 kV and below
	Secondary voltage	600V and below
Dry-Type Rating	Single-phase	10–833 kVA
	Three-phase	15–2500 kVA
Liquid Rating	Single-phase	10–833 kVA
	Three-phase	15–2500 kVA

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Transformers that are currently specifically excluded from the scope of NEMA Standard TP-1-2002 include:

- Liquid-filled transformers below 10 kVA
- Dry-type transformers below 15 kVA
- AC and DC drives transformers
- Rectifier transformers designed for high harmonics
- Autotransformers
- Non-distribution transformers, such as UPS transformers
- Special impedance or regulation transformers
- Regulating transformers
- Sealed and non-ventilated transformers
- Machine tool transformers
- Welding transformers
- Transformers with tap ranges greater than 15%
- Transformers with a frequency other than 60 Hz
- Grounding transformers
- Testing transformers

Efficiency levels set forth in NEMA TP-1-2002.

NEMA TP-1-2002 Efficiency Levels

**Tables of Energy Efficiency
NEMA Class 1 Efficiency Levels
Dry-Type Distribution Transformers—
Low Voltage (600V and below)**

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

Features, Benefits and Functions

- 60 Hz operation (except as noted)
- Short-term overload capability as required by ANSI
- Meet NEMA ST-20 sound levels
- Meet federal energy efficiency requirements for low voltage dry-type distribution transformers effective as of January 1, 2007

Standards and Certifications

- UL® listed

**Industry Standards**

All Eaton dry-type distribution and control transformers are built and tested in accordance with applicable NEMA, ANSI and IEEE Standards. All 600 volt class transformers are UL listed unless otherwise noted.

Seismically Qualified

Eaton manufactured dry-type distribution transformers are seismically qualified and exceed requirements of the Uniform Building Code (UBC), International Building Code (IBC) and California Code Title 24.

NEMA TP-1 Energy-Efficient Transformers

Three-Phase—Type DT-3 60 Hz NEMA TP-1 Energy-Efficient—Aluminum Windings

480 Delta Volts to 208Y/120 Volts

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kVA	Full Capacity Taps		Type	°C Temp. Rise	Frame	Wiring Diagram Number	Weight Lbs (kg) ①	Weathershield	Catalog Number
15	2 at +2.5%	4 at -2.5%	DT-3	150	912D	280B	204 (93)	WS38	V48M28T15EE
30	2 at +2.5%	4 at -2.5%	DT-3	150	912D	280B	291 (132)	WS38	V48M28T30EE
37.5	2 at +2.5%	4 at -2.5%	DT-3	150	912D	280B	381 (173)	WS38	V48M28T37EE
45	2 at +2.5%	4 at -2.5%	DT-3	150	912D	280B	351 (159)	WS38	V48M28T45EE
50	2 at +2.5%	4 at -2.5%	DT-3	150	914F	280B	531 (241)	WS39	V48M28T50EE
75	2 at +2.5%	4 at -2.5%	DT-3	150	914F	280B	553 (251)	WS39	V48M28T75EE
112.5	2 at +2.5%	4 at -2.5%	DT-3	150	916A	280B	793 (360)	WS19	V48M28T12EE
150	2 at +2.5%	4 at -2.5%	DT-3	150	916A	280B	913 (415)	WS19	V48M28T49EE
225	2 at +2.5%	4 at -2.5%	DT-3	150	928	657B	1160 (527)	WS41	V48M28T22EE
300	2 at +2.5%	4 at -2.5%	DT-3	150	929	657B	1415 (642)	WS42	V48M28T33EE
500	2 at +2.5%	2 at -2.5%	DT-3	150	924	428B	2415 (1097)	WS40	V48D28T55EE
750	2 at +2.5%	4 at -2.5%	DT-3	150	920E	275A	3340 (1516)	WS35	V48M28T77EE
15	2 at +2.5%	4 at -2.5%	DT-3	115	912D	280B	202 (92)	WS38	V48M28F15EE
30	2 at +2.5%	4 at -2.5%	DT-3	115	912D	280B	311 (141)	WS38	V48M28F30EE
45	2 at +2.5%	4 at -2.5%	DT-3	115	912D	280B	418 (190)	WS38	V48M28F45EE
75	2 at +2.5%	4 at -2.5%	DT-3	115	914F	280B	581 (264)	WS39	V48M28F75EE
112.5	2 at +2.5%	4 at -2.5%	DT-3	115	916A	280B	829 (376)	WS19	V48M28F12EE
150	2 at +2.5%	4 at -2.5%	DT-3	115	916A	280B	996 (452)	WS19	V48M28F49EE
225	2 at +2.5%	4 at -2.5%	DT-3	115	918A	280B	1569 (712)	WS34	V48M28F22EE
300	2 at +2.5%	4 at -2.5%	DT-3	115	923	280B	1908 (866)	WS37	V48M28F33EE
500	2 at +2.5%	4 at -2.5%	DT-3	115	920E	275A	3117 (1415)	WS35	V48M28F55EE
15	2 at +2.5%	4 at -2.5%	DT-3	80	912D	280B	276 (125)	WS38	V48M28B15EE
30	2 at +2.5%	4 at -2.5%	DT-3	80	912D	280B	350 (159)	WS38	V48M28B30EE
45	2 at +2.5%	4 at -2.5%	DT-3	80	914F	280B	560 (254)	WS39	V48M28B45EE
75	2 at +2.5%	4 at -2.5%	DT-3	80	916A	280B	810 (368)	WS19	V48M28B75EE
112.5	2 at +2.5%	4 at -2.5%	DT-3	80	916A	280B	944 (429)	WS19	V48M28B12EE
150	2 at +2.5%	4 at -2.5%	DT-3	80	917	280B	1438 (653)	WS34	V48M28B49EE
225	2 at +2.5%	4 at -2.5%	DT-3	80	923	280B	1746 (793)	WS37	V48M28B22EE
300	2 at +2.5%	4 at -2.5%	DT-3	80	919E	275A	2400 (1090)	WS35	V48M28B33EE
500	2 at +2.5%	4 at -2.5%	DT-3	80	920E	275A	3418 (1552)	WS35	V48M28B55EE

Notes

① Weights subject to change.

