

# NIDEC MOTOR CORPORATION

8050 WEST FLORISSANT AVE.  
ST. LOUIS, MO 63136



**DATE:** 3/20/2024

**P.O. NO.:** FC89  
**Order/Line NO.:** 23260 MN 100

**TO:**

**Model Number:** FC89  
**Catalog Number:** D1P2D  
Warning  
MOD,NOTES

**REVISIONS:**  
(NONE)

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THANK YOU FOR YOUR ORDER AND THE OPPORTUNITY TO SERVE YOU.**

## Features:

Horsepower ..... 00001.00 ~ KW: .746  
Enclosure ..... ODP  
Poles ..... 04 ~ RPM: 1800  
Frame Size ..... 143~T  
Phase/Frequency/Voltage.. 3~060~230/460  
Winding Type ..... Random Wound  
Service Factor ..... 1.15  
Insulation Class ..... Class "F" ~ Insulife 1000  
Altitude In Feet (Max) .. 3300 Ft.(1000 M)  
Ambient In Degree C (Max) +40 C  
Assembly Position ..... "F-1" Assembly Position  
Efficiency Class ..... Premium Efficiency  
Application ..... Unknown  
Customer Part Number ....  
Secondary Rating:  
1 Horsepower ~ 50 Hertz ~ 190/380 Volts  
"AK" Dimension (Inches).. NA  
Temperature Rise (Sine Wave): "B" Rise @ 1.0 SF (Resist)  
Starting Method ..... Direct-On-Line Start  
Duty Cycle ..... Continuous Duty  
Efficiency Value ..... 85.5 % ~ Typical  
Load Inertia: NEMA ~ Standard Inertia: 5.8 LB-FT2  
Number Of Starts Per Hour: NEMA  
Motor Type Code ..... DE  
Rotor Inertia (LB-FT<sup>2</sup>) ..... .096 LB-FT<sup>2</sup>  
Qty. of Bearings PE (Shaft) ..... 1  
Qty. of Bearings SE (OPP) ..... 1  
Bearing Number PE (Shaft) ..... 6205-2RS  
Bearing Number SE (OPP) ..... 6203-2RS

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**Accessories:**

Special Bearings  
Standard Leadtime: NA  
Est. Weight (lbs ea): 30 ~ F.O.B.:  
~  
~

**USE THE DATA PROVIDED BELOW TO SELECT THE APPROPRIATE DIMENSION PRINT**

<b>Horsepower</b>	1
<b>Pole(s)</b>	04
<b>Voltage(s)</b>	460-230 / 380-190
<b>Frame Size</b>	143T
<b>Shaft U Diameter</b>	0.875

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EFFECTIVE:  
**11-JUN-14**

SUPERSEDES:  
**07-MAY-14**

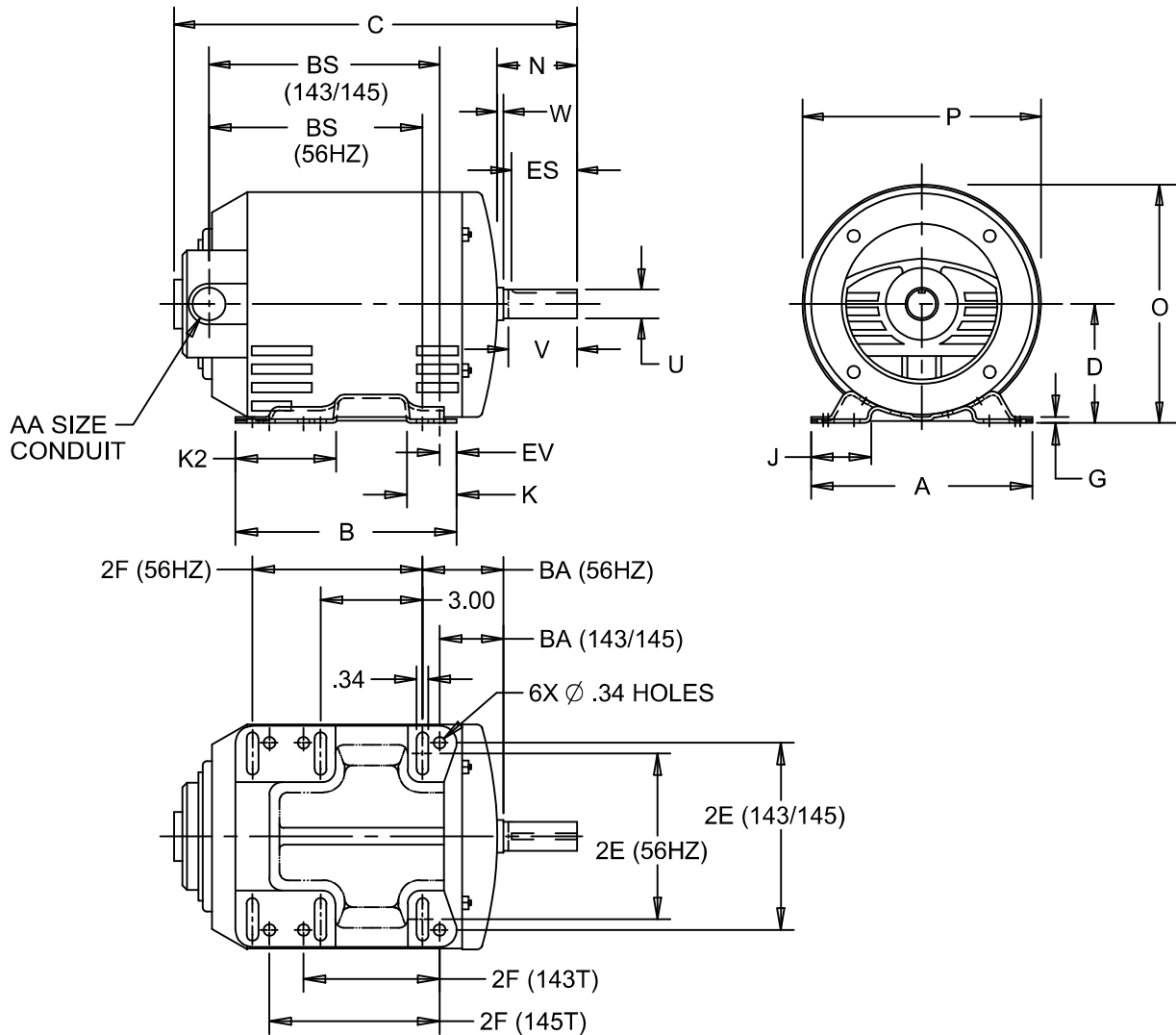
# DIMENSION PRINT

## ODP WITH MULTI-MOUNT BASE

FRAME: 143-5T/56HZ  
BASIC TYPE: DE

PRINT:  
**07-3117**

SHEET:  
**1 OF 1**



ALL DIMENSIONS ARE IN INCHES AND MILLIMETERS

UNITS	A	B	C	D -.06	G	J	K	K2	N
IN	6.50	6.50	12.84	3.50	.13	1.75	1.75	3.25	2.31
MM	165	165	326	89	3	44	44	83	59

UNITS	O	P <sup>2</sup>	U -.0005	V MIN	W	AA	ES MIN	EV	SQ KEY
IN	6.72	6.44	.8750	2.00	.06	3/4 NPT	1.41	.50	.188
MM	171	164	22.225	51	2		36	13	4.78

FRAME	UNITS	2E ±.03	2F ±.03	BA	BS
56HZ (6.50")	IN	4.88	5.00	2.75	6.41
	MM	124	127	70	163
143T (6.50")	IN	5.50	4.00	2.25	6.91
	MM	140	102	57	176
145T (6.50")	IN	5.50	5.00	2.25	6.91
	MM	140	127	57	176

1. ALL ROUGH DIMENSIONS MAY VARY BY .25" DUE TO CASTING AND/OR FABRICATION VARIATIONS.
2. LARGEST MOTOR WIDTH.
3. TOLERANCES SHOWN ARE IN INCHES ONLY.

07-3117/B

**Nidec Motor Corporation**  
St. Louis, Missouri

INFORMATION DISCLOSED ON THIS DOCUMENT  
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CONSENT OF NIDEC MOTOR CORPORATION



