

# NIDEC MOTOR CORPORATION

8050 WEST FLORISSANT AVE.  
ST. LOUIS, MO 63136



DATE: 8/11/2015

P.O. NO.: CU88  
Order/Line NO.: 19933 MN 100

TO:

Model Number: CU88  
Catalog Number: X40P1BS  
Horiz. XP Premium Eff. Config.  
CONF,MOTOR,HORIZ XP PRE EFF

REVISIONS:  
(NONE)

ALL DOCUMENTS HEREIN ARE CONSIDERED CERTIFIED BY NIDEC MOTOR CORPORATION.  
THANK YOU FOR YOUR ORDER AND THE OPPORTUNITY TO SERVE YOU.

## Features:

Horsepower ..... 00040.00 ~ KW: 29.84  
Enclosure ..... TEFC  
Poles ..... 02 ~ RPM: 3600  
Frame Size ..... 324~TS  
Phase/Frequency/Voltage.. 3~060~230/460 ~ Random Wound  
Service Factor ..... 1.00  
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 ....  
Hazardous Location Info:  
Division 1 ~ Class I ~ Group C & D  
Class II ~ Group F & G ~ T3C Temp Code  
"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 ..... 92.4 % ~ NEMA Nominal  
Load Inertia (lb-ft<sup>2</sup>): NEMA ~ NEMA Inertia: 39.80 ~ 1.00  
Number Of Starts Per Hour: NEMA  
Motor Type Code ..... LE  
Rotor Inertia (LB-FT<sup>2</sup>) ..... 4.03 LB-FT<sup>2</sup>  
Qty. of Bearings PE (Shaft) 1  
Qty. of Bearings SE (OPP) 1  
Bearing Number PE (Shaft) 6311-J/C3  
Bearing Number SE (OPP) 6211-J/C3

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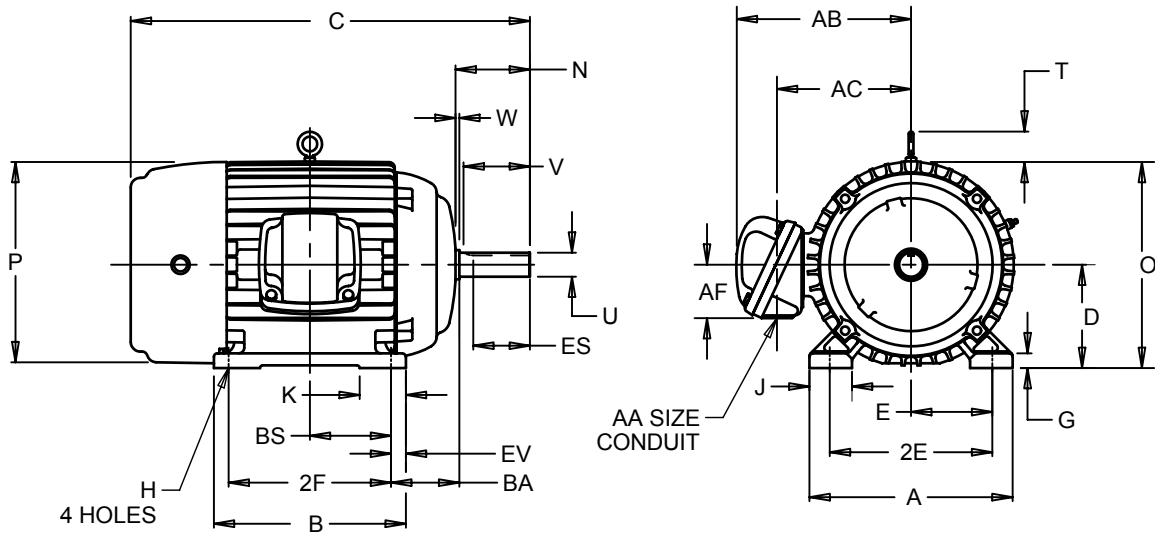
**Accessories:**

Thermostats - Normally Closed  
Standard Leadtime: REFER TO OFFICE  
Est. Weight (lbs ea): 575 ~ F.O.B.: St. Louis, MO

