

Operation and Maintenance Manual

Screw Conveyor – Nord Drive



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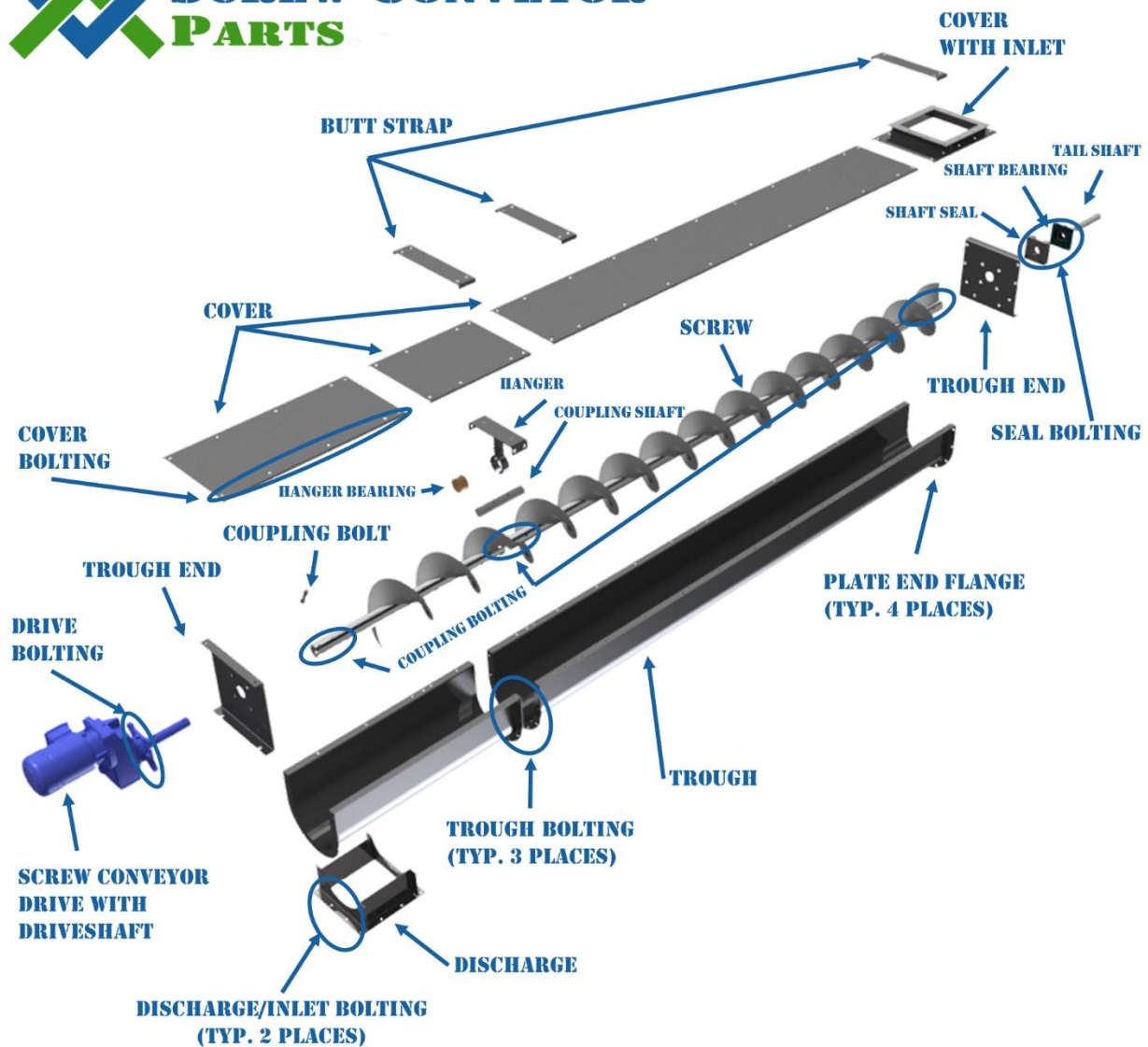
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SCREW CONVEYOR SAFETY OPERATION AND MAINTENANCE MANUAL



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INTRODUCTION

The *Engineering Conference Screw Conveyor Committee* of CEMA (Conveyor Equipment Manufacturers Association) was assigned the task of bringing together, under one cover, the accumulated experience of many individuals and their companies in an effort to provide a common basis for the safety, operation and maintenance of screw conveyors.

The **Screw Conveyor Safety Operation and Maintenance Manual** contains instructions for the safe installation, operation and maintenance of screw conveyors. The reliability and service life depend on the proper care taken while installing and preparing the equipment for its intended use.

Read **ALL** instructions in this manual and manufacturer's manuals **BEFORE** installing, operating and maintaining the equipment.

Screw conveyor safety begins with a plan that considers every possible danger and potential hazard. Operation and maintenance personnel must be thoroughly trained in safe operating procedures, recognition of possible hazards, and maintenance of a safe area around screw conveyors.

CEMA has a comprehensive safety program that includes:

- Warning and Safety Reminder for Screw Conveyors, Drag Conveyors and Bucket Elevators - (CEMA Document: SC2018-01)
- CEMA Safety Label Brochure - (CEMA Document: 201)
- CEMA Safety Label Placement Guidelines:
 - Screw Conveyor - (CEMA Document: SC-2)
 - Vertical Screw Conveyor - (CEMA Document: SC-3)
- Screw Conveyor Safety Poster - (CEMA Screw Conveyor Safety Poster)
- Screw Conveyor, Drag Conveyor and Bucket Elevator Safety DVD - (CEMA Document: AV6) This DVD describes key safety practices that personnel must follow when operating and maintaining screw conveyors, drag conveyors and bucket elevators.

Screw conveyor accidents can be avoided by implementation and enforcement of an in-plant safety program. A number of safety precautions are included in this manual. Carefully study and follow the safety precautions. Remember - accidents are usually caused by negligence or carelessness.

It is the responsibility of the contractor, installer, owner and user to install, maintain and operate the conveyor, components and, conveyor assemblies in such a manner as to comply with the Occupational Safety and Health Act and with all state and local laws and ordinances and the American National Standards Institute (ANSI) B20.1 Safety Code.

Paragraph 5.16 of ANSI B20.1 addresses risk assessment and risk reduction. Risk assessment and related risk reduction should be performed by the owner and user at each phase of a conveyor or conveyor system's life cycle. Examples of risk assessment processes can be found in the following:

1. CEMA Technical Report 2015-01
2. ASSE Z590.3 (American Society of Safety Engineers)
3. MIL-STD-882 (U.S. Military Standard)

In order to avoid an unsafe or hazardous condition, the assemblies or parts must be installed and operated in accordance with the following minimum provisions.

1. Conveyors shall not be operated unless all covers and/or guards for the conveyor and drive unit are in place. If the conveyor is to be opened for inspection cleaning, maintenance or observation, the electric power to the motor driving the conveyor must be LOCKED OUT in such a manner that the conveyor cannot be restarted by anyone; however remote from the area, until conveyor cover or guards and drive guards have been properly replaced.
2. If the conveyor must have an open housing as a condition of its use and application, the entire conveyor is then to be guarded by a railing or fence in accordance with ANSI standard B20.1.(Request current edition and addenda)
3. Feed openings for shovel, front loaders or other manual or mechanical equipment shall be constructed in such a way that the conveyor opening is covered by a grating. If the nature of the material is such that a grating cannot be used, then the exposed section of the conveyor is to be guarded by a railing or fence and there shall be a warning sign posted.
4. Do not attempt any maintenance or repairs of the conveyor until power has been LOCKED OUT.

5. Always operate conveyor in accordance with these instructions and those contained on the caution labels affixed to the equipment.

6. Do not place hands, feet, or any part of your body, in the conveyor.

7. Never walk on conveyor covers, grating or guards.

8. Do not use conveyor for any purpose other than that for which it was intended.

9. Do not poke or prod material into the conveyor with a bar or stick inserted through the openings.

10. Keep area around conveyor drive and control station free of debris and obstacles.

11. Eliminate all sources of stored energy (materials or devices that could cause conveyor components to move without power applied) before opening the conveyor

12. Do not attempt to clear a jammed conveyor until power has been LOCKED OUT.

13. Do not attempt field modification of conveyor or components.

14. Conveyors are not normally manufactured or designed to handle materials that are hazardous to personnel. These materials which are hazardous include those that are explosive, flammable, toxic or otherwise dangerous to personnel. Conveyors may be designed to handle these materials. Conveyors are not manufactured or designed to comply with local, state or federal codes for unfired pressure vessels. If hazardous materials are to be conveyed or if the conveyor is to be subjected to internal or external pressure, manufacturer should be consulted prior to any modifications.

CEMA insists that disconnecting and locking out the power to the motor driving the unit provides the only real protection against injury. Secondary safety devices are available; however, the decision as to their need and the type required must be made by the owner-assembler as we have no information regarding plant wiring, plant environment, the interlocking of the screw conveyor with

other equipment, extent of plant automation, etc. Other devices should not be used as a substitute for locking out the power prior to removing guards or covers. We caution that use of the secondary devices may cause employees to develop a false sense of security and fail to lock out power before removing covers or guards. This could result in a serious injury should the secondary device fail or malfunction.

There are many kinds of electrical devices for interlocking of conveyors and conveyor systems such that if one conveyor in a system or process is stopped other equipment feeding it, or following it can also be automatically stopped.

Electrical controls, machinery guards, railings, walkways, arrangement of installation, training of personnel, etc., are necessary ingredients for a safe working place. It is the responsibility of the contractor, installer, owner and user to supplement the materials and services furnished with these necessary items to make the conveyor installation comply with the law and accepted standards.

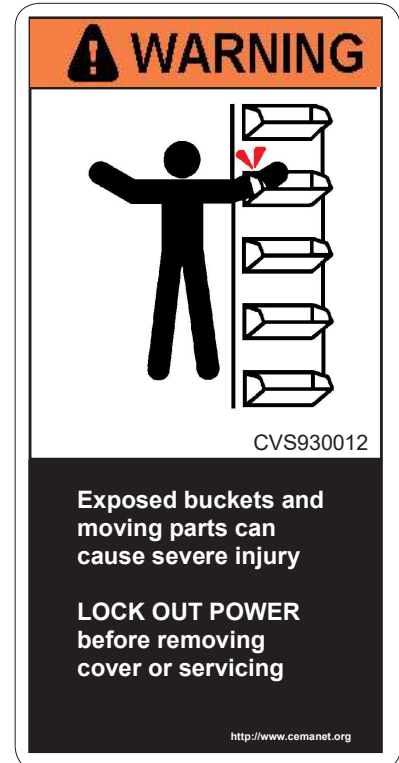
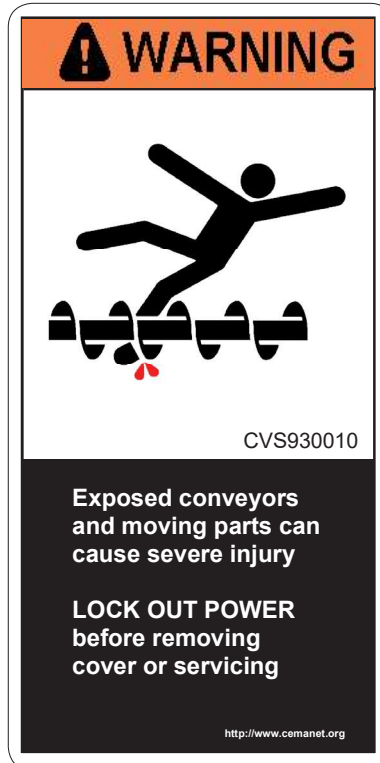
Conveyor inlet and discharge openings are designed to connect to other equipment or machinery so that the flow of material into and out of the conveyor is completely enclosed.

One or more warning labels should be visible on conveyor housings, conveyor covers and elevator housings. If the labels attached to the equipment become illegible, please order replacement warning labels from the OEM or CEMA.

The Conveyor Equipment Manufacturers Association (CEMA) has produced an audio-visual presentation entitled "Safe Operation of Screw Conveyors, Drag Conveyors, and Bucket Elevators." CEMA encourages acquisition and use of this source of safety information to supplement your safety program.

SEE NEXT PAGE FOR SAFETY LABELS

The CEMA safety labels shown below should be used on screw conveyors, drag conveyors, and bucket elevators. Safety labels should be placed on inlets, discharges, troughs, covers, inspection doors & drive guards. See CEMA Safety Label Placement Guidelines on CEMA Website: www.cemanet.org



**PROMINENTLY DISPLAY THESE SAFETY LABELS
ON INSTALLED EQUIPMENT**
SEE PREVIOUS PAGE FOR SAFETY REMINDERS

Note: Labels alone do not substitute for a thorough in-plant safety training program centered on the hazards associated with operating your installed equipment.

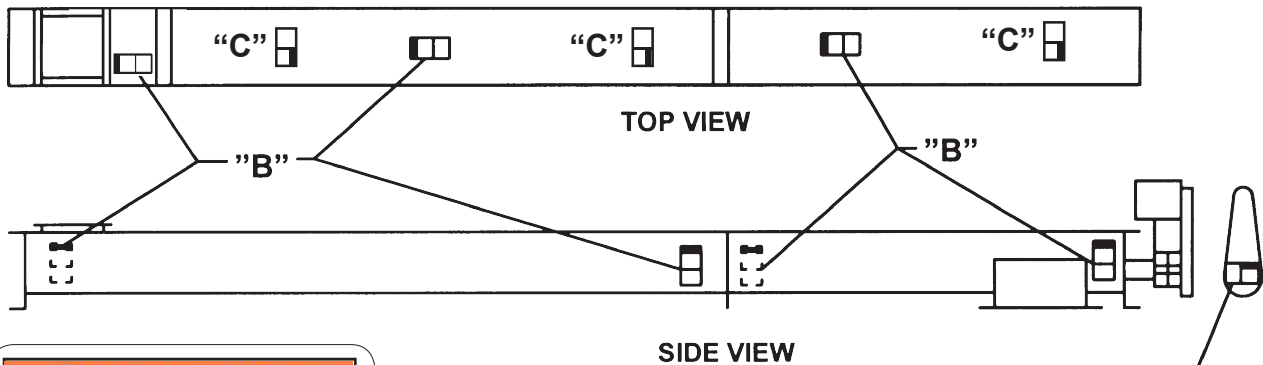
Contact CEMA or Your Equipment Manufacturer for Replacement Labels

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Product: Bulk Handling Equipment

Equipment: Screw Conveyor - SC-2



"B"

To be placed on inlets and discharges, troughs, covers, and inspection doors of screw conveyors to provide warning against exposed moving parts while in operation.

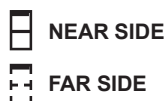


"A"



"C"

To be placed on removable guards to warn that operation of the machinery with guards removed would expose chains, belts, gears, shafts, pulleys, couplings, etc. which create hazards

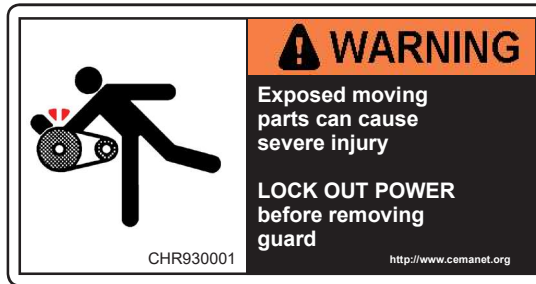
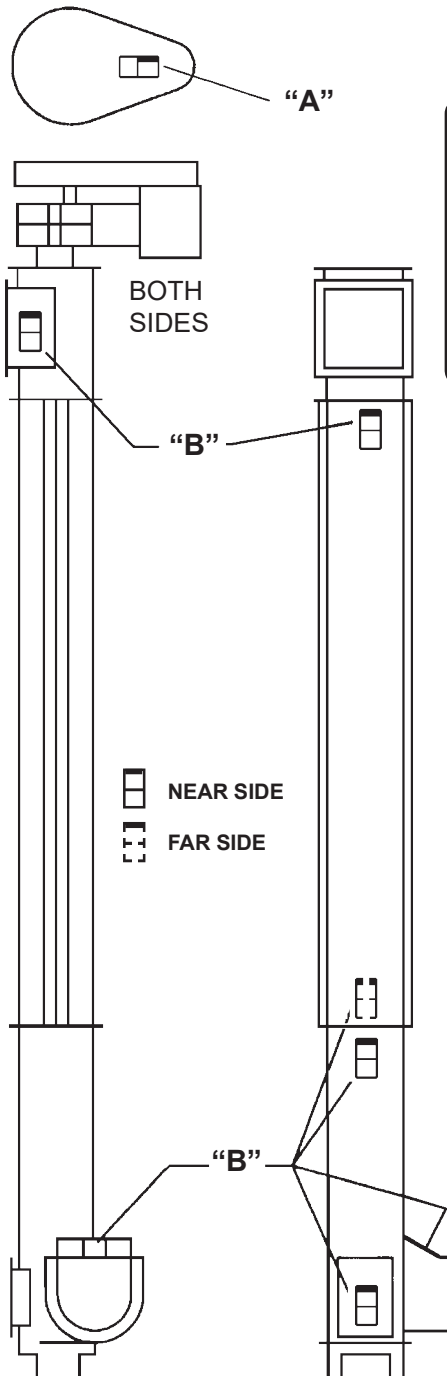


USE LABEL "A" ON BELT GUARD
USE LABEL "B" ON ENDS OF TROUGH, MIDDLE OF COVERS AND AT INLET OPENING.
USE LABEL "C": ON TOP OF COVERS

Product: Bulk Handling Equipment

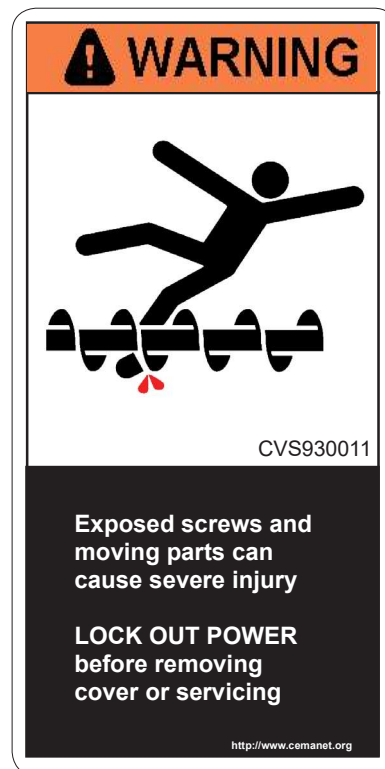
Equipment: Vertical Screw Conveyor - SC-3

USE LABEL "A" ON BELT GUARD
USE LABEL "B" ON ENDS OF TROUGH,
ON INTAKE INSPECTION DOOR, AND BOTH SIDES OF DISCHARGE SPOUT



"A"

To be placed on removable guards to warn that operation of the machinery with guards removed would expose chains, belts, gears, shafts, pulleys, couplings, etc. which create hazards



"B"

To be placed on inlets and discharges, troughs, covers, and inspection doors of screw conveyors to provide warning against exposed moving parts while in operation.

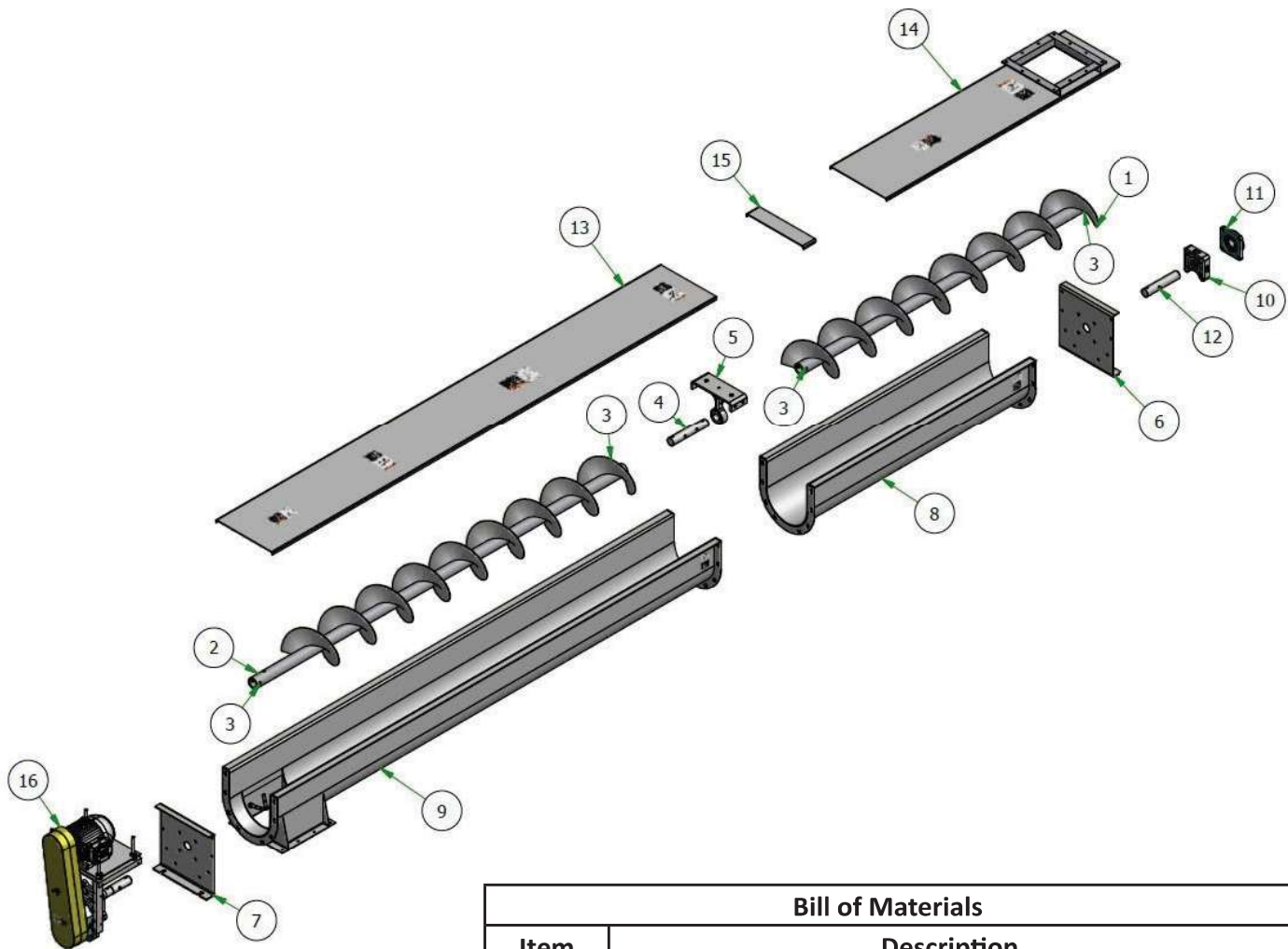


Screw Conveyors



 <p>Do Not Climb, Sit, Stand or Walk, On Conveyor At Any Time</p>	 <p>Do Not Perform Maintenance on Conveyor Until Electrical, Air, Hydraulic and Gravity Energy Sources Have Been Locked Out and Blocked</p>	 <p>Operate Equipment Only With All Approved Covers and Guards in Place</p>
 <p>LOCK OUT ALL Power and Block Gravity Loads Before Servicing</p>	 <p>Ensure That All Personnel Are Clear of Equipment Before Starting</p>	 <p>Allow Only Authorized And Trained Personnel To Operate or Maintain Conveyors and Accessories</p>
 <p>Keep Clothing, Body Parts, and Hair Away from Conveyors</p>	 <p>Clean Up Spillage Near Moving Parts ONLY When the Power Is Locked Out AND Guards Are In Place</p>	 <p>DO NOT Modify Conveyor or Controls</p>
 <p>Ensure That All Controls are Visible and Accessible</p>	 <p>Operate Equipment Only With All Approved Covers, Guards, and Safety Labels In Place</p>	 <p>Report All Unsafe Conditions</p>

POST IN PROMINENT AREA



Bill of Materials	
Item	Description
1	Screw
2	Screw with Bare Pipe at Discharge
3	Coupling Bolts (Not Shown)
4	Coupling Shaft
5	Hanger with Bearing
6	Tail End Trough End
7	Trough End for Screw Conveyor Drive
8	Trough End for Screw Conveyor Drive
9	Trough with Discharge Spout
10	Seal
11	Bearing
12	Tail Shaft
13	Flanged Cover
14	Flanged Cover with Inlet
15	Buttstrap
16	Screw Conveyor Drive Unit with Motor Mount, V-Belt



RECEIVING

1. Screw conveyors may be ordered as individual components with all the assembly operations performed in the field, or assembled completely by the manufacturer, with drawings and bill of materials.
2. Immediately upon receipt all items in the shipment should be checked against shipping papers for shortages and inspected for damage.
3. Items to be inspected include troughs, screws, covers and drive units.
4. DO NOT ATTEMPT TO INSTALL DAMAGED COMPONENTS OR ASSEMBLIES.

LIFTING AND MOVING

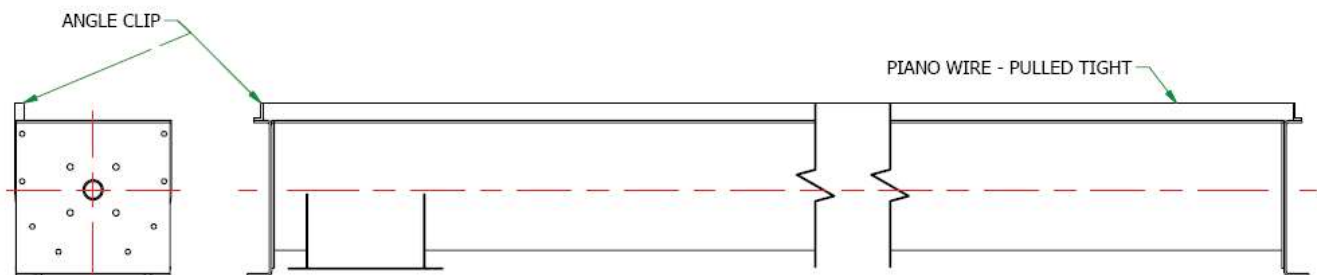
1. Extreme care must be taken to prevent damage when moving assembled conveyors or components.
2. Spreader bars with slings are the recommended support method for lifting.
3. Unsupported span should be no greater than 12'.
4. NEVER LIFT A CONVEYOR WITH ONLY ONE SUPPORT POINT.
5. Unusually heavy items such as drives or gates shall be considered when choosing support points because of load balance and their bending effect.
6. Shop assembled conveyors are typically match marked and shipped in the longest sections for practical shipment.

ASSEMBLY

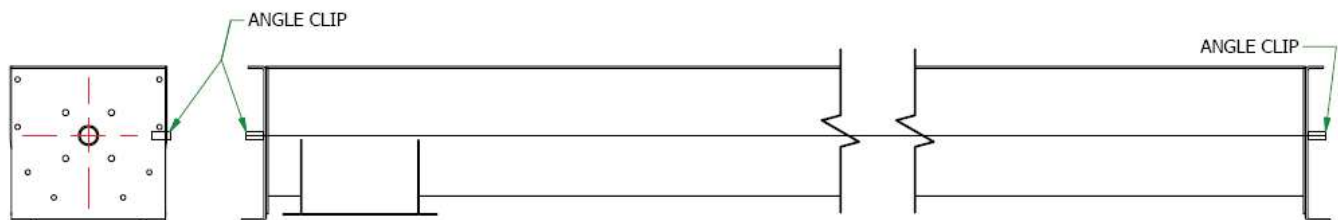
1. The mounting surface for supporting the conveyor must be level and true.
2. Screw conveyor troughs must be assembled straight and true with no distortion.
3. Place troughs in proper sequence with discharge spout properly located.
4. Connect the joints loosely. DO NOT TIGHTEN BOLTS.
5. Assemble each trough end to proper end of conveyor.
6. Attach piano wire full length of conveyor at centerline. Make sure piano wire is pulled tight. Refer to *Figure 1* at the end of this section.
7. Tighten trough flange bolts keeping the trough assembly true to piano wire. Alignment must be checked in both horizontal and vertical directions. Maximum deviation in either direction at any point along the length of the conveyor is 1/8". Torque bolts to proper torque rating per Chart A.
8. Anchor trough assembly to mounting surface. Make sure entire length of trough is straight and true. CEMA recommends supporting trough assemblies every 10' to 12'. Saddles and feet may be required.
9. Mount drive or thrust unit on correct trough end. Drive or thrust units are normally located at discharge end of conveyor. Make sure drive or thrust unit is centered in seal and trough end openings. Torque bolts to proper torque rating per Chart A.
10. Place the first screw section in the trough starting at the drive or thrust end. Install screw so end lugs are opposite carrying side of flight.
11. Insert screw onto drive shaft and install coupling bolts. DO NOT TIGHTEN COUPLING BOLTS.
12. Insert coupling shaft into opposite end of screw and install coupling bolts. DO NOT TIGHTEN COUPLING BOLTS.
13. Pull screw section away from drive or thrust unit to seat thrust connection.
14. Insert hanger onto coupling shaft.
15. Raise hanger and screw section until hanger top bar is flush with top of trough. Make sure correct clearance exist between outside diameter of screw and inside of trough. Match mark and drill troughs to mount hanger assembly. Insert hanger assembly bolts and hand tighten.
16. Assemble screw sections, couplings and hangers until all are installed by repeating steps 10 through 15. Install screw sections so flighting is 180 degrees from end of flighting of previous screw section.
17. Center hanger bearings between screw sections. Torque hanger assembly bolts to proper torque rating per Chart A.
18. Assemble seal and bearing to opposite trough end. Make sure end shaft is centered in seal and trough end openings. Torque bolts to proper torque rating per Chart A.

19. Insert end shaft thru BOLTS.
20. Rotate entire screw assembly to check alignment and adjust hanger assemblies as required.
21. Torque ALL coupling bolts to proper torque rating. Over tightening of coupling bolts could result in failure in tension. CEMA recommends tightening coupling bolts to 75% of the values given in the **Bolt Torque Guide** (Chart A) to eliminate over tightening of coupling bolts.
22. Adjust seals as required.
23. Remove all debris from conveyor.
24. Install covers in proper sequence starting at inlet end and attach with provided fasteners.
25. Lubricate drive and all bearings in accordance with manufacturer's instructions. DRIVES GENERALLY SHIPPED WITHOUT OIL.
26. MAKE SURE ALL CEMA SAFETY LABELS ARE IN PROPER LOCATIONS.

DO NOT TIGHTEN COUPLING



CEMA COMMONLY USED PIANO WIRE SETUP
PIANO WIRE ATTACHED TO TOP OF CONVEYOR ON SIDE



OPTIONAL PIANO WIRE SETUP
PIANO WIRE ATTACHED TO CENTERLINE OF CONVEYOR ON SIDE

Figure 1 - Piano Wire Setup Diagrams

Proper equipment alignment is critical to successful long-term operation. Alignment must be checked in both horizontal and vertical directions. Maximum deviation in either direction is 1/8". Please refer to the manufacturer's Operations and Maintenance Manual for additional information.

BEFORE INITIAL START-UP

1. LOCKOUT/TAGOUT ALL POWER.
2. Lubricate all bearings in accordance with manufacturer's instructions.
3. Lubricate all gear reducers in accordance with manufacturer's instructions. Gear reducers are normally shipped without lubrication.
4. Check conveyor to ensure all tools and foreign materials have been removed.
5. Turn drive unit by hand to check for alignment and obstructions.
6. Check conveyor to ensure all covers, guards and safety devices are installed and operating properly.
7. Attach gates to inlet and discharge chutes, where applicable.

INITIAL START-UP (WITHOUT MATERIAL)

1. Reenergize power to conveyor.
2. Start conveyor momentarily to check for proper conveyor rotation. If conveyor rotation is NOT correct, quickly shutdown and have qualified electrician change wiring.
3. Operate conveyor without material for several hours as a break in period. Observe for excessive bearing temperature, unusual noise or drive misalignment. If these conditions occur refer to Troubleshooting Section of this document.
4. Stop the conveyor and LOCKOUT/TAGOUT ALL POWER.
5. Remove covers and check tightness of coupling bolts. Torque bolts to proper torque rating. Over tightening of coupling bolts could result in failure in tension. CEMA recommends tightening coupling bolts to 75% of the values given in the **Bolt Torque Guide** (Chart A) to eliminate over tightening of coupling bolts. Replace covers.
6. Check all assembly and mounting bolts. Torque bolts to proper torque rating.
7. Check conveyor discharge. Discharge must be clear to ensure that material flow out of conveyor will not be impeded.

INITIAL START-UP (WITH MATERIAL)

1. Reenergize power to conveyor.
2. Start conveyor and operate without material for several minutes.
3. Feed material gradually until design capacity is reached.
4. DO NOT EXCEED CONVEYOR SPEED, CAPACITY AND MATERIAL DENSITY.
5. Start and stop conveyor several times. Operate conveyor for several hours with material.
6. Check motor amperage when conveying at design capacity and compare to full load amperage of motor. Problems may exist if amperage is excessive. Check voltage to ensure that it is within normal operating limits.
7. Stop the conveyor and LOCKOUT/TAGOUT ALL POWER.
8. Remove covers and check tightness of coupling bolts. Torque bolts to proper torque rating. Over tightening of coupling bolts could result in failure in tension. CEMA recommends tightening coupling bolts to 75% of the values given in the **Bolt Torque Guide** (Chart A) to eliminate over tightening of coupling bolts.
9. Check hanger bearings and realign if necessary.
10. Replace covers.
11. Check all assembly and mounting bolts. Torque bolts to proper torque rating per Chart A.

Practice good housekeeping. Keep area around conveyor clean and free of obstacles to provide easy access and to avoid interference with the function of the conveyor.

Establish routine periodic inspection of the entire conveyor to ensure continuous maximum operating performance.

LOCKOUT/TAGOUT ALL POWER BEFORE INSPECTION OF CONVEYORS. Periodic inspections should be made of the following:

- Bearings – Check for proper lubrication. Lubricate all bearings in accordance with manufacturer's instructions. Check hanger bearings for proper alignment and excessive wear. Replace hanger bearings when wear exceeds 1/8".
- Gear Reducers – Check for proper lubrication. Lubricate all gear reducers in accordance with manufacturer's instructions.
- Drives – Check for wear on belts and proper tension. Check for lubrication on chains and proper tension. Replace belts or chains as necessary.
- Screws – Check for damage, excessive wear and material buildup. Replace screw sections as necessary.
- Troughs – Check for damage, excessive wear and material buildup. Check trough alignment using piano wire as described in Installation Section of this document. Replace trough sections as necessary.
- Shafts – Check for bolt hole elongation and wear. Check for run-out. Replace shafts when wear exceeds 1/8".
- Seals – Check for leakage. Adjust seal or replace packing as necessary.
- Coupling Bolts – Check for wear. Replace worn coupling bolts as necessary. It is recommended to replace coupling bolts and lock nuts when replacing screw sections. Torque ALL coupling bolts to proper torque rating. Over tightening of coupling bolts could result in failure in tension. CEMA recommends tightening coupling bolts to 75% of the values given in the **Bolt Torque Guide** (Chart A) to eliminate over tightening of coupling bolts.
- Assembly Bolts – Check for tightness. Torque ALL assembly bolts to proper torque rating per Chart A.
- Guards – Check for clearance and bolt tightness. Check oil level on oil-tight guards.

REPLACING SCREW CONVEYOR COMPONENTS

1. LOCKOUT/TAGOUT ALL POWER
2. Removal of a screw section must proceed from the end opposite the drive or thrust unit.
3. Remove trough end, screw sections, coupling shafts and hangers until the damaged screw section is reached and removed.
4. Reassemble conveyor components in accordance with the Installation Section of this document.

NOTE: Quick disconnect screws can be removed at intermediate locations without first removing adjacent sections.



EMERGENCY SHUTDOWN

An emergency shutdown may be necessary to clear obstructions or to replace damaged or worn components.

1. LOCKOUT/TAGOUT ALL POWER.
2. Remove all covers.
3. Remove all obstructions and product from conveyor.
4. Inspect all components for damage or wear. Check conveyor components in accordance with the Maintenance Section of this document.
5. Replace all damaged or worn components. Replace conveyor components in accordance with the Installation Section of this document.
6. Turn drive unit by hand to check for alignment and obstructions.
7. Replace all covers and guards.
8. Restart conveyor in accordance with the Operation Section of this document.

EXTENDED SHUTDOWN

An extended shutdown may be necessary if the conveyor is not in operation for a long period of time.

1. Operate conveyor until all product is removed.
2. LOCKOUT/TAGOUT ALL POWER.
3. Remove all covers.
4. Remove all obstructions and product from conveyor.
5. Inspect all components for damage or wear. Check conveyor components in accordance with the Maintenance Section of this document.
6. Replace all damaged or worn components. Replace conveyor components in accordance with the Installation Section of this document.
7. Lubricate drive and all bearings in accordance with manufacturer's instructions.
8. Coat all exposed metal surfaces with rust preventative.
9. Rotate screws by hand every week. Screws may sag and permanently deform if not rotated.

NOTE: When operation is to resume, restart conveyor in accordance with the Operation Section of this document.

STORAGE

1. Protect conveyor from weather, moisture and extreme temperatures. DO NOT use coverings that promote condensation.
2. Coat all exposed metal surfaces with rust preventative.
3. Rotate screws by hand every week. Screws may sag and permanently deform if not rotated.

NOTE: When operation is to resume, restart conveyor in accordance with the Operation Section of this document.

PROBLEM	CAUSE	REMEDY
1. ACCELERATED FLIGHT WEAR	FLIGHT THICKNESS TOO LIGHT	INCREASE FLIGHT THICKNESS. USE ABRASION RESISTANT MATERIALS OR HARDFACING.
	RPM TOO HIGH OR TROUGH LOADING TOO HIGH	REDUCE SPEED. CONSULT ANSI/CEMA 350 BOOK TO DETERMINE RECOMMENDED SPEED AND TROUGH LOADING.
2. HANGER BEARING FAILURE	INCORRECT ALIGNMENT	REALIGN TROUGH ASSEMBLY AND HANGERS IN ACCORDANCE WITH ASSEMBLY SECTION OF THIS DOCUMENT.
	IMPROPER SPEED AND TROUGH LOADING	CONSULT ANSI/CEMA 350 BOOK TO DETERMINE RECOMMENDED SPEED AND TROUGH LOADING.
	IMPROPER HANGER BEARING MATERIAL	CONSULT ANSI/CEMA 350 BOOK TO DETERMINE RECOMMENDED BEARING MATERIAL.
	EXCESSIVE BEARING WEAR	REPLACE HANGER BEARING.
3. PREMATURE TROUGH FAILURE	TROUGH THICKNESS TOO LIGHT	INCREASE TROUGH THICKNESS. USE ABRASION RESISTANT MATERIAL. CONSULT ANSI/CEMA No. 350 TO DETERMINE RECOMMENDED TROUGH THICKNESS.
	SCREW DEFLECTION	CONSULT ANSI/CEMA No. 350 TO DETERMINE PROPER PIPE SIZE AND SCREW LENGTH.
	BENT SCREW	STRAIGHTEN OR REPLACE SCREW.
4. SHAFT HOLE ELONGATION	INSUFFICIENT NUMBER OF COUPLING BOLTS	INCREASE NUMBER OF COUPLING BOLTS.
	CONVEYOR SUBJECT TO FREQUENT STOP/START	CEASE FREQUENT STOP/START. INCREASE BEARING CAPACITY OF SHAFT AND/OR INCREASE NUMBER OF COUPLING BOLTS.
	FREQUENT OVERLOADS	
5. DRIVE SHAFT BREAKAGE	EXCESSIVE TORQUE	CONSULT ANSI/CEMA No. 350 TO DETERMINE PROPER TORQUE RATING.
6. MOTOR OVERLOAD	MOTOR UNDERSIZED	CONSULT ANSI/CEMA STANDARD No. 350 TO DETERMINE PROPER HORSEPOWER REQUIREMENTS.
	UPSET LOADING CONDITION	EMPTY TROUGH, CONTROL FEED AND OPERATE UNDER DESIGN SPECIFICATIONS.

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SCREW CONVEYOR
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PROBLEM	CAUSE	REMEDY
7. TROUGH END BEARING FAILURE	BEARING CONTAMINATION	UPGRADE OR REPLACE SEAL. CHANGE TO OUTBOARD BEARING.
	INSUFFICIENT LUBRICATION	LUBRICATE IN ACCORDANCE WITH MAINTENANCE SECTION OF THIS DOCUMENT.
	IMPROPER SHAFT RUNOUT	CHECK SCREW STRAIGHTNESS AND REPLACE AS NECESSARY.
8. COUPLING SHAFT BREAKAGE	EXCESSIVE TORQUE	CONSULT ANSI/CEMA No. 350 TO DETERMINE PROPER TORQUE RATING.
	INCORRECT ALIGNMENT	REALIGN TROUGH ASSEMBLY AND HANGERS IN ACCORDANCE WITH ASSEMBLY SECTION OF THIS DOCUMENT.
	EXCESSIVE SHAFT WEAR	REPLACE COUPLING SHAFT.


GENERAL BOLT TIGHTENING TORQUE (ft-lbs)

Bolt Diameter (in)	Threads Per (in) (UNC)	SAE 2	SAE 5	SAE 8	18-8 & 316 Stainless Steel
1/4	20	5	9	12	6
5/16	18	11	18	25	11
3/8	16	18	31	44	20
7/16	14	28	49	69	29
1/2	13	44	73	105	40
9/16	12	63	108	149	52
5/8	11	96	147	212	86
3/4	10	158	252	351	115
7/8	9	219	389	552	180
1	8	316	589	784	240

All bolted applications should be evaluated to determine optimum tightening torque.

K factor in the formula below is considered an estimate.

The most commonly used K factor is 0.20 for plain finished bolts.

Formula: $T = K \times D \times P$

- T Target tighten torque (the result of this formula is in-lbs, dividing by 12 yields ft-lbs)
- K Coefficient of friction (nut factor), always an estimation in this formula
- D Bolts nominal diameter (in)
- P Bolt's desired tensile load (in-lbs) (generally 75% of yield strength)

$$P \text{ (lbs)} = (75\%) \text{ Yield Strength} * \text{Tensile Stress Area}$$

Bolt Torque Guide is for fasteners used to assemble screw conveyors and does not include coupling bolts. Over tightening of coupling bolts could result in failure in tension.

CEMA recommends tightening coupling bolts to 75% of the values given in the Bolt Torque Guide to eliminate over tightening of coupling bolts

Intelligent Drivesys

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B1000

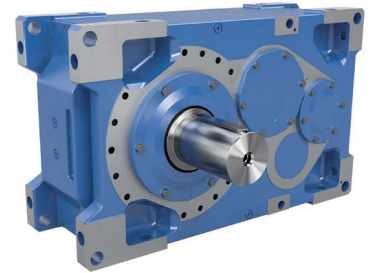
Operating & Instruction Manuals
For Gear Units





NORD Delivers

NORD offers full-featured drive solutions that can tackle the toughest requirements. All components are carefully selected and precisely configured to meet your exact specifications. In the rare case that standard components won't meet your needs, our in-house engineering team will work with you to design custom components or a complete customized system.



Reduce Lead Times and Decrease Inventory

- ▶ 25% of orders ship same day or next day with NO expedite fees
- ▶ 47% of orders ship within 5 working days
- ▶ 81% of orders ship in 2-3 weeks



Global Product Designs, Standards, and Support

- ▶ Innovative product range (one-stop shop)
- ▶ Global connected presence
- ▶ Mechanical and electrical application engineers ready to assist you
- ▶ Online resources



Increase Efficiency and Reduce Operation Costs

- ▶ First-class customer service and support, plus myNORD online tools
- ▶ Product flexibility through standard components and customizations
- ▶ Program personalization, such as weekly shipment schedules and custom nameplates
- ▶ Partner with a company that is easy to do business with and wants to see you succeed!





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TITLE	Document Number & Hyperlink
General Instructions	U10000
Safety Notes	U10020
Storage & Commissioning	U10040
Unit Installation	U10060
Solid Shaft Connections	U10250
Keyed Hollow Shaft	U10270
Shaft Fixing Kit	U10280
Hollow Shaft With Shrink Disc	U10290
NORD GRIPMAXX™	U10310
Reducer Mounting Footed & Flange Mount Gear Units	U10500
Clincher™ Shaft-Mount With Rubber Buffers	U10580
Right Angle Shaft-Mount with Torque Arm (D)	U10600
90.1 Helical-bevel shaft-mount with Bottom Mount Torque Arm (K)	U10620
Helical & Bevel Reducer Lubrication	U10750
Conveyor Drive Reducer lubrication	U10751
Conveyor Drive Extended Bearing Lubrication	U10752
VL2 & VL3 Extended Bearing Lubrication	U10760
Helical Worm Reducer Lubrication	U10770
Minicase™ (SM) Worm Reducer Lubrication	U10790
Minicase™ (SMI/SMID) Worm Reducer Lubrication	U10800
FLEXBLOC™ Worm Reducer Lubrication	U10810
Expansion Chambers Installation & Maintenance Manual	U10830
Helical & Bevel Reducer Lubrication Types	U11000
Conveyor Drive Lubrication Information	U11001
Helical Worm Reducer Lubrication Types	U11020
Minicase™ (SM) Worm Reducer Lubrication Types	U11040
Minicase™ (SMI/SMID) Worm Reducer Lubrication Types	U11050
FLEXBLOC™ Worm Reducer Lubrication Types	U11060
Standard In-Line Footed Oil Fill Quantities	U11500
Standard In-Line Flanged Oil Fill Quantities	U11600
Helical In-Line Footed Oil Fill Quantities	U11700
Helical In-Line Flanged Oil Fill Quantities	U11800
CLINCHER™ Oil Fill Quantities	U11900
90.1 Helical-Bevel Footed Oil Fill Quantities	U12000
90.1 Helical-Bevel Flanged Oil Fill Quantities	U12100
92 Series Helical-Bevel Footed Oil Fill Quantities	U12200
92.1/93.1 Series Helical Bevel Oil Fill Quantities	U12205
92 Series Helical-Bevel Flanged Oil Fill Quantities	U12300
Helical-Worm Footed Oil Fill Quantities	U12400
Helical-Worm Solid Shaft/Flanged Oil Fill Quantities	U12500
Helical-Worm Hollow Shaft Oil Fill Quantities	U12600

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TITLE	Document Number & Hyperlink
Nordbloc Footed Oil Fill Quantities	U12700
Nordbloc Flanged Oil Fill Quantities	U12800
Nordbloc.1 Footed Oil Fill Quantities	U12900
Nordbloc.1 Flanged Oil Fill Quantities	U13000
Minicase™ (SM) Footed Oil Fill Quantities	U13100
Minicase™ (SMI) Footed Oil Fill Quantities	U13150
Minicase™ Flanged (SM) Oil Fill Quantities	U13200
Minicase™ Flanged (SMI) Oil Fill Quantities	U13250
FLEXBLOC™ Oil Fill Quantities	U13300
Standard In-Line Oil Plug & Vent Locations	U14000
Helical In-Line Oil Plug & Vent Locations	U14100
CLINCHER™ Oil Plug & Vent Locations	U14200
92 Series Helical-Bevel Oil Plug & Vent Locations	U14300
92.1/93.1 Series Helical-Bevel Oil Plug & Vent Locations	U14305
90.1 Helical-Bevel Oil Plug & Vent Locations	U14400
Conveyor Drive Oil Plug & Vent Locations	U14401
Helical-Worm Oil Plug & Vent Locations	U14500
Nordbloc Oil Plug & Vent Locations	U14600
Nordbloc.1 Oil Plug & Vent Locations	U14700
Minicase™ (SMI) Worm Oil Plug & Vent Locations	U14750
FLEXBLOC™ Vent Locations	U14800
Troubleshooting	U19000
Titan Adjustable Speed Drives	U21005
Nordisc Adjustable Speed Drives	U21010
Motors - AC Induction, Single and Polyphase	U30000
Motor Brakes Installation & Maintenance	U35000
Fast Acting Brake Rectifiers [GPE, GPU & PMG]	U35100
Current sensing relay	U35200
NEMA/IEC/SERVO Inputs Adapters & Their Couplings	U45100
NEMA or IEC Input Adapter Lubrication Options	U45250
NEMA or IEC Input Adapter with Grease Fitting	U45255
Solid Input Shaft [W]	U45300
Motor Mount Platform [MK]	U45400
Sugar Scoop	U45500
NSD tuph Touch-Up Kit	U65100
Terms & Conditions of Sale	Terms

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RETAIN FOR FUTURE USE

1. Importance of the operating instructions

These operating instructions are intended to provide general information and safety guidelines. It is the responsibility of the buyer, machine builder, installer and user of the NORD product to make sure that all the proper safety notes and operating instructions have been reviewed and understood. If the contents of this instruction or any applicable operating instructions are not understood, please consult NORD.



WARNING

Electric motors, gearmotors, electrical brakes, variable frequency drives, and gear reducers contain potentially dangerous high-voltage, rotating-components and surfaces that may become hot during operation. All work involved in the transport, connection, commissioning and maintenance of any NORD product must be carried out by qualified and responsible technicians.

2. Inspect incoming freight

Before accepting shipment from the freight company, thoroughly inspect the NORD equipment for any shipping and handling damage. If any goods called for in the bill of lading or express receipt are damaged, or if the quantity is short, do not accept until the freight express agent makes an appropriate notation on your freight bill or express receipt. If any concealed loss or damage is discovered later, notify your freight carrier or express agent at once, and request a formal review of your claim.

Claims for loss or damage in shipment must not be deducted from the NORD invoice, nor should payment of the NORD invoice be withheld awaiting adjustment of such claims, as the carrier guarantees safe delivery. NORD will try to assist in collecting claims for loss or damage during shipment; however, this willingness on our part does not remove the transportation company's responsibility in reimbursing you for collection of claims or replacement of material.

3. Obtaining order specific user manuals and spare parts lists

One can receive the detailed installation and maintenance instructions by entering a serial number (or NORD order number) at the appropriate location on the NORD web site.

- Record the serial number from your gearmotor, gear reducer, or motor nameplate, or record the serial number found on your order confirmation.
- Go to <https://shop.nord.com/US-en/mynord/documentcenter> to download the appropriate operating instructions.
- Obtain order-specific parts lists and place orders online via the Parts shop at <https://shop.nord.com/US-en/home>

EXAMPLE: <https://shop.nord.com/US-en/mynord/documentcenter>

Home ► myNORD ► Online Service ► Serial Number Lookup

201360663-100 EN-US - English (United States)

Type	Name	Pages	Filesize	Download
PDF	Complete Manual for 201360663-100	5	1.14 MB	↓
ZIP	All Manuals for 201360663-100		454.10 KB	↓

► Manuals (1)

Detail

Order Number: 201360663-100

Product Name: Standard helical gearbox

NORD Model Type: SKOF-71L4 TF F T14

Ratio: 7,71

Mounting Position: M1

Lubricant: ISO VG 220 mineral oil

Lubrication Qty: 0,130 L

4. Intended use

NORD is a supplier of electric motors, gearmotors, reducers, electromechanical brakes, mechanical variators, and electrical variable frequency drives that are intended for commercial installations on larger systems and machines.



WARNING

NORD does not accept any liability for damage or injury caused by:

- Inappropriate use, operation or adaptation of the drive system.
- Unauthorized removal of housing covers, safety and inspection covers, guarding, etc.
- Unauthorized modifications to the drive system.
- Improper servicing or repair work on the drive system.
- Damage caused during shipment or transportation.
- Disregard of the important Safety Notes or Operating Instructions.

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PARTS**



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5. Notes concerning warranty and liability

All units are supplied according to the terms described in our standard "Conditions of Sale." The unit limited warranty is also defined in our "Conditions of Sale" and is located in the back of our product catalogs as well as the back of your order invoice.

All NORD Safety Notes and all related NORD Operating instructions shall be considered up-to-date at the time in which they were compiled by the buyer, machine builder, installer or user. NORD reserves the right to incorporate technical modifications and information updates to any safety/operating instructions that are within the scope of providing additional knowledge or clarification, communicating design changes, or product enhancements. Information updates may include any NORD product, or subsequent products purchased and supplied by NORD; No specific claims can be derived from the information or illustrations and descriptions contained in the safety notes or related operating instructions.



WARNING

NORD assumes no liability for personal injury, equipment damage or malfunctions resulting from failure to comply with any installation safety notes. The applicable national, regional, and local work regulations and safety requirements must also be complied with. Failure to comply with any safety notes or regulations may result in serious injury, damage to property, or even death.

6. Checklist for installation and operation

- ☒ Verify that the purchased NORD product has been supplied with the expected accessories & options. Check the received goods and packing slip to make sure items are properly received.
- ☒ Make sure that you have all of the required Operating Instructions for your NORD electric motor, gearmotor, reducer, electromechanical brake, mechanical variable speed drives, or electrical variable frequency drives.
- ☒ Consult NORD if you feel you are missing any documentation or if you have questions.



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1. Safety & information symbols

All work including transportation, storage, installation, electrical connection, commissioning, servicing, maintenance and repair must be performed **only by qualified specialists or personnel**. It is recommended that repairs to NORD Products are carried out by the NORD Service Department. Instructions related to operational safety will be emphasized as shown.

Symbol	Meaning
	Danger, Caution or Warning - Severe risk or danger of personal injury or death by working around dangerously high electrical voltage or moving machinery. Proper safety precautions must be taken.
NOTICE	Notice - Care must be taken to avoid the possibility of damaging the drive unit, driven machine, or the environment.
	Important Note - Useful note or tip to help assure trouble-free operation.
	Material Disposal Note - Important note concerning suggested material disposal.

2. Safety warnings

	DANGER
<ul style="list-style-type: none"> 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! Gear unit installation and maintenance work may only be performed when no power is available to the prime mover or motor. Electric motors, electrical brakes, and variable frequency drives, contain potentially dangerous high-voltage. Prior to installation or maintenance, shut down the power at the circuit breaker or power switch. While working on the drive, make sure the power from the prime mover is isolated or secured on "lock-out" to prevent accidental start-up and to safeguard against injury! Surfaces of motors and gear units may become hot during operation or shortly after start-up. In some instances additional protection against accidental contact may be necessary. Use caution to avoid burns or serious injury! 	

3. Observe published performance range & nameplate data

NOTICE

Observe the data on all reducer nameplates and verify published ratings for the NORD item/s in question. Do not operate any NORD equipment outside the published performance range. Failure to comply may result in damage to the drive unit, driven machine, or the environment.

U.S. Nameplate

NORD GEAR CORPORATION-USA / WWW.NORD.COM	
SK ①	
S/N ②	
RATIO ③	SF ④
TORQUE ⑤	LB-IN
SPEED ⑥	RPM
⑦ MTG POS	
UNIGASE™	

- ① Model/Type
- ② Serial Number
- ③ Gear Ratio
- ④ Service Factor
- ⑤ Torque Rating
- ⑥ Output Speed RPM
- ⑦ Mounting Position

European Nameplate

Getriebebau NORD GrbH&Co KG D - 22934 Bargteheide	
Type	SK ①
No.	②
i=	③
n2=	④ min ⁻¹
Siehe Wartungsanleitung See maintenance instructions Voir instructions d'entretien	

- ① Model/Type
- ② Serial Number
- ③ Gear Ratio
- ④ Speed

4. Transportation and handling

Make sure that all eyebolts and lifting lugs are tight and lift only at designed points. Protect the mounting surface from possible damage during transportation.



WARNING

Do not attach other machinery or loads to the NORD assembly, the supplied lifting bolts are not designed for this purpose and may result in drive damage or personal injury.

If the gearmotor or assembly is equipped with two suspension eye bolts, then both locations should be used for transportation and placement of the unit; in this case the tension force of the slings must not exceed a 45° angle.

In some instances it may be appropriate to use additional lifting straps or slings in order to assure safe transportation of the assembly. Always use sufficiently rated handling equipment and ensure that adequate safety measures are taken to protect personnel from injury during transportation. Once the NORD assembly is properly installed, remove the transportation fixtures.

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PARTS**



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5. DISPOSAL



MATERIAL DISPOSAL

Properly dispose of all used gear units and internal parts in accordance with all local regulations. In particular, all lubricants must be properly collected and disposed.

For confirmation of specific materials used in a specific reducer or gearmotor assembly, please consult NORD with the appropriate unit identification or serial number.

Components	Material
Gear wheels, shafts, rolling bearings, parallel keys, snap rings, spacers, shims, etc.	Steel
Gear housing and housing components	Cast iron or Aluminum (depending on type and size)
Worm gears	Bronze alloy
Radial seals, sealing caps, and rubber components	Elastomers with some steel
Coupling components	Plastic or Elastomer with Steel
Housing gaskets and flat oil seals	Asbestos-free sealing or gasket material (various types used)
Gear Oil	Mineral, SHC-Synthetic or PG-Synthetic (can vary)



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1. Storage



IMPORTANT NOTE

For storage periods longer than 9 months, or for storage in less than desirable conditions, please consult NORD for recommendations.

Storage for up to 9 months is possible, so long as the following conditions are observed:

- Store the gear unit in its actual mounting position in accordance with the specified oil fill-level, in a clean and dry temperature controlled area. Avoid temperature fluctuations within the range of 0°C and 40°C (32°F to 104°F) and avoid relative humidity conditions in excess of 60%.
- Protect all exposed or unpainted shaft and flange surfaces with an anti-corrosion agent or grease.
- Store in a location free from shock and vibration, to avoid false brinelling of bearing elements and raceways.
- Whenever possible, rotate the shafts periodically, by hand if necessary, to help prevent brinelling (bearing damage) and to help keep the shaft seals pliable.
- Avoid direct exposure to the sun or UV light and aggressive or corrosive materials in the environment (ozone, gases, solvents, acids, caustic solutions, salts, radioactivity, etc).

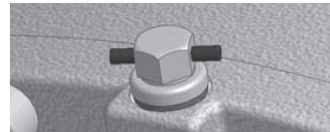
2. Commissioning

Prior to gear unit start-up, complete the following:

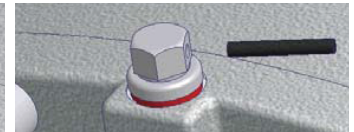
- Please check your gear unit for a vent and if applicable to your product, remove the sealing plug to activate.

NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up. Excessive pressure may cause damage to internal gearbox components and leakage.



Sealed vent



Activated vent

- Check the lubricant and be sure the gear unit is filled with the proper oil type, to the proper level, as determined by the mounting position.



IMPORTANT NOTE

Some smaller gear units are supplied as maintenance free/lubricated for life gear units. Oil level may not be checked on some of these units.

- Check the condition of all shaft seals and all assembled flange gasket areas. If any change is detected in the shape, color, hardness or permeability, or if any leaks are detected, the corresponding shaft seals and/or gaskets must be replaced.
- Remove all anti-corrosive metal protectant from otherwise bare metal surfaces. Follow product manufacturers directions and warnings during surface protection removal.
- Check the resistance of all motor and brake windings to verify the integrity of the winding insulation and inspect all terminal box openings and wire connection areas to verify that all components are dry and free of corrosion.

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3. Long-Term Storage

By taking special precautions, problems such as seal leakage and reducer failure due to the lack of lubrication, improper lubrication quantity, or contamination can be avoided. The following precautions will protect gear reducers during periods of extended storage:

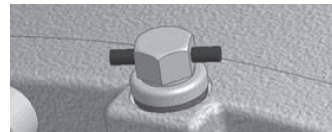
- Store the gear unit in its actual mounting position in accordance with the specified oil fill-level, in a clean and dry temperature controlled area. Avoid temperature fluctuations within the range of 0°C and 40°C (32°F to 104°F) and avoid relative humidity conditions in excess of 60%.
- Fill the reducer full with oil that is compatible with the product normally used or recommended during service.
- Apply grease to all unpainted or unprotected shafts, bores, keyways, flange surfaces, tapped holes, and to the exterior of all oil seals.
- Store in a location free from shock and vibration, to avoid false brinelling of bearing elements and raceways.
- Once every few months rotate the input shaft approximately 10-20 revolutions to redistribute the weight of gears and shafts and to prevent brinelling of the bearings and drying of the seal track.
- Avoid direct exposure to the sun or UV light and aggressive or corrosive materials in the environment (ozone, gases, solvents, acids, caustic solutions, salts, radioactivity, etc.)

4. Commissioning After Long-Term Storage

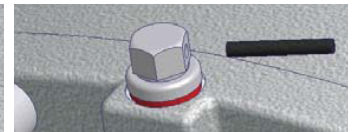
- Please check your gear unit for a vent and if applicable to your product, remove the sealing plug to activate.

NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up. Excessive pressure may cause damage to internal gearbox components and leakage.



Sealed vent



Activated vent

- Remove all anti-corrosive metal protectant from otherwise bare metal surfaces. Follow product manufacturers directions and warnings during surface protection removal.
- Drain the reducer and refill it with the proper type and amount of lubricant.
- Observe start-up and initial operation to make sure there are no seal or gasket leaks, or unusual sounds, vibration or heat rise during operation.
- Check the resistance of all motor and brake windings to verify the integrity of the winding insulation and inspect all terminal box openings and wire connection areas to verify that all components are dry and free of corrosion.



DRIVESYSTEMS

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U10060 - 1 of 2

1. Installation site

Drives must be properly installed if they are to produce the rated torque. Improper installation may lead to oil leaks, reduced life, or even catastrophic failure. NORD gear drives and motors are intended to be installed at a suitable mounting site under the following conditions:

- Unimpeded airflow to and around the units.
- Accessibility to oil drain, level and breather plugs.
- On brakemotors, allow adequate space for removing the fan guard and replacing and adjusting the brake.
- Mounting surfaces must be flat, torsionally rigid, and dampened against vibration.
- Unless special measures are taken, the immediate vicinity around the gear drive or motor should not be exposed to any aggressive or corrosive substances, contaminated air, ozone, gases, solvents, acids, alkalis, salts, radioactivity, etc.

2. Mounting position

Reducer mounting position charts illustrate the standard mounting positions for horizontal and vertical mounting. All gear units are assembled with the oil fill-level, oil-drain and vent plugs installed in their proper locations, **according to the customer-specified mounting position**. For mounting orientations other than shown consult NORD Gear.

NOTICE

Improper oil levels may lead to premature component wear and diminished service life. The gear reducer may not receive proper lubrication if the unit is not mounted in the position for which it is designed. Observe the mounting position designated on the reducer nameplate, or specified in the order acknowledgement. Consult NORD prior to changing mounting position in the field. While it is often possible to simply relocate the oil fill-level and vent locations, and adjust the oil fill amount, in some cases, different mounting positions may lend themselves to different internal construction features.

3. Reducer mounting

- The support foundation must be straight, level and flat. Whether the gear unit is foot-mounted or flange-mounted, NORD recommends that the straightness and flatness of the customer-supplied support foundation follow **Table 1**.
- The gear unit must be properly aligned with the driven shaft of the machine in order to prevent additional stress or load forces from being imposed upon the gear unit.
- To facilitate oil drainage it may be desirable to elevate the gear box foundation above the surrounding support structure.
- All bolting surfaces must be clean and free from contamination and corrosion.

Table 1: Recommended Straightness and Flatness of Customer-Supplied Support Foundation

Above (in)	To & Including (in)	General Tolerance on Straightness & Flatness ISO 2768-2, Tolerance Class K
0.00	0.39	+/- 0.002 in
0.39	1.18	+/- 0.004 in
1.18	3.9	+/- 0.008 in
3.9	11.8	+/- 0.016 in
11.8	39	+/- 0.024 in
39	118	+/- 0.031 in

Above (mm)	To & Including (mm)	General Tolerance on Straightness & Flatness ISO 2768-2, Tolerance Class K
0	10	+/- 0.05 mm
10	30	+/- 0.1 mm
30	100	+/- 0.2 mm
100	300	+/- 0.4 mm
300	1000	+/- 0.6 mm
1000	3000	+/- 0.8 mm

Straightness: Based upon the length of the corresponding line.

Flatness: Based upon the longer lateral surface or the diameter of the circular surface.



IMPORTANT NOTE

The responsibility for the design and construction of the support foundation is with the user. The foundation must be adequate to withstand normal operating loads and possible overloads while maintaining alignment to attached system components under such loads. **Motors and drive components mounted on prefabricated base plates can become misaligned during shipment. Always check alignment after installation.**

4. Steel foundation

An engineered structural steel foundation should be designed to provide adequate rigidity and prevent loads from distorting the housing or causing misalignment of internal gears and shafts. When foot-mounting the gear reducer, a base plate or sole plate with suitable thickness (generally equal or greater than the thickness of the drive feet) should be securely bolted to steel supports and extend under the entire gear drive assembly. When flange-mounting the gear unit, the bulk head plate must be engineered to minimize buckling distortions and support the cantilevered weight of the gear unit or gear motor.

NOTICE

Do not weld on the gear unit or use the gear unit as an earth or ground connection for any welding procedure as this may cause permanent damage to the bearings and gears.

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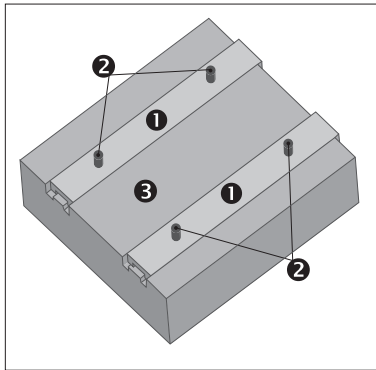
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5. Concrete foundation

If a concrete foundation is used, allow the concrete to set firmly before bolting down the gear drive. Grout structural steel mounting pads and bolts of sufficient size into the concrete, to adequately distribute the load stress onto the concrete foundation.

Figure 1: Concrete Foundation



- ① Grouted Structural Steel Mounting Pads
- ② Mounting Bolts
- ③ Concrete Foundation

6. Bolt connections for footed & flange mounted units

NORD footed reducers and flange-mount reducers (with B5 flange) have clearance designed into the mounting holes to allow for some minor adjustments in alignment. Bolt size, strength and quantity should be verified to insure proper torque reaction capacity whatever the mounting arrangement. Tightening torque for gear reducer mounting bolts, and recommended fastener grades, are provided in Table 2.

Table 2A: Tightening Torque for Inch Reducer Mounting Bolts

Thread Size (in)	Grade SAE 5 / ASTM A449		Grade SAE 8	
	(lb-ft)	(Nm)	(lb-ft)	(Nm)
1/4-20	7.1	9.6	10.0	13.6
5/16-18	16	21	22	30
3/8-16	28	37	39	53
1/2-13	69	93	98	132
5/8-11	138	188	195	264
3/4-10	247	334	348	472
7/8-9	396	537	558	757
1-8	592	802	833	1,130
1 1/8-7	-	-	1,233	1,672
1 1/4-7	-	-	1,717	2,327
1 3/8-6	-	-	2,267	3,073
1 1/2-6	-	-	2,983	4,045
1 3/4-5	-	-	4,458	6,045

- Calculated tightening torques are based a conventional 60°, clean and dry (un-lubricated) thread, with thread-friction and head-friction equal to 0.15.
- When using inch-fasteners, NORD recommends a minimum Grade SAE 5 (ASTM A-449) for sizes up to 1-8 UNC, and Grade SAE 8 for all larger sizes.

Table 2B: Tightening Torque for Metric Reducer Mounting Bolts

Above (mm)	ISO Grade 8.8		ISO Grade 10.9		ISO Grade 12.9	
	(lb-ft)	(Nm)	(lb-ft)	(Nm)	(lb-ft)	(Nm)
M4	2.4	3.2	3.5	4.7	4.1	5.5
M5	4.7	6.4	6.9	9.3	8.1	11
M6	8	11	12	16	14	19
M8	20	27	29	39	34	46
M10	39	53	58	78	67	91
M12	68	92	100	135	110	155
M14	107	145	159	215	180	250
M16	170	230	247	335	290	390
M18	240	325	343	465	400	540
M20	339	460	487	660	570	770
M22	465	630	664	900	770	1,050
M24	583	790	848	1,150	960	1,300
M27	848	1,150	1,217	1,650	1,440	1,950
M30	1,180	1,600	1,660	2,250	1,950	2,650
M36	2,050	2,780	2,884	3,910	3,470	4,710
M42	3,297	4,470	4,639	6,290	5,560	7,540
M48	4,940	6,700	7,010	9,500	8,260	11,200

- Calculated tightening torques are based on a conventional 60°, clean and dry (un-lubricated) thread, with thread-friction and head-friction equal to 0.15.
- When using metric-fasteners, NORD recommends a minimum ISO Grade 8.8 bolt.

7. Mounting the prime mover

When the motor is not flange mounted or integrally mounted to the gearbox, it is important to properly secure and align the gear drive with respect to the driven machine before attempting to align the prime mover or motor.

- After the main gear drive is properly aligned and bolted in place, align the prime mover with respect to the reducer input shaft.
- Use shims under the feet of the prime mover as needed, and secure in place with the proper mounting bolts. Dowel pins may be field-installed to help prevent misalignment and ensure proper realignment if removed for service.



IMPORTANT NOTE

When using a high speed coupling connection between the prime mover and the reducer, check alignment per the coupling manufacturers recommendations. If the coupling is misaligned, the reducer alignment or shimming is incorrect. Re-align the gear reducer and re-check the high-speed coupling alignment before re-aligning the motor.



DRIVESYSTEMS

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U10250 - 1 of 2

1. Solid shaft diameter tolerance

Reducer input and output shaft extensions have a diameter tolerance as specified in Table 1.

Table 1: Solid Shaft Diameter Tolerance

Above ø (in)	To & Including ø (in)	Tolerance (in)
0.375	1.750	+0.0000 / -0.0005
1.750	7.500	+0.0000 / -0.0010

Above ø (mm)	To & Including ø (mm)	Tolerance (mm)	ISO 286-2 Fit Class
10	18	+0.012 / +0.001	k6
18	30	+0.015 / +0.002	k6
30	50	+0.018 / +0.002	k6
50	80	+0.030 / +0.011	m6
80	120	+0.035 / +0.013	m6
120	180	+0.040 / +0.015	m6
180	190	+0.046 / +0.017	m6

2. Fitting drive elements onto the reducer solid shaft

Solid input and output shaft extensions are provided with a drill and tap feature as indicated in Table 2. When installing drive elements such as coupling hubs, pulleys, sprockets, or gears, NORD recommends using the threaded hole in the end of the shaft, along with a suitable assembly device fitted into the threaded hole.

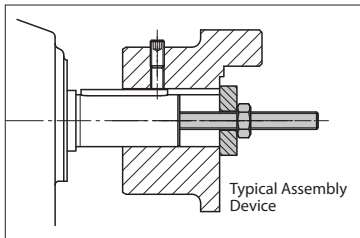


Table 2: Solid Shaft End - Threaded Holes

Above ø (in)	To & Including ø (in)	Tap Size & Depth (in)
0.375	0.500	10-24 x 0.43 in
0.500	0.875	1/4-20 x 0.59 in
0.875	0.938	5/16-18 x 0.71 in
0.938	1.100	3/8-16 x 0.87 in
1.100	1.300	1/2-13 x 1.10 in
1.300	1.875	5/8-11 x 1.42 in
1.875	3.500	3/4-10 x 1.73 in
3.500	7.500	1-8 x 2.63 in
5.125	8.875	1 1/4 - 7 x 3.15*
6.000	8.875	1 3/8 - 6 x 3.46**

Above ø (mm)	To & Including ø (mm)	Tap Size & Depth (mm)
10	13	M4 x 10 mm
13	16	M5 x 12.5 mm
16	21	M6 x 16 mm
21	24	M8 x 19 mm
24	30	M10 x 22 mm
30	38	M12 x 28 mm
38	50	M16 x 36 mm
50	85	M20 x 42 mm
85	130	M24 x 50 mm
130	225	M30 x 60 mm*
130	225	M36 x 74 mm**

* Only used on the SK9096.1 Helical-Bevel Gear Unit.

** Only used on the SK10382.1 & SK11382.1 CLINCHER™ gear units.

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NOTICE

DO NOT DRIVE or HAMMER the coupling hub, pulley, sprocket, or gear into place. An endwise blow to the reducer shaft can generate damaging axial forces and cause damage to the reducer housing, bearings or internal components.



WARNING

To avoid serious injury the user must provide suitable safety guards for all rotating shafts and shaft components such as couplings, chain drives, belt drives, etc. All guarding must adhere to local regulations and safety standards.

3. Installing interference-fit hubs to the reducer shaft

Prior to installing any interference-fit hubs to the reducer shaft, consult with the manufacturer to determine proper assembly and fit. Interference-fits usually require heating the coupling, sprocket or gear hub, per the manufacturer's recommendations. Coupling hub installation typically follows ANSI/AGMA 9002-A86. Always make sure the reducer shaft seals are protected from the heat source. Apply uniform heat to the drive element hub to prevent distortion. NORD does not recommend heating the drive element hub beyond 212°F to 275°F (100°C to 135° C).



WARNING

When using heat to mount a drive element hub, do not use open flame in a combustible atmosphere or near flammable materials. Use suitable protection to avoid burns or serious injury.



IMPORTANT NOTE

When using external chain or belt drives, make sure the reducer is sized so that the shaft and bearings have adequate capacity. To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, etc.) so that the applied load center is as close to the gear housing as possible and check component alignment and tension of any belts or chains per the manufacturer's recommendation. Do not over tighten the belts or chains.

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4. Coupling installation

The performance and life of any coupling depends upon how well it is installed. Coupling hubs are typically mounted flush with the shaft ends, unless specifically ordered for overhung mounting. Shaft couplings should be installed according to the coupling manufacturer's recommendations for gap, angular and parallel alignment. To help obtain critical shaft alignment coupling hubs may be installed to the machine shafts prior to final shimming or tightening of the foundation bolts. Proper coupling alignment allows for thermal and mechanical shaft movement during operation and ensures that only torque (no radial load) is transmitted between the mating shafts.

Coupling gap and angular alignment

The shaft gap must be sufficient to accommodate any anticipated thermal or mechanical axial movement. When setting the coupling gap, insert a spacer or shim stock equal to the required spacing or gap between the coupling hub faces. Measure the clearance using feeler gauges at 90-degree intervals, to verify the angular alignment.

Parallel (or offset) alignment

Mount a dial indicator to one coupling hub, and rotate this hub, sweeping the outside diameter of the other hub. The parallel or offset misalignment is equal to one-half of the total indicator reading. Another method is to rest a straight edge squarely on the outside diameter of the hubs at 90° intervals and measure any gaps with feeler gauges. The maximum gap measurement is the parallel or offset misalignment.

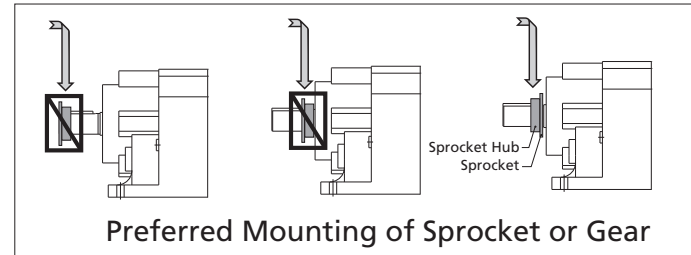
Check alignment

After both angular and parallel alignments are within specified limits, tighten all foundation bolts securely and re-check critical alignment. If any of the specified limits for alignment are exceeded, realign the coupling.

5. Installing sheaves (pulleys), sprockets and gears

To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, gears, etc.) so that the applied load center is as close to the gear housing as possible, as shown in **Figure 2**.

Figure 2: Sprocket or Gear Mounting



Align the driver sheave or sprocket with the driven sheave or sprocket by placing a straight-edge length-wise across the face of the sheaves or sprockets. Alignment of bushed sheaves and sprockets should be checked only after bushings have been tightened. Check horizontal shaft alignment by placing one leg of a square or a level vertically against the face of the sheave or sprocket.

Always check component alignment and tension any belts or chains per the manufacturer's recommendation. The ideal belt or chain tension allows proper wrap of the driver and driven wheels, while maintaining the lowest possible tension of the belts or chain, so that no slipping occurs under load conditions. Check belt or chain tension frequently over the first 24 to 48 hours of operation.



IMPORTANT NOTE

When using external chain or belt drives, make sure the reducer is sized so that the shaft and bearings have adequate capacity. To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, etc.) so that the applied load center is as close the gear housing as possible and check component alignment and tension of any belts or chains per the manufacturer's recommendation. Do not over tension the belts or chains.

6. Outboard pinion gear alignment

Align outboard pinion gears and adjust the gear tooth clearance according to the manufacturer's recommendations, checking for acceptable outboard pinion tooth contact. The foundation bolts may have to be loosened and the gear unit moved slightly to obtain proper gear tooth contact. After the unit is moved to correct tooth contact, the prime mover may need to be realigned.



DRIVESYSTEMS

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PARTS**

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RETAIN FOR FUTURE USE

1. Keyed hollow shaft design

NORD uses high quality carbon steel to manufacture hollow-shafts. Upon request, NORD can provide alternate materials, such as stainless steel. NORD hollow shafts are designed with a bore relief (reduced contact area) between the mating shafts.

The bore relief provides a cavity to hold an anti-seize assembly paste. It also acts as a design feature intended to help prevent corrosion and to facilitate gearbox removal from the solid shaft.

NORD furnishes dual keys designed to be used in each of the bore land areas, as opposed to supplying a single long key. The dual keys are intended to simplify assembly onto the machine's solid shaft.



IMPORTANT NOTE

If a single shaft key or dual shaft keys are supplied by others, the key/s must engage the full bore-land length at each end of the hollow shaft.

2. Key and keyway dimensions

Unless otherwise indicated, inch keys and keyways follow the ANSI B17.1 standard and metric keys and keyways follow the DIN6885-1 standard. Inch bores will typically utilize square keys but in some instances the larger hollow shaft bore sizes utilize the alternate rectangular key shown in the ANSI B17.1 standard.

Key slots for the solid machine shaft should be made with a Class 2, transitional-fit class (slightly loose to slightly tight). Key slots in the female shaft are designed to be a low clearance fit. These suggested practices should allow for easier assembly with the mating solid shaft, without allowing excessive clearance which could cause keys to work loose during reducer operation.



IMPORTANT NOTE

If the key fit is too tight, light filing of the key sides and hand-fitting of the keys may be required.

3. Keyed hollow-shaft bore tolerances

Standard keyed hollow-shaft bore tolerances are shown in the following table.

Table 1 - Keyed hollow bore tolerances

Above ø [in]	To and Including ø [in]	Bore Diameter Tolerance ø [in]
0.4375	1.6250	+0.0010 / -0.0000
1.6250	3.2500	+0.0012 / -0.0000
3.2500	7.0000	+0.0014 / -0.0000

Above ø [mm]	To and Including ø [mm]	Bore Diameter Tolerance ø [mm]
10	18	+0.018 / -0.000
18	30	+0.021 / -0.000
30	50	+0.025 / -0.000
50	80	+0.030 / -0.000
80	120	+0.035 / -0.000
120	180	+0.040 / -0.000
180	190	+0.035 / -0.000

Metric hollow bore tolerances per ISO286-2, Class H7

4. Suggested solid shaft (machine shaft) tolerances

NORD recommends a close fit of the customer-supplied solid shaft or machine-shaft, for the following reasons:

- To help minimize the potential for fretting and corrosion.
- To help prevent excessive free play in the shaft connection that could lead to excessive load stress on the driven system, the gear drive, or both.

Table 2 - Suggested solid shaft tolerances

Above ø [in]	To and Including ø [in]	Shaft Diameter Tolerance	
		Uniform Load ø [in]	Shock Load ø [in]
0.4375	0.8750	+0.0000 / -0.0005	+0.0000 / +0.0005
0.8750	4.5000	+0.0000 / -0.0010	+0.0000 / +0.0010
4.5000	7.0000	+0.0000 / -0.0012	+0.0000 / +0.0015

Above ø [mm]	To and Including ø [mm]	Shaft Diameter Tolerance	
		Uniform Load ① ø [mm]	Shock Load ② ø [mm]
10	18	+0.000 / -0.011	+0.012 / +0.001
18	30	+0.000 / -0.013	+0.015 / +0.002
30	50	+0.000 / -0.016	+0.018 / +0.002
50	80	+0.000 / -0.019	+0.021 / +0.002
80	120	+0.000 / -0.022	+0.025 / +0.003
120	180	+0.000 / -0.025	+0.028 / +0.003
180	190	+0.000 / -0.029	+0.033 / +0.004

① Uniform load: Mating shaft diameter tolerance per ISO286-2, class h6

② Shock load: Mating shaft diameter tolerance per ISO286-2, class k6

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RETAIN FOR FUTURE USE

As indicated in Table 2, different solid shaft tolerances are suggested depending upon the load type.

- If the machine load conditions are considered “Uniform” a clearance fit is allowed.
- If the machine load conditions are considered to have “Shock Load” a light clearance to interference fit condition is suggested.

Typically the machine builder will have good knowledge as to the load type. As an alternate method to classify load type, one could follow the “Mass Acceleration Factor Selection Method” that is discussed in NORD’s product catalog/s.

Straightness, roundness, and diameter tolerance variations of both shafts should be controlled as accurately as possible. When mating, solid shaft design features are not controlled, reducer installation may be very difficult without ordering special hollow-bore design features to accommodate.

NOTICE

The supporting solid shaft or driven machine shaft must be of adequate size and strength to withstand normal operating loads and peak loads without damage to itself or any of the system components.

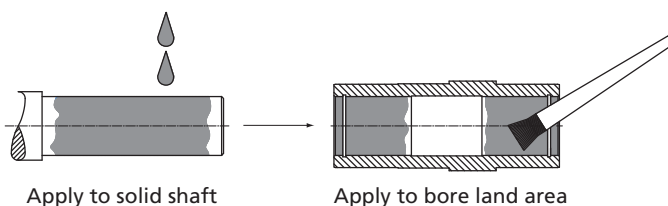
5. Suggested solid-shaft mating shaft surface finish

Controlling the mating shaft surface finish helps to assure proper fit and assembly while minimizing the possibility of corrosion and fretting. NORD recommends that the mating solid shaft surface should be at least 125 micro-inches (3.2 microns) or smoother.

6. Assembly to the machine shaft

- Clean and remove any dirt, grease, or rust-preventative coatings from both the reducer hollow shaft and the machine shaft.
- Make sure the edges of both the reducer hollow shaft and machine shaft are free from any nicks or burrs. If nicks or burrs are present remove them using an abrasive material such as an emery cloth.
- Before installing the gear reducer onto the machine shaft, apply an anti-seize compound or anti-corrosive lubricant to the mating shafts as shown in Figure 1. Assembly and subsequent dismantling will be aided by the anti-seize agent.

Figure 1 – Application of anti-seize to the mating shafts



Apply to solid shaft

Apply to bore land area

- Fit the shaft key/s into place on the machine shaft. Depending upon the key slot design on the machine shaft, it may be necessary to stake or Loctite® the key/s into place so they do not slide axially while fitting the reducer to the shaft.
- Lift the gear unit assembly into place and align it carefully with respect to the machine shaft.
- Fit the gear unit assembly onto the machine shaft using a suitable pulling device.
- Secure the reducer onto the machine shaft in an axial direction, to prevent the reducer from shifting or walking out of place during operation.

NOTICE

Do not use excessive force or try to hammer the gear unit into place. The housing, shafting, bearings or gear wheels may become damaged.

7. Securing the reducer onto the machine shaft

There are slight shaft oscillations during operation in any rotating shaft equipment or any shaft-mounted reducer assembly. Therefore it is important to secure the reducer in an axial direction onto the machine shaft, to prevent the reducer from shifting or walking out of place during operation.

Possible methods to secure the reducer axially to the machine shaft include:

- Using commercial set collars, retaining rings, or snap rings.
- Using the optional “NORD Fixing Element Kit” (see U10280).

The NORD Fixing Element Kit includes all of the necessary parts to secure the shaft by using a tapped hole in the end of the mating male shaft.

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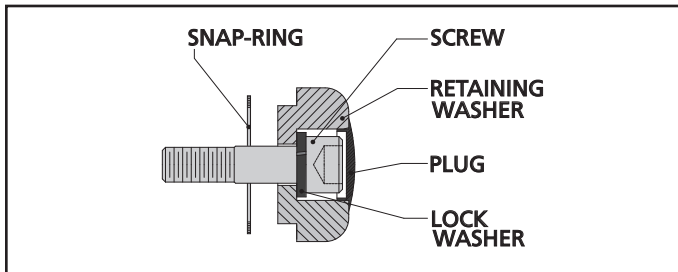


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1. Shaft fixing kit - basic design

The NORD Fixing Kit provides a method for securing the reducer in an axial direction, after the keyed-hollow shaft reducer is mounted onto the machine shaft. The fixing kit prevents the reducer from shifting or walking out of place during operation. NORD offers a variety of standard fixing kits, based upon bore size, as shown on Page 2 of this manual.

Figure 1 – Fixing kit components



IMPORTANT NOTE

For installation of the keyed-hollow bore reducer to the machine-shaft, see user manual U10270.

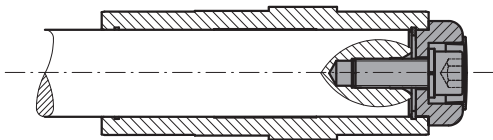
2. Assembly types

There are two types of assembly methods commonly used for securing the fixing kit.

Figure 2 – Fixing kit assembly methods

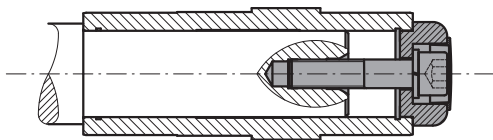
Type 1

The machine-shaft is located against a fixed snap-ring located inside the bore of the reducer.



Type 2

The machine shaft is shouldered and is pulled tight against the hollow-shaft; the snap-ring is no longer required.



NOTICE

The maximum edge break on the solid machine shaft must not exceed the values shown on Page 2 of this manual. Otherwise the load-bearing capacity of the snap-ring will be reduced and may result in failure.

3. Assembly

- If using a Type 1 assembly, secure the appropriate snap-ring into the bore of the reducer. With Type 2 assembly, no snap-ring is required.
- Draw the hollow bore gear reducer onto the machine shaft as instructed in U10270. Remember to apply a suitable assembly paste or anti-seize compound to the mating shafts.
- Install the retaining washer over the end of the hollow bore.
- Secure the appropriate cap-screw into the machine shaft and tighten the screw based upon the assembly type, as noted below. Then install the protective plug over the screw hole.

Type 1 - Screw tightening

Tighten until lightly snug and secure the screw with a thread-locking compound to prevent the screw from backing out.

NOTICE

Over tightening the retaining screw may cause the snap ring to be pulled out of its seating groove, causing damage to the hollow-bore or snap ring.

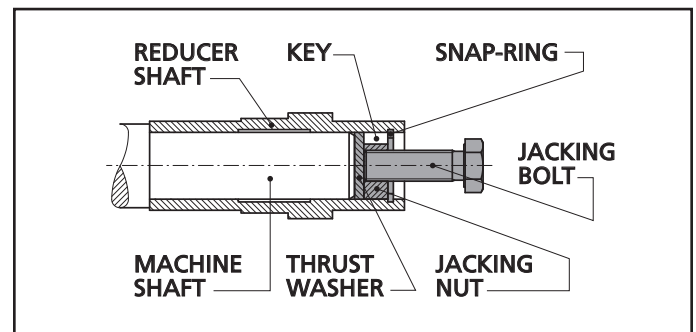
Type 2 - Screw tightening

Follow the cap screw manufactures guidelines and tighten the screw to the proper torque, based upon the bolt grade and material. For reference tightening torque values, also see manual U10060, Table 2.

4. Disassembly

When using Type 2 assembly, it is possible to design a simple disassembly tool to allow easier removal of the hollow-bore reducer. The solid shaft is shouldered to rest against the hollow-bore of the reducer. The machine shaft is supported in both of the hollow bore land areas, but the overall length is reduced compared to Type 1 assembly.

Figure 3 – Disassembly Tool



IMPORTANT NOTE

For suggestions on how to construct a disassembly tool for a particular reducer and bore size, please consult NORD's application engineering department.

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5. Standard fixing kit size offerings

NORD offers a variety of standard fixing kit sizes as shown by the following tables.

Table 1 - Standard fixing kit size offerings

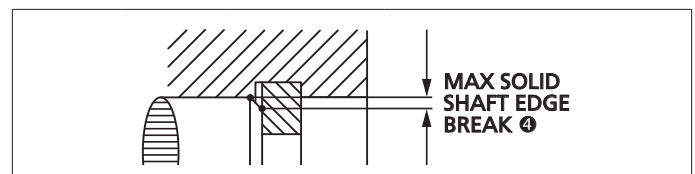
Shaft Bore [in]	Bolt Size	Allowable Thrust		Max. Edge Break ④ in [mm]
		Groove ② lb [N]	Ring ③ lb [N]	
0.500	10-32	730 [3255]	520 [2300]	0.02 [0.5]
0.750	1/4-20	1800 [7905]	560 [2500]	0.04 [1]
1.000	3/8-16	2900 [13020]	1000 [4600]	0.04 [1]
1.188	7/16-14	5100 [22630]	1000 [4700]	0.04 [1]
1.250	7/16-14	5100 [22630]	1000 [4700]	0.04 [1]
1.375	5/8-11	6500 [29140]	1400 [6400]	0.06 [1.5]
1.438	5/8-11	6900 [30690]	1500 [6500]	0.06 [1.5]
1.500	5/8-11	7800 [34875]	1500 [6700]	0.06 [1.5]
1.625	5/8-11	9900 [44020]	1900 [8400]	0.08 [2]
1.688	5/8-11	10500 [46810]	1800 [8200]	0.08 [2]
1.938	5/8-11	11100 [49600]	1900 [8400]	0.08 [2]
2.000	5/8-11	14100 [62775]	2700 [12100]	0.08 [2]
2.063	5/8-11	14100 [62775]	2700 [12100]	0.08 [2]
2.188	5/8-11	16800 [74865]	2900 [13000]	0.08 [2]
2.375	3/4-10	17400 [77190]	2900 [13000]	0.08 [2]
2.438	3/4-10	17400 [77190]	2900 [13000]	0.08 [2]
2.750	3/4-10	19600 [87110]	4700 [21000]	0.10 [2.5]
2.938	3/4-10	20900 [93000]	4700 [21000]	0.10 [2.5]
3.188	3/4-10	27700 [123225]	7000 [31200]	0.12 [3]
3.438	3/4-10	29300 [130200]	7000 [31400]	0.12 [3]
3.625	3/4-10	30900 [137330]	7000 [31400]	0.12 [3]
3.938	7/8-9	32400 [144305]	6900 [30800]	0.12 [3]
4.000	7/8-9	39000 [173600]	16400 [73000]	0.12 [3]
4.063	7/8-9	39000 [173600]	16400 [73000]	0.12 [3]
4.375	7/8-9	41500 [184450]	16200 [72000]	0.12 [3]
4.438	7/8-9	41500 [184450]	16200 [72000]	0.12 [3]
4.750	7/8-9	44200 [196850]	15700 [70000]	0.12 [3]
4.938	7/8-9	48000 [213900]	15500 [69000]	0.12 [3]

Upon request, additional hollow-bore sizes & fixing kit sizes may be offered.

Shaft Bore	Bolt Size	Allowable Thrust		Max. Edge Break ④
		Groove ②	Ring ③	
[mm]		N	N	mm
		[lb]	[lb]	[in]
16	M5	Not applicable ①		
20	M6	8370	5600	1.0
		[1900]	[1300]	[0.04]
25	M10	12400	7300	1.0
		[2800]	[1600]	[0.04]
30	M10	17515	7200	1.0
		[3900]	[1600]	[0.04]
35	M12	29140	8700	1.5
		[6500]	[1900]	[0.06]
40	M16	41850	10900	2.0
		[9400]	[2400]	[0.08]
45	M16	46810	10700	2.0
		[10500]	[2400]	[0.08]
50	M16	62775	19000	2.0
		[14100]	[4300]	[0.08]
60	M20	74865	29200	2.0
		[16800]	[6600]	[0.08]
70	M20	87110	30300	2.5
		[19600]	[6800]	[0.10]
80	M20	115630	56000	2.5
		[26000]	[12600]	[0.10]
90	M24	130200	56000	3.0
		[29300]	[12600]	[0.12]
100	M24	144305	55000	3.0
		[32400]	[12400]	[0.12]
110	M24	181350	71000	3.0
		[40800]	[16000]	[0.12]
120	M24	196850	70000	3.0
		[44300]	[15700]	[0.12]

Upon request, additional hollow-bore sizes and fixing kit sizes may be offered.

- ① This fixing kit is not supplied with a snap-ring. A Type 2 machine shaft is required.
- ② Thrust load-bearing capacity of the groove is based upon using a hollow-shaft material with a yield-strength of at least 45,000 psi (310 N/mm²).
- ③ Thrust load-bearing capacity of the snap-ring is based upon a typical snap-ring material with a yield-strength of at least 30,500 psi (210 N/mm²).
- ④ On the solid machine shaft, observe the maximum edge break (radius or chamfer) shown. A larger edge break will result in reduced load-bearing capacity of the snap-ring.

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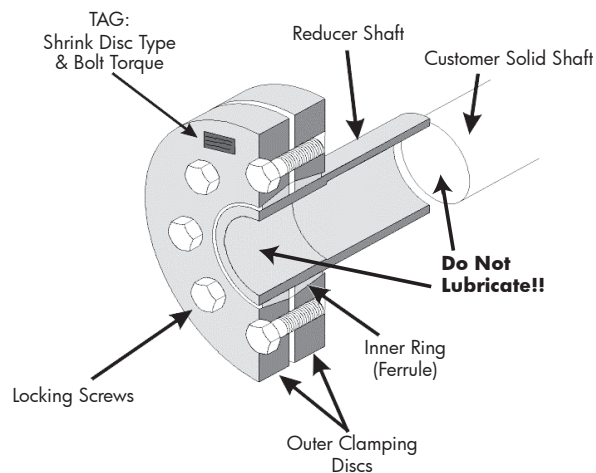
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1. Shrink disc design concept

A shrink disc option is adaptable to many NORD hollow-bore reducers. The shrink disc applies a high-capacity, zero backlash, interference fit to the driven machine shaft. The double tapered inner ring converts most all of the screw clamping load into radial contact pressure, as the outer clamping discs are pulled together by proper tightening of the locking screws. As the inner ring is contracted, the clearance between the customer solid shaft and reducer shaft is absorbed.

- In their relaxed state, shrink discs provide a generous assembly clearance, thus eliminating the typical assembly and disassembly challenges of using interference fits.
- Shrink discs also reduce solid machine shaft stresses by eliminating the need for shaft keys and keyways.
- When properly applied, high shrink fits help eliminate shaft fretting corrosion and allow for easier shaft mounting and dismounting.



2. Solid (machine) shaft design guidelines

Always use a solid shaft material of adequate strength and apply proper shaft fits in order to establish adequate clamping force during assembly and assure proper shaft release during disassembly.

- Use solid shaft material with yield strength of at least 52,260 psi (360 N/mm²).
- The solid machine shaft should be machined according to ISO 286-2, Class h6 fit tolerances, with a shaft finish of 125 micro inches (3.2 µm) or smoother, per Table 1.
- The solid machine shaft must extend the full length of the reducer hollow shaft.



IMPORTANT NOTE

Contact NORD when using a shrink disc in an application where the shrink disc connection must simultaneously transmit torque and thrust.

3. Safety

NOTICE

- The supporting solid shaft or driven machine shaft must be of adequate size and strength to withstand normal operating loads and peak loads without damage to itself or any of the system components.
- The transmissible torque and the gripping capacity of the shrink disc may be reduced if shaft tolerances or clearances are larger than specified.
- Excessive tightening torque can result in permanent deformation of the inner ring and the reducer hollow bore, making disassembly very difficult. Do not over tighten the shrink disc to compensate for excessive clearance between the machine shaft and reducer bore.
- Observe the published ratings and safety factors for both the reducer and shrink disc. Overload conditions or excessively high torque can cause the shrink disc connection to slip. In extreme cases localized galling or welding of components may occur.

4. Shrink disc shaft tolerances

Recommended solid shaft tolerances and reducer bore tolerances are shown in the table below.

Table 1: Shrink disc shaft tolerances

Above & Including ø [in]	To & Including ø [in]	Solid Shaft Tolerance ø [in]	Reducer Bore Tolerance ø [in]	Max. Assembly Clearance [in]
0.7500	1.1250	+0.0000 / -0.0005	+0.0008 / -0.0000	0.0013
1.1250	1.9375	+0.0000 / -0.0006	+0.0009 / -0.0000	0.0015
2.0000	3.1250	+0.0000 / -0.0007	+0.0011 / -0.0000	0.0018
3.1875	4.6875	+0.0000 / -0.0008	+0.0013 / -0.0000	0.0021
4.7500	7.0625	+0.0000 / -0.0009	+0.0015 / -0.0000	0.0024
7.1250	7.5000	+0.0000 / -0.0011	+0.0018 / -0.0000	0.0029

Above ø [mm]	To & Including ø [mm]	Solid Shaft Tolerance ø [mm]	Reducer Bore Tolerance ø [mm]	Max. Assembly Clearance [mm]
18	30	+0.000 / -0.013	+0.021 / -0.000	0.034
30	50	+0.000 / -0.016	+0.025 / -0.000	0.041
50	80	+0.000 / -0.019	+0.030 / -0.000	0.049
80	120	+0.000 / -0.022	+0.035 / -0.000	0.057
120	180	+0.000 / -0.025	+0.040 / -0.000	0.065
180	190	+0.000 / -0.029	+0.046 / -0.000	0.075

Shaft/bore tolerances per ISO 282-6, Class h6/H7.

Solid shaft finish should be 125 micro inches (3.2 micro meters) or smoother.



DRIVESYSTEMS

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PARTS**

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5. Installation



WARNING

Disconnect all power sources from the equipment before beginning this installation procedure. Gearmotors, variable frequency drives and gear reducers contain potentially dangerous high voltage, rotating components and surfaces that may become hot during operation. Handle the components with care and avoid all sharp machined edges to prevent personal injury.

NOTICE

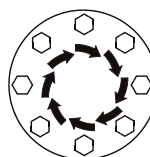
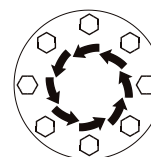
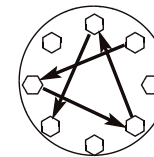
Do not tighten any of the shrink disc locking screws prior to installing the reducer with shrink disc onto the machine shaft. The inner ring of the shrink disc can become permanently contracted or damaged at relatively low tightening torque.

- Inspect the gear unit received. Make sure the shrink disc and extended hollow shaft projection is on the side of the reducer where it was specified or ordered.
- Loosen the shrink disc locking screws but do not take the shrink disc completely apart. Remove and discard any packaging material or transportation spacers that come with the shrink disc.
- Remove all burrs, rust, corrosion, lubricants, and foreign matter from the surfaces of the solid shaft and hollow-bore.
- Make sure the shrink disc is positioned onto the hollow shaft until the outer clamping ring is flush with the edge of the hollow shaft.
- To aid in assembly, it is acceptable to lightly grease the solid shaft, only in the area that will come in contact with the bronze-bushing side of the reducer hollow-shaft. **The reducer hollow shaft must be completely de-greased and free of lubricant, especially in the area of the shrink disc.**
- Position the gear reducer onto the solid machine shaft and make certain the area under the shrink disc is completely supported by the solid shaft.
- After confirming the proper positioning of gear reducer and the shrink disc, hand tighten (3) or (4) equally spaced locking screws to make sure the outer collars of the shrink disc are drawn together in a parallel fashion. Then hand-tighten the remaining screws.
- Refer to Table 2 for the specified tightening torques for the shrink disc locking screws. Using a properly set torque wrench using approximately $\frac{1}{4}$ (90°) turns; tighten the locking screws, by working in a circular clockwise or counterclockwise sequence around the shrink disc.
- Continue the tightening sequence (Step H.) even if some locking screws initially require very low tightening torque to achieve $\frac{1}{4}$ turns; do this for several passes until $\frac{1}{4}$ turns can no longer be achieved.
- Reset the torque wrench to approximately 3-5% over-torque and tighten the locking screws for 1 or 2 more passes. This procedure will compensate for relaxation of the locking screws, since tightening of a given screw will always tend to relax the adjacent screw. Without a slight overtightening of the screws, an infinite number of passes would be required to reach the desired tightening torque.

Table 2 - Shrink Disc Locking Screw Torque

Screw Size	Wrench Size [mm]	Tightening Torque		
		[Nm]	[lb-in]	[lb-ft]
M5	8	7	62	5.2
M6	10	12	106	8.9
M8	13	30	266	22
M10	17	59	522	44
M12	19	100	885	74
M16	24	250	2213	184
M20	30	490	4337	361
M24	36	840	7435	620
M30	46	1700	15050	1254

BOLT TIGHTENING PATTERN

CLOCKWISE
CIRCULAR
PATTERN
RIGHTCOUNTER
CLOCKWISE
CIRCULAR
PATTERN
RIGHTSTAR
PATTERN
WRONG

- Reset the torque wrench to the correct tightening torque as indicated in Table 2. Make sure each locking screw has been properly tightened until the screws are no longer turning at the specified torque wrench setting. If necessary repeat Steps G. & H.

6. Removal

- Loosen the shrink disc locking screws in a circular pattern by using $\frac{1}{2}$ (180°) turns, until the shrink disc hub can be moved or until the shrink disc hub and reducer shaft will return to their original fits.



WARNING

Do not completely remove the locking screws before the outer clamping disks of the shrink disc are disengaged from the inner ring. A sudden release of the outer collars will create high separating forces and could result in injury or even death.

- Loosen the outer collars of the shrink disc from the tapered inner ring. This may require tapping the bolts with a **soft faced** hammer or prying lightly between the outer collars.
- Remove the gear reducer from the machine shaft.

7. Re-installation

- It may be possible to re-use the shrink disc. However the shrink disc should not be re-used if it becomes damaged during removal, or excessively rusty or corroded. Shrink discs must always be disassembled and thoroughly cleaned before re-using.
- After cleaning the shrink disc, lubricate between the taper of the outer clamping disks and the outside of the inner ring using MOLYKOTE® G-Rapid Plus Paste (product of Dow Corning) or equivalent. In addition, grease screw threads and head contact area with multi-purpose grease.

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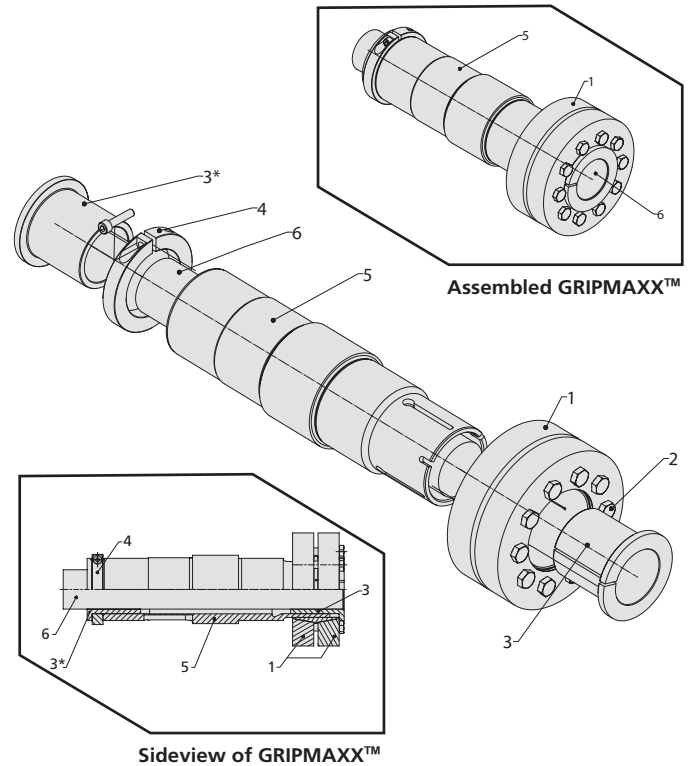
1. General information

The NORD GRIPMAXX™ keyless bushing system is adaptable to most all NORD shaft-mounted reducers. The bushing system offers interchangeable bushings to accommodate a large range of driven machine-shaft sizes.

The unique design of the NORD GRIPMAXX™ bushing system offers a number of distinct advantages as follows:

- The NORD GRIPMAXX™ allows the machine builder to utilize standard cold finished shaft stock, without the need for additional shaft machining or shaft keys.
- It uses a NORD shrink disc to apply a high-capacity, zero backlash, interference fit to the driven machine shaft, while eliminating the typical assembly and disassembly challenges of using interference fits.
- The built in clearance between the customer shaft and the bushing system helps to ensure easy installation and removal of the gearbox. To help ensure easy removal, the NORD GRIPMAXX™ bushings are prepared with a special low-wear, corrosion-resistant hardened surface treatment, that minimizes the formation of shaft corrosion and fretting.
- The NORD GRIPMAXX™ is ideal for start-stop operation and bi-directional loading because it does not depend on keys or keyways that transmit torque, which can also become loose or deform when subjected to these loading conditions.
- Unlike the typical conical or tapered bushing kits, the NORD GRIPMAXX™ design allows a tight fit against a shouldered machine shaft.
- The torque bushing and support bushing are the same part and are fully interchangeable with one another.

2. GRIPMAXX™ assembly detail



- [1] NORD Shrink Disc
[2] Locking Screw
[3] Bushing (Torque Side)
[3*] Bushing (Support Side)

- [4] Clamp Ring
[5] Gear Reducer Hollow Shaft
[6] Machine Shaft



IMPORTANT NOTE

NORD recommends that the machine shaft have a yield strength of at least 52,260psi (360N/mm²)



IMPORTANT NOTE

Observe the recommended machine shaft tolerances in table 1, page 2.

NOTICE

The supporting solid shaft or driven machine shaft must be of adequate size and strength to withstand normal operating loads and peak loads without damage to itself or any of the system components.


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3. Installation


WARNING

Disconnect all power sources from the equipment before beginning this installation procedure. Gear-motors, variable frequency drives and gear reducers contain potentially dangerous high voltage, rotating components and surfaces that may become hot during operation. Handle the components with care and avoid all sharp or machined edges to prevent personal injury.

NOTICE

Do not tighten any of the shrink disc locking screws prior to installing the reducer with shrink disc onto the machine shaft. The inner ring of the shrink disc can become permanently contracted or damaged at a relatively low tightening torque.

Table 1 - Required Machined Shaft Tolerance

Inch Machine Shaft			Metric Machine Shaft		
From	To	ISO 286-2 Tolerance h11(-)	Over	Including	ISO 286-2 Tolerance h11(-)
ø [in]	ø [in]	[in]	ø [mm]	ø [mm]	[mm]
0.4375	0.6875	- 0.004	10	18	- 0.11
0.7500	1.0625	- 0.005	18	30	- 0.13
1.1250	1.9375	- 0.006	30	50	- 0.16
2.0000	3.1250	- 0.007	50	80	- 0.19
3.1875	4.6875	-0.008	80	120	-0.22
4.7500	7.0625	-0.009	120	180	-0.25

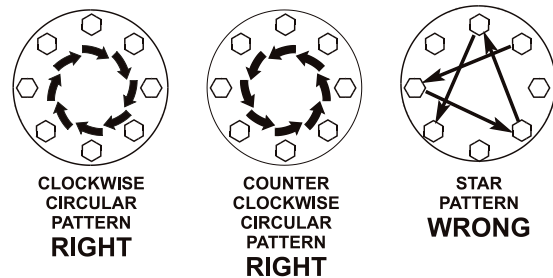
- A. Carefully inspect the machine shaft [6] and remove all burrs, rust, corrosion, lubricants, and foreign matter from the shaft surface. Verify that the diameter is within the dimensional tolerances shown in Table 1.
- B. Inspect the gear unit received to confirm the correct position of the shrink disc [1]. Make sure the hollow shaft [5] projection is on the side of the reducer where it was specified or ordered.
- C. In addition to cleaning the machine shaft [6], remove all dirt, grease or oils from the reducer hollow shaft [5], bushings [3], clamp ring [4], and shrink disk [1]. **Do not apply lubricants, corrosion preventatives, anti-sieze compounds or coatings to the mating surfaces of the shaft, bushings, clamp collars or shrink disc.**
- D. Position the clamp ring [4] and support bushing [3*] over the machine shaft [6], making sure the support bushing is in its desired location. Then secure the support bushing [3*] with the clamp ring [4] and tighten the clamp ring screw.
- E. Slide the gear reducer onto the machine shaft [6] until the gear reducer stops against the secured support bushing [3*].

- F. Without taking the shrink disc [1] apart, loosen the shrink disc locking screws [2]. Slide the shrink disc over the reducer shaft [5] and slide the torque bushing [3] onto the machine shaft, making sure it is seated completely.
- G. Confirm the positioning of the shrink disc [1] and torque bushing [3]. **Do not tighten the shrink disc until the machine shaft and torque bushing are in proper position, or the reducer shaft will be damaged.** Hand-tighten 3 or 4 or locking screws [2] and make sure the outer collars of the shrink disc are drawn together in a parallel fashion and then hand-tighten the remaining screws.
- H. Refer to Table 2 for the specified tightening torques for the shrink disc locking screws. Using a properly set torque wrench using approximately ¼ (90°) turns; tighten the locking screws, by working in a circular clockwise or counterclockwise sequence around the shrink disc.
- I. Continue the tightening sequence (Step H.) even if some locking screws initially require very low tightening torque to achieve ¼ turns; do this for several passes until ¼ turns can no longer be achieved.
- J. Reset the torque wrench to approximately 3-5% over-torque and tighten the locking screws for 1 or 2 more passes. This procedure will compensate for relaxation of the locking screws, since tightening of a given screw will always tend to relax the adjacent screw. Without a slight overtorquing of the screws, an infinite number of passes would be required to reach the desired tightening torque.

Table 2 - Shrink Disc Locking Screw Torque

Screw Size	Wrench Size [mm]	Tightening Torque		
		[Nm]	[lb-in]	[ft-lb]
M5	8	7	62	5.2
M6	10	12	106	8.9
M8	13	30	266	22
M10	17	59	522	44
M12	19	100	885	74
M16	24	250	2213	184
M20	30	490	4337	361

BOLT TIGHTENING PATTERN



- K. Reset the torque wrench to the correct tightening torque as indicated in Table 2. Make sure each locking screw has been properly tightened until the screws are no longer turning at the specified torque wrench setting. If necessary repeat Steps G. & H.



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RETAIN FOR FUTURE USE

5. Bushing kit removal

- A. Loosen the shrink disc locking screws [2] in circular pattern by using $\frac{1}{2}$ (180°) turns, until the shrink disc hub can be moved or until the shrink disc hub and reducer shaft will return to their original fits.



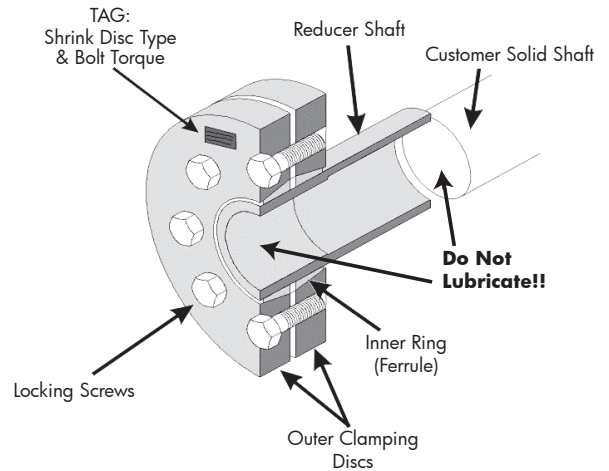
WARNING

Do not completely remove the locking screws before the outer clamping disks of the shrink disc are disengaged from the inner ring. A sudden release of the outer collars will create high separating forces and may result in injury or even death.

- B. Loosen the outer collars of the shrink disc from the tapered inner ring. This may require tapping the bolts with a **soft faced** hammer or prying lightly between the outer collars.
- C. Remove the gear reducer from the machine shaft.

6. Re-installation

- A. It may be possible to re-use the bushings and shrink disc that are part of the NORD bushing system. However these components should not be re-used if they are damaged during removal, or excessively rusty or corroded.
- B. Never re-use any of the bushing kit components without prior cleaning. Shrink discs must always be disassembled and thoroughly cleaned before re-using.
- C. After cleaning the shrink disc, lubricate between the taper of the outer clamping disks and the outside of the inner ring using MOLYKOTE® G-Rapid Plus Paste (product of Dow Corning) or equivalent. In addition, grease screw threads and head contact area with multipurpose grease.



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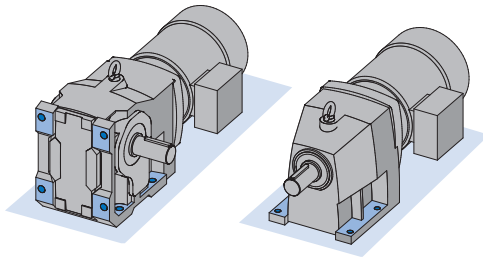
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1. Foot-mounted reducers

When installing the foot-mounted gear unit, observe the flatness specifications and bolt tightening torque guidelines provided in U10060 and make sure the mating mounting surface and reducer feet are clean and free of debris. Use of shims under the feet of the gear unit may be required in order to align the output shaft to the driven equipment. Make sure that all feet are supported so that the housing will not distort when it is bolted down. Improper shimming will cause mis-alignment and may reduce the life of the gear unit or cause component failure. Dowel pins may be field-installed to help prevent misalignment and ensure proper realignment if removed for service.



IMPORTANT NOTE

Gear units may be subjected to radial loads or side pull, caused by external chain drives or belt drives. In these instances it is recommended that the mounting base be designed with a slide-plate adjustment to accommodate extra slack in the chain or the belt after the feet are loosened. When using an external chain or belt drive, make sure the reducer is sized so that the shaft and bearings have adequate capacity.

2. Flange-mounted reducers (with B5 flange)

When using the B5 flange to mount the gear unit, the bulk head plate must be engineered to minimize buckling distortions and support the cantilevered weight of the gear reducer or gearmotor. When the mating hole is designed with the proper fit, the flange pilot tenon provides a means of accurately positioning the reducer while the hold-down bolts are properly secured; once the reducer is secured, the tenon helps prevent movement of the reducer and it helps locate the center of the reducer output shaft. The flange centering shoulder tolerance for standard units is listed in table 1. For units with NSD Tuph please see table 2 on the following page.

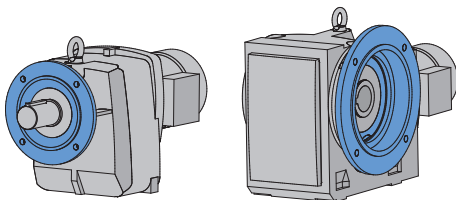


Table 1 : Flange Centering Shoulder Tolerance

Above ø (in)	To & Including ø (in)	Tolerance (in)	ISO 286-2 Fit Class
1.969	3.150	+0.0005 / -0.0003	j6
3.150	4.724	+0.0005 / -0.0004	j6
4.724	7.087	+0.0006 / -0.0004	j6
7.087	9.055	+0.0006 / -0.0005	j6
9.055	9.843	+0.0000 / -0.0011	h6
9.843	12.402	+0.0000 / -0.0013	h6
12.402	15.748	+0.0000 / -0.0014	h6
15.748	19.685	+0.0000 / -0.0016	h6
19.685	21.654	+0.0000 / -0.0017	h6

Above ø (mm)	To & Including ø (mm)	Tolerance (mm)	ISO 286-2 Fit Class
50	80	+0.012 / -0.007	j6
80	120	+0.013 / -0.009	j6
120	180	+0.014 / -0.011	j6
180	230	+0.016 / -0.013	j6
230	250	+0.000 / -0.029	h6
250	315	+0.000 / -0.032	h6
315	400	+0.000 / -0.036	h6
400	500	+0.000 / -0.040	h6
500	550	+0.000 / -0.044	h6

When installing the flange mounted gear unit, observe the flatness specifications and bolt tightening torque guidelines provided in U10060. Make sure the mating mounting surface and reducer flange are clean and free of debris. Use a straight edge or parallel bar to check for high spots on the mating mounting surface and remove any raised material around the mounting holes.

Set the gear unit into place and tighten the bolts until they are snug. Before final bolt-tightening check for any material gaps between the mating surfaces and if shimming is required, use "U" shaped shims at least 2 times the width of the bolt. Avoid over shimming a very irregular surface as this will make it very difficult to achieve proper alignment.

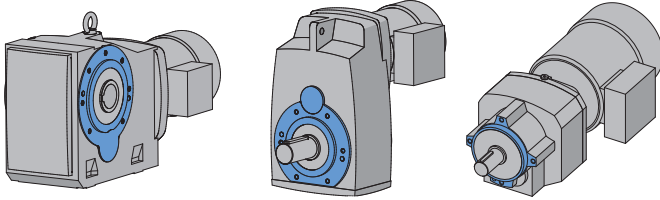


IMPORTANT NOTE

For heavy shock applications, it is advisable to field-install dowel pins through the mounting flange connection (in addition to the mounting bolts). This will help control flange movement or flange rotation and relieve the mounting bolts from this additional stress.

3. Flange-mounted reducers (with B14 flange)

When using the B14 flange to mount the gear unit, the bulk head plate must be engineered to minimize buckling distortions and support the cantilevered weight of the gear reducer or gearmotor. When properly installed, the output flange of the reducer housing is designed to enable the permissible torques and radial forces to be reliably transmitted by the bolt connections. The flange centering shoulder tolerance for standard units is listed in table 1 on the previous page. For units with NSD Tuph please see table 2 below.



IMPORTANT NOTE

When using the B14 flange-face for mounting, if dowel pin holes are provided in addition to the threaded holes, then it is advisable to also use the proper dowel pins, to help control flange movement or flange rotation and relieve the mounting bolts from this additional stress. This is especially important for heavy shock applications.

Table 2 : Flange Centering Shoulder Tolerance on NSD Tuhp Units

Above ϕ (in)	To & Including ϕ (in)	Tolerance (in)
1.969	3.150	+0.0020 / +0.0013
3.150	4.724	+0.0021 / +0.0012
4.724	7.087	+0.0021 / +0.0011
7.087	9.055	+0.0022 / +0.0011

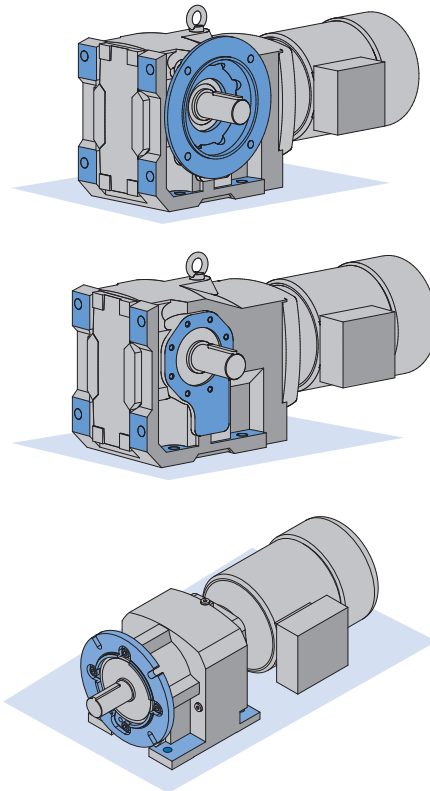
Above ϕ (mm)	To & Including ϕ (mm)	Tolerance (mm)
50	80	+0.052 / +0.033
80	120	+0.053 / +0.031
120	180	+0.054 / +0.029
180	230	+0.056 / +0.027

4. Foot & flange reducer housings

Some gear reducer housings are available with a foot and an output flange. Units with a foot and a B5 Flange are designated with the suffix XF after the primary model number and units with a B14 face-flange are designated with the suffix XZ after the primary model number. When a gear unit is provided with both a foot and a flange, the foot is considered the primary mounting surface. The flange is generally considered to be the secondary mounting option and it is intended that this surface be used for auxiliary add on elements that place minimal load stress on the reducer housing.

NOTICE

To prevent overstress on the main gear unit housing, never tighten the reducer mounting feet and the mounting flange against one-another. Auxiliary add-on elements that are mounted to the reducer flange, must not transmit excessive force, torque or vibration to the main gear housing.





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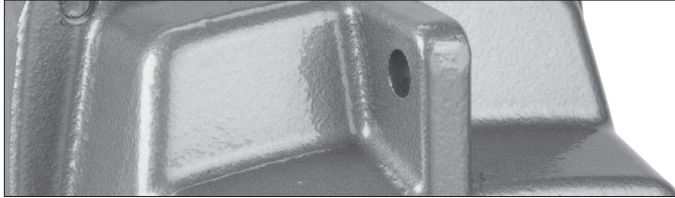
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RETAIN FOR FUTURE USE

1. Purpose of the built-in torque arm lug

The preferred method of installing a shaft-mounted Clincher™ reducer is to support the weight of the gear unit or gearmotor assembly from the driven solid machine shaft. In order to restrain the gearbox, react the torque, and keep the gear unit from spinning around the shaft, the Clincher™ gear units have a built-in torque arm lug or tab cast into the reducer housing. This torque tab is intended to be used in conjunction with the NORD Rubber Buffers.