ISSUED BY  
**R. KING**

APPROVED BY  
**J. HAGENE**

IHP\_DP\_NMCA (MAR-2011) SOLIDEDGE

# NAMEPLATE DATA

CATALOG NUMBER: <input style="width: 150px;" type="text" value="D1P2D"/>		NAMEPLATE PART #: <input style="width: 150px;" type="text" value="422702-007"/>	
MODEL <input style="width: 60px;" type="text" value="FC89"/> <input style="width: 60px;" type="text" value="FR"/> <input style="width: 60px;" type="text" value="143T"/>	TYPE <input style="width: 60px;" type="text" value="DE"/> ENCL <input style="width: 60px;" type="text" value="ODP"/>		
SHAFT END BRG <input style="width: 150px;" type="text" value="6205-2RS - QTY 1"/>		OPP END BRG <input style="width: 150px;" type="text" value="6203-2RS - QTY 1"/>	
PH <input style="width: 40px;" type="text" value="3"/> MAX AMB <input style="width: 60px;" type="text" value="40 C"/>	ID# <input style="width: 150px;" type="text"/>		
INSUL CLASS <input style="width: 40px;" type="text" value="F"/> Asm. Pos. <input style="width: 150px;" type="text" value="F1"/>	DUTY <input style="width: 150px;" type="text" value="CONT"/>		
HP <input style="width: 40px;" type="text" value="1"/> RPM <input style="width: 60px;" type="text" value="1760"/>	HP <input style="width: 40px;" type="text" value="1"/> RPM <input style="width: 60px;" type="text" value="1445"/>		
VOLTS <input style="width: 40px;" type="text" value="460"/> <input style="width: 40px;" type="text" value="230"/>	VOLTS <input style="width: 40px;" type="text" value="380"/> <input style="width: 40px;" type="text" value="190"/>		
FL AMPS <input style="width: 40px;" type="text" value="1.6"/> <input style="width: 40px;" type="text" value="3.1"/>	FL AMPS <input style="width: 40px;" type="text" value="1.8"/> <input style="width: 40px;" type="text" value="3.5"/>		
SF AMPS <input style="width: 40px;" type="text" value="1.7"/> <input style="width: 40px;" type="text" value="3.4"/>	SF AMPS <input style="width: 40px;" type="text"/> <input style="width: 40px;" type="text"/>		
SF <input style="width: 40px;" type="text" value="1.15"/> DESIGN <input style="width: 40px;" type="text" value="B"/> CODE <input style="width: 40px;" type="text" value="N"/>	SF <input style="width: 40px;" type="text" value="1.00"/> DESIGN <input style="width: 40px;" type="text" value="B"/> CODE <input style="width: 40px;" type="text" value="K"/>		
NEMA NOM EFFICIENCY <input style="width: 40px;" type="text" value="85.5"/> NOM PF <input style="width: 40px;" type="text" value="70.2"/> KiloWatt <input style="width: 40px;" type="text" value=".75"/>	NEMA NOM EFFICIENCY <input style="width: 40px;" type="text" value="84.4"/> NOM PF <input style="width: 40px;" type="text" value="77.0"/>		
GUARANTEED EFFICIENCY <input style="width: 40px;" type="text" value="82.5"/> MAX KVAR <input style="width: 40px;" type="text" value=".7"/> HZ <input style="width: 40px;" type="text" value="60"/>	GUARANTEED EFFICIENCY <input style="width: 40px;" type="text" value="81.5"/> MAX KVAR <input style="width: 40px;" type="text" value=".6"/> HZ <input style="width: 40px;" type="text" value="50"/>		

**HAZARDOUS LOCATION DATA (IF APPLICABLE):**

DIVISION <input style="width: 100px;" type="text"/>	CLASS I <input style="width: 100px;" type="text"/>	GROUP I <input style="width: 100px;" type="text"/>
TEMP CODE <input style="width: 100px;" type="text"/>	CLASS II <input style="width: 100px;" type="text"/>	GROUP II <input style="width: 100px;" type="text"/>



**VFD DATA (IF APPLICABLE):**

VOLTS <input style="width: 150px;" type="text"/>	AMPS <input style="width: 150px;" type="text"/>
TORQUE 1 <input style="width: 150px;" type="text"/>	TORQUE 2 <input style="width: 150px;" type="text"/>
VFD LOAD TYPE 1 <input style="width: 150px;" type="text"/>	VFD LOAD TYPE 2 <input style="width: 150px;" type="text"/>
VFD HERTZ RANGE 1 <input style="width: 150px;" type="text"/>	VFD HERTZ RANGE 2 <input style="width: 150px;" type="text"/>
VFD SPEED RANGE 1 <input style="width: 150px;" type="text"/>	VFD SPEED RANGE 2 <input style="width: 150px;" type="text"/>
SERVICE FACTOR <input style="width: 150px;" type="text"/>	FL SLIP <input style="width: 150px;" type="text"/>
NO. POLES <input style="width: 150px;" type="text" value="4"/>	MAGNETIZING AMPS <input style="width: 150px;" type="text" value="1.1"/>
VECTOR MAX RPM <input style="width: 150px;" type="text"/>	Encoder PPR <input style="width: 150px;" type="text"/>
Radians / Seconds <input style="width: 150px;" type="text"/>	Encoder Volts <input style="width: 150px;" type="text"/>

**TEAO DATA (IF APPLICABLE):**

HP (AIR OVER) <input style="width: 100px;" type="text"/>	HP (AIR OVER M/S) <input style="width: 100px;" type="text"/>	RPM (AIR OVER) <input style="width: 100px;" type="text"/>	RPM (AIR OVER M/S) <input style="width: 100px;" type="text"/>
FPM AIR VELOCITY <input style="width: 100px;" type="text"/>	FPM AIR VELOCITY M/S <input style="width: 100px;" type="text"/>	FPM AIR VELOCITY SEC <input style="width: 100px;" type="text"/>	

**ADDITIONAL NAMEPLATE DATA:**

Decal / Plate	WD=344136	Customer PN	
Notes		Non Rev Ratchet	
Max Temp Rise	80C RISE/RES@FL 60HZ	OPP/Upper Oil Cap	GREASE
Thermal (WDG)		SHAFT/Lower Oil Cap	GREASE
Altitude		Usable At	
Regulatory Notes		Regulatory Compliance	CC 030A
COS		Marine Duty	
Balance		Arctic Duty	
3/4 Load Eff.	84.1	Inrush Limit	
Motor Weight (LBS)	30	Direction of Rotation	
Sound Level		Special Note 1	
Vertical Thrust (LBS)		Special Note 2	
Thrust Percentage		Special Note 3	
Bearing Life		Special Note 4	
Starting Method		Special Note 5	
Number of Starts		Special Note 6	
200/208V 60Hz Max Amps	3.5	SH Max. Temp.	
190V 50 hz Max Amps	3.9	SH Voltage	
380V 50 Hz Max Amps	1.8	SH Watts	
NEMA Inertia		Load Inertia	
Sumpheater Voltage		Sumpheater Wattage	
Special Accessory Note 1		Special Accessory Note 16	
Special Accessory Note 2		Special Accessory Note 17	
Special Accessory Note 3		Special Accessory Note 18	
Special Accessory Note 4		Special Accessory Note 19	
Special Accessory Note 5		Special Accessory Note 20	
Special Accessory Note 6		Special Accessory Note 21	
Special Accessory Note 7		Special Accessory Note 22	
Special Accessory Note 8		Special Accessory Note 23	
Special Accessory Note 9		Special Accessory Note 24	
Special Accessory Note 10		Special Accessory Note 25	
Special Accessory Note 11		Special Accessory Note 26	
Special Accessory Note 12		Special Accessory Note 27	
Special Accessory Note 13		Special Accessory Note 28	
Special Accessory Note 14		Special Accessory Note 29	
Special Accessory Note 15		Special Accessory Note 30	
Heater in C/B Voltage		Heater in C/B Watts	
Zone 2 Group		Division 2 Service Factor	
Note 1		Note 2	
Note 3		Note 4	
Note 5		Note 6	
Note 7		Note 8	
Note 9		Note 10	
Note 11		Note 12	
Note 13		Note 14	
Note 15		Note 16	
Note 17		Note 18	
Note 19		Note 20	
Note 21		Note 22	

**NIDEC MOTOR CORPORATION**  
ST. LOUIS, MO

TYPICAL NAMEPLATE DATA  
ACTUAL MOTOR NAMEPLATE LAYOUT MAY VARY  
SOME FIELDS MAY BE OMITTED



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# MOTOR PERFORMANCE

MODEL NO.	CATALOG NO.	PHASE	TYPE	FRAME	
FC89	D1P2D	3	DE	143T	
<b>ORDER NO.</b>		23260		<b>LINE NO.</b>	
MPI:		182191	182192	182193	182194
HP:		1	1	1	1
POLES:		4	4	4	4
VOLTS:		460	230	208	380
HZ:		60	60	60	50
SERVICE FACTOR:		1.15	1.15	1.15	1.15
EFFICIENCY (%):					
	S.F.	85.8	85.8	85.4	84
	FULL	85.5	85.5	85.5	84.4
	3/4	84.1	84.1	84.9	84.4
	1/2	80.3	80.3	82	82
	1/4	69.2	69.2	72.4	73
POWER FACTOR (%):					
	S.F.	74.3	74.3	79.7	80.5
	FULL	70.2	70.2	76.3	77
	3/4	60.8	60.8	67.8	68.2
	1/2	47.7	47.7	54.6	54.5
	1/4	30.1	30.1	35.1	34.6
	NO LOAD	8.5	8.5	9	8.4
	LOCKED ROTOR	69.3	69.3	68.2	74.2
AMPS:					
	S.F.	1.7	3.4	3.5	1.9
	FULL	1.6	3.1	3.2	1.8
	3/4	1.4	2.7	2.7	1.5
	1/2	1.2	2.4	2.3	1.3
	1/4	1.1	2.2	2	1.1
	NO LOAD	1.1	2.2	2	1.1
	LOCKED ROTOR	14.8	29.5	26.3	13.1
NEMA CODE LETTER		N	N	L	K
NEMA DESIGN LETTER		B	B	B	B
FULL LOAD RPM		1760	1760	1750	1445
NEMA NOMINAL / EFFICIENCY (%)		85.5	85.5	85.5	84.4
GUARANTEED EFFICIENCY (%)		82.5	82.5	82.5	81.5
MAX KVAR		0.7	0.7	0.6	0.6
AMBIENT (°C)		40	40	40	40
ALTITUDE (FASL)		3300	3300	3300	3300
SAFE STALL TIME-HOT (SEC)		16	16	21	22
SOUND PRESSURE (DBA @ 1M)		0	0	0	51
TORQUES:					
	BREAKDOWN{% F.L.}	572	572	460	425
	LOCKED ROTOR{% F.L.}	456	456	362	357
	FULL LOAD{LB-FT}	3	3	3	3.6

NEMA Nominal and Guaranteed Efficiencies are up to 3,300 feet above sea level and 25 ° C ambient.