Additional voltage combinations are available. Contact your local Eaton sales office for assistance if the voltage you require is not included in this catalog. For other ratings or catalog numbers not shown, or for special enclosure types (including stainless steel), refer to Eaton. Frame drawings/dimensions information begins on **Page V2-T2-216**.

Accessories

Please refer to Section 2.7 **Page V2-T2-191**.

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Technical Data and Specifications

Frequency

Eaton standard dry-type distribution transformers are designed for 60 Hz operation. Transformers required for other frequencies are available and must be specifically designed.

Overload Capability

Short-term overload is designed into transformers as required by ANSI. Dry-type distribution transformers will deliver 200% nameplate load for one-half hour, 150% load for one hour and 125% load for four hours without being damaged, provided that a constant 50% load precedes and follows the overload. See ANSI C57.96-01.250 for additional limitations.

Continuous overload capacity is not deliberately designed into a transformer because the design objective is to be within the allowed winding temperature rise with nameplate loading.

Insulation System and Temperature Rise

Industry standards classify insulation systems and rise as shown below:

Insulation System Classification

Ambient	+ Winding Rise	+ Hot Spot	= Temp. Class
40°C	55°C	10°C	105°C
40°C	80°C	30°C	150°C
25°C	135°C	20°C	180°C
40°C	115°C	30°C	185°C
40°C	150°C	30°C	220°C

The design life of transformers having different insulation systems is the same—the lower-temperature systems are designed for the same life as the higher-temperature systems.

Enclosures

Eaton's ventilated transformers, Types DS-3 and DT-3, use a NEMA 2 rated (drip-proof) enclosure as standard, and are rated NEMA 3R with the addition of weathershields.

Winding Terminations

Primary and secondary windings are terminated in the wiring compartment. Encapsulated units have copper leads or stabs brought out for connections. Ventilated transformers have leads brought out to terminals that are pre-drilled to accept Cu/Al lugs. Aluminum-wound transformers have aluminum terminals; copper-wound models have copper terminals. **Lugs are not supplied with these transformers.** Eaton recommends external cables be rated 90°C (sized at 75°C ampacity) for encapsulated designs and 75°C for ventilated designs.

Series-Multiple Windings

Series-multiple windings consist of two similar coils in each winding that can be connected in series or parallel (multiple). Transformers with series-multiple windings are designated with an "x" or "/" between the voltage ratings, such as voltages of "120/240" or "240 x 480." If the series-multiple winding is designated by an "x," the winding can be connected only for a series or parallel. With the "/" designation, a mid-point also becomes available in addition to the series or parallel connection. As an example, a 120 x 240 winding can be connected for either 120 (parallel) or 240 (series), but a 120/240 winding can be connected for 120 (parallel), or 240 (series), or 240 with a 120 mid-point.

For additional information, please refer to Section 2.7 **Page V2-T2-191**.

Sound Levels

All Eaton 600 volt class general-purpose dry-type distribution transformers are designed to meet NEMA ST-20 sound levels listed here. These are the sound levels measured in a soundproof environment. Actual sound levels measured at an installation

will likely be higher (as much as 15 dB greater) due to electrical connections and environmental conditions. Lower sound levels are available and should be specified when the transformer is going to be installed in an area where sound may be a concern.

Average Sound Levels

NEMA ST-20 Average Sound Level, dB

Equivalent Winding kVA Range	Self-Cooled Ventilated (up to 1.2 kV) K-Factor 1, 4, 9	K-Factor 13, 20	Encapsulated (up to 1.2 kV)
3.00 and below	40	40	45
3.01 to 9.00	40	40	45
9.01 to 15.00	45	45	50
15.01 to 30.00	45	45	50
30.01 to 50.00	45	48	50
50.01 to 75.00	50	53	55
75.01 to 112.50	50	53	55
112.51 to 150.00	50	53	55
150.01 to 225.00	55	58	57
225.01 to 300.00	55	58	57
300.01 to 500.00	60	63	59
500.01 to 700.00	62	65	61
700.01 to 1000.00	64	67	63
Greater than 1000	Consult factory	Consult factory	Consult factory

Note

For other ratings or catalog numbers not shown, or for special enclosure types (including stainless steel), refer to Eaton.

Standards and Certifications

Eaton dry-type distribution transformers are approved, listed, recognized or may comply with the following standards.

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Engineering Standards

Catalog Product Name	UL Standard ①	UL/cUL File Number	UL Listed Control Number	cUL Energy Efficiency File Number	CSA File Number	Insulation System Temp/°C	kVA Single-Phase	kVA Three-Phase	Applicable IEC Standard
Industrial Control Transformer									
MTE	5085	E46323	702X	—	LR27533	105	0.025–1.5	N/A	61558
MTK	5085	E46323	702X	—	LR27533	180	0.05–5	N/A	61558
Encapsulated Transformer									
AP	5085	E10156	591H	—	—	180	3–10	N/A	61558
AP	1561	E78389	591H	—	—	180	15	N/A	61558
EP	5085	E10156	591H	—	LR60545	180	0.05–10	N/A	61558
EP	1561	E78389	591H	EV157 ②	LR60545 ③	180	15–50	N/A	61558 ④ / 726 ⑤
EPT	5085	E10156	591H	—	LR60545	180	N/A	3–9	61558 ⑥ / 726 ⑦
EPT	1561	E78389	591H	EV157 ⑧	LR60545 ⑨	180	N/A	15–75	726
MPC	1062	E53449	591H	—	LR60546	180	3–25	15–30	—
Ventilated Transformer									
DS-3	1561	E78389	591H	—	—	220	15–167	N/A	60726
DT-3	1561	E78389	591H	—	—	220	N/A	15–750	60726
KT	1561	E78389	591H	—	—	220	N/A	9–500	N/A

Notes

- ① UL 5085 replaces UL 506.
- ② Applies to 25–50 kVA.
- ③ Applies to 25 kVA.
- ④ Applies to 15–25 kVA.
- ⑤ Applies to 37.5 kVA.
- ⑥ Applies to 3 kVA.
- ⑦ Applies to 5–9 kVA.
- ⑧ Applies to 30–75 kVA.
- ⑨ Applies to 30 kVA.