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

|                         |         |
|-------------------------|---------|
| <b>Horsepower</b>       | 40      |
| <b>Pole(s)</b>          | 02      |
| <b>Voltage(s)</b>       | 460-230 |
| <b>Frame Size</b>       | 324TS   |
| <b>Shaft U Diameter</b> | 1.875   |
| <b>Outlet Box AF</b>    | 3.88    |
| <b>Outlet Box AA</b>    | 2.00    |

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ALL DIMENSIONS ARE IN INCHES AND MILLIMETERS

| UNITS | A     | B     | C     | D    | E    | 2E    | G    | H   | J    | K    | N    |
|-------|-------|-------|-------|------|------|-------|------|-----|------|------|------|
| IN    | 15.75 | 15.00 | 29.19 | 8.00 | 6.25 | 12.50 | 1.13 | .66 | 3.25 | 4.65 | 4.13 |
| MM    | 400   | 381   | 741   | 203  | 159  | 318   | 29   | 17  | 83   | 118  | 105  |

| UNITS | O     | P <sup>2</sup> | T    | U     | V    | W   | AA       | AB    | AC    | AF   | BA   |
|-------|-------|----------------|------|-------|------|-----|----------|-------|-------|------|------|
| IN    | 16.13 | 16.22          | 2.03 | 1.875 | 3.50 | .38 | 2.00 NPT | 14.26 | 10.76 | 3.88 | 5.25 |
| MM    | 410   | 412            | 52   | 47.63 | 89   | 10  |          | 362   | 273   | 98   | 133  |

| UNITS | BS   | ES   | EV   | SQ    |
|-------|------|------|------|-------|
| IN    | 6.00 | 2.03 | 1.50 | .500  |
| MM    | 152  | 52   | 38   | 12.70 |

| FRAME | UNITS | 2F    |
|-------|-------|-------|
| 324TS | IN    | 10.50 |
|       | MM    | 267   |
| 326TS | IN    | 12.00 |
|       | MM    | 305   |

- ALL ROUGH DIMENSIONS MAY VARY .25" DUE TO CASTING AND/OR FABRICATION VARIATIONS.
- LARGEST MOTOR WIDTH.
- TOLERANCES SHOWN ARE IN INCHES ONLY.
- STANDARD ASSEMBLY POSITION F-1 IS SHOWN F-2 IS PROVIDED WHEN SPECIFIED. CONDUIT OPENINGS MAY BE LOCATED IN STEPS OF 90° REGARDLESS OF LOCATION. STANDARD AS SHOWN WITH CONDUIT OPENING DOWN



# NAMEPLATE DATA

|                          |      |                   |       |                   |        |                          |    |
|--------------------------|------|-------------------|-------|-------------------|--------|--------------------------|----|
| CATALOG NUMBER           |      | X40P1BS           |       | NAMEPLATE PART #: |        | 422696-001               |    |
| MODEL                    | CJ88 | FR                | 324TS | TYPE              | LE     | ENCL                     | TE |
| SHAFT<br>END BRG         |      | 6311-J/C3 - QTY 1 |       | OPP<br>END BRG    |        | 6211-J/C3 - QTY 1        |    |
| PH                       | 3    | MAX<br>AMB        | 40 C  | ID#               |        |                          |    |
| INSUL<br>CLASS           | F    | Asm.<br>Pos.      | F1    | DUTY              | CONT   |                          |    |
| HP                       | 40   | RPM               | 3545  | HP                |        | RPM                      |    |
| VOLTS                    | 460  | 230               |       | VOLTS             |        |                          |    |
| FL<br>AMPS               | 45.0 | 90.0              |       | FL<br>AMPS        |        |                          |    |
| SF<br>AMPS               |      |                   |       | SF<br>AMPS        |        |                          |    |
| SF                       | 1.00 | DESIGN            | B     | CODE              | F      | SF                       |    |
| NEMA NOM<br>EFFICIENCY   | 92.4 | NOM<br>PF         | 89.8  | KiloWatt          | 29.840 | NEMA NOM<br>EFFICIENCY   |    |
| GUARANTEED<br>EFFICIENCY | 91.0 | MAX<br>KVAR       | 5.5   | HZ                | 60     | GUARANTEED<br>EFFICIENCY |    |