The Above Data Is Typical, Sinewave Power Unless Noted Otherwise

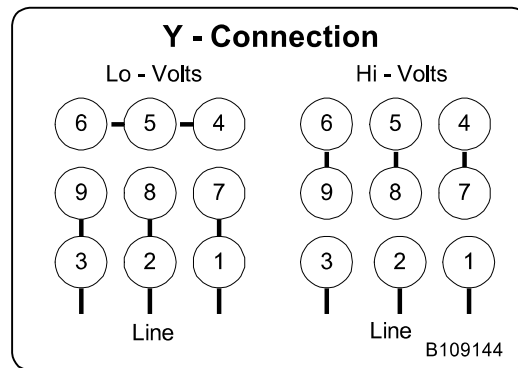
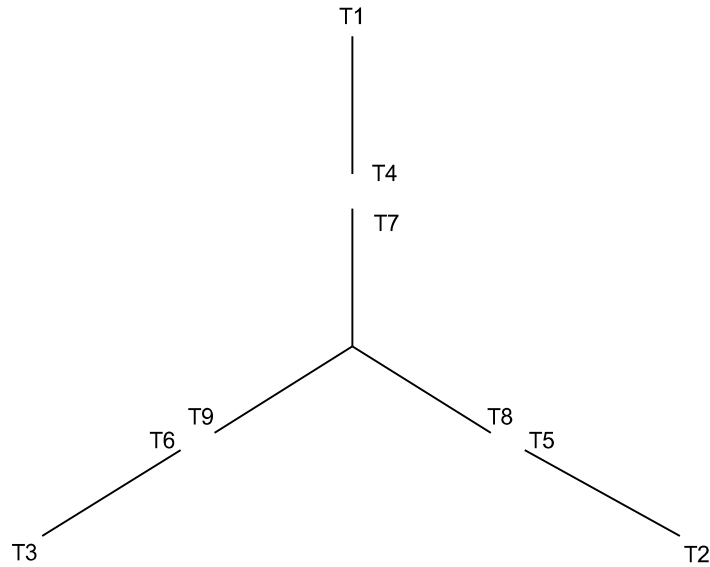
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ST. LOUIS, MO





**B109144**

**Motor Wiring Diagram**  
**9 Lead, Dual Voltage (WYE Conn.)**



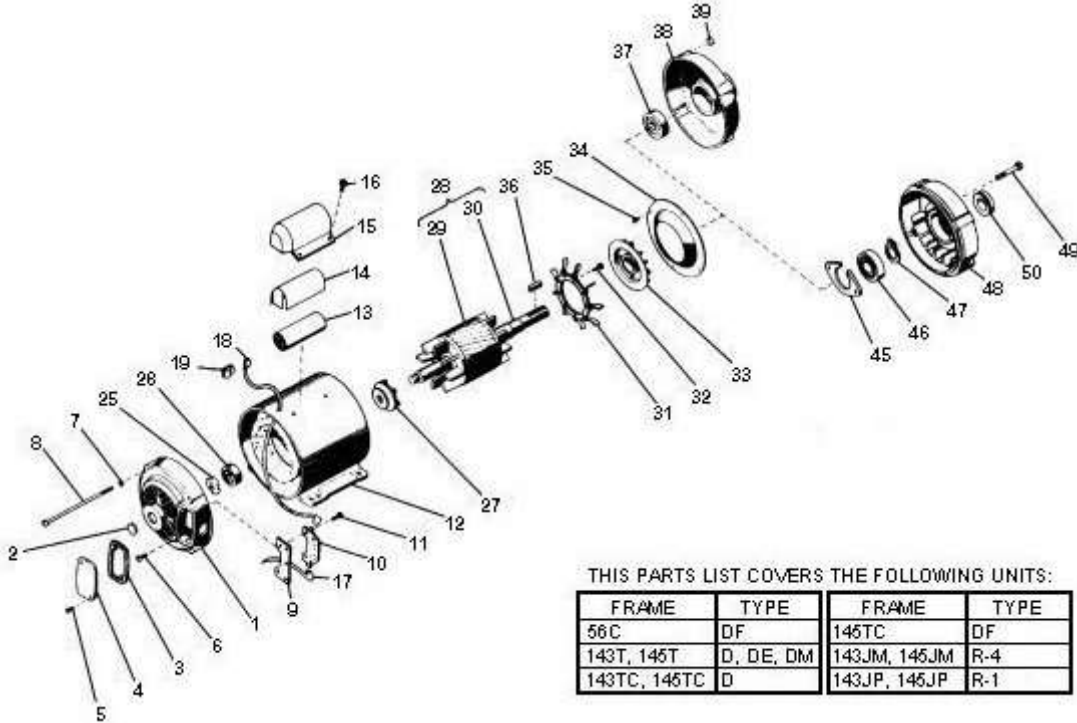
To reverse direction of rotation interchange connections L1 and L2.

Each lead may have one or more cables comprising that lead.  
In such case each cable will be marked with the appropriate lead number.

# RENEWAL PARTS

## FRAMES 56 THRU 145 - OPEN DRIPPROOF

TYPES: D, D4, DE, DE1, DE4, DEF, DEF1, DEF4, DF, DF1, DF4, DI, D1, FD, FDF, FD1, FD4, FDF1, FDF4, R1, R4



THIS PARTS LIST COVERS THE FOLLOWING UNITS:

FRAME	TYPE	FRAME	TYPE
56C	DF	145TC	DF
143T, 145T	D, DE, DM	143JM, 145JM	R-4
143TC, 145TC	D	143JP, 145JP	R-1

ITEM NO.	QTY	NAME OF PART
1	1	Bracket
2	1	Bracket Plug (Used on types D with "C" bracket DF, R-1 and R-4)
3	1	Gasket
4	1	Cover Plate
5	2	Self Tapping Screw
6	1	Self Tapping Screw (Ground) (Used on types D, DE & DF)
7	4	Bushing
8	4	Round Head Machine Screw
9	1	Switch Insulator (Type DM Only)
10	1	Starting Switch Assembly (Type DM Only)
11	2	Self Tapping Screw (Type DM Only)
12	1	Wound Stator Assembly
13	1	Starting Capacitor (Type DM Only)
14	1	Capacitor Insulator (Type DM Only)
15	1	Capacitor Box (Type DM Only)
16	4	Self Tapping Screw (Type DM Only)
17	1	Connection Lead Assembly No. 5 (included with Wound Stator Assembly Item 11) (Type DM Only)
18	1	Connection Lead Assembly No. 10 (included with Wound Stator Assembly Item 11) (Type DM Only)
19	4	Sleeving Insulation (Included with items no. 17 & 18)
20-24	-	Not Used
25	1	Spring Wave Washer (Used on types D without "C" bracket, DE and DM)

ITEM NO.	QTY	NAME OF PART
26	1	Ball Bearing (Refer to section 775)
27	1	Rotor Actuator (Type DM Only)
28	1	Rotor Assmely (Includes Items 29 & 30)
29	1	Rotor Core
30	1	Rotor Shaft
31	1	Rotor Fan (Used on types D with "C" bracket, DF, R-1 & R-4)
32	3	Self Tapping Screws (Used on types D with "C" bracket, DF, R-1 & R-4)
33	1	Shaft Fan (Type DM Only)
34	1	Air Deflector (Not used on type DM)
35	3	Self Tapping Screws (Not used on type DM)
36	1	Square Key
Items 37-39 for types D (without "C" bracket), DE & DM		
37	1	Ball Bearing (Refer to Section 775)
38	1	Bracket
39	4	Hex Nut
40-44	-	Not Used
Items 45-50 for types D (with "C" bracket), DF, R-1 & R-4		
45	1	Clamping Plate
46	1	Ball Bearing (Refer to section 775)
47	1	Retaining Snap Ring
48	1	"C" Bracket
49	2	Hex Head Cap Screw
50	1	Water Deflector (Types R-1 & R-4 only)

**WARNING:**

Any disassembly or repair work on explosionproof motors will void the Underwriters Laboratories, Inc. label unless done by the manufacturer, or a facility approved by the Underwriters Laboratories, Inc. Refer to your nearest sales office for assistance.

**BEARINGS:**

Refer to motor nameplate for the bearing numbers.

**PRICES:**

Parts stocking distributors: refer to renewal parts numerical index. All Others: refer to your nearest parts distributor.

reference: Renewal Parts Section 700, Page 3



# General Information for Integral Horsepower (IHP) Motors on Variable Frequency Drives (VFDs)

## Variable Frequency Drives (VFD)

A VFD is a type of controller used to vary the speed of an electric motor. The VFD takes a fixed AC voltage and frequency and allows it to be adjusted in order to get different speeds from the motor. Motor speed can be varied by changing the frequency of the input power waveform. The equation below shows how the frequency affects the speed of a three phase induction motor.

$$\text{Speed} = \frac{120 * \text{Fundamental Input Frequency}}{\text{Number of Motor Poles}}$$

## How does a VFD work?

A VFD takes the fixed frequency and voltage sine wave from the power grid or power station and puts it through a few steps in order to allow the VFD user to vary the frequency and in turn control the motor speed. First it rectifies the AC power into DC Power. Because of this step, a term commonly used instead of VFD is inverter. This only describes one step of what the VFD does to the power waveform. Once rectified into a DC voltage the drive sends the power through a set of transistors or switches. These switches can take the DC waveform and by opening and closing at certain speeds and durations can create an output waveform that mimics the sine wave that is required to drive a three phase electric motor. The output wave form is known as a Pulse Width Modulation (PWM) waveform because the waveform is created by multiple pulses of the switches at short intervals.

