



# MOTORS - AC INDUCTION, SINGLE & POLYPHASE



## 1. Overview

This user manual applies to NORD Motor products and it provides general information for motor operation, installation, maintenance, inspection, repair, and trouble shooting, which is relevant to most of the motor products shipped by NORD. Information and instructions provided in this manual, safety and commissioning information and all other manuals applicable to any items supplied by NORD must be observed.

This instruction manual is not intended to include comprehensive details and information related to all possible design variations or accessories options available with NORD motors. If there is any uncertainty about specific procedures, instructions or motor details, then please refer these questions to NORD for additional information or clarification.

Before installing, operating, or performing maintenance on any electrical motor become familiar with the following:

- The detailed operating instructions and wiring diagrams.
- All applicable national, local and system-specific regulations, codes and practices.
- The national / regional regulations governing safety and accident prevention.
- The proper use of any tools, transportation or hoisting equipment, and safety equipment needed to complete the installation.
- To avoid serious injury or possible damage to the equipment or machine, compliance with all safety and information notes is mandatory!

	<b>WARNING</b>	
<p>All work involved in the transport, connection, commissioning and maintenance of any NORD product must be carried out by qualified and responsible technicians. All applicable national, regional, and local work regulations and safety requirements must also be complied with. NORD assumes no liability for personal injury, accidental death, or equipment damage and malfunctions resulting from failure to comply with installation or operating instructions, safety notes, or any work regulations and laws!</p>		

	<b>WARNING</b>	
<p>To avoid electrocution, injury or death, make certain the motor is properly grounded, completely de-energized and brought to a no-voltage condition prior to working on any electrical connections.</p>		

## 2. Motor Types

NORD AC electric induction motors described in this manual generally include the following types:

- Single speed or two-speed design.
- Three phase alternating current or single phase design.
- Enclosure types: TEFC, TENV, and TEBC.

### 3. Enclosure Types

#### Totally enclosed fan cooled (TEFC).

TEFC motor designs rely on fan that is mounted on the motor's rotor shaft so the cooling capacity can vary based upon the motor's operating speed.

#### Totally enclosed, non-ventilated (TENV)

The TENV motor designs rely purely on convection cooling and they have no fan. Often TENV designs are labeled for intermittent or periodic duty or at a lower power rating than is typical for the given motor frame size.

#### Totally enclosed, blower cooled (TEBC)

The TEBC design uses separate blower or ventilator fan, with its own low wattage motor and a separate power supply, to provide continuous airflow and cooling. The blower can be used to extend the speed range of the motor and allow extreme slow speed operation without causing a concern for overheating. Blower data is provided in Table 6, page 11.

## 4. Voltage and Frequency Variation

Voltage and frequency variations are based upon the assumption that the nameplate horsepower will not be exceeded and that the motor temperature may increase. Standard allowable deviations are based upon the type of motor labeling.

### NEMA and CSA Labeled Motors

Variations are based upon the nominal utilization voltage, and not the service (supply) voltage as per ANSI C84.1.

Service Voltages	Utilization Voltages
120V, 208V, 240V, 480V, 600V	115V, 200V, 230V, 460V, 575V

- Voltage variation at rated frequency =  $\pm 10\%$ .
- Frequency variations at rated voltage =  $\pm 5\%$ .
- Combined voltage/frequency variation =  $\pm 5\%$ .

### CE Labeled Motors

Per IEC 60038, allowable service voltage variations on in the current system, compared to the previous system, are as indicated.

Previous Service Voltages	Current Service Voltages
220V, 380V, 660V	230V, 400V, 690V +6/-10%
240V, 415V	230V, 400V +10/-6%

- Per EN 60034-1 a  $\pm 5\%$  voltage variation and a  $\pm 2\%$  frequency variation can be tolerated.
- The allowed variations are based upon the voltage (or voltage range) indicated on the motor nameplate.



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## 5. Motor Nameplate Information

The motor nameplate and the display of technical information may vary slightly depending upon the global standard/s that the motor conforms to and the efficiency level. Please reference the examples below.

www.nord.com

0851278

Type SK 1

2 ~ Mot. No. 3

INS 5 NEMA IP 6 7 AMB 8 °C 9 DP

10 Hz 11 V 12 A 13 HP 14 PF 15 kW

EFF 17 CODE 18

SF 19 SF 20 A SF 19 SF 20 A

21 V 22 A/SF 23 24 25 26

nord.com

www.nord.com

085500-0

Mtr 1

No. 3

PH 2 SF 19 NEMA DUTY 6 IP 7

INS 5 EFF 17 % PF 14 FR 15

AMB 8 ° ENCL 9 DP CODE 18

16 rpm 10 Hz 16 rpm 10 Hz

11 V 11 V

12 A 12 A

Brake 24 Nm 25 VAC 26 VDC

www.nord.com

0851278

Type SK 1

2 ~ Mot. No. 3

INS 5 NEMA IP 6 7 AMB 8 °C 9 DP

10 Hz 11 V 12 A 13 HP 14 PF 15 kW

EFF 17 CODE 18

SF 19 SF 20 A SF 19 SF 20 A

21 V 22 A/SF 23 24 25 26

nord.com

www.nord.com

085511-4

Mtr 1

No. 3

PH 2 SF 19 NEMA DUTY 6 IP 7

INS 5 EFF 17 % PF 14 FR 15

AMB 8 °C ENCL 9 DP CODE 18

16 rpm 10 Hz 16 rpm 10 Hz

11 V 11 V

12 A 12 A

Brake 24 Nm 25 VAC 26 VDC

www.nord.com

0851278

Type SK 1

2 ~ Mot. No. 3

Th.Cl. 5 IP 6 7 IEC 60034 (H)

10 Hz 11 V 12 A 13 kW 14 A 15 kW

COS φ 14 16 min<sup>-1</sup> COS φ 14 16 min<sup>-1</sup>

21 V 22 A 22 V A

17 24 25 26

www.nord.com

www.nord.com

085020-0

Type SK 1

2 ~ Mot. Nr 3

Th Cl 5 F IP 6 S 7

EN 60034 (H)

11 v 12 A

kW 16 1/min

COS φ 14 10 Hz

MB= 24 Nm, AC 25 V~, DC 26 V=

Table 1. Nameplate Data

Field	Definition
1	Model / Type
2	Number of Phases
3	Order Number
4	Serial Number
5	Insulation Class
6	IP (Ingress Protection) Enclosure Rating
7	Duty Cycle
8	Ambient Temperature Rating (°C)
9	Enclosure Type
10	Motor Frequency (Hz)
11	Voltage Rating (V)
12	Current Rating (A)
13	Rated Power (HP or kW)

Field	Definition
14	Power Factor
15	Motor Frame Size
16	Full Load Speed (rpm or 1/min <sup>2</sup> )
17	Efficiency
18	NEMA Code Letter
19	Service Factor
20	Current Rating (If Service Factor ≥ 1.15)
21	Operating Voltage Range (A)
22	Current Rating at Operating Voltage Range (A)
23	Service Factor at Operating Voltage Range (A)
24	Brake Rating (Nm)
25	Brake Supply Voltage (VAC)
26	Brake Coil Voltage (VDC)