Figure 1: Built-in torque lug



2. Rubber buffers

When specified, NORD provides two rubber buffers that are installed on either side of the gear unit's integral torque lug.

When properly used in tandem, on either side of the torque-arm lug, the rubber buffers help isolate and absorb the load forces present in the system and increase the reducer's service life by reducing cumulative torsional shock loads.

- The primary load force acts in the direction of driven shaft rotation, reacts the torque of the reducer, keeping the gearbox from spinning on the shaft.
- Additional forces present themselves in the direction opposite of the shaft rotation, due to the typical slight out-of-round condition present in the machine shaft. This condition is the reason most shaft mounted-reducers have a slight shaft-wobble, which is normal.

For further dampening it is possible to combine several rubber buffers in a row, on either side of the torque lug.



IMPORTANT NOTE

Please reference Table 1 on page 2 of this manual for dimensional information.

NOTICE

Always mount at least one rubber buffer on either side of the reducer's torque-arm lug. When using rubber buffers in tandem, make sure equal numbers are used on both sides of the torque tab. Failure to do so will not properly cushion the reducer and can result in excessive binding, bearing stress, and damage to the reducer.

3. Machine support



WARNING

It is the responsibility of the machine builder to design a support bracket of adequate strength and rigidity, and supply an appropriate tightening bolt assembly. Failure to do so may result in injury caused from a damaged or broken torque-reaction assembly.

A single customer-supplied machine support bracket, of adequate strength and rigidity, can provide adequate restraint for both directions. This is because when the rubber buffer system is used, the applied load forces are always parallel to the retaining bolt and there are no twisting forces induced onto the bolt in either the clockwise or counter-clockwise direction. In some cases the customer may desire to supply a rigid support on either side of the rubber buffers. In these instances, longer assembly hardware is required.

4. Installation of the rubber buffers

- Install the Clincher™ hollow bore reducer onto the machine shaft. Line up the hole in the reducer's torque-arm lug with the hole in the machine's support bracket and temporarily hold the reducer in place.
- Properly secure the gear unit assembly to the driven shaft in an axial direction. If using the NORD Shaft Fixing Kit, follow the instructions in User Manual U10280.
- Install the rubber buffers on either side of the gear unit's torque-arm lug. Apply a thread locking compound to the end of the fixing bolt. Then place the fixing bolt through the rubber buffers, torque-arm lug and rigid machine support bracket and loosely secure the nut onto the end of the bolt.
- Tighten the fixing bolt and nut until lightly snug until all of the free play is eliminated from the rubber buffer assembly. Then snug the fixing bolt assembly by tightening an additional 1/4 to 1/2 turn.

NOTICE

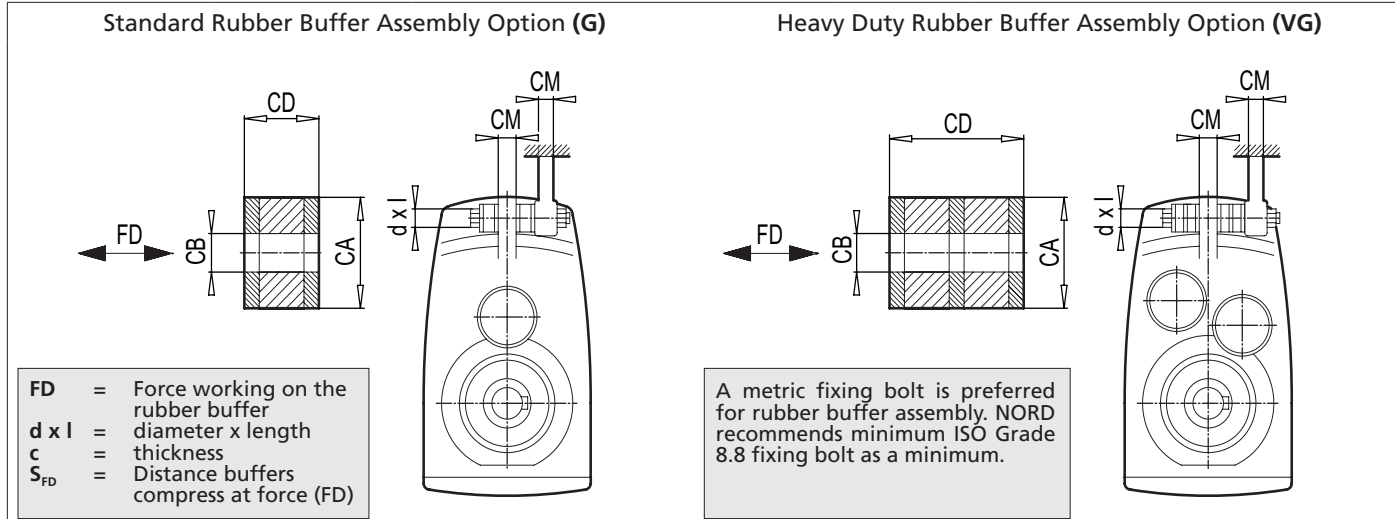
To help prevent damage to the rubber buffers, avoid over-tightening.



IMPORTANT NOTE

- A min. of (2) rubber buffers are required for each unit.
- For larger size CLINCHER'S™, NORD offers the heavy-duty rubber buffer (Option VG).
- A metric fixing bolt is preferred for rubber buffer assembly. NORD recommends a minimum ISO Grade 8.8 fixing bolt.

Table 1: Rubber buffer assembly/typical dimensions



Type	Rubber Buffer P/N	CB inch [mm]	CA inch [mm]	CD inch [mm]	CM inch [mm]	Bolt d x l [metric]	FD lb [kN]	SFD inch [mm]
SK0182NB G	29603000	0.43 [11]	1.18 [30]	0.59 [15]	0.39 [10]	M10 x 70	217 [0.967]	0.06 [1.5]
SK0282NB G	29603000	0.43 [11]	1.18 [30]	0.59 [15]	0.47 [12]	M10 x 70	234 [1.04]	0.07 [1.7]
SK1282 G	29603000	0.43 [11]	1.18 [30]	0.59 [15]	0.55 [14]	M10 x 80	504 [2.24]	0.14 [3.6]
SK1382NB G	29603000	0.43 [11]	1.18 [30]	0.59 [15]	0.55 [14]	M10 x 80	402 [1.79]	0.11 [2.8]
SK2282 G	29604000	0.49 [12.5]	1.57 [40]	0.59 [15]	0.63 [16]	M12 x 90	600 [2.67]	0.07 [1.8]
SK3282 G	29604000	0.49 [12.5]	1.57 [40]	0.59 [15]	0.71 [18]	M12 x 90	935 [4.16]	0.11 [2.9]
SK4282 G	29606000	0.83 [21]	2.36 [60]	1.18 [30]	0.87 [22]	M20 x 150	1661 [7.39]	0.29 [7.3]
SK5282 G	29606000	0.83 [21]	2.36 [60]	1.18 [30]	1.1 [28]	M20 x 150	2133 [9.49]	0.37 [9.4]
SK6282 G	29608000	0.98 [25]	3.15 [80]	1.57 [40]	1.38 [35]	M24 x 190	3779 [16.81]	0.36 [9.2]
SK7282 G	29608000	0.98 [25]	3.15 [80]	1.57 [40]	1.57 [40]	M24 x 200	4676 [20.8]	0.45 [11.4]
SK8282 G	29610000	1.22 [31]	3.94 [100]	1.97 [50]	1.97 [50]	M30 x 260	6382 [28.39]	0.64 [16.3]
SK9282 G	29610000	1.22 [31]	3.94 [100]	1.97 [50]	2.17 [55]	M30 x 260	9777 [43.49]	0.98 [24.9]

Type	Rubber Buffer P/N	CB inch [mm]	CA inch [mm]	CD inch [mm]	CM inch [mm]	Bolt d x l [metric]	FD lb [kN]	SFD inch [mm]
SK7282 VG	29620850	0.98 [25]	3.35 [85]	2.36 [60]	1.57 [40]	M24 x 240	4676 [20.8]	0.48 [12.2]
SK8282 VG	29621100	1.22 [31]	4.33 [110]	3.54 [90]	1.97 [50]	M30 x 340	6382 [28.39]	0.76 [19.3]
SK9282 VG	29621400	1.22 [31]	5.51 [140]	4.33 [110]	2.17 [55]	M30 x 380	9777 [43.49]	0.83 [21.2]
SK10282 VG	29621800	1.22 [31]	5.51 [140]	4.33 [110]	3.15 [80]	M30 x 430	12670 [56.36]	1.08 [27.4]
SK10382 VG	29621800	1.93 [49]	7.09 [180]	5.91 [150]	3.54 [90]	M48 x 550	18185 [80.89]	1.52 [38.5]
SK10382.1 VG	29621800	1.93 [49]	7.09 [180]	5.91 [150]	3.54 [90]	M48 x 550	23720 [105.51]	1.98 [50.2]



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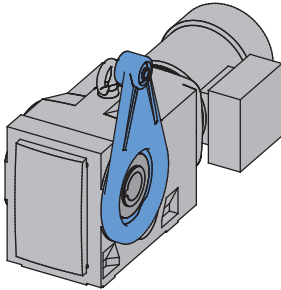
U10600 - 1 of 2

RETAIN FOR FUTURE USE

1. Torque arm (D)

The preferred method of installing a shaft-mounted reducer is to support the weight of the gear unit or gearmotor assembly from the driven solid machine shaft. A torque arm is required in order to restrain the gearbox, react the load torque, and keep the gear unit from spinning around the shaft.

The Torque-Arm (D) bracket is mounted to either side of the right-angle gear unit using mounting screws that thread into the B14 flange-face of the reducer. The anchor hole of the torque-arm bracket is supplied with a resilient rubber bushing.



IMPORTANT NOTE

The side of the reducer that the torque arm is mounted on, and the angular position can be specified at time of order. Consult the appropriate NORD catalog for specific Torque Arm (D) mounting options and ordering guidelines.

2. Purpose of the built-in resilient rubber bushing

The resilient rubber bushing installed into the anchor hole end of the torque-arm helps isolate and absorb all the load forces present in the system and increase the reducer's service life by reducing cumulative torsional shock loads.

- The primary load force acts in the direction of driven shaft rotation, reacts the load torque of the reducer, and prevents the gearbox from spinning on the shaft.
- Additional forces present themselves in the direction opposite of the shaft rotation, due to the typical slight out-of-round condition present in the machine shaft. This condition is the reason most shaft mounted-reducers have a slight shaft-wobble, which is normal.

NOTICE

Always make sure that the Torque Arm (D) has the resilient rubber bushing installed into the anchor hole end of the torque arm. Failure to do so will not properly cushion the reducer and can result in excessive binding, bearing stress, and damage to the reducer.

3. Machine support

The user must supply a suitably strong and rigid mating machine support that provides load bearing capacity on both sides of the torque-arm bracket.



WARNING

It is the responsibility of the machine builder to design a support bracket of adequate strength and rigidity, and supply an appropriate tightening bolt assembly. Failure to do so may result in injury caused from a damaged or broken torque-reaction assembly.

4. Installation of a right-angle reducer with torque arm

A. Make sure the Torque-Arm (D) is mounted in the correct position on the reducer. Assembled screw heads should always sit flush with the torque arm.

- To reposition the torque-arm, remove the mounting screws, relocate the torque-arm, and reassemble the mounting screws as noted above.
- If the torque-arm was shipped loose, position the torque-arm in the correct location on the gear unit, and secure the torque-arm as noted above.



IMPORTANT NOTES

- Torque arm mounting screws should be secured with a thread locking product (ex. Loctite® 242 or Loxeal® 54-03) and tightened per the table on page 2.
- Assembled screw heads should always sit flush with the torque arm.
- The support bracket should provide support on both sides of the torque arm or be in the form of a U-shape.
- Do not force the torque-arm. The torque arm must remain at a right angle to the gear unit.
- If mounting holes do not align properly the machine support may need to be moved.

B. Install the right-angle hollow bore reducer onto the machine shaft. Then line up the hole in the reducer's torque-arm with the hole in the machine's support bracket, and temporarily hold the reducer in place.

C. Apply a thread locking compound such as Loctite® 242 or Loxeal® 54-03 to the end of the anchor bolt that is used to secure the torque arm in place.

D. Place the anchor bolt through the support bracket and the reducer torque-arm. Attach the mating nut to the bolt and tighten the assembly until snug. At least one bolt diameter should protrude from the nut after assembly.

NOTICE

Do not force misalignment of the torque-arm. The torque arm must remain at a right angle to the gear unit or excessive load may be placed on the reducer shaft and bearings.

E. Properly secure the gear unit assembly to the driven shaft in an axial direction.

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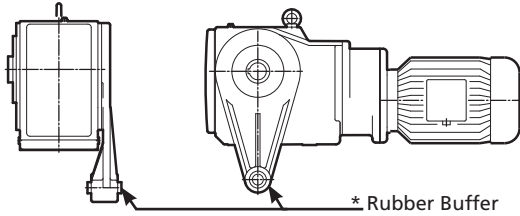
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Table 1 - Torque Arm (D) with rubber buffer


- For all 90.1 Series Helical-Bevel gear units, NORD also offers a bottom mount Torque Arm (K). See User Manual U10620.
- For the large 90.1 Series Helical-Bevel gear units sizes: SK9082.1, SK9086.1, SK9092.1, and SK9096.1, please use the Torque Arm (K).
- A metric fixing bolt is preferred for fastening the Torque-Arm(D) to the machine support bracket.

Gear Unit Series	Torque Arm				Torque Arm Mounting Screw				
	Type	Rubber Buffer P/N	Anchor Hole Size	Anchor Bolt Size	Qty	Size	Grade	Torque (Nm)	Torque (lb-ft)
92.1/93.1 Series Helical-Bevel	SK92072.1AD/SK93072.1AD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 25	8.8	27	20
	SK92172.1AD/SK93172.1AD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 25	8.8	27	20
	SK92372.1AD/SK93372.1AD	29602505	10.5 mm [0.41 in]	M10	4	M10 x 30	8.8	53	39
	SK92672.1AD/SK93672.1AD	29602505	10.5 mm [0.41 in]	M10	4	M10 x 30	8.8	53	39
	SK92772.1AD/SK93772.1AD	29603605	16.5 mm [0.65 in]	M16	4	M12 x 30	8.8	92	68
92 Series Helical-Bevel	SK92172AZD	29602505	10.5 mm [0.41 in]	M10	8	M6 x 16	8.8	11	8
	SK92372AZD	29602505	10.5 mm [0.41 in]	M10	8	M8 x 25	8.8	27	20
	SK92672AZD	29602505	10.5 mm [0.41 in]	M10	8	M8 x 25	8.8	27	20
	SK92772AZD	29603605	16.5 mm [0.65 in]	M16	8	M8 x 25	8.8	27	20
90.1 Series Helical-Bevel	SK9012.1AZD/SK9013.1AZD	29602505	10.5 mm [0.41 in]	M10	7	M8 x 20	8.8	27	20
	SK9016.1AZD/SK9017.1AZD	29602505	10.5 mm [0.41 in]	M10	7	M8 x 20	8.8	27	20
	SK9022.1AZD/SK9023.1AZD	29603605	16.5 mm [0.65 in]	M16	7	M8 x 25	8.8	27	20
	SK9032.1AZD/SK9033.1AZD	29603605	16.5 mm [0.65 in]	M16	7	M10 x 30	8.8	53	39
	SK9042.1AZD/SK9043.1AZD	29605205	25 mm [0.98 in]	M24	7	M12 x 35	8.8	92	68
	SK9052.1AZD/SK9053.1AZD	29605205	25 mm [0.98 in]	M24	7	M12 x 35	8.8	92	68
	SK9072.1AZD	29605205	25 mm [0.98 in]	M24	7	M16 x 45	8.8	230	170
Helical-Worm	SK02040AZD	29602505	10.5 mm [0.41 in]	M10	4	M6 x 20	8.8	11	8
	SK02050AZD/SK13050AZD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 20	8.8	27	20
	SK12063AZD/SK13063AZD	29602505	10.5 mm [0.41 in]	M10	7	M8 x 22	8.8	27	20
	SK12080AZD/SK13080AZD	29602505	10.5 mm [0.41 in]	M10	7	M10 x 25	8.8	53	39
	SK32100AZD/SK33100AZD	29603605	16.5 mm [0.65 in]	M16	7	M12 x 30	8.8	92	68
	SK42125AZD/SK43125AZD	29603605	16.5 mm [0.65 in]	M16	7	M12 x 30	8.8	92	68
MINICASE® SMI Series Worm	SK1SMI31AZD	29602505	10.5 mm [0.41 in]	M10	4	M6 x 16	8.8	11	8
	SK1SMI40AZD/SK2SMI40AZD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 22	8.8	27	20
	SK1SMI50AZD/SK2SMI50AZD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 22	8.8	27	20
	SK1SMI50AZD/SK2SMI50AZD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 22	8.8	27	20
	SK1SMI63AZD/SK2SMI63AZD	29602505	10.5 mm [0.41 in]	M10	4	M10 x 25	8.8	53	39
	SK1SMI75AZD	29602505	10.5 mm [0.41 in]	M10	4	M12 x 30	8.8	92	68
MINICASE® SM Series Worm	SK1SM31AZD	29602505	10.5 mm [0.41 in]	M10	4	M6 x 20	8.8	11	8
	SK1SM40AZD/SK2SM40AZD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 20	8.8	27	20
	SK1SM50AZD/SK2SM50AZD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 20	8.8	27	20
	SK1SM63AZD/SK2SM63AZD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 20	8.8	27	20
"FLECBLOC™ SI Series Worm"	SK1SI31D	29602505	10.5 mm [0.41 in]	M10	4	M6 x 16	8.8	11	8
	SK1SI40D	29602505	10.5 mm [0.41 in]	M10	4	M8 x 22	8.8	27	20
	SK1SI50D	29602505	10.5 mm [0.41 in]	M10	4	M8 x 22	8.8	27	20
	SK1SI63D	29602505	10.5 mm [0.41 in]	M10	4	M10 x 25	8.8	53	39
	SK1SMI75D	29602505	10.5 mm [0.41 in]	M10	4	M12 x 30	8.8	92	68



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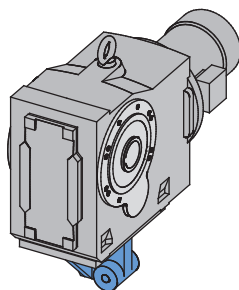
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U10620 - 1 of 2

1. Torque arm (K)

The preferred method of installing a shaft-mounted reducer is to support the weight of the gear unit or gearmotor assembly from the driven solid machine shaft. A torque arm is required in order to restrain the gearbox, react to the load torque, and keep the gear unit from spinning around the shaft.

Table 1 (Page 2) provides a list of Torque-Arm (K) part numbers available for the 90.1 Series Helical-Bevel gear units. The Torque Arm (K) is secured to the base of the reducer. On most sizes there is an integral resilient rubber bushing located at the fastening hole-end of the torque arm. On the larger sizes, rubber buffers are used in conjunction with the torque arm and when properly used they are applied in tandem, on either side of the torque arm lug.



IMPORTANT NOTE

When ordering the Torque Arm (K) one can specify which side of the reducer to mount the fastening hole that bolts to the machine support bracket. Consult the appropriate NORD catalog for specific Torque Arm (K) mounting options and ordering guidelines.

2. Purpose of the rubber bushing or rubber buffers

Regardless if the Torque Arm (K) is supplied with the integral rubber bushing or whether separate rubber buffers are required, the bushing/buffers help isolate and absorb all the load forces present in the system and increase the reducer's service life by reducing cumulative torsional shock loads.

- The primary load force acts in the direction of driven shaft rotation, reacts the load torque of the reducer, and prevents the gearbox from spinning on the shaft.
- Additional forces present themselves in the direction opposite of the shaft rotation, due to the typical slight out-of-round condition present in the machine shaft. This condition is the reason most shaft mounted-reducers have a slight shaft-wobble, which is normal.

NOTICE

Always make sure that the Torque Arm (K) is used in conjunction with the required rubber bushing/s. Failure to do so will not properly cushion the reducer and can result in excessive binding, bearing stress, and damage to the reducer.

3. Machine support

The user must supply a suitably strong and rigid mating machine support that provides load bearing capacity on both sides of the machine support bracket.



WARNING

It is the responsibility of the machine builder to design a support bracket of adequate strength and rigidity, and supply an appropriate tightening bolt assembly. Failure to do so may result in injury caused from a damaged or broken torque-reaction assembly.

4. Installation of the right-angle reducer with torque arm (K)

- Make sure the Torque-Arm (K) is mounted so that the machine fastening hole is on the correct side of the reducer.
 - The torque-arm can be repositioned on the as-received unit by removing the fixing screws, re-position the torque-arm in the correct location, and re-securing the fixing screws to the proper tightening torque, as indicated in Table 2 (Page 2).
 - If the torque-arm was shipped loose, position the torque-arm in the correct location on the gear unit, and secure the torque-arm with the proper fixing screws & tightening torque, as indicated in Table 2 (Page 2).
- Install the right-angle hollow bore reducer onto the machine shaft. Line up the hole in the reducer's torque-arm with the hole in the machine's support bracket, and temporarily hold the reducer in place
- Properly secure the gear unit assembly to the driven shaft in an axial direction.
- Apply thread locking compound to the end of the fixing bolt, then place the fastening bolt through the rigid machine support bracket and reducer torque-arm and loosely secure the nut onto the end of the bolt.
- If the torque arm has an integral rubber bushing follow step F and skip steps G-H. If the torque arm uses rubber buffers skip forward to steps G-H.
- Tighten the fixing bolt to the proper tightening torque as indicated in Table 2 (Page 2).
- Install the rubber buffers on either side of the gear unit's torque-arm lug and place the fixing bolt through the rubber buffers and torque-arm lug and into the rigid machine support bracket.
- Tighten the fixing bolt and nut lightly snug, until all the free-play is eliminated from the rubber buffer assembly. Then snug the fixing bolt assembly by tightening an additional $\frac{1}{4}$ to $\frac{1}{2}$ turn.

NOTICE

To prevent damage to the rubber buffers, avoid over-tightening.

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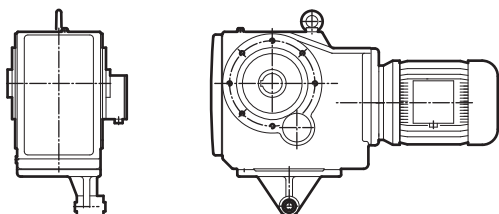
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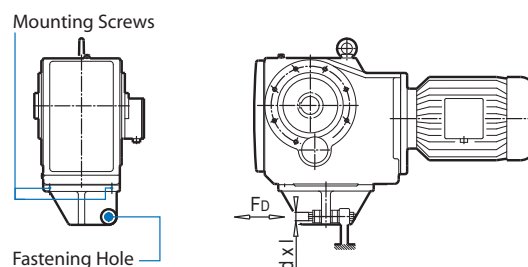
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Torque Arm (K) with integrated bushing



Available for Sizes SK9012.1 - SK9072.1

Torque Arm (K) with rubber buffer



Available for Sizes SK9082.1 - SK90906.1

- For most all 90.1 series Helical-Bevel gear units, an optional tear-drop shaped side-mounted torque arm (D) is available. See user manual U10600.

- A metric fixing bolt is preferred for fastening the torque arm (K) to the machine support bracket.

Type	Torque Arm P/N	Reducer Hardware Hex Head Cap Screws + Lock Washer	Mounting Screw P/N	Lock Washer P/N	Rubber Buffer P/N	Fastening Hole In [mm]	Fastening Bolt Size	Bolt d x l [metric]	FD lb [N]	SFD inch [mm]
SK9012.1...K SK9013.1...K	68190600	M10 X 30 + A10 (Qty 3 Ea.)	22010300	28560106	N/A	0.41 [10.5]	M10	N/A	N/A	N/A
SK9016.1...K SK9017.1...K	68190600	M10 X 30 + A10 (Qty 3 Ea.)	22010300	28560106	N/A	0.41 [10.5]	M10	N/A	N/A	N/A
SK9022.1...K SK9023.1...K	68290610	M12 X 35 + A12 (Qty 3 Ea.)	22012350	28560126	N/A	0.65 [16.5]	M16	N/A	N/A	N/A
SK9032.1...K SK9033.1...K	68390610	M12 X 35 + A12 (Qty 3 Ea.)	22012350	28560126	N/A	0.65 [16.5]	M16	N/A	N/A	N/A
SK9042.1...K SK9043.1...K	68490610	M16 X 40 + A16 (Qty 3 Ea.)	22016400	28560166	N/A	0.98 [25]	M24	N/A	N/A	N/A
SK9052.1...K SK9053.1...K	68590620	M16 X 40 + A16 (Qty 3 Ea.)	22016450	28560166	N/A	0.98 [25]	M24	N/A	N/A	N/A
SK9072.1...K	68690620	M24 X 60 + A24 (Qty 4 Ea.)	22024060	28560246	N/A	0.98 [25]	M24	N/A	N/A	N/A
SK9082.1...K SK9082.1...SHK	68819010	M24 x 65 + A24 (Qty 4 Ea.)	22024650	22024650	29610000	1.22 [31]	M30	M30 x 260	5300 [23.64]	0.53 [13.5]
SK9086.1...K SK9086.1...SHK	68819010	M24 x 65 + A24 (Qty 4 Ea.)	22024650	22024650	29610000	1.22 [31]	M30	M30 x 260	6900 [30.77]	0.69 [17.6]
SK9092.1...SHK	68919010	M36 x 90 + A36 (Qty 4 Ea.)	22036900	28560366	29610000	1.22 [31]	M30	M30 x 260	10300 [45.71]	1.03 [26.2]
SK9096.1...SHK	69019000	M42 x 120 + A42 (Qty 4 Ea.)	22042120	28560426	29621800	1.93 [49]	M48	M48 x 550	12,500 [55.56]	1.06 [27.0]

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U10750 - 1 of 2

1. Importance of proper lubrication

Proper gearbox lubrication is essential in order to reduce friction, heat, and component wear. Lubricants reduce heat and wear by inserting a protective “fluid boundary” between mating parts and preventing direct metal to metal contact. Lubricants also help prevent corrosion and oxidation, minimize foam, improve heat transfer, optimize reducer efficiency, absorb shock loads and reduce noise.

Most NORD reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position.

2. Standard oil type

The following tables indicate the standard oil fill type used. Please see user manual U11000 for more specific information and for optional helical and bevel gear lubricants:

Serviceable Gear Units	
Helical In-line	Standard Oil Fill: ISO VG 220, Mineral Oil
Clincher Parallel-Shaft	
Right-Angle Bevel	
NORDBLOC® Series In-line	
NORDBLOC®.1 Series In-line	
Standard Series In-line	



IMPORTANT NOTE

For shipping purposes, the following large Clincher™ gear units are supplied without oil:

- Clincher™ Sizes SK11282, SK11382, SK11382.1 and SK12382

Maintenance-free / Lubricated For Life Gear Units	
Clincher™ sizes SK0182NB, SK0282NB & SK1382NB	Standard Oil Fill: ISO VG220 SHC/PAO Synthetic Oil
NORDBLOC® Sizes SK172, SK272, SK371F, SK372, SK373, SK320	



IMPORTANT NOTE

Maintenance-free units are supplied as sealed units with no vent-plug. Consult NORD prior to ordering if interested in ordering any of the above sizes as serviceable gear units.



IMPORTANT NOTE

Consult the sticker adjacent to the fill plug to determine the type of lubricant installed at the factory. Some units have special lubricants designed to operate in certain environments or intended to extend the service life or service temperature range of the lubricant. If in doubt about which lubricant is needed for a certain application, please contact NORD Gear.

3. Lubrication replacement

If the gear unit is filled with mineral oil, the lubricant should be replaced at least after every 10,000 operating hours or after every two years. If the gear unit is filled with synthetic oil, the lubricant should be replaced at least after every 20,000 operating hours or after every four years. Often gear reducers are exposed to extreme ambient conditions, hostile environments, wet conditions, or dirty and dusty operating areas. Especially in these situations, it is important to establish a condition-based oil service interval.

4. Oil viscosity

Viscosity, or the oil's resistance to shear under load, is often considered the single most important property of any gear oil.

- Often one will consider making a viscosity correction to the oil to improve the performance when operating the gear unit at low temperature or high temperature.
- In cases of extreme load conditions, gear pairs and antifriction bearings may be more susceptible to sliding or scuffing wear. In these operating conditions, it may also be beneficial to consider an increased lubrication viscosity and/or a lubrication with improved antiwear additive packages.



IMPORTANT NOTE

The user should consult with their primary lubrication supplier before considering changes in oil type or viscosity.

5. Maximum oil sump temperature limit

To prevent reducer overheating, the reducer's maximum oil sump temperature limit must not be exceeded for prolonged periods of operation (up to 3 hours continuous operation depending upon reducer size).

Oil Type	Maximum Oil Temperature Limit	
	NORD	AGMA 9005-D94
Mineral	80-85°C (176-185°F)	95°C (203°F)
Synthetic	105°C (220°F)	107°C (225°F)



IMPORTANT NOTE

Use caution when specifying gear reducers for high temperature service. If there is concern about exceeding the allowable safe operating temperatures, please consult NORD to discuss alternatives.

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6. The importance of routine oil analysis

Routine oil analysis, sound lubrication practices, and good tracking of oil performance trends will help establish proper lubrication maintenance and change-out intervals. To maximize equipment reliability, NORD Gear generally recommends a condition-based lubrication maintenance program. One may take exceptions to this general recommendation on sealed-for-life or maintenance-free gear units or smaller and less costly gear units. In these instances, the replacement cost of the gear unit is often small compared to the costs associated with this type of oil analysis program.

NOTICE

NORD suggests replacing the gear oil if oil analysis indicates any of the following. Failure to replace the oil may cause internal damage to gearbox and diminished performance:

- Viscosity has changed by approximately 10% or more.
- Debris particles (silicon, dust, dirt or sand) exceed 25 ppm.
- Iron content exceeds 150-200 ppm.
- Water content is greater than 0.05% (500 ppm).
- The total acid number (TAN) tests indicate a significant level of oxidative break-down of the oil, and a critical reduction in performance; If the TAN number measured changes by more than 5% over the new oil, then an oil change would be recommended.

7. Mounting position and oil fill quantity

All NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. **For additional information, please see the separate mounting position diagrams and the corresponding oil fill quantity tables for the specified gear unit.**

The gearbox nametag will indicate the mounting position that was provided. **For mounting orientations other than shown in the mounting position charts, please consult NORD Gear.**



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

8. Oil plug locations

All gear units are assembled with the oil fill-level, oil-drain and vent plugs installed in their proper locations, according to the specified mounting position. All standard plugs are metric and utilize sealing gaskets between the head of the plug and the reducer housing.

9. Drain and fill-level plugs

All reducer drain plugs are metric socket head cap screws. For easier identification, it is NORD's standard practice to provide a hex-head screw for the fill-level plug. For ease of draining the used oil from the gear reducer, use the socket head screw located at the lowest part of the gearbox.



Drain Plug



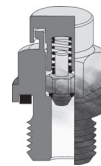
Fill Level Plug

10. Vent plug locations

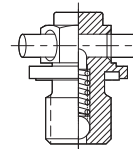
Reducer venting allows for air pressure differences that occur during operation, between the inner space of the reducer and the atmosphere, while ensuring leak-free operation. The AUTOVENT™ is standard for all vented gear units, unless otherwise noted.

AUTOVENT™ - The AUTOVENT™ helps prevent bearing and gear damage by behaving like a check valve to block the entry of foreign material and prevent lubrication contamination from dust particles, moisture and air-borne process chemicals. The breather opens at approximately 0.3-0.9 psi during operation and closes tightly as the gearbox cools. This option is perfect for humid conditions and wash-down environments, helping to maintain proper oil cleanliness, while reducing foaming and oxidation.

Figure 1 AUTOVENT™ Types



Type 1



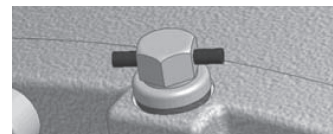
Type 2 with transportation plug



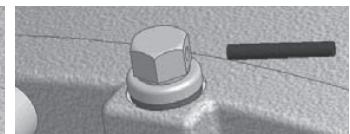
Open Vent - An optional open vent can be supplied by NORD. The open vent comes closed upon delivery with a transportation sealing plug (see Warning).

NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up. Excessive pressure may cause damage to internal components and cause leakage.



Sealed vent



Activated vent

Filtered Vent - NORD may offer an optional filtered vent, which allows gases to permeate, but does not allow dust and debris to pass through the vent.



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U10751 - 1 of 2

1. Importance of proper lubrication

Proper gearbox lubrication is essential in order to reduce friction, heat, and component wear. Lubricants reduce heat and wear by inserting a protective “fluid boundary” between mating parts and preventing direct metal to metal contact. Lubricants also help prevent corrosion and oxidation, minimize foam, improve heat transfer, optimize reducer efficiency, absorb shock loads and reduce noise.

2. Factory oil type

All SK 9055 and SK9155 Conveyor Drive reducers shipped from the factory with a pre-determined oil fill level in accordance to the specified mounting position. Oil filling before shipment prevents damage from dry start-ups and helps assure that the proper lubrication is used.

Standard Oil Fill

The standard oil fill for the SK 9055 and SK 9155 Conveyor Drive is ISO VG 220, Mineral Oil.

Optional Oil Fill

Both synthetic and food grade oil options are also available upon request.



IMPORTANT NOTE

Consult the sticker adjacent to the fill plug to determine the type of lubricant installed at the factory. Some units have special lubricants designed to operate in certain environments or intended to extend the service life or service temperature range of the lubricant. If in doubt about which lubricant is needed for a certain application, please contact NORD Gear.

3. Lubrication replacement

If the gear unit is filled with mineral oil, the lubricant should be replaced at least after every 10,000 operating hours or after every two years. If the gear unit is filled with synthetic oil, the lubricant should be replaced at least after every 20,000 operating hours or after every four years. Often gear reducers are exposed to extreme ambient conditions, hostile environments, wet conditions, or dirty and dusty operating areas. Especially in these situations, it is important to establish a condition-based oil service interval.

4. Oil viscosity

Viscosity, or the oil’s resistance to shear under load, is often considered the single most important property of any gear oil.

- Often one will consider making a viscosity correction to the oil to improve the performance when operating the gear unit at low temperature or high temperature.
- In cases of extreme load conditions, gear pairs and antifriction bearings may be more susceptible to sliding or scuffing wear. In these operating conditions, it may also be beneficial to consider an increased lubrication viscosity and/or a lubrication with improved antiwear additive packages.



IMPORTANT NOTE

The user should consult with their primary lubrication supplier before considering changes in oil type or viscosity.

5. Maximum oil sump temperature limit

To prevent reducer overheating, the reducer’s maximum oil sump temperature limit must not be exceeded for prolonged periods of operation (up to 3 hours continuous operation depending upon reducer size).

Oil Type	Maximum Oil Temperature Limit	
	NORD	AGMA 9005-D94
Mineral	85°C (185°F)	95°C (203°F)
Synthetic	105°C (220°F)	107°C (225°F)



IMPORTANT NOTE

Use caution when specifying gear reducers for high temperature service. If there is concern about exceeding the allowable safe operating temperatures, please consult NORD to discuss alternatives.

6. The importance of routine oil analysis

Routine oil analysis, sound lubrication practices, and good tracking of oil performance trends will help establish proper lubrication maintenance and change-out intervals. To maximize equipment reliability, NORD Gear generally recommends a condition-based lubrication maintenance program. One may take exceptions to this general recommendation on sealed-for-life or maintenance-free gear units or smaller and less costly gear units. In these instances, the replacement cost of the gear unit is often small compared to the costs associated with this type of oil analysis program.

NOTICE

NORD suggests replacing the gear oil if oil analysis indicates any of the following. Failure to replace the oil may cause internal damage to gearbox and diminished performance:

- Viscosity has changed by approximately 10% or more.
- Debris particles (silicon, dust, dirt or sand) exceed 25 ppm.
- Iron content exceeds 150-200 ppm.
- Water content is greater than 0.05% (500 ppm).
- The total acid number (TAN) tests indicate a significant level of oxidative break-down of the oil, and a critical reduction in performance; If the TAN number measured changes by more than 5% over the new oil, then an oil change would be recommended.

7. Mounting position and oil fill quantity

Please see the separate mounting position diagrams and the corresponding oil fill quantity tables for the specified gear unit.

The gearbox nametag will indicate the mounting position that was provided. **For mounting orientations other than shown in the mounting position charts, please consult NORD Gear.**



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

8. Oil plug locations

All gear units are assembled with the oil fill-level, oil-drain and vent plugs installed in their proper locations, according to the specified mounting position. All standard plugs are metric and utilize sealing gaskets between the head of the plug and the reducer housing.

9. Drain and fill-level plugs

All reducer drain plugs are metric socket head cap screws. For easier identification, it is NORD's standard practice to provide a hex-head screw for the fill-level plug. For ease of draining the used oil from the gear reducer, use the socket head screw located at the lowest part of the gearbox.



Drain Plug



Fill Level Plug

10. Vent plug locations

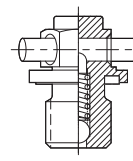
Reducer venting allows for air pressure differences that occur during operation, between the inner space of the reducer and the atmosphere, while ensuring leak-free operation. The AUTOVENT™ is standard for all vented gear units, unless otherwise noted.

AUTOVENT™ - The AUTOVENT™ helps prevent bearing and gear damage by behaving like a check valve to block the entry of foreign material and prevent lubrication contamination from dust particles, moisture and air-borne process chemicals. The breather opens at approximately 0.3-0.9 psi during operation and closes tightly as the gearbox cools. This option is perfect for humid conditions and wash-down environments, helping to maintain proper oil cleanliness, while reducing foaming and oxidation.

Figure 1 AUTOVENT™ Types



Type 1



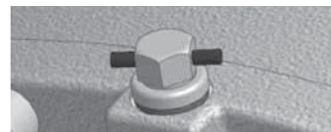
Type 2 with transportation plug



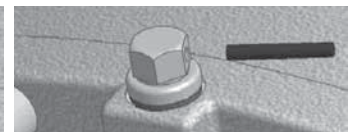
Open Vent - An optional open vent can be supplied by NORD. The open vent comes closed upon delivery with a transportation sealing plug (see Warning).

NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up. Excessive pressure may cause damage to internal components and cause leakage.



Sealed vent



Activated vent

Filtered Vent - NORD may offer an optional filtered vent, which allows gases to permeate, but does not allow dust and debris to pass through the vent.



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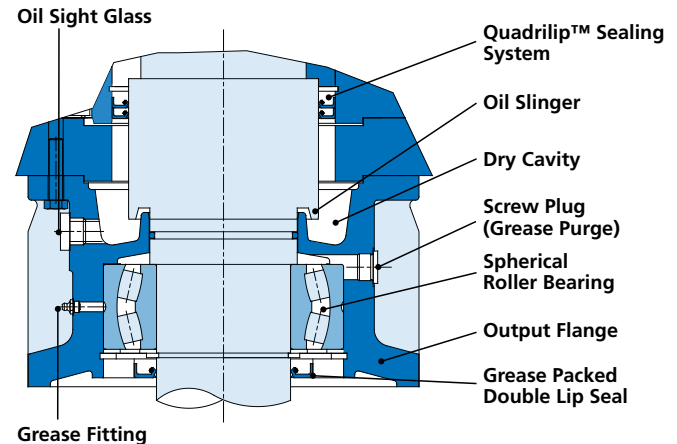
U10752 - 1 of 1

1. SK 9055 and SK 9155 Conveyor Drive Units

The NORD SK 9055 and SK 9155 Conveyor Drive reducers are designed to be a 'mounting flange and output shaft drop-in' for existing 'industry-standard' overhead conveyor drives.

2. Spread Bearing Design with Dry Cavity

The SK 9055 and SK 9155 Overhead Conveyor Drive gear units have two main features: a spread bearing design or large output bearing span and an oil leakage protection system. The spread bearing design enables the NORD box to handle high, overhung loads. The top bearing is a cylindrical roller bearing and the bottom bearing is a spherical roller bearing, selected for its high radial load capacity.



3. Service Guidelines for the Extended Bearing Flange

The spherical roller bearing on the extended bearing housing should be re-greased with 0.75 to 1.0 ounces (20-25 grams) of grease after every 2,500 hours of service or at least every 6 months. Prior to re-greasing the screw plug located opposite to the grease nipple should be unscrewed. After re-greasing the screw plug must be reinstalled and tightened. The extended bearing is factory assembled with the proper amount and type of grease. The type of grease supplied depends upon the type of oil specified at time of order.

Bearing Grease Options

Reducer Oil Type	NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type
MIN-EP	NLGI 2	Li-Complex	MIN	-30 to 60°C (-22 to 140°F)	Mobil Grease XHP222
PAO	NLGI 2	Li-Complex	PAO	-40 to 80°C (-40 to 176°F)	Mobil / Mobilith SHC 220
FG or FG-PAO	NLGI 2	Polyurea	FG-PAO	-30 to 80°C (-22 to 176°F)	Mobil SHC Polyrex 222

NOTICE

Grease compatibility depends upon the type of thickener or soap complex used, the base oil type suspended within the thickener, and the type of additives used. The user should check with the lubrication supplier before making substitutions in brand and type in order to assure compatibility and to avoid causing possible damage to the extended bearing.



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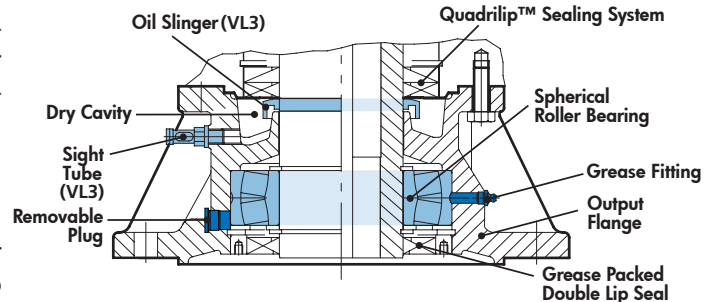
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U10760 - 1 of 1

1. VL2 – Spread Bearing Design

NORD offers reinforced output shaft bearings with increased bearing distance. The lower bearing is a oversized, double row spherical bearing, which absorbs high overhung and thrust loads while providing a longer bearing service life. The spherical roller bearing is especially useful in compensating for alignment errors in long agitator shafts. The VL2 spread bearing design is commonly used for shredders, mixers, overhead conveyors or applications requiring increased bearing load carrying capacities. Included with the VL2 design is a grease fitting for the lower bearing and a removable plug to allow excess grease to purge from the bearing cavity.



2. VL3 – Spread Bearing Design with Oil Safe Dry Cavity

The VL3 dry cavity design adds additional oil leak protective measures to the VL2 spread bearing design. NORD's Quadralip™ sealing system prevents oil from leaking from the gearbox into the VL2 flange. If in any case oil does leak past the Quadralip™ seals, it would flow down to the oil slinger mounted onto the shaft. As the shaft rotates, the oil will sling off into the dry cavity. A sight tube is provided for dry cavity inspection. At the bottom of the spread bearing flange is greased packed, double lip seal.

3. Service Guidelines for the Extended Bearing Flange

The spherical roller bearing on the extended bearing housing should be re-greased with 0.75 to 1.0 ounces (20-25 grams) of grease after every 2,500 hours of service or at least every 6 months. Prior to re-greasing the screw plug located opposite to the grease nipple should be unscrewed. After re-greasing the screw plug must be reinstalled and tightened. The extended bearing is factory assembled with the proper amount and type of grease. The type of grease supplied depends upon the type of oil specified at time of order.

Bearing Grease Options

Reducer Oil Type	NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type
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PAO	NLGI 2	Li-Complex	PAO	-40 to 80°C (-40 to 176°F)	Mobil / Mobilith SHC 220
FG or FG-PAO	NLGI 2	Polyurea	FG-PAO	-30 to 80°C (-22 to 176°F)	Mobil SHC Polyrex 222

NOTICE

Grease compatibility depends upon the type of thickener or soap complex used, the base oil type suspended within the thickener, and the type of additives used. The user should check with the lubrication supplier before making substitutions in brand and type in order to assure compatibility and to avoid causing possible damage to the extended bearing.

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DRIVESYSTEMS

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U10770 - 1 of 2

1. Importance of proper lubrication

Proper gearbox lubrication is essential in order to reduce friction, heat, and component wear. Lubricants reduce heat and wear by inserting a protective “fluid boundary” between mating parts and preventing direct metal to metal contact. Lubricants also help prevent corrosion and oxidation, minimize foam, improve heat transfer, optimize reducer efficiency, absorb shock loads and reduce noise.

NORD helical-worm reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position.

2. Standard oil type

NORD helical worm gear reducers are filled with ISO VG 680 synthetic-hydrocarbon/polyalphaolefin (SHC/PAO) worm gear oil.

- SHC/PAO worm gear oils have good high and low temperature stability, are compatible with most paint and seal types, and are miscible with mineral oils.
- SHC/PAO worm gear oils also contain a small amount of organic ester and other antiwear (AW) packages to offer improved lubrication conditions, especially in the worm mesh, where a sideways sliding motion prevails.

Please see user manual U11020 for more specific information and for optional helical worm lubricants.

NOTICE

In worm gears avoid using extreme pressure (EP) gear oils containing sulfur-phosphorous chemistries; these additives can react adversely with bronze worm gears, and accelerate wear.



IMPORTANT NOTE

Consult the sticker adjacent to the fill plug to determine the type of lubricant installed at the factory. Some units have special lubricants designed to operate in certain environments or intended to extend the service life or service temperature range of the lubricant. If in doubt about which lubricant is needed for a certain application, please contact NORD Gear.

3. Lubrication replacement

The helical-worm gear oil should be replaced at least after every 20,000 operating hours or after every four years. Often gear reducers are exposed to extreme ambient conditions, hostile environments, wet conditions, or dirty and dusty operating areas. Especially in these situations, it is important to establish a condition-based oil service interval.

4. Efficiency

Helical worm gears reach efficiencies up to 92% and are generally much more efficient than worm-only gear units. However, it is important to consider the following, when using worm gears.

- Worm gears reach their peak rated efficiency, after they undergo a natural run-in process (up to 25 hours operating time at maximum rated load). Catalog published power and torque figures are based upon the rated efficiency after the run-in is complete.
- Worm gears have naturally lower startup efficiencies compared to operating efficiencies. As input speed increases the enhanced hydrodynamic effects of the oil result in less tooth friction and increased worm gear efficiency.



IMPORTANT NOTE

Worm gear reducers applied in cold temperature service, may require increased motor power for the following reasons:

- Lower operating temperatures, cause lubrication viscosity to increase in both the gearbox and in the moving areas of the driven machine.
- Worm-gears have naturally lower start-up efficiencies compared to operating efficiencies.
- In extreme cases, one might need to consider increasing the motor power and lowering the oil viscosity

5. Oil Viscosity

Viscosity, or the oil's resistance to shear under load, is often considered the single most important property of any gear oil.

- Often one will consider making a viscosity correction to the oil to improve the performance when operating the gear unit at low temperature or high temperature.
- In cases of extreme load conditions, gear pairs and antifriction bearings may be more susceptible to sliding or scuffing wear. In these operating conditions, it may also be beneficial to consider an increased lubrication viscosity and/or a lubrication with improved antiwear additive packages.



IMPORTANT NOTE

The user should consult with their primary lubrication supplier before considering changes in oil type or viscosity.

6. Maximum oil sump temperature limit

To prevent reducer overheating, the reducer's maximum oil sump temperature limit must not be exceeded for prolonged periods of operation (up to 3 hours continuous operation depending upon reducer size).

Oil Type	Maximum Oil Temperature Limit	
	NORD	AGMA 9005-D94
Synthetic	105°C (220°F)	107°C (225°F)



IMPORTANT NOTE

Use caution when specifying gear reducers for high temperature service. If there is concern about exceeding the allowable safe operating temperatures, please consult NORD to discuss alternatives.

NORD Gear Limited

Toll Free in Canada: 800.668.4378

08.04.17

NORD Gear Corporation

Toll Free in the United States: 888.314.6673

www.nord.com

7. The importance of routine oil analysis

Routine oil analysis, sound lubrication practices, and good tracking of oil performance trends will help establish proper lubrication maintenance and change-out intervals. To maximize equipment reliability, NORD Gear generally recommends a condition-based lubrication maintenance program. One may take exceptions to this general recommendation on sealed-for-life or maintenance-free gear units or smaller and less costly gear units. In these instances, the replacement cost of the gear unit is often small compared to the costs associated with this type of oil analysis program.

NOTICE

NORD suggests replacing the gear oil if oil analysis indicates any of the following. Failure to replace the oil may cause internal damage to gearbox and diminished performance:

- Viscosity has changed by approximately 10% or more.
- Debris particles (silicon, dust, dirt or sand) exceed 25 ppm.
- Iron content exceeds 150-200 ppm.
- Water content is greater than 0.05% (500 ppm).
- The total acid number (TAN) tests indicate a significant level of oxidative break-down of the oil, and a critical reduction in performance; If the TAN number measured changes by more than 5% over the new oil, then an oil change would be recommended.

8. Mounting position and oil fill quantity

All NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. **For additional information, please see the separate mounting position diagrams and the corresponding oil fill quantity tables for the specified gear unit.**

The gearbox nametag will indicate the mounting position that was provided. **For mounting orientations other than shown in the mounting position charts, please consult NORD Gear.**



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

9. Oil plug locations

All gear units are assembled with the oil fill-level, oil-drain and vent plugs installed in their proper locations, according to the specified mounting position. All standard plugs are metric and utilize sealing gaskets between the head of the plug and the reducer housing.

10. Drain and fill-level plugs

All reducer drain plugs are metric socket head cap screws. For easier identification, it is NORD's standard practice to provide a hex-head screw for the fill-level plug. For ease of draining the used oil from the gear reducer, use the socket head screw located at the lowest part of the gearbox.



Drain Plug



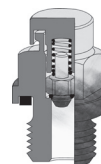
Fill Level Plug

11. Vent plug locations

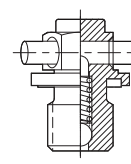
Reducer venting allows for air pressure differences that occur during operation, between the inner space of the reducer and the atmosphere, while ensuring leak-free operation. The AUTOVENT™ is standard for all vented gear units, unless otherwise noted.

AUTOVENT™ - The AUTOVENT™ helps prevent bearing and gear damage by behaving like a check valve to block the entry of foreign material and prevent lubrication contamination from dust particles, moisture and air-borne process chemicals. The breather opens at approximately 0.3-0.9 psi during operation and closes tightly as the gearbox cools. This option is perfect for humid conditions and wash-down environments, helping to maintain proper oil cleanliness, while reducing foaming and oxidation.

Figure 1 AUTOVENT™ Types



Type 1



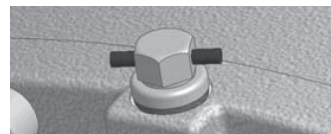
Type 2 with transportation plug



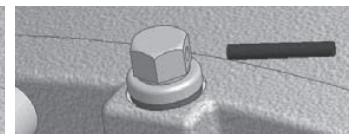
Open Vent - An optional open vent can be supplied by NORD. The open vent comes closed upon delivery with a transportation sealing plug (see Warning).

NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up. Excessive pressure may cause damage to internal components and cause leakage.



Sealed vent



Activated vent

Filtered Vent - NORD may offer an optional filtered vent, which allows gases to permeate, but does not allow dust and debris to pass through the vent.



1. Importance of proper gearbox lubrication

Proper gearbox lubrication is essential in order to reduce friction, heat, and component wear. Lubricants reduce heat and wear by inserting a protective "fluid boundary" between mating parts and preventing direct metal to metal contact. Lubricants also help prevent corrosion and oxidation, minimize foam, improve heat transfer, optimize reducer efficiency, absorb shock loads and reduce noise.

2. Maintenance free design

MINICASE® (SM series) worm gear reducers are designed to be maintenance-free and are supplied completely sealed. They are factory oil-filled with a pre-determined oil fill amount in accordance to the specified reducer size and mounting position. The synthetic lubrication used is suitable for the life of the product so the MINICASE™ is inherently maintenance free.

3. Standard oil type

The standard factory oil fill for MINICASE® (SM) worm gear reducers is ISO viscosity VG synthetic hydrocarbon/polyalphaolefin (SHC/PAO oil) food grade oil suitable for NSF-H1 incidental contact and is a factory stocked lubricant. Food grade oil suitable for NSF-H1 incidental contact is a factory stocked option.

See user manual U11040 for specific information and for optional MINICASE® (SM) worm lubrication types and options.

NOTICE

In worm gears avoid using extreme pressure (EP) gear oils containing sulfur-phosphorous chemistries; these additives can react adversely with bronze worm gears, and accelerate wear.

4. Efficiency

It is important to consider the following, when using worm gears.

- Worm gears reach their peak rated efficiency, after they undergo a natural run-in process (up to 25 hours operating time at maximum rated load). Catalog published power and torque figures are based upon the rated efficiency after the run-in is complete.
- Worm gears have naturally lower startup efficiencies compared to operating efficiencies. As input speed increases the enhanced hydrodynamic effects of the oil result in less tooth friction and increased worm gear efficiency.



IMPORTANT NOTE

Worm gear reducers applied in cold temperature service, may require increased motor power for the following reasons:

- Lower operating temperatures, cause lubrication viscosity to increase in both the gearbox and in the moving areas of the driven machine.
- Worm-gears have naturally lower start-up efficiencies compared to operating efficiencies.
- In extreme cases, one might need to consider increasing the motor power and/or lowering the oil viscosity.

5. Maximum oil sump temperature limit

To prevent reducer overheating, the reducer's maximum oil sump temperature limit must not be exceeded for prolonged periods of operation (up to 3 hours continuous operation depending upon reducer size).

Oil Type

Maximum Oil Temperature Limit

	NORD	AGMA 9005-D94
Synthetic	105°C (220°F)	107°C (225°F)



IMPORTANT NOTE

Use caution when specifying gear reducers for high temperature service. If there is concern about exceeding the allowable safe operating temperatures, please consult NORD to discuss alternatives.



6. Oil Viscosity

The viscosity rating determines the operating oil's resistance to shear under load conditions. Some important viscosity considerations include the following:

- Lightly loaded gears require lower viscosity oils than highly loaded gears.
- Lower viscosity will provide thin oil film, lower friction, higher mechanical efficiency, and better heat removal conditions.
- Higher viscosity will provide thicker oil film, and better resistance to sliding wear, scuffing wear, and galling at high pressure.
- Higher operating temperatures will cause a reduction in viscosity and lower operating temperatures, cause an increase in viscosity or a thickening of the oil.

The standard oil-fill is considered acceptable for most applications. In certain situations an oil viscosity change may be beneficial.

- If the gear unit is exposed to frequent high load conditions. A higher viscosity oil will have a higher film thickness offering better overall resistance to oil shear, sliding wear and scuffing wear in gears and roller element bearings.
- An oil viscosity correction or lubrication change may improve the overall performance when operating the gear unit at very low or high ambient temperature conditions.



IMPORTANT NOTE

The user should consult with their primary lubrication supplier before considering changes in oil type or viscosity.

7. Viscosity Index

Viscosity index helps quantify the rate of oil viscosity change with respect to temperature changes. Oils with a reasonably high viscosity index tend to be more stable in a changing temperature environment. The ability of an oil to maintain a small viscosity differential over the operating range of the gearbox provides a more consistent lubricating film and better wear performance.

Synthetic oils typically have a higher viscosity index than mineral oils and polyglycol oils tend to have an exceptionally high viscosity index compared to other synthetic oils like polyalphaolefin or ester based products.



1. Importance of proper gearbox lubrication

Proper gearbox lubrication is essential in order to reduce friction, heat, and component wear. Lubricants reduce heat and wear by inserting a protective "fluid boundary" between mating parts and preventing direct metal to metal contact. Lubricants also help prevent corrosion and oxidation, minimize foam, improve heat transfer, optimize reducer efficiency, absorb shock loads and reduce noise.

2. Factory Oil-Filled / Maintenance-Free

NORD modular worm gear units are inherently maintenance-free, factory oil filled, and supplied with a high-quality, long-life, synthetic oil which is intended to be suitable for the life of the gear unit.

MINICASE® (SMI/SMID) worm gear units are assembled at the factory from stocked component parts. They are filled at time of assembly in accordance to the specified reducer mounting position. See user manuals U13150 and U13250 for more info.

3. Standard Oil Types

MINICASE® (SMI/SMID) worm gear units are factory filled with synthetic poly glycol oil. Food-grade polyglycol oil is optional. The specific oil type and viscosity grade are displayed on the reducer nameplate. See user manual 11050 for specific MINICASE® (SMI/SMID) worm lubrication types and options.

NOTICE

In worm gears avoid using extreme pressure (EP) gear oils containing sulfur-phosphorous chemistries; these additives can react adversely with bronze worm gears, and accelerate wear.

4. Efficiency

It is important to consider the following, when ordering worm gears.

- Worm gears reach their peak rated efficiency, after they undergo a natural run-in process (up to 25 hours operating time at maximum rated load). Catalog published power and torque figures are based upon the rated efficiency after the run-in is complete.
- Worm gears have naturally lower startup efficiencies compared to operating efficiencies. As input speed increases the enhanced hydrodynamic effects of the oil result in less tooth friction and increased worm gear efficiency.



IMPORTANT NOTE

Worm gear reducers applied in cold temperature service, may require increased motor power for the following reasons:

- Lower operating temperatures, cause lubrication viscosity to increase in both the gearbox and in the moving areas of the driven machine.
- Worm-gears have naturally lower start-up efficiencies compared to operating efficiencies.
- In extreme cases, one might need to consider increasing the motor power and lowering the oil viscosity

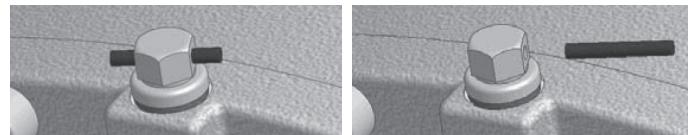
5. Optional Vent Kits

MINICASE® (SMI/SMID) worm gear units are designed to operate sealed or vented. As a standard the modular worm gear units are factory oil filled and supplied with oil plugs in the housing, making vent plugs optional. See user manual U14750.

NORD can supply an AUTOVENT™ or an open vent with each gear unit size. If a vent is desired the type must be specified at the time of order. Reducer vents are sealed with a transportation plug that must be removed prior to gear unit start-up.

Type	Transportation Seal	Installation	Part Number
AUTOVENT™	Included	Factory or Field site	66093510
Open Vent	None	Field Only	60693500
Open Vent	Included	Factory or Field site	22008004 (vent) 25308120 (gasket)

Unless noted by a separate part number, vent kits include the housing gasket



NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start-up. Excessive pressure may cause damage to internal components and cause leakage.

6. AUTOVENT™

The AUTOVENT™ helps prevent bearing and gear damage by behaving like a check valve to block the entry of foreign material and prevent lubrication contamination from dust particles, moisture and air-borne process chemicals. The breather opens at approximately 0.3-0.9 psi during operation and closes tightly as the gearbox cools. This option is perfect for humid conditions and wash-down environments, helping to maintain proper oil cleanliness, while reducing foaming and oxidation.

7. Open Vent

A typical gearbox industry open vent option can also be supplied by NORD. This option allows free exchange of air and does not build-up any back pressure inside the gear unit. This option is ideal for many operating conditions where the geared product is used in relatively clean and moisture-free environment.



DRIVESYSTEMS



U10800 - 2 of 2

8. When to Use a Sealed or a Vented Unit

There are many conditions that should be considered when deciding whether to use a sealed or vented unit.

1. If the duty cycle is intermittent, the run times are short, and any build-up of internal pressure or temperature is relatively low, the sealed unit option may be used.
2. If running continuous and under moderate to high load conditions, worm gears can generate higher operating temperatures and a build-up of internal pressure. In these instances a vent is strongly recommended. Consult NORD if operation at high load conditions is required.
3. If running continuous at 4-pole electric motor speeds (1800 rpm at 60 Hz) or higher, then a vent option is usually recommended. Consult NORD if operation at higher speeds is required.
4. Radial shaft seals produce a hydrodynamic pumping action to help push lubricant back into the gear unit, causing a small amount of ingested air and a small pressure increase (1-2 psi) that does not normally require a reducer vent; however when combined with continuous operation under high load (Condition 2), additional operating pressures will result and a vent should be used.
5. When the environment is contaminated with water, dirt, or other objects that may be ingested into the breather, increased wear of bearings, gearing, and lubrication breakdown can result. In these instances the sealed option or an AUTOVENT™ should be considered.