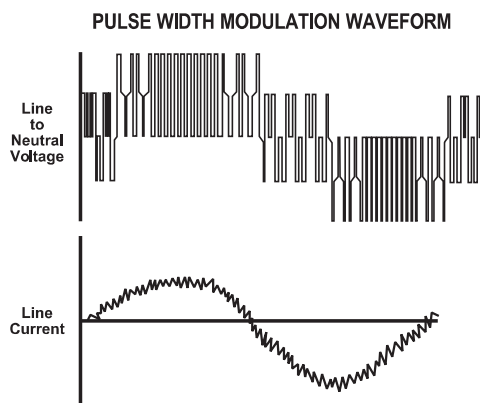


Figure 1 PWM Waveform

## What variables should be considered when deciding whether to power a motor with a VFD?

VFD compatibility with motors is complex. As a result, many variables must be considered when determining the suitability of a particular motor for use with a VFD. These variables include:

- Torque requirements (Constant or Variable)
- Speed Range
- Line / System Voltage
- Cable length between the VFD and the motor
- Drive switching (carrier) frequency
- Motor construction

- VFD dv/dt - winding end turn differential in voltage versus differential in time
- High temperatures or high humidity
- Grounding system

Wider speed ranges, higher voltages, higher switching frequencies, insufficient grounding and increased cable lengths all add to the severity of the application and, therefore, the potential for premature motor failure.

## How does a VFD affect the motor?

There are many things to consider when a motor is powered using a VFD or PWM power. When a motor is powered by a PWM waveform the motor windings very often see a large differential voltage, either from phase to phase or turn to turn. When the voltage differential becomes large enough it creates a reaction at the molecular level that converts available oxygen into O<sub>3</sub>. This phenomenon is called partial discharge or corona. This reaction creates energy in the form of light and heat. This energy has a corrosive effect on the varnish used to protect the motor windings. PWM waveforms can also magnify shaft voltages which lead to arcing across the bearing and causing premature bearing failure. Corrective action must be taken to mitigate these issues that arise when using an electric motor with a VFD.

## How do I protect the motor?

Nidec Motor Corporation (NMC) has developed specific motor designs to decrease the harmful affects that a VFD can have on a motor. NMC's INVERTER GRADE<sup>®</sup> insulation system is the first line of defense against corona and phase to phase faults that can be common when a motor is powered using a PWM waveform. The INVERTER GRADE<sup>®</sup> insulation system is standard on all of NMC's Inverter Duty products. Along with the INVERTER GRADE<sup>®</sup> insulation, thermostats are installed as a minimum protection against over heating the motor. Special consideration must also be given to bearings in motors powered by VFD's. In order to create a low resistance path to ground for built up shaft voltages a shaft grounding device can be used. On larger horsepower motors an insulated bearing system should be used in conjunction with the shaft grounding device when installed, to force the stray shaft voltages to ground. The bearing failures are more prominent on motors with thrust handling bearings. NMC has created an Inverter Duty vertical motor line that not only uses the INVERTER GRADE<sup>®</sup> insulation system, but that also comes standard with a shaft grounding device. On motors that are 100 HP and greater the thrust bearing is also insulated for additional protection.

## What does "Inverter Duty" mean?

An Inverter Duty motor should describe a motor that helps mitigate potential failure modes of a motor that is powered by a VFD. Inverter duty motor windings should be able to withstand the voltage spikes per NEMA MG1 Part 31.4.4.2 and protect against overheating when the motor is run at slow speeds. On thrust handling bearings it is apparent that the bearings require additional protection. Inverter Duty vertical motors should have a shaft grounding device to protect the motor bearings from fluting due to voltage discharge through the bearing. On larger motors (100HP and larger) the shaft should also be electrically isolated from the frame in order to aid the shaft grounding ring in discharging the shaft voltages to ground.

\*This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL<sup>®</sup> & CSA<sup>®</sup> listings where indicated.

## Thermal Overloads and Single Phase Motors

Motors with thermal overloads installed may not operate properly on a VFD. The current carrying thermal overload is designed for sine wave power. Operation on a VFD may cause nuisance tripping or potentially not protect the motor as would be expected on line power. Thermostats or thermistors installed in the motor and connected properly to the VFD may provide suitable thermal overload protection when operating on a VFD. (consult codes for installation requirements)

Single phase motors and other fractional horsepower ratings are not designed to be operated on a VFD. Within Nidec Motor Corporation standard products, all motors NEMA® 48 frame (5.5" diameter) and smaller are not suitable for VFD applications. Three phase 56 and 143/145 frame applications should be noted on the catalog price page; or if in doubt ask a Nidec Motor Corporation technical representative for recommendations on compatibility with a VFD.

## Slow Speed Motors

Motors with a base design of slower than six poles require special consideration regarding VFD sizing and minimizing harmonic distortion created at the motor terminals due to cable installation characteristics. Additional external PWM waveform filters and shielded motor cables designed for PWM power may be required to provide acceptable motor life. Harmonic distortion on the output waveform should be kept to a minimum level (less than 10%) mismatch impedance.

## 690V Applications

Motors that are rated for 690VAC and that will be powered by 690VAC PWM VFDs require the use of an external filter to limit peak voltage spikes and the use of an INVERTER GRADE® motor. Where available, an alternative to using an output filter is to upgrade to a 2300V insulation system.

## Low Voltage TITAN® Motors

When using 449 frame and larger motors on PWM type VFDs consider the use of an external filter and shielded motor cables designed for PWM power to minimize harmonic distortion and peak voltages at the motor terminals. Harmonic distortion on the output waveform should be kept to a minimum level (less than 10%).

## Bearing Currents Related to PWM Waveforms

Protection of the motor bearings from shaft currents caused by common mode voltages is becoming a standard feature on Inverter Duty motor products. Some installations may be prone to a voltage discharge condition through the motor bearings called Electrical Discharge Machining (EDM) or fluting. Vertical HOLLOWSHAFT and HOSTILE DUTY World Motor come with grounding devices installed as standard. EDM damage is related to characteristics of the PWM waveform, and the VFD programming, and installations factors.

### Bearing Protection on Inverter Duty Vertical Motors

All U.S. MOTORS® brand "Inverter Duty" vertical products have a shaft grounding system that allows damaging shaft currents a low resistance path to ground. **Bearings on vertical motors fed by VFD power without this bearing protection are not covered under any warranty.** All other bearing failure is covered per NMC's standard warranty. An electric motor repair shop approved to service U.S. MOTORS® brand motors must verify that the cause of the bearing failure was not due to EDM damage.

## Guideline For Insulated Anti-Friction Bearings

Bearing insulation is required to prevent circulating shaft currents which can damage bearings. Circulating shaft current can be caused by use of improper power and/or ground cables, improper grounding systems and higher switching frequencies. Finding and correcting the external condition(s) is the responsibility of the system designer or specifying engineer. To prevent circulating shaft current in motors with anti-friction bearings, Nidec Motor Corporation's standard practice is to insulate the non-drive end bearing.

Adjustable Speed Drives produce a common mode voltage condition. To interrupt common mode voltage on induction motors of all sizes, NEMA MG1-2018 Part 31 recommends insulating both bearings. In cases where both anti-friction bearings are insulated, the system designer or specifying engineer should determine whether to apply one or more of the following options to prevent or reduce shaft currents: sinewave filters, line reactors or mechanical devices, such as shaft grounding or an insulated half coupling. Motors with shaft grounding devices are not suitable for installation in hazardous locations unless housed in an enclosure suitable for the specified Division (or Zone), Class and Group(s).

\* This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL® & CSA® listings where indicated.

## Multiple Motors on a Single VFD

Special considerations are required when multiple motors are powered from a single VFD unit. Most VFD manufacturers can provide guidelines for proper motor thermal considerations and starting/stopping of motors. Cable runs from the VFD and each motor can create conditions that will cause extra stress on the motor winding. Filters may be required at the motor to provide maximum motor life.

## Grounding and Cable Installation Guidelines

Proper output winding and grounding practices can be instrumental in minimizing motor related failures caused by PWM waveform characteristics and installation factors. VFD manufacturers typically provide detailed guidelines on the proper grounding of the motor to the VFD and output cable routing. Cabling manufacturers provide recommended cable types for PWM installations and critical information concerning output wiring impedance and capacitance to ground.

## Integrated Motor and Inverter

By integrating the motor and inverter at NMC's manufacturing facility, many of the motor compatibility problems are minimized or eliminated. During the manufacturing process, the motor is matched to the inverter characteristics which ensures the winding temperature and torque levels meet the design specification. Since the inverter output wiring to the motor is nearly eliminated, bearing currents are rarely experienced. When the unit is properly grounded, reducing the output cable lengths in conjunction with an inverter grade insulation system and low factory setting of the switching frequency of the inverter drive, results in low risk of voltage peaks produced by the PWM waveform.

## Vertical Motors on VFDs

Vertical motors operated on VFD power present unique conditions that may require consideration by the user or installation engineer:

- Locked rotor and drive tripping caused by non-reversing-ratchet operation at low motor speeds. It is not recommended to operate motors at less than 1/4 of synchronous speed. If slow speeds are required contact NMC engineering.
- Unexpected / unacceptable system vibration and or noise levels caused by the torque pulsation characteristics of the PWM waveform, a system critical frequency falling inside the variable speed range of the process or the added harmonic content of the PWM waveform exciting a system component
- Application related problems related to the controlled acceleration/deceleration and torque of the motor on VFD power and the building of system pressure/ load.
- The impact the reduction of pump speed has on the down thrust reflected to the pump motor and any minimum thrust requirements of the motor bearings
- Water hammer during shutdown damaging the non-reversing ratchet

## Humidity and Non-operational Conditions

The possible build-up of condensation inside the motor due to storage in an uncontrolled environment or non-operational periods in an installation, can lead to an increased rate of premature winding or bearing failures when combined with the stresses associated with PWM waveform characteristics. Moisture and condensation in and on the motor winding over time can provide tracking paths to ground, lower the resistance of the motor winding to ground, and lower the Corona Inception Voltage (CIV) level of the winding.