**NORD Gear Limited**  
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**NORD Gear Corporation**  
Toll Free in the United States: 888.314.6673



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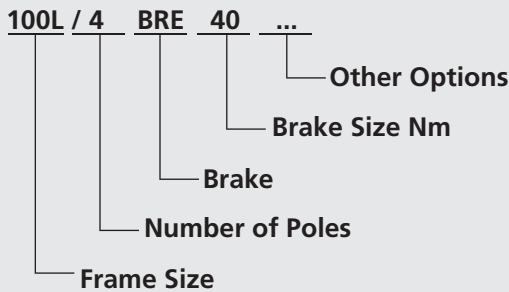
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## 6. Motor Options And Nomenclature

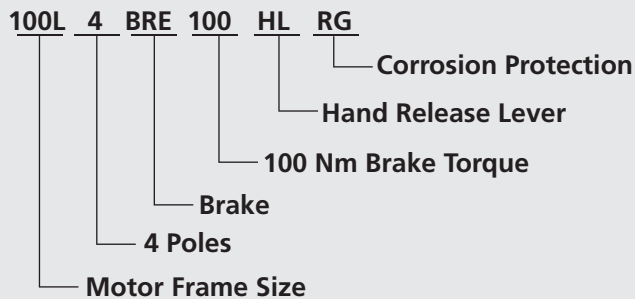
NORD offers many options for its motors. The option code will be shown in the motor nomenclature. Below are commonly used options.

Code	Description	Code	Description
AICM	Additional Internal Insulation Coating Applied	OL	TENV Motor – Without Fan / With Cover
BRE	With Brake	OL/H	TENV Motor - Without Fan & Cover
EAR	Single Phase, Start Cap/Run Cap	P	Premium Efficient Motors
ECR	Single Phase, Start Cap/Run Cap Increased SF	RD	Canopy Cover
EHB	Single Phase, Run Capacitor Only	RDD	Double Canopy Cover
EP	Epoxy Dipped Windings	RG	Brake – Corrosion Protected
F	Blower Cooling Fan - 3ph & 1ph	RLS	Backstop
FC	Blower Cooling Fan - 1ph	SH	Motor Space Heater
FHL	Brake – Lockable Manual Release	SR	Brake – Dust Protected
H	Energy Efficient	TF	Thermistor
HL	Brake – Manual Hand Release	TW	Thermostat
IG	Incremental Encoder	VN	10:1 Constant Torque Rated Motor
IP66	IP66 Environmental Protection	VR	5:1 Constant Torque Rated Motor
IR	Brake – Current Sensing Relay	VW	20:1 Constant Torque Rated Motor
KB	Condensation Holes - Removable Plugs	VZ-F	1000+:1 Constant Torque Rated Motor
KD	Condensation Holes - Open	WE	2nd Motor Shaft End
MIK	Brake – Microswitch	WU	High Slip Rotor
MS	Power Plug Connector	Z	High Inertia Motor Fan

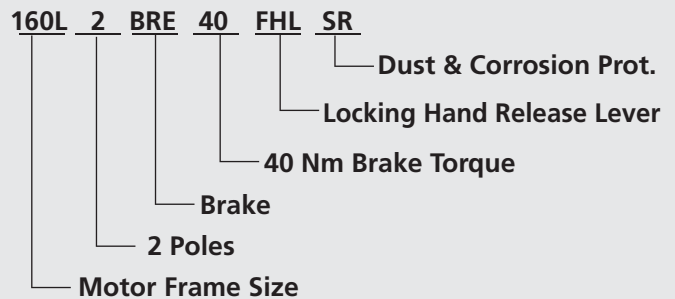
### Motor Nomenclature



### Ordering Examples



100 Frame Motor with 4 poles, Brake, 100 Nm with a hand release lever, corrosion protected brake, and a current sensing relay.



63 Frame Energy efficient motor with 4 poles, Brake, 40 Nm with a locking hand release lever and dust & corrosion protection.



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## 7. Application Conditions

Standard NORD motors are designed to operate in dusty or moist environments and have anti-fungal, thermal class F insulation.

- Enclosure Protection Rating = IP55 (minimum).
- Maximum Installation Height = 3300 ft (1000 m).
- Ambient Temperature = -4 to 104°F (-20 to 40 °C).
- Tropical-proof, Thermal Class F insulation.

The protection level and maximum ambient temperature are stated on the motor nameplate.

	<b>IMPORTANT NOTE</b>	
<p>NORD can provide motors for an expanded range of applications and service conditions including higher protection levels, extreme ambient conditions and, higher altitudes.</p>		

	<b>WARNING</b>	
<p>Consult NORD for recommendations if motors are operated under extreme loading conditions, exposed to high inertia loads, or need to operate under unusually high cycling conditions with high starting and stopping frequency.</p>		

	<b>WARNING</b>	
<p>Special design and assembly considerations are needed if NORD motors are subject to any of the following conditions:</p> <ul style="list-style-type: none"> <li>• Outdoor installation with motor in a vertical position.</li> <li>• Direct contact with aggressive or corrosive materials (acids, bases, salts, certain gases, etc.).</li> <li>• Exposure to extreme high or low temperatures, high relative humidity, condensation moisture or very wet environments.</li> <li>• Subject to extreme material build-up on the unit (dirt, dust, sand, etc.).</li> <li>• Hazardous Locations (risk of fire or explosion).</li> </ul>		

## 8. Transportation

During transportation observe the following:

- Make sure that all eyebolts and lifting lugs are tight and firmly against their supporting surface.
- Use all the lifting eyes that are intentionally supplied with the motor.
- Lift only at designed points.
- Protect the mounting surface from possible damage during transportation.
- Always use sufficiently rated handling equipment, lift mechanisms and lifting straps.
- With heavier objects or unbalanced loads, it may be appropriate to use more than one lifting point or an additional strap or sling to assure safe transportation of the assembly. This is especially true of assembled gearmotors and motorized reducers.
- Once the NORD motor or assembly is properly installed, remove the transportation fixtures completely or make certain they are properly re-secured and tightened.

	<b>WARNING</b>	
<p><b>Transportation – Use of Lifting Devices</b></p> <p>To avoid death, serious injury or equipment damage...</p> <ul style="list-style-type: none"> <li>• Hoisting lugs or lifting eyes attached to the motor are designed for the weight of the motor only! Do not attach any additional loads!</li> <li>• The motor must only be transported and lifted using the lifting eyes, in a position that is appropriate for its type of construction. Otherwise, it could fall over or slip in the lifting tackle.</li> <li>• During suspended transport, two straps must be able to carry the entire load weight safely.</li> <li>• When required use additional, suitable means of support for transportation, installation or removal.</li> <li>• Always secure the support equipment to prevent it from slipping.</li> </ul>		



## 9. Storage

If the motor is not in service, store it according to the following conditions:

- Store the motor in a clean, dry, dirt-free, vibration free area.
- Storage temperatures of 10°C (50°F) to 50°C (120°F) must be maintained.
- Relative humidity must not exceed 60%.
- If vibration in the area exceeds 0.002 inch (0.05 mm) at 60 hertz, then vibration isolation pads are suggested to prevent brinelling of the bearings.
- Treat the unprotected shaft end and mating flange surfaces with a corrosion inhibitor that can be cleaned off prior to commissioning.
- Before placing the motor into service, visually inspect the motor exterior for evidence of deterioration during storage. Turn the motor shaft by hand to make sure the shaft turns freely.
- Motor space heaters, when provided, are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional. Remove motor from the storage container when the heater is energized.
- If the motor needs to be stored for extended periods, or if it is stored in less than favorable conditions, it is recommended that the winding insulation resistance be checked prior to commissioning (page 7).
- Even if stored in favorable conditions, the antifriction motor bearings and motor shaft seals may need to be replaced if the storage period is more than 4 years.