In addition to the above standards, Eaton dry-type distribution transformers are also manufactured in compliance with the applicable standards listed below.

Not all of the following standards apply to every transformer.

NEC: National Electrical Code

NEMA ST-1: Specialty Transformers (C89.1) (control transformers).

NEMA ST-20: General-Purpose Transformers.

NEMA TP-1: Guide for Determining Energy Efficiency for Distribution Transformers.

NEMA 250: Enclosures for Electrical Equipment (1000 volts maximum).

IEEE C57.12.01: General Requirements for Dry-Type Distribution and Power Transformers (including those with solid-cast and/or resin-encapsulated windings).

ANSI C57.12.70: Terminal Markings and Connections for Distribution and Power Transformers.

ANSI C57.12.91: Standard Test Code for Dry-Type Distribution and Power Transformers.

CSA C22 No. 47-M90: Air-Cooled Transformers (Dry-Type).

CSA C9-M1981: Dry-Type Transformers.

CSA C22.2 No. 66: Specialty Transformers.

CSA 802-94: Maximum Losses for Distribution, Power and Dry-Type Transformers.

NEMA TP-2: Standard Test Method for Measuring the Energy Consumption of Distribution Transformers.

NEMA TP-3



Catalog Number Selection

General-Purpose, Energy-Efficient, Mini-Power Center, Shielded Isolation, Nonlinear, Buck-Boost, Marine Duty Transformers—
Example: S20N11S05A

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Prefix Options		Primary Voltage		kVA		Suffix Options	
C = CSA labeled ventilated transformer		13 = 110 x 220 12 = 120 10 = 120 x 240 29 = 208 72 = 200 25 = 220 23 = 230 24 = 240 20 = 240 x 480 27 = 277 38 = 380 39 = 400 43 = 416 44 = 440 45 = 450 48 = 480 57 = 575 60 = 600 42 = 2400 46 = 4160 49 = 4800 40 = Export model 54 = 120/208/240/277		81 = 0.05 85 = 0.075 82 = 0.10 83 = 0.15 26 = 0.25 51 = 0.50 76 = 0.75 01 = 1 16 = 1.5 02 = 2 03 = 3 05 = 5 06 = 6 07 = 7.5 09 = 9 10 = 10 15 = 15 21 = 22.5 25 = 25 30 = 30 37 = 37.5 45 = 45 50 = 50 75 = 75 99 = 100 12 = 112.5 49 = 150 67 = 167 22 = 225 52 = 250 33 = 300 54 = 333 55 = 500 60 = 600 77 = 750 11 = 1000 14 = 1500		A...Y = ① CU = ② SS = ③ ZZ = ④ NV = ⑤ X = ⑥ LS = ⑦ AF = ⑧ TR = ⑨ SR = ⑩ CE = ⑪ T = ⑫ EE = ⑬ NON = ⑭ POS = ⑮ NEG = ⑯ THR = ⑰ E3 = ⑱ SS4X = ⑲ Z = ⑳ S6 = ㉑ I2 = ㉒ I3 = ㉓ I4 = ㉔ N3 = ㉕	
Type		Temperature Rise		Secondary Voltage			
S = EP (single-phase encapsulated) Y = EPT (three-phase encapsulated) T = DS-3 (single-phase ventilated) V = DT-3 (three-phase ventilated) P = Mini-power center Z = Class 1 Division 2 Groups A, B, C, D X = Harmonic mitigating (three-phase ventilated) Nonlinear H = KT-4 (three-phase ventilated) B = KT-9 (three-phase ventilated) N = KT-13 (three-phase ventilated) G = KT-20 (three-phase ventilated) J = KT-30 (three-phase ventilated) A = KT-40 (three-phase ventilated) K = KT-50 (three-phase ventilated) HT = KT-4 (single-phase ventilated) NT = KT-13 (single-phase ventilated) GT = KT-20 (single-phase ventilated)		T = 150°C rise with 220°C insulation system (ventilated) F = 115°C rise with 220°C insulation system (ventilated) B = 80°C rise with 220°C insulation system (ventilated) H = 130°C rise with 200°C insulation system (ventilated) G = 115°C rise with 200°C insulation system (ventilated) J = 80°C rise with 220°C insulation system (ventilated) P = 115°C rise with 130°C insulation system (encapsulated) S = 115°C rise with 180°C insulation system (encapsulated and MPC) L = 80°C rise with 180°C insulation system (encapsulated and MPC)		04 = 12/24 06 = 16/32 08 = 24/48 14 = 110/220 12 = 120 10 = 120 x 240 11 = 120/240 54 = 127/254 19 = 190Y/110 28 = 208Y/120 29 = 208 25 = 220 delta 31 = 220Y/127 26 = 220 delta/110 midtap 22 = 240 delta/120 midtap 64 = 240Y/139 24 = 240 delta 20 = 240 x 480 21 = 240/480 27 = 277 38 = 380 delta 37 = 380Y/220 34 = 400Y/231 51 = 416Y/240 35 = 440Y/254 62 = 460Y/266 47 = 480Y/277 48 = 480 delta 60 = 600 delta 61 = 600Y/346 42 = 2400 41 = 4160Y/2400 46 = 4160 49 = 4800			
Taps							
D = 2 at +2.5%, 2 at -2.5% E = 1 at +5%, 1 at -5% F = 1 at -10% G = 2 at -5% J = 4 at -2.5% K = 1 at -10% x 2 at -5% L = 2 at -5% x 4 at -2.5% M = 2 at +2.5%, 4 at -2.5% N = None R = 1 at +5%, 2 at -5% P = 1 at +5%, 2 at -5% x 2 at +2.5%, 4 at -2.5% T = 1 at +4.2%, 1 at -4.2% U = 1 at +2.5%, 3 at -2.5% W = 1 at +3.5%, 1 at -3.5% X = 2 at +3.1%, 2 at -3.1%							

Notes

- ① Model number is not used on newly designed/redesigned transformers.
- ② Copper windings.
- ③ Grade 304 stainless steel enclosure (does not imply a NEMA 4X rating).
- ④ Open type core and coil assembly.
- ⑤ Totally enclosed non-ventilated DS-3 or DT-3.
- ⑥ 50/60 Hz.
- ⑦ Low sound design. LS47 indicates low sound equal to 47 dB; LS42 indicates 42 dB.