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

|           |     |          |    |          |    |
|-----------|-----|----------|----|----------|----|
| DIVISION  | 1   | CLASS I  | I  | GROUP I  | CD |
| TEMP CODE | T3C | CLASS II | II | GROUP II | FG |

**VFD DATA (IF APPLICABLE):**

|                   |     |  |  |
|-------------------|-----|--|--|
| VOLTS             |     |  |  |
| AMPS              |     |  |  |
| TORQUE 1          |     |  |  |
| VFD LOAD TYPE 1   |     |  |  |
| VFD HERTZ RANGE 1 |     |  |  |
| VFD SPEED RANGE 1 |     |  |  |
| SERVICE FACTOR    |     |  |  |
| NO. POLES         | 2   |  |  |
| VECTOR MAX RPM    |     |  |  |
| Radians/ Seconds  | 1   |  |  |
| TORQUE 2          |     |  |  |
| VFD LOAD TYPE 2   |     |  |  |
| VFD HERTZ RANGE 2 |     |  |  |
| VFD SPEED RANGE 2 |     |  |  |
| FL SLIP           |     |  |  |
| MAGNETIZING AMPS  | 8.1 |  |  |
| Encoder PPR       |     |  |  |
| Encoder Volts     |     |  |  |

**TEAO DATA (IF APPLICABLE):**

|                  |  |                      |  |                      |  |                    |  |
|------------------|--|----------------------|--|----------------------|--|--------------------|--|
| HP (AIR OVER)    |  | HP (AIR OVER M/S)    |  | RPM (AIR OVER)       |  | RPM (AIR OVER M/S) |  |
| FPM AIR VELOCITY |  | FPM AIR VELOCITY M/S |  | FPM AIR VELOCITY SEC |  |                    |  |

**ADDITIONAL NAMEPLATE DATA:**

|                           |                     |                           |         |
|---------------------------|---------------------|---------------------------|---------|
| Decal / Plate             | WD=109145           | Customer PN               |         |
| Notes                     |                     | Non Rev Ratchet           |         |
| Max Temp Rise             | 80C RISE/RES@1.00SF | OPP/Upper Oil Cap         | GREASE  |
| Thermal (WDG)             |                     | SHAFT/Lower Oil Cap       | GREASE  |
| Altitude                  |                     |                           |         |
| Regulatory Notes          |                     | Regulatory Compliance     | CC 030A |
| COS                       |                     | Marine Duty               |         |
| Balance                   |                     | Arctic Duty               |         |
| 3/4 Load Eff.             | 92.8                | Inrush Limit              |         |
| Motor Weight (LBS)        | 575                 | 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    |                     | SH Max. Temp.             |         |
| 190V 50 hz Max Amps       |                     | SH Voltage                |         |
| 380V 50 Hz Max Amps       |                     | 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 |         |

**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 |
|-----------|-------------|-------|------|-------|
| CU88      | X40P1BS     | 3     | LE   | 324TS |