9. Maximum Oil Sump Temperature Limit

To prevent reducer overheating, the reducer's maximum oil-ump temperature limit must not be exceeded for prolonged periods of operation.

Oil Type	Maximum Oil Temperature Limit	
	NORD	AGMA 9005-D94
Synthetic	105°C (220°F)	107°C (225°F)



IMPORTANT NOTE

Use caution when specifying gear reducers for high temperature service. If there is concern about exceeding the safe operating temperature limit, please consult NORD to discuss alternatives.

10. Oil Viscosity

The viscosity rating determines the operating oil's resistance to shear under load conditions. Some important viscosity considerations include the following:

- Lightly loaded gears require lower viscosity oils than highly loaded gears.
- Lower viscosity will provide thin oil film, lower friction, higher mechanical efficiency, and better heat removal conditions.
- Higher viscosity will provide thicker oil film, and a better resistance to sliding wear, scuffing wear, and galling at high pressure.
- Higher operating temperatures will cause a reduction in viscosity and lower operating temperatures, cause an increase in viscosity or a thickening of the oil.

The standard oil-fill is considered acceptable for most applications. In certain situations an oil viscosity change may be beneficial.

- If the gear unit is exposed to frequent high load conditions. A higher viscosity oil will have a higher film thickness offering better overall resistance to oil shear, sliding wear and scuffing wear in gears and roller element bearings.
- An oil viscosity correction or lubrication change may improve the overall performance when operating the gear unit at very low or high ambient temperature conditions.



IMPORTANT NOTE

The user should consult with their primary lubrication supplier before considering changes in oil type or viscosity.

11. Viscosity Index

Viscosity index helps quantify the rate of oil viscosity change with respect to temperature changes. Oils with a reasonably high viscosity index tend to be more stable in a changing temperature environment. The ability of an oil to maintain a small viscosity differential over the operating range of the gearbox provides a more consistent lubricating film and better wear performance.

Synthetic oils typically have a higher viscosity index than mineral oils and polyglycol oils tend to have an exceptionally high viscosity index compared to other synthetic oils like polyalpha-olefin or ester based products.

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**SCREW CONVEYOR PARTS****EAR**

DRIVESYSTEMS

RETAIN FOR FUTURE USE

U10810 - 1 of 2

1. Importance of Proper Lubrication

Proper gearbox lubrication is essential in order to reduce friction, heat, and component wear. Lubricants reduce heat and wear by inserting a protective "fluid boundary" between mating parts and preventing direct metal to metal contact. Lubricants also help prevent corrosion and oxidation, minimize foam, improve heat transfer, optimize reducer efficiency, absorb shock loads and reduce noise.

2. Factory Oil-Filled / Maintenance-Free

NORD modular worm gear units are inherently maintenance-free, factory oil filled, and supplied with a high-quality, long-life, synthetic oil which is intended to be suitable for the life of the gear unit.

FLEXBLOC™ SI worm gear units are filled at time of assembly to a universal oil fill, allowing for many mounting position possibilities. See user manual U13300.

3. Standard oil type

FLEXBLOC™ (SI/SID) worm gear units are factory filled with synthetic poly glycol oil. Food-grade polyglycol oil is optional. The specific oil type and viscosity grade are displayed on the reducer nameplate. See user manual 11060 for specific FLEXBLOC™ (SI/SID) worm lubrication types and options.

NOTICE

In worm gears avoid using extreme pressure (EP) gear oils containing sulfur-phosphorous chemistries; these additives can react adversely with bronze worm gears, and accelerate wear.

4. Efficiency

It is important to consider the following, when ordering worm gears.

- Worm gears reach their peak rated efficiency, after they undergo a natural run-in process (up to 25 hours operating time at maximum rated load). Catalog published power and torque figures are based upon the rated efficiency after the run-in is complete.
- Worm gears have naturally lower startup efficiencies compared to operating efficiencies. As input speed increases the enhanced hydrodynamic effects of the oil result in less tooth friction and increased worm gear efficiency.



IMPORTANT NOTE

Worm gear reducers applied in cold temperature service, may require increased motor power for the following reasons:

- Lower operating temperatures, cause lubrication viscosity to increase in both the gearbox and in the moving areas of the driven machine.
- Worm-gears have naturally lower start-up efficiencies compared to operating efficiencies.
- In extreme cases, one might need to consider increasing the motor power and lowering the oil viscosity

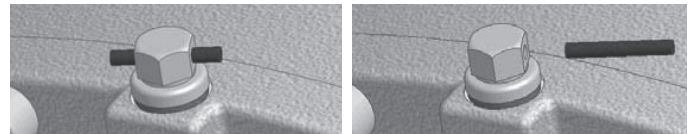
5. Optional Vent Kits

FLEXBLOC™ (SI) worm gear units are designed to operate sealed or vented. As a standard the modular worm gear units are factory oil filled and supplied with oil plugs in the housing, making vent plugs optional. See user manual U14800 for vent locations.

NORD can supply an AUTOVENT™ or an open vent with each gear unit size. If a vent is desired the type must be specified at the time of order. Reducer vents are sealed with a transportation plug that must be removed prior to gear unit start-up.

Type	Transportation Seal	Installation	Part Number
AUTOVENT™	Included	Factory or Field site	66093510
Open Vent	None	Field Only	60693500
Open Vent	Included	Factory or Field site	22008004 (vent) 25308120 (gasket)

Unless noted by a separate part number, vent kits include the housing gasket



NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start-up. Excessive pressure may cause damage to internal components and cause leakage.

6. AUTOVENT™

The AUTOVENT™ helps prevent bearing and gear damage by behaving like a check valve to block the entry of foreign material and prevent lubrication contamination from dust particles, moisture and air-borne process chemicals. The breather opens at approximately 0.3-0.9 psi during operation and closes tightly as the gearbox cools. This option is perfect for humid conditions and wash-down environments, helping to maintain proper oil cleanliness, while reducing foaming and oxidation.

7. Open Vent

A typical gearbox industry open vent option can also be supplied by NORD. This option allows free exchange of air and does not build-up any back pressure inside the gear unit. This option is ideal for many operating conditions where the geared product is used in relatively clean and moisture-free environment.

NORD Gear Limited

Toll Free in Canada: 800.668.4378

NORD Gear Corporation

Toll Free in the United States: 888.314.6673

**FLEX**

Courtesy of:

**SCREW CONVEYOR PARTS****GEAR**

DRIVESYSTEMS

RETAIN FOR FUTURE USE

U10810 - 2 of 2

8. When to Use a Sealed or a Vented Unit

There are many conditions that should be considered when deciding whether to use a sealed or vented unit.

1. If the duty cycle is intermittent, the run times are short, and any build-up of internal pressure or temperature is relatively low, the sealed unit option may be used.
2. If running continuous and under moderate to high load conditions, worm gears can generate higher operating temperatures and a build-up of internal pressure. In these instances a vent is strongly recommended. Consult NORD if operation at high load conditions is required.
3. If running continuous at 4-pole electric motor speeds (1800 rpm at 60 Hz) or higher, then a vent option is usually recommended. Consult NORD if operation at higher speeds is required.
4. Radial shaft seals produce a hydrodynamic pumping action to help push lubricant back into the gear unit, causing a small amount of ingested air and a small pressure increase (1-2 psi) that does not normally require a reducer vent; however when combined with continuous operation under high load (Condition 2), additional operating pressures will result and a vent should be used.
5. When the environment is contaminated with water, dirt, or other objects that may be ingested into the breather, increased wear of bearings, gearing, and lubrication breakdown can result. In these instances the sealed option or an AUTOVENT™ should be considered.

9. Maximum Oil Sump Temperature Limit

To prevent reducer overheating, the reducer's maximum oil-ump temperature limit must not be exceeded for prolonged periods of operation.

Oil Type	Maximum Oil Temperature Limit	
	NORD	AGMA 9005-D94
Synthetic	105°C (220°F)	107°C (225°F)

**IMPORTANT NOTE**

Use caution when specifying gear reducers for high temperature service. If there is concern about exceeding the allowable safe operating temperatures, please consult NORD to discuss alternatives.

10. Oil Viscosity

The viscosity rating determines the operating oil's resistance to shear under load conditions. Some important viscosity considerations include the following:

- Lightly loaded gears require lower viscosity oils than highly loaded gears.
- Lower viscosity will provide thin oil film, lower friction, higher mechanical efficiency, and better heat removal conditions.
- Higher viscosity will provide thicker oil film, and better resistance to sliding wear, scuffing wear, and galling at high pressure.
- Higher operating temperatures will cause a reduction in viscosity and lower operating temperatures, cause an increase in viscosity or a thickening of the oil.

The standard oil-fill is considered acceptable for most applications. In certain situations an oil viscosity change may be beneficial.

- If the gear unit is exposed to frequent high load conditions. A higher viscosity oil will have a higher film thickness offering better overall resistance to oil shear, sliding wear and scuffing wear in gears and roller element bearings.
- An oil viscosity correction or lubrication change may improve the overall performance when operating the gear unit at very low or high ambient temperature conditions.

**IMPORTANT NOTE**

The user should consult with their primary lubrication supplier before considering changes in oil type or viscosity.

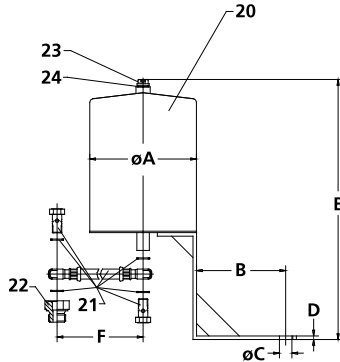
11. Viscosity Index

Viscosity index helps quantify the rate of oil viscosity change with respect to temperature changes. Oils with a reasonably high viscosity index tend to be more stable in a changing temperature environment. The ability of an oil to maintain a small viscosity differential over the operating range of the gearbox provides a more consistent lubricating film and better wear performance.

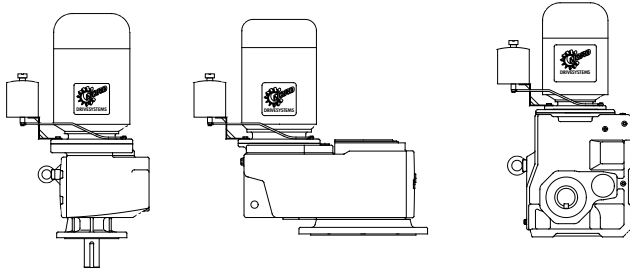
Synthetic oils typically have a higher viscosity index than mineral oils and polyglycol oils tend to have an exceptionally high viscosity index compared to other synthetic oils like polyalphaolefin or ester based products.

Installation Instructions

Sometimes NORD requires the use of an oil expansion chamber when the motor or reducer input is mounted vertically. Consult your NORD catalog for additional information and application considerations.



1. Secure the gear reducer in the proper mounting position for the application and remove the vent plug from the gear reducer. The hose assembly kit (21) will be fitted to the reducer using the housing port provided.
2. When using the larger 2.7 and 5.4 liter chambers, screw the adapter fitting (22) into the reducer housing port. Use all sealing gaskets provided.
3. Mount the overflow tank (20) at the highest location from the reducer, as permitted by the hose assembly kit (21). Typical mounting configurations are represented below. Use one of the input cover's mounting bolts, to mount the chamber support leg to the reducer.



4. Be sure to use the proper fittings. Assemble one end of the vent-hose assembly (21) to bottom of the chamber and one-end to the reducer.
5. Secure the vent-plug (23) and gasket (24) that is supplied with the kit to the top of the expansion chamber.

NOTICE

Remove the protective "rubber element" from the supplied vent prior to use so that an open-vent is formed on top of the overflow tank. Avoid using a pressurized AUTOVENT™ breather on the overflow tank since this may create an undesired pressure-vacuum in the overflow tank.

Expansion Chamber Kit Dimensions & Parts List

Kit Part Number: 28390390 - 0.7 Liter Oil Expansion Chamber

Kit P/N	Ø A	B	Ø C	D	E	F	Units
28390390 (0.7 Liter)	3.94 100	1.97 50	0.53 13.5	0.20 5	8.50 216	19.69 500	inch mm

Item	Part Number	Description
20	28300390	Overflow Tank - 0.7 Liter
21	28310020	Flexible Vent Hose Assembly - Includes: Hose, metal gaskets & 2 Hollow Bolts (1 Bolt. - M12 X 1.5 and 1 Pc. - G1/4)
22	None	Adapter Fitting
23	22012004	Normal Style Vent Plug (M12 X 1.5, DIN 910)
24	25312150	Vent Plug Gasket (12 X 15.5 X 1.5)

Kit Part Number: 28390400 - 2.7 Liter Oil Expansion Chamber

Kit P/N	Ø A	B	Ø C	D	E	F	Units
28390400 (2.7 Liter)	5.91 150	4.92 125	0.69 17.5	0.20 5	15.22 386.5	27.56 700	inch mm

Item	Part Number	Description
20	28300400	Overflow Tank - 2.7 Liter
21	28310030	Flexible Vent Hose Assy - Includes: Hose, metal gaskets & 2 Hollow Bolts (2 Pcs. - G1/4)
22	22024030	Adapter Fitting (M24 X 1.5 to G1/4)
23	22012004	Normal Style Vent Plug (M12 X 1.5, DIN 910)
24	25312150	Vent Plug Gasket (12 X 15.5 X 1.5)

Kit Part Number: 28390410 - 5.4 Liter Oil Expansion Chamber

Kit P/N	Ø A	B	Ø C	D	E	F	Units
28390410 (5.4 Liter)	7.09 180	3.54 90	0.69 17.5	0.20 5	15.18 385.5	31.50 800	inch mm

Item	Part Number	Description
20	28300410	Overflow Tank - 5.4 Liter
21	28310040	Flexible Vent Hose Assy - Includes: Hose, metal gaskets & 2 Hollow Bolts (2 Pcs. - G1/4)
22	22030030	Adapter Fitting (M30 X 1.5 to G1/4)
23	22012004	Normal Style Vent Plug (M12 X 1.5, DIN 910)
24	25312150	Vent Plug Gasket (12 X 15.5 X 1.5)

Please see page 2 for gearbox compatibility

Expansion Chamber Compatability Chart

Helical In-line	NORDBLOC™	NORDBLOC.1™	Clincher™	Helical-Bevel	Part Number	[lb]
SK 42/43 SK 52/53 SK 63	SK472/473 SK572/573 SK672/673 SK772/773 SK872/873 SK972/973	SK572.1/573.1* SK672.1/673.1* SK772.1/773.1 SK872.1/873.1 SK972.1/973.1	SK 4282/4382 SK 5282/5382 SK 6382	SK 9042.1/9043.1 SK 9052.1/9053.1	28390390	11.0
SK 62 SK 72/73			SK 6282 SK 7282/7382	SK 9072.1 SK 9082.1	28390400	13.2
SK 82/83 SK 92/93 SK 102/103			SK 8282/8382	SK 9086.1 SK 9092.1 SK 9096.1	28390410	15.4





* Need to additionally order part #28390380 which is sub-assembly shown below.

Expansion Chamber Compatability Chart

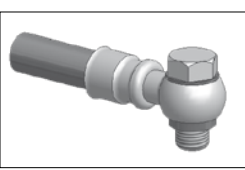
Helical Worm	Two-Stage Helical Bevel	NORDBLOC.1™	Clincher™	Part Number
SK 02040.1	SK 920072.1 SK 92072.1	SK 072.1 / 071.1 SK 172.1	N/A	28390840**
N/A	SK 92172.1	SK 171.1 SK 372.1	SK 0182.1 SK 0282.1 SK 1382.1	28390850**

* See page 3 for assembly information

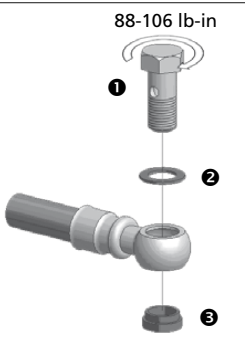
Sub-Assembly P/N 28390380 for NORDBLOC®.1 gear units with M10x1 air vent.

 1 1x DIN 7643 M10x1 283 00380	 2 1x DIN 7603A Cu 10x16x1 253 10166	 3 1x Ring 10x14x5 283 00370	 4 1xDIN 9021 ø8,4 227 10840
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Assembly of the expansion unit at the gear unit. Types SK 572.1/573.1, SK 672.1/673.1



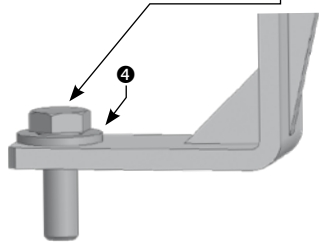
Vent Hose Sub-Assembly



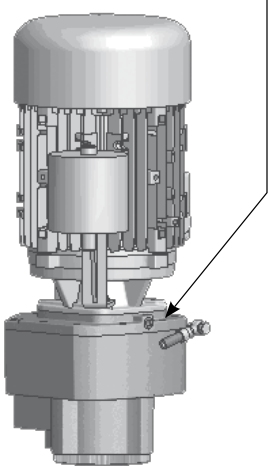
88-106 lb-in

4 For motor sizes 63, 71, 80, 90, 100 & 112

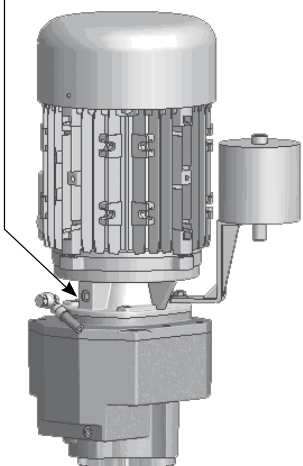
- Motor attachment bolt



Motor Sizes 63, 71 & 80:
Assembly vent-hose to port as shown.



Motor Sizes 90, 100 & 112:
Assembly vent-hose to port as shown.



Assembly instruction for 0.25-liter oil expansion chamber (OA)

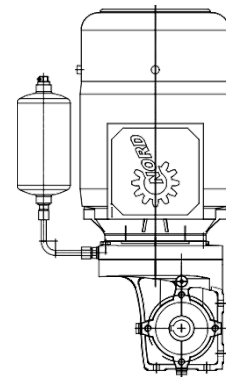
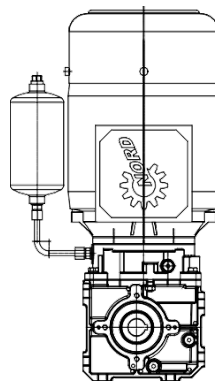
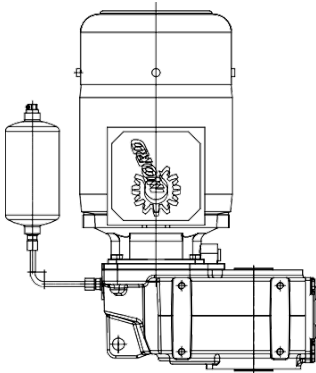
1. After fitting the drive in the find operating position remove vent-plug of the drive.

2. Assemble the expansion unit (suggestions for position listed below).

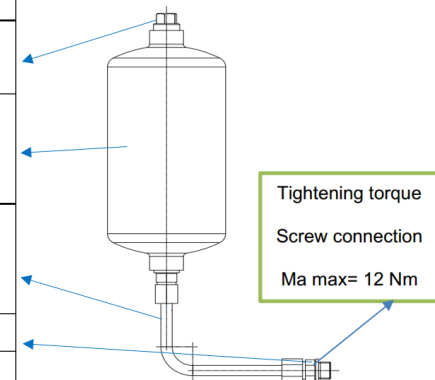
Attention: Terminal box position for the construction M4 in position 2 is not possible.

The expansion tank should be screwed straight, parallel to the motor axis.

Attention: On ATEX gearboxes, screw the pressure vent plug M10x1.0, into the expansion unit.



Designation	0 A	0 B
Vent plug M10x1.0 with oil seal	X	X
Expansion tank (l)	0.25	0.25
Pipe 6 mm	PR 06	PR 06
Gear connection	M8x1	M10x1
Part number	28390840	28390850





Courtesy of:



**SCREW CONVEYOR
PARTS**



DRIVESYSTEMS

RETAIN FOR FUTURE USE

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Lubrication Tables – Helical and Bevel Gear Units

Standard Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG220	MIN-EP	0 to 40°C (32 to 104°F)	Mobilgear 600XP220	⚙️①
	PAO-EP	-35 to 60°C (-31 to 140°F)	Mobil SHC Gear 220	⚙️②
	FG	-5 to 40°C (23 to 104°F)	Fuchs FM220	⚙️

Optional Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG460	PAO-EP	-35 to 80°C (-31 to 176°F)	Mobil SHC Gear 460	-
	FG-PAO	-35 to 80°C (-31 to 176°F)	Mobil SHC Cibus 460	-
VG220	FG-PAO	-35 to 60°C (-31 to 140°F)	Mobil SHC Cibus 220	S
VG150	PAO-EP	-35 to 25°C (-31 to 77°F)	Mobil SHC Gear 150	-

Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type	Notes
NLGI 2	Li-Complex	MIN	-30 to 60°C (-22 to 140°F)	Mobil Grease XHP222	⚙️①
	Li-Complex	PAO	-40 to 80°C (-40 to 176°F)	Mobil / Mobilith SHC 220	⚙️②
	Polyurea	FG-PAO	-30 to 80°C (-22 to 176°F)	Mobil SHC Polyrex 222	⚙️

⚙️ Stocked Lubricants

① Standard product on serviceable gear units

② Standard product on maintenance free gear units



IMPORTANT NOTE

- The “Ambient Temperature” is intended to be an operation guideline based upon the typical properties of all the lubricant. The viscosity and other properties of the lubricant change based upon load, speed, ambient conditions, and reducer operating temperatures. The user should consult with their lubrication supplier & NORD gear before considering changes in oil type or viscosity.
- To prevent reducer overheating, observe the maximum operating oil temperature limits:
Mineral Oil: 85 °C (185 °F).
Synthetic Oil: 105 °C (225 °F).
- In the following instances, please consult NORD for specific recommendations:
 - ✓ Gear units will operate in high ambient temperature conditions exceeding 40 °C (104 °F).
 - ✓ Gear units will operate in cold ambient temperature conditions approaching 0 °C (32 °F) or lower.
 - ✓ Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.
 - ✓ Fluid grease is required for lubricating the gear unit.
- Observe the general lubrication guidelines outlined in user manual U10750.

Oil Formulation Codes

MIN-EP	-	Mineral Oil with EP Additive
PAO-EP	-	Synthetic Polyalphaolefin Oil with EP Additive
PAO	-	Synthetic Polyalphaolefin Oil
PG	-	Synthetic Polyglycol Oil
FG	-	Food-Grade Oil
FG-PAO	-	Food-Grade, Synthetic Polyalphaolefin Oil
FG-PG	-	Food-Grade, Synthetic Polyglycol Oil

Lubrication Notes

- Avoid using (EP) gear oils in worm gears that contain sulfur-phosphorous chemistries, as these additives can react adversely with bronze worm gears and accelerate wear.
- Food grade lubricants must be in compliance with FDA 212 CFR 178.3570 and qualify as a NSF-H1 lubricant. Please consult with lubrication manufacturer for more information.
- When making a lubrication change, check with the lubrication supplier to assure compatibility and to obtain recommended cleaning or flushing procedures.
- Do not mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not miscible with other oil types and should never be mixed with mineral oil or polyalphaolefin (PAO) synthetic oil.

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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PARTS**

U11000 - 2 of 2

Oil Cross-reference Chart

ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	FUCHS	KLÜBER LUBRICATION
VG150	MIN-EP	0 to 25°C (32 to 77°F)	Mobilgear 600XP150	Omala S2 G 150	Alpha SP150	Renolin EP150	Klüberoil GEM 1-150N
	PAO-EP	-30 to 25 °C (-22 to 77 °F)	Mobil SHC Gear 150	Omala S4 GX 150	Alphasyn EP150	Gearmaster SYN150/NA	Klübersynth EG 4-150
	PAO	-30 to 25°C (-22 to 77°F)	Mobil SHC629	Morlina S4 B 150	Alphasyn T150	N/A	Klübersynth GEM 4-150N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	Omala S4 WE 150	Alphasyn PG150	Renolin PG150	Klübersynth GH 6-150
	FG	0 to 25°C (32 to 77°F)	Mobil DTE FM 150	N/A	N/A	N/A	N/A
	FG-PAO	-15 to 25°C (5 to 77°F)	Mobil SHC Cibus 150	N/A	N/A	Cassida GL150	Klüberoil 4 UH 1-150N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	N/A	N/A	N/A	Klübersynth UH1 6-150
VG220	MIN-EP	0 to 40°C (32 to 104°)	Mobilgear 600XP220	Omala S2 G 220	Alpha SP220	Renolin EP220	Klüberoil GEM 1-220N
	PAO-EP	-30 to 60 °C (-22 to 140 °F)	Mobil SHC Gear 220	Omala S4 GX 220	Alphasyn EP220	Gearmaster SYN220/NA	Klübersynth EG 4-220
	PAO	-30 to 60°C (-22 to 140°F)	Mobil SHC630	Morlina S4 B 220	Alphasyn T220	N/A	Klübersynth GEM 4-220N
	PG	-25 to 60°C (-13 to 140°F)	Mobil Glygoyle 220	Omala S4 WE 220	Alphasyn PG220	Renolin PG220	Klübersynth GH 6-220
	FG	0 to 40°C (32 to 104°F)	Mobil DTE FM 220	N/A	N/A	Fuchs FM220	N/A
	FG-PAO	-25 to 60°C (-13 to 140°F)	Mobil SHC Cibus 220	N/A	N/A	Cassida GL220	Klüberoil 4 UH 1-220N
	FG-PG	-25 to 60°C (-13 to 140°F)	Mobil Glygoyle 220	N/A	N/A	Cassida WG220	Klübersynth UH1 6-220
VG460	MIN-EP	0 to 40°C (32 to 104°F)	Mobilgear 600XP460	Omala S2 G 460	Alpha SP460	Renolin EP460	Klüberoil GEM 1-460N
	PAO-EP	-20 to 80°C (-4 to 176°F)	Mobil SHC Gear 460	Omala S4 GX 460	Alphasyn EP460	Gearmaster SYN460/NA	Klübersynth EG 4-460
	PAO	-20 to 80°C (-4 to 176°F)	Mobil SHC 634	Morlina S4 B 460	Alphasyn T460	N/A	Klübersynth GEM 4-460N
	PG	-20 to 80°C (-4 to 176°F)	Mobil Glygoyle 460	Omala S4 WE 60	Alphasyn PG460	N/A	Klübersynth GH 6-460
	FG	0 to 40°C (32 to 104°F)	Mobil DTE FM460	N/A	N/A	Fuchs FM460	N/A
	FG-PAO	-20 to 80°C (-4 to 176°F)	Mobil SHC Cibus 460	N/A	N/A	Cassida GL460	Klüberoil 4 UH 1-460N
	FG-PG	-20 to 80°C (-4 to 176°F)	Mobil Glygoyle 460	N/A	N/A	Cassida WG460	Klübersynth UH1 6-460

Low-end service temperature limit may vary for a specific lubricant; Please also see the important notes on Page 1.

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Lubrication Tables – SK 9055 and SK 9155 Gear Units

Standard Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG220	MIN-EP	0 to 40°C (32 to 104°F)	Mobilgear 600XP220	⚙️①
	PAO-EP	-35 to 60°C (-31 to 140°F)	Mobil SHC Gear 220	⚙️②
	FG	-5 to 40°C (23 to 104°F)	Fuchs FM220	⚙️

Optional Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG460	PAO-EP	-35 to 80°C (-31 to 176°F)	Mobil SHC Gear 460	-
	FG-PAO	-35 to 80°C (-31 to 176°F)	Mobil SHC Cibus 460	-
VG220	FG-PAO	-35 to 60°C (-31 to 140°F)	Mobil SHC Cibus 220	-
VG150	PAO-EP	-35 to 25°C (-31 to 77°F)	Mobil SHC Gear 150	-

Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type	Notes
NLGI 2	Li-Complex	MIN	-30 to 60°C (-22 to 140°F)	Mobil Grease XHP222	⚙️①
	Li-Complex	PAO	-40 to 80°C (-40 to 176°F)	Mobil / Mobilith SHC 220	⚙️②
	Polyurea	FG-PAO	-30 to 80°C (-22 to 176°F)	Mobil SHC Polyrex 222	⚙️

⚙️ Stocked Lubricants

① Standard product on serviceable gear units

② Standard product on maintenance free gear units



IMPORTANT NOTE

- The “Ambient Temperature” is intended to be an operation guideline based upon the typical properties of all the lubricant. The viscosity and other properties of the lubricant change based upon load, speed, ambient conditions, and reducer operating temperatures. The user should consult with their lubrication supplier & NORD gear before considering changes in oil type or viscosity.
- To prevent reducer overheating, observe the maximum operating oil temperature limits:
Mineral Oil: 85 °C (185 °F).
Synthetic Oil: 105 °C (225 °F).
- In the following instances, please consult NORD for specific recommendations:
 - ✓ Gear units will operate in high ambient temperature conditions exceeding 40 °C (104 °F).
 - ✓ Gear units will operate in cold ambient temperature conditions approaching 0 °C (32 °F) or lower.
 - ✓ Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.
 - ✓ Fluid grease is required for lubricating the gear unit.
- Observe the general lubrication guidelines outlined in user manual U10750.

Oil Formulation Codes

MIN-EP	-	Mineral Oil with EP Additive
PAO-EP	-	Synthetic Polyalphaolefin Oil with EP Additive
PAO	-	Synthetic Polyalphaolefin Oil
PG	-	Synthetic Polyglycol Oil
FG	-	Food-Grade Oil
FG-PAO	-	Food-Grade, Synthetic Polyalphaolefin Oil
FG-PG	-	Food-Grade, Synthetic Polyglycol Oil

Lubrication Notes

- Avoid using (EP) gear oils in worm gears that contain sulfur-phosphorous chemistries, as these additives can react adversely with bronze worm gears and accelerate wear.
- Food grade lubricants must be in compliance with FDA 212 CFR 178.3570 and qualify as a NSF-H1 lubricant. Please consult with lubrication manufacturer for more information.
- When making a lubrication change, check with the lubrication supplier to assure compatibility and to obtain recommended cleaning or flushing procedures.
- Do not mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not miscible with other oil types and should never be mixed with mineral oil or polyalphaolefin (PAO) synthetic oil.

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Oil Cross-reference Chart

ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	FUCHS	KLÜBER LUBRICATION
VG150	MIN-EP	0 to 25°C (32 to 77°F)	Mobilgear 600XP150	Omala S2 G 150	Alpha SP150	Renolin EP150	Klüberoil GEM 1-150N
	PAO-EP	-30 to 25 °C (-22 to 77 °F)	Mobil SHC Gear150	Omala S4 GX 150	Alphasyn EP150	Gearmaster SYN150/NA	Klübersynth EG 4-150
	PAO	-30 to 25°C (-22 to 77°F)	Mobil SHC629	Morlina S4 B 150	Alphasyn T150	N/A	Klübersynth GEM 4-150N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	Omala S4 WE 150	Alphasyn PG150	Renolin PG150	Klübersynth GH 6-150
	FG	0 to 25°C (32 to 77°F)	Mobil DTE FM 150	N/A	N/A	N/A	N/A
	FG-PAO	-15 to 25°C (5 to 77°F)	Mobil SHC Cibus 150	N/A	N/A	Cassida GL150	Klüberoil 4 UH 1-150N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	N/A	N/A	N/A	Klübersynth UH1 6-150
VG220	MIN-EP	0 to 40°C (32 to 104°F)	Mobilgear 600XP220	Omala S2 G 220	Alpha SP220	Renolin EP220	Klüberoil GEM 1-220N
	PAO-EP	-30 to 60 °C (-22 to 140 °F)	Mobil SHC Gear 220	Omala S4 GX 220	Alphasyn EP220	Gearmaster SYN220/NA	Klübersynth EG 4-220
	PAO	-30 to 60°C (-22 to 140°F)	Mobil SHC630	Morlina S4 B 220	Alphasyn T220	N/A	Klübersynth GEM 4-220N
	PG	-25 to 60°C (-13 to 140°F)	Mobil Glygoyle 220	Omala S4 WE 220	Alphasyn PG220	Renolin PG220	Klübersynth GH 6-220
	FG	0 to 40°C (32 to 104°F)	Mobil DTE FM 220	N/A	N/A	Fuchs FM220	N/A
	FG-PAO	-25 to 60°C (-13 to 140°F)	Mobil SHC Cibus 220	N/A	N/A	Cassida GL220	Klüberoil 4 UH 1-220N
	FG-PG	-25 to 60°C (-13 to 140°F)	Mobil Glygoyle 220	N/A	N/A	Cassida WG220	Klübersynth UH1 6-220
VG460	MIN-EP	0 to 40°C (32 to 104°F)	Mobilgear 600XP460	Omala S2 G 460	Alpha SP460	Renolin EP460	Klüberoil GEM 1-460N
	PAO-EP	-20 to 80°C (-4 to 176°F)	Mobil SHC Gear 460	Omala S4 GX 460	Alphasyn EP460	Gearmaster SYN460/NA	Klübersynth EG 4-460
	PAO	-20 to 80°C (-4 to 176°F)	Mobil SHC 634	Morlina S4 B 460	Alphasyn T460	N/A	Klübersynth GEM 4-460N
	PG	-20 to 80°C (-4 to 176°F)	Mobil Glygoyle 460	Omala S4 WE 60	Alphasyn PG460	N/A	Klübersynth GH 6-460
	FG	0 to 40°C (32 to 104°F)	Mobil DTE FM460	N/A	N/A	Fuchs FM460	N/A
	FG-PAO	-20 to 80°C (-4 to 176°F)	Mobil SHC Cibus 460	N/A	N/A	Cassida GL460	Klüberoil 4 UH 1-460N
	FG-PG	-20 to 80°C (-4 to 176°F)	Mobil Glygoyle 460	N/A	N/A	Cassida WG460	Klübersynth UH1 6-460

Low-end service temperature limit may vary for a specific lubricant; Please also see the important notes on Page 1.

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Lubrication Tables – Helical Worm Gear Units**Standard Oil Lubricants**

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG680	PAO	0 to 60°C (32 to 140°F)	Mobil SHC636	⬇

Optional Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG460	PAO	0 to 50°C (32 to 122°F)	Mobil SHC 634	-
	FG-PAO	0 to 50°C (32 to 122°F)	Mobil SHC Cibus 460	-

Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type	Notes
NLGI 2	Li-Complex	PAO	-40 to 80°C (-40 to 176°F)	Mobil / Mobilith SHC 220	⬇
	Polyurea	FG-PAO	-30 to 80°C (-22 to 176°F)	Mobil SHC Polyrex 222	⬇

⬇ Stocked Lubricants**IMPORTANT NOTE**

- The “Ambient Temperature” is intended to be an operation guideline based upon the typical properties of all the lubricant. The viscosity and other properties of the lubricant change based upon load, speed, ambient conditions, and reducer operating temperatures. The user should consult with their lubrication supplier & NORD Gear before considering changes in oil type or viscosity.
- To prevent reducer overheating, observe the maximum operating oil temperature limits:
Synthetic Oil: 105 °C (225 °F).
- In the following instances, please consult NORD for specific recommendations:
 - ✓ Gear units will operate in high ambient temperature conditions exceeding 40 °C (104 °F).
 - ✓ Gear units will operate in cold ambient temperature conditions approaching 0 °C (32 °F) or lower.
 - ✓ Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.
 - ✓ Fluid grease is required for lubricating the gear unit.
- Observe the general lubrication guidelines outlined in user manual U10770.

Oil Formulation Codes

PAO	-	Synthetic Polyalphaolefin Oil
PG	-	Synthetic Polyglycol Oil
FG-PAO	-	Food-Grade, Synthetic Polyalphaolefin Oil
FG-PG	-	Food-Grade, Synthetic Polyglycol Oil

Lubrication Notes

- Avoid using (EP) gear oils in worm gears that contain sulfur-phosphorous chemistries, as these additives can react adversely with bronze worm gears and accelerate wear.
- Food grade lubricants must be in compliance with FDA 212 CFR 178.3570 and qualify as a NSF-H1 lubricant. Please consult with lubrication manufacturer for more information.
- When making a lubrication change, check with the lubrication supplier to assure compatibility and to obtain recommended cleaning or flushing procedures.
- Do not to mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not miscible with other oil types and should never be mixed with mineral oil or polyalphaolefin (PAO) synthetic oil.

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Oil Cross-reference Chart

ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	FUCHS	KLÜBER LUBRICATION
VG 100	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC627	Morlina S4 B 100	N/A	N/A	Klübersynth GEM 4-100N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth GH 6-100
	FG-PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC Cibus 100	N/A	N/A	N/A	Klüberoil 4 UH 1-100N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth UH1 6-100
VG150	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC629	Morlina S4 B 150	Alphasyn T150	N/A	Klübersynth GEM 4-150N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	Omala S4 WE 150	Alphasyn PG150	Renolin PG150	Klübersynth GH 6-150
	FG-PAO	-15 to 25°C (5 to 77°F)	Mobil SHC Cibus 150	N/A	N/A	Cassida GL150	Klüberoil 4 UH 1-150N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	N/A	N/A	N/A	Klübersynth UH1 6-150
VG220	PAO	-15 to 40°C (5 to 104°F)	Mobil SHC630	Morlina S4 B 220	Alphasyn T220	N/A	Klübersynth GEM 4-220N
	PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	Omala S4 WE 220	Alphasyn PG220	Renolin PG220	Klübersynth GH 6-220
	FG-PAO	-25 to 40°C (-13 to 104°F)	Mobil SHC Cibus 220	N/A	N/A	Cassida GL220	Klüberoil 4 UH 1-220N
	FG-PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	N/A	N/A	Cassida WG220	Klübersynth UH1 6-220
VG460	PAO	0 to 50°C (32 to 122°F)	Mobil SHC 634	Morlina S4 B 460	Alphasyn T460	N/A	Klübersynth GEM 4-460N
	PG	0 to 50°C (32 to 122°F)	Mobil Glygoyle 460	Omala S4 WE 60	Alphasyn PG460	N/A	Klübersynth GH 6-460
	FG-PAO	0 to 50°C (32 to 122°F)	Mobil SHC Cibus 460	N/A	N/A	Cassida GL460	Klüberoil 4 UH 1-460N
	FG-PG	0 to 50°C (32 to 122°F)	Mobil Glygoyle 460	N/A	N/A	Cassida WG460	Klübersynth UH1 6-460
VG680	PAO	0 to 60°C (32 to 140°F)	Mobil SHC636	Morlina S4 B 680	N/A	N/A	Klübersynth GEM 4-680N
	PG	0 to 60°C (32 to 140°F)	Mobil Glygoyle 680	Omala S4 WE 680	N/A	N/A	Klübersynth GH 6-680
	FG-PAO	0 to 60°C (32 to 140°F)	N/A	N/A	N/A	Cassida GL680	Klüberoil 4 UH1-680N
	FG-PG	0 to 60°C (32 to 140°F)	Mobil Glygoyle 680	N/A	N/A	Cassida WG680	Klübersynth UH1 6-680

Low-end service temperature limit may vary for a specific lubricant; Please also see the important notes on Page 1.

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Lubrication Tables – MINICASE® (SM series) Worm Gear Units

Standard Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG680	PG	-20 to 40°C (-4 to 104°F)	Klübersynth GH 6-680	⬇

Optional Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG680	FG-PG	-25 to 80°C (-13 to 176°F)	Klübersynth UH1 6-680	⬇

Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type	Notes
NLGI 2	Li-Complex	PAO	-25 to 80°C (-13 to 176°F)	Kluber / Petamo GHY133N	⬇
	Aluminum	FG	-25 to 40°C (-13 to 104°F)	Kluber / Klübersynth UH1 14-151	⬇

⬇ Stocked Lubricants



IMPORTANT NOTE

- Observe the general lubrication guidelines in User Manual U17900.
- Ambient temperature range is a guideline only. The allowed operating temperature range for the gear unit is dependent upon assembly components used, their individual temperature limits, and the actual operating conditions.
- The selected oil type and viscosity is considered appropriate for most applications utilizing the specified NORD gear unit type. Different oil types or viscosity grades may be recommended if the gear unit is exposed to frequent high load conditions or operating under extreme low or high ambient temperature conditions.
- To prevent reducer overheating, observe the maximum operating oil temperature limits:
Synthetic oil: 105 °C (225 °F).
- Consult NORD for recommendations in the following instances:
 - ✓ The gear unit is exposed to frequent high load conditions.
 - ✓ Ambient temperature conditions exceed 40 °C (104 °F) or approach 0 °C (32 °F) or lower.
 - ✓ Fluid grease is being considered or specified for lubricating the gear unit.
 - ✓ Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.

Oil Formulation Codes

PAO	-	Synthetic Polyalphaolefin Oil
PG	-	Synthetic Polyglycol Oil
FG-PAO	-	Food-Grade, Synthetic Polyalphaolefin Oil
FG-PG	-	Food-Grade, Synthetic Polyglycol Oil

NOTICE

- Avoid using (EP) gear oils in worm gears that contain sulfur-phosphorous chemistries, as these additives can react adversely with bronze worm gears and accelerate wear.
- Food grade lubricants must be in compliance with FDA 212 CFR 178.3570 and qualify as a NSF-H1 lubricant. Please consult with lubrication manufacturer for more information.
- When making a lubrication change, check with the lubrication supplier to assure compatibility and to obtain recommended cleaning or flushing procedures.
- Do not mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not miscible with other oil types and should never be mixed with mineral or polyalphaolefin (PAO) oils.



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Oil Cross-reference Chart

ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	FUCHS	KLÜBER LUBRICATION
VG 100	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC627	Morlina S4 B 100	N/A	N/A	Klübersynth GEM 4-100N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth GH 6-100
	FG-PAO	-30 to 25°C (-22 to 77°F)	Mobil SHC Cibus 100	N/A	N/A	N/A	Klüberoil 4 UH 1-100N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth UH1 6-100
VG150	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC629	Morlina S4 B 150	Alphasyn T150	N/A	Klübersynth GEM 4-150N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	Omala S4 WE 150	Alphasyn PG150	Renolin PG150	Klübersynth GH 6-150
	FG-PAO	-15 to 25°C (5 to 77°F)	Mobil SHC Cibus 150	N/A	N/A	Cassida GL150	Klüberoil 4 UH 1-150N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	N/A	N/A	N/A	Klübersynth UH1 6-150
VG220	PAO	-35 to 40°C (-31 to 104°F)	Mobil SHC630	Morlina S4 B 220	Alphasyn T220	N/A	Klübersynth GEM 4-220N
	PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	Omala S4 WE 220	Alphasyn PG220	Renolin PG220	Klübersynth GH 6-220
	FG-PAO	-25 to 40°C (-13 to 104°F)	Mobil SHC Cibus 220	N/A	N/A	Cassida GL220	Klüberoil 4 UH 1-220N
	FG-PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	N/A	N/A	Cassida WG220	Klübersynth UH1 6-220
VG460	PAO	-20 to 40°C (-4 to 104°F)	Mobil SHC 634	Morlina S4 B 460	Alphasyn T460	N/A	Klübersynth GEM 4-460N
	PG	-20 to 40°C (-4 to 104°F)	Mobil Glygoyle 460	Omala S4 WE 60	Alphasyn PG460	N/A	Klübersynth GH 6-460
	FG-PAO	-5 to 40°C (23 to 104°F)	Mobil SHC Cibus 460	N/A	N/A	Cassida GL460	Klüberoil 4 UH 1-460N
	FG-PG	-5 to 40°C (23 to 104°F)	Mobil Glygoyle 460	N/A	N/A	Cassida WG460	Klübersynth UH1 6-460
VG680	PAO	-20 to 40°C (-4 to 104°F)	Mobil SHC636	Morlina S4 B 680	N/A	N/A	Klübersynth GEM 4-680N
	PG	-20 to 40°C (-4 to 104°F)	Mobil Glygoyle 680	Omala S4 WE 680	N/A	N/A	Klübersynth GH 6-680
	FG-PAO	-5 to 40°C (23 to 104°F)	N/A	N/A	N/A	Cassida GL680	Klüberoil 4 UH1-680N
	FG-PG	-25 to 80°C (-13 to 176°F)	Mobil Glygoyle 680	N/A	N/A	Cassida WG680	Klübersynth UH1 6-680

Low-end service temperature limit may vary for a specific lubricant; Please also see the important notes on Page 1.



Lubrication Tables – MINICASE® (SMI/SMID series) Worm Gear Units

Standard Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG680	PG	-20 to 40°C (-4 to 104°F)	Klübersynth GH 6-680	⬇

Optional Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG680	FG-PG	-25 to 80°C (-13 to 176°F)	Klübersynth UH1 6-680	⬇

Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type	Notes
NLGI 2	Li-Complex	PAO	-25 to 80°C (-13 to 176°F)	Kluber / Petamo GHY133N	⬇
	Aluminum	FG	-25 to 40°C (-13 to 104°F)	Kluber / Klubersynth UH1 14-151	⬇

⬇ Stocked Lubricants



IMPORTANT NOTE

- Observe the general lubrication guidelines in User Manual U10800.
- Ambient temperature range is a guideline only. The allowed operating temperature range for the gear unit is dependent upon assembly components used, their individual temperature limits, and the actual operating conditions.
- The selected oil type and viscosity is considered appropriate for most applications utilizing the specified NORD gear unit type. Different oil types or viscosity grades may be recommended if the gear unit is exposed to frequent high load conditions or operating under extreme low or high ambient temperature conditions.
- To prevent reducer overheating, observe the maximum operating oil temperature limits:
Synthetic oil: 105 °C (225 °F).
- Consult NORD for recommendations in the following instances:
 - ✓ The gear unit is exposed to frequent high load conditions.
 - ✓ Ambient temperature conditions exceed 40 °C (104 °F) or approach 0 °C (32 °F) or lower.
 - ✓ Fluid grease is being considered or specified for lubricating the gear unit.
 - ✓ Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.

Oil Formulation Codes

PAO	-	Synthetic Polyalphaolefin Oil
PG	-	Synthetic Polyglycol Oil
FG-PAO	-	Food-Grade, Synthetic Polyalphaolefin Oil
FG-PG	-	Food-Grade, Synthetic Polyglycol Oil

NOTICE

- Avoid using (EP) gear oils in worm gears that contain sulfur-phosphorous chemistries, as these additives can react adversely with bronze worm gears and accelerate wear.
- Food grade lubricants must be in compliance with FDA 212 CFR 178.3570 and qualify as a NSF-H1 lubricant. Please consult with lubrication manufacturer for more information.
- When making a lubrication change, check with the lubrication supplier to assure compatibility and to obtain recommended cleaning or flushing procedures.
- Do not mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not miscible with other oil types and should never be mixed with mineral or polyalphaolefin (PAO) oils.



DRIVESYSTEMS



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Oil Cross-reference Chart

ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	FUCHS	KLÜBER LUBRICATION
VG 100	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC627	Morlina S4 B 100	N/A	N/A	Klübersynth GEM 4-100N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth GH 6-100
	FG-PAO	-30 to 25°C (-22 to 77°F)	Mobil SHC Cibus 100	N/A	N/A	N/A	Klüberoil 4 UH 1-100N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth UH1 6-100
VG150	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC629	Morlina S4 B 150	Alphasyn T150	N/A	Klübersynth GEM 4-150N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	Omala S4 WE 150	Alphasyn PG150	Renolin PG150	Klübersynth GH 6-150
	FG-PAO	-15 to 25°C (5 to 77°F)	Mobil SHC Cibus 150	N/A	N/A	Cassida GL150	Klüberoil 4 UH 1-150N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	N/A	N/A	N/A	Klübersynth UH1 6-150
VG220	PAO	-35 to 40°C (-31 to 104°F)	Mobil SHC630	Morlina S4 B 220	Alphasyn T220	N/A	Klübersynth GEM 4-220N
	PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	Omala S4 WE 220	Alphasyn PG220	Renolin PG220	Klübersynth GH 6-220
	FG-PAO	-25 to 40°C (-13 to 104°F)	Mobil SHC Cibus 220	N/A	N/A	Cassida GL220	Klüberoil 4 UH 1-220N
	FG-PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	N/A	N/A	Cassida WG220	Klübersynth UH1 6-220
VG460	PAO	-20 to 40°C (-4 to 104°F)	Mobil SHC 634	Morlina S4 B 460	Alphasyn T460	N/A	Klübersynth GEM 4-460N
	PG	-20 to 40°C (-4 to 104°F)	Mobil Glygoyle 460	Omala S4 WE 60	Alphasyn PG460	N/A	Klübersynth GH 6-460
	FG-PAO	-5 to 40°C (23 to 104°F)	Mobil SHC Cibus 460	N/A	N/A	Cassida GL460	Klüberoil 4 UH 1-460N
	FG-PG	-5 to 40°C (23 to 104°F)	Mobil Glygoyle 460	N/A	N/A	Cassida WG460	Klübersynth UH1 6-460
VG680	PAO	-20 to 40°C (-4 to 104°F)	Mobil SHC636	Morlina S4 B 680	N/A	N/A	Klübersynth GEM 4-680N
	PG	-20 to 40°C (-4 to 104°F)	Mobil Glygoyle 680	Omala S4 WE 680	N/A	N/A	Klübersynth GH 6-680
	FG-PAO	-5 to 40°C (23 to 104°F)	N/A	N/A	N/A	Cassida GL680	Klüberoil 4 UH1-680N
	FG-PG	-25 to 80°C (-13 to 176°F)	Mobil Glygoyle 680	N/A	N/A	Cassida WG680	Klübersynth UH1 6-680

Low-end service temperature limit may vary for a specific lubricant; Please also see the important notes on Page 1.

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DRIVESYSTEMS

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Lubrication Tables – FLEXBLOC™ (SI/SID Series) Worm Gear Units**Standard Oil Lubricants**

NORD uses a semi automated assembly process to produce the FLEXBLOC™ gear unit assemblies. During this process the gear units are factory filled in accordance with the following table.

Standard Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG680	FG-PG	-25 to 80°C (-13 to 176°F)	Klübersynth UH1 6-680	Inch
	PG	-20 to 40°C (-4 to 104°F)	Klübersynth GH 6-680	Metric
VG220	FG-PG	-25 to 40°C (-13 to 104°F)	Klübersynth UH1 6-220	Inch
	PG	-25 to 40°C (-13 to 104°F)	Klübersynth GH 6-220	Metric

Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type	Notes
NLGI 2 0	Li-Complex	PAO	-25 to 80°C (-13 to 176°F)	Kluber / Petamo GHY133N	⬇
	Aluminum	FG	-25 to 40°C (-13 to 104°F)	Kluber / Klubersynth UH1 14-151	⬇

⬇ Stocked Lubricants**IMPORTANT NOTE**

- Observe the general lubrication guidelines in User Manual U10800.
- Ambient temperature range is a guideline only. The allowed operating temperature range for the gear unit is dependent upon assembly components used, their individual temperature limits, and the actual operating conditions.
- The selected oil type and viscosity is considered appropriate for most applications utilizing the specified NORD gear unit type. Different oil types or viscosity grades may be recommended if the gear unit is exposed to frequent high load conditions or operating under extreme low or high ambient temperature conditions.
- To prevent reducer overheating, observe the maximum operating oil temperature limits:
Synthetic oil: 105 °C (225 °F).
- Consult NORD for recommendations in the following instances:
 - ✓ The gear unit is exposed to frequent high load conditions.
 - ✓ Ambient temperature conditions exceed 40 °C (104 °F) or approach 0 °C (32 °F) or lower.
 - ✓ Fluid grease is being considered or specified for lubricating the gear unit.
 - ✓ Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.

Oil Formulation Codes

- PAO - Synthetic Polyalphaolefin Oil
- PG - Synthetic Polyglycol Oil
- FG-PAO - Food-Grade, Synthetic Polyalphaolefin Oil
- FG-PG - Food-Grade, Synthetic Polyglycol Oil

NOTICE

- Avoid using (EP) gear oils in worm gears that contain sulfur-phosphorous chemistries, as these additives can react adversely with bronze worm gears and accelerate wear.
- Food grade lubricants must be in compliance with FDA 212 CFR 178.3570 and qualify as a NSF-H1 lubricant. Please consult with lubrication manufacturer for more information.
- When making a lubrication change, check with the lubrication supplier to assure compatibility and to obtain recommended cleaning or flushing procedures.
- Do not mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not miscible with other oil types and should never be mixed with mineral or polyalphaolefin (PAO) oils.

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U11060 - 2 of 2

Oil Cross-reference Chart

ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	FUCHS	KLÜBER LUBRICATION
VG 100	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC627	Morlina S4 B 100	N/A	N/A	Klübersynth GEM 4-100N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth GH 6-100
	FG-PAO	-30 to 25°C (-22 to 77°F)	Mobil SHC Cibus 100	N/A	N/A	N/A	Klüberoil 4 UH 1-100N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth UH1 6-100
VG150	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC629	Morlina S4 B 150	Alphasyn T150	N/A	Klübersynth GEM 4-150N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	Omala S4 WE 150	Alphasyn PG150	Renolin PG150	Klübersynth GH 6-150
	FG-PAO	-15 to 25°C (5 to 77°F)	Mobil SHC Cibus 150	N/A	N/A	Cassida GL150	Klüberoil 4 UH 1-150N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	N/A	N/A	N/A	Klübersynth UH1 6-150
VG220	PAO	-35 to 40°C (-31 to 104°F)	Mobil SHC630	Morlina S4 B 220	Alphasyn T220	N/A	Klübersynth GEM 4-220N
	PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	Omala S4 WE 220	Alphasyn PG220	Renolin PG220	Klübersynth GH 6-220
	FG-PAO	-25 to 40°C (-13 to 104°F)	Mobil SHC Cibus 220	N/A	N/A	Cassida GL220	Klüberoil 4 UH 1-220N
	FG-PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	N/A	N/A	Cassida WG220	Klübersynth UH1 6-220
VG460	PAO	-20 to 40°C (-4 to 104°F)	Mobil SHC 634	Morlina S4 B 460	Alphasyn T460	N/A	Klübersynth GEM 4-460N
	PG	-20 to 40°C (-4 to 104°F)	Mobil Glygoyle 460	Omala S4 WE 60	Alphasyn PG460	N/A	Klübersynth GH 6-460
	FG-PAO	-5 to 40°C (23 to 104°F)	Mobil SHC Cibus 460	N/A	N/A	Cassida GL460	Klüberoil 4 UH 1-460N
	FG-PG	-5 to 40°C (23 to 104°F)	Mobil Glygoyle 460	N/A	N/A	Cassida WG460	Klübersynth UH1 6-460
VG680	PAO	-20 to 40°C (-4 to 104°F)	Mobil SHC636	Morlina S4 B 680	N/A	N/A	Klübersynth GEM 4-680N
	PG	-20 to 40°C (-4 to 104°F)	Mobil Glygoyle 680	Omala S4 WE 680	N/A	N/A	Klübersynth GH 6-680
	FG-PAO	-5 to 40°C (23 to 104°F)	N/A	N/A	N/A	Cassida GL680	Klüberoil 4 UH1-680N
	FG-PG	-25 to 80°C (-13 to 176°F)	Mobil Glygoyle 680	N/A	N/A	Cassida WG680	Klübersynth UH1 6-680

Low-end service temperature limit may vary for a specific lubricant; Please also see the important notes on Page 1.