## 10. Safety Considerations

When installing, servicing or replacing electric motors it is important to be working in a "voltage-free" state. Observe the following safety rules.

### Five Safety Rules

1. Disconnect the system. Disconnect the auxiliary circuits (brakes, space heaters, etc.).
2. Prevent reconnection (follow safe lock-out/tag-out practices).
3. Make sure that the equipment is at zero voltage.
4. Make certain the equipment is properly grounded and short-circuited.
5. Cover or isolate nearby components that are still electrically live.

To energize the system, apply the measures in reverse order.

### Qualified Personnel

All work involved in the transport, connection, commissioning and maintenance of any NORD product must be carried out by qualified and responsible technicians.

For the purpose of this documentation, a qualified personnel is taken to mean a person or people who fulfill the following requirements:

- Through appropriate training and experience, they are able to recognize and avoid risks and potential dangers in their particular field of activity.
- They have been instructed to carry out work on the machine by the appropriate person responsible.
- They are responsible for knowing and complying with all applicable national, regional, and local work regulations and safety requirements.



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## 10. Safety Considerations Ctd.

### General Warnings and Cautions

	<b>WARNING</b>	
<p>To avoid electrocution, injury or death, make certain all electrical devices (motors, brakes, variable frequency drives, etc.) are properly grounded, completely de-energized, and brought to a no-voltage condition prior to working on any electrical connections. Remember that most of these devices carry potentially dangerous energy levels for a period of time after power is removed. Always follow proper lock-out/tag-out procedures.</p>		

	<b>WARNING</b>	
<p>Electrical machines contain dangerous voltage levels, electrically live parts, rotating surfaces and hot surfaces. To prevent injury, death or possible equipment damage always observe the following:</p> <ul style="list-style-type: none"> <li>• Keep all safety covers and guards in place during operation. Remove and replace covers in compliance with the applicable safety regulations.</li> <li>• Allow the machine to cool down before starting any work on it.</li> <li>• Operate the machines properly.</li> <li>• Perform regular maintenance on the machine.</li> <li>• Secure and guard free-standing shaft extensions.</li> </ul>		

	<b>WARNING</b>	
<p><b>Electrically Live Parts</b></p> <p>Electrical machines contain electrically live parts. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.</p>		

	<b>WARNING</b>	
<p><b>Rotating Parts</b></p> <p>Electrical machines contain dangerous rotating parts. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.</p>		

	<b>WARNING</b>	
<p><b>Hot Surfaces</b></p> <p>Electrical machines have hot surfaces. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly. Allow the machine to cool down before starting any work on it.</p>		

	<b>WARNING</b>	
<p><b>Maintain Proper Cooling</b></p> <p>Operating the motor without the intended cooling fan may cause overheating and result in very hot surfaces, personal injury and material damage. Never commission a motor intended to be fan cooled when it is missing the shaft-driven fan or external blower assembly.</p>		

	<b>WARNING</b>	
<p><b>Condensation Drain Holes (Optional)</b></p> <p>Inserting objects into the condensation drain holes can damage the winding and can result in death, serious injury and damage to property!</p> <ul style="list-style-type: none"> <li>• Before opening sealed drain holes, make sure the motor is in a no-voltage condition. Close the condensation drain holes before re-commissioning.</li> <li>• Exercise caution around drain holes that are intended to be left open, especially when the motor is energized.</li> </ul>		

	<b>HARMFUL SITUATION</b>	
<p>Before start-up check the following:</p> <ul style="list-style-type: none"> <li>• All electrical connections are secure, well grounded and properly made.</li> <li>• The motor is rotating in the correct direction (when de-coupled from the driven load).</li> <li>• There are no temperature-sensitive parts (cables etc.), in contact with motor enclosure.</li> <li>• Condensation drain holes are always located at the lowest point of the motor.</li> </ul>		



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## 11. Checking the Insulation

Before putting the motor into operation for the first time, after a lengthy period of storage or standstill (approx. 6 months), the insulation resistance of the winding should be checked.

	<b>WARNING</b>	
During and directly after measurement the motor connection terminals carry hazardous voltages.		

### A. Control

The insulation resistance of new, cleaned, or repaired motor windings against the grounded housing and against one another should be > 200 Mega-Ohms.

### B. Measurement

Using a Mega-Ohm meter apply a DC voltage of 500 VDC to the motor winding for a period of 60 seconds and record the winding insulation resistance compared to ground.

- The 500 VDC test voltage is applicable to low voltage motors up to 1000 VAC.
- When performing this test the temperature of the windings should be 25°C ± 15°C (77°F ± 27°F).

### C. Verification

- If the insulation resistance of the winding is less than 50 Mega-Ohms, the cause may be moisture. The windings should be dried and the test should be repeated.
- After any lengthy period of operation the insulation resistance may drop. So long as the measured value does not fall below the critical value of 50 Mega-Ohm, the motor may continue to be operated.
- If the measured value falls below the critical 50 Mega-Ohm level, the cause must be established and the windings or winding sections must be cleaned, dried, repaired, or replaced as needed.

## 12. Bearing Lubrication

NORD motor frame sizes 63 up to and including 225 are normally supplied with internally grease lubricated bearings and require no lubrication during normal operation.

NORD motor frame sizes 250 and larger are supplied with grease fittings for re-greasing the motor bearings.

	<b>IMPORTANT NOTE</b>	
Motors with grease fittings are normally supplied with a label indicating the grease type used, the suggested re-lubrication interval, and the amount of new grease to be applied. General bearing maintenance guidelines are listed in Table 3.		

Typical motor bearing grease is an NLGI No. 2 consistency, high grade product with a polyurea base thickener, synthetic or blended mineral/synthetic oil, and stabilizing agents to protect against heat and oxidation.

Table 3 – Motor Bearing Maintenance Guidelines

Frame Size	Power	Poles	Re-greasing Interval
63-225	0.16-60 HP (0.12-45 kW)	All	Maintenance Free
250 to 280	75-125 HP (55-75 kW)	2	4000 h
		4 to 8	8000 h
315	150-250 HP (132-200 kW)	2	3000 h
		4 to 8	6000 h

	<b>HARMFUL SITUATION</b>	
When re-greasing motor bearings do not to mix different greases without verifying the compatibility with a reputable grease lubrication supplier. Mixing incompatible products can lead to bearing failure.		

## 13. Mechanical Installation

Integral motors, NEMA C-face motors, and IEC flange mounted motors must be rigidly secured to their mating connection surface using all fastening screws tightened to the proper bolt torque. It is good practice to apply a medium strength thread-locking agent (Loctite® 242) to the mounting screws.