| ORDER NO. | 19933 | LINE NO. |
|-----------|-------|----------|
|-----------|-------|----------|

|                             |        |        |
|-----------------------------|--------|--------|
| MPI:                        | 122096 | 122097 |
| HP:                         | 40     | 40     |
| POLES:                      | 2      | 2      |
| VOLTS:                      | 460    | 230    |
| HZ:                         | 60     | 60     |
| SERVICE FACTOR:             | 1      | 1      |
| EFFICIENCY (%):             |        |        |
| S.F.                        |        |        |
| FULL                        | 92.4   | 92.4   |
| 3/4                         | 92.8   | 92.8   |
| 1/2                         | 91.8   | 91.8   |
| 1/4                         | 87.2   | 87.2   |
| POWER FACTOR (%):           |        |        |
| S.F.                        |        |        |
| FULL                        | 89.8   | 89.8   |
| 3/4                         | 90.1   | 90.1   |
| 1/2                         | 88     | 88     |
| 1/4                         | 77.5   | 77.5   |
| NO LOAD                     | 15.4   | 15.4   |
| LOCKED ROTOR                | 33     | 33     |
| AMPS:                       |        |        |
| S.F.                        |        |        |
| FULL                        | 45     | 90     |
| 3/4                         | 34     | 67     |
| 1/2                         | 23.2   | 46     |
| 1/4                         | 13.9   | 27.7   |
| NO LOAD                     | 8.1    | 16.1   |
| LOCKED ROTOR                | 275    | 550    |
| NEMA CODE LETTER            | F      | F      |
| NEMA DESIGN LETTER          | B      | B      |
| FULL LOAD RPM               | 3545   | 3545   |
| NEMA NOMINAL EFFICIENCY (%) | 92.4   | 92.4   |
| GUARANTEED EFFICIENCY (%)   | 91     | 91     |
| MAX KVAR                    | 5.5    | 5.5    |
| AMBIENT (°C)                | 40     | 40     |
| ALTITUDE (FASL)             | 3300   | 3300   |
| SAFE STALL TIME-HOT (SEC)   | 16     | 16     |
| SOUND PRESSURE (DBA @ 1M)   | 81     | 81     |
| TORQUES:                    |        |        |
| BREAKDOWN{% F.L.}           | 270    | 270    |
| LOCKED ROTOR{% F.L.}        | 189    | 189    |
| FULL LOAD{LB-FT}            | 59.3   | 59.3   |

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

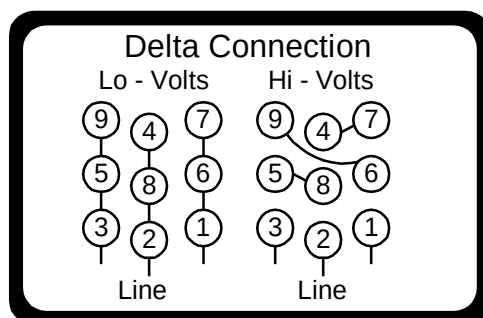
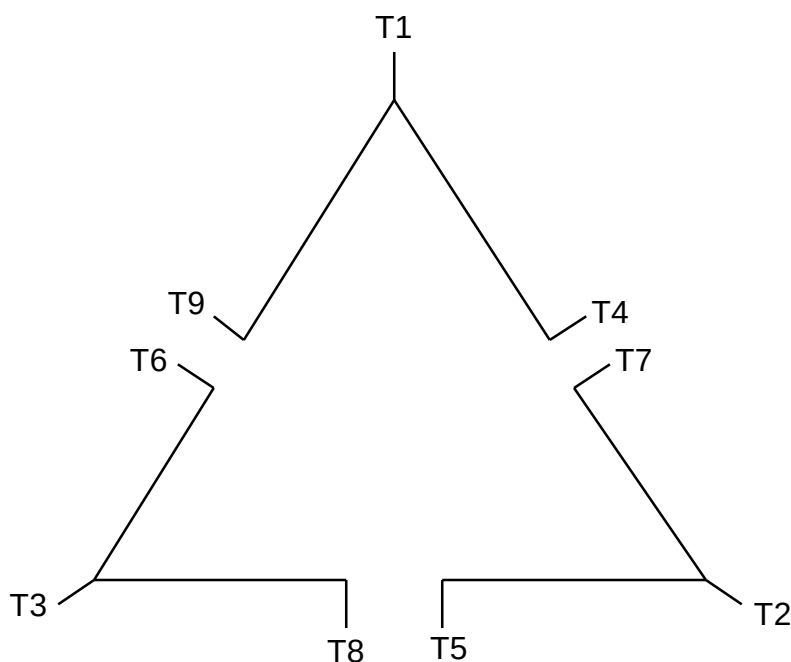


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**A109145**

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

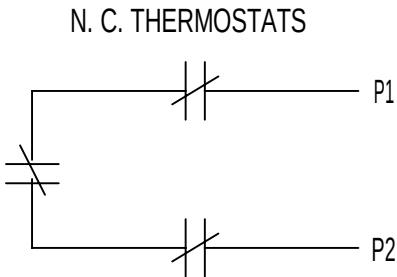


To reverse direction of rotation interchange connections L1 and L2.