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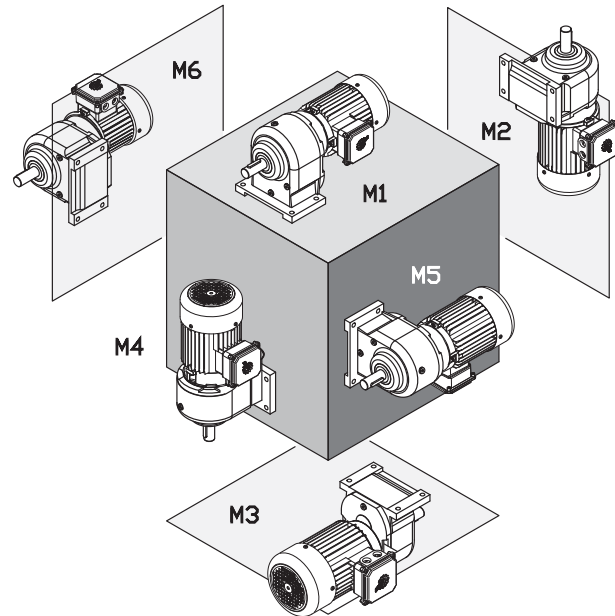
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Standard In-line footed lubrication

All Standard In-line reducers are shipped from NORD with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. When filling these gear units the oil must be measured and added until one establishes the proper fill quantity. For additional information please refer to the "Oil & vent plug locations" documentation for your specified gear unit

**IMPORTANT NOTE**

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK0 / SK05	0.14	0.13	0.23	0.22	0.14	0.13	0.23	0.22	0.14	0.13	0.14	0.13
SK000	0.25	0.24	0.42	0.40	0.25	0.24	0.42	0.40	0.25	0.24	0.25	0.24
SK01 / SK015	0.23	0.22	0.40	0.38	0.23	0.22	0.40	0.38	0.23	0.22	0.23	0.22
SK010 / SK0105	0.40	0.38	0.63	0.60	0.40	0.38	0.63	0.60	0.40	0.38	0.40	0.38
SK20 / SK205	0.58	0.55	1.06	1.00	0.58	0.55	1.06	1.00	0.58	0.55	0.58	0.55
SK200 / SK2005	0.85	0.80	1.37	1.30	0.85	0.80	1.37	1.30	0.85	0.80	0.85	0.80
SK25 / SK255	0.53	0.50	1.06	1.00	0.53	0.50	1.06	1.00	0.53	0.50	0.53	0.50
SK250 / SK2505	1.27	1.20	1.59	1.50	1.27	1.20	1.59	1.50	1.27	1.20	1.27	1.20
SK30 / SK305	0.95	0.90	1.37	1.30	0.95	0.90	1.37	1.30	0.95	0.90	0.95	0.90
SK300 / SK3005	1.27	1.20	2.11	2.00	1.27	1.20	2.11	2.00	1.27	1.20	1.27	1.20
SK33 / SK335	1.06	1.00	1.69	1.60	1.06	1.00	1.69	1.60	1.06	1.00	1.06	1.00
SK330 / SK3305	1.90	1.80	2.96	2.80	1.90	1.80	2.96	2.80	1.90	1.80	1.90	1.80

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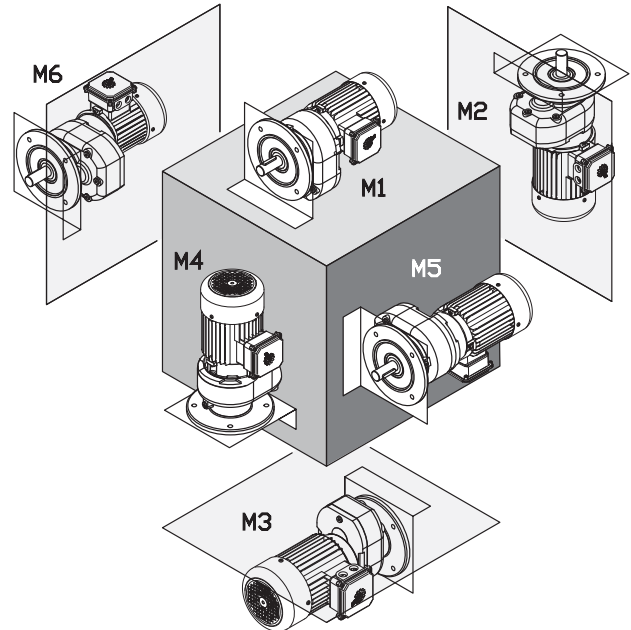
U11600 - 1 of 1

Standard In-line flanged lubrication

All Standard In-line reducers are shipped from NORD with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. When filling these gear units the oil must be measured and added until one establishes the proper fill quantity. For additional information please refer to the "Oil & vent plug locations" documentation for your specified gear unit

**IMPORTANT NOTE**

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK0 F / SK05 F	0.14	0.13	0.23	0.22	0.14	0.13	0.23	0.22	0.14	0.13	0.14	0.13
SK000 F	0.25	0.24	0.43	0.41	0.25	0.24	0.43	0.41	0.25	0.24	0.25	0.24
SK01 F	0.23	0.22	0.40	0.38	0.23	0.22	0.40	0.38	0.23	0.22	0.23	0.22
SK010 F / SK0105 F	0.37	0.35	0.69	0.65	0.37	0.35	0.78	0.74	0.37	0.35	0.37	0.35
SK20 F	0.37	0.35	0.63	0.60	0.37	0.35	0.63	0.60	0.37	0.35	0.37	0.35
SK200 F / SK2005 F	0.69	0.65	1.00	0.95	0.69	0.65	1.16	1.10	0.69	0.65	0.69	0.65
SK25 F	0.53	0.50	1.06	1.00	0.53	0.50	1.06	1.00	0.53	0.50	0.53	0.50
SK250 F / SK2505 F	0.95	0.90	1.48	1.40	0.95	0.90	1.69	1.60	0.95	0.90	0.95	0.90
SK30 F	0.74	0.70	1.16	1.10	0.74	0.70	1.16	1.10	0.74	0.70	0.74	0.70
SK300 F / SK3005 F	1.32	1.25	1.59	1.50	1.32	1.25	1.90	1.80	1.32	1.25	1.32	1.25
SK33 F / SK335F	1.06	1.00	1.59	1.50	1.06	1.00	1.59	1.50	1.06	1.00	1.06	1.00
SK330 F / SK3305 F	1.69	1.60	2.64	2.50	1.69	1.60	3.06	2.90	1.69	1.60	1.69	1.60

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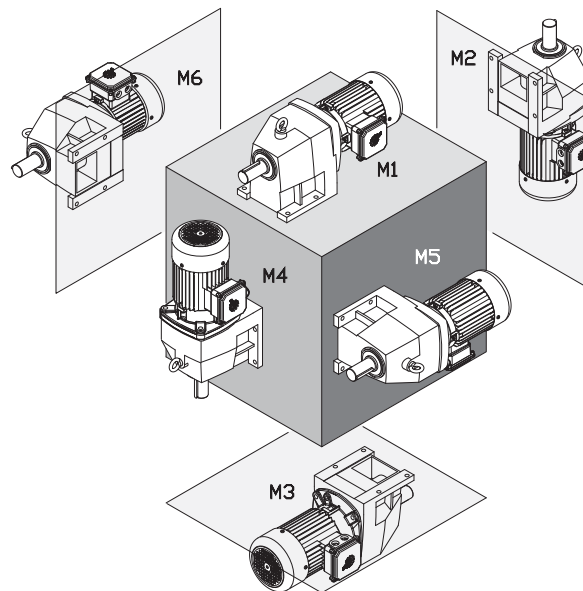
Helical In-line footed lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

**IMPORTANT NOTE**

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK02	0.21	0.20	0.79	0.75	0.79	0.75	0.69	0.65	0.63	0.60	0.63	0.60
SK 03	0.37	0.35	1.27	1.20	0.85	0.80	1.06	1.00	0.74	0.70	0.74	0.70
SK11E	0.26	0.25	0.53	0.50	0.69	0.65	0.53	0.50	0.42	0.40	0.42	0.40
SK12	0.26	0.25	0.85	0.80	0.90	0.85	0.79	0.75	0.58	0.55	0.58	0.55
SK 13	0.79	0.75	1.37	1.30	1.37	1.30	1.27	1.20	0.79	0.75	0.79	0.75
SK21E	0.63	0.60	1.27	1.20	1.37	1.30	1.06	1.00	1.06	1.00	1.06	1.00
SK22	0.53	0.50	2.01	1.90	2.22	2.10	1.90	1.80	1.48	1.40	1.48	1.40
SK 23	1.27	1.20	2.11	2.00	2.01	1.90	2.54	2.40	1.69	1.60	1.69	1.60
SK31E	1.16	1.10	2.11	2.00	2.32	2.20	1.80	1.70	1.59	1.50	1.59	1.50
SK32	0.95	0.90	2.64	2.50	3.28	3.10	3.28	3.10	2.11	2.00	2.11	2.00
SK 33N	1.85	1.75	3.17	3.00	3.59	3.40	4.23	4.00	2.43	2.30	2.43	2.30
SK41E	1.69	1.60	2.75	2.60	3.49	3.30	2.96	2.80	2.43	2.30	2.43	2.30
SK42	1.48	1.40	4.76	4.50	4.76	4.50	4.54	4.30	3.38	3.20	3.38	3.20
SK 43	3.17	3.00	5.92	5.60	5.49	5.20	6.97	6.60	3.80	3.60	3.80	3.60
SK51E	1.90	1.80	3.70	3.50	4.33	4.10	4.23	4.00	4.02	3.80	4.02	3.80
SK52	2.64	2.50	7.40	7.00	7.19	6.80	7.19	6.80	5.39	5.10	5.39	5.10
SK 53	4.76	4.50	9.19	8.70	8.14	7.70	9.19	8.70	6.34	6.00	6.34	6.00
SK62	6.87	6.50	15.9	15.0	13.7	13.0	16.9	16.0	15.9	15.0	15.9	15.0
SK 63	13.7	13.0	15.3	14.5	15.3	14.5	16.9	16.0	13.7	13.0	13.7	13.0
SK72	10.6	10.0	24.3	23.0	19.0	18.0	27.5	26.0	24.3	23.0	24.3	23.0
SK 73	21.7	20.5	21.1	20.0	23.8	22.5	28.5	27.0	21.1	20.0	21.1	20.0
SK82	14.8	14.0	37.0	35.0	28.5	27.0	46.5	44.0	33.8	32.0	33.8	32.0
SK 83	31.7	30.0	32.8	31.0	35.9	34.0	39.1	37.0	34.9	33.0	34.9	33.0
SK92	26.4	25.0	77.0	73.0	49.7	47.0	80.0	76.0	55.0	52.0	55.0	52.0
SK 93	56.0	53.0	74.0	70.0	62.0	59.0	76.0	72.0	52.0	49.0	52.0	49.0
SK102	38.0	36.0	84.0	79.0	70.0	66.0	108	102	75.0	71.0	75.0	71.0
SK 103	78.0	74.0	75.0	71.0	78.0	74.0	102	97.0	71.0	67.0	71.0	67.0

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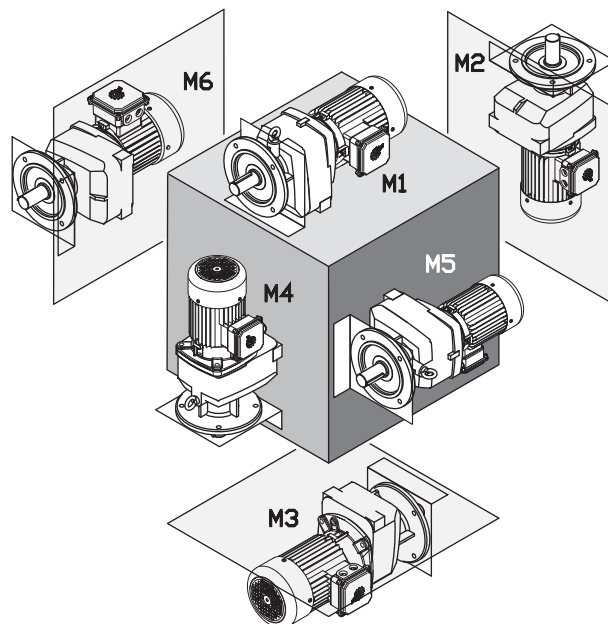
Helical In-line flanged lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

**IMPORTANT NOTE**

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK02F	0.26	0.25	0.74	0.70	0.74	0.70	0.74	0.70	0.53	0.50	0.53	0.50
SK 03 F	0.58	0.55	1.00	0.95	0.95	0.90	1.27	1.20	0.95	0.90	0.95	0.90
SK11E F	0.32	0.30	0.53	0.50	0.53	0.50	0.48	0.45	0.42	0.40	0.42	0.40
SK12F	0.37	0.35	0.90	0.85	0.95	0.90	0.95	0.90	0.74	0.70	0.74	0.70
SK 13 F	1.06	1.00	1.37	1.30	1.37	1.30	1.27	1.20	1.06	1.00	1.06	1.00
SK21E F	0.53	0.50	1.27	1.20	1.37	1.30	0.63	0.60	0.95	0.90	0.95	0.90
SK22F	0.74	0.70	1.90	1.80	1.90	1.80	1.90	1.80	1.48	1.40	1.48	1.40
SK 23 F	1.48	1.40	2.75	2.60	2.43	2.30	2.96	2.80	2.96	2.80	2.96	2.80
SK31E F	0.95	0.90	1.90	1.80	1.74	1.65	1.37	1.30	1.32	1.25	1.32	1.25
SK32F	1.27	1.20	2.96	2.80	3.28	3.10	3.28	3.10	2.32	2.20	2.32	2.20
SK 33N F	2.32	2.20	3.17	3.00	3.59	3.40	4.44	4.20	2.43	2.30	2.43	2.30
SK41E F	1.27	1.20	2.43	2.30	2.85	2.70	2.11	2.00	2.01	1.90	2.01	1.90
SK42F	1.90	1.80	4.65	4.40	4.76	4.50	4.23	4.00	3.91	3.70	3.91	3.70
SK 43 F	3.70	3.50	6.02	5.70	5.28	5.00	6.45	6.10	4.33	4.10	4.33	4.10
SK51E F	1.90	1.80	3.70	3.50	4.33	4.10	3.17	3.00	4.02	3.80	4.02	3.80
SK52F	3.17	3.00	7.19	6.80	6.55	6.20	7.82	7.40	5.92	5.60	5.92	5.60
SK 53 F	5.49	5.20	8.88	8.40	7.40	7.00	9.40	8.90	7.08	6.70	7.08	6.70
SK 62 F	7.40	7.00	15.9	15.0	14.8	14.0	19.5	18.5	16.9	16.0	16.9	16.0
SK 63 F	14.3	13.5	14.8	14.0	16.4	15.5	19.0	18.0	14.8	14.0	14.8	14.0
SK 72 F	10.6	10.0	24.3	23.0	19.5	18.5	29.6	28.0	24.3	23.0	24.3	23.0
SK 73 F	23.2	22.0	23.8	22.5	24.3	23.0	29.1	27.5	21.1	20.0	21.1	20.0
SK 82 F	15.9	15.0	39.1	37.0	30.6	29.0	47.6	45.0	36.5	34.5	36.5	34.5
SK 83 F	32.8	31.0	35.9	34.0	37.0	35.0	42.3	40.0	35.9	34.0	35.9	34.0
SK 92 F	27.5	26.0	77.0	73.0	49.7	47.0	82.0	78.0	55.0	52.0	55.0	52.0
SK 93 F	56.0	53.0	74.0	70.0	62.0	59.0	78.0	74.0	52.0	49.0	52.0	49.0
SK 102 F	42.3	40.0	86.0	81.0	70.0	66.0	110	104	76.0	72.0	76.0	72.0
SK 103 F	73.0	69.0	82.0	78.0	82.0	78.0	105	99.0	71.0	67.0	71.0	67.0

NORD Gear Limited

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Courtesy of:

**SCREW CONVEYOR
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U11900 - 1 of 1

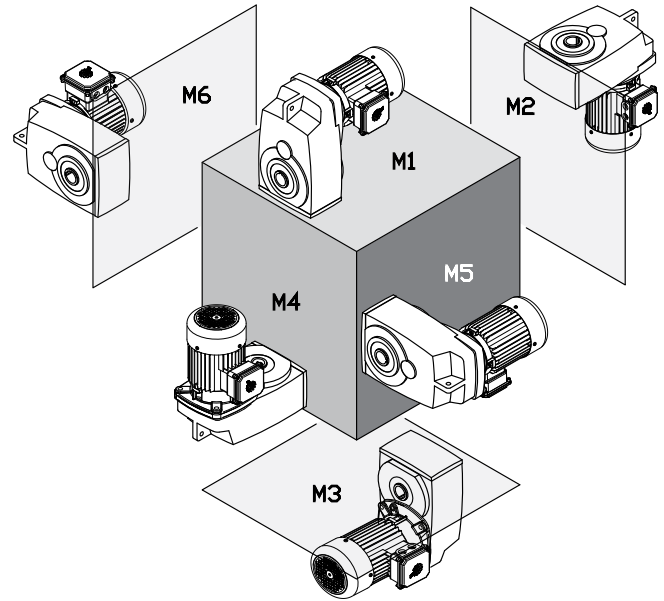
CLINCHER™ lubrication

Unless otherwise noted below, the following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

**IMPORTANT NOTE**

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 0182NB	0.42	0.40	0.58	0.55	0.58	0.55	0.42	0.40	0.42	0.40	0.42	0.40
SK 0182.1	0.74	0.7	1.14	1.08	0.66	0.62	0.93	0.88	0.63	0.6	0.68	0.64
SK 0282NB	0.74	0.70	1.16	1.10	0.85	0.80	1.16	1.10	0.95	0.90	0.95	0.90
SK 0282.1	1.08	1.02	1.48	1.4	0.85	0.8	1.41	1.33	0.85	0.8	0.92	0.87
SK 1282	1.00	0.95	1.37	1.30	0.95	0.90	1.37	1.30	1.06	1.00	1.06	1.00
SK 1282.1	1.77	1.67	2.28	2.16	1.11	1.05	2.06	1.95	1.35	1.28	1.42	1.34
SK 1382NB	1.48	1.40	2.43	2.30	2.32	2.20	2.32	2.20	2.11	2.00	2.11	2.00
SK 1382	1.53	1.45	1.69	1.6	1.22	1.15	1.8	1.7	1.16	1.1	1.16	1.1
SK 1382.1	1.77	1.67	2.11	2	1.11	1.05	2.06	1.95	1.35	1.28	1.42	1.34
SK 2282	1.80	1.70	2.43	2.30	1.80	1.70	2.32	2.20	2.01	1.90	2.01	1.90
SK 2382	2.43	2.30	2.85	2.70	2.22	2.10	3.38	3.20	2.11	2.00	2.11	2.00
SK 3282	2.96	2.80	4.23	4.00	3.49	3.30	4.02	3.80	3.17	3.00	3.17	3.00
SK 3382	4.02	3.80	4.54	4.30	3.17	3.00	5.81	5.50	3.17	3.00	3.17	3.00
SK 4282	4.44	4.20	5.71	5.40	4.65	4.40	5.28	5.00	4.44	4.20	4.44	4.20
SK 4382	6.45	6.10	7.29	6.90	5.18	4.90	8.88	8.40	5.28	5.00	5.28	5.00
SK 5282	7.93	7.50	9.30	8.80	7.93	7.50	9.30	8.80	7.61	7.20	7.61	7.20
SK 5382	13.2	12.5	12.7	12.0	7.08	6.70	14.8	14.0	8.77	8.30	8.77	8.30
SK 6282	18.0	17.0	16.4	15.5	13.2	12.5	18.5	17.5	11.6	11.0	14.8	14.0
SK 6382	16.9	16.0	13.7	13.0	10.6	10.0	19.0	18.0	14.8	14.0	13.2	12.5
SK 7282	26.9	25.5	22.2	21.0	21.7	20.5	28.5	27.0	16.9	16.0	22.2	21.0
SK 7382	23.2	22.0	22.2	21.0	16.9	16.0	26.4	25.0	24.3	23.0	23.2	22.0
SK 8282	39.6	37.5	34.9	33.0	32.2	30.5	46.5	44.0	32.8	31.0	32.8	31.0
SK 8382	36.5	34.5	34.3	32.5	26.4	25.0	40.2	38.0	37.0	35.0	31.7	30.0
SK 9282	79.2	75.0	74.0	70.0	58.1	55.0	76.1 †	72.0 †	63.4	60.0	62.4	59.0
SK 9382	78.2	74.0	74.0	70.0	47.6	45.0	79.2 †	75.0 †	68.7	65.0	63.4	60.0
SK 10282	95.0	90.0	95.0	90.0	42.3	40.0	95.0 †	90.0 †	63.0	60.0	87.0	82.0
SK 10382	90.0	85.0	95.0	90.0	77.0	73.0	106 †	100 †	85	80.0	85.0	80.0
SK10382.1	80.3	76.0	84.5	80.0	75.0	71.0	98.2	93.0	76.1	72.0	70.8	67.0
SK 11282*	174	165	169	160	153	145	206 †	195 †	106	100	148	140
SK 11382*	169	160	164	155	148	140	222 †	210 †	164	155	143	135
SK11382.1*	134.2	127	140.5	133	124.7	118	205	194	131	124	118.4	112
SK 12382*	169	160	164	155	148	140	222 †	210 †	164	155	143	135

* For shipping purposes the larger Clincher™ gear units are supplied without oil.

† Oil quantities shown are for the gearbox only. When the OT (oil tank) option is used, the oil must be filled to the level shown on the dipstick which is located inside of the oil tank. Even when the gear unit is filled by NORD, the user MUST add more oil until the oil is filled to the proper level.

NORD Gear Limited

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Courtesy of:

**SCREW CONVEYOR
PARTS**

U12000 - 1 of 1

90.1 Helical-bevel footed lubrication

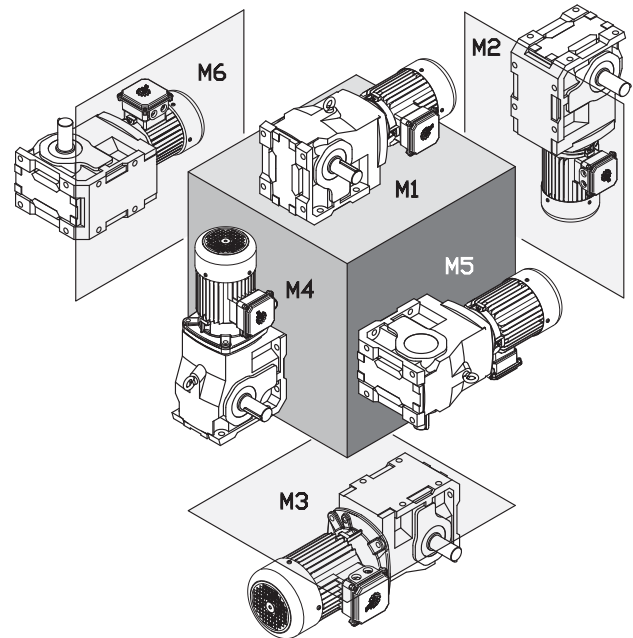
Unless otherwise noted below, the following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 9012.1	0.74	0.70	1.80	1.70	2.01	1.90	2.22	2.10	1.16	1.10	1.59	1.50
SK 9013.1	1.43	1.35	2.22	2.10	2.27	2.15	2.91	2.75	1.06	1.00	1.90	1.80
SK 9016.1	0.74	0.70	1.80	1.70	2.01	1.90	2.22	2.10	1.16	1.10	1.59	1.50
SK 9017.1	1.37	1.30	2.11	2.00	2.22	2.10	2.85	2.70	1.06	1.00	1.80	1.70
SK 9022.1	1.37	1.30	3.06	2.90	3.49	3.30	4.02	3.80	1.80	1.70	2.96	2.80
SK 9023.1	2.32	2.20	3.38	3.20	3.80	3.60	4.97	4.70	2.32	2.20	3.06	2.90
SK 9032.1	1.90	1.80	5.71	5.40	6.45	6.10	7.19	6.80	3.17	3.00	4.86	4.60
SK 9033.1	3.28	3.10	6.02	5.70	6.66	6.30	8.45	8.00	3.59	3.40	5.07	4.80
SK 9042.1	2.85	2.70	9.51	9.00	10.6	10.0	11.3	10.7	5.49	5.20	8.14	7.70
SK 9043.1	5.28	5.00	10.7	10.1	11.6	11.0	14.1	13.3	6.02	5.70	8.56	8.10
SK 9052.1	6.87	6.50	16.9	16.0	20.1	19.0	22.7	21.5	11.6	11.0	16.4	15.5
SK 9053.1	10.6	10.0	18.0	17.0	21.1	20.0	25.9	24.5	12.2	11.5	17.4	16.5
SK 9062.1	10.6	10.0	29.1	27.5	33.8	32.0	38.0	36.0	19.0	18.0	25.4	24.0
SK 9072.1	10.6	10.0	29.1	27.5	33.8	32.0	38.0	36.0	19.0	18.0	25.4	24.0
SK 9082.1	18.0	17.0	54.0	52.0	66.0	63.0	76.0	72.0	34.9	33.0	49.1	46.5
SK 9086.1	30.6	29.0	77.0	73.0	90.0	85.0	108	102	51.0	48.0	66.0	62.0
SK 9092.1	43.3	41.0	166	157	180	170	182	172	85.0	80.0	95.0	90.0
SK 9096.1	74.0	70.0	198	187	205	194	268	254	115	109	161	152

Oil Levels shown apply to base models and gear units ending in LX, AX, & VX.

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Courtesy of:

**SCREW CONVEYOR
PARTS**

U12100 - 1 of 1

90.1 Helical-bevel flanged lubrication

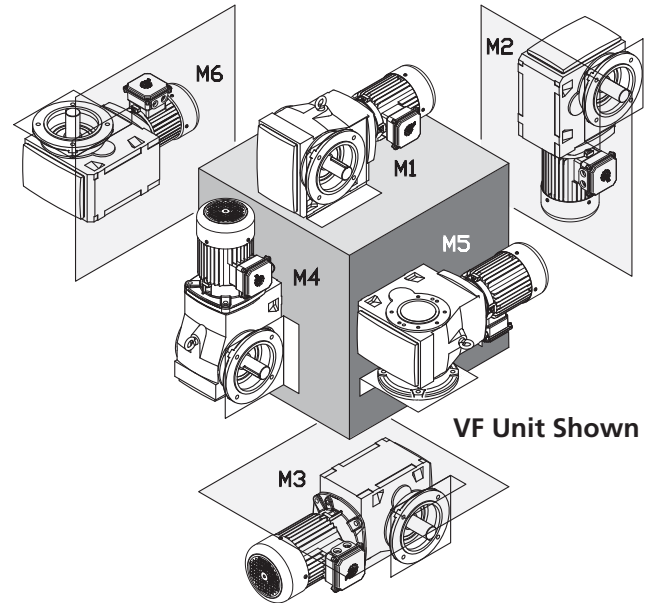
Unless otherwise noted below, the following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 9012.1	1.06	1.00	2.01	1.90	2.01	1.90	2.32	2.20	1.27	1.20	1.80	1.70
SK 9013.1	1.53	1.45	2.43	2.30	2.22	2.10	2.96	2.80	1.11	1.05	1.90	1.80
SK 9016.1	1.06	1.00	2.01	1.90	2.01	1.90	2.32	2.20	1.27	1.20	1.80	1.70
SK 9017.1	1.53	1.45	2.43	2.30	2.22	2.10	2.96	2.80	1.11	1.05	1.90	1.80
SK 9022.1	1.69	1.60	3.70	3.50	3.70	3.50	4.44	4.20	2.43	2.30	2.96	2.80
SK 9023.1	2.43	2.30	3.70	3.50	4.02	3.80	5.60	5.30	2.32	2.20	3.59	3.40
SK 9032.1	2.22	2.10	5.07	4.80	6.76	6.40	7.50	7.10	3.49	3.30	5.39	5.10
SK 9033.1	3.91	3.70	6.02	5.70	7.08	6.70	9.09	8.60	3.80	3.60	5.60	5.30
SK 9042.1	4.76	4.50	10.6	10.0	10.6	10.0	12.2	11.5	6.87	6.50	8.66	8.20
SK 9043.1	6.87	6.50	11.1	10.5	12.6	11.9	15.5	14.7	7.08	6.70	9.83	9.30
SK 9052.1	7.93	7.50	17.4	16.5	21.1	20.0	24.8	23.5	12.2	11.5	19.0	18.0
SK 9053.1	13.7	13.0	19.0	18.0	22.7	21.5	28.0	26.5	13.7	13.0	18.0	17.0
SK 9062.1	12.7	12.0	29.1	27.5	34.9	33.0	40.7	38.5	20.1	19.0	27.5	26.0
SK 9072.1	12.7	12.0	29.1	27.5	34.9	33.0	40.7	38.5	20.1	19.0	27.5	26.0
SK 9082.1	22.2	21.0	57.0	54.0	70.0	66.0	85.0	80.0	40.2	38.0	55.0	52.0
SK 9086.1	38.0	36.0	82.0	78.0	96.0	91.0	113	107	56.0	53.0	80.0	76.0
SK 9092.1	42.3	40.0	137	130	163	154	185	175	87.0	82.0	96.0	91.0
SK 9096.1	85.0	80.0	198	187	204	193	272	257	119	113	165	156

Oil Levels shown apply to base models and gear units ending in AZ, AF, VZ, & VF.

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U12200 - 1 of 1

92 Helical-bevel footed lubrication

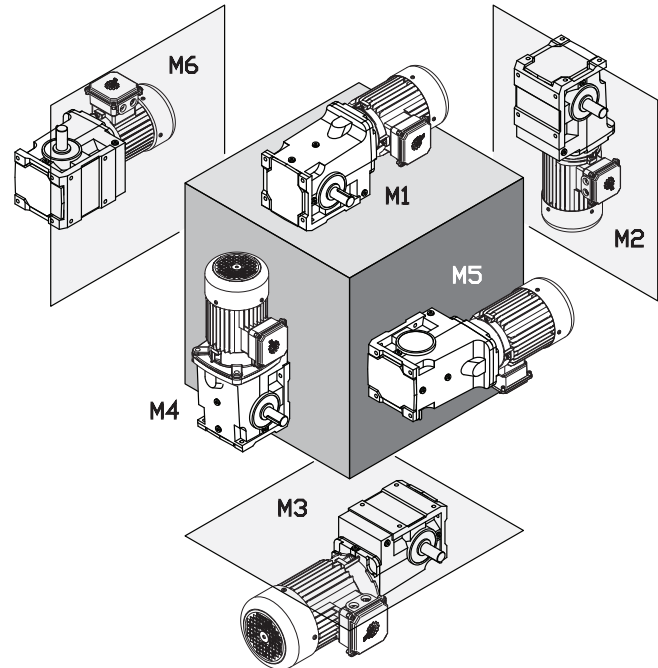
The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 92072	0.42	0.40	0.63	0.60	0.53	0.50	0.58	0.55	0.42	0.40	0.42	0.40
SK 92172	0.63	0.60	0.95	0.90	1.06	1.00	1.16	1.10	1.16	1.10	0.85	0.80
SK 92372	0.95	0.90	1.69	1.60	1.59	1.50	2.01	1.90	1.59	1.50	0.95	0.90
SK 92672	1.90	1.80	3.70	3.50	3.80	3.60	3.59	3.40	2.75	2.60	2.75	2.60
SK 92772	2.43	2.30	4.76	4.50	4.86	4.60	5.60	5.30	4.33	4.10	4.33	4.10

Oil Levels shown apply to base models and gear units ending in LX, AX, & VX.



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U12205 - 1 of 1

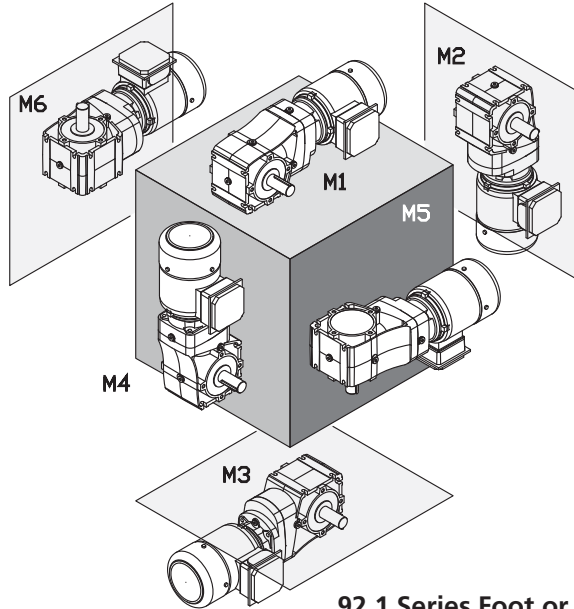
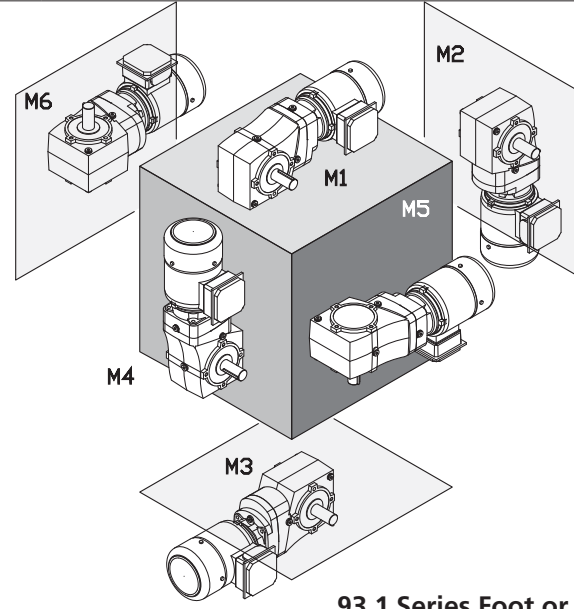
92.1/93.1 Helical-bevel mount lubrication

All NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size & mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

**IMPORTANT NOTE**

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

**92.1 Series Foot or Flange Mount****93.1 Series Foot or Flange Mount****92.1 Series Oil Fill**

Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 920072.1	0.22	0.21	0.50	0.47	0.22	0.36	0.22	0.34	0.22	0.28	0.22	0.28
SK 92072.1	0.28	0.26	0.52	0.49	0.44	0.42	0.57	0.54	0.31	0.29	0.33	0.31
SK 92172.1	0.36	0.34	0.65	0.61	0.55	0.52	0.71	0.67	0.44	0.42	0.51	0.48
SK 92372.1	0.45	0.43	0.97	0.92	0.77	0.73	0.88	0.83	0.58	0.55	0.65	0.61
SK 92672.1	0.90	0.85	1.69	1.60	1.27	1.20	1.59	1.50	1.08	1.02	1.08	1.02
SK 92772.1	1.37	1.30	2.80	2.65	1.97	1.86	2.85	2.70	1.69	1.60	1.69	1.60

Oil levels shown apply to all foot & flange mounted units.

93.1 Series Oil Fill

Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 930072.1	0.30	0.28	0.69	0.65	0.22	0.56	0.22	0.54	0.22	0.39	0.22	0.39
SK 93072.1	0.41	0.39	0.98	0.93	0.83	0.79	1.08	1.02	0.52	0.49	0.66	0.62
SK 93172.1	0.63	0.60	1.24	1.17	0.99	0.94	1.29	1.22	0.69	0.65	0.90	0.85
SK 93372.1	1.06	1.00	2.08	1.97	1.74	1.65	2.26	2.14	1.18	1.12	1.42	1.34
SK 93672.1	1.90	1.80	3.41	3.23	2.86	2.71	4.02	3.80	2.13	2.02	2.59	2.45
SK 93772.1	2.87	2.72	4.89	4.63	3.91	3.70	6.13	5.80	3.10	2.93	3.43	3.25

Oil levels shown apply to all foot & flange mounted units.

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U12300 - 1 of 1

RETAIN FOR FUTURE USE

92 Helical-bevel flanged lubrication

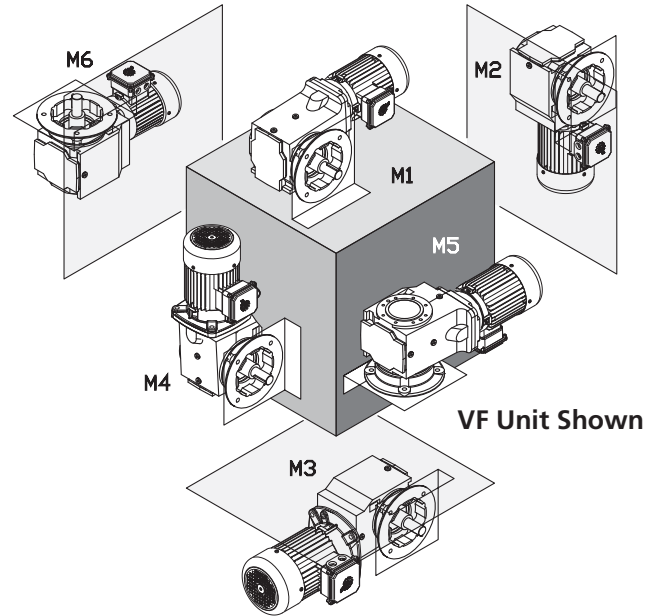
The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 92072	0.42	0.40	0.63	0.60	0.58	0.55	0.58	0.55	0.42	0.40	0.42	0.40
SK 92172	0.53	0.50	1.06	1.00	0.95	0.90	1.11	1.05	0.95	0.90	0.63	0.60
SK 92372	1.27	1.20	1.69	1.60	1.59	1.50	2.01	1.90	1.37	1.30	1.37	1.30
SK 92672	1.69	1.60	2.96	2.80	2.64	2.50	3.49	3.30	2.54	2.40	2.54	2.40
SK 92772	2.96	2.80	4.65	4.40	4.76	4.50	5.81	5.50	3.70	3.50	3.70	3.50

Oil Levels shown apply to gear units ending in AZ, AF, VZ, & VF.



DRIVESYSTEMS

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PARTS**

U12400 - 1 of 1

RETAIN FOR FUTURE USE

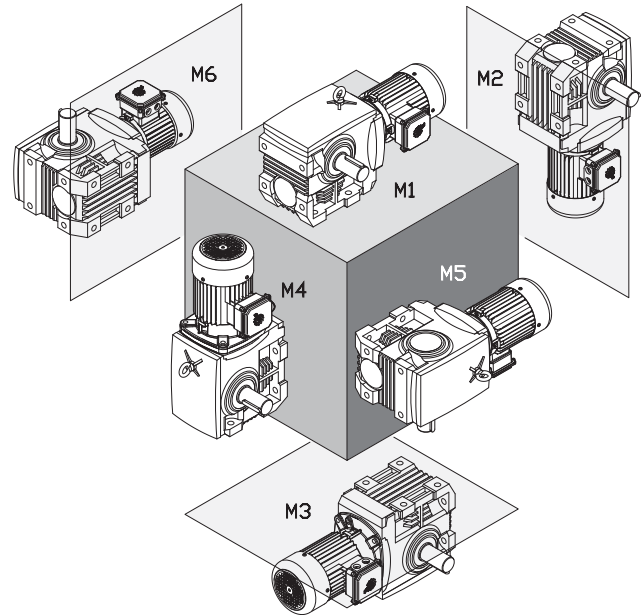
Helical-worm footed lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

**IMPORTANT NOTE**

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 02040	0.42	0.40	0.85	0.80	0.79	0.75	0.69	0.65	0.53	0.50	0.53	0.50
SK 02040.1	0.13	0.12	0.48	0.45	0.31	0.29	0.41	0.39	0.30	0.28	0.30	0.28
SK 02050	0.42	0.40	1.48	1.40	1.16	1.10	1.37	1.30	0.74	0.70	0.74	0.70
SK 13050	0.79	0.75	1.85	1.75	1.37	1.30	1.85	1.75	0.79	0.75	0.79	0.75
SK 12063	0.63	0.60	1.90	1.80	1.27	1.20	1.69	1.60	1.06	1.00	1.06	1.00
SK 13063	1.06	1.00	2.43	2.30	1.59	1.50	2.32	2.20	1.16	1.10	1.16	1.10
SK 12080	0.95	0.90	3.28	3.10	2.54	2.40	3.17	3.00	1.90	1.80	1.90	1.80
SK 13080	1.80	1.70	3.70	3.50	3.70	3.50	3.70	3.50	2.11	2.00	2.11	2.00
SK 32100	1.59	1.50	6.66	6.30	5.92	5.60	5.81	5.50	3.80	3.60	3.80	3.60
SK 33100	2.54	2.40	6.76	6.40	5.71	5.40	6.87	6.50	3.59	3.40	3.59	3.40
SK 42125	2.96	2.80	12.5	11.8	10.8	10.2	10.6	10.0	6.55	6.20	6.55	6.20
SK 43125	4.49	4.25	13.7	13.0	11.1	10.5	14.3	13.5	7.61	7.20	7.61	7.20

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U12500 - 1 of 1

Helical-worm solid shaft/flanged lubrication

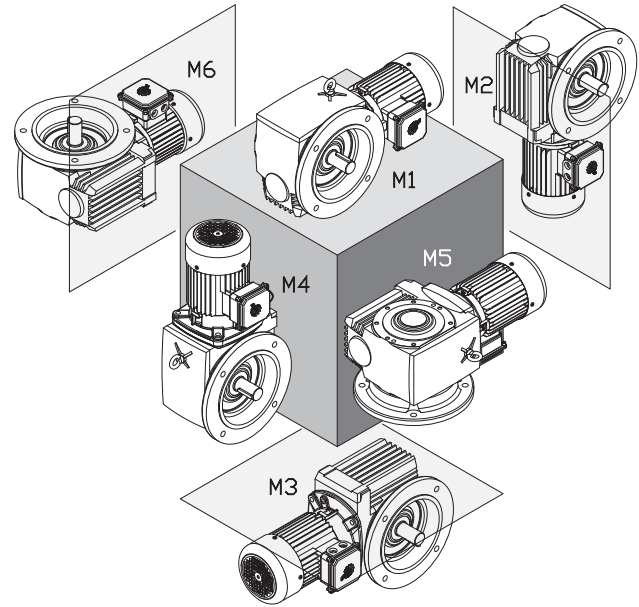
The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 02040 VF	0.53	0.50	0.85	0.80	0.79	0.75	0.63	0.60	0.53	0.50	0.53	0.50
SK 02040.1	0.13	0.12	0.48	0.45	0.31	0.29	0.41	0.39	0.30	0.28	0.30	0.28
SK 02050 VF	0.42	0.40	1.59	1.50	1.32	1.25	1.27	1.20	0.95	0.90	0.79	0.75
SK 13050 VF	0.79	0.75	1.90	1.80	1.59	1.50	1.80	1.70	1.11	1.05	0.95	0.90
SK 12063 VF	0.53	0.50	2.06	1.95	1.80	1.70	1.85	1.75	1.27	1.20	1.00	0.95
SK 13063 VF	1.06	1.00	2.43	2.30	2.01	1.90	2.32	2.20	1.43	1.35	1.16	1.10
SK 12080 VF	0.95	0.90	3.91	3.70	3.38	3.20	3.59	3.40	2.64	2.50	2.43	2.30
SK 13080 VF	1.69	1.60	4.02	3.80	3.70	3.50	4.12	3.90	2.85	2.70	2.64	2.50
SK 32100 VF	1.48	1.40	6.66	6.30	6.45	6.10	6.45	6.10	4.23	4.00	3.80	3.60
SK 33100 VF	2.80	2.65	7.61	7.20	6.76	6.40	8.03	7.60	4.54	4.30	4.02	3.80
SK 42125 VF	3.17	3.00	12.2	11.5	12.2	11.5	11.6	11.0	8.88	8.40	7.71	7.30
SK 43125 VF	4.97	4.70	15.9	15.0	13.7	13.0	16.9	16.0	9.51	9.00	8.14	7.70



DRIVESYSTEMS

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U12600 - 1 of 1

RETAIN FOR FUTURE USE

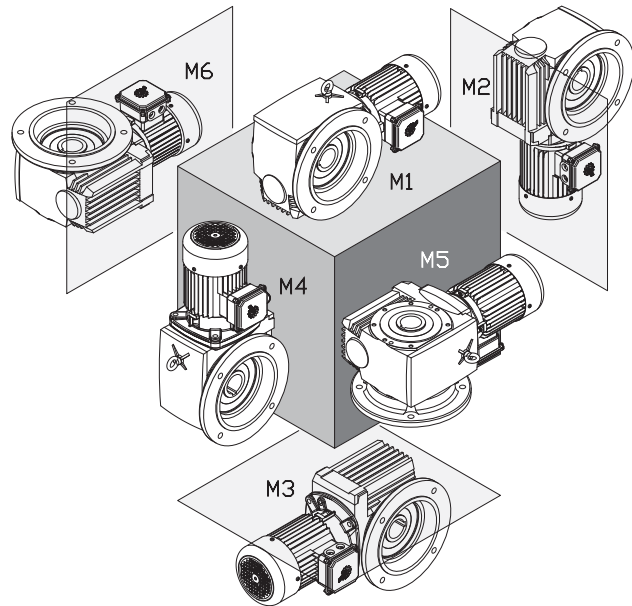
Helical-worm hollow shaft lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

**IMPORTANT NOTE**

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

**AF Unit Shown**

Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 02040	0.42	0.40	0.74	0.70	0.69	0.65	0.69	0.65	0.58	0.55	0.58	0.55
SK 02040.1	0.13	0.12	0.48	0.45	0.31	0.29	0.41	0.39	0.30	0.28	0.30	0.28
SK 02050	0.48	0.45	1.32	1.25	1.22	1.15	1.16	1.10	0.79	0.75	0.79	0.75
SK 13050	0.95	0.90	1.90	1.80	1.37	1.30	1.74	1.65	1.37	1.30	1.37	1.30
SK 12063	0.58	0.55	1.53	1.45	1.69	1.60	1.69	1.60	1.16	1.10	1.16	1.10
SK 13063	1.11	1.05	2.22	2.10	1.90	1.80	2.22	2.10	1.48	1.40	1.48	1.40
SK 12080	0.85	0.80	3.28	3.10	3.38	3.20	2.96	2.80	1.90	1.80	1.90	1.80
SK 13080	1.69	1.60	3.80	3.60	3.06	2.90	3.80	3.59	2.11	2.00	2.11	2.00
SK 32100	1.59	1.50	5.92	5.60	5.92	5.60	5.60	5.30	3.38	3.20	3.38	3.20
SK 33100	2.75	2.60	6.34	6.00	6.13	5.80	6.66	6.30	3.70	3.50	3.70	3.50
SK 42125	3.17	3.00	13.2	12.5	11.4	10.8	11.4	10.8	6.87	6.50	6.87	6.50
SK 43125	4.86	4.60	14.4	13.6	12.0	11.4	15.1	14.3	8.03	7.60	8.03	7.60

Oil Levels shown apply to gear units ending in AZ, AF.

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Courtesy of:

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U12700 - 1 of 1

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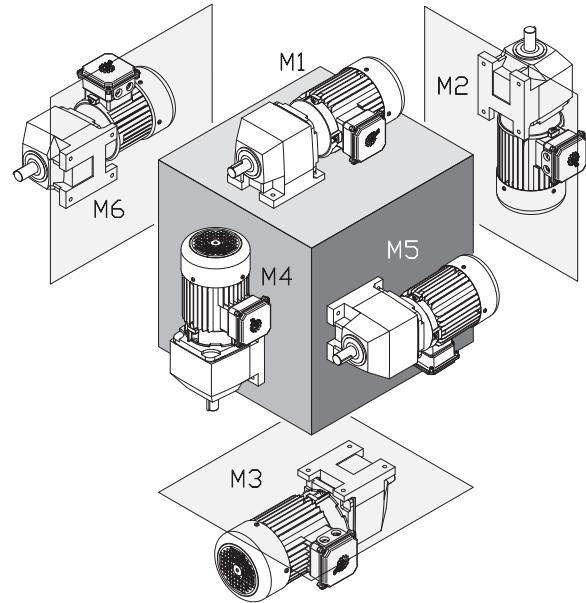
NORDBLOC® footed lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

**IMPORTANT NOTE**

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 172	0.37	0.35	0.53	0.50	0.53	0.50	0.53	0.50	0.53	0.50	0.53	0.50
SK 272	0.63	0.60	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00
SK 273	0.66	0.62	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10
SK 372	0.63	0.60	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00
SK 373	0.58	0.55	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10
SK 472	1.06	1.00	2.01	1.90	2.01	1.90	2.11	2.00	1.90	1.80	1.90	1.80
SK 473	1.37	1.30	2.64	2.50	2.22	2.10	2.54	2.40	2.22	2.10	2.22	2.10
SK 572	1.06	1.00	2.01	1.90	2.01	1.90	2.11	2.00	1.90	1.80	1.90	1.80
SK 573	1.37	1.30	2.64	2.50	2.22	2.10	2.54	2.40	2.22	2.10	2.22	2.10
SK 672	1.48	1.40	3.59	3.40	3.28	3.10	3.33	3.15	1.53	1.45	3.33	3.15
SK 673	1.90	1.80	4.02	3.80	3.38	3.20	3.59	3.40	3.06	2.90	3.17	3.00
SK 772	2.11	2.00	3.49	3.30	3.70	3.50	4.44	4.20	2.85	2.70	3.49	3.30
SK 773	2.64	2.50	4.76	4.50	3.91	3.70	4.86	4.60	3.49	3.30	3.49	3.30
SK 872	3.91	3.70	10.1	9.60	9.62	9.10	7.71	7.30	4.97	4.70	8.45	8.00
SK 873	6.55	6.20	8.88	8.40	7.93	7.50	9.62	9.10	7.93	7.50	7.93	7.50
SK 972	6.87	6.50	16.9	16.0	16.6	15.7	15.5	14.7	8.98	8.50	14.8	14.0
SK 973	11.6	11.0	16.7	15.8	13.7	13.0	16.9	16.0	14.1	13.3	13.7	13.0

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PARTS**

U12800 - 1 of 1

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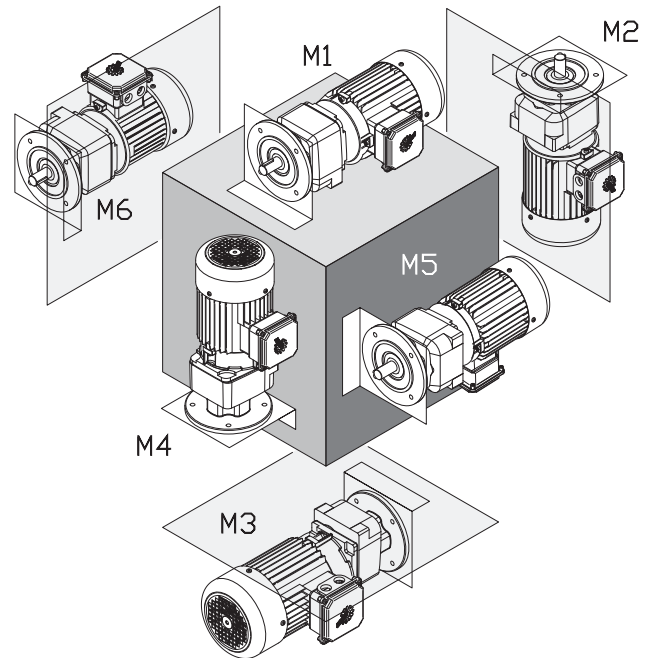
NORDBLOC® flanged lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

**IMPORTANT NOTE**

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Mounting Position	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 172 F	0.37	0.35	0.53	0.50	0.53	0.50	0.53	0.50	0.53	0.50	0.53	0.50
SK 272 F	0.63	0.60	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00
SK 273 F	0.66	0.62	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10
SK 372 F	0.63	0.60	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00
SK 373 F	0.58	0.55	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10
SK 472 F	1.06	1.00	2.01	1.90	2.01	1.90	2.01	1.90	2.01	1.90	1.59	1.50
SK 473 F	1.32	1.25	2.54	2.40	2.22	2.10	2.64	2.50	2.22	2.10	2.22	2.10
SK 572 F	1.06	1.00	2.01	1.90	2.01	1.90	2.01	1.90	2.01	1.90	1.59	1.50
SK 573 F	1.32	1.25	2.54	2.40	2.22	2.10	2.64	2.50	2.22	2.10	2.22	2.10
SK 672 F	1.22	1.15	3.59	3.40	2.85	2.70	2.96	2.80	1.32	1.25	2.85	2.70
SK 673 F	1.80	1.70	4.02	3.80	3.17	3.00	3.38	3.20	3.17	3.00	3.17	3.00
SK 772 F	1.69	1.60	3.49	3.30	3.70	3.50	3.49	3.30	3.28	3.10	3.28	3.10
SK 773 F	2.43	2.30	5.28	5.00	3.80	3.60	4.76	4.50	4.12	3.90	4.12	3.90
SK 872 F	3.70	3.50	9.51	9.00	8.35	7.90	8.14	7.70	4.12	3.90	7.61	7.20
SK 873 F	5.28	5.00	9.30	8.80	8.03	7.60	8.45	8.00	8.45	8.00	8.45	8.00
SK 972 F	6.87	6.50	15.9	15.0	13.7	13.0	14.3	13.5	6.87	6.50	12.7	12.0
SK 973 F	10.9	10.3	17.4	16.5	13.7	13.0	16.9	16.0	14.8	14.0	14.8	14.0

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U12900 - 1 of 1

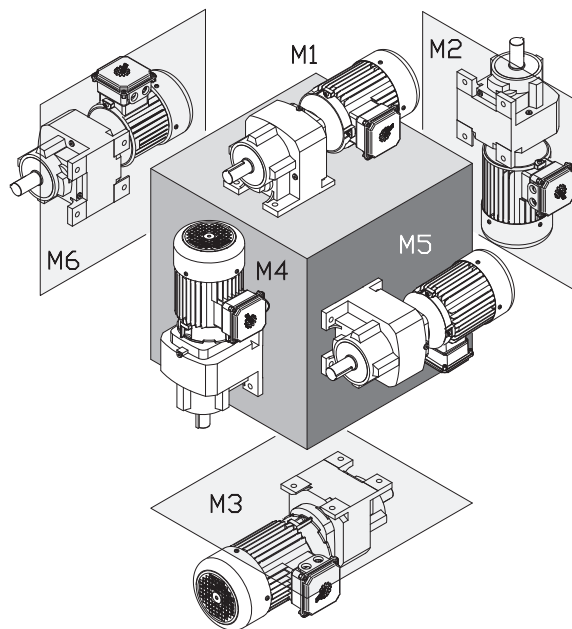
NORDBLOC®.1 Fill Quantities (Footed)

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For oil plug & vent locations please see U14700.

**IMPORTANT NOTE**

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The correct oil level should be located at the lower edge of the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 071.1	0.19	0.18	0.42	0.40	0.40	0.38	0.42	0.40	0.32	0.30	0.32	0.30
SK 072.1	0.17	0.16	0.34	0.32	0.22	0.21	0.24	0.23	0.19	0.18	0.21	0.20
SK 171.1	0.23	0.22	0.42	0.40	0.38	0.36	0.42	0.40	0.35	0.33	0.35	0.33
SK 172.1	0.29	0.27	0.62	0.59	0.44	0.42	0.48	0.45	0.34	0.32	0.41	0.39
SK 371.1	0.37	0.35	0.61	0.58	0.58	0.55	0.61	0.58	0.52	0.49	0.52	0.49
SK 372.1	0.48	0.45	1.10	1.05	0.79	0.75	1.10	1.00	0.63	0.60	0.69	0.65
SK 373.1	0.48	0.45	1.10	1.05	0.79	0.75	1.10	1.00	0.63	0.60	0.69	0.65
SK 571.1	0.51	0.48	0.91	0.86	0.85	0.80	0.97	0.92	0.72	0.68	0.72	0.68
SK 572.1	0.79	0.75	2.00	1.90	1.60	1.50	2.10	2.00	1.20	1.10	1.20	1.15
SK 573.1	0.79	0.75	2.00	1.90	1.60	1.50	2.10	2.00	1.20	1.10	1.20	1.15
SK 672.1	1.20	1.10	2.70	2.60	2.30	2.15	2.90	2.70	1.60	1.55	1.70	1.65
SK 673.1	1.20	1.10	2.70	2.60	2.30	2.15	2.90	2.70	1.60	1.55	1.70	1.65
SK 771.1	0.95	0.90	1.60	1.50	1.30	1.20	1.80	1.70	1.20	1.16	1.20	1.16
SK 772.1	1.40	1.30	4.00	3.80	2.50	2.40	3.40	3.20	1.70	1.60	2.60	2.50
SK 772.1 VL	2.10	2.00	4.00	3.80	2.50	2.40	3.40	3.20	1.70	1.60	2.60	2.50
SK 773.1	2.40	2.30	4.00	3.80	3.50	3.30	3.40	3.20	2.50	2.40	3.30	3.10
SK 773.1 VL	2.40	2.30	4.00	3.80	3.50	3.30	3.40	3.20	2.50	2.40	3.30	3.10
SK 871.1	1.59	1.5	3.38	3.2	3.38	3.2	2.75	2.6	2.43	2.3	2.43	2.3
SK 872.1	3.10	2.90	8.20	7.80	4.90	4.60	6.80	6.40	2.60	2.50	4.20	4.00
SK 872.1 VL	5.30	5.00	8.20	7.80	4.90	4.60	6.80	6.40	2.60	2.50	4.20	4.00
SK 873.1	4.40	4.20	8.20	7.80	6.20	5.90	6.80	6.40	4.30	4.10	6.20	5.90
SK 873.1 VL	4.40	4.20	8.20	7.80	6.20	5.90	6.80	6.40	4.30	4.10	6.20	5.90
SK 971.1	2.01	1.9	4.12	3.9	4.12	3.9	3.59	3.4	3.28	3.1	3.28	3.1
SK 972.1	4.80	4.50	13.00	12.00	7.90	7.50	12.00	11.50	4.40	4.20	7.90	7.50
SK 972.1 VL	9.00	8.50	13.00	12.00	7.90	7.50	12.00	11.50	4.40	4.20	7.90	7.50
SK 973.1	7.90	7.50	13.00	12.00	11.00	10.50	12.00	11.50	7.90	7.50	11.00	10.50
SK 973.1 VL	7.90	7.50	13.00	12.00	11.00	10.50	12.00	11.50	7.90	7.50	11.00	10.50
SK 1071.1	3.49	3.3	7.82	7.4	7.82	7.4	7.08	6.7	5.6	5.3	5.6	5.3

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PARTS**

U13000 - 1 of 1

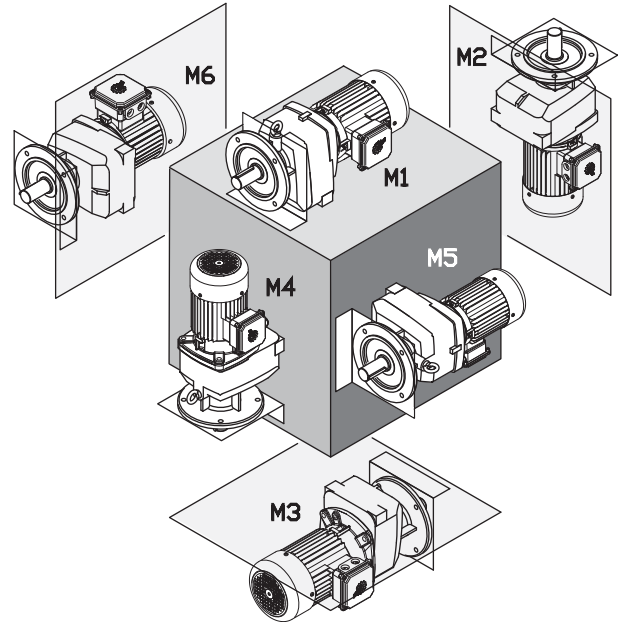
NORDBLOC®.1 Fill Quantities (Flanged)

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

**IMPORTANT NOTE**

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The correct oil level should be located at the lower edge of the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 071.1 F	0.19	0.18	0.42	0.40	0.40	0.38	0.42	0.40	0.32	0.30	0.32	0.30
SK 072.1 F	0.17	0.16	0.34	0.32	0.22	0.21	0.24	0.23	0.19	0.18	0.21	0.20
SK 171.1 F	0.23	0.22	0.42	0.40	0.38	0.36	0.42	0.40	0.35	0.33	0.35	0.33
SK 172.1 F	0.29	0.27	0.62	0.59	0.44	0.42	0.48	0.45	0.34	0.32	0.41	0.39
SK 371.1 F	0.37	0.35	0.61	0.58	0.58	0.55	0.61	0.58	0.52	0.49	0.52	0.49
SK 372.1 F	0.48	0.45	1.10	1.05	0.79	0.75	1.10	1.00	0.63	0.60	0.69	0.65
SK 373.1 F	0.48	0.45	1.10	1.05	0.79	0.75	1.10	1.00	0.63	0.60	0.69	0.65
SK 571.1 F	0.51	0.48	0.91	0.86	0.85	0.80	0.97	0.92	0.72	0.68	0.72	0.68
SK 572.1 F	0.79	0.75	2.00	1.90	1.60	1.50	2.10	2.00	1.20	1.10	1.20	1.15
SK 573.1 F	0.79	0.75	2.00	1.90	1.60	1.50	2.10	2.00	1.20	1.10	1.20	1.15
SK 672.1 F	1.20	1.10	2.70	2.60	2.30	2.15	2.90	2.70	1.60	1.55	1.70	1.65
SK 673.1 F	1.20	1.10	2.70	2.60	2.30	2.15	2.90	2.70	1.60	1.55	1.70	1.65
SK 771.1 F	0.95	0.90	1.60	1.50	1.30	1.20	1.80	1.70	1.20	1.16	1.20	1.16
SK 772.1 F	1.40	1.30	4.00	3.80	2.50	2.40	3.50	3.30	1.80	1.70	2.50	2.40
SK 772.1 VL F	2.10	2.00	4.00	3.80	2.50	2.40	3.50	3.30	1.80	1.70	2.50	2.40
SK 773.1 F	2.10	2.00	3.70	3.50	3.40	3.20	3.10	2.90	2.40	2.30	3.20	3.00
SK 773.1 VL F	2.10	2.00	3.70	3.50	3.40	3.20	3.10	2.90	2.40	2.30	3.20	3.00
SK 871.1 F	1.59	1.5	3.38	3.2	3.38	3.2	2.75	2.6	2.43	2.3	2.43	2.3
SK 872.1 F	3.40	3.20	7.90	7.50	5.40	5.10	7.10	6.70	2.70	2.60	4.50	4.30
SK 872.1 VL F	5.30	5.00	7.90	7.50	5.40	5.10	7.10	6.70	2.70	2.60	4.50	4.30
SK 873.1 F	4.30	4.10	8.00	7.60	7.30	6.90	7.00	6.60	5.30	5.00	7.00	6.60
SK 873.1 VL F	4.30	4.10	8.00	7.60	7.30	6.90	7.00	6.60	5.30	5.00	7.00	6.60
SK 971.1 F	2.01	1.9	4.12	3.9	4.12	3.9	3.59	3.4	3.28	3.1	3.28	3.1
SK 972.1 F	4.80	4.50	13.00	12.50	8.50	8.00	13.00	12.50	4.80	4.50	8.10	7.70
SK 972.1 VL F	9.00	8.50	13.00	12.50	8.50	8.00	13.00	12.50	4.80	4.50	8.10	7.70
SK 973.1 F	7.80	7.40	13.00	12.20	12.00	11.10	12.00	11.60	8.50	8.00	12.00	10.90
SK 973.1 VL F	7.80	7.40	13.00	12.20	12.00	11.10	12.00	11.60	8.50	8.00	12.00	10.90
SK 1071.1 F	3.49	3.3	7.82	7.4	7.82	7.4	7.08	6.7	5.6	5.3	5.6	5.3

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U13100 - 1 of 1

MINICASE® (SM Series) Lubrication

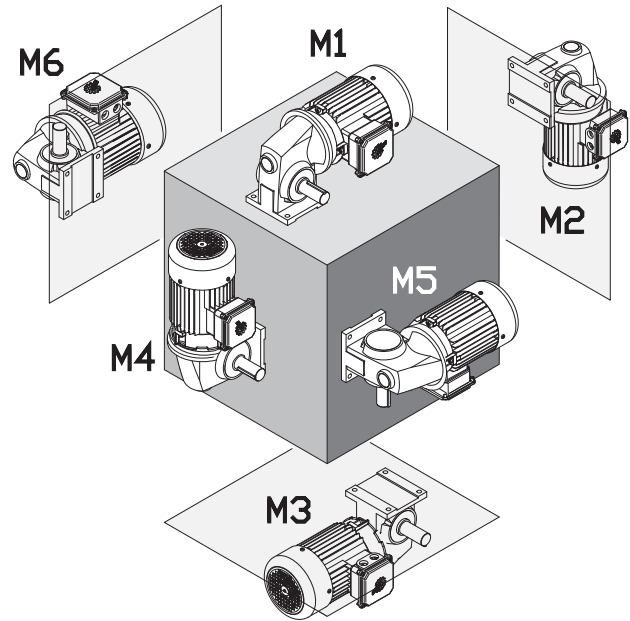
NORD MINICASE® (SM Series) worm gear reducers and worm gearmotors are inherently maintenance free, factory oil filled, and supplied with a high quality, long life synthetic gear oil intended to be suitable for the life of the product. These gear units are also supplied without oil service plugs or vents.

Related User Manuals

U10790 MINICASE® (SM Series) Worm – Lubrication Guidelines.
U11040 MINICASE® (SM Series) Worm – Lubrication Types.