Proper storage and maintenance guidelines are important to minimize the potential of premature failures. Space heaters or trickle voltage heating methods are the common methods for drying out a winding that has low resistance readings. **Damage caused by these factors are not covered by the limited warranty provided for the motor unless appropriate heating methods are properly utilized during non-operational periods and prior to motor start-up.**

NEMA® Application Guide for AC Adjustable Speed Drive Systems: <http://www.nema.org/stds/acadjustable.cfm#download>

# Warranty Guidelines for Integral Horsepower (IHP)\* Motors on Variable Frequency Drives

## Warranty Guidelines

The information in the following section refers to the motor and drive application guidelines and limitations for warranty.

### Hazardous Location Motors

Use of a variable frequency drive with the motors in this catalog, intended for use in hazardous locations, is only approved for Division 1, Class I, Group D hazardous location motors with a T2B temperature code, with a limitation of 2:1 constant torque or 10:1 variable torque output. **No other stock hazardous location motors are inherently suitable for operation with a variable frequency drive.** If other requirements are needed, including non-listed Division 2, please contact your Nidec Motor Corporation territory manager to conduct an engineering inquiry.

### 575 Volt Motors

575 volt motors can be applied on Inverters when output filters are used. Contact the drive manufacturer for filter selection and installation requirements.

### Applying INVERTER GRADE® Insulated Motors on Variable Frequency Drives (2, 4, 6 pole)

The products within this catalog labeled "Inverter Duty" or "Vector Duty" are considered INVERTER GRADE® insulated motors. INVERTER GRADE® motors exceed the NEMA® MG-1 Part 31 standard. Nidec Motor Corporation provides a three-year limited warranty on all NEMA® frame INVERTER GRADE® insulated motors and allows long cable runs between the motor and the VFD (limited to 400 feet without output filters). Cable distance can be further limited by hot and humid environments and VFD manufacturers cable limits. These motors may be appropriate for certain severe inverter applications or when the factors relating to the end use application are undefined (such as spares).

Nidec Motor Corporation's U.S. Motors® brand is available in the following INVERTER GRADE® insulated motors:

- Inverter Duty NEMA® frame motors good for 20:1 Variable Torque & 5:1 Constant Torque, including Vertical Type RUSI (10:1 V.T.)
- Inverter Duty motors rated for 20:1 Constant Torque
- ACCU-Torq® and Vector Duty Motors with full torque to 0 Speed or 5000:1
- 841 Plus® NEMA® Frame Motors

### Applying Premium Efficient motors (that do not have INVERTER GRADE® insulation) on Variable Frequency Drives (2, 4, 6 pole)

Premium efficient motors without INVERTER GRADE insulation meet minimum NEMA® MG-1, Section IV, Part 31.4.4.2. These motors can be used with Variable Frequency Drives (with a reduced warranty period) under the following parameters:

- On NEMA® frame 447 and smaller motors, 20:1 speed rating on variable torque loads & 4:1 speed range on constant torque loads.
- On TITAN® 449 and larger frame motors, 10:1 speed rating on variable torque loads.

- On TITAN® frame motors, inquiry required for suitability on constant torque loads.

Cable distances are for reference only and can be further limited by hot and humid environments (refer to Table 1). Refer to specific VFD

Table 1 - Cable Distances			
Maximum Cable Distance VFD to Motor			
Switching Frequency	460 Volt	230 Volt	380 Volt
3 KHz	127 ft	400 ft	218 ft
6 KHz	90 ft	307 ft	154 ft
9 KHz	73 ft	251 ft	126 ft
12 KHz	64 ft	217 ft	109 ft
15 KHz	57 ft	194 ft	98 ft
20 KHz	49 ft	168 ft	85 ft

manufacturers cable limits. Refer to the Motor/ Inverter Compatibility page for special consideration of vertical motor bearings.

## Warranty Period Clarifications and Exceptions

### Standard Energy Efficient Exclusion

Applying Standard & Energy Efficient Motors on Variable Frequency Drives is not recommended. VFD related failures on standard and energy efficient motors will not be covered under warranty.

### Vertical Motor Windings

Premium efficient vertical motors without INVERTER GRADE® insulation that are installed using the criteria described in this document and applied in the correct applications shall have a warranty while powered by a VFD for 12 months from date of installation or 18 months from date of manufacturing whichever comes first. See limited warranty page for horizontal motor warranty periods.

### Bearing Exclusion for Thrust Handling Bearings

Bearings used in premium efficient vertical motors, and all thrust handling bearings, that are powered by VFDs without shaft grounding devices or insulated bearings (when required) will not be covered under any warranty for damages caused from being powered by a VFD. All other bearing failure is covered per NMC's standard warranty. An electric motor repair shop approved to service U.S. MOTORS® brand motors must verify that the cause of the bearing failure was not due to Electrical Discharge Machining.

### Medium Voltage and Slow Speed Considerations

Motors that are rated above 700 VAC or that are eight pole and slower require special consideration and installation and are not covered under the warranty guidelines in this document. Motors that are rated above 700VAC have special cable length and voltage differential issues that are specific to the VFD type and manufacture. The motor construction and cost may vary dramatically depending on the VFD topology and construction. Contact your NMC representative with VFD manufacturer name and model type for application and motor construction considerations. Motors that are designed eight pole and slower also require special installation and filters per the drive manufacturer.

\* This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL® & CSA® listings where indicated.

# General Purpose Three Phase Open Drip Proof (ODP) NEMA<sup>®</sup> Premium Efficient


**NEMA  
Premium**

DE, RE

## APPLICATIONS:

For pumps, fans, compressors, material handling, and other general purpose applications where contaminants are minimal.

## FEATURES:

- Class F Insulation, Class B Rise At Service Factor
- Rolled Steel Frame 56-320, Cast Iron Frame 360-440
- Aluminum End Shields 56-250, Cast Iron End Shields 280-440
- 40°C Ambient, NEMA<sup>®</sup> Design B Performance On 60 Hz Sine Wave Power
- 1.15 Service Factor
- Reversible Rotation
- Regreasable Bearings 210 Frame & Up
- Double Shielded Bearings 140-400, Open on 440
- Bearing Caps On 400 & 440 Frames
- F1 Assembly Position except where noted
- Lifting Provisions 180 Frame & Up
- Conversion Kits: Drip Cover Kits (140-320 Frame)

HP	RPM	Voltage	Frame	Catalog Number	List	Discount Symbol	SF	"C" Dim. (inches)	Ship Wt. (lbs.)	NEMA Nom. Eff.	Full Load Amps	Notes
1/4	1800	208-230/460	48	D14P2B4	\$265	DS-3E	1.35	9.6	17	69.5	1.3-1.3/7	
	1800	208-230/460	56H	D14P2AH	\$275	DS-3E	1.35	10.9	26	69.5	1.1-1.1/0.5	
	1200	208-230/460	56	D14P3A	\$397	DS-3E	1.35	11.9	32	67.2	1.4-1.4/0.7	
1/3	1800	208-230/460	56H	D13P2AH	\$282	DS-3E	1.35	11.4	26	73.4	1.4-1.4/0.7	
1/2	1800	208-230/460	56H	D12P2AH	\$322	DS-3E	1.25	11.4	24	78.2	1.99-1.9/0.98	
	1800	208-230/460	56	D12P2D	\$322	DS-3E	1.00	10.4	20	78.2	2.0-2.0/1.0	
	1200	208-230/460	56H	D12P3AH	\$511	DS-3E	1.25	12.4	38	75.3	2.4/1.2	
3/4	3600	230/460	48	D34P1B	\$346	DS-3E	1.25	10.1	19	76.8	2.4/1.2	
	1800	208-230/460	56	D34P2AH	\$359	DS-3E	1.25	10.0	25	81.1	2.8-2.8/1.4	
1	3600	208-230/460	56	D1P1A	\$400	DS-3E	1.25	10.4	25	77.0	2.8-2.8/1.4	
	1800	200	143T	D1P2H	\$443	DS-3E	1.15	12.8	30	85.5	3.6	
	1800	208-230/460	56H	D1P2AH	\$405	DS-3E	1.15	12.4	32	83.5	3.2-3.0/1.5	
	1800	208-230/460	56HZ	D1P2DHz	\$443	DS-3E	1.15	13.8	26	83.5	3.3-3.3/1.6	
	1800	208-230/460	143T	D1P2D	\$443	DS-3E	1.15	12.8	30	85.5	3.2-3.1/1.6	03
	1800	575	143T	D1P2G	\$443	DS-3E	1.15	12.8	30	85.5	1.3	
	1200	200	145T	D1P3H	\$595	DS-3E	1.15	14.1	35	82.5	4.5	
	1200	208-230/460	145T	D1P3D	\$595	DS-3E	1.15	14.1	35	82.5	4-4/2	03
	1200	575	145T	D1P3G	\$595	DS-3E	1.15	14.1	35	82.5	1.6	
	900	230/460	182T	D1P4E	\$686	DS-3E	1.15	13.7	50	75.5	4.5/2.2	03
1 1/2	3600	200	143T	D32P1H	\$472	DS-3E	1.15	12.8	30	84.0	4.3	
	3600	208-230/460	143T	D32P1D	\$472	DS-3E	1.15	12.8	30	85.5	4.2-3.8/1.9	03
	3600	575	143T	D32P1G	\$472	DS-3E	1.15	12.8	30	85.5	1.5	
	1800	200	145T	D32P2H	\$466	DS-3E	1.15	12.8	35	86.5	4.9	
	1800	208-230/460	56H	D32P2AH	\$466	DS-3E	1.15	12.9	33	86.5	5.0-4.8/2.4	
	1800	208-230/460	145T	D32P2D	\$466	DS-3E	1.15	12.8	35	86.5	4.4-4.2/2.1	03
	1800	230/460	145T	D32P2B2	\$466	DS-3E	1.15	12.8	45	86.5	4.2/2.1	05
	1800	575	145T	D32P2G	\$466	DS-3E	1.15	12.8	35	86.5	1.7	
	1200	200	182T	D32P3H	\$600	DS-3E	1.15	15.0	45	86.5	6.3	
	1200	208-230/460	182T	D32P3D	\$600	DS-3E	1.15	13.7	45	86.5	5.2-5.3/2.6	03
	1200	575	182T	D32P3G	\$600	DS-3E	1.15	13.7	45	86.5	2.1	
	2	3600	200	145T	D2P1H	\$515	DS-3E	1.15	12.8	35	85.5	5.6
3600		208-230/460	56H	D2P1AH	\$462	DS-3E	1.15	11.9	32	85.5	6.0-5.4/2.7	
3600		208-230/460	145T	D2P1D	\$515	DS-3E	1.15	12.8	35	85.5	5.5-5.2/2.5	03
3600		575	145T	D2P1G	\$515	DS-3E	1.15	12.8	35	85.5	2	
1800		200	145T	D2P2H	\$512	DS-3E	1.15	12.8	35	86.5	6.4	
1800		208-230/460	56H	D2P2AH	\$415	DS-3E	1.15	12.9	40	86.5	6.6-6.6/3.3	
1800		208-230/460	56HZ	D2P2DHz	\$444	DS-3E	1.15	14.3	42	86.5	6.2-6.0/3.0	
1800		208-230/460	145T	D2P2D	\$512	DS-3E	1.15	12.8	35	86.5	5.9-5.6/2.8	03
1800		230/460	145T	D2P2B2	\$512	DS-3E	1.15	12.8	35	86.5	5.6/2.8	05