- ⑧ Fungus proof.
- ⑨ Certified test report of standard production tests for the specific serial number to be shipped.
- ⑩ Certified sound level report.
- ⑪ CE Marked.
- ⑫ Thermal indicator embedded in center coil. Suffix "TT" indicates two thermal indicators of different temperature ratings, are installed.
- ⑬ NEMA TP-1 efficient.

- ⑭ 0° phase-shift (used with HMTs).
- ⑮ +15° phase-shift (used with HMTs).
- ⑯ -15° phase-shift (used with HMTs).
- ⑰ -30° phase-shift (used with HMTs).
- ⑱ CSL3 DOE 2007 energy-efficient.
- ⑲ NEMA 4X Grade 304 stainless steel enclosure.
- ㉑ Easy install base.
- ㉒ Grade 316 stainless steel enclosure (does not imply NEMA 4X rating).
- ㉓ Integral 2-inch infrared viewing window.
- ㉔ Integral 3-inch infrared viewing window.
- ㉕ Integral 4-inch infrared viewing window.
- ㉖ NEMA Premium® Efficient.

For Eaton's industrial control transformers catalog number selection, see **Page V2-T2-188**.

Contact your local Eaton sales office for voltage combinations not shown. Use table for catalog number breakdown only. Do not use to create catalog numbers because all combinations may not be valid.

Three-Phase Transformers

How to Select Three-Phase Units

1. Determine the primary (source) voltage—the voltage presently available.
2. Determine the secondary (load) voltage—the voltage needed at the load.
3. Determine the kVA load:
 - If the load is defined in kVA, a transformer can be selected from the tabulated data
 - If the load rating is given in amperes, determine the load kVA from the chart (below right). To determine kVA when volts and amperes are known, use the formula:

$$\text{kVA} = \frac{\text{Volts} \times \text{Amperes} \times 1.732}{1000}$$

- If the load is an AC motor, determine the minimum transformer kVA from the chart at the right
 - Select a transformer rating equal to or greater than the load kVA
4. Define tap arrangements needed.
 5. Define temperature rise.

Using the above procedure, select the transformer from the listings in this catalog.

Three-Phase AC Motors

Horsepower	Full Load Amperes					Minimum Transformer kVA ^①
	208 Volts	230 Volts	380 Volts	460 Volts	575 Volts	
0.5	2.2	2.0	1.2	1.0	0.8	0.9
3/4	3.1	2.8	1.7	1.4	1.1	1.2
1	4.0	3.6	2.2	1.8	1.4	1.5
1.5	5.7	5.2	3.1	2.6	2.1	2.1
2	7.5	6.8	4.1	3.4	2.7	2.7
3	10.7	9.6	5.8	4.8	3.9	3.8
5	16.7	15.2	9.2	7.6	6.1	6.3
7.5	24	22	14	11	9	9.2
10	31	28	17	14	11	11.2
15	46	42	26	21	17	16.6
20	59	54	33	27	22	21.6
25	75	68	41	34	27	26.6
30	88	80	48	40	32	32.4
40	114	104	63	52	41	43.2
50	143	130	79	65	52	52
60	170	154	93	77	62	64
75	211	192	116	96	77	80
100	273	248	150	124	99	103
125	342	312	189	156	125	130
150	396	360	218	180	144	150
200	528	480	291	240	192	200

Full Load Current in Amperes—Three-Phase Circuits

kVA	Voltage						
	208	240	380	480	600	2400	4160
3	8.3	7.2	4.6	3.6	2.9	0.72	0.42
6	16.6	14.4	9.1	7.2	5.8	1.4	0.83
9	25	21.6	13.7	10.8	8.6	2.2	1.2
15	41.7	36.1	22.8	18.0	14.4	3.6	2.1
22.5	62.4	54.1	34.2	27.1	21.6	5.4	3.1
30	83.4	72.3	45.6	36.1	28.9	7.2	4.2
37.5	104	90.3	57.0	45.2	36.1	9.0	5.2
45	124	108	68.4	54.2	43.4	10.8	6.3
50	139	120	76	60.1	48.1	12.0	6.9
75	208	180	114	90	72	18.0	10.4
112.5	312	270	171	135	108	27.1	15.6
150	416	360	228	180	144	36.1	20.8
225	624	541	342	270	216	54.2	31.3
300	832	721	456	360	288	72.2	41.6
500	1387	1202	760	601	481	120	69.4
750	2084	1806	1140	903	723	180	104
1000	2779	2408	1519	1204	963	241	139

Notes

^① If motors are started more than once per hour, increase minimum transformer kVA by 20%.

When motor service factor is greater than 1, increase full load amperes proportionally.
Example: If service factor is 1.15, increase above ampere values by 15%.

Type DT-3

2



Product Description

Note: The following pages provide listings for most standard transformer ratings and catalog numbers. For other ratings or catalog numbers not shown, or for special enclosure types (including stainless steel), refer to Eaton.