**IMPORTANT NOTE**

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SM31	4.1	120	4.1	120	4.1	120	4.1	120	4.1	120	4.1	120
SK 1SM40	7.4	220	7.4	220	7.4	220	7.4	220	7.4	220	7.4	220
SK 2SM40	11.2	330	11.2	330	11.2	330	12.2	360	11.2	330	11.2	330
SK 1SM50	8.5	250	8.5	250	8.5	250	8.5	250	8.5	250	8.5	250
SK 2SM50	11.8	350	11.8	350	11.8	350	14.2	420	11.8	350	11.8	350
SK 1SM63	14.2	420	14.2	420	14.2	420	14.2	420	14.2	420	14.2	420
SK 2SM63	17.9	530	17.9	530	17.9	530	21.3	630	17.9	530	17.9	530

Oil levels shown apply to any foot-mount gear housings including those ending with no suffix or ending with LX or AX.

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DRIVESYSTEMS

RETAIN FOR FUTURE USE

U13150 - 1 of 1

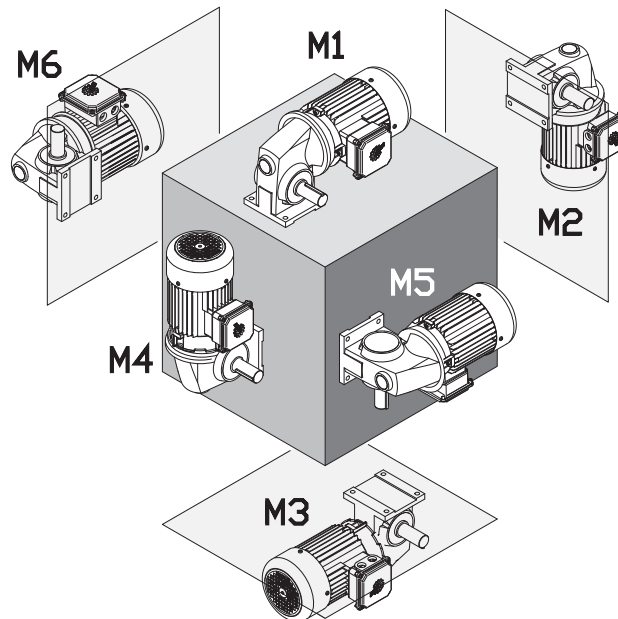
MINICASE® (SMI/SMID Series) Lubrication

NORD MINICASE® (SMI/SMID Series) worm gear reducers and worm gearmotors are inherently maintenance free, factory oil filled, and supplied with a high quality, long life synthetic gear oil intended to be suitable for the life of the product. For lubrication types see user manual U11050.

NORD MINICASE® (SMI/SMID Series) worm gear reducers and worm gearmotors are equipped with oil plugs. Venting the gear unit is optional as discussed in user manual U14750.

Related User Manuals

- U10800 - MINICASE® (SMI/SMID Series) Worm – Lubrication Guidelines.
- U11050 - MINICASE® (SMI/SMID Series) Worm – Lubrication Types
- U14750 - MINICASE® (SMI/SMID Series) Worm – Oil Plug Locations



IMPORTANT NOTE

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

MINICASE® (SMI Series) Gear Reducer Oil Fill - Foot Housing

Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SMI31	1.5	45	1.5	45	1.5	45	1.5	45	1.5	45	1.5	45
SK 1SMI40	2.7	80	2.7	80	2.7	80	2.7	80	2.7	80	2.7	80
SK 1SMI50	4.4	130	4.4	130	4.4	130	4.4	130	4.4	130	4.4	130
SK 1SMI63	9.1	270	9.1	270	9.1	270	9.1	270	9.1	270	9.1	270
SK 1SMI75	14.2	420	14.2	420	14.2	420	14.2	420	14.2	420	14.2	420

Oil fill level is universal and independent of mounting position

Oil levels shown apply to any foot-mount gear housings including those ending with no-suffix or LX or AX.

MINICASE® (SMID Series) Integral Gearmotor Oil Fill - Foot Housing

Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SMID31	2.0	60	3.6	105	2.4	70	1.7	50	2.4	70	2.4	70
SK 1SMID40	3.4	100	5.6	165	4.1	120	3.0	90	4.1	120	4.1	120
SK 1SMID50	5.9	175	8.8	260	6.6	195	5.4	160	6.6	195	6.6	195
SK 1SMID63	9.6	285	14.4	425	11.0	325	9.1	270	11.0	325	11.0	325

Oil levels shown apply to any foot-mount gear housings including those ending with no-suffix or LX or AX.

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U13200 - 1 of 1

MINICASE® (SM Series) Lubrication

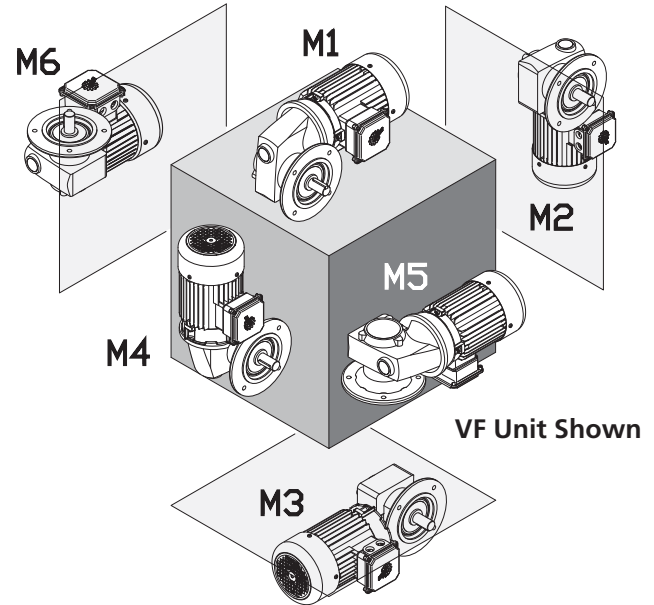
NORD MINICASE® (SM Series) worm gear reducers and worm gearmotors are inherently maintenance free, factory oil filled, and supplied with a high quality, long life synthetic gear oil intended to be suitable for the life of the product. These gear units are also supplied without oil service plugs or vents.

Related User Manuals

U10790 MINICASE® (SM Series) Worm – Lubrication Guidelines.
U11040 MINICASE® (SM Series) Worm – Lubrication Types.

**IMPORTANT NOTE**

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SM31	4.4	130	4.4	130	4.4	130	4.4	130	4.4	130	4.4	130
SK 1SM40	8.1	240	8.1	240	8.1	240	8.1	240	8.1	240	8.1	240
SK 2SM40	11.5	340	11.5	340	11.5	340	12.8	380	11.5	340	11.5	340
SK 1SM50	9.1	270	9.1	270	9.1	270	9.1	270	9.1	270	9.1	270
SK 2SM50	12.5	370	12.5	370	12.5	370	15.2	450	12.5	370	12.5	370
SK 1SM63	15.2	450	15.2	450	15.2	450	15.2	450	15.2	450	15.2	450
SK 2SM63	20.3	600	20.3	600	20.3	600	24.7	730	20.3	600	20.3	600

Oil Levels shown apply to flange-mount gear housings with model type ending in AZ, AF, VZ or VF.

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U13250 - 1 of 1

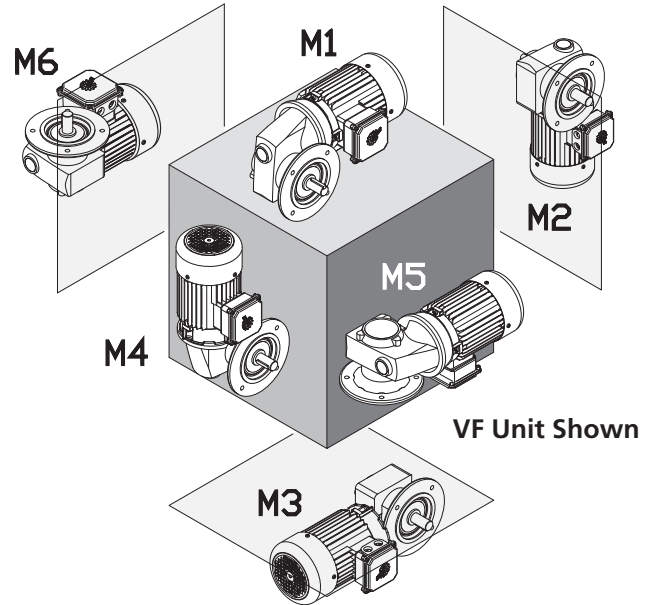
MINICASE® (SMI/SMID Series) Lubrication

NORD MINICASE® (SMI/SMID Series) worm gear reducers and worm gearmotors are inherently maintenance free, factory oil filled, and supplied with a high quality, long life synthetic gear oil intended to be suitable for the life of the product. For lubrication types see user manual U11050.

NORD MINICASE® (SMI/SMID Series) worm gear reducers and worm gearmotors are equipped with oil plugs. Venting the gear unit is optional as discussed in user manual U14750.

Related User Manuals

- U10800 - MINICASE® (SMI/SMID Series) Worm – Lubrication Guidelines.
- U11050 - MINICASE® (SMI/SMID Series) Worm – Lubrication Types
- U14750 - MINICASE® (SMI/SMID Series) Worm – Oil Plug Locations

**IMPORTANT NOTE**

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

MINICASE® (SMI Series) Gear Reducer Oil Fill - Flange Housing

Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SMI31	1.5	45	1.5	45	1.5	45	1.5	45	1.5	45	1.5	45
SK 1SMI40	2.7	80	2.7	80	2.7	80	2.7	80	2.7	80	2.7	80
SK 1SMI50	4.4	130	4.4	130	4.4	130	4.4	130	4.4	130	4.4	130
SK 1SMI63	9.1	270	9.1	270	9.1	270	9.1	270	9.1	270	9.1	270
SK 1SMI75	14.2	420	14.2	420	14.2	420	14.2	420	14.2	420	14.2	420

Oil Fill is universal and independent of mounting position.

Oil Levels shown apply to flange-mount gear housings with model type ending in AZ, AF, VZ or VF.

MINICASE® (SMID Series) Integral Gearmotor Oil Fill - Flange Housing

Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SMID31	2.0	60	3.6	105	2.4	70	1.7	50	2.4	70	2.4	70
SK 1SMID40	3.4	100	5.6	165	4.1	120	3.0	90	4.1	120	4.1	120
SK 1SMID50	5.9	175	8.8	260	6.6	195	5.4	160	6.6	195	6.6	195
SK 1SMID63	9.6	285	14.4	425	11.0	325	9.1	270	11.0	325	11.0	325

Oil Levels shown apply to flange-mount gear housings with model type ending in AZ, AF, VZ or VF.

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**FLEX**

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U13300 - 1 of 1

FLEXBLOC™ (SI/SID Series) Lubrication

NORD FLEXBLOC™ worm gear reducers are inherently maintenance free, factory oil filled, and supplied with a high quality, long life synthetic gear oil intended to be suitable for the life of the product. For lubrication types see User Manual U11060.

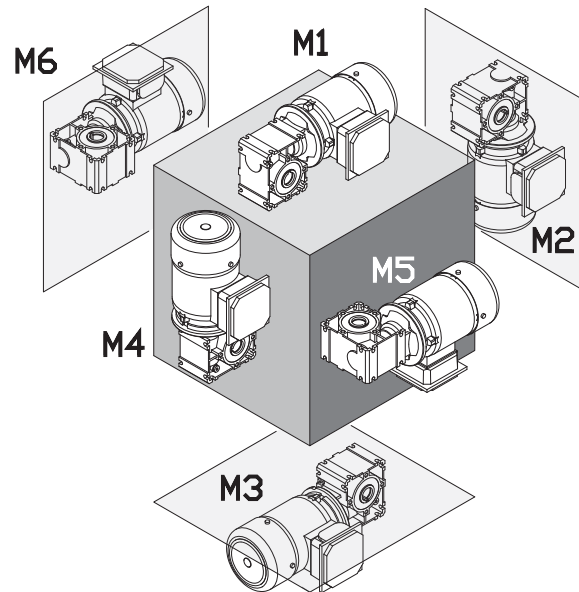
NORD FLEXBLOC™ worm gear reducers are equipped with oil plugs. Venting the gear unit is optional as discussed in User Manual U14800.

Related User Manuals

U10810 FLEXBLOC™ (SI/SID Series) Worm – Lubrication Guidelines

U11060 FLEXBLOC™ Worm (SI/SID Series) – Lubrication Types

U14800 FLEXBLOC™ Worm (SI/SID Series) – Oil Plug Locations

**FLEXBLOC™ (SI Series) Gear Reducer Oil Fill**

Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SI31	1.0	30	1.0	30	1.0	30	1.0	30	1.0	30	1.0	30
SK 1SI40	1.9	55	1.9	55	1.9	55	1.9	55	1.9	55	1.9	55
SK 1SI50	3.2	95	3.2	95	3.2	95	3.2	95	3.2	95	3.2	95
SK 1SI63	6.1	180	6.1	180	6.1	180	6.1	180	6.1	180	6.1	180
SK 1SI75	12.2	360	12.2	360	12.2	360	12.2	360	12.2	360	12.2	360

Oil Fill is universal and independent of mounting position.

FLEXBLOC™ (SID Series) Gear Reducer Oil Fill

Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SID31	1.7	50	3.0	90	2.4	70	1.7	50	2.4	70	2.4	70
SK 1SID40	3.0	90	5.1	150	3.7	110	2.7	80	4.1	120	4.1	120
SK 1SID50	5.7	170	6.8	200	5.7	170	5.1	150	6.1	180	6.1	180
SK 1SID63	9.8	280	12.2	360	9.8	290	8.1	240	10.5	310	10.5	310

Integral gear motors only available upon special request.

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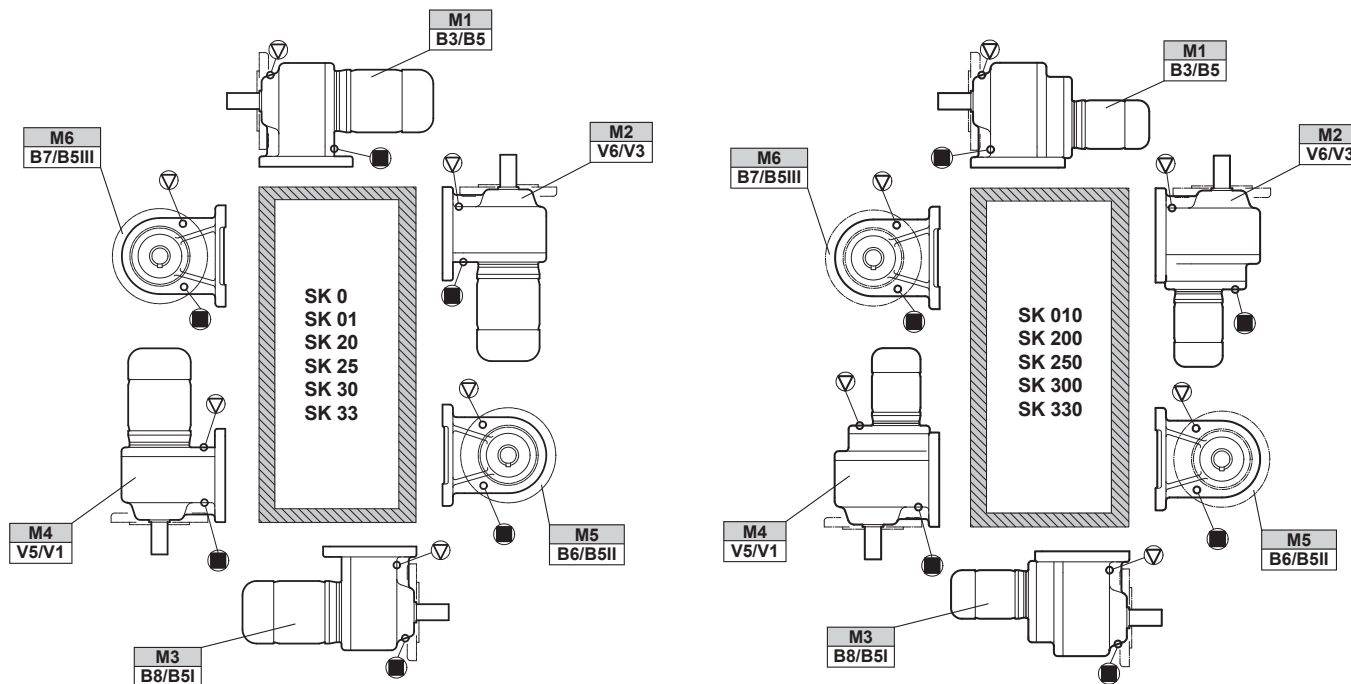
**SCREW CONVEYOR
PARTS**



U14000 - 1 of 1

Oil plug connections

All reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. *For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.*



▽ = Vent
■ = Oil Plug

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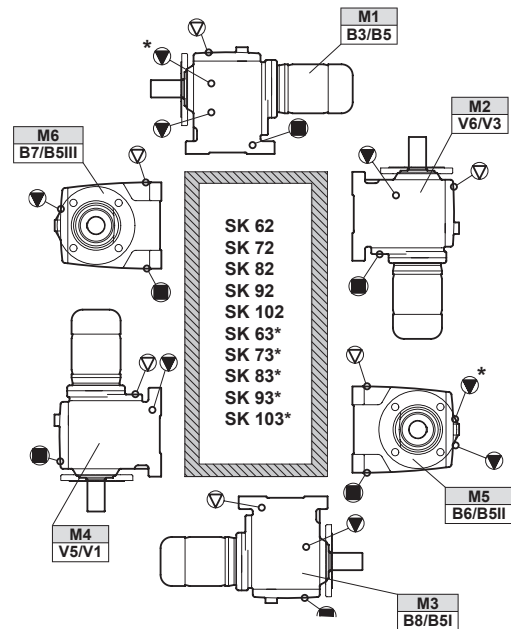
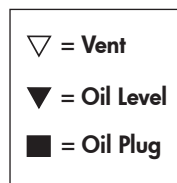
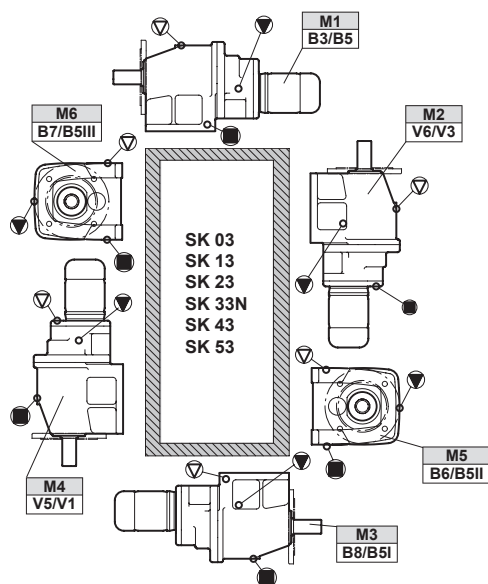
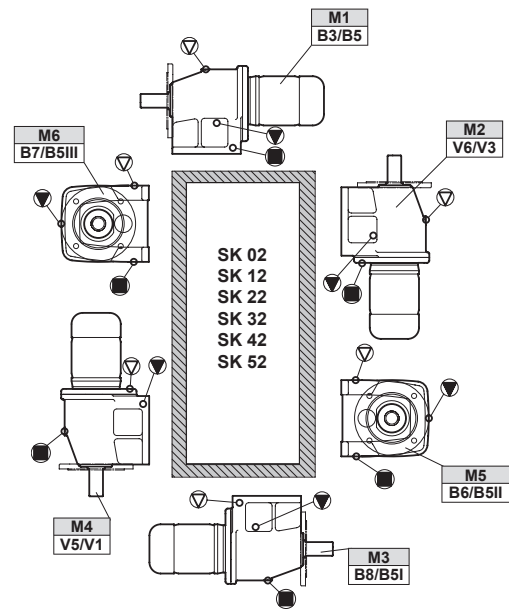
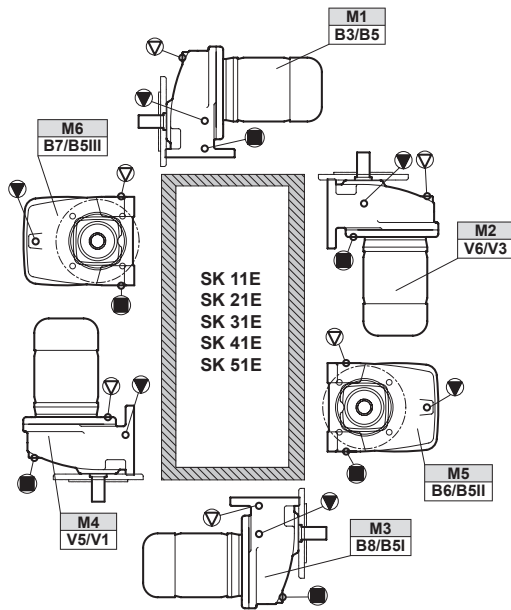
SCREW CONVEYOR PARTS



U14100 - 1 of 1

Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. **For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.**



* Oil level for 3 stage gear units.

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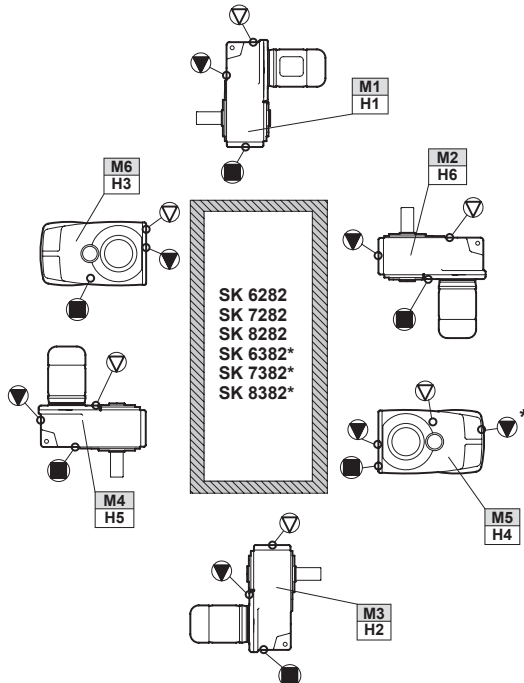
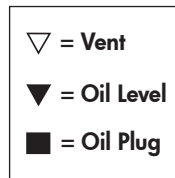
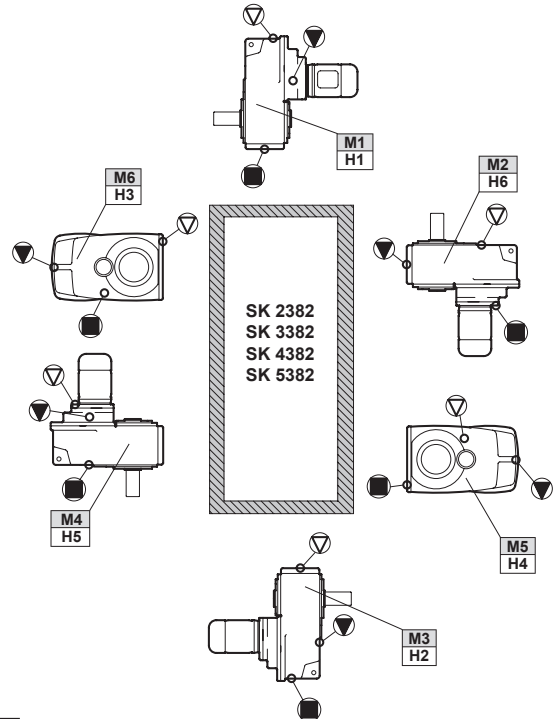
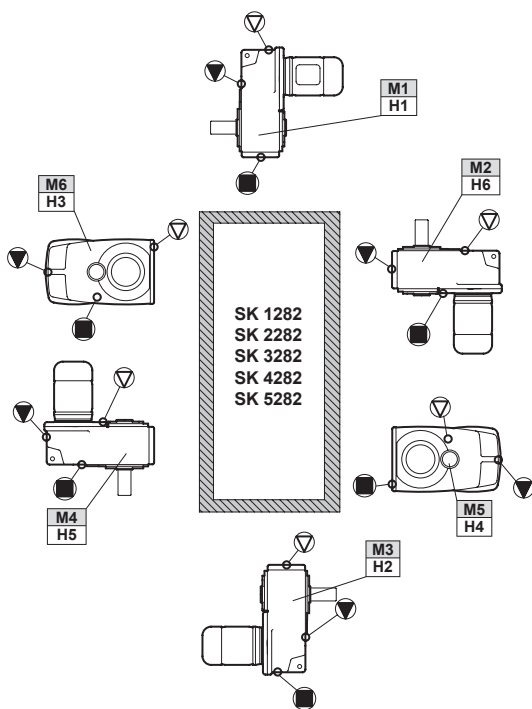
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**SCREW CONVEYOR
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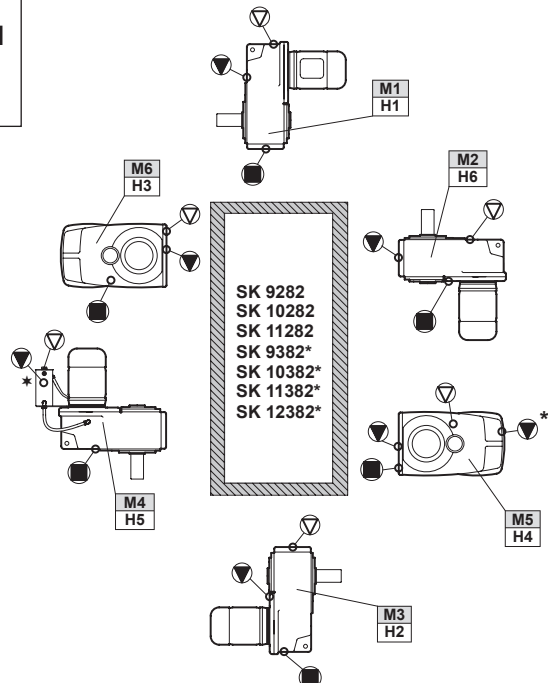
U14200 - 1 of 2

Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. **For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.**



* Oil level for 3 stage gear units



* Oil level for 3 stage gear units

* Oil fill level should be verified using the dip stick located in the oil tank for the M4/H5 position.

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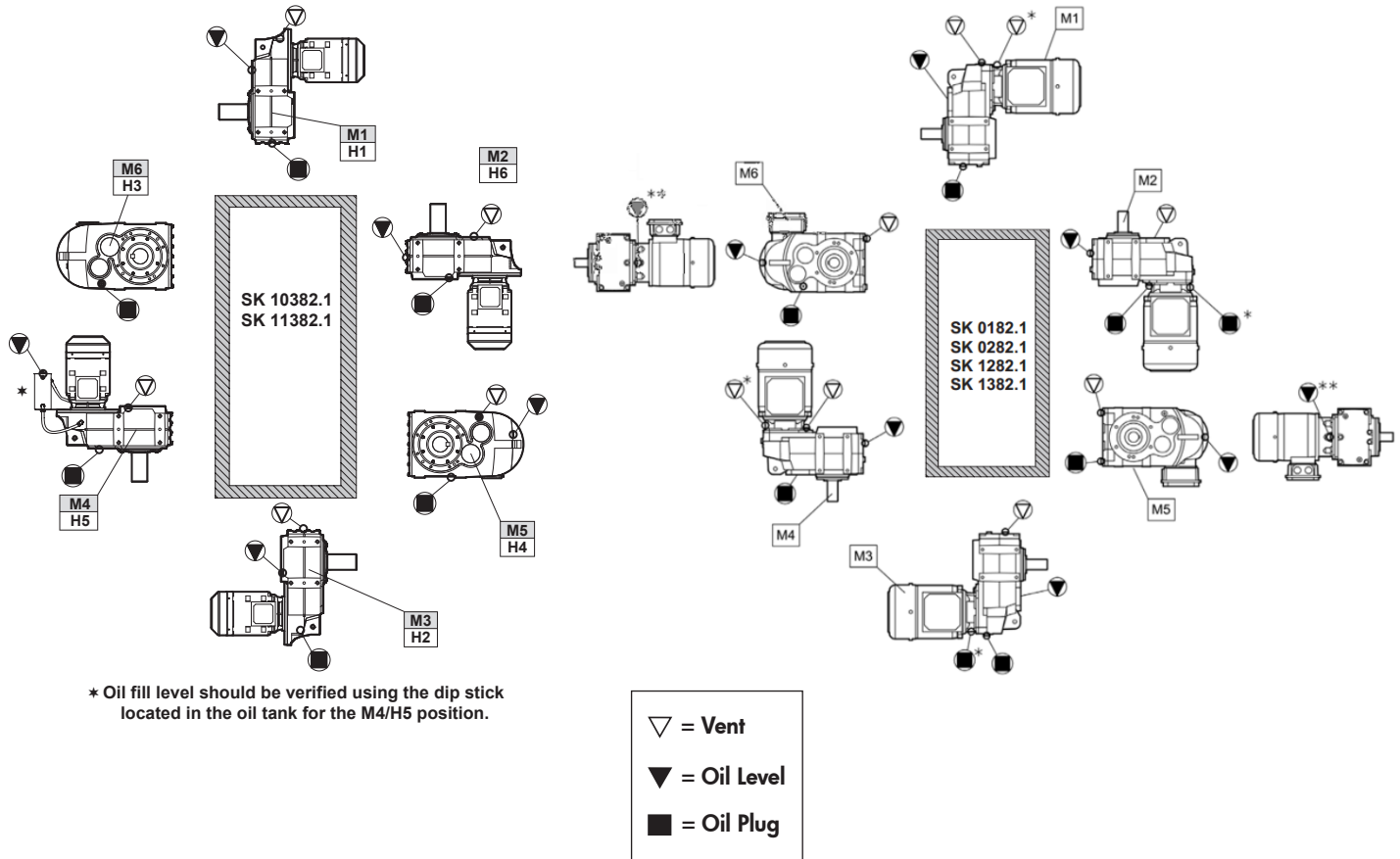
**SCREW CONVEYOR
PARTS**

U14200 - 2 of 2

RETAIN FOR FUTURE USE

Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. **For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.**

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PARTS**

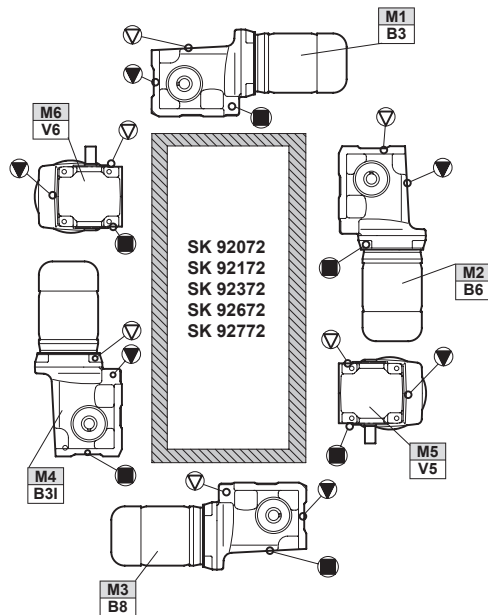
U14300 - 1 of 1

RETAIN FOR FUTURE USE

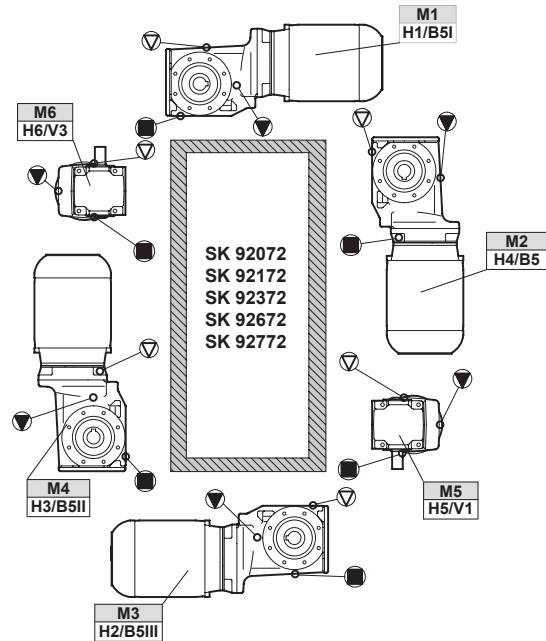
Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. **For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.**

Foot Mount



Shaft/Flange Mount



- ▽ = Vent
- ▼ = Oil Level
- = Oil Plug

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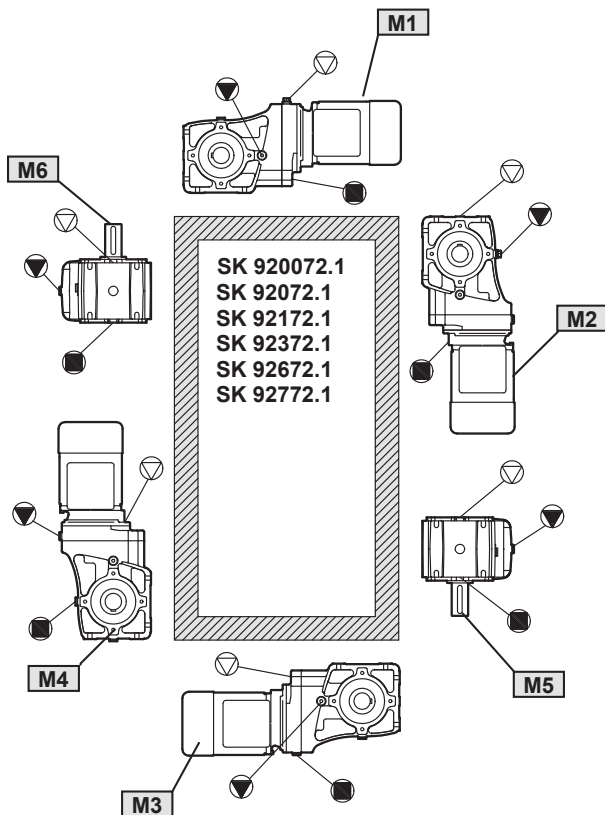
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U14305 - 1 of 1

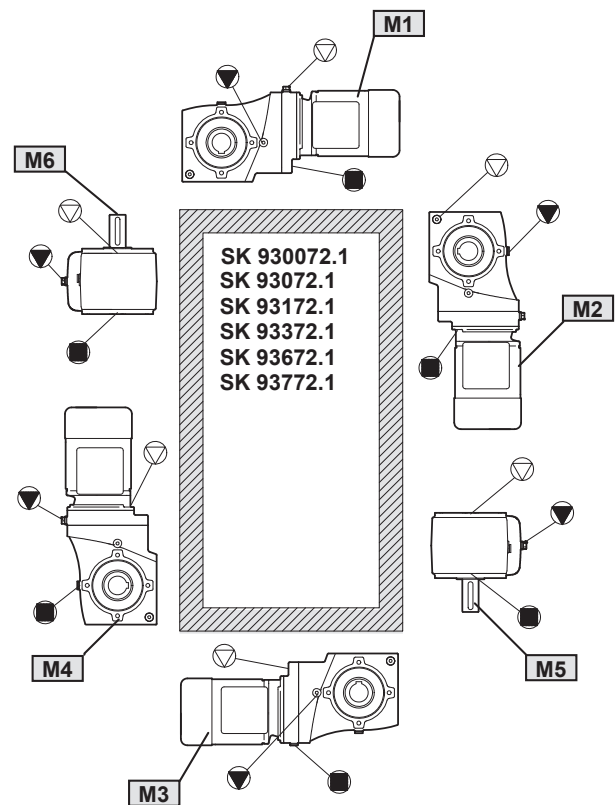
Oil plug locations

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. *For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.*

92.1 Series



93.1 Series



▽ = Vent

▼ = Oil Level

■ = Oil Plug

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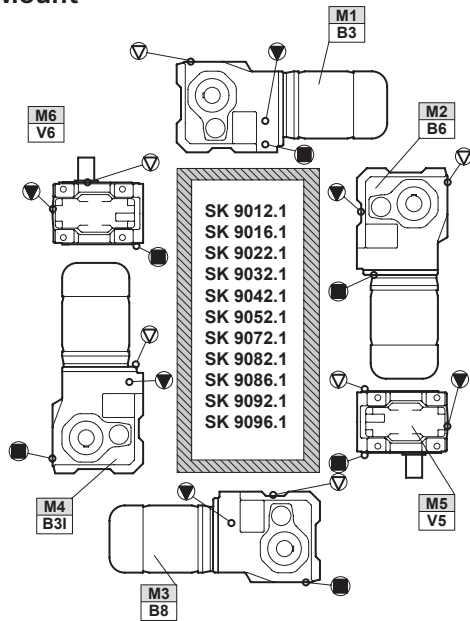
U14400 - 1 of 1

RETAIN FOR FUTURE USE

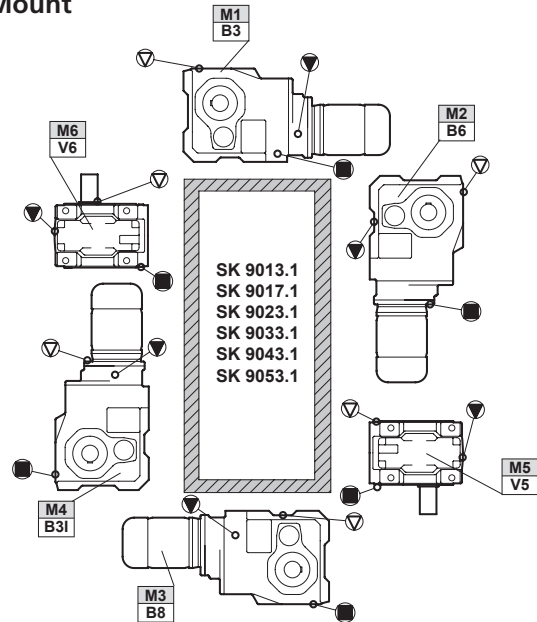
Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. **For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.**

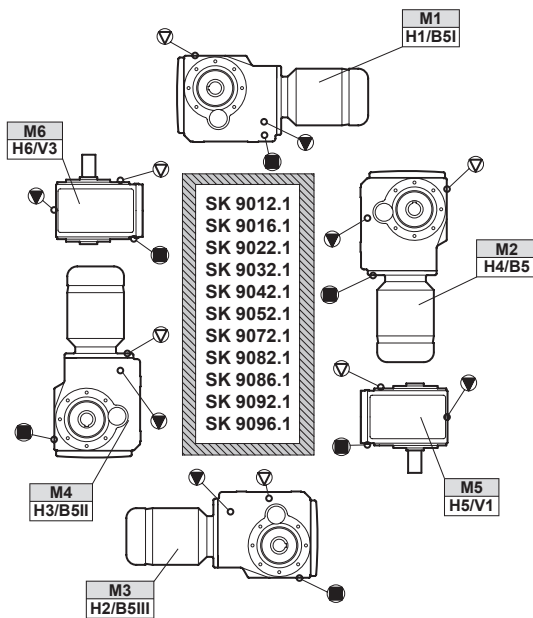
Foot Mount



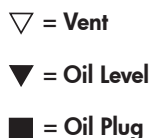
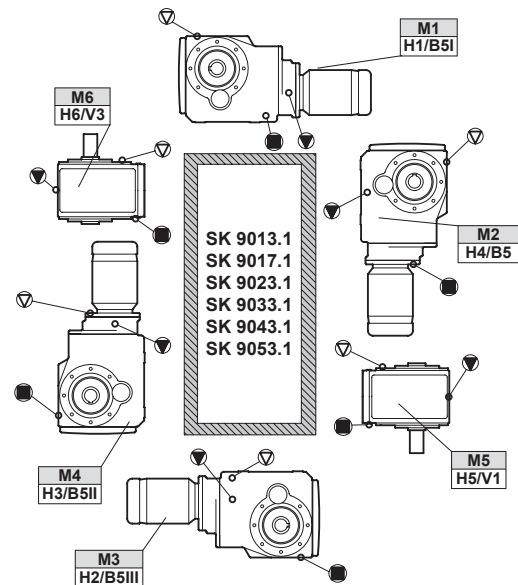
Foot Mount



Shaft/Flange Mount



Shaft/Flange Mount

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U14401 - 1 of 1

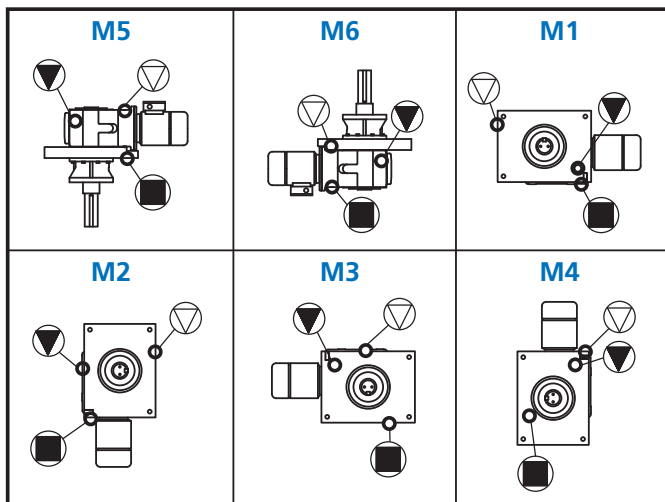
Oil Plug Locations

The NORD SK 9055 and SK 9155 Conveyor Drive reducers are designed to be output flange mounted. The following charts detail the six basic mounting positions for the SK 9055 and SK 9155 gear units. The standard or most typical mounting position is M5.

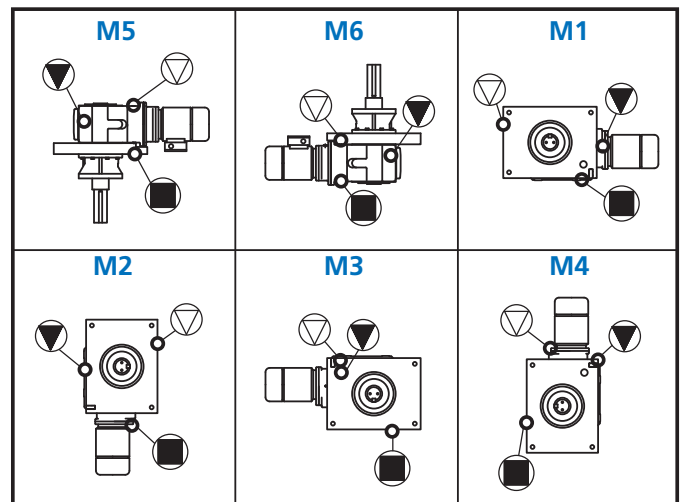
All SK 9055 and SK 9155 NORD gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. The mounting position also determines the position of the oil drain, oil fill and oil vent locations on the gear unit. SK 9155/42 and SK 9155/32 compound gear unit assemblies have separate oil sump areas.

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. **For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.**

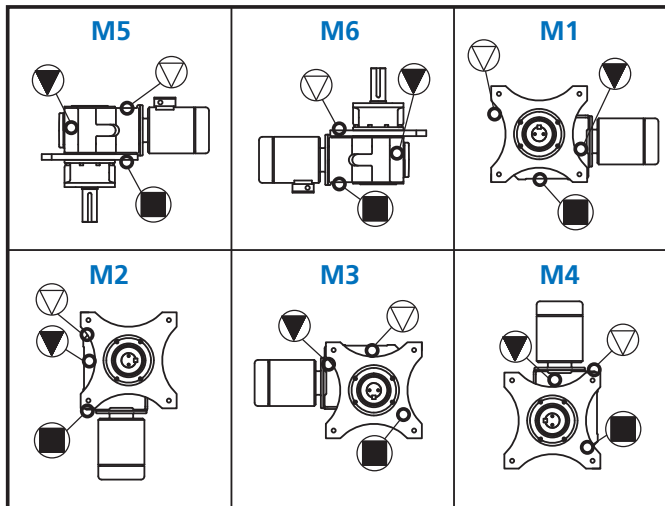
SK 9055 (3 Stage)



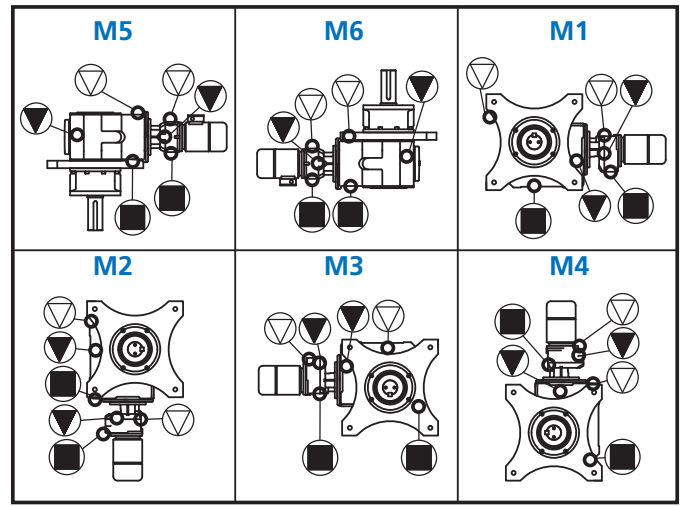
SK 9055 (4 Stage)



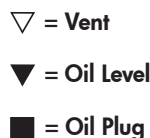
SK 9155



SK 9155/42



For mounting positions other than shown, please consult NORD Gear.



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PARTS**

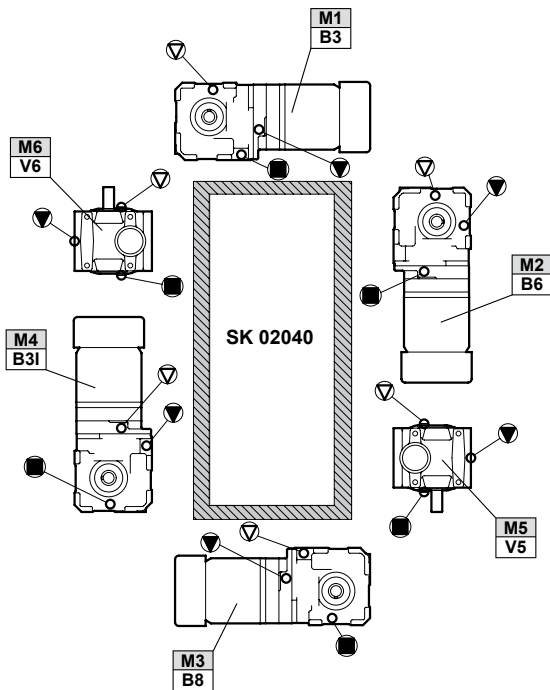
U14500 - 1 of 2

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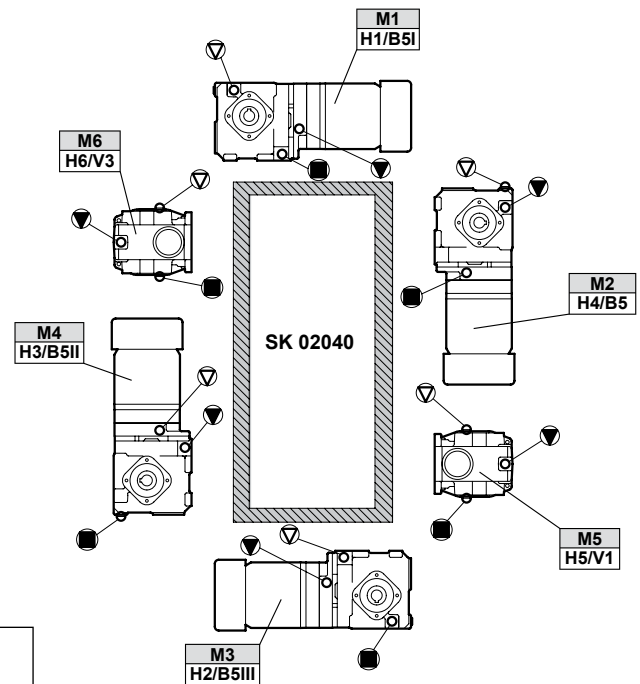
Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. **For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.**

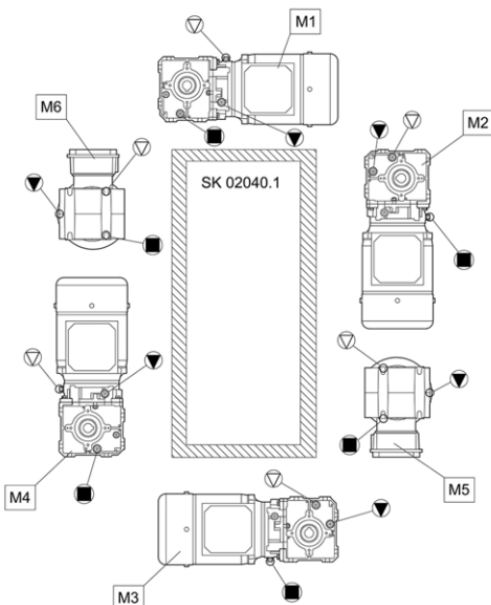
Foot Mount



Shaft/Flange Mount



▽ = Vent
▼ = Oil Level
■ = Oil Plug

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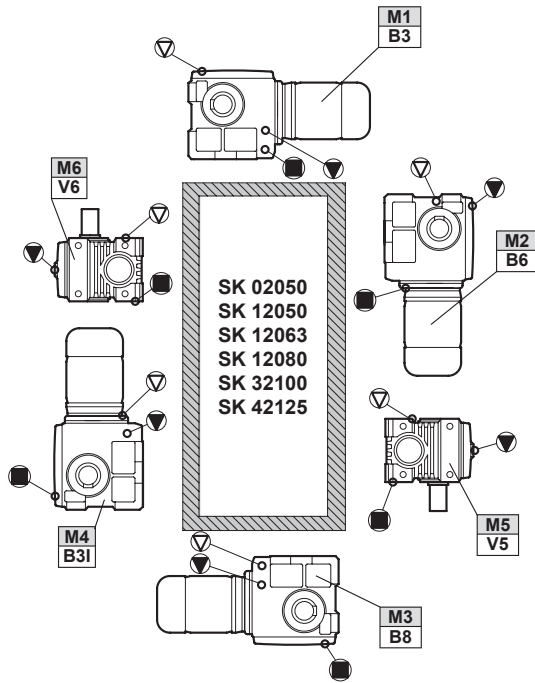
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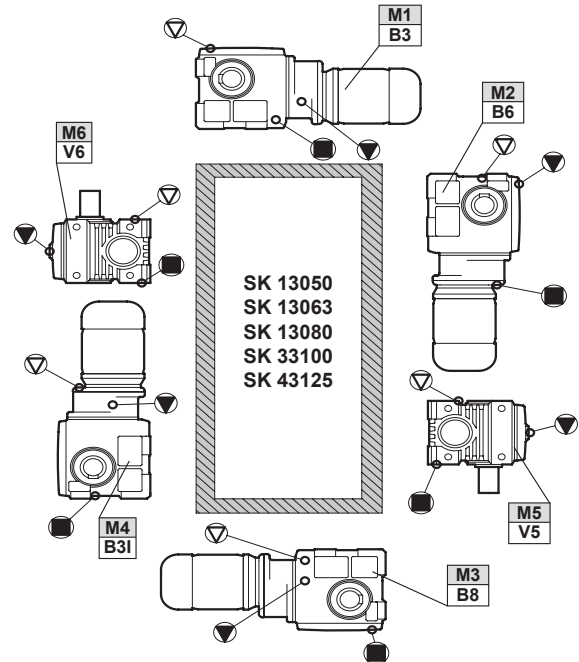
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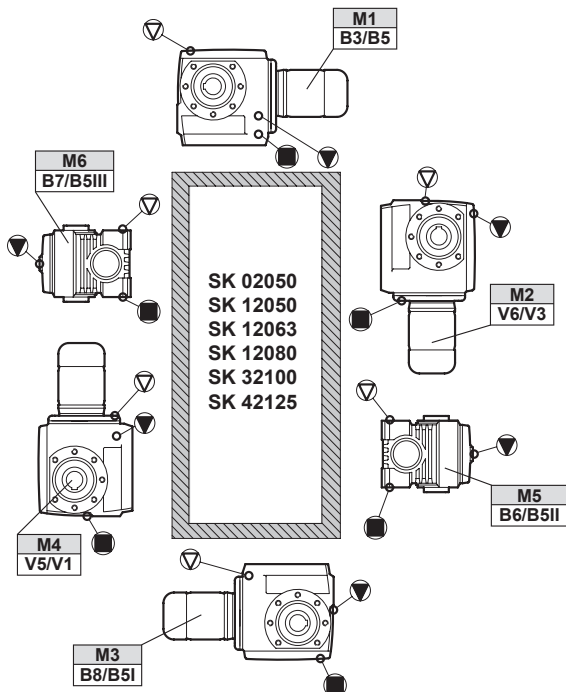
Foot Mount



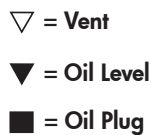
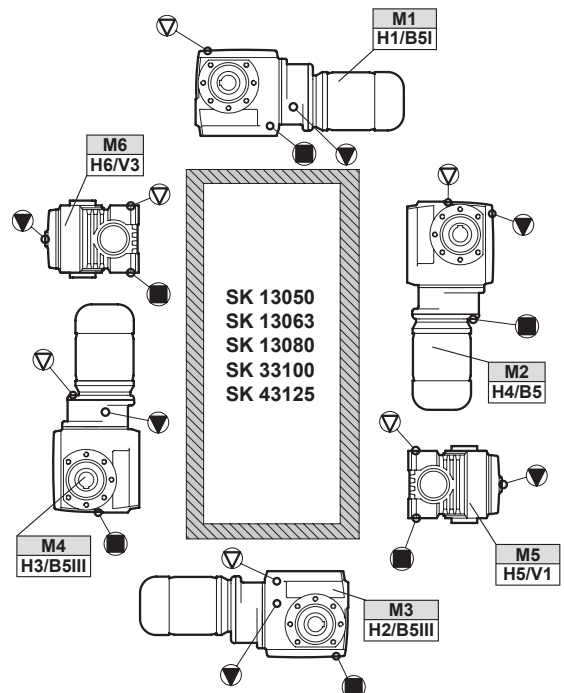
Foot Mount



Shaft/Flange Mount



Shaft/Flange Mount





DRIVESYSTEMS

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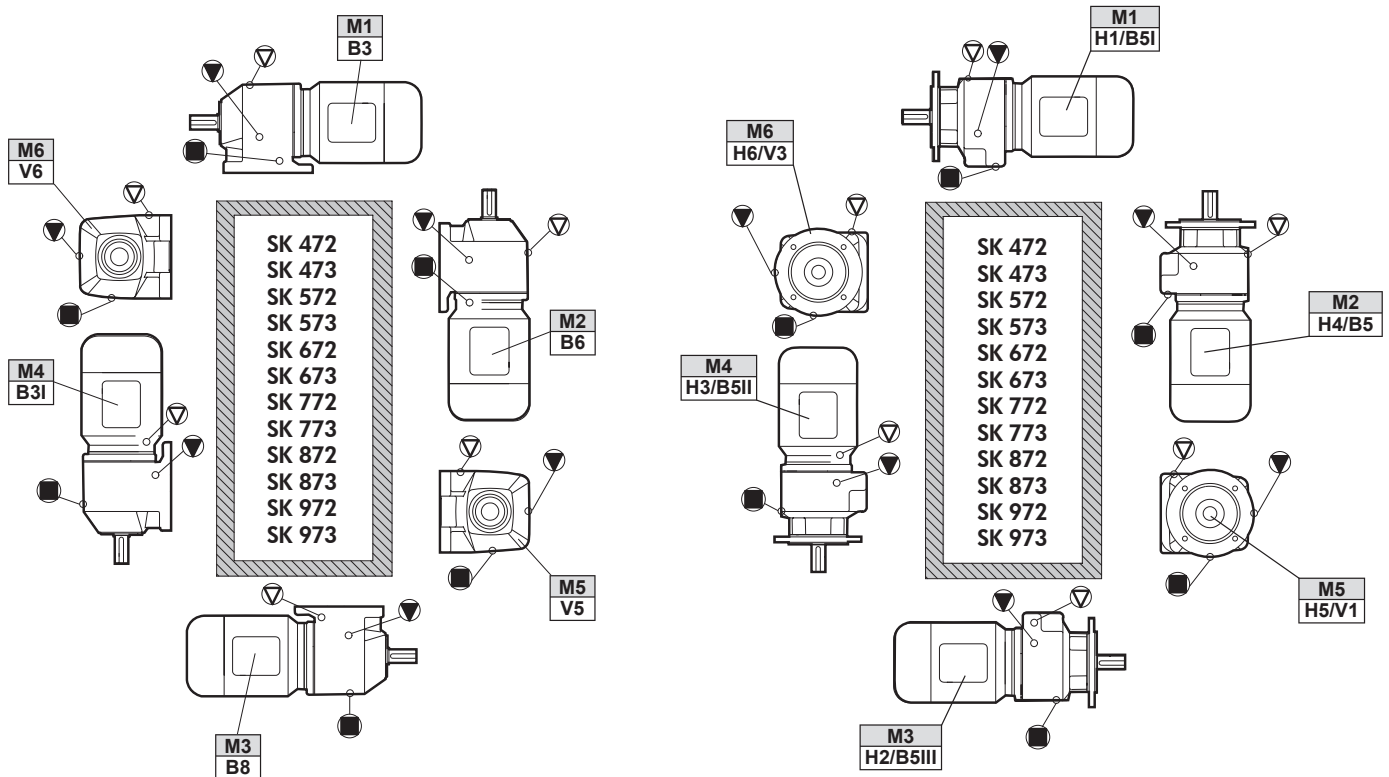
**SCREW CONVEYOR
PARTS**

U14600 - 1 of 1

RETAIN FOR FUTURE USE

Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. *For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.*

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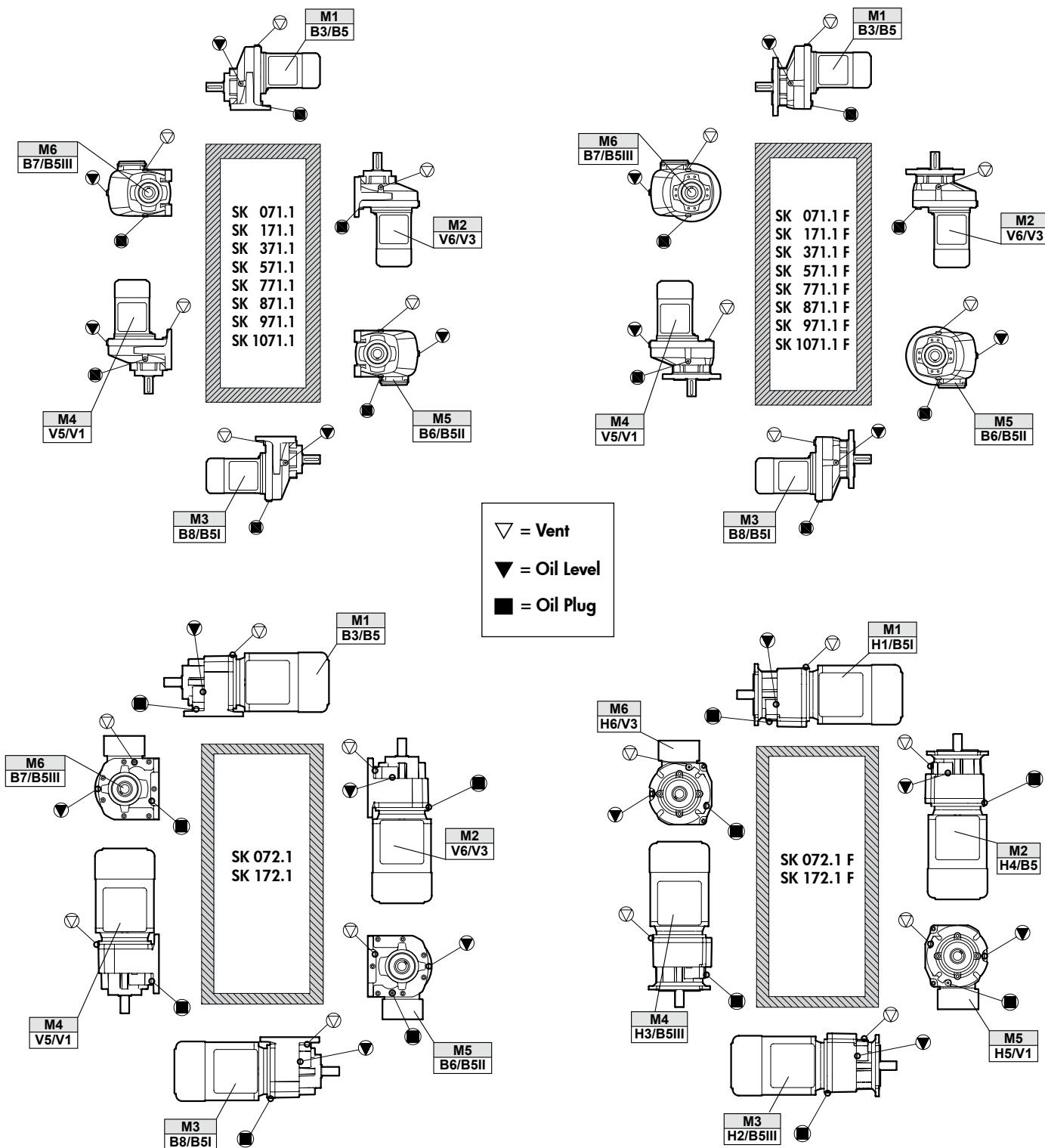
DRIVESYSTEMS

RETAIN FOR FUTURE USE

U14700 - 1 of 2

Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The correct oil level should be located at the lower edge of the oil level hole. **For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.**



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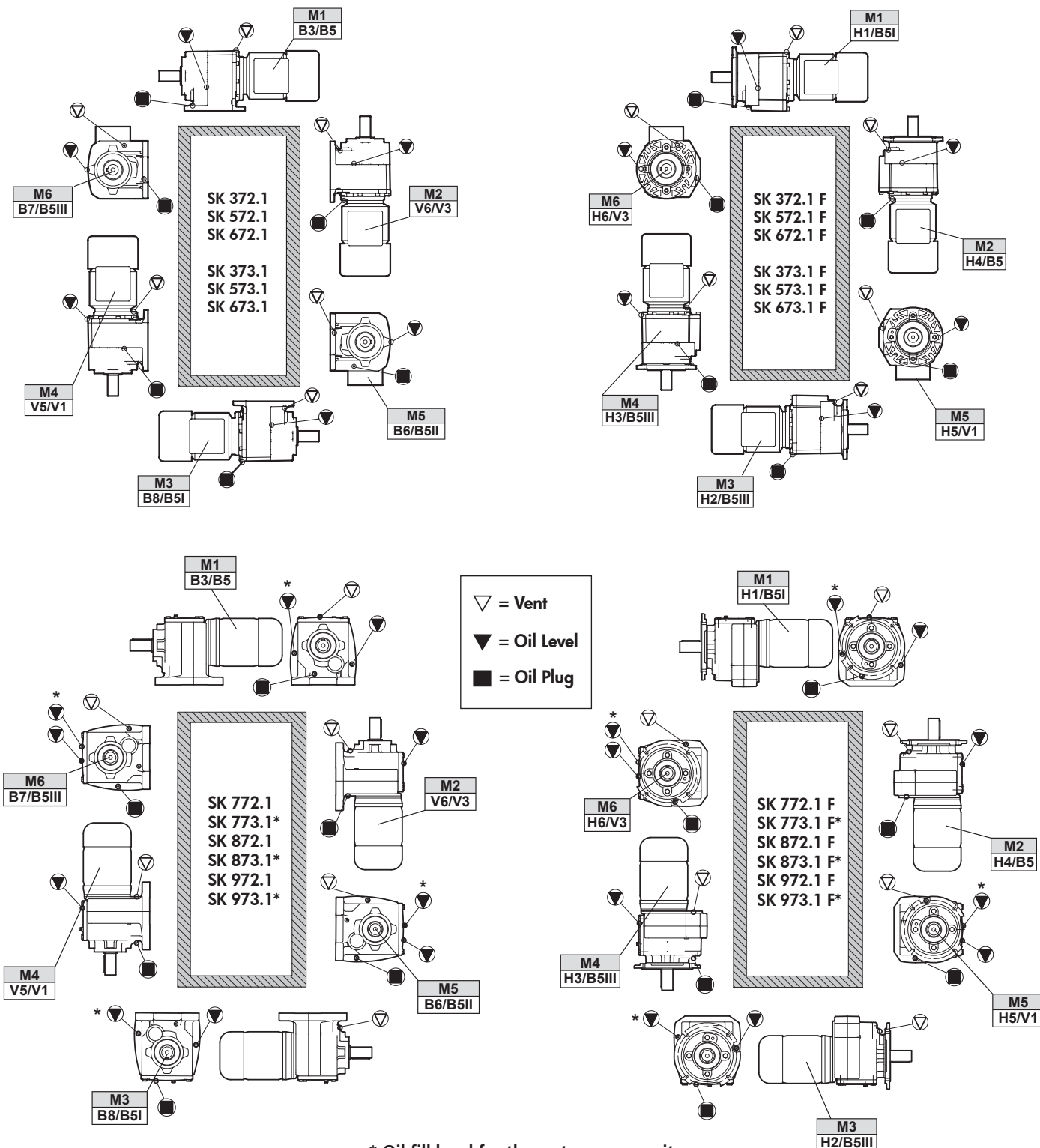
DRIVESYSTEMS

RETAIN FOR FUTURE USE

U14700 - 2 of 2

Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The correct oil level should be located at the lower edge of the oil level hole. **For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.**



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MI

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SCREW CONVEYOR
PARTS

AR



U14750 - 1 of 1

Oil Plug and Vent Locations

MINICASE® (SMI/SMID) reducers and gear motors are fitted with oil plugs to allow for optional venting of the gear unit. NORD can supply either an AUTOVENT™ (valve-type) vent or an open vent. Vent options are available for most gear unit sizes and positions as indicated by the table below. For more complete details on vent options and when to consider reducer venting, see user manual U10800.