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

THERMOSTATS

- 1. MOTOR IS EQUIPPED WITH QTY-3 (1 PER PHASE) NORMALLY CLOSED THERMOSTATS. THERMOSTATS ARE SET TO OPEN AT HIGH TEMPERATURE.
- 2. CONTACT RATINGS FOR THERMOSTATS: 120-600 VAC, 720 VA



NOTE: THERMOSTATS LEADS MAY BE LOCATED IN EITHER THE MAIN OUTLET BOX OR IF SO EQUIPPED, AN AUXILIARY BOX.

|                        |
|------------------------|
| ACCESSORY LISTING      |
| QTY-3 N.C. THERMOSTATS |

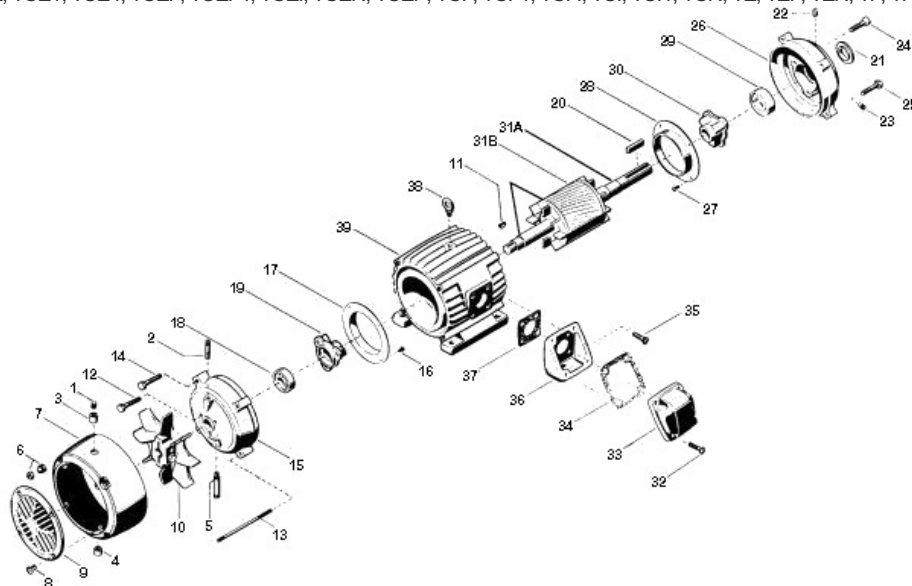
|                                |                                                       |       |                             |             |                         |              |          |
|--------------------------------|-------------------------------------------------------|-------|-----------------------------|-------------|-------------------------|--------------|----------|
| REVISION DESCRIPTION FOR: MISC | SCALE                                                 | UNITS | TITLE                       |             | NIDEC MOTOR CORPORATION |              |          |
| STL0211 - UPDATED FORMAT .     | NONE                                                  | IN    |                             |             |                         |              |          |
|                                | TOLERANCES ON DIMENSIONS (UNLESS OTHERWISE SPECIFIED) |       | CUSTOMER CONNECTION DIAGRAM |             | REVISION DATE           |              |          |
|                                | INCHES                                                | mm    |                             |             |                         |              |          |
| MATERIAL:                      |                                                       |       | ISSUED BY                   | APPROVED BY | 24-FEB-11               |              |          |
| ---                            |                                                       |       | R. KING                     | C. CADE     |                         |              |          |
|                                | ANGLES X°= ±1°                                        |       | CODE                        | DWG NO.     | REV                     | SHEET NUMBER | DWG SIZE |
|                                |                                                       |       |                             | 0834066     | G                       | 1 OF 1       | A        |