Types DS-3, DT-3

- Ventilated, NEMA 2 enclosure standard
- Suitable for indoor applications, outdoors when weathershields are also installed
- Upright mounting only
- 220°C insulation system
- 150°C rise standard; 115°C or 80°C rise optional
- Available in single-phase ratings 15–167 kVA, 600 volts primary (DS-3)
- Available in three-phase ratings 15–1500 kVA and up to 600 volts primary (DT-3)

Application Description

NEMA TP-1-2002 compliant energy-efficient transformers are specifically designed to meet the energy efficiency standards set forth in NEMA Standards publication, TP-1-2002, “Guide for Determining Energy Efficiency for Distribution Transformers.” Surveys have shown that the average loading of low voltage dry-type distribution transformers, over a 24-hour period, is approximately 35%. NEMA TP-1 compliant transformers are optimized to offer maximum efficiency at 35% of nameplate rating.

The range of products covered by NEMA TP-1-2002 are:

NEMA TP-1-2002 Product Range

Rating	Voltage Class	Voltage
	Primary voltage	34.5 kV and below
	Secondary voltage	600V and below
Dry-Type Rating	Single-phase	10–833 kVA
	Three-phase	15–2500 kVA
Liquid Rating	Single-phase	10–833 kVA
	Three-phase	15–2500 kVA

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Transformers that are currently specifically excluded from the scope of NEMA Standard TP-1-2002 include:

- Liquid-filled transformers below 10 kVA
- Dry-type transformers below 15 kVA
- AC and DC drives transformers
- Rectifier transformers designed for high harmonics
- Autotransformers
- Non-distribution transformers, such as UPS transformers
- Special impedance or regulation transformers
- Regulating transformers
- Sealed and non-ventilated transformers
- Machine tool transformers
- Welding transformers
- Transformers with tap ranges greater than 15%
- Transformers with a frequency other than 60 Hz
- Grounding transformers
- Testing transformers

Efficiency levels set forth in NEMA TP-1-2002.

NEMA TP-1-2002 Efficiency Levels

**Tables of Energy Efficiency
NEMA Class 1 Efficiency Levels
Dry-Type Distribution Transformers—
Low Voltage (600V and below)**

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

Features, Benefits and Functions

- 60 Hz operation (except as noted)
- Short-term overload capability as required by ANSI
- Meet NEMA ST-20 sound levels
- Meet federal energy efficiency requirements for low voltage dry-type distribution transformers effective as of January 1, 2007

Standards and Certifications

- UL® listed

**Industry Standards**

All Eaton dry-type distribution and control transformers are built and tested in accordance with applicable NEMA, ANSI and IEEE Standards. All 600 volt class transformers are UL listed unless otherwise noted.

Seismically Qualified

Eaton manufactured dry-type distribution transformers are seismically qualified and exceed requirements of the Uniform Building Code (UBC), International Building Code (IBC) and California Code Title 24.

NEMA TP-1 Energy-Efficient Transformers

Three-Phase—Type DT-3 60 Hz NEMA TP-1 Energy-Efficient—Aluminum Windings

480 Delta Volts to 208Y/120 Volts

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kVA	Full Capacity Taps		Type	°C Temp. Rise	Frame	Wiring Diagram Number	Weight Lbs (kg) ①	Weathershield	Catalog Number
15	2 at +2.5%	4 at -2.5%	DT-3	150	912D	280B	204 (93)	WS38	V48M28T15EE
30	2 at +2.5%	4 at -2.5%	DT-3	150	912D	280B	291 (132)	WS38	V48M28T30EE
37.5	2 at +2.5%	4 at -2.5%	DT-3	150	912D	280B	381 (173)	WS38	V48M28T37EE
45	2 at +2.5%	4 at -2.5%	DT-3	150	912D	280B	351 (159)	WS38	V48M28T45EE
50	2 at +2.5%	4 at -2.5%	DT-3	150	914F	280B	531 (241)	WS39	V48M28T50EE
75	2 at +2.5%	4 at -2.5%	DT-3	150	914F	280B	553 (251)	WS39	V48M28T75EE
112.5	2 at +2.5%	4 at -2.5%	DT-3	150	916A	280B	793 (360)	WS19	V48M28T12EE
150	2 at +2.5%	4 at -2.5%	DT-3	150	916A	280B	913 (415)	WS19	V48M28T49EE
225	2 at +2.5%	4 at -2.5%	DT-3	150	928	657B	1160 (527)	WS41	V48M28T22EE
300	2 at +2.5%	4 at -2.5%	DT-3	150	929	657B	1415 (642)	WS42	V48M28T33EE
500	2 at +2.5%	2 at -2.5%	DT-3	150	924	428B	2415 (1097)	WS40	V48D28T55EE
750	2 at +2.5%	4 at -2.5%	DT-3	150	920E	275A	3340 (1516)	WS35	V48M28T77EE
15	2 at +2.5%	4 at -2.5%	DT-3	115	912D	280B	202 (92)	WS38	V48M28F15EE
30	2 at +2.5%	4 at -2.5%	DT-3	115	912D	280B	311 (141)	WS38	V48M28F30EE
45	2 at +2.5%	4 at -2.5%	DT-3	115	912D	280B	418 (190)	WS38	V48M28F45EE
75	2 at +2.5%	4 at -2.5%	DT-3	115	914F	280B	581 (264)	WS39	V48M28F75EE
112.5	2 at +2.5%	4 at -2.5%	DT-3	115	916A	280B	829 (376)	WS19	V48M28F12EE
150	2 at +2.5%	4 at -2.5%	DT-3	115	916A	280B	996 (452)	WS19	V48M28F49EE
225	2 at +2.5%	4 at -2.5%	DT-3	115	918A	280B	1569 (712)	WS34	V48M28F22EE
300	2 at +2.5%	4 at -2.5%	DT-3	115	923	280B	1908 (866)	WS37	V48M28F33EE
500	2 at +2.5%	4 at -2.5%	DT-3	115	920E	275A	3117 (1415)	WS35	V48M28F55EE
15	2 at +2.5%	4 at -2.5%	DT-3	80	912D	280B	276 (125)	WS38	V48M28B15EE
30	2 at +2.5%	4 at -2.5%	DT-3	80	912D	280B	350 (159)	WS38	V48M28B30EE
45	2 at +2.5%	4 at -2.5%	DT-3	80	914F	280B	560 (254)	WS39	V48M28B45EE
75	2 at +2.5%	4 at -2.5%	DT-3	80	916A	280B	810 (368)	WS19	V48M28B75EE
112.5	2 at +2.5%	4 at -2.5%	DT-3	80	916A	280B	944 (429)	WS19	V48M28B12EE
150	2 at +2.5%	4 at -2.5%	DT-3	80	917	280B	1438 (653)	WS34	V48M28B49EE
225	2 at +2.5%	4 at -2.5%	DT-3	80	923	280B	1746 (793)	WS37	V48M28B22EE
300	2 at +2.5%	4 at -2.5%	DT-3	80	919E	275A	2400 (1090)	WS35	V48M28B33EE
500	2 at +2.5%	4 at -2.5%	DT-3	80	920E	275A	3418 (1552)	WS35	V48M28B55EE