Vent Compatibility by Unit Size & Mounting Position

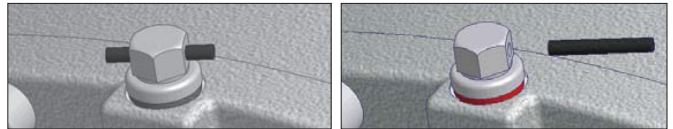
	M1	M2	M3	M4	M5	M6
SMI/SMID 31		✓	✓	✓		✓
SMI/SMID 40		✓	✓	✓		✓
SMI/SMID 50	✓	✓	✓	✓		✓
SMI/SMID 63	✓	✓	✓	✓	✓	✓
SMI/SMID 75	✓	✓	✓	✓		✓

Continuous Input speed ≤ 1800 rpm

Vent Kit Part Numbers

Type	Transportation Seal	Installation	Part Number
AUTOVENT™	Included	Factory or Field site	60693510
Open Vent	None	Field Only	60693500
Open Vent	Included	Factory or Field site	22008004 (vent) 25308120 (gasket)

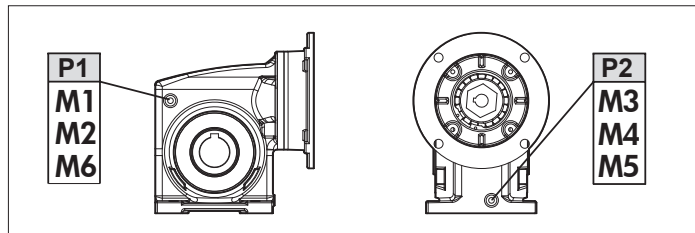
Unless noted by a separate part number, vent kits include the housing gasket



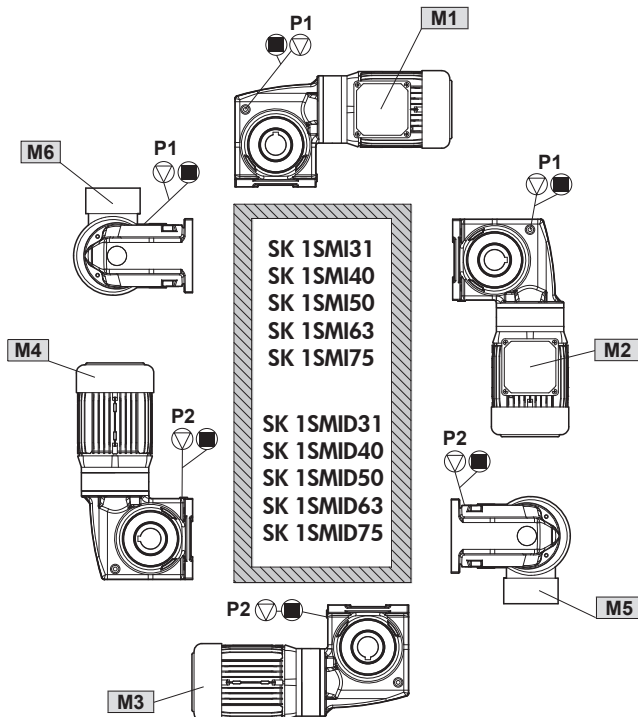
NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start-up. Excessive pressure may cause damage to internal components and cause leakage.

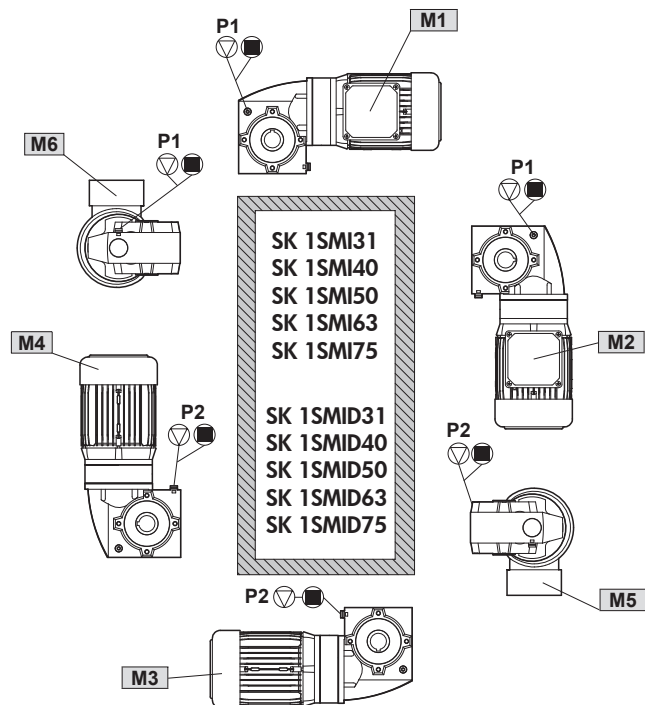
Optional Vent Locations



MINICASE® (SMI/SMID) Foot Housing



MINICASE® (SMI/SMID) Flange Housing



▽ = Vent
■ = Oil Plug

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FLEX

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PARTS****GEAR**

U14800 - 1 of 1

Vent locations

FLEXBLOC™ (SI/SID SERIES) reducers are fitted with oil plugs to allow for optional venting of the gear unit. NORD can supply either an AUTOVENT™ (valve-type) vent or an open vent. Vent options are available for most gear unit sizes and positions as indicated by the table below. For more complete details on vent options and when to consider reducer venting, see user manual U10810.

Vent Compatibility by Unit Size & Mounting Position

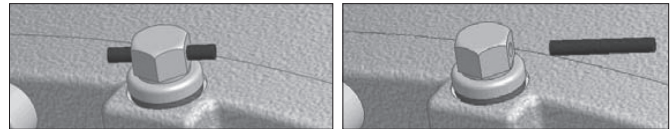
	M1	M2	M3	M4	M5	M6
SI/SID 31		✓	✓	✓		✓
SI/SID 40		✓	✓	✓		✓
SI/SID 50	✓	✓	✓	✓		✓
SI/SID 63	✓	✓	✓	✓	✓	✓
SI/SID 75	✓	✓	✓	✓		✓

Continuous Input speed ≤ 1800 rpm

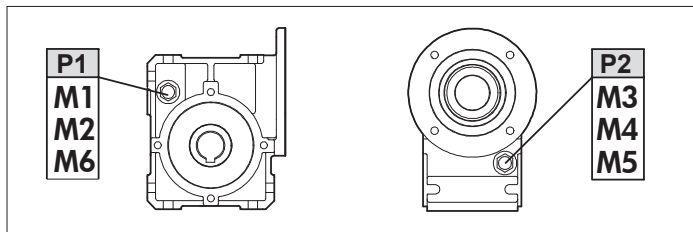
Vent Kit Part Numbers

Type	Transportation Seal	Installation	Part Number
AUTOVENT™	Included	Factory or Field site	66093510
Open Vent	None	Field Only	60693500
Open Vent	Included	Factory or Field site	22008004 (vent) 25308120 (gasket)

Unless noted by a separate part number, vent kits include the housing gasket



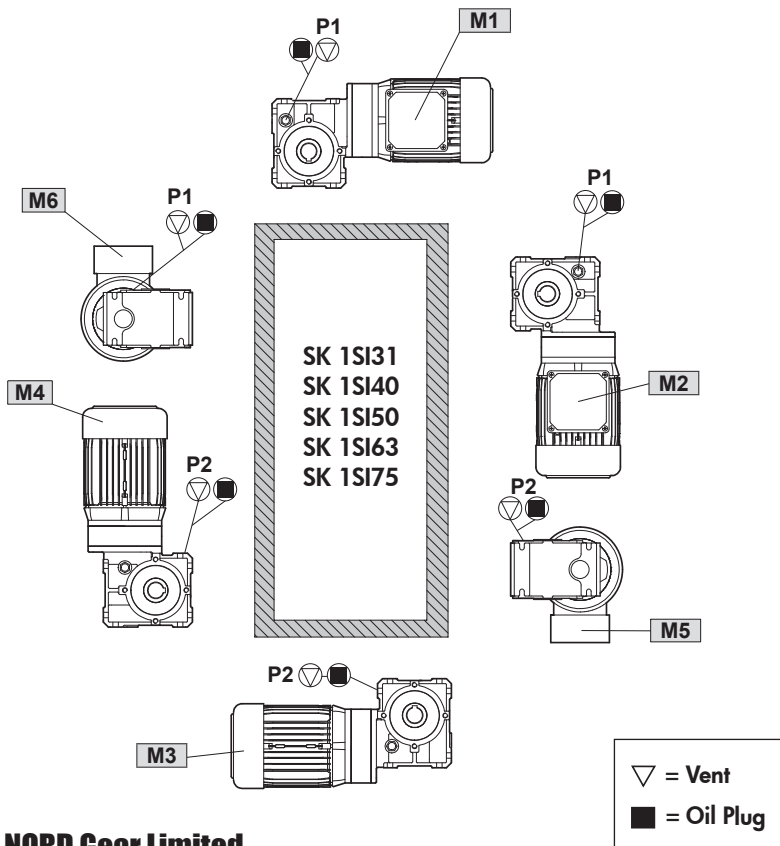
Optional Vent Locations



NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start-up. Excessive pressure may cause damage to internal components and cause leakage.

FLEXBLOC™ (SI Series) Universal Housing

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PARTS**

RETAIN FOR FUTURE USE

U19000 - 1 of 1

Troubleshooting

This section identifies some of the most common issues involved with NORD Gear speed reducers, and provides recommendations to assist you in defining and answering your questions as you work with our products. You may also contact our Engineering/Application departments if your questions are not answered in the table below.

Problem With the Reducer		Possible Causes	Suggested Remedy
Runs Hot	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce the load.
	Improper lubrication	Insufficient lubrication	Check lubricant level and adjust up to recommended levels
		Excessive lubrication	Check lubricant level and adjust down to recommended levels.
		Wrong lubrication	Flush out and refill with correct lubricant as recommended
Runs Noisy	Loose foundation bolts	Weak mounting structure	Inspect mounting of reducer. Tighten loose bolts and/or reinforce mounting and structure.
		Loose hold down bolts	Tighten bolts
	Failure of bearings	May be due to lack of lubricant	Replace bearing. Clean and flush reducer and fill with recommended lubricant.
		Overload	Check rated capacity of reducer.
	Insufficient lubricant	Level of lubricant in reducer not properly maintained.	Check lubricant level and adjust to factory recommended level.
Output shaft does not turn	Internal parts are broken or missing	Overloading of reducer can cause damage	Replace broken parts. Check rated capacity of reducer.
		Key missing or sheared off on input shaft.	Replace key.
		Coupling loose or disconnected	Properly align reducer and coupling. Tighten coupling.
Oil Leakage	Worn seals	Caused by dirt or grit entering seal.	Replace seals. Autovent may be clogged. Replace or clean.
	Unit runs hot or leaks	Overfilled reducer	Check lubricant level and adjust to recommended level.
		Vent clogged.	Clean or replace, being sure to prevent any dirt from falling into the reducer.
	Incorrect fill level	Improper mounting position, such as wall or ceiling mount of horizontal reducer.	Check mounting position on the name tag & verify with mounting chart in manual.



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U21005 - 1 of 12

1. Basic operation and speed adjustment

⚠
WARNING
⚠

Lock-out power before any maintenance is performed. Make absolutely sure that no voltage is applied while work is being done on the drive unit.

Titan™ Adjustable-Speed Drives are ideal for use when operating conditions dictate infinitely variable output speeds over a fixed range. The Titan™ Drive consists of a motor, belt casing, and main gear drive.

The beltbox contains an Adjusting Pulley (Driver) that is attached to the motor output shaft. A handwheel or optional Electric Remote Control Motor (EMFST) is used to vary the operating pitch diameters of the driver pulley in-turn making a corresponding adjustment to the Spring Pulley (Driven). Belt center distance remains fixed. Speed is typically adjusted by loosening the lock nut handle on the handwheel.

Pulleys are manufactured from the corrosive resistant and extremely durable alloy "Durfondal" to provide superior wear resistance and assure grooving and wear will be minimized under rated operating conditions. All sliding components are coated to resist fretting and corrosion. Pulleys are permanently grease lubricated and require no service during the normal life of the Titan™ drive.

⚠
WARNING
⚠

NORD does not support the use of the Titan™ belt drive in explosion proof or hazardous environments. While the belt is non-sparking, the Titan™ belt drive assembly does not have a safety to disengage the belt. In the event of an overload the belt can slip and generate excessive heat.

STOP
HARMFUL SITUATION
STOP

Operational speed adjustments must be performed when the motor is operational. Failure to comply may damage the belt and pulleys.

ⓘ
IMPORTANT NOTE
ⓘ

- In order to renew the grease coating over the full tracking distance of the pulleys and to avoid damage to the pulley surfaces and/or belt, the Titan™ belt drive should occasionally be operated over the entire speed range.
- Speeds stops located on the adjustment spindle are factory adjusted; further adjustments can cause damage to the belt box and/or main drive.
- When operating in areas of higher ambient temps, or when installed where ventilation is poor, additional cooling may need to be applied to the belt housing.
- The adjustment wheel and speed adjustment shaft should also be cleaned periodically and coated with molybdenum based anti-seize compound.

2. Motor

⚠
WARNING
⚠

To prevent possible injury and/or damage to the electric motor, the variable speed drive, or the driven equipment, it is important to follow the motor manufacturer's instructions pertaining to safe handling, installation, and maintenance of the electric motor.

Connect the motor in accordance with the wiring information supplied by the motor manufacturer and make sure the motor nameplate voltage and frequency agree with the available power supply. Use the proper protective motor switches to help protect the motor windings from overload and/or phase failure.

To insure the same performance the replacement motor must be of the same design and style as the original. The end of the motor shaft must also have a tapped hole in it as shown below.

NEMA Frame Size	Thread Size	Minimum Thread Depth
56C	1/4-20	1.00 inch
143TC/145TC	1/4-20	1.00 inch
182TC/184TC	3/8-16	1.25 inch
213TC/215TC	5/8-11	1.25 inch
254TC/256TC	5/8-11	1.50 inch
284TC	5/8-11	1.50 inch



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U21005 - 2 of 12

3. Installation

Titan™ drive packages may be supplied with a variety of gear units including foot-mounted, flange-mounted or shaft-mounted options.

When selecting the drive installation site, one should remember that air-cooled motors are ideally designed for ambient temperatures between -4°F and +104°F (-20°C and +40°C) and for installation at altitudes of 3,300ft (1,000m) above mean sea level.

The installation site should also ensure the following:

- Unrestricted airflow over the motor and variable speed drive.
- Accessibility to the oil fill-hole, level-hole and vent-hole locations on the main gear drive.
- A foundation (mounting base) of adequate size that is flat, torsionally rigid, and vibration-proof.
- Adequate shaft alignment between the drive and the driven equipment.
- Adequate space to allow motor removal and/or maintenance.
- In cases where brake motors are used, fan guard removal may be necessary to allow for brake adjustment and maintenance.

4. V-Belt replacement

Please reference the general parts lists starting on Page 6 of this manual.

- Run the Titan™ drive to its maximum speed and switch off. Be certain the power can not be inadvertently switched on again.
- Unscrew the socket head screws (521) and remove the belt casing cover, together with the entire speed control unit.
- Remove the old V-belt by first drawing it over the cones of the spring-loaded pulley (507) and then sliding over the open adjustable pulley (506). Installing a tapered wedge made of soft pine between the spring pulley halves will help keep the adjustable pulley open, and may aid in the removal of the old V-belt.
- Wrap the new V-belt around the cones of the open adjustable pulley (506) and then draw it over the spring-loaded pulley (507). Installing a tapered wedge made of soft pine between the spring pulley halves will help keep the adjustable pulley open, and may aid in the installation of the new V-belt.
- Reassemble the belt casing cover.



WARNING



NORD does not support the use of the Titan™ belt drive in explosion proof or hazardous environments. While the belt is non-sparking, the Titan™ belt drive assembly does not have a safety to disengage the belt. In the event of an overload the belt can slip and generate excessive heat.

TITAN™ V-Belt part numbers and sizes

TYPE	Belt P/N	Belt Size
R100	71092000	22 x 7 x 567 x 28°
R150	71592000	28 x 8 x 754 x 28°
R196	71992000	33 x 9 x 906 x 28°
R210	72192000	37 x 10 x 954 x 28°
R250	72592000	47 x 12 x 1135 x 28°
R280	72892100	55 x 15 x 1255 x 28°
R300	73092100	51 x 16 x 1444 x 28°
R350	73592100	70 x 18 x 1515 x 30°
R375	73792100	83 x 23 x 1767 x 32°
R400	74092100	83 x 23 x 1842 x 32°
R500	75092100	83 x 26 x 2877 x 32°

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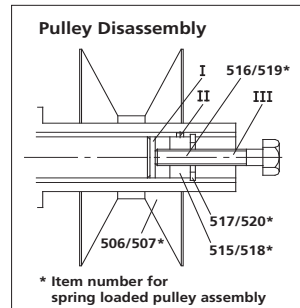
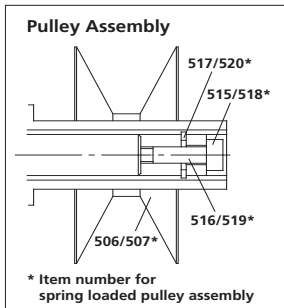
5. Pulley replacement

STOP
HARMFUL SITUATION
STOP

- Install new pulleys in the same exact orientation as the old pulleys to prevent damage to the machinery.
- Special care must be taken when reassembling the Z-Flow pattern, as the moving parts of the pulleys must always be situated on opposite (diagonal) sides.
- Do not attempt to disassemble spring pulley. Failure to remove the spring without the proper fixtures/tools can result in serious injury.

Please reference the instructions and diagrams shown below, as well as the general parts lists that start on Page 6 of this manual.

- A. The spring loaded pulley (507) and the adjustable pulley (506) are held securely to the shaft using a holding screw (519/516), a thrust washer (518/515), and a snap ring (520/517). Remove the screw (519/516), thrust washer (518/515) and snap ring (520/517) that are used to hold the pulley on the shaft.
- B. In order to protect the tapped hole in the shaft, place a steel disc (I), slightly smaller than the shaft diameter, against the end of the shaft.
- C. The thrust washer has an internal thread diameter that is slightly larger than the thread on the holding screw (516/519). Refit the snap ring (520/517) and replace the thrust washer (518/515). In order to aid in the removal of the pulley, a disassembly screw, slightly larger than the holding screw (516/519) can be inserted into the thrust washer (518/515) and tightened against the steel disc (I). Remove the spring loaded pulley (507) or the adjustable pulley (506) by using the thrust washer and disassembly screw (III) as a "jacking bolt".
- D. If the thrust washer (518/515) rotates when trying to remove the pulley, secure the thrust washer with a pin inserted into the keyway (II).
- E. After the old pulley is removed, disassemble or remove the disassembly screw (III), thrust washer (518/515), snap ring (520/517), and protective steel disc (I) that was placed over the shaft.
- F. Before installing the new pulley, apply an anti-seize compound to the shaft. Reassemble the snap ring (520/517) and thrust washer (518/515) into the pulley bore. Use the holding screw (519/516), pull the pulley onto the shaft. Do not drive the pulley onto the shaft with a hammer.

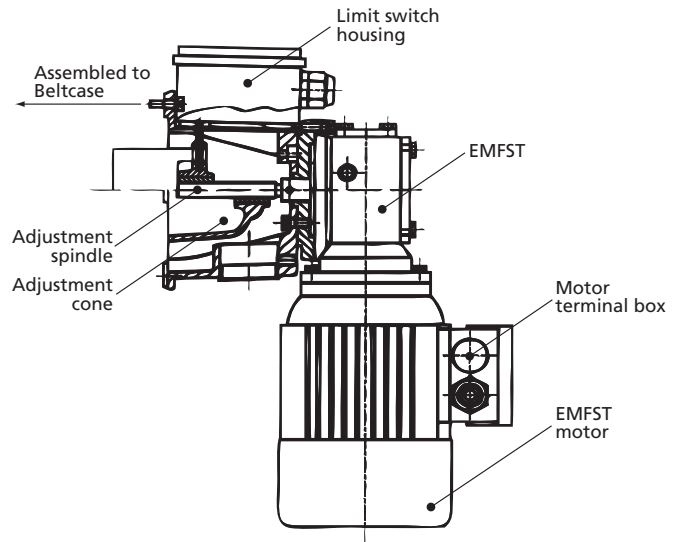


6. Electromechanical remote control speed adjustment

The Electromechanical Remote Control (EMFST) replaces the hand wheel when remote speed adjustment is desired. With the EMFST the speed range is set by adjusting the limit switches that are supplied with the motor. The limit switches are factory preset to operate within the specified speed range of the Titan™ variator.

STOP
HARMFUL SITUATION
STOP

The EMFST is assembled to the control-side of the Titan™ belt case; prior to assembly, the adjustment cone of the EMFST control must be driven towards the "full-back" or "minimum speed" position. This must be done by powering the EMFST motor. To prevent damage to the adjustment spindle, nut, or EMFST gear unit, one must be very careful to stop the motor prior to reaching the final "full-back" position.



Dual Rated – Electronic Remote Control Motor Option (EMFST)

Type	FY63 A-4
Phase	3 ~
Nominal Frequency	50 / 60 Hz
Nominal Power	0.12/0.14 kW
Nominal Speed	1360 / 1660
Voltage	265Δ - 460Y/230Δ - 400Y
Current at High Voltage	0.43/0.50 Amp
Starting Current Ratio	3.5
Starting Torque Ratio	1.8
Breakdown Torque Ratio	1.9
Efficiency	45.2%
Power Factor	0.68/0.70
Enclosure	IP55
Insulation Class/Rise	F/B
Weight	4.0 kg or 8.82 lb



Courtesy of:

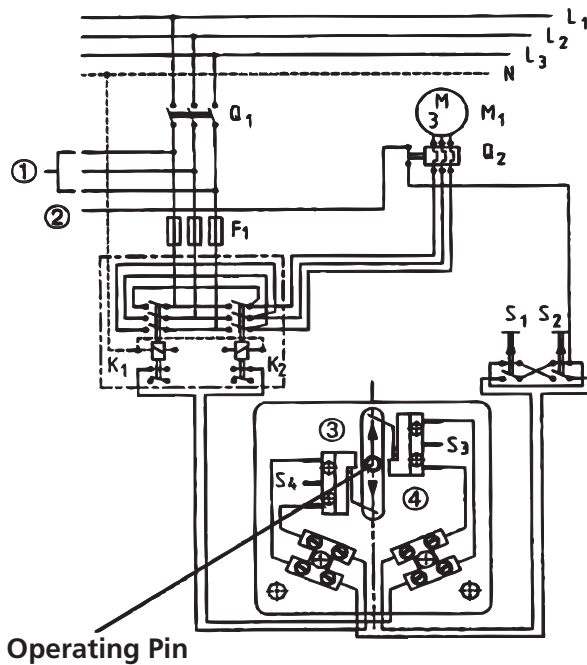


DRIVESYSTEMS

RETAIN FOR FUTURE USE

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7. Wiring diagram

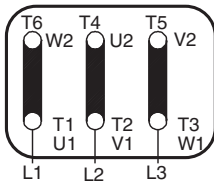


Symbol legend - wiring diagram

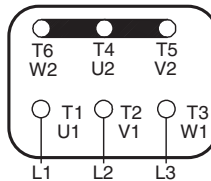
L ₁ , L ₂ , L ₃	Incoming Power
K ₁ , K ₂	Combined relay for phase reversal of the EMFST motor (CW or CCW shaft rotation)
M ₁	EMFST motor
Q ₁	Main switch
Q ₂	Motor protection switch
S ₁	Push Button "speed increase"
S ₂	Push Button "speed decrease"
S ₃	Limit switch "upper limit"
S ₄	Limit switch "lower limit"
①	Main drive motor
②	Control for servo motor and motor protection switch
③	Direction of "speed increase"
④	Direction of "speed decrease"



low voltage



high voltage



8. Limit switch adjustment



HARMFUL SITUATION



The main motor and Titan™ variator must be operating while trying to adjust the limit switches of the EMFST motor.

- Wire the EMFST motor according to the motor wiring diagram (Page 4).
- Open the cover plate of the limit switch housing and check the direction of rotation while in operation as follows:
 - Pressing Push Button S₁ should move the operating pin forward or towards the belt case.
 - Pressing Push Button S₂ should move the operating pin in the opposite direction or away from the belt case.
 - If the direction of rotation is incorrect, reverse the polarity of the electric remote control motor (EMFST).
- Check the function of the limit switches as follows:
 - Actuate Limit Switch S₃ (upper speed limit) and press Push Button S₁ (speed increase).
 - Actuate Limit Switch S₄ (lower speed limit) and press Push Button S₂ (speed decrease).
 - In both cases there should be no movement of the operating pin.
- Operate the EMFST motor towards minimum speed. Use a tachometer to check the final output speed of the drive unit. As minimum speed is approached, make only small incremental adjustments in speed. Re-check the output speed of the drive unit.
- Upon reaching the required minimum speed, stop the EMFST unit.



IMPORTANT NOTE



There should be no "wheezing" noise emitted from the belt drive at this stage. If there is such a noise the belt may be "bottoming" on the "adjustable control pulley". You should then increase the speed of the drive slightly.

NORD Gear Limited

Toll Free in Canada: 800.668.4378

11.06.15

NORD Gear Corporation

Toll Free in the United States: 888.314.6673

www.nord.com



DRIVESYSTEMS

Courtesy of:



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8. Limit switch adjustment (ctd)

- F. Unscrew the two fixing screws of the minimum speed limit switch. Adjust the limit switch by putting it against the operating pin and re-tightening the screws.
- G. Operate the EMFST motor towards maximum speed. Use a tachometer to check the final output speed of the drive unit. As maximum speed is approached, make only small incremental adjustments in speed. Re-check the output speed of the drive unit.
- H. Upon reaching the required maximum speed, stop the EMFST unit.

**IMPORTANT NOTE**

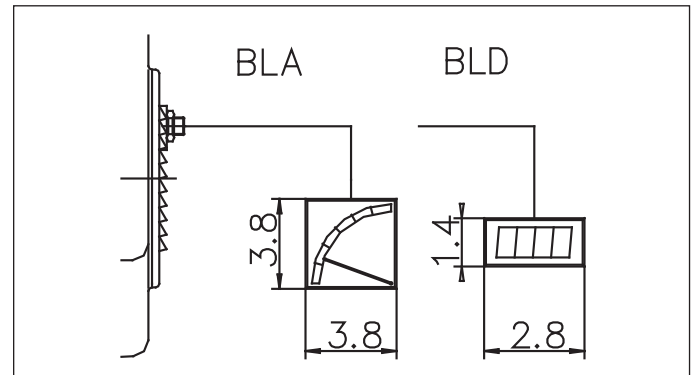
There should be no "wheezing" noise emitted from the belt drive at this stage. If there is such a noise the belt may be bottoming on the "spring pulley". You should then decrease the speed of the drive slightly.

- I. Unscrew the two fixing screws of the maximum speed limit switch. Adjust the limit switch by putting it against the operating pin and re-tightening the screws.
- J. Re-check both minimum and maximum speed positions by operating the EMFST and moving towards the limit switch settings. Use a tachometer to check the speed range at the output of the final drive. Readjust limit switches if necessary.

9. Non-contacting speed indicator**IMPORTANT NOTE**

The speed indicator options are not available when using the EMFST.

The speed indicator contains a built in sensor which converts the signals coming from the pulse generator into a direct current signal for the speed indicator. Adjustment of the analog style meter is possible by means of set screws on the back of the meter.

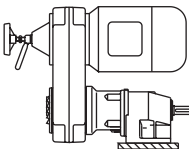
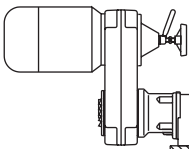
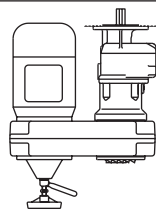
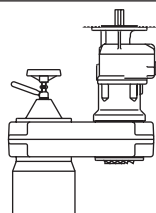
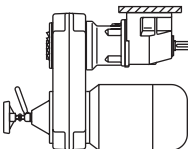
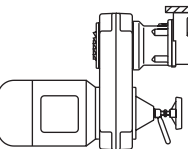
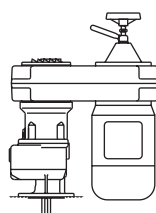
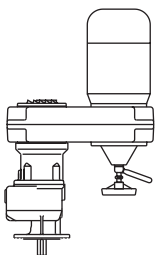

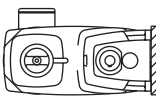

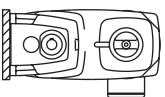
**Type BLA: analog speed indicator**

Scale Marking: 0-100% - Scale deflection: 90°
Type of enclosure: IP 53 – Terminals IP 00

Type BLD: digital speed indicator

Digital indicator: 4 digits – 7 segment red LED display.
Type of enclosure: IP 50 – Terminals IP 00.

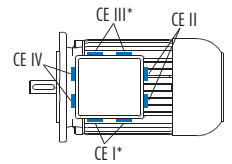
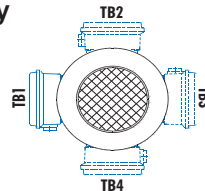
Variable Speed Helical In-Line Gear Units Mounting Positions

M1 U	M1 Z	M2 U	M2 Z	M3 U	M3 Z
					
M4 U	M4 Z	M5 U	M5 Z	M6 U	M6 Z
					

Variable Speed Helical-in-Line Position of terminal box and cable entry

Please specify position of terminal box and cable entry.

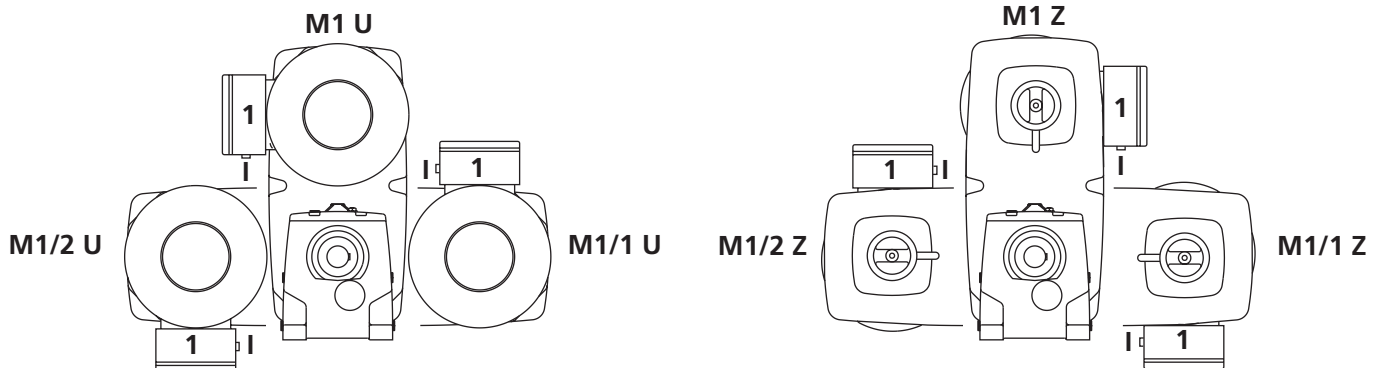
Normal Design: Cable entry at 3 and terminal box at I or III only.
If other positions are required, please specify while ordering.



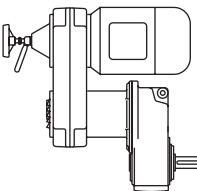
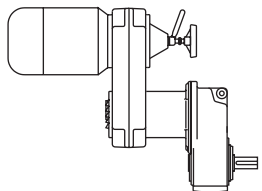
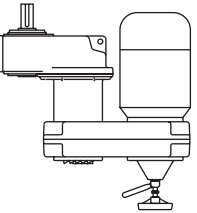
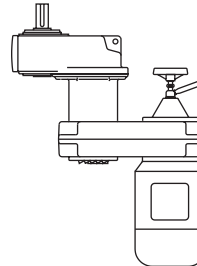
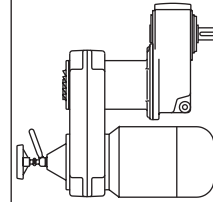
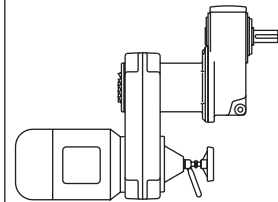
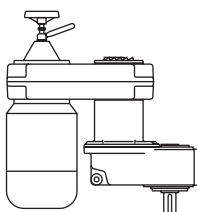
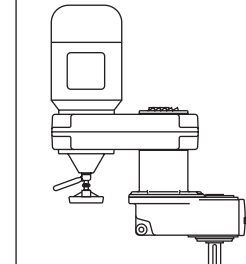
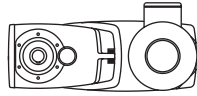
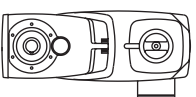

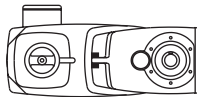
Terminal Box Positions
(Position M1 shown)

Conduit Entry Positions
(Position M1 shown)

In all mounting positions the variable speed drive may be mounted at an angle interval of 90°.



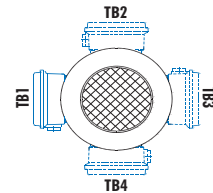
Variable Speed Clincher™ Gear Units Mounting Positions

M1 U	M1 Z	M2 U	M2 Z	M3 U	M3 Z
					
M4 U	M4 Z	M5 U	M5 Z	M6 U	M6 Z
					

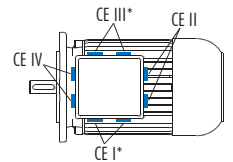
Variable Speed Clincher™ Position of terminal box and cable entry

Please specify position of terminal box and cable entry.

Normal Design: Cable entry at 3 and terminal box at I or III only.
If other positions are required, please specify while ordering.

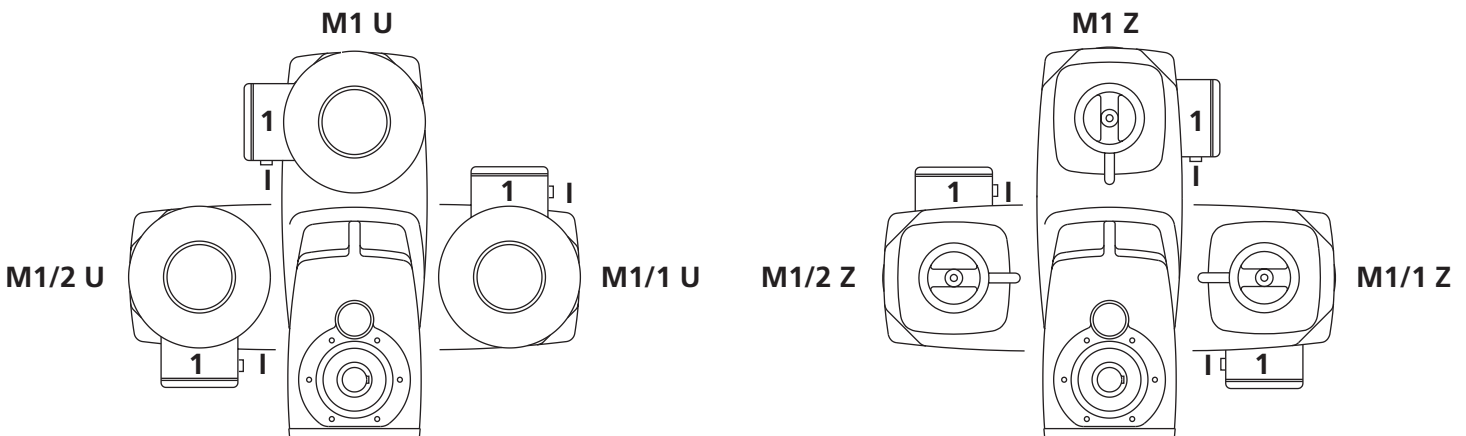


Terminal Box Positions
(Position M1 shown)

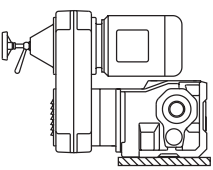
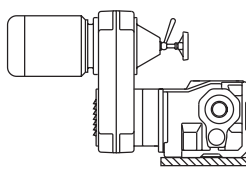
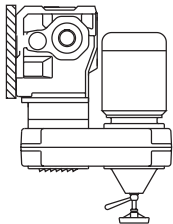
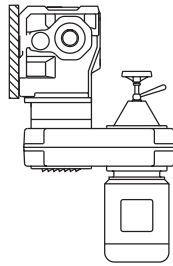
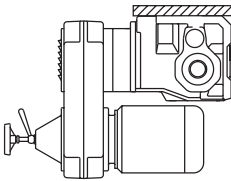
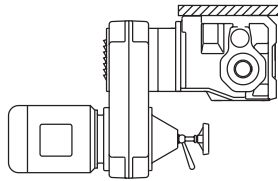
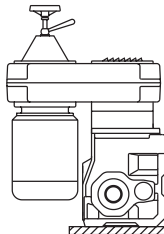
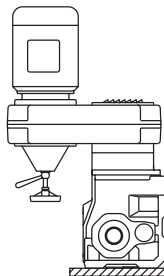
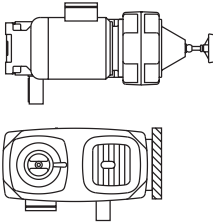
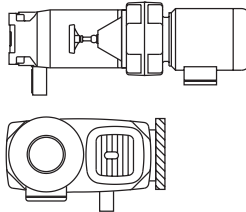
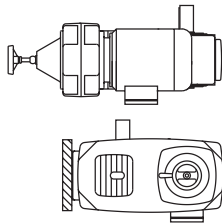
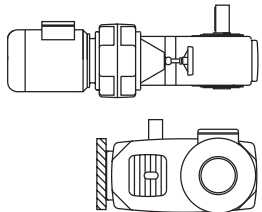


Conduit Entry Positions
(Position M1 shown)

In all mounting positions the variable speed drive may be mounted at an angle interval of 90°.



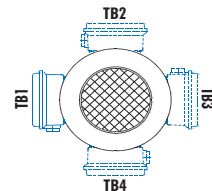
Variable Speed Helical Bevel Gear Units Mounting Positions

M1 U	M1 Z	M2 U	M2 Z	M3 U	M3 Z
					
M4 U	M4 Z	M5 U	M5 Z	M6 U	M6 Z
					

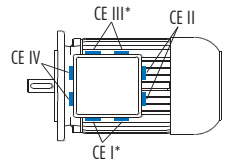
Variable Speed Helical-bevel Position of terminal box and cable entry

Please specify position of terminal box and cable entry.

Normal Design: Cable entry at 3 and terminal box at I or III only.
If other positions are required, please specify while ordering.

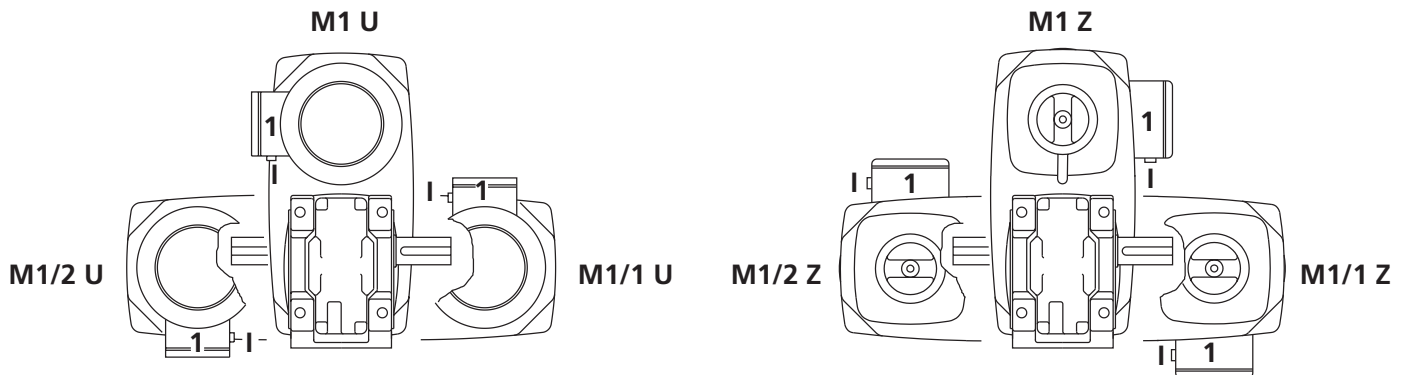


Terminal Box Positions
(Position M1 shown)

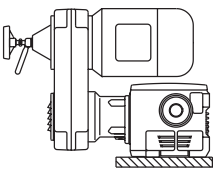
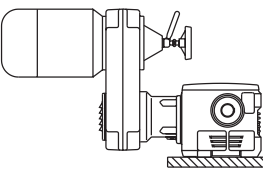
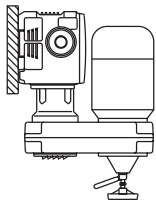
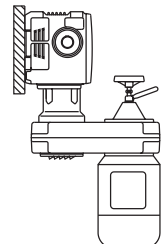
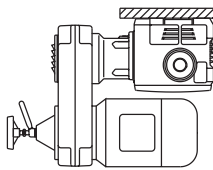
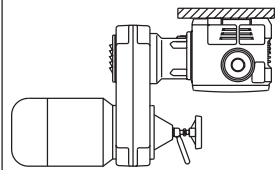
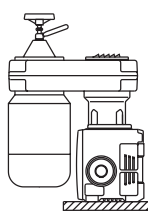
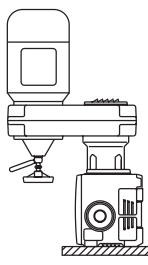
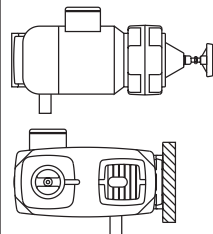
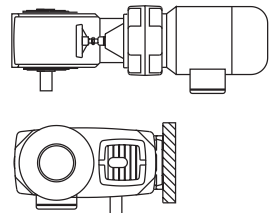
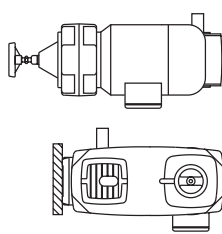
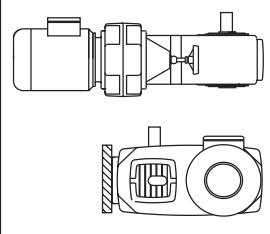


Conduit Entry Positions
(Position M1 shown)

In all mounting positions the variable speed drive may be mounted at an angle interval of 90°.



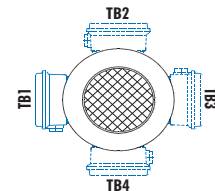
Variable Speed Helical Worm Gear Units Mounting Positions

M1 U	M1 Z	M2 U	M2 Z	M3 U	M3 Z
					
M4 U	M4 Z	M5 U	M5 Z	M6 U	M6 Z
					

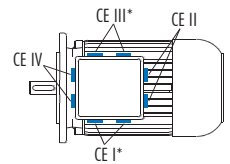
Variable Speed Helical-worm Position of terminal box and cable entry

Please specify position of terminal box and cable entry.

Normal Design: Cable entry at 3 and terminal box at I or III only.
If other positions are required, please specify while ordering.

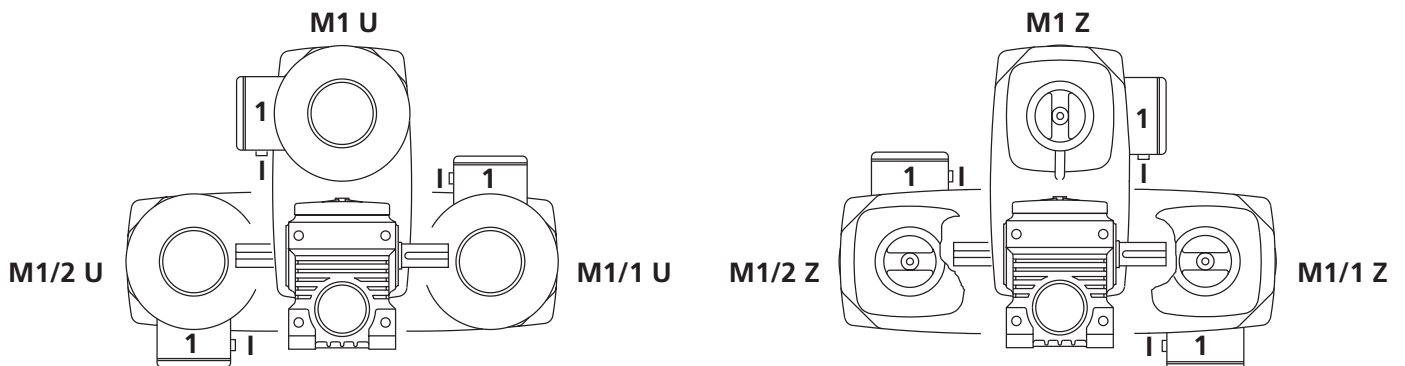


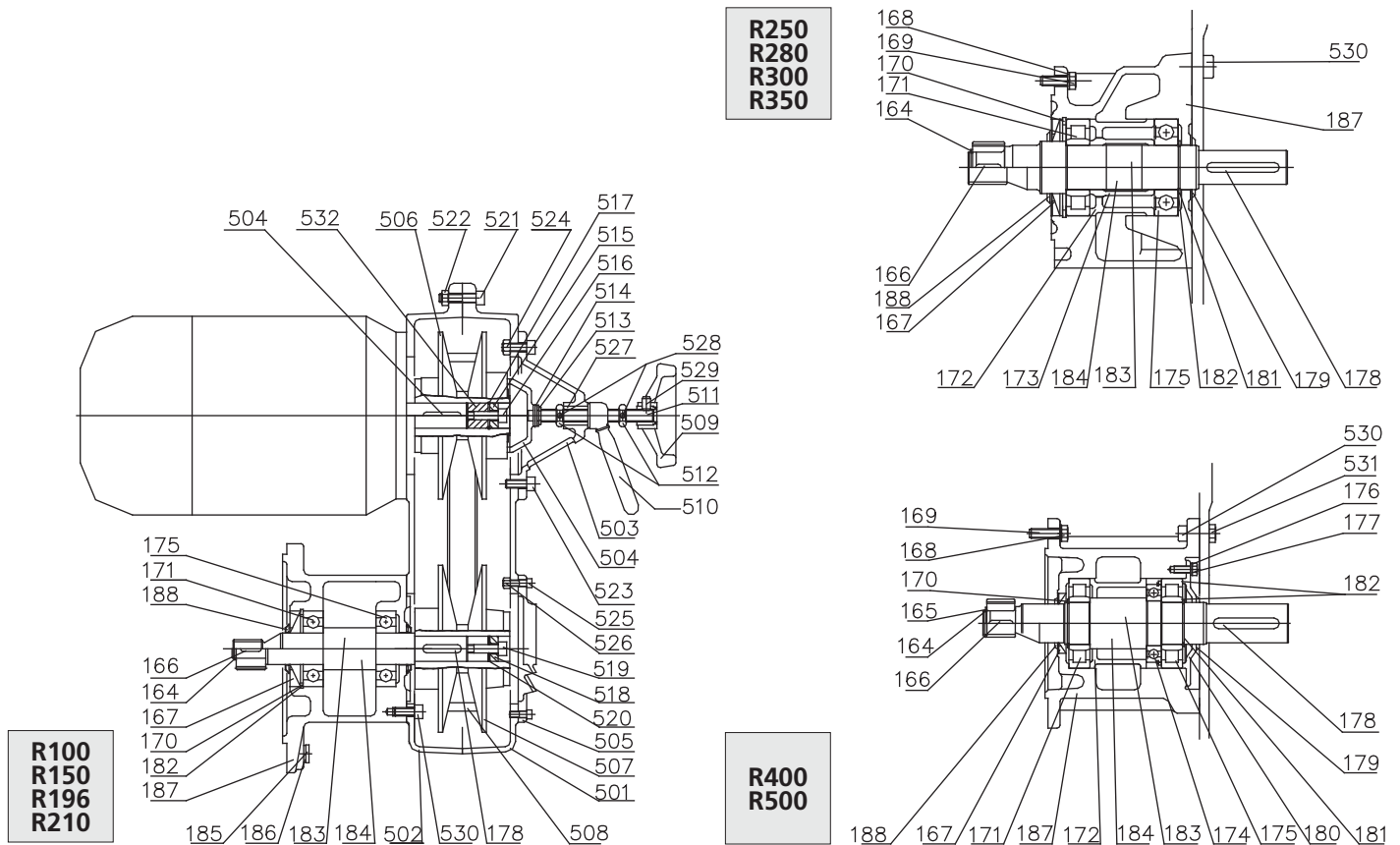
Terminal Box Positions
(Position M1 shown)



Conduit Entry Positions
(Position M1 shown)

In all mounting positions the variable speed drive may be mounted at an angle interval of 90°.

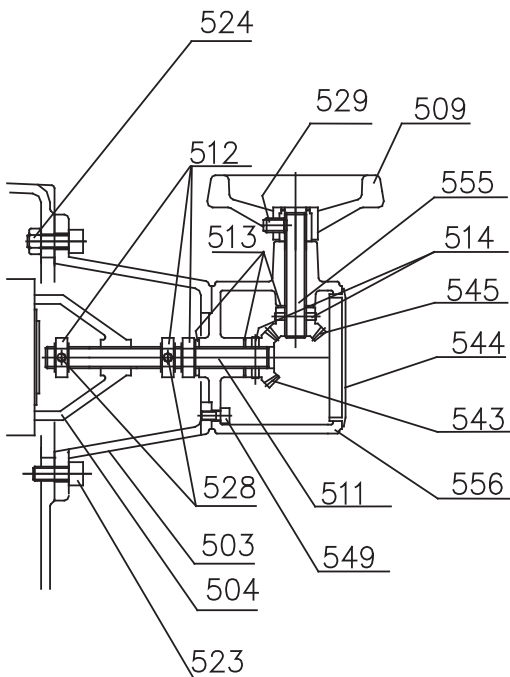




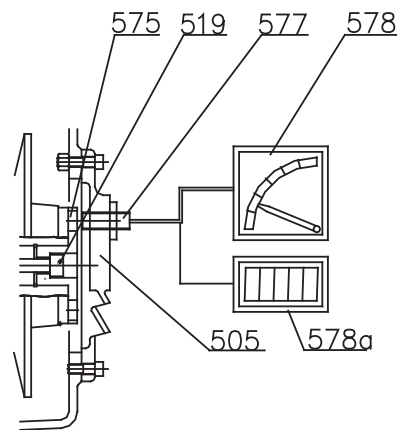
TITAN™ General Parts List

164	Circlip / Snap ring	184	Input shaft, cut gear	515	Thrust Washer
165	Shim	185	Locking screw	516	Socket head bolt
166	Key	186	Seal washer	517	Circlip / Snap ring
167	Shaft Seal	187	Reducer input housing	518	Thrust washer
168	Washer	188	Oil slinger	519	Socket head bolt
169	Hex head bolt	501	Beltcase cover	520	Circlip / Snap ring
170	Circlip / Snap ring	502	Beltcase connecting cover	521	Socket head bolt
171	Input shaft bearing	503	Hand wheel adjustment cover	522	Hex nut
172	Spacer	504	Adjustment cone	523	Socket head bolt
173	Spacer	505	Ventilation cover	524	Hex nut
174	Ball bearing	506	Adjustable pulley	525	Socket head bolt
175	Input shaft bearing	507	Spring loaded pulley	526	Hex nut
177	Hex head bolt	508	V-belt	527	Screw bushing
178	Key	509	Handwheel	528	Set screw
179	Oil slinger	510	Locking Handle	529	Set screw
180	Bearing cover	511	Adjustment Spindle	530	Socket head bolt
181	Circlip / Snap ring	512	Locknut (speed stop)	531	Hex nut
182	Shim	513	Washer	532	Spacer
183	Input shaft, plain	514	Spiral Pin / Spring Cotter		

**Angular Handwheel Assembly
for R100-R400**



**Non-Contacting Speed Indicator
for R100-R500 ***



Angular Handwheel Assembly & Non-contacting Speed Indicator

503	Adjustment Cover	519*	Socket head bolt	549	Socket head bolt
504	Adjusting Cone	523	Socket head bolt	555	Handwheel shaft
505*	Ventilation Cover	524	Hex nut	556	Bevel gear case
509	Handwheel	528	Set screw	575*	Pulse generator
511	Adjustment Spindle	529	Set screw	577*	Pulse Sensor
512	Locknut	543	Bevel Gear	578*	Speed Indicator (Type BLA)
513	Washer	544	Seal plug	578a*	Speed Indicator (Type BLD)
514	Spiral Pin / Spring Cotter	545	Bevel gear		



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11. TITAN™ Belt replacement part numbers

Ttan™ Type	Belt P/N	Belt Size
R100	71092000	22 x 7 x 567 x 28°
R150	71592000	28 x 8 x 754 x 28°
R196	71992000	33 x 9 x 906 x 28°
R210	72192000	37 x 10 x 954 x 28°
R250	72592000	47 x 12 x 1135 x 28°
R280	72892100	55 x 15 x 1255 x 28°
R300	73092100	51 x 16 x 1444 x 28°
R350	73592100	70 x 18 x 1515 x 30°
R375	73792100	83 x 23 x 1767 x 32°
R400	74092100	83 x 23 x 1842 x 32°
R500	75092100	83 x 26 x 2877 x 32°

12. TROUBLESHOOTING

Problem with Variable Speed Unit	Possible Causes	Suggested Remedy
Drive Slips	V-Belt is worn	Replace V-Belt.
	V-Belt or face of adjustment pulley is dirty or contaminated.	Clean Contaminated part: <ul style="list-style-type: none"> • V-Belt – use dry cloth or paper. • Adjustment Pulley – okay to use mild solvent provide excess is cleaned with a dry cloth.
	Load is too high.	Check measured power and reduce operating load to catalog values.
Drive heats up excessively	Load is too high.	Check measured power and reduce operating load to catalog values.
Drive appears noisy or too loud.	V-Belt is damaged: <ul style="list-style-type: none"> • May be caused after a brief stalling of the drive. • May be caused by intermittent loading of the drive. 	Determine cause of damage, and replace V-Belt.

Problem with Electromechanical Remote Control (EMFST)	Possible Causes	Suggested Remedy
Speed cannot be adjusted.	Unit is not wired properly.	Wire unit in accordance with circuit diagram.
Speed range cannot be reached.	Motor limit switches turn off too early.	Adjust limit switches.



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1. Basic operation and speed adjustment

The NORDISC™ Friction Drive will supply infinite variable speed adjustments over a fixed speed range. The NORDISC™ Drive consists of a motor, dry traction drive, and main gear drive. The motor is typically furnished as an integral mount to the traction drive, however a NEMA C-face Input Adapter (Flex-C-Input Adapter) is also available.

Attached to the output shaft of a constant speed motor, is the driving disc portion of the traction drive. The driven disc is angled approximately 2°, localizing the friction contact on the disc pair. As the adjustment spindle is rotated, the input side of the housing moves either up or down, changing the effective pitch diameter of the driving disc. Speed is typically adjusted by the handwheel.

STOP	HARMFUL SITUATION	STOP
Speed adjustments must be performed when the motor is running to prevent possible damage to the traction drive parts.		