Note 03 60/50 Hz rated with no derate on HP; 230/460 volt 60 Hz ratings operate on 190/380 volt 50 Hz, 460V 60 Hz ratings operate on 380V 50 Hz; Full 60 & 50 Hz data on Nameplate

Note 05 F2 Assembly Position

# General Purpose Three Phase Open Drip Proof (ODP) NEMA<sup>®</sup> Premium Efficient



**NEMA**  
**Premium**

(continued)

DE, RE

HP	RPM	Voltage	Frame	Catalog Number	List	Discount Symbol	SF	"C" Dim. (inches)	Ship Wt. (lbs.)	NEMA Nom. Eff.	Full Load Amps	Notes
2	1800	575	145T	D2P2G	\$512	DS-3E	1.15	12.8	35	85.5	2.2	
	1200	200	184T	D2P3H	\$672	DS-3E	1.15	15.0	60	87.5	7.3	
	1200	208-230/460	184T	D2P3D	\$672	DS-3E	1.15	13.7	60	87.5	6.4-6.3/3.1	03
	1200	575	184T	D2P3G	\$672	DS-3E	1.15	15.0	60	87.5	2.5	
	900	230/460	213T	D2P4E	\$1,119	DS-3E	1.15	16.0	90	86.5	7.2/3.6	03
3	3600	200	145T	D3P1H	\$529	DS-3E	1.15	12.8	35	85.5	8.4	
	3600	208-230/460	145T	D3P1D	\$529	DS-3E	1.15	12.8	35	85.5	8.3-7.4/3.7	03
	3600	575	145T	D3P1G	\$529	DS-3E	1.15	12.8	35	85.5	2.9	
	1800	200	182T	D3P2H	\$544	DS-3E	1.15	13.7	50	89.5	8.8	
	1800	208-230/460	56HZ	D3P2AHZ	\$576	DS-3E	1.15	13.5	21	86.9	9.7-9.4/4.6	
	1800	208-230/460	182T	D3P2D	\$544	DS-3E	1.15	13.7	50	90.2	8.3-7.6/3.8	03
	1800	208-230/460	182T	D3PA2D	\$794	DS-3E	1.15	15.0	50	90.2	8.3-7.6/3.8	24
	1800	575	182T	D3P2G	\$544	DS-3E	1.15	13.7	50	89.5	3.1	
	1200	200	213T	D3P3H	\$855	DS-3E	1.15	16.0	90	88.5	10.5	
	1200	208-230/460	213T	D3P3D	\$855	DS-3E	1.15	16.0	94	88.5	9.4-8.9/4.4	
	1200	575	213T	D3P3G	\$855	DS-3E	1.15	16.0	90	88.5	3.6	
	900	230/460	215T	D3P4E	\$1,435	DS-3E	1.15	17.5	105	87.5	10.8/5.4	03
5	3600	200	182T	D5P1H	\$564	DS-3E	1.15	13.7	50	88.5	14.1	
	3600	208-230/460	182T	D5P1D	\$564	DS-3E	1.15	13.7	50	86.5	13.8-12.5/6.2	03
	3600	575	182T	D5P1G	\$564	DS-3E	1.15	13.7	50	87.5	5	
	1800	200	184T	D5P2H	\$586	DS-3E	1.15	13.7	70	89.5	14.2	
	1800	208-230/460	184T	D5P2D	\$586	DS-3E	1.15	13.7	70	89.5	13.7-12.4/6.2	03
	1800	208-230/460	184T	D5PA2A	\$836	DS-3E	1.15	15.0	60	89.5	13.8-12.6/6.3	24, LA
	1800	575	184T	D5P2G	\$586	DS-3E	1.15	13.7	70	89.5	4.9	
	1200	200	215T	D5P3H	\$1,122	DS-3E	1.15	17.5	105	89.5	16.1	
	1200	208-230/460	215T	D5P3D	\$1,122	DS-3E	1.15	17.5	105	89.5	15.2-14.5/7.3	LA
	1200	575	215T	D5P3G	\$1,122	DS-3E	1.15	17.5	105	89.5	5.7	
	900	208-230/460	254T	D5P4D	\$2,271	DS-3E	1.15	22.6	150	88.5	16.2-15.7/7.9	02,03
	900	575	254T	D5P4G	\$2,271	DS-3E	1.15	22.6	150	88.5	6.2	02
7 1/2	3600	200	184T	D7P1H	\$880	DS-3E	1.15	13.7	60	88.5	20.8	
	3600	208-230/460	184T	D7P1D	\$880	DS-3E	1.15	13.7	60	88.5	20.3-18.1/9.1	03
	3600	575	184T	D7P1G	\$880	DS-3E	1.15	13.7	60	88.5	7.3	
	1800	200	213T	D7P2H	\$857	DS-3E	1.15	16.0	94	91.0	21.4	
	1800	208-230/460	213T	D7P2D	\$857	DS-3E	1.15	16.0	105	91.0	20.2-18.5/9.3	
	1800	208-230/460	213T	D7PA2A	\$1,207	DS-3E	1.15	16.0	90	91.0	20.5-18.5/9.2	24
	1800	575	213T	D7P2G	\$857	DS-3E	1.15	16.0	94	91.0	7.3	
	1200	200	254T	D7P3H	\$1,423	DS-3E	1.15	22.6	150	91.0	21.9	
	1200	208-230/460	254T	D7P3D	\$1,423	DS-3E	1.15	19.1	150	91.0	20.5-18.9/9.5	02,03
	1200	575	254T	D7P3G	\$1,423	DS-3E	1.15	19.1	150	91.0	7.6	02
	900	208-230/460	256T	D7P4D	\$2,889	DS-3E	1.15	22.6	160	89.5	23.7-22.7/11.3	02,03
	900	575	256T	D7P4G	\$2,889	DS-3E	1.15	23.2	160	89.5	9.1	02
10	3600	200	213T	D10P1H	\$1,029	DS-3E	1.15	16.0	90	90.2	28	
	3600	208-230/460	213T	D10P1D	\$1,029	DS-3E	1.15	16.0	90	90.2	27.1-24.3/12.2	03
	3600	575	213T	D10P1G	\$1,029	DS-3E	1.15	16.0	90	90.2	9.7	
	1800	200	215T	D10P2H	\$1,043	DS-3E	1.15	17.5	100	91.7	28.1	
	1800	208-230/460	215T	D10P2D	\$1,043	DS-3E	1.15	17.5	133	92.4	26.3-23.8/11.9	
	1800	575	215T	D10P2G	\$1,043	DS-3E	1.15	17.5	104	91.7	9.8	
	1200	200	256T	D10P3H	\$1,851	DS-3E	1.15	23.2	160	91.7	29.3	
	1200	208-230/460	256T	D10P3D	\$1,851	DS-3E	1.15	21.0	160	91.7	27.2-25/12.5	02,03
	1200	575	256T	D10P3G	\$1,851	DS-3E	1.15	20.4	160	91.7	10.2	02
	900	208-230/460	284T	D10P4D	\$3,266	DS-3E	1.15	24.9	225	90.2	31-29.2/14.6	02,03

Note 02 Suitable for Wye-Delta start on voltages shown  
 Note 03 60/50 Hz rated with no derate on HP; 230/460 volt 60 Hz ratings operate on 190/380 volt 50 Hz, 460V 60 Hz ratings operate on 380V 50 Hz; Full 60 & 50 Hz data on Nameplate

Note 24 Automatic Reset Thermal Protector Overload  
 Note LA Limited Availability

GENERAL PURPOSE UNIMOUNT™  
 GENERAL PURPOSE C-FACE  
 GENERAL PURPOSE HOSTILE DUTY  
 GENERAL PURPOSE CORRO-DUTY™  
 GENERAL PURPOSE 841 PLUS™  
 GENERAL PURPOSE OPEN DRIPPROOF™  
 GENERAL PURPOSE HAZARDOUS LOCATION  
 GENERAL PURPOSE AUTOMOTIVE DUTY  
 COOLING TOWER DUTY  
 HAZARDOUS LOCATION  
 C-FACE MOTORS  
 VARIABLE SPEED MOTORS AND DRIVES

# General Purpose Three Phase Open Drip Proof (ODP) NEMA®† Premium Efficient


**NEMA  
Premium**

DE, RE

(continued)