## RENEWAL PARTS

### FRAMES 254T THRU 447T - TOTALLY ENCLOSED AND EXPLOSIONPROOF MOTORS

TYPES: CE, CE1, CE4, CEF, CT, CT1, CT4, CTC, CTE, CTE1, CTE4, CTEF, CTEF1, CTEF4, CTEI, CTEN, CTF, CTF1, CTF4, CTFI, CTFI1, CTFI4, CTFN, CTI, CTI4, CTN, CTNI, EC, ECEI, FCT, FCTF, FCTF1, FCTN, FD, FDF, FDF1, FL, FLC, FLCA, FLCF, FLF, FN, FNC, FTC, FTCF, JAD, JDE, L, L1, L4, LC, LC1, LCA, LCAE, LCE, LCEF, LCEI, LCE1, LCF, LCFI, LCI, LE, LE1, LE4, LEF, LF, LF1, LF4, LFC, LFI, LI, LN, N, NC, NCE, NCEF, NCF, NCFI, NCI, NE, NF, NN, T, T1, T4, TC, TC1, TC4, TCA, TCE, TCE1, TCE4, TCEF, TCEI, TCEN, TCEP, TCF, TCF1, TCFI, TCI, TCI1, TCN, TE, TEF, TEN, TF, TFC, TFN, TN



| ITEM NO. | QTY | NAME OF PART                                   |
|----------|-----|------------------------------------------------|
| 1        | 1   | Slotted Headless Pipe Plug                     |
| 2        | 1   | Pipe Coupling                                  |
| 3        | 1   | Pipe Nipple                                    |
| 4        | 1   | Pipe Cap                                       |
| 5        | 1   | Pipe Nipple                                    |
| 6        | 2   | Cap and Jam Nut                                |
| 7        | 1   | Fan Cover Guard                                |
| 8        | 3   | Screw & Lockwasher                             |
| 9        | 1   | Grill                                          |
| 10       | 1   | Vent Fan Assembly                              |
| 11       | 1   | Woodruff Key (Not used on frames 254T & 256T)  |
| 12       | 2   | Screw                                          |
| 13       | 2   | Stud & Nut                                     |
| 14       | 2   | Screw (Qty 6 on frames 254T & 256T)            |
| 15       | 1   | Bracket                                        |
| 16       | 4   | Screw (Used only on frame 286T & 326T)         |
| 17       | 1   | Air Deflector (Used only on frame 286T & 326T) |
| 18       | 1   | Ball Bearing                                   |
| 19       | 1   | Bearing Cap                                    |
| 20       | 1   | Key                                            |
| 21       | 1   | Water Deflector                                |

| ITEM NO. | QTY | NAME OF PART                                    |
|----------|-----|-------------------------------------------------|
| 22       | 1   | Slotted Headless Pipe Plug                      |
| 23       | 1   | Pipe Plug                                       |
| 24       | 2   | Screw                                           |
| 25       | 4   | Screw (Qty 8 on frames 286T & 326T)             |
| 26       | 1   | Bracket (Not used on types TF)                  |
| 27       | 4   | Screw (Used only on frame 286T & 326T)          |
| 28       | 1   | Air Deflector ((Used only on frame 286T & 326T) |
| 29       | 1   | Ball Bearing                                    |
| 30       | 1   | Bearing Cap                                     |
| 31       | 1   | Rotor Assembly (Includes items 31A & 31B)       |
| 31A      | 1   | Motor Shaft                                     |
| 31B      | 1   | Rotor Core                                      |
| 32       | 4   | Screw                                           |
| 33       | 1   | Outlet Box Cover                                |
| 34       | 1   | Gasket                                          |
| 35       | 4   | Screw (Qty 2 on frames 254T & 256T)             |
| 36       | 1   | Outlet Box Base                                 |
| 37       | 1   | Gasket (Outlet Box Base)                        |
| 38       | 1   | Eyebolt                                         |
| 39       | 1   | Wound Stator Assembly                           |

#### 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 19

# Suitability of Integral Horsepower (IHP)\* Motors on Variable Frequency Drives

## Variable Frequency Drives (VFD)

All Nidec Motor Corporation inverter duty motors have 40°C ambient, 1.0 SF on Inverter Power, 3300 ft. max altitude, 460 voltage or less line power, up to 10:1 speed range on Variable Torque and Class F Insulation.