STOP	HARMFUL SITUATION	STOP
Initial adjustments of the speed stops located internal to the traction drive are completed at the factory. Further adjustments of the speed stops can cause damage to the traction drive and/or main drive.		

2. NORDISC™ Friction Drive

The variable speed drive requires only minimal maintenance. However, the friction ring is a wear item.

STOP	HARMFUL SITUATION	STOP
The traction drive should be periodically operated through its entire speed range, in order to prevent localized wear patterns on the driving disc and/or possible damage to the driving disc.		

The friction drive does not require lubrication unless it is disassembled for an overhaul. Units should be checked periodically for:

- Increased noise level.
- Increased operating temperatures.
- Increased vibration.
- Increased motor amperage draw.
- Increased or excessive shaft movement.

Every 10,000 hours of operation, it is suggested that the bearings be cleaned and re-greased with a lithium-based NLGI #2 Grease.

The adjustment wheel and speed adjustment shaft should also be cleaned periodically and coated with molybdenum-based anti-seize compound.

3. Motor

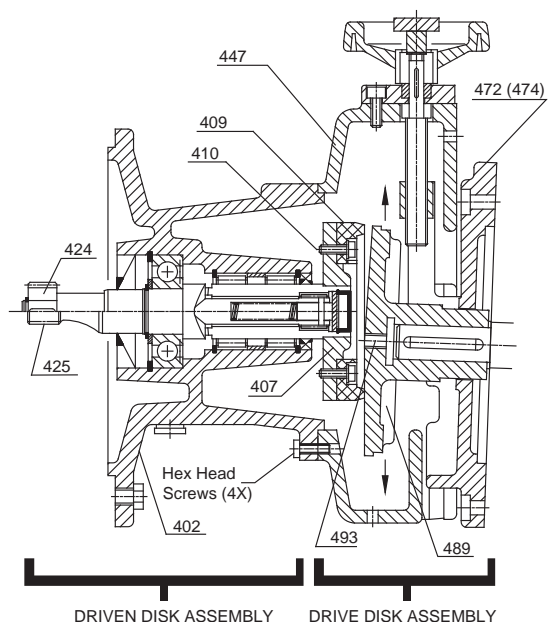
!	WARNING	!
To prevent possible injury and/or damage to the electric motor, the variable speed drive, or the driven equipment, it is important to follow the motor manufacturer's instructions pertaining to safe handling, installation, and maintenance of the electric motor.		

Connect the motor in accordance with the wiring information supplied by the motor manufacturer and make sure the motor nameplate voltage and frequency agree with the available power supply. Use the proper protective motor switches to help protect the motor windings from overload and/or phase failure.

!	WARNING	!
Explosion proof motors should not be used on the friction drive. The friction drive is not recommended for use in explosion proof atmospheres.		

4. Separating the driven disc assembly from the driving disc assembly

- Lockout the electric power to the motor and make sure the wires are disconnected.
- Support the intermediate housing (Item 447) and the attached motor assembly.
- Remove the four hex head screws that connect the driving disc assembly (intermediate housing / Item 447) to the driven disc assembly (output housing / Item 402).
- Slide the intermediate housing (Item 447) away from the output housing (Item 402).





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5. Friction disc replacement

- Separate the driven disc assembly from the driving disc assembly (See Separate Instructions).
- Once the friction disc (Item 409), is exposed remove the socket head cap screws (Item 410) that hold the friction disc or friction ring (Item 409) to the friction disc carrier (Item 407).
- Clean the contact surface between the friction disc and friction disc carrier.
- Vacuum or brush out the NORDISC™ drive housing to remove accumulated friction material dust. Be careful not to ingest dust while cleaning.
- Inspect main housing for damaged parts while disassembled.
- Attach the new friction disc to the carrier using the socket head cap screws. Permissible tightening torques are per the table below:

Type	Screw Size	Material Grade	Tightening Torque
RV10	M5 X 12	8.8	6 N-m / 53 lb-in
RV20	M5 X 16	8.8	6 N-m / 53 lb-in
RV30	M6 x 16	8.8	10 N-m / 88 lb-in
RV40	M6 x 20	8.8	10 N-m / 88 lb-in

- Re-assemble intermediate housing or "RV" housing (Item 447) to output bearing housing (Item 402). To re-assemble, apply Steps 1-4 in reverse order. Use a thread-locking compound to secure the hex head screws.

6. Bearing and seal replacement - NORDISC™ output

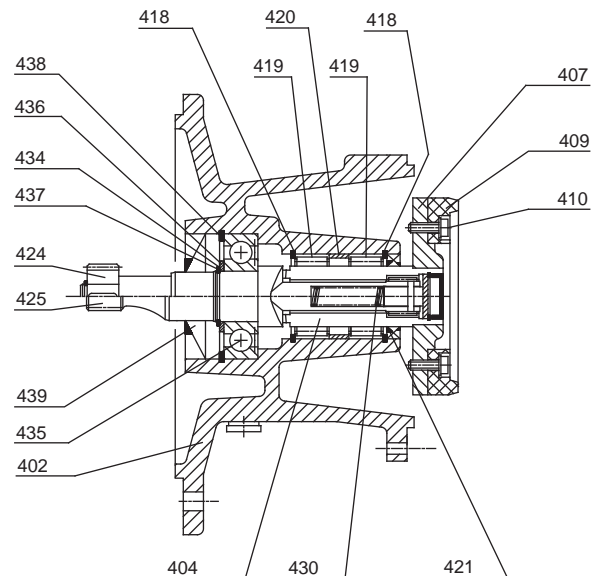
- Separate the driven disc assembly from the driving disc assembly (See Separate Instructions).
- Slide the intermediate housing (Item 447) away from the output housing (Item 402) and remove the shaft oil seal (Item 439).
- Remove circlips/snap-rings (Item 437 and 438).
- Remove shims and supporting disc (Items 434 & 436).
- Slide the hollow shaft/friction disc carrier assembly (Item 404) away from output housing (Item 402).
- Press output gear-shaft (Item 424 or 425) and bearing (Item 435) out of output housing. Shaft and bearing come out on the output or gear-shaft side.
- Remove oil seal (Item 421) from output housing.
- Remove two circlips/snap-rings (Items 418) from output housing and remove needle bearings and spacer (Items 419 and 420).
- Re-assemble in the reverse order, replacing ball bearing, needle bearings, and oil seals (Items 435, 419, 421 and 439). If required, also replace any shims, spacers, or circlips (Items 434, 436, 420, 437, 438, and 418). During assembly, repack bearings with a lithium-based NLGI #2 grease. Needle bearing cavity should be approximately 1/3 full after re-greasing.



WARNING



- The output shaft compression spring (Item 430) does not require maintenance. If the spring fractures the complete shaft should be replaced as a complete assembly or returned to NORD Gear for repair.
- Special fixtures are required to remove and install the spring. Personal injury can result if this repair is attempted in the field.





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7. Driving disc disassembly and reassembly

The driving disc (Item 489) is attached directly to either the motor shaft or the shaft of the C-Face Input (Flex-C-Input) Adapter. One must first remove the driving disc from the input-side of the NORDISC™ in order to:

- Replace the motor.
- Replace the bearings in the C-Face Adapter.

Driving Disc Removal

- Separate the driven disc assembly from the driving disc assembly (See Separate Instructions).
- Slide the intermediate housing (Item 447) away from the output housing (Item 402).
- After removing the input side from the output side, position the driving disc (Item 489) in the middle of the housing by turning the speed adjusting hand wheel (Item 462).
- Remove the setscrew in the middle of the driving disc (Item 493). Insert a hardened bolt in the hole that is in the center of the driving disc (Item 489), and tighten the bolt against the shaft to separate or remove the driving disc from the shaft (see table).

Type	Setscrew Size	Bolt Size
RV10	1/4-20	1/4-20 x 2-1/4 in
RV20	5/16-18	5/16-8 x 2-3/4 in
RV30	1/2-13	1/2-13 x 3 in
RV40	5/8-11	5/8-11 x 4 in

Driving Disc Re-Assembly

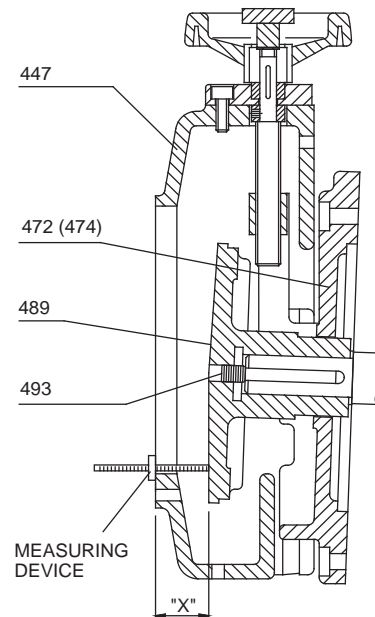
- Installation of the driving disc (Item 489) may require heating the disc in an oven or on a hot plate, to allow the disc to be positioned all the way on to the motor shaft or C-Face Input shaft.

	WARNING	
Exercise extreme caution when handling the hot driving disc. Protective gloves are recommended.		

- After heating the disc, position it all the way onto the shaft until it bottoms.
- Using the table below, measure the "X" dimension from the bottom edge of the friction drive housing (Item 447) to the face of the driving disc (Item 489).

Type	Setscrew Size	"X" Dimension
RV10	1/4-20	0.837/0.867 in
RV20	5/16-18	0.975/1.005 in
RV30	1/2-13	1.133/1.163 in
RV40	5/8-11	1.311/1.341 in

- Insert the setscrew (Item 493) into the hole in the center of the driving disc, and tighten the setscrew snug to the shaft of the motor or C-Face input assembly. Use a thread-locking compound to help secure the setscrew.





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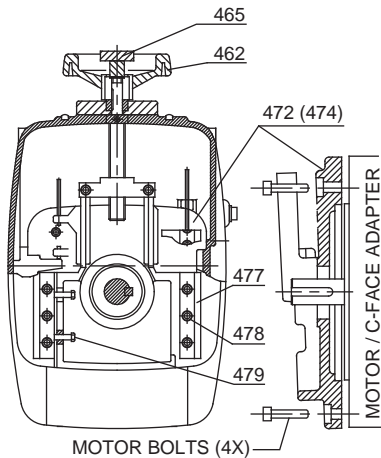
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Removal and re-assembly of motor or C-face input adapter (Flex-C-Input)

- A. Separate the driven disc assembly from the driving disc assembly and remove the driving disc (See Separate Instructions).
- B. After removing the driving disc (Item 489), the mounting bolts for the motor or C-Face adapter can be accessed. To gain access to all four bolts requires the removal of the two cam grooves (Item 477). The cam grooves can be removed by first removing the socket head screws (Item 478). Then, the motor or adapter bolts ((Item 453) can be removed.
- C. Assembly is the reverse of disassembly.

**IMPORTANT NOTE**

The cam grooves or tapered gibs (Item 477) need to be adjusted during assembly.

Cam groove or tapered gib adjustment

The cam groove or tapered gib on the right side (Item 477) is not adjustable. The cam groove on the left-hand side is to be adjusted by the screws (Item 479) located next to the slide bar (Item 477). The cam grooves are properly adjusted when the slide plate (Item 472 or 474) is allowed to move freely through its complete range.

- A. Remove the handwheel assembly nut (Item 465) and handwheel (Item 462) before making adjustment.
- B. Clean sliding surfaces of the slide plate and cam grooves, and then re-apply a molybdenum-based anti-seize compound to these surfaces.
- C. Assemble the motor and/or c-face adapter to the slide-plate (Item 472/474) by re-installing the motor bolts. Apply a thread-locking agent to the screw threads during assembly.
- D. Place the non-adjustable (right-side) cam groove onto the slide plate and tighten the socket head setscrews (Item 478). Apply a thread-locking agent to the screw threads during assembly.
- E. Place the intermediate housing (Item 447) onto the slide plate (Item 472 or 474) and then install the adjustable (Left-side) cam groove (Item 477).
- F. Install the socket head screws (Item 478) and the adjustment setscrews (Item 479). Apply a thread-locking agent to the screw threads during assembly. Do not completely tighten either set of screws – follow Steps 7 & 8!
- G. Adjust the cam groove set screws (Item 479) so that there is minimal side-play or side-movement and be certain that the friction drive housing (Item 447) can move freely.
- H. Then, tighten the socket head setscrews (Item 478).
- I. After completing the adjustment of the cam grooves (Item 477) the handwheel (Item 462) and handwheel assembly nut (Item 465) can be re-installed.
- J. Re-assemble the driving disc and re-connect the driving disc assembly and the driven disc assembly.



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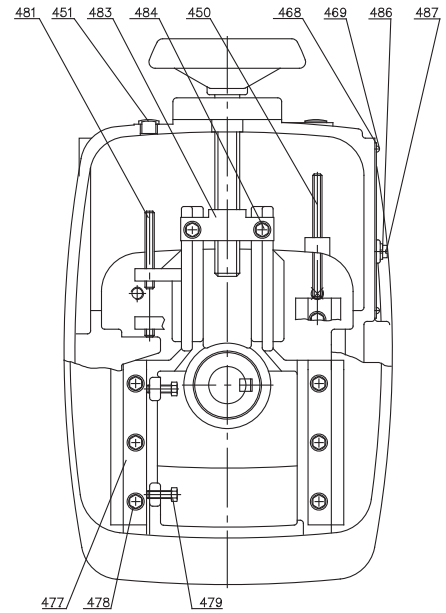
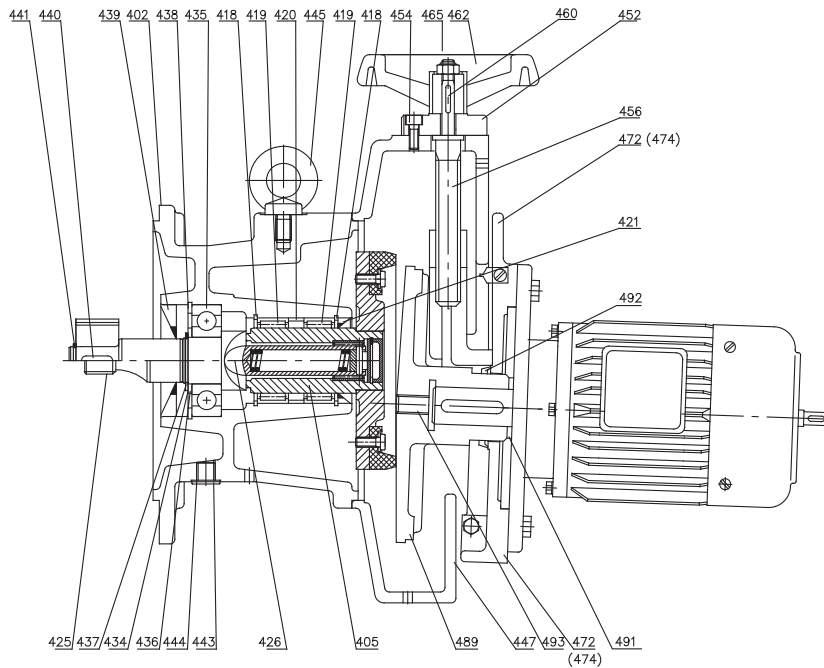
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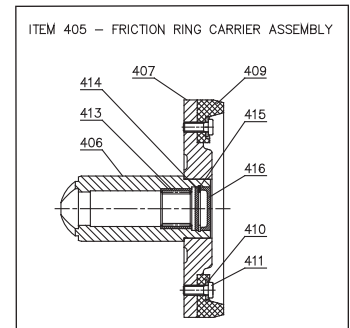
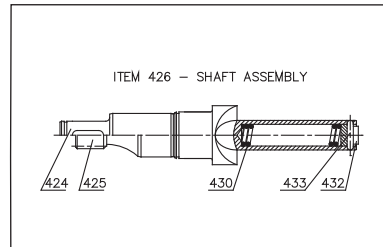


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Item 426 (Shaft assembly) and Item 405 (Friction ring carrier assembly) are stocked as complete assemblies.

Item 409 (Friction disc) can be ordered separately per the Table on page 6.



NORDISC™ Parts List

402 Housing	456 Adjusting spindle	426 Complete shaft assembly
418 Snap Ring	460 Key	424 Shaft, plain cut *
419 Needle roller bearing	462 Hand wheel	425 Shaft, gear cut *
420 Spacer	464 Washer	430 Compression spring *
421 Seal	465 Hex nut	433 Dowel pin *
434 Shim	468 Scale	432 Spiral pin *
435 Ball Bearing	469 Rivet / self-tapping screw	
436 Supporting disc	472 Slide-plate (NEMA)	* Included with Item 426
437 Snap ring	474 Slide-plate (IEC)	
438 Snap ring	477 Cam groove / taper gib	405 Friction ring carrier assy
439 Seal	478 Socket head screw	406 Hollow shaft **
440 Key	479 Screw	407 Friction ring carrier **
441 Snap ring	481 Set screw	409 Friction disc **
443 Oil plug	483 Spindle nut	410 Socket head screw **
444 Gasket	484 Socket head screw	411 Washer **
445 Flanged eye bolt	486 Indicator	413 Needle roller bearing **
447 Intermediate housing	487 Indicator screw	414 Washer **
450 Set screw	489 Driving disc	415 Snap ring **
451 Bore plug	491 Supporting disc	416 Bore plug **
452 Spindle cover	492 V-ring seal	
454 Socket head screw	493 Set screw	** Included with Item 405
455 Snap ring		

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8. NORDISC™ FRICTION DISC REPLACEMENT PART NUMBERS

NORDISC™ Type	RV10	RV20	RV30	RV40
Item 409 - Friction Disc Part Number	79119000	79219000	79319000	79419000

9. TROUBLESHOOTING

Problem With Variable Speed Unit	Possible Causes	Suggested Remedy
Drive Slips.	Friction Disc is worn. Friction Disc or Drive Disc face is dirty or contaminated. Load is too high.	Replace Friction Disc (Page 3). Clean Contaminated part: <ul style="list-style-type: none"> • Friction Disc – use dry cloth or paper. • Drive Disc – okay to use mild solvent provided excess is removed or cleaned with a dry cloth. Check measured power and reduce operating load to catalog values.
Drive heats up excessively.	Load is too high.	Check measured power and reduce operating load to catalog values.
Drive appears noisy or too loud.	Friction Disc is damaged: <ul style="list-style-type: none"> • May be caused after a brief stalling of the drive. • May be caused by intermittent loading of the drive. 	Determine cause of damage, and replace friction disc (Page 3).
Adjust rate is too low.	Sluggish adjustment rate may be due to corrosion between the slide plate and the cam grooves that are internal to the intermediate housing.	Re-establish low-friction conduction. <ul style="list-style-type: none"> • Separate driven disc assembly from driving disc assembly. • Clean and re-lubricate slide plate and cam grooves by applying a molybdenum-based anti-seize compound to these surfaces. • In extreme instances it may be necessary to remove the motor and cam grooves in order to thoroughly clean the cam grooves and slide plate. Reference instructions on Page 4, “Cam Groove or Tapered Gib Adjustment”.



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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!



WARNING

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!



DANGER

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.



IMPORTANT NOTE

See B1091 user manual for Class I, Division 2 (ID2) and Class II, Division 2 (IID2) Motors.
<https://www.nord.com/us/documentation/manuals/details/b1091.jsp>

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.
- See B1091 manual for Class I, Division 2 (ID2) and Class II, Division 2 (IID2) Motors.

<https://www.nord.com/us/documentation/manuals/details/b1091.jsp>

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.

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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 ²)
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)

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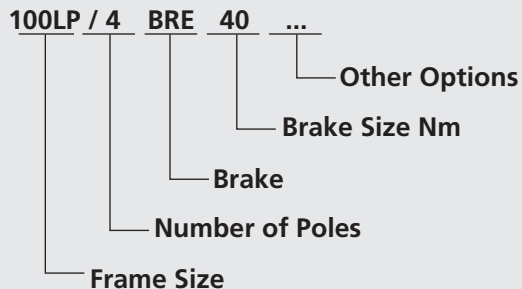
6. Motor Options And Nomenclature

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

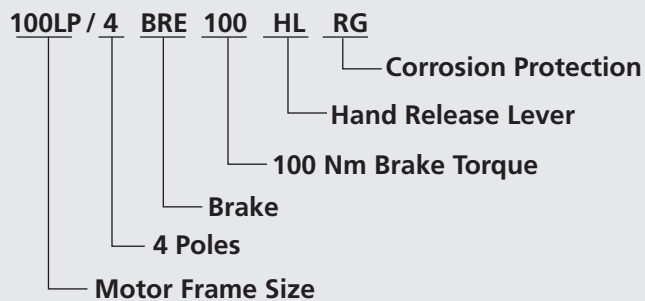
Code	Description
AICM	Additional Internal Insulation Coating Applied
BRE	With Brake
EAR	Single Phase, Start Cap/Run Cap
ECR	Single Phase, Start Cap/Run Cap Increased SF
EHB	Single Phase, Run Capacitor Only
EP	Epoxy Dipped Windings
F	Blower Cooling Fan - 3ph & 1ph
FC	Blower Cooling Fan - 1ph
FHL	Brake – Lockable Manual Release
H	Energy Efficient
HL	Brake – Manual Hand Release
IG	Incremental Encoder
IP66	IP66 Environmental Protection
IR	Brake – Current Sensing Relay
KB	Condensation Holes - Removable Plugs
KD	Condensation Holes - Open
MIK	Brake – Microswitch
MS	Power Plug Connector

Code	Description
OL	TENV Motor – Without Fan / With Cover
OL/H	TENV Motor - Without Fan & Cover
P	Premium Efficient Motors
RD	Canopy Cover
RDD	Double Canopy Cover
RG	Brake – Corrosion Protected
RLS	Backstop
SH	Motor Space Heater
SR	Brake – Dust Protected
TF	Thermistor
TW	Thermostat
VN	10:1 Constant Torque Rated Motor
VR	5:1 Constant Torque Rated Motor
VW	20:1 Constant Torque Rated Motor
VZ-F	1000+:1 Constant Torque Rated Motor
WE	2nd Motor Shaft End
WU	High Slip Rotor
Z	High Inertia Motor Fan

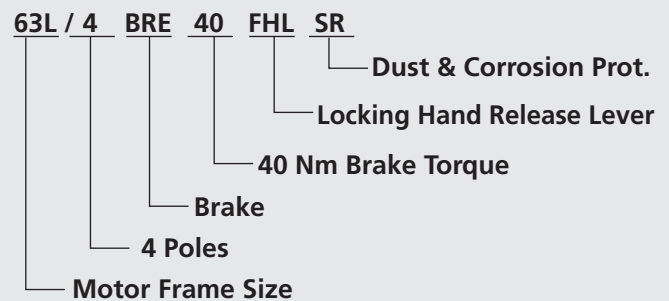
Motor Nomenclature



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 motor with 4 poles, a 40 Nm Brake 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.



IMPORTANT NOTE

NORD can provide motors for an expanded range of applications and service conditions including higher protection levels, extreme ambient conditions and, higher altitudes.



IMPORTANT NOTE

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.



DANGER

Special design and assembly considerations are needed if NORD motors are subject to any of the following conditions. Environmental conditions may lead to premature damage and/or failure without the proper protective features. Consult NORD for design considerations:

- Outdoor installation with motor in a vertical position.
- Direct contact with aggressive or corrosive materials (acids, bases, salts, certain gases, etc.).
- Exposure to extreme high or low temperatures, high relative humidity, condensation moisture or very wet environments.
- Subject to extreme material build-up on the unit (dirt, dust, sand, etc.).
- Hazardous Locations (risk of fire or explosion).

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.



WARNING

Transportation – Use of Lifting Devices

To avoid death, serious injury or equipment damage...

- Hoisting lugs or lifting eyes attached to the motor are designed for the weight of the motor only! Do not attach any additional loads!
- 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.
- During suspended transport, two straps must be able to carry the entire load weight safely.
- When required use additional, suitable means of support for transportation, installation or removal.
- Always secure the support equipment to prevent it from slipping.



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 recommend 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.

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****DANGER**

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.

**DANGER**

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:

- Keep all safety covers and guards in place during operation. Remove and replace covers in compliance with the applicable safety regulations.
- Allow the machine to cool down before starting any work on it.
- Operate the machines properly.
- Perform regular maintenance on the machine.
- Secure and guard free-standing shaft extensions.

**DANGER****Electrically Live Parts**

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.

**WARNING****Rotating Parts**

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.

**WARNING****Hot Surfaces**

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.

**WARNING****Maintain Proper Cooling**

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.

**DANGER****Condensation Drain Holes (Optional)**

Inserting objects into the condensation drain holes can damage the winding and can result in death, serious injury and damage to property!

- Before opening sealed drain holes, make sure the motor is in a no-voltage condition. Close the condensation drain holes before re-commissioning.
- Exercise caution around drain holes that are intended to be left open, especially when the motor is energized.

**IMPORTANT NOTE**

Before start-up check the following:

- All electrical connections are secure, well grounded and properly made.
- The motor is rotating in the correct direction (when de-coupled from the driven load).
- There are no temperature-sensitive parts (cables etc.), in contact with motor enclosure.
- Condensation drain holes are always located at the lowest point of the motor.



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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.



WARNING

During or directly after measurement the motor connection terminals carry hazardous voltages. 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.

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 $25^{\circ}\text{C} \pm 15^{\circ}\text{C}$ ($77^{\circ}\text{F} \pm 27^{\circ}\text{F}$).

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.



IMPORTANT NOTE

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



NOTICE

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.

NOTICE

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 quite, 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.

NOTICE

Inaccurate alignment may lead to bearing damage, excessive vibrations and shaft breakage.



IMPORTANT NOTE

For motor replacement guidelines see section 20 on page 15 and section 21 on page 16.

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14. Electrical Connections



DANGER

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°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] [Nm]	
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] [Nm]	
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

15. Direction of Rotation

The motor shaft rotation is defined per IEC 600034, Part 8. The motor shaft rotation can be controlled by the way the incoming line power is connected. When connecting the incoming line power in phase order to the terminal block posts, T1 (U1), T2 (V1), and T3 (W1) respectively, the motor shaft rotation will be clockwise when viewing the motor shaft at the drive-end.



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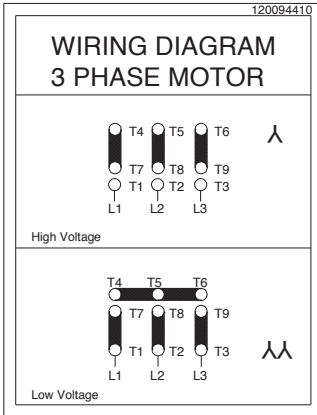
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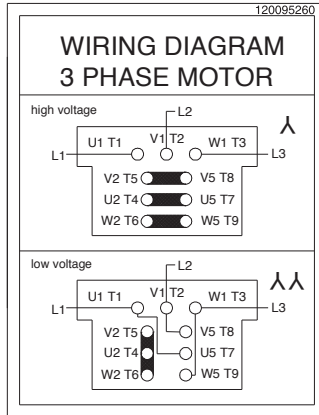
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15. Wiring Diagrams - Motor & Motor Option Connection Diagrams

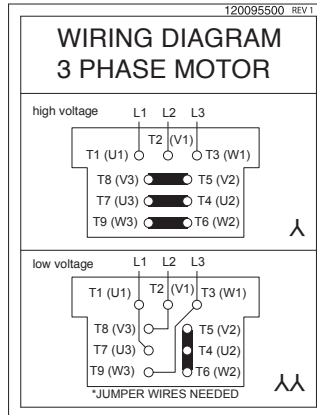
NORD Frames 63-225
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø



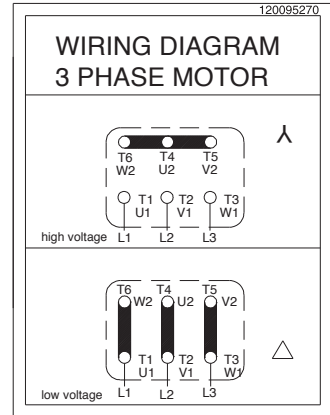
NORD Mfg by Siemens - Frames 200+
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø
190 / 380V, 60Hz, 3Ø



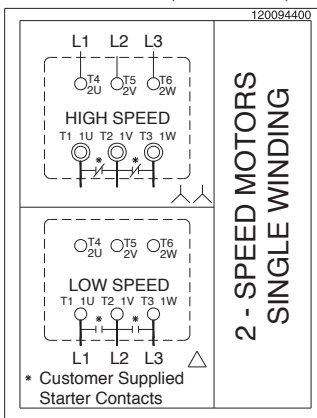
NORD Mfg by Siemens - Frames 200+
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø
190 / 380V, 60Hz, 3Ø



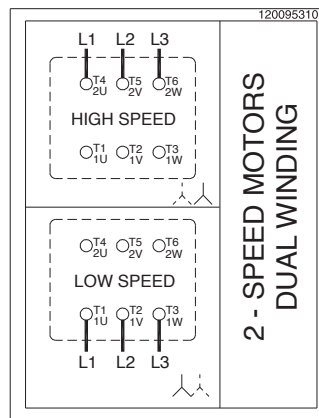
NORD Frames 63-225
460 / 800V, 60Hz, 3Ø | 230 / 400V, 50Hz, 3Ø
208 / 360V, 60Hz, 3Ø | 400 / 690V, 50Hz, 3Ø
332 / 575V, 60Hz, 3Ø



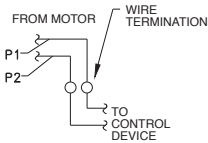
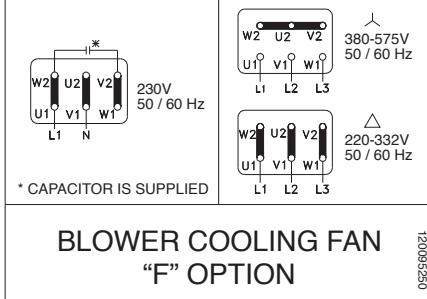
NORD 2 - SPEED MOTORS
SINGLE WINDING (4-2 & 8-4 POLE)



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



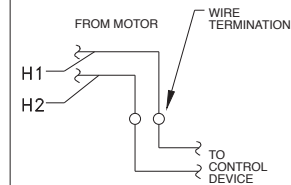
OPTION "F" 1 PH



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

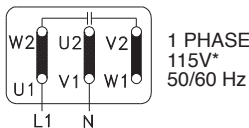
THERMISTOR
"TF" OPTION

120095240



SPACE HEATER
"SH" OPTION

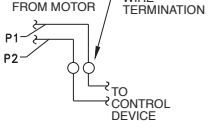
120095220



* CAPACITOR IS SUPPLIED

BLOWER COOLING FAN
"FC" OPTION

120095450



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

THERMISTATS
"TW" OPTION

120095230

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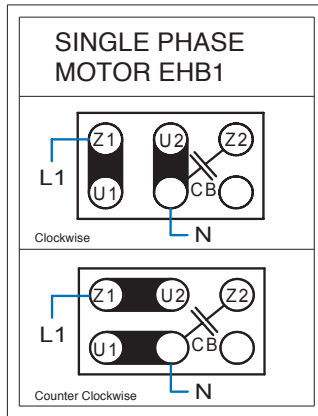


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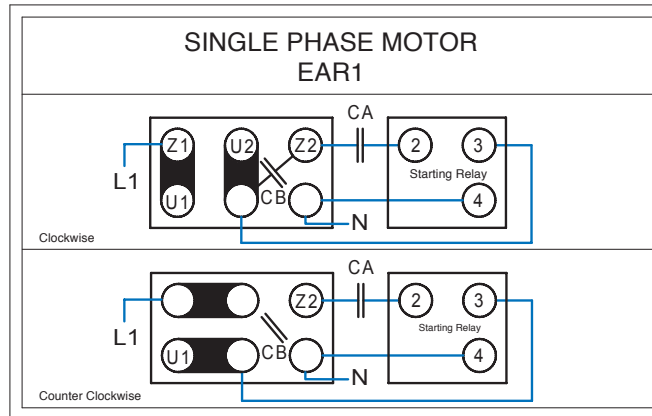
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15. Wiring Diagrams Ctd. - Single Phase Motor Connection Diagrams

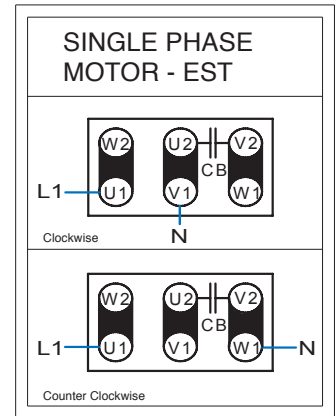
Motor Frame Sizes 63-90
230V, 50Hz, 1Ø



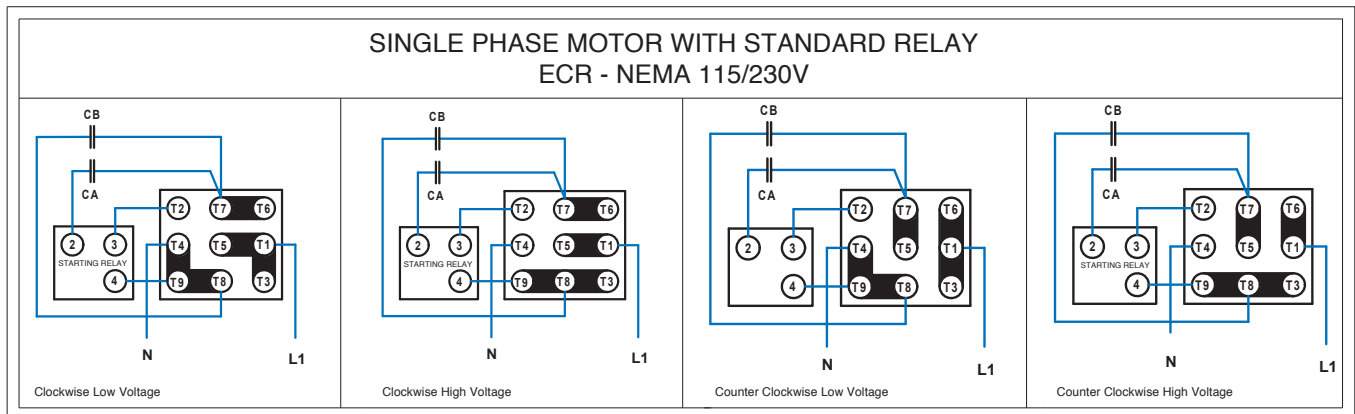
Motor Frame Sizes 63-90
230V, 50Hz, 1Ø



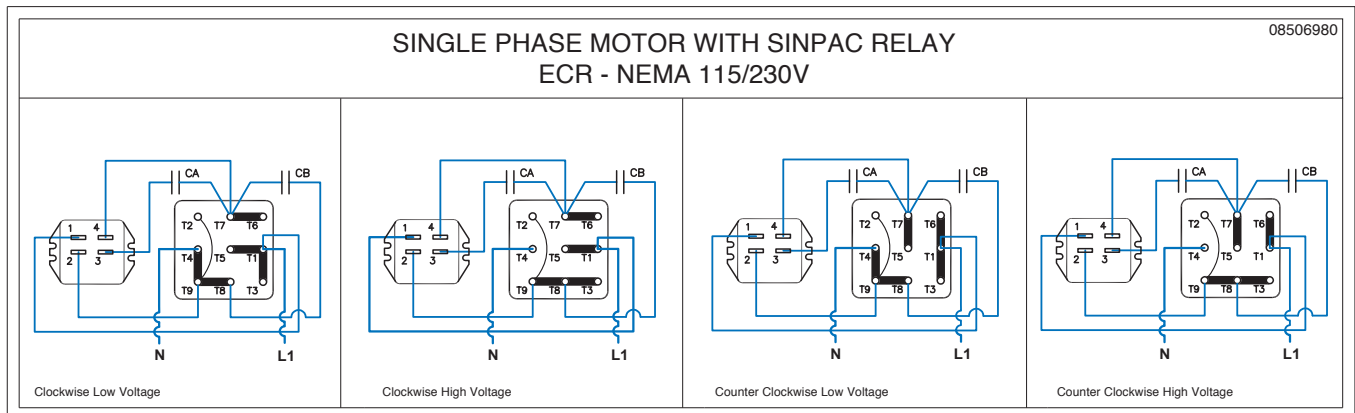
Motor Frame Sizes 63-90
230V, 50Hz, 1Ø



Motor Frame Sizes 63-90
115 / 230, 60Hz, 1Ø



Motor Frame Sizes 63-90
115 / 230, 60Hz, 1Ø





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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

Table 6 – Option F & FC**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]
Single phase connection - Δ (Delta)						
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
Three phase low-voltage connection - Δ (Delta)						
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 – 332	0.49	165	220 – 290	0.52	155
Three phase high-voltage connection - (Y)						
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]
Single Phase Connection - Δ (Delta)						
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

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16. Motor Acc. Ctd. - Motors with Thermal Protection

Effective July 15th, 2016 many newly manufactured NORD motors that require a thermal protection device will use WAGO® Series 221 Series Compact Splicing Connectors. These connectors will be used for splicing the leads of the thermal protection option supplied by NORD to the customer supplied control device.

- The WAGO® connector will facilitate assembly of NORD 63-132 frame, 60Hz, CUS approved motors
- An oversized brake terminal box and secondary 2-post wire termination strip will no longer be required.
- NORD will supply (2) Wago® Series 221, 2 conductor splicing connectors for each motor requiring thermal protection (NORD P/N 18251607)

Table 7 – Motors Receiving the WAGO® Connector

Motor Supplier	NORD
Frame Size	63 to 132
Type	CUS
Thermal Protection Option	TW, TF, PT100, KTY
Motor Connection	Wye-Wye/Wye (YY/Y)
Voltage – Hz	230/460V – 60 Hz
Brake Motors Affected	No
EKK Small Terminal Box	Not possible (space limited)

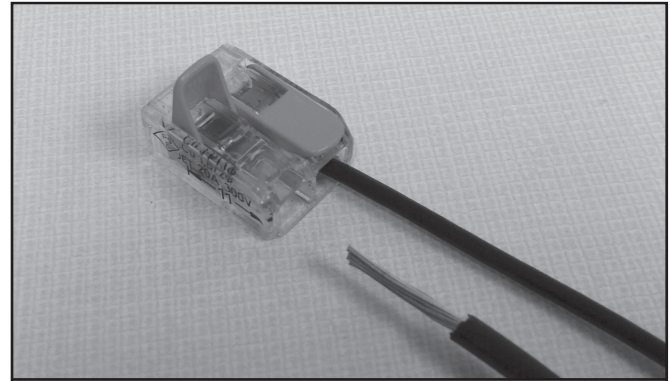
Table 8 – WAGO® Series 221 Connector Ratings

Wire Size	12-24 AWG (solid stranded or fine stranded) 0.14 - 4mm ² (fine stranded) 0.2 - 2mm ² (solid stranded)
Rated Voltage	600V
Rated Current	20A
Operating Temp.	105°C (221°F)
Global Approvals	cULus, ENC 05, EAC, PSE

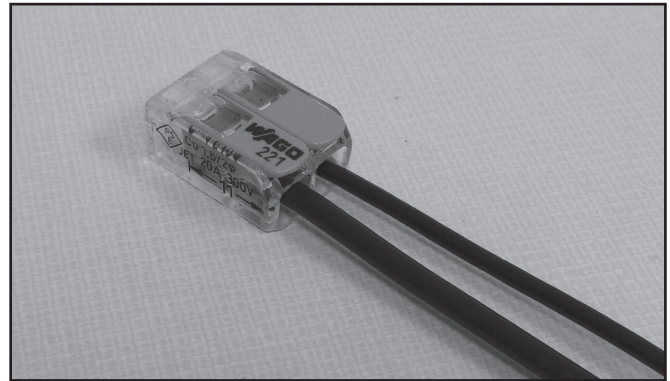
UL Certificate E69654

Operation of WAGO® Series 221 Connector

1. Strip the wire/s to be connected to 11 mm (0.43 in).
2. Open up the lever of the lever-nut, place the wire in the receptical and close the clamp.
3. Repeat for the additional wires being joined.



WAGO® receptical in the open position



WAGO® receptical in the closed position

The WAGO Connector remains optional for the following NORD motors:

Brake Motors - An oversized conduit box is utilized with a secondary 2-post wire termination block for the thermal protection option

Delta/Wye (Δ/Y) Connected Motors - These utilize an 8 post terminal box (6 primary posts for the supply power and 2 auxillary posts for thermal protection)

Motors 160 Frame and Larger - The terminal box is large enough to allow the use of a secondary 2-post wire termination block for your thermal protection device.



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Thermostats (TW & 2TW)

Table 9. TW & 2TW options, Thermostats

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 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 as indicated below.

Thermistors (TF)

Table 10. TF option, Thermistors

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.

**IMPORTANT NOTE**

- Thermostats and Thermistors will automatically reset.
- All wiring must be completed by qualified personal and adhere to all local codes.

16. Motor Acc. Ctd. - 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 11. 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.

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17. Inspection

Inspect the motor after every 500 operating hours. Please use table 12 below for inspection guidelines.

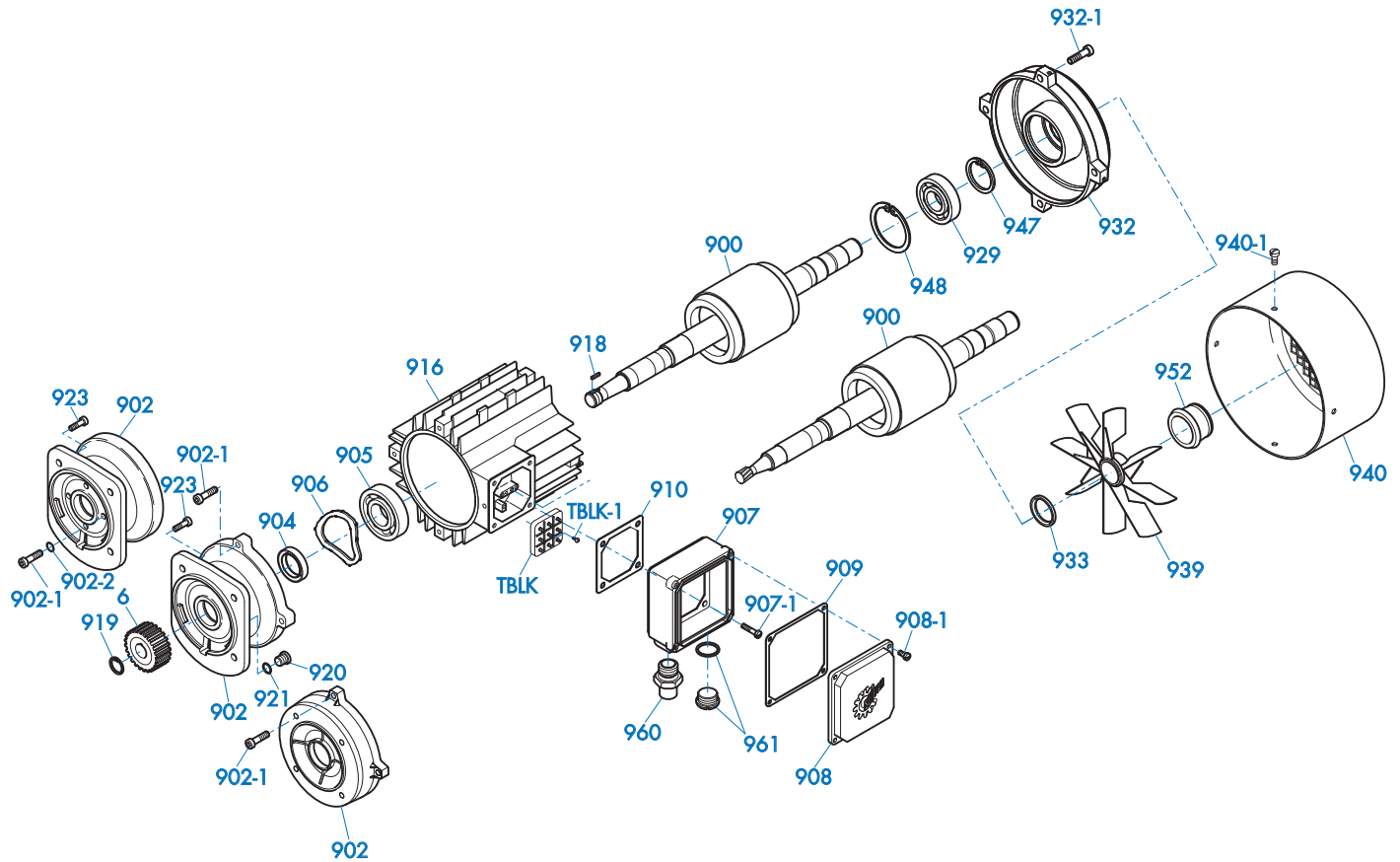


CAUTION

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.

Table12. - Motor Inspection Guidelines

Inspect	Check	Action
Motor Exterior	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.
Motor Mountings	Make sure the mounting hardware is secure.	If the mounting hardware is not secure, check the motor/gearbox alignment, and tighten the mounting hardware.
Motor Electrical Connections	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.
Insulation Resistance	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.
Motor Brake	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.



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



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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.



IMPORTANT NOTE

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.

- 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.



IMPORTANT NOTE

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.

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

NOTICE

Do not mix oil types. Mixing oil types may lead to component damage and diminished performance. Consult NORD for assistance or reference oil type listed on gearbox tag.

- 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.



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

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RETAIN FOR FUTURE USE

General Instructions

This manual provides information on brake rectifiers along with typical connection diagrams for NORD motors with brakes. It is not intended to include a comprehensive listing of all details or procedures required for installation, operation, maintenance or troubleshooting.

NORD utilizes brakes manufactured by Precima and Mayr. NORD recommends referencing the supplier documentation for information regarding operation and maintenance.

- BRE5 - BRE150 and BRE1200 sizes utilize Precima brakes as standard
- BRE250 - BRE 800 sizes utilize Precima or Mayr

PDF copies of all NORD or supplier-specific manuals are also available on our website. Filters are available to drill down to the specific required documentation.

Obtaining Brake Supplier Documentation

The myNORD Serial Number Lookup tool provides unit documentation specific to your product. Simply enter the sales order number from the product nameplate to access all relevant operation & maintenance manuals including supplier-specific documentation.

<https://shop.nord.com/US-en/mynord/documentcenter#?order=&language=EN-US>

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Detail

Order Number:
202962538-100

NORD Model Type:
100LP/4 CUS BRE20 HL TW VR SH

Type	Name	Pages	Filesize	Download
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PDF	U10040-Storage & Commissioning U10040 Version 0.03	2	536.12 KB	↓
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PDF	U30000-Motors- AC INDUCTION, SINGLE & POLYPHASE U30000 Version 0.07	18	1.39 MB	↓
	U35000-Motor Brakes -Installation & Maintenance U35000 Version 0.14	0	5.59 MB	↓

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Brake Control Rectifiers

NORD brake control rectifiers convert AC voltage to DC voltage. Rectifiers are used because most applications require AC voltage to power the motor, but DC power is required to power the brake and DC power is not typically available. NORD brake motors typically include the rectifier located inside the terminal box.

Rectifier Advantages

- Individual power source for each brake.
- Compact size, mounted inside the terminal box.
- Multiple types, voltage options and release/engagement modes available.
- Mountable in a separate control cabinet.
- Integral protection against voltage spikes.

Model	Type	Part No.	Color	Input Voltage $V_{AC} \pm 10\%$	Rated Current A_{DC}	
					(40°C)	(75°C)
GVE20L	Full-wave	19141000	Black	110-275	1.5	1.0
GVE20V	Full-wave	19141030	Black	110-275	1.5	1.0
GHE40L	Half-wave	19141010	Yellow	200-480	2.0	1.0
GHE40V	Half-wave	19141040	Yellow	200-480	2.0	1.0
GHE50L	Half-wave	19141020	Gray	200-575	2.0	1.0
GHE50V	Half-wave	19141050	Gray	200-575	2.0	1.0
GUE40V	Dual-wave	19140300	Black	190-460	0.7	0.5
PMG500	Push-Hybrid	19140200	Black	200-500	4.0	2.8

Rectifier electronics are sealed for moisture-protection; electronics on models ending with the suffix "V" are resin-encapsulated to provide added protection if water should get into the motor terminal box.

Rectifier Types

Full-wave rectifier [GVE]:

A rectifier in which both the positive and negative half-cycles of the AC input signal are rectified to produce a uni-directional DC current supply to the load or the brake. The output voltage is 90% of the input voltage ($V_{DC} = 0.90 \times V_{AC}$).

Half-wave rectifier [GHE]:

A rectifier in which only alternate half-cycles of the AC input signal are rectified to produce a uni-directional DC current supply to the load or the brake. The output voltage is 45% of the input voltage ($V_{DC} = 0.45 \times V_{AC}$).

Dual Wave Rectifier [GUE]

A rectifier that can be wired as either a full-wave rectifier or a half-wave rectifier depending upon how it is connected to the AC input signal.



IMPORTANT NOTE

If the motor is connected to a frequency inverter, soft start, or is a two-speed motor, then separate AC power must be supplied to the brake rectifier.

Rectifier Types [Ctd.]

PMG 500 Push-Hybrid rectifier [PMG]:

A fast-acting or push-hybrid brake rectifier provides an initial "push" in the form of a timed full-wave brake-release function, which is then followed by a continuous half-wave brake-holding function. There are two ways to apply these rectifiers as follows:

- "Overexcitation" of the brake coil provides faster brake release or improved cycling capacity. The DC voltage of the brake coil is determined based upon using a half-wave rectifier. The output voltage is 45% of the input voltage ($V_{DC} = 0.45 \times V_{AC}$).
- "Reducer-Power Holding" of the brake coil maintains the brake in a released state by using only 25% of the power needed for the initial brake release. This results in very fast brake stopping. The DC voltage of the brake coil is determined based upon using a full-wave rectifier. The output voltage is 90% of the input voltage. ($V_{DC} = 0.90 \times V_{AC}$).

NORD offers additional fast-acting rectifiers besides the PMG 500. For additional details please reference User Manual U35100 – Fast Acting Brake Rectifiers.

NOTICE

In order to prevent rapid wear, the PMG 500 rectifier is required when utilizing the larger 800 Nm (590 lb-ft) and 1200 Nm (885 lb-ft) twin-rotor brakes. The PMG 500 rectifier is wired to "overexcite" the brake during its initial release.

Brake Switching Options

The rectifiers discussed in this manual can be wired to allow brake switching at either the AC power source (input) or the DC power source (output).

- AC switching allows the brake rectifier to be powered directly from the motor's terminal block with no additional wiring. However, this provides a slower brake stopping time due to the additional time needed to de-energize or collapse the motor's magnetic field.
- DC switching directly interrupts the current flow in the DC circuit of the brake rectifier. This method of brake switching guarantees faster brake stopping or brake engagement times.



WARNING

When the moving system undergoes a change in height (such as in a lift or incline conveyor application) or if the system tends to speed up or overhaul during normal operation, then DC-switching of the brake is required in order to prevent excessive load movement, drift or falling loads during stopping.

Figure 2.1: GVE/GHE Dimensions

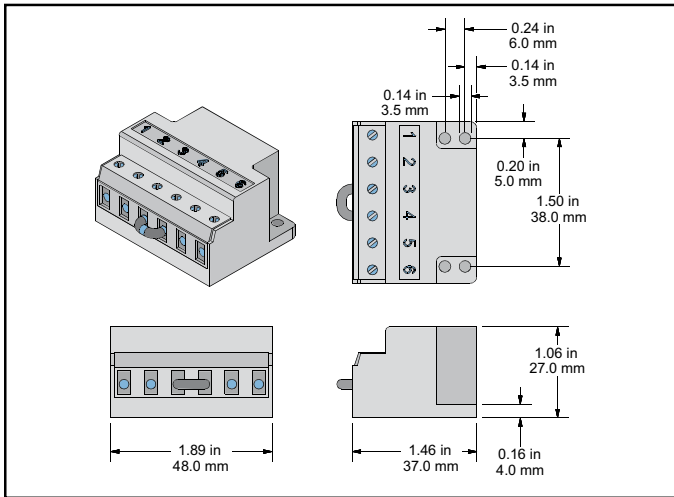


Figure 3.1: GUE Dimensions

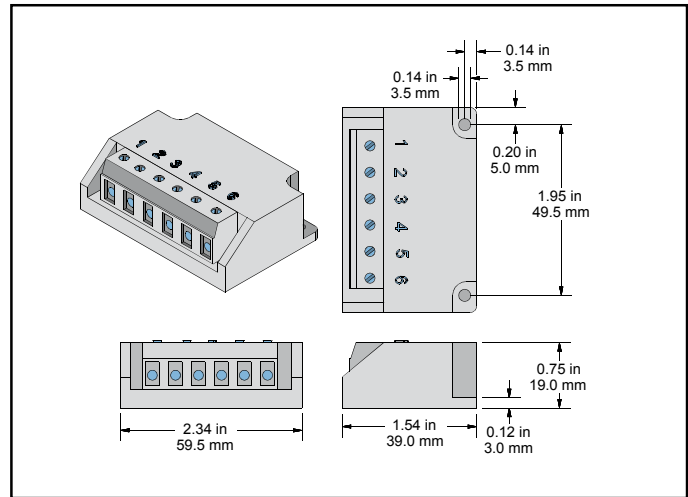


Figure 2.2: GVE/GHE Braking Methods

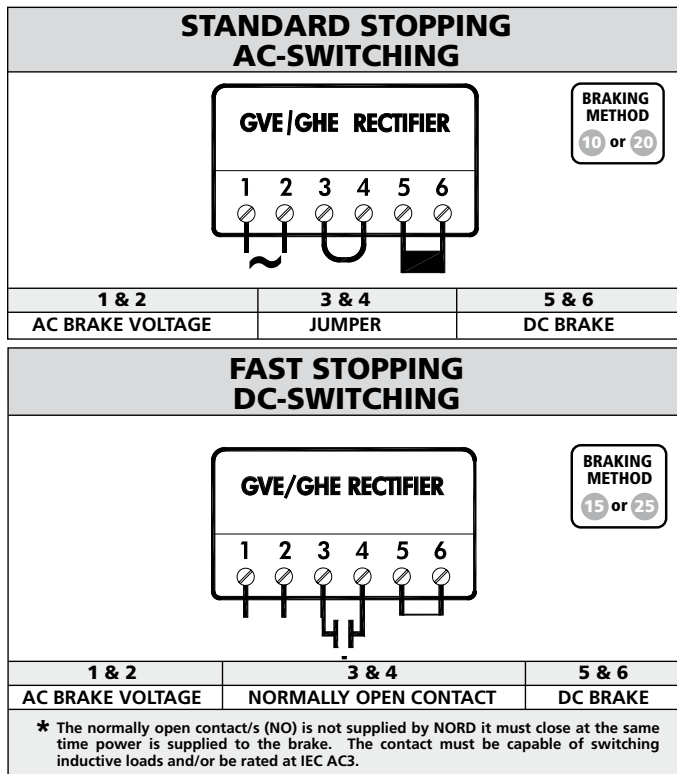
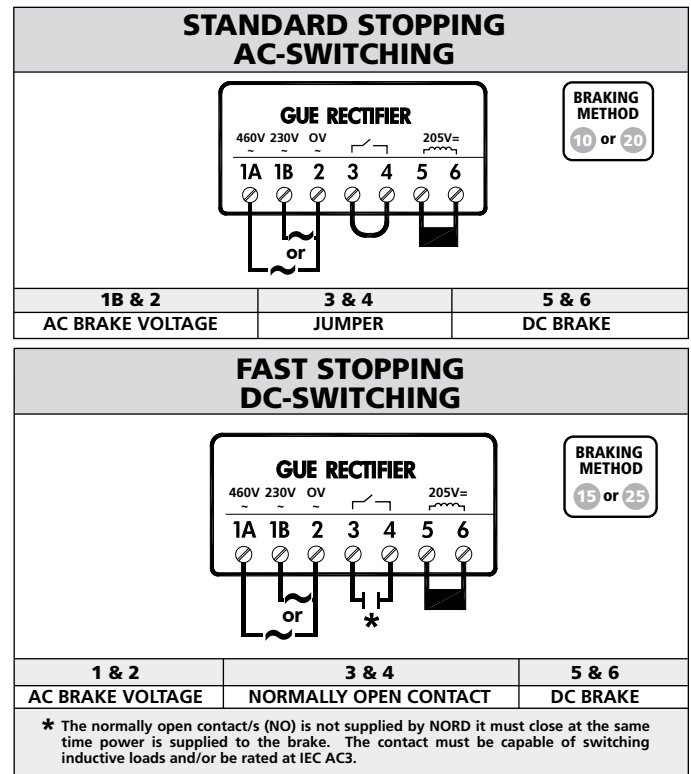


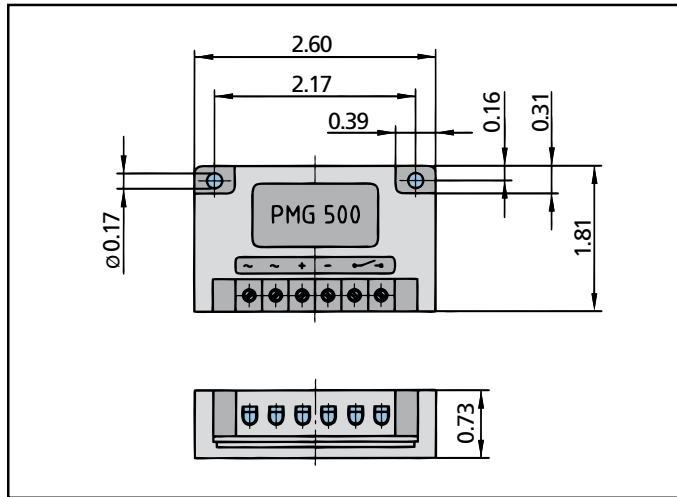
Figure 3.2: GVE/GHE Braking Methods



Braking Method	Break Release (Start)	Brake Engage (Stop)	Power Source
10	Standard	Standard (AC-Switching)	Motor terminals
15	Standard	Fast (DC-switching)	Motor terminals
20	Standard	Standard (AC-Switching)	Separate power
25	Standard	Fast (DC-switching)	Separate power

Braking Method	Break Release (Start)	Brake Engage (Stop)	Power Source
10	Standard	Standard (AC-Switching)	Motor terminals
15	Standard	Fast (DC-switching)	Motor terminals
20	Standard	Standard (AC-Switching)	Separate power
25	Standard	Fast (DC-switching)	Separate power

Figure 4.1: PMG 500 Dimensions



PMG 500 Push-Hybrid Rectifier

The PMG 500 rectifier provides an initial “push” the form of a timed full-wave brake-release function, which is then followed by a continuous half-wave brake-holding function.

- In order to prevent rapid wear, the PMG 500 rectifier is required when utilizing the larger 800 Nm (590 lb-ft) - and 1200 Nm (885 lb-ft) twin-rotor brakes.
- The PMG 500 rectifier is wired to “overexcite” the brake during its initial release. The DC voltage of the brake coil is determined based upon using a half-wave rectifier.

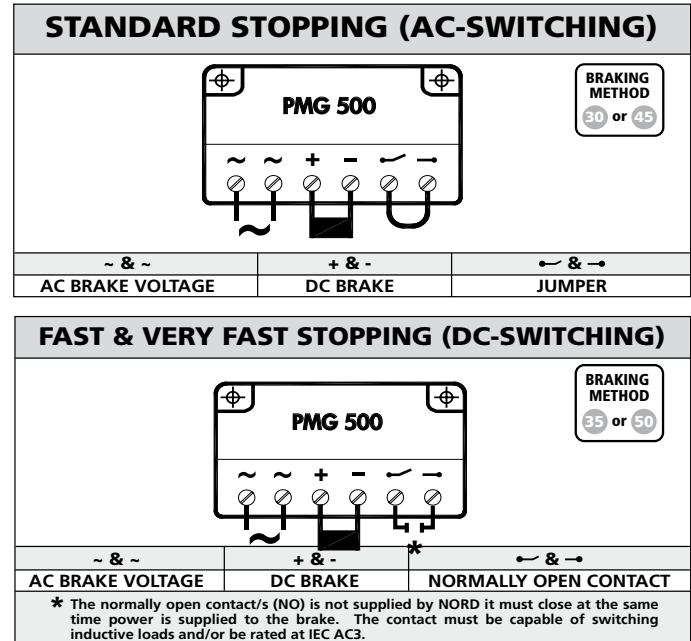
In some applications the PMG rectifier may be used for “Reduced Power Holding” or very fast brake engagement (See user manual U35100 for details).



IMPORTANT NOTE