HP	RPM	Voltage	Frame	Catalog Number	List	Discount Symbol	SF	"C" Dim. (inches)	Ship Wt. (lbs.)	NEMA Nom. Eff.	Full Load Amps	Notes
15	3600	200	215T	D15P1H	\$1,414	DS-3E	1.15	17.5	100	90.2	41	
	3600	208-230/460	215T	D15P1D	\$1,414	DS-3E	1.15	17.5	100	90.2	40-36/18	03
	3600	575	215T	D15P1G	\$1,414	DS-3E	1.15	17.5	104	90.2	14.6	
	1800	200	254T	D15P2H	\$1,426	DS-3E	1.15	19.1	150	93.0	42	02
	1800	208-230/460	254T	D15P2D	\$1,426	DS-3E	1.15	19.1	150	93.0	40-37/18.3	02,03
	1800	575	254T	D15P2G	\$1,426	DS-3E	1.15	19.1	150	93.0	14.8	02
	1200	200	284T	D15P3H	\$2,363	DS-3E	1.15	24.9	300	91.7	42	
	1200	208-230/460	284T	D15P3D	\$2,363	DS-3E	1.15	24.9	300	91.7	41-37/18.5	
	1200	575	284T	D15P3G	\$2,363	DS-3E	1.15	24.9	300	91.7	14.7	02
	900	208-230/460	286T	D15P4D	\$4,292	DS-3E	1.15	24.9	250	90.2	46/43	02,03
20	3600	200	254T	D20P1H	\$1,711	DS-3E	1.15	22.6	150	91.7	53	02
	3600	208-230/460	254T	D20P1D	\$1,711	DS-3E	1.15	22.6	150	91.7	52-46/23.1	02,03
	3600	575	254T	D20P1G	\$1,711	DS-3E	1.15	22.6	150	91.0	18.7	02
	1800	200	256T	D20P2H	\$1,829	DS-3E	1.15	23.2	160	93.0	54	02
	1800	208-230/460	256T	D20P2D	\$1,829	DS-3E	1.15	23.2	160	93.0	52-47/23.6	02,03
	1800	575	256T	D20P2G	\$1,829	DS-3E	1.15	23.2	160	93.0	18.8	02
	1200	200	286T	D20P3H	\$2,880	DS-3E	1.15	24.9	325	92.4	56	
	1200	208-230/460	286T	D20P3D	\$2,880	DS-3E	1.15	24.9	325	92.4	53-48/24	02,03
	1200	575	286T	D20P3G	\$2,880	DS-3E	1.15	24.9	325	92.4	19.3	02
	900	230/460	324T	D20P4E	\$4,316	DS-3E	1.15	27.3	385	91.0	54/27	02,03
25	3600	200	256T	D25P1H	\$2,237	DS-3E	1.15	23.2	160	91.7	67	02
	3600	208-230/460	256T	D25P1D	\$2,237	DS-3E	1.15	23.2	160	91.7	65-57/28.7	02,03
	3600	575	256T	D25P1G	\$2,237	DS-3E	1.15	23.2	160	91.7	22.9	02
	1800	200	284T	D25P2H	\$2,214	DS-3E	1.15	24.9	300	93.6	67	02,03
	1800	200	284TS	D25P2HS	\$2,214	DS-3E	1.15	23.5	300	93.6	67	
	1800	208-230/460	284T	D25P2D	\$2,214	DS-3E	1.15	24.9	300	93.6	64-58/29	02,03
	1800	208-230/460	284TS	D25P2DS	\$2,214	DS-3E	1.15	23.5	300	93.6	64-58/29	
	1800	460	284TS	D25P2CS	\$2,214	DS-3E	1.15	23.5	300	93.6	29	
	1800	575	284T	D25P2G	\$2,214	DS-3E	1.15	24.9	300	93.6	23.1	
	1800	575	284TS	D25P2GS	\$2,214	DS-3E	1.15	23.5	300	93.6	23.1	02
	1200	200	324T	D25P3H	\$3,163	DS-3E	1.15	27.3	385	93.0	67	02
	1200	208-230/460	324T	D25P3D	\$3,163	DS-3E	1.15	27.3	385	93.0	65-58/29.1	02,03
	1200	575	324T	D25P3G	\$3,163	DS-3E	1.15	27.3	385	93.0	23.5	02
	900	230/460	326T	D25P4E	\$5,113	DS-3E	1.15	27.3	460	91.0	67/33	02,03
30	3600	200	284TS	D30P1HS	\$2,637	DS-3E	1.15	23.5	225	92.4	78	02
	3600	208-230/460	284TS	D30P1DS	\$2,637	DS-3E	1.15	23.5	300	92.4	79-68/34	
	3600	575	284TS	D30P1GS	\$2,637	DS-3E	1.15	23.5	312	93.0	27.4	
	1800	200	286T	D30P2H	\$2,629	DS-3E	1.15	24.9	350	94.1	79	
	1800	200	286TS	D30P2HS	\$2,629	DS-3E	1.15	23.5	350	94.1	79	
	1800	208-230/460	286T	D30P2D	\$2,629	DS-3E	1.15	24.9	250	94.1	77-69/34	
	1800	208-230/460	286TS	D30P2DS	\$2,629	DS-3E	1.15	23.5	250	94.1	77-69/34	
	1800	575	286T	D30P2G	\$2,629	DS-3E	1.15	24.9	362	94.1	27.7	
	1800	575	286TS	D30P2GS	\$2,629	DS-3E	1.15	23.5	350	94.1	27.5	02
	1200	200	326T	D30P3H	\$3,629	DS-3E	1.15	27.3	415	93.6	81	02,14
	1200	208-230/460	326T	D30P3D	\$3,629	DS-3E	1.15	27.3	415	93.6	78-70/35	02,03,14
	1200	575	326T	D30P3G	\$3,629	DS-3E	1.15	27.3	415	93.6	28	02,14

- Note 02 Suitable for Wye-Delta start on voltages shown  
 Note 03 60/50 Hz rated with no derate on HP; 230/460 volt 60 Hz ratings operate on 190/380 volt 50 Hz, 460V 60 Hz ratings operate on 380V 50 Hz; Full 60 & 50 Hz data on Nameplate  
 Note 14 NEMA Design A

# General Purpose Three Phase Open Drip Proof (ODP) NEMA<sup>®</sup> Premium Efficient



**NEMA**  
**Premium**

(continued)

DE, RE

HP	RPM	Voltage	Frame	Catalog Number	List	Discount Symbol	SF	"C" Dim. (inches)	Ship Wt. (lbs.)	NEMA Nom. Eff.	Full Load Amps	Notes
40	3600	200	286TS	D40P1HS	\$2,883	DS-3E	1.15	23.5	250	93.0	104	02
	3600	208-230/460	286TS	D40P1DS	\$2,883	DS-3E	1.15	23.5	250	93.0	104-90/45	02,03
	3600	575	286TS	D40P1GS	\$2,883	DS-3E	1.15	23.5	362	93.0	36	
	1800	200	324T	D40P2H	\$2,889	DS-3E	1.15	25.8	454	94.1	105	02
	1800	200	324TS	D40P2HS	\$2,889	DS-3E	1.15	25.8	454	94.1	105	02
	1800	208-230/460	324T	D40P2D	\$2,889	DS-3E	1.15	27.3	385	94.1	102-91/46	02,03
	1800	208-230/460	324TS	D40P2DS	\$2,889	DS-3E	1.15	25.8	454	94.1	102-91/46	02,03
	1800	575	324T	D40P2G	\$2,889	DS-3E	1.15	27.3	454	94.5	37	
	1800	575	324TS	D40P2GS	\$2,889	DS-3E	1.15	25.8	454	94.1	36	02
	1200	230/460	364T	D40P3E	\$5,786	DS-3E	1.15	28.7	580	94.5	92/46	02,03
	1200	575	364T	D40P3G	\$5,786	DS-3E	1.15	28.7	580	94.5	37	02
	900	230/460	365T	D40P4E	\$7,020	DS-3E	1.15	29.7	600	92.4	106/53	02,03
50	3600	200	324TS	D50P1HS	\$3,243	DS-3E	1.15	25.8	385	93.0	134	02
	3600	208-230/460	324TS	D50P1DS	\$3,243	DS-3E	1.15	25.8	450	93.0	130-117/59	02,03
	3600	575	324TS	D50P1GS	\$3,243	DS-3E	1.15	25.8	385	93.0	47	02
	1800	200	326T	D50P2H	\$3,386	DS-3E	1.15	27.3	415	94.5	130	02
	1800	200	326TS	D50P2HS	\$3,386	DS-3E	1.15	25.8	415	94.5	130	02
	1800	208-230/460	326T	D50P2D	\$3,386	DS-3E	1.15	27.3	460	94.5	126-113/56	02,03
	1800	208-230/460	326TS	D50P2DS	\$3,386	DS-3E	1.15	25.8	415	94.5	56	02,03
	1800	460 & 380	326TS	D50P2FS	\$3,386	DS-3E	1.15	25.8	415	94.5	56	02,03
	1800	575	326T	D50P2G	\$3,386	DS-3E	1.15	27.3	460	94.5	46	
	1800	575	326TS	D50P2GS	\$3,386	DS-3E	1.15	25.8	415	94.5	45	02
	1200	230/460	365T	D50P3E	\$6,506	DS-3E	1.15	29.7	580	94.5	115/57	
	1200	575	365T	D50P3G	\$6,506	DS-3E	1.15	29.7	580	94.5	46	02
900	230/460	404T	D50P4E	\$8,364	DS-3E	1.15	32.5	750	92.4	132/66	02,03	
60	3600	200	326TS	D60P1HS	\$4,469	DS-3E	1.15	25.8	460	93.6	155	02
	3600	208-230/460	326TS	D60P1DS	\$4,469	DS-3E	1.15	25.8	460	93.6	152-134/67	02,03
	3600	575	326TS	D60P1GS	\$4,469	DS-3E	1.15	25.8	415	93.6	54	02,14
	1800	230/460	364T	D60P2E	\$4,657	DS-3E	1.15	28.7	580	95.0	138/69	02,03
	1800	230/460	364TS	D60P2ES	\$4,657	DS-3E	1.15	26.6	580	95.0	138/69	
	1800	460 & 380	364TS	D60P2FS	\$4,657	DS-3E	1.15	26.6	580	95.0	69	
	1800	575	364T	D60P2G	\$4,657	DS-3E	1.15	28.7	580	95.0	55	02
	1800	575	364TS	D60P2GS	\$4,657	DS-3E	1.15	26.6	580	95.0	55	02
	1200	230/460	404T	D60P3E	\$7,706	DS-3E	1.15	32.6	750	95.0	137/69	02,03
	1200	575	404T	D60P3G	\$7,706	DS-3E	1.15	32.6	750	94.5	55	
	900	230/460	405T	D60P4E	\$9,698	DS-3E	1.15	34.0	800	93.0	157/79	02,03
	75	3600	230/460	364TS	D75P1ES	\$5,886	DS-3E	1.15	26.6	580	94.1	171/86
3600		575	364TS	D75P1GS	\$5,886	DS-3E	1.15	26.6	580	94.1	69	02
1800		230/460	365T	D75P2E	\$5,514	DS-3E	1.15	29.7	735	95.0	172/86	02,03
1800		230/460	365TS	D75P2ES	\$5,514	DS-3E	1.15	27.6	600	95.0	172/86	
1800		460 & 380	365TS	D75P2FS	\$5,514	DS-3E	1.15	27.6	600	95.0	86	
1800		575	365T	D75P2G	\$5,514	DS-3E	1.15	29.7	600	95.0	69	02
1800		575	365TS	D75P2GS	\$5,514	DS-3E	1.15	27.6	600	95.0	69	02
1200		230/460	405T	D75P3E	\$8,674	DS-3E	1.15	34.1	800	95.0	172/86	02,03
1200		575	405T	D75P3G	\$8,674	DS-3E	1.15	34.1	800	94.5	69	02
900		230/460	444T	D75P4E	\$11,665	DS-3E	1.15	39.8	1100	94.1	194/97	02,03