Nidec Motor Corporation's INVERTER GRADE® insulated motors exceeded NEMA® MG-1 Part 30 & 31 before the standards were established.

We are a leader in the development of electric motors to withstand pulse width modulated (PWM) drives evolution from power transistors to higher switching frequency insulated gate bipolar transistors (IGBTs).

Today, as the need for medium duty motor inverter applications grows, Nidec Motor Corporation provides products to meet these demands.

Through continued research and development, Nidec Motor Corporation has included the insulation wire from its INVERTER GRADE® motors in all Premium Efficient motors, enhancing their potential inverter compatibility.

Inverter compatibility with motors is complex. As a result, many variables must be considered when determining the suitability of certain types of motors. These variables include:

- Torque requirements (Constant or Variable)
- Speed Range
- Line/System Voltage
- Cable Length between VFD & Motor
- Drive Switching (Carrier) Frequency Motor Construction
- VFD dv/dt
- High Temperatures High Humidity

Wider speed ranges, higher voltages, higher switching frequencies and increased cable lengths all add to the severity of the application and therefore the potential for premature motor failure. Nidec Motor Corporation has differentiated its products into families for your ease of selection for various inverter applications.

## Warranty Guidelines

The information within this 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.

## 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 and allows long cable runs between the motor and the VFD (limited to 400 feet typical 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 application or when the factors relating to the end use application are undefined (such as spares).

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 typical 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 application 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 10:1 Variable Torque & 5:1 Constant Torque, including Vertical Type RUSI
- Inverter Duty motors rated for 10:1 Constant Torque
- ACCU-Torq® and Vector Duty Motors with full torque to 0 Speed
- 841 Plus® NEMA® Frame Motors

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

Meet NEMA® MG-1, Section IV, Part 31.4.4.2. They can be used with adjustable frequency drives under the following parameters: On NEMA® frame motors, 10:1 speed rating on variable torque loads & 4:1 speed range on constant torque loads. On TITAN® 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 specific VFD manufacturers cable limits.

| 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    |

**Applying Standard & Energy Efficient Motors on Variable Frequency Drives is not recommended. VFD related failures on standard and energy efficient motors 444 frame and above will not be covered under warranty.**

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

† All marks shown within this document are properties of their respective owners.



# Motor / Inverter Compatibility

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## 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. Thermo-stats 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)

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<sup>®†</sup> 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 an 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%).

## 690V Applications

Motors that will be applied to 690VAC PWM VFDs require the use of an external filter to limit peak voltage spikes and the use of an INVERTER GRADE<sup>®</sup> motor. Where available, an alternative to using an output filter is to upgrade to a 2300V insulation system.

## Low Voltage TITAN<sup>®</sup> 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 waveform

Due to the uniqueness of this condition occurring in the field, protection of the motor bearings from shaft currents caused by common mode voltages is not a standard feature on sine wave or Inverter Duty motor products, unless explicitly noted. Some installations may be prone to a voltage discharge condition through the motor bearings called fluting.

Fluting damage is related to characteristics of the PWM waveform, VFD programming and characteristics and installation.

Bearing fluting as a result of VFD waveform characteristics may be prevented by the installation of a shaft grounding device such as a brush or ring and/or correction of the installation characteristics causing the shaft voltage condition. Insulated bearing(s) may be required. VFD filters may be needed if bearing fluting is to be avoided.

## 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.

## Vertical Motors on VFDs

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

- Non-reversing-ratchet operation can interfere at low speeds (up to 300 RPM) causing locked rotor and drive tripping.
- 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 Megohm resistance of the motor winding to ground, and lower the Corona Inception Voltage 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 preferred methods for drying out a winding that has low megaohm readings. Damage caused by these factors are not covered by the limited warranty provided unless appropriate heating methods are properly utilized during non-operational periods and prior to motor start-up.

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

\*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.

† All marks shown within this document are properties of their respective owners.