Notes

① Weights subject to change.

Additional voltage combinations are available. Contact your local Eaton sales office for assistance if the voltage you require is not included in this catalog. For other ratings or catalog numbers not shown, or for special enclosure types (including stainless steel), refer to Eaton. Frame drawings/dimensions information begins on **Page V2-T2-216**.

Accessories

Please refer to Section 2.7 **Page V2-T2-191**.

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Technical Data and Specifications

Frequency

Eaton standard dry-type distribution transformers are designed for 60 Hz operation. Transformers required for other frequencies are available and must be specifically designed.

Overload Capability

Short-term overload is designed into transformers as required by ANSI. Dry-type distribution transformers will deliver 200% nameplate load for one-half hour, 150% load for one hour and 125% load for four hours without being damaged, provided that a constant 50% load precedes and follows the overload. See ANSI C57.96-01.250 for additional limitations.

Continuous overload capacity is not deliberately designed into a transformer because the design objective is to be within the allowed winding temperature rise with nameplate loading.

Insulation System and Temperature Rise

Industry standards classify insulation systems and rise as shown below:

Insulation System Classification

Ambient	+ Winding Rise	+ Hot Spot	= Temp. Class
40°C	55°C	10°C	105°C
40°C	80°C	30°C	150°C
25°C	135°C	20°C	180°C
40°C	115°C	30°C	185°C
40°C	150°C	30°C	220°C

The design life of transformers having different insulation systems is the same—the lower-temperature systems are designed for the same life as the higher-temperature systems.

Enclosures

Eaton's ventilated transformers, Types DS-3 and DT-3, use a NEMA 2 rated (drip-proof) enclosure as standard, and are rated NEMA 3R with the addition of weathershields.

Winding Terminations

Primary and secondary windings are terminated in the wiring compartment. Encapsulated units have copper leads or stabs brought out for connections. Ventilated transformers have leads brought out to terminals that are pre-drilled to accept Cu/Al lugs. Aluminum-wound transformers have aluminum terminals; copper-wound models have copper terminals. **Lugs are not supplied with these transformers.** Eaton recommends external cables be rated 90°C (sized at 75°C ampacity) for encapsulated designs and 75°C for ventilated designs.

Series-Multiple Windings

Series-multiple windings consist of two similar coils in each winding that can be connected in series or parallel (multiple). Transformers with series-multiple windings are designated with an "x" or "/" between the voltage ratings, such as voltages of "120/240" or "240 x 480." If the series-multiple winding is designated by an "x," the winding can be connected only for a series or parallel. With the "/" designation, a mid-point also becomes available in addition to the series or parallel connection. As an example, a 120 x 240 winding can be connected for either 120 (parallel) or 240 (series), but a 120/240 winding can be connected for 120 (parallel), or 240 (series), or 240 with a 120 mid-point.

For additional information, please refer to Section 2.7 **Page V2-T2-191**.

Sound Levels

All Eaton 600 volt class general-purpose dry-type distribution transformers are designed to meet NEMA ST-20 sound levels listed here. These are the sound levels measured in a soundproof environment. Actual sound levels measured at an installation

will likely be higher (as much as 15 dB greater) due to electrical connections and environmental conditions. Lower sound levels are available and should be specified when the transformer is going to be installed in an area where sound may be a concern.

Average Sound Levels

NEMA ST-20 Average Sound Level, dB

Equivalent Winding kVA Range	Self-Cooled Ventilated (up to 1.2 kV) K-Factor 1, 4, 9	K-Factor 13, 20	Encapsulated (up to 1.2 kV)
3.00 and below	40	40	45
3.01 to 9.00	40	40	45
9.01 to 15.00	45	45	50
15.01 to 30.00	45	45	50
30.01 to 50.00	45	48	50
50.01 to 75.00	50	53	55
75.01 to 112.50	50	53	55
112.51 to 150.00	50	53	55
150.01 to 225.00	55	58	57
225.01 to 300.00	55	58	57
300.01 to 500.00	60	63	59
500.01 to 700.00	62	65	61
700.01 to 1000.00	64	67	63
Greater than 1000	Consult factory	Consult factory	Consult factory

Note

For other ratings or catalog numbers not shown, or for special enclosure types (including stainless steel), refer to Eaton.

Standards and Certifications

Eaton dry-type distribution transformers are approved, listed, recognized or may comply with the following standards.