Foot mounted motors must be securely installed to a rigid and level foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. All mounting hole locations must be utilized. Tighten all hold down screws or bolts to the proper bolt torque.

	<b>HARMFUL SITUATION</b>	
Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.		

Accurate alignment and proper balancing of output devices (couplings, belts, pulleys, etc.) is required to assure quiet, low vibration, trouble free operation. When the motor is directly coupled to a gear drive or a driven machine make sure that the motor shaft and driven machine shaft are aligned with one another axially.

	<b>HARMFUL SITUATION</b>	
Inaccurate alignment may lead to bearing damage, excessive vibrations and shaft breakage.		

	<b>IMPORTANT NOTE</b>	
For motor replacement guidelines see section 20 on page 15 and section 21 on page 16.		



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## 14. Electrical Connections

**WARNING**

To avoid electrocution, injury or death, make certain all electrical devices (motors, brakes, variable frequency drives, etc.) are properly grounded, completely de-energized, and brought to a no-voltage condition prior to working on any electrical connections. Remember that most of these devices potentially dangerous energy levels for a period of time after power is removed. Always follow proper lock-out/tag-out procedures.

**IMPORTANT NOTE**

External motor brakes have their own connection requirements as indicated in the appropriate brake instruction manuals.

**WARNING**

If the motor has an integral brake, make certain there is no load connected to the driven equipment before releasing the brake. Otherwise serious injury, death, or damage to the equipment may result.

- The supply voltage and frequency must agree with the motor nameplate data.
- Always feed the connecting leads into the terminal box using appropriate mating cable glands. The mating connection cables and cable glands should be suitable for temperatures  $\geq 194^{\circ}\text{F}$  ( $90^{\circ}\text{C}$ ).
- Provide the ends of the connecting leads and ground lead with cable lugs or curved ring eyelets before connecting them to the terminal board.
- Make certain that the wiring connections and arrangement of the terminal board jumpers conform to the appropriate wiring diagram as provided in the motor terminal box and/or page 9 of this manual.

- Tighten the terminal board screw connections on the on the main terminal board per the table below.

**Table 4 – Tightening Torque:  
Terminal Board and Grounding Screws**

Thread Size	Nut Size [mm]	Tightening Torque	
		[lb-ft]	[N-m]
M4	7	0.6-0.9	0.8-1.2
M5	8	1.3-1.8	1.8-2.5
M6	10	2.0-3.0	2.7-4
M8	13	4.0-5.9	5.5-8
M10	17	6.6-9.6	9-13
M12	19	11.8-14.8	16-20

- Upon final assembly, the terminal box cover must be sealed so that it is dust-tight and water-tight.

**Table 5 – Tightening Torque:  
Terminal Box Cover Screws**

Thread Size	Tightening Torque	
	[lb-ft]	[N-m]
M4	0.6-0.9	0.8-1.2
M5	0.9-1.3	1.2-1.8
M6	1.1-1.8	1.5-2.5
M8	2.2-3.7	3.0-5.0





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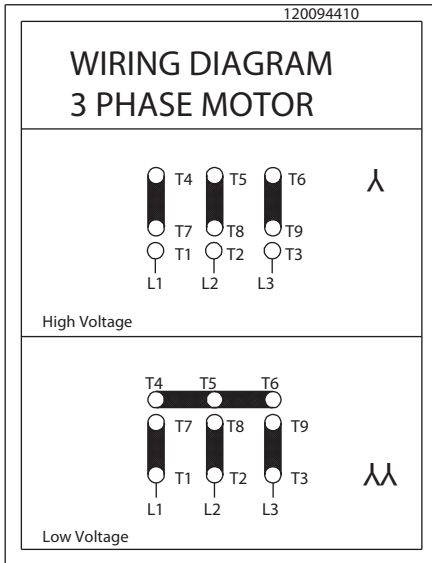
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## 15. Wiring Diagrams

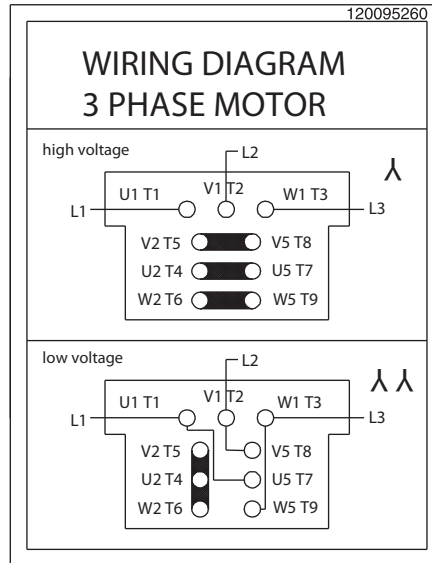
Frames 63-132

230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø  
190 / 380V, 60Hz, 3Ø



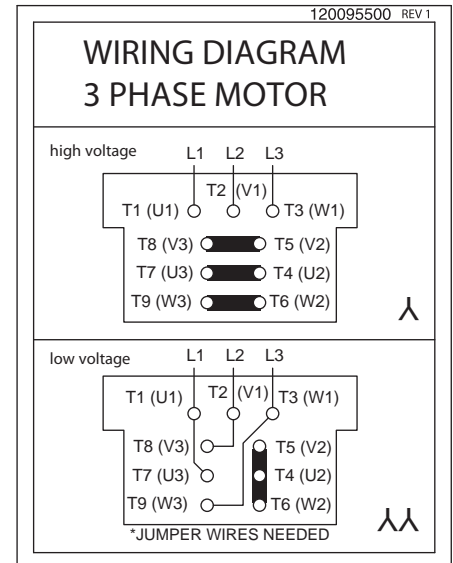
Frames 160 +

230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø  
190 / 380V, 60Hz, 3Ø

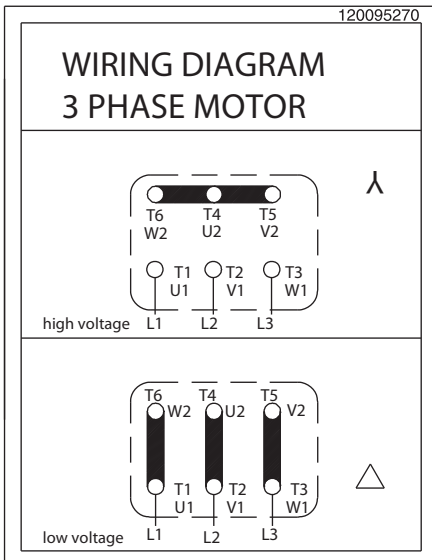


Frames 160 +

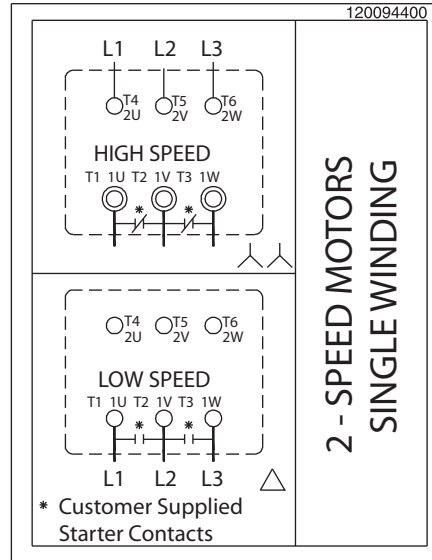
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø  
190 / 380V, 60Hz, 3Ø