Note 02 Suitable for Wye-Delta start on voltages shown  
 Note 03 60/50 Hz rated with no derate on HP; 230/460 volt 60 Hz ratings operate on 190/380 volt 50 Hz, 460V 60 Hz ratings operate on 380V 50 Hz;  
 Full 60 & 50 Hz data on Nameplate  
 Note 14 NEMA Design A

GENERAL PURPOSE UNIMOUNT™  
 GENERAL PURPOSE C-FACE  
 GENERAL PURPOSE HOSTILE DUTY  
 GENERAL PURPOSE CORRO-DUTY™  
 GENERAL PURPOSE 841 PLUS™  
 GENERAL PURPOSE OPEN DRIPPROOF™  
 GENERAL PURPOSE HAZARDOUS LOCATION  
 GENERAL PURPOSE AUTOMOTIVE DUTY  
 COOLING TOWER DUTY  
 HAZARDOUS LOCATION  
 C-FACE MOTORS  
 VARIABLE SPEED MOTORS AND DRIVES

## General Purpose Three Phase Open Drip Proof (ODP) NEMA<sup>®</sup> Premium Efficient


**NEMA  
Premium**

DE, RE

(continued)

HP	RPM	Voltage	Frame	Catalog Number	List	Discount Symbol	SF	"C" Dim. (inches)	Ship Wt. (lbs.)	NEMA Nom. Eff.	Full Load Amps	Notes
100	3600	230/460	365TS	D100P1ES	\$6,500	DS-3E	1.15	27.6	600	94.1	224/112	LA
	3600	575	365TS	D100P1GS	\$6,500	DS-3E	1.15	27.6	600	94.1	90	02
	1800	230/460	404T	D100P2E	\$6,571	DS-3E	1.15	32.6	750	95.4	226/113	02,03
	1800	230/460	404TS	D100P2ES	\$6,571	DS-3E	1.15	29.6	750	95.4	226/113	02,03
	1800	460 & 380	404TS	D100P2FS	\$6,571	DS-3E	1.15	29.6	750	95.4	113	02,03
	1800	575	404T	D100P2G	\$6,571	DS-3E	1.15	32.6	750	95.4	90	02
	1800	575	404TS	D100P2GS	\$6,571	DS-3E	1.15	29.6	750	95.4	90	02
	1200	230/460	444T	D100P3E	\$10,274	DS-3E	1.15	39.8	1100	95.0	234/117	02,03
	1200	575	444T	D100P3G	\$10,274	DS-3E	1.15	39.8	1100	95.0	94	02
	900	230/460	445T	D100P4E	\$16,450	DS-3E	1.15	39.8	1200	94.1	255/128	02,03
125	3600	460 & 380	404TS	D125P1FS	\$8,706	DS-3E	1.15	29.6	750	95.0	136	02,03
	3600	575	404TS	D125P1GS	\$8,706	DS-3E	1.15	29.6	750	94.5	109	02
	1800	460 & 380	405T	D125P2F	\$8,743	DS-3E	1.15	34.1	800	95.4	140	02,03
	1800	460 & 380	405TS	D125P2FS	\$8,743	DS-3E	1.15	31.1	800	95.4	140	02,03
	1800	575	405T	D125P2G	\$8,743	DS-3E	1.15	34.1	800	95.4	112	
	1800	575	405TS	D125P2GS	\$8,743	DS-3E	1.15	31.1	800	95.4	112	02
	1200	460 & 380	445T	D125P3F	\$11,097	DS-3E	1.15	39.8	1200	95.0	146	02,03
	1200	575	445T	D125P3G	\$11,097	DS-3E	1.15	39.8	1200	95.0	118	02
150	3600	460 & 380	405TS	D150P1FS	\$10,743	DS-3E	1.15	31.1	800	94.5	164	02,03
	3600	575	405TS	D150P1GS	\$10,743	DS-3E	1.15	31.1	813	94.1	131	
	1800	460 & 380	444T	D150P2F	\$11,431	DS-3E	1.15	39.8	1100	95.8	170	02,03
	1800	460 & 380	444TS	D150P2FS	\$11,431	DS-3E	1.15	36.1	1100	95.8	170	02,03
	1800	575	444T	D150P2G	\$11,431	DS-3E	1.15	39.8	1100	95.8	135	02
	1200	460 & 380	445T	D150P3F	\$14,949	DS-3E	1.15	39.8	1200	95.4	174	02,03
	1200	575	445T	D150P3G	\$14,949	DS-3E	1.15	39.8	1200	95.4	141	
200	3600	460 & 380	444TS	D200P1FS	\$13,917	DS-3E	1.15	36.1	1100	95.0	224	02,03
	3600	575	444TS	D200P1GS	\$13,917	DS-3E	1.15	36.1	1100	95.0	179	02
	1800	460 & 380	445T	D200P2F	\$14,286	DS-3E	1.15	39.8	1200	95.8	225	02,03
	1800	460 & 380	445TS	D200P2FS	\$14,286	DS-3E	1.15	36.1	1200	95.8	225	02,03
	1800	575	445T	D200P2G	\$14,286	DS-3E	1.15	39.8	1200	95.8	179	02
	1200	460 & 380	447T	D200P3F	\$19,649	DS-3E	1.15	43.3	1700	95.4	250	02,03
	1200	575	447T	D200P3G	\$19,649	DS-3E	1.15	43.3	1700	95.4	205	02
	250	3600	460 & 380	445TS	D250P1FS	\$18,343	DS-3E	1.15	36.1	1200	95.0	276
3600		575	445TS	D250P1GS	\$18,343	DS-3E	1.15	36.1	1200	95.0	222	02
1800		460 & 380	445T	D250P2FF	\$16,151	DS-3E	1.15	39.8	1200	95.8	280	02,03
1800		460 & 380	445TS	D250P2FFS	\$16,151	DS-3E	1.15	36.1	1200	95.8	280	02,03
1800		575	445T	D250P2GF	\$16,151	DS-3E	1.15	39.8	1200	95.8	224	02
1200		575	447T	D250P3G	\$22,343	DS-3E	1.15	43.3	1700	95.4	228	02

- Note 02 Suitable for Wye-Delta start on voltages shown  
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 Note LA Limited Availability



# General Purpose Three Phase Open Drip Proof (ODP) NEMA<sup>®</sup> Premium Efficient



**NEMA  
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(continued)

DE, RE

HP	RPM	Voltage	Frame	Catalog Number	List	Discount Symbol	SF	"C" Dim. (inches)	Ship Wt. (lbs.)	NEMA Nom. Eff.	Full Load Amps	Notes
300	3600	460 & 380	445TS	D300P1FFS	\$25,362	DS-3E	1.15	36.1	1200	95.4	325	02,03
	1800	460 & 380	447T	D300P2F	\$21,169	DS-3E	1.15	43.3	1700	95.8	328	
	1800	460 & 380	447TS	D300P2FS	\$21,169	DS-3E	1.15	39.5	1700	95.8	328	
	1800	575	447TS	D300P2GS	\$21,169	DS-3E	1.15	39.5	1700	95.8	262	02, 03
350	3600	460 & 380	447TS	D350P1FS	\$29,028	DS-3E	1.15	39.5	1723	95.8	379	
	1800	460 & 380	447T	D350P2F	\$28,679	DS-3E	1.15	43.3	1700	95.8	383	
	1800	460 & 380	447TS	D350P2FS	\$28,679	DS-3E	1.15	39.5	1723	95.8	383	
400	3600	460 & 380	449TS	D400P1FS	\$34,056	DS-3E	1.15	44.5	2000	95.8	432	
	1800	460 & 380	449T	D400P2F	\$33,647	DS-3E	1.15	48.3	2000	95.8	442	

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