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Engineering Standards

Catalog Product Name	UL Standard ①	UL/cUL File Number	UL Listed Control Number	cUL Energy Efficiency File Number	CSA File Number	Insulation System Temp/°C	kVA Single-Phase	kVA Three-Phase	Applicable IEC Standard
Industrial Control Transformer									
MTE	5085	E46323	702X	—	LR27533	105	0.025–1.5	N/A	61558
MTK	5085	E46323	702X	—	LR27533	180	0.05–5	N/A	61558
Encapsulated Transformer									
AP	5085	E10156	591H	—	—	180	3–10	N/A	61558
AP	1561	E78389	591H	—	—	180	15	N/A	61558
EP	5085	E10156	591H	—	LR60545	180	0.05–10	N/A	61558
EP	1561	E78389	591H	EV157 ②	LR60545 ③	180	15–50	N/A	61558 ④ / 726 ⑤
EPT	5085	E10156	591H	—	LR60545	180	N/A	3–9	61558 ⑥ / 726 ⑦
EPT	1561	E78389	591H	EV157 ⑧	LR60545 ⑨	180	N/A	15–75	726
MPC	1062	E53449	591H	—	LR60546	180	3–25	15–30	—
Ventilated Transformer									
DS-3	1561	E78389	591H	—	—	220	15–167	N/A	60726
DT-3	1561	E78389	591H	—	—	220	N/A	15–750	60726
KT	1561	E78389	591H	—	—	220	N/A	9–500	N/A

Notes

- ① UL 5085 replaces UL 506.
- ② Applies to 25–50 kVA.
- ③ Applies to 25 kVA.
- ④ Applies to 15–25 kVA.
- ⑤ Applies to 37.5 kVA.
- ⑥ Applies to 3 kVA.
- ⑦ Applies to 5–9 kVA.
- ⑧ Applies to 30–75 kVA.
- ⑨ Applies to 30 kVA.

In addition to the above standards, Eaton dry-type distribution transformers are also manufactured in compliance with the applicable standards listed below.

Not all of the following standards apply to every transformer.

NEC: National Electrical Code

NEMA ST-1: Specialty Transformers (C89.1) (control transformers).

NEMA ST-20: General-Purpose Transformers.

NEMA TP-1: Guide for Determining Energy Efficiency for Distribution Transformers.

NEMA 250: Enclosures for Electrical Equipment (1000 volts maximum).

IEEE C57.12.01: General Requirements for Dry-Type Distribution and Power Transformers (including those with solid-cast and/or resin-encapsulated windings).

ANSI C57.12.70: Terminal Markings and Connections for Distribution and Power Transformers.

ANSI C57.12.91: Standard Test Code for Dry-Type Distribution and Power Transformers.

CSA C22 No. 47-M90: Air-Cooled Transformers (Dry-Type).

CSA C9-M1981: Dry-Type Transformers.

CSA C22.2 No. 66: Specialty Transformers.

CSA 802-94: Maximum Losses for Distribution, Power and Dry-Type Transformers.

NEMA TP-2: Standard Test Method for Measuring the Energy Consumption of Distribution Transformers.

NEMA TP-3



Catalog Number Selection

General-Purpose, Energy-Efficient, Mini-Power Center, Shielded Isolation, Nonlinear, Buck-Boost, Marine Duty Transformers—
Example: S20N11S05A

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Prefix Options		Primary Voltage		kVA		Suffix Options	
C = CSA labeled ventilated transformer		13 = 110 x 220 12 = 120 10 = 120 x 240 29 = 208 72 = 200 25 = 220 23 = 230 24 = 240 20 = 240 x 480 27 = 277 38 = 380 39 = 400 43 = 416 44 = 440 45 = 450 48 = 480 57 = 575 60 = 600 42 = 2400 46 = 4160 49 = 4800 40 = Export model 54 = 120/208/240/277		81 = 0.05 85 = 0.075 82 = 0.10 83 = 0.15 26 = 0.25 51 = 0.50 76 = 0.75 01 = 1 16 = 1.5 02 = 2 03 = 3 05 = 5 06 = 6 07 = 7.5 09 = 9 10 = 10 15 = 15 21 = 22.5 25 = 25 30 = 30 37 = 37.5 45 = 45 50 = 50 75 = 75 99 = 100 12 = 112.5 49 = 150 67 = 167 22 = 225 52 = 250 33 = 300 54 = 333 55 = 500 60 = 600 77 = 750 11 = 1000 14 = 1500		A...Y = ① CU = ② SS = ③ ZZ = ④ NV = ⑤ X = ⑥ LS = ⑦ AF = ⑧ TR = ⑨ SR = ⑩ CE = ⑪ T = ⑫ EE = ⑬ NON = ⑭ POS = ⑮ NEG = ⑯ THR = ⑰ E3 = ⑱ SS4X = ⑲ Z = ⑳ S6 = ㉑ I2 = ㉒ I3 = ㉓ I4 = ㉔ N3 = ㉕	
Type		Taps		Temperature Rise		Secondary Voltage	
S = EP (single-phase encapsulated) Y = EPT (three-phase encapsulated) T = DS-3 (single-phase ventilated) V = DT-3 (three-phase ventilated) P = Mini-power center Z = Class 1 Division 2 Groups A, B, C, D X = Harmonic mitigating (three-phase ventilated) Nonlinear H = KT-4 (three-phase ventilated) B = KT-9 (three-phase ventilated) N = KT-13 (three-phase ventilated) G = KT-20 (three-phase ventilated) J = KT-30 (three-phase ventilated) A = KT-40 (three-phase ventilated) K = KT-50 (three-phase ventilated) HT = KT-4 (single-phase ventilated) NT = KT-13 (single-phase ventilated) GT = KT-20 (single-phase ventilated)		D = 2 at +2.5%, 2 at -2.5% E = 1 at +5%, 1 at -5% F = 1 at -10% G = 2 at -5% J = 4 at -2.5% K = 1 at -10% x 2 at -5% L = 2 at -5% x 4 at -2.5% M = 2 at +2.5%, 4 at -2.5% N = None R = 1 at +5%, 2 at -5% P = 1 at +5%, 2 at -5% x 2 at +2.5%, 4 at -2.5% T = 1 at +4.2%, 1 at -4.2% U = 1 at +2.5%, 3 at -2.5% W = 1 at +3.5%, 1 at -3.5% X = 2 at +3.1%, 2 at -3.1%		T = 150°C rise with 220°C insulation system (ventilated) F = 115°C rise with 220°C insulation system (ventilated) B = 80°C rise with 220°C insulation system (ventilated) H = 130°C rise with 200°C insulation system (ventilated) G = 115°C rise with 200°C insulation system (ventilated) J = 80°C rise with 220°C insulation system (ventilated) P = 115°C rise with 130°C insulation system (encapsulated) S = 115°C rise with 180°C insulation system (encapsulated and MPC) L = 80°C rise with 180°C insulation system (encapsulated and MPC)		04 = 12/24 06 = 16/32 08 = 24/48 14 = 110/220 12 = 120 10 = 120 x 240 11 = 120/240 54 = 127/254 19 = 190Y/110 28 = 208Y/120 29 = 208 25 = 220 delta 31 = 220Y/127 26 = 220 delta/110 midtap 22 = 240 delta/120 midtap 64 = 240Y/139 24 = 240 delta 20 = 240 x 480 21 = 240/480 27 = 277 38 = 380 delta 37 = 380Y/220 34 = 400Y/231 51 = 416Y/240 35 = 440Y/254 62 = 460Y/266 47 = 480Y/277 48 = 480 delta 60 = 600 delta 61 = 600Y/346 42 = 2400 41 = 4160Y/2400 46 = 4160 49 = 4800	