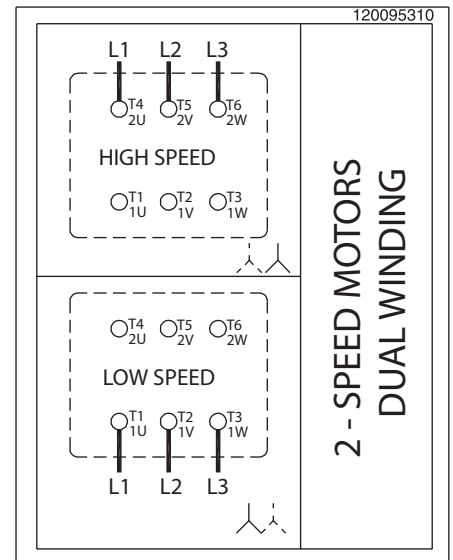
460 / 800V, 60Hz, 3Ø | 230 / 400V, 50Hz, 3Ø  
208 / 360V, 60Hz, 3Ø | 400 / 690V, 50Hz, 3Ø  
332 / 575V, 60Hz, 3Ø



2 - SPEED MOTORS  
SINGLE WINDING (4-2 & 8-4 POLE)



2 - SPEED MOTORS  
DUAL WINDING (8-2 POLE)





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## 15. Wiring Diagrams Ctd.

FROM MOTOR  
P1  
P2  
TERMINAL BLOCK  
TO CONTROL DEVICE

- \* MAX. OPERATING VOLTAGE 2.5V.
- \* SWITCH TEMP. 155°C
- \* RESPONSE TIME < 5 SECONDS

**THERMISTOR  
"TF" OPTION**

120095240

FROM MOTOR  
P1  
P2  
TERMINAL BLOCK  
TO CONTROL DEVICE

- \* NC (NORMALLY CLOSED)
- \* CONTACTS RATED 1.6A AT 2.50 VAC
- \* 6-500 VAC WORKING RANGE
- \* AUTOMATIC RESET AT 30 ± 15°C TEMP. DROP

**THERMISTATS  
"TW" OPTION**

120095230

W2 U2 V2  
U1 V1 W1  
L1 N

1 PHASE  
115V\*  
50/60 Hz

\* CAPACITOR IS SUPPLIED

**BLOWER COOLING FAN  
"FC" OPTION**

120095450

OPTION "F" 1 PH  
W2 U2 V2  
U1 V1 W1  
L1 N  
230V  
50 / 60 Hz

OPTION "F" 3 PH  
W2 U2 V2  
U1 V1 W1  
L1 L2 L3  
380-575V  
50 / 60 Hz  
220-332V  
50 / 60 Hz

\* CAPACITOR IS SUPPLIED

**BLOWER COOLING FAN  
"F" OPTION**

120095250

FROM MOTOR  
H1  
H2  
TERMINAL BLOCK  
TO CONTROL DEVICE

**SPACE HEATER  
"SH" OPTION**

120095220



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## 16. Motor Accessories

### Blower Cooling Fan (Option F & FC)

- Connection Diagram Shown on page 10
- Option FC is 1-phase, 115V
- Option F has capability of 1 phase by connecting a supplied capacitor

### Option F – 3ph & 1ph 220-575V 50/60Hz

Motor Frame	60Hz Ratings			50Hz Ratings		
	Voltage [V]	Current [A]	Power [W]	Voltage [V]	Current [A]	Power [W]
<b>Single phase connection - Δ (Delta)</b>						
63	230 – 277	0.11	38	230 – 277	0.10	27
71	230 – 277	0.12	41	230 – 277	0.10	28
80	230 – 277	0.13	44	230 – 277	0.11	29
90	230 – 277	0.25	88	230 – 277	0.26	72
100	230 – 277	0.28	88	230 – 277	0.26	70
112	230 – 277	0.31	107	230 – 277	0.26	73
132	230 – 277	0.27	89	230 – 277	0.29	82
160 - 225	230 – 277	0.41	140	230 – 277	0.45	128
<b>Three phase low-voltage connection - (Delta)</b>						
63	220 – 332	0.08	23	220 – 290	0.10	27
71	220 – 332	0.08	24	220 – 290	0.10	30
80	220 – 332	0.08	25	220 – 290	0.01	29
90	220 – 332	0.21	64	220 – 290	0.28	86
100	220 – 332	0.21	66	220 – 290	0.27	86
112	220 – 332	0.23	70	220 – 290	0.27	85
132	220 – 332	0.25	74	220 – 290	0.32	96
160 - 225	220 – 322	0.49	165	220 – 290	0.52	155
<b>Three phase high-voltage connection - (Y)</b>						
63	380 – 575	0.04	23	380 – 500	0.05	29
71	380 – 575	0.04	25	380 – 500	0.05	30
80	380 – 575	0.04	26	380 – 500	0.05	29
90	380 – 575	0.12	62	380 – 500	0.16	82
100	380 – 575	0.12	66	380 – 500	0.16	83
112	380 – 575	0.13	70	380 – 500	0.16	82
132	380 – 575	0.14	75	380 – 500	0.18	96
160 - 225	380 – 575	0.28	165	380 – 500	0.29	155

### Option FC – 115V 50/60Hz 1ph

Motor Frame	60Hz Ratings			50Hz Ratings		
	Voltage [V]	Current [A]	Power [W]	Voltage [V]	Current [A]	Power [W]
<b>Single Phase Connection - Δ (Delta)</b>						
63	100 – 135	0.23	42	100 – 135	0.30	42
71	100 – 135	0.23	47	100 – 135	0.30	44
80	100 – 135	0.27	57	100 – 135	0.30	43
90	100 – 135	0.46	102	100 – 135	0.57	78
100	100 – 135	0.53	105	100 – 135	0.54	78
112	100 – 135	0.60	115	100 – 135	0.55	80

Table 6 – Option F & FC



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## 16. Motor Accessories Ctd.

### Thermostats (Option TW and Option 2TW)

Standard connection	Series connected, one per phase
Contact	NC (Normally Closed)/ Auto Re-setting
Response Temperature (Option TW)	311 °F (155 °C) Shut-Off Device
Response Temperature (Option 2TW)	311 °F (155 °C) Shut-Off Device + 266°F (130 °C) Alarm Device
Nominal Current	1.6 Amp at 250 V
Resistance	< 50 mΩ
Switch Rebound	< 1ms
Insulation Rating	2000 VAC
Cycles	10,000 max
Lead Identification (inside terminal box)	P1 and P2 or TB1 and TB2 / 2TB1 and 2TB2

Motor thermostats or bi-metallic switches can be wired directly into the control circuit without a separate control module or tripping device. Thermostats operate on a relatively high control voltage so they are much less sensitive to voltage interference from the main power supply. Often one can run thermostat leads and motor power leads next to each other when using the appropriate shielded cable. The installer is responsible to wire the thermostats into the motor control circuit. The leads may be labeled in a variety of ways as indicated.

### Thermistors (Option TF)

Standard Connection	Three devices, series connected, one per phase
Type	Positive temperature coefficient (PTC)
Transition Temperature	150°C±5 °C
Resistance	20... 500Ω (below transition) > 4 kΩ (above transition)
Reed Current	< 1mA
Max Voltage	30V
Lead Identification (inside terminal box)	P1 and P2 or TP1 and TP2

With a separate control module or tripping device (ex. Kirwan INT69) thermistors are used to sense motor overload/over temperature conditions by converting the critical operating temperature limit into large internal resistance change. Due to their small size, heat sink construction, and high change in resistance value, minor resistance variations caused by relatively long lead runs can be tolerated. This feature also allows for one controller to be used for several temperature sensing locations. Many variable frequency drives come with on-board thermistor inputs. NORD does not supply the thermistor control module.

⚠	<b>WARNING</b>	⚠
Thermostats and Thermistors will automatically reset.		

⚠	<b>WARNING</b>	⚠
All wiring must be completed by qualified personal and adhere to all local codes.		

### Space Heaters (Option SH)

- Connection Diagram shown on Page 9
- Space Heaters are mounted directly on the motor winding
- The leads are brought into the terminal box and labeled H1 and H2
- They require a separate voltage supply and must not be energized when the motor is energized
- The heaters will keep the winding of the motor approximately 5°C above the surrounding ambient

Table 5. Space Heater Data

Frame Size	Wattage	Voltages	Heater Strips/MTR
63 & 71	18W	110V	1
		230V	
		460V	
80	25W	110V	1
		230V	
		460V	
90 – 112	50W	110V	2
		230V	
		460V	
132-180	100W	110V	2
		230V	
		460V	
200 & 225	120W	110V	2
		230V	
		460V	

### Encoder (Option IG)

- Most standard encoders will be enclosed inside the fan cover
- Incremental, Quadrature, Differential, Marker Channel
- IP66 Protection
- IG1 = 1024PPR, IG2 = 2048PPR, IG4 = 4096PPR
- TTL/RS422, HTL/Push-Pull, Line Driver.
- 5V or 10-30V available.
- Absolute encoders also available.
- Separate encoder wiring instructions are provided by NORD.





# MOTORS - AC INDUCTION, SINGLE & POLYPHASE



## 17. Inspection

Inspect the motor after every 500 operating hours.

 <b>WARNING</b> 
If it is necessary to clean the motor exterior, do not use shop air. Shop air can force contaminants into the motor and may cause parts damage or result in blowing debris causing injury.

**Table 8 - Inspection Guidelines**

Inspect	Check	Action
<b>Motor Exterior</b>	Check the external surfaces for contamination. Accumulation of dirt and fibrous deposits must be removed.	Clean the motor external surfaces using clean, lint-free cloths.  Clean deposits from between cooling fins using a vacuum cleaner and a stiff-bristled nylon brush.
	Check the external surfaces for oil film and greasy deposits.	Clean the oil film and greasy deposits from the motor surface using clean, lint-free cloths.  If necessary, moisten the cloth with an approved non-flammable, residue-free solvent. Do not pour solvent on the motor.
	Check for evidence of damage or overheating.	If the motor has physical damage, replace the motor.
<b>Motor Mountings</b>	Make sure the mounting hardware is secure.	If the mounting hardware is not secure, check the motor/gearbox alignment, and tighten the mounting hardware.
<b>Motor Electrical Connections</b>	Check that all electrical connections are secure.	If the electrical connections are not secure, tighten them.
	Check the electrical connections for evidence of arcing.	Loose electrical connections can cause arcing, which is evident by discoloration and charring. If you find evidence of arcing, replace the damaged connections.
<b>Insulation Resistance</b>	Using an ohmmeter, check and record the resistance of motor winding insulation.	Compare the current resistance reading to previous readings. If the resistance drops significantly, perform an internal inspection for insulation damage or deterioration.
<b>Motor Brake</b>	On motors that have a brake, use a feeler gauge to check the air gap in between the brake pad and the rotor according to the appropriate user manual.	If the air gap exceeds the maximum allowed for that brake configuration provided in the manual, adjust the air gap or replace the brake pad according to user manual U35000.



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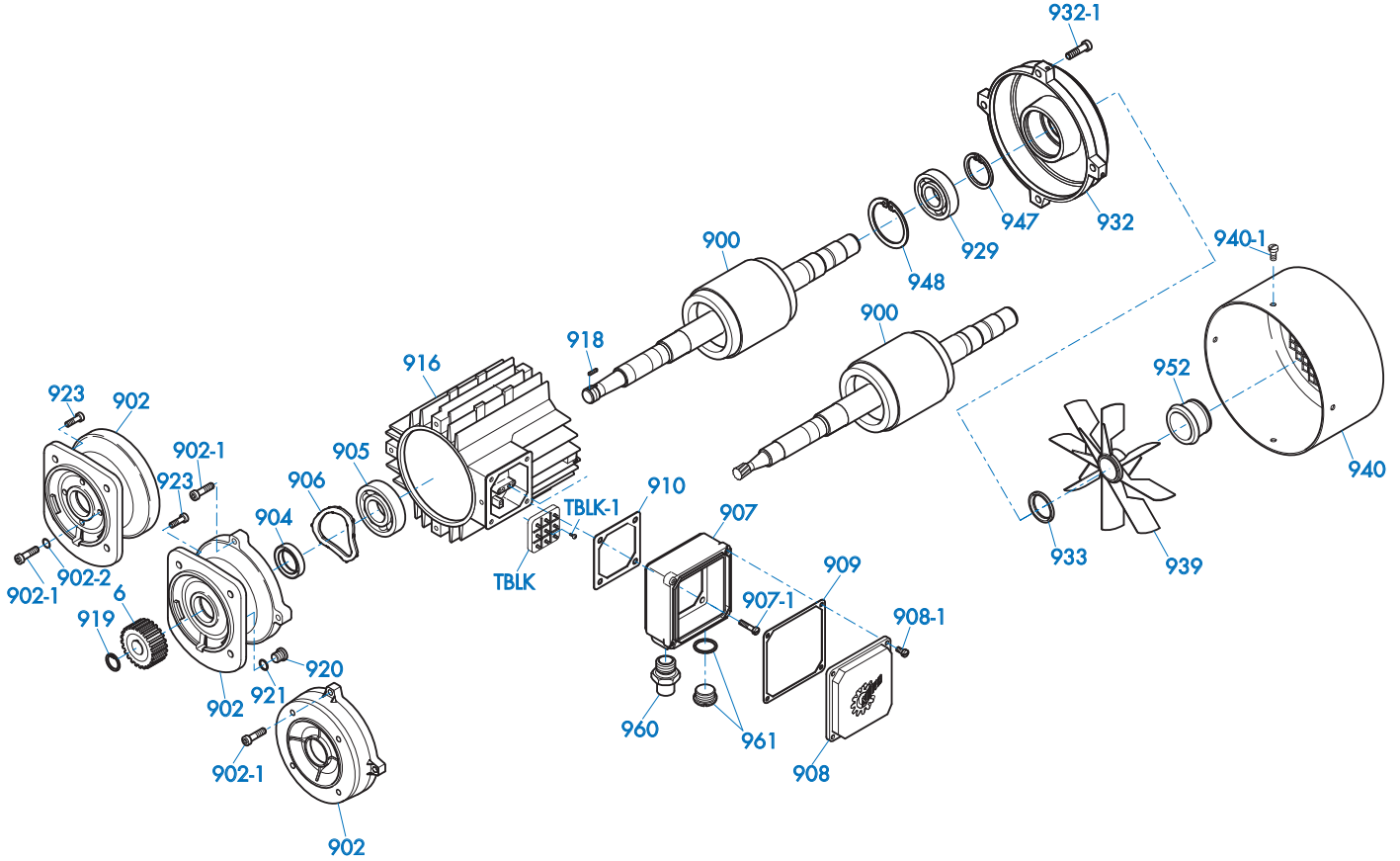
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## 18. Parts List

If you are ordering a part, provide the model and order number (table 1, page 2) of your motor. This will determine the specific part number you need.



Part Number	Part Description	Qty per Assembly
6	Input Pinion	1
900	Rotor Assembly	1
902	A-Endbell	1
902-1	Screw	4
902-2	Dubo Seal	4
904	Oil Seal	1
905	Bearing	1
906	Preload Spring	1
907	Terminal Box Frame	1
907-1	Screw	4
908	Terminal Box Cover	1
908-1	Screw	4
909	Gasket - Terminal Box Frame	1
910	Gasket - Terminal Box Cover	1
916	Stator	1
918	Key	1
919	Retaining Ring	1
920	Oil Plug	1

Part Number	Part Description	Qty per Assembly
921	Gasket	1
923	Screw	4
929	Bearing	1
932	B-Endbell	1
932-1	Screw	4
933	Oil Seal	1
939	Fan	1
940	Fan Cover	1
940-1	Screw	4
947	Retaining Ring	1
948	Retaining Ring	1
952	Fan Clip	1
960	NPT Thread Adapter	1
961	Plug (includes O-ring)	1
TBLK	Terminal Block	1
TBLK-1	Screw, Terminal Block Mounting	2
	Jumper Bar (not illustrated)	AR

**NORD Gear Limited**  
Toll Free in Canada: 800.668.4378

**NORD Gear Corporation**  
Toll Free in the United States: 888.314.6673



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## 19. Repair

Reference the parts list drawing on page 14 for clarification.

- A. Disassemble the motor according to the general exploded view in PARTS INFORMATION. Disassemble only as far as necessary to replace the failed parts.
- B. Whenever the motor is disassembled, clean all dust and contamination from the motor interior using a vacuum cleaner and a soft-bristled nylon brush.
- C. The following parts must be replaced if they are removed:
  - Oil seal (904), Oil seal (933)
  - Gasket (909), Gasket (910), Gasket (921)
  - Gasket on plug (961) • Self-locking screws (907-1, 908-1, 923, 932-1, 940-1)
  - Dubo Seals (902-2)
- D. If the following parts are removed, inspect them, and replace them if they are deformed or damaged:
  - Retaining ring (919), Retaining ring (947), Retaining ring (948)
  - Fan clip (952)

## 20. Removing and Replacing Integral Motors

Reference the parts list on Page 14 for clarification.

- A. Disconnect the power to the electric motor. Make certain the motor is properly grounded, de-energized and secured with a lock-out/tag-out device.
- B. Drain the oil from the mating gearbox, or rotate the motor/gearbox assembly so that the motor is up, to prevent oil from spilling from the gearbox when the motor is removed.
- C. Support the motor and prepare it for removal. Steady the motor and support it. For larger motors, use of mechanical lifting or support devices to may be appropriate.
- D. Remove the fastening screws that hold the motor to the reducer input.

	<b>IMPORTANT NOTE</b>	
<p>Most integral motor installations have mounting bolts accessible from the motor exterior. If the bolts are not clearly visible, unbolt the input flange from the gearbox. Remove the bolts securing the motor to the reducer input flange, and discard the old DUBO sealing rings that were under the screw heads.</p>		

- E. Maintain motor shaft alignment and move the motor directly away from its mounting surface until the motor shaft and mating input gear clear both the internal gear mesh and reducer input.

- F. Remove and discard the old flange gasket.
- G. Clean the gasket faces on the motor and gearbox, making sure no cleaning debris enters the gearbox.
- H. Check the replacement motor to make sure the motor flange, motor shaft, and motor pinion are identical to the motor that was removed.
- I. Place a new gasket between the gearbox and new motor.
- J. Position the motor on the gearbox, making sure the input pinion meshes with the input gear. Rotate the motor as necessary to align the bolt holes and seat the motor flange. Make sure the gasket remains properly aligned and seated
- K. Apply a medium strength thread locking compound to the bolt threads. Install the bolts and tighten them to the appropriate torque.

	<b>IMPORTANT NOTE</b>	
<p>If the motor/gearbox installation uses an input flange, first mount the input flange to the motor using the four mounting bolts and NEW DUBO sealing rings under the head of each fastening screw. Make sure the fastening screws are clean and apply new thread sealant if necessary.</p>		

- L. Check the gearbox oil level in accordance with the appropriate User Manual/s. If necessary fill or add oil to the gearbox.

	<b>HARMFUL SITUATION</b>	
<p>Do not mix different types of oil!</p>		

- M. Re-establish the electrical connection to the motor.
- N. Observe the subsequent start-up closely to make certain the equipment is operating properly and there are no seal or gasket leaks.



## 21. Removing and Replacing NEMA C-Face or IEC Flange-Mounted Motors

For further clarification of these instructions, reference the parts list on Page 14 of this manual.

- A. Disconnect the power to the electric motor. Make certain the motor is properly grounded, de-energized and secured with a lock-out/tag-out device.
- B. Support the motor and prepare it for removal. Steady the motor and support it. For larger motors, use of mechanical lifting or support devices to may be appropriate.
- C. Remove the fastening screws that hold the motor to the C-face or IEC mounting flange.
- D. Maintain motor shaft alignment, and move the motor directly away from its mounting surface until the motor shaft and mating coupling clear the mounting flange surface of the driven equipment.
- E. Measure and record the proper placement of the motor shaft coupling prior to removing it from the old motor.
- F. Make sure the new motor shaft, key and key slot are free of all nicks, burrs, and lubrication or grease.
- G. Install the new shaft key on the new motor. If the shaft key is not captured or if an open-ended key slot is utilized it is good practice to secure the key into the key slot with a medium strength thread locking agent or alternatively one may stake the key in place.
- H. Re-install the coupling on the new motor shaft, making sure the placement of the coupling is in the same location as it was on the old motor (See Step E).
- I. Clean all old gasket material, sealants, contamination, and corrosion from the flange surface on the driven equipment.
- J. If the motor is utilized in a wet or wash down environment apply a sealing gasket or gasket eliminating compound to the mating flange surface, as would seem most appropriate for the application.
- K. Support the new motor and mount it flush against the mating flange surface of the driven equipment.
- L. Apply a medium strength thread locking agent to the bolt threads.
- M. Install the bolts and tighten them to the appropriate torque.
- N. Re-establish the electrical connection to the motor.
- O. Observe the subsequent start-up closely to make certain the equipment is operating properly.

## 22. Testing



### IMPORTANT NOTE



NORD electric motors do not require periodic testing. However, if a motor is removed from its installation, NORD recommends that the motor be checked according to the following static and dynamic testing procedures before it is reinstalled. Finding a condition that will require future repair before the motor is reinstalled decreases the overall maintenance time.

This section provides general test information and functional checks for the types of motors covered by this manual. Read and understand the tests and checks before performing them on your motor.

Record and date all measurements taken.

If the motor fails any of the test procedures provided below, use the troubleshooting guide to determine the motor problem.

### Static Testing

- A. The motor can only be static tested if it is disconnected from the component it drives and securely mounted on a fixture or mounting plate. These tests are usually conducted when a motor has been removed for any reason other than failure
- B. Turn the motor shaft slowly by hand. Feel and listen for evidence of a failed bearing, which is indicated by a rough feel as the shaft rotates, and by noise.
- C. Check for smooth rotation, with no evidence of binding or catching. If the shaft does not rotate smoothly, or binds or catches, the bearings are worn or failing, lack lubrication, or are contaminated.
- D. Check the motor shaft for side play by applying pressure at right angles to the shaft in several places around the circumference. If the shaft moves perceptibly, the front bearing may be worn.

### Dynamic Testing

- A. Find the motor voltage and rated load current values as listed on the motor nameplate.
- B. Using a volt-ohmmeter, verify that the motor power supply is in the correct range.
- C. Run the motor with no load. As the motor is operating, listen for unusual motor noise and check for excessive vibration. Vibration and motor noise are indications of bearing contamination, lack of lubrication, damage, or failure.
- D. Use an ammeter to measure the no-load current. Record the no-load current for comparison with previous readings, and for reference during future testing.
- E. If the motor passes the no-load test, operate the motor at rated load and check and record the current.
- F. Check the motor operating temperature at rated load. If the motor operates at a higher than normal temperature, the motor may be damaged, overloaded or failing.





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## 23. Troubleshooting

Fault	Likely Cause	Corrective Action
Motor fails to start.	<ul style="list-style-type: none"> <li>Motor is mis-wired</li> <li>Brake is may not be releasing.</li> <li>Fan guard damaged and contacting fan.</li> <li>Motor protection device has tripped or does not switch</li> <li>1-Ph Capacitor or start switch has failed.</li> </ul>	<ul style="list-style-type: none"> <li>Verify and correct motor wiring.</li> <li>Troubleshoot brake per User Manual U35000.</li> <li>Replace damaged fan guard.</li> <li>Check motor protection device for correct setting and correct error.</li> <li>Discharge capacitor and use a volt-ohm meter to check the capacitor for an open circuit - replace if needed. Inspect switch and connections. Replace if contacts look burned or pitted.</li> </ul>
Fuses blow or motor protection faults immediately.	<ul style="list-style-type: none"> <li>Short circuit in line.</li> <li>Lines connected incorrectly.</li> <li>Fuse or circuit breaker tripped.</li> <li>Motor is overloaded or equipment jammed.</li> <li>Stator is shorted or went to ground.</li> </ul>	<ul style="list-style-type: none"> <li>Rectify short circuit.</li> <li>Check circuit diagram and make corrections.</li> <li>Replace fuse or circuit breaker.</li> <li>Make sure load is free. Verify motor amp draw compared to nameplate rating.</li> <li>A damaged or blown stator will show a burn mark. Stator must be repaired or replaced.</li> </ul>
Motor hums and has high current consumption	<ul style="list-style-type: none"> <li>Brake may not be releasing.</li> <li>Rotor may be rubbing stator.</li> <li>Defective or incorrect stator winding.</li> </ul>	<ul style="list-style-type: none"> <li>Troubleshoot brake per User Manual U35000.</li> <li>Send motor to a repair specialist.</li> </ul>
Severe speed loss under load or excessive acceleration time.	<ul style="list-style-type: none"> <li>Overload.</li> <li>Excessive voltage drop.</li> <li>Damaged or failing motor bearings.</li> <li>Damaged or worn gear unit.</li> <li>1-Ph Capacitor or start switch has failed.</li> </ul>	<ul style="list-style-type: none"> <li>Check load conditions and make certain system is unobstructed. Reduce load or consider a larger motor.</li> <li>Verify service voltage is within specification. Check if nearby equipment is affecting incoming power. Make sure connection harness and wiring is adequate.</li> <li>Replace motor bearings.</li> <li>Replace or repair damaged gear unit.</li> <li>See instructions under "Motor fails to start".</li> </ul>
Motor runs the incorrect direction.	<ul style="list-style-type: none"> <li>Incorrect wiring.</li> </ul>	<ul style="list-style-type: none"> <li>Rewire motor according to system schematic and/or switch two incoming motor phases.</li> </ul>
Motor heats up excessively or thermal overload protection trips	<ul style="list-style-type: none"> <li>Overload.</li> <li>Ambient temperature is too high.</li> <li>Inadequate cooling.</li> <li>Operation is outside the allowed duty cycle.</li> <li>Motor protection device may be defective.</li> <li>Excessive supply voltage.</li> <li>System short or damaged stator.</li> </ul>	<ul style="list-style-type: none"> <li>Make sure load is free. Verify motor amp draw compared to nameplate rating. Reduce load or consider a larger motor.</li> <li>Do not operate above the rated conditions.</li> <li>Correct cooling air supply. Open and clear cooling air passages. Retrofit with forced ventilator fan if needed.</li> <li>Adjust operating duty cycle or contact a specialist to select a suitable motor or drive.</li> <li>Replace motor protection device.</li> <li>Adapt motor supply voltage.</li> <li>Check for loose, cut or damaged wires. Check stator winding for defects or burn damage.</li> </ul>
Excessive Noise or Vibration	<ul style="list-style-type: none"> <li>Motor bearings contaminated or damaged.</li> <li>Excessive motor shaft end play.</li> <li>Misaligned or imbalanced load.</li> </ul>	<ul style="list-style-type: none"> <li>Test motor by itself. If bearings are bad noise may be heard or roughness detected. Replace bearings. Add lubrication if bearings have grease fittings.</li> <li>Check shaft endplay with motor and system power disconnected. If shaft movement is excessive replace motor shaft bearings.</li> <li>Check all mating shaft connections for proper alignment and correct all imbalanced load conditions.</li> </ul>
1 Ph Start Capacitor Failures	<ul style="list-style-type: none"> <li>Motor is not coming up to speed quickly enough.</li> <li>Motor is being cycled frequently</li> <li>Start switch is defective or damaged.</li> </ul>	<ul style="list-style-type: none"> <li>Verify motor size to load conditions. Motor should come up to speed in no more than 2-3 seconds.</li> <li>Verify duty cycle and consult specialist for recommendations.</li> <li>Replace start switch.</li> </ul>
1 Ph Run Capacitor Failures	<ul style="list-style-type: none"> <li>Possible power surge to motor caused by transient voltage or lightning.</li> <li>Excessive ambient temperature.</li> </ul>	<ul style="list-style-type: none"> <li>Install proper surge protection.</li> <li>Verify ambient conditions do not exceed nameplate value.</li> </ul>