Notes

- Model number is not used on newly designed/redesigned transformers.
- Copper windings.
- Grade 304 stainless steel enclosure (does not imply a NEMA 4X rating).
- Open type core and coil assembly.
- Totally enclosed non-ventilated DS-3 or DT-3.
- 50/60 Hz.
- Low sound design. LS47 indicates low sound equal to 47 dB; LS42 indicates 42 dB.

- Fungus proof.
- Certified test report of standard production tests for the specific serial number to be shipped.
- Certified sound level report.
- CE Marked.
- Thermal indicator embedded in center coil. Suffix "TT" indicates two thermal indicators of different temperature ratings, are installed.
- NEMA TP-1 efficient.

- 0° phase-shift (used with HMTs).
- +15° phase-shift (used with HMTs).
- 15° phase-shift (used with HMTs).
- 30° phase-shift (used with HMTs).
- CSL3 DOE 2007 energy-efficient.
- NEMA 4X Grade 304 stainless steel enclosure.
- Easy install base.
- Grade 316 stainless steel enclosure (does not imply NEMA 4X rating).
- Integral 2-inch infrared viewing window.
- Integral 3-inch infrared viewing window.
- Integral 4-inch infrared viewing window.
- NEMA Premium® Efficient.

For Eaton's industrial control transformers catalog number selection, see **Page V2-T2-188**.

Contact your local Eaton sales office for voltage combinations not shown. Use table for catalog number breakdown only. Do not use to create catalog numbers because all combinations may not be valid.

Three-Phase Transformers

How to Select Three-Phase Units

1. Determine the primary (source) voltage—the voltage presently available.
2. Determine the secondary (load) voltage—the voltage needed at the load.
3. Determine the kVA load:
 - If the load is defined in kVA, a transformer can be selected from the tabulated data
 - If the load rating is given in amperes, determine the load kVA from the chart (below right). To determine kVA when volts and amperes are known, use the formula:

$$\text{kVA} = \frac{\text{Volts} \times \text{Amperes} \times 1.732}{1000}$$
 - If the load is an AC motor, determine the minimum transformer kVA from the chart at the right
 - Select a transformer rating equal to or greater than the load kVA
4. Define tap arrangements needed.
5. Define temperature rise.

Using the above procedure, select the transformer from the listings in this catalog.

Three-Phase AC Motors

Horsepower	Full Load Amperes					Minimum Transformer kVA ^①
	208 Volts	230 Volts	380 Volts	460 Volts	575 Volts	
0.5	2.2	2.0	1.2	1.0	0.8	0.9
3/4	3.1	2.8	1.7	1.4	1.1	1.2
1	4.0	3.6	2.2	1.8	1.4	1.5
1.5	5.7	5.2	3.1	2.6	2.1	2.1
2	7.5	6.8	4.1	3.4	2.7	2.7
3	10.7	9.6	5.8	4.8	3.9	3.8
5	16.7	15.2	9.2	7.6	6.1	6.3
7.5	24	22	14	11	9	9.2
10	31	28	17	14	11	11.2
15	46	42	26	21	17	16.6
20	59	54	33	27	22	21.6
25	75	68	41	34	27	26.6
30	88	80	48	40	32	32.4
40	114	104	63	52	41	43.2
50	143	130	79	65	52	52
60	170	154	93	77	62	64
75	211	192	116	96	77	80
100	273	248	150	124	99	103
125	342	312	189	156	125	130
150	396	360	218	180	144	150
200	528	480	291	240	192	200

Full Load Current in Amperes—Three-Phase Circuits

kVA	Voltage						
	208	240	380	480	600	2400	4160
3	8.3	7.2	4.6	3.6	2.9	0.72	0.42
6	16.6	14.4	9.1	7.2	5.8	1.4	0.83
9	25	21.6	13.7	10.8	8.6	2.2	1.2
15	41.7	36.1	22.8	18.0	14.4	3.6	2.1
22.5	62.4	54.1	34.2	27.1	21.6	5.4	3.1
30	83.4	72.3	45.6	36.1	28.9	7.2	4.2
37.5	104	90.3	57.0	45.2	36.1	9.0	5.2
45	124	108	68.4	54.2	43.4	10.8	6.3
50	139	120	76	60.1	48.1	12.0	6.9
75	208	180	114	90	72	18.0	10.4
112.5	312	270	171	135	108	27.1	15.6
150	416	360	228	180	144	36.1	20.8
225	624	541	342	270	216	54.2	31.3
300	832	721	456	360	288	72.2	41.6
500	1387	1202	760	601	481	120	69.4
750	2084	1806	1140	903	723	180	104
1000	2779	2408	1519	1204	963	241	139

Notes

① If motors are started more than once per hour, increase minimum transformer kVA by 20%.

When motor service factor is greater than 1, increase full load amperes proportionally.
Example: If service factor is 1.15, increase above ampere values by 15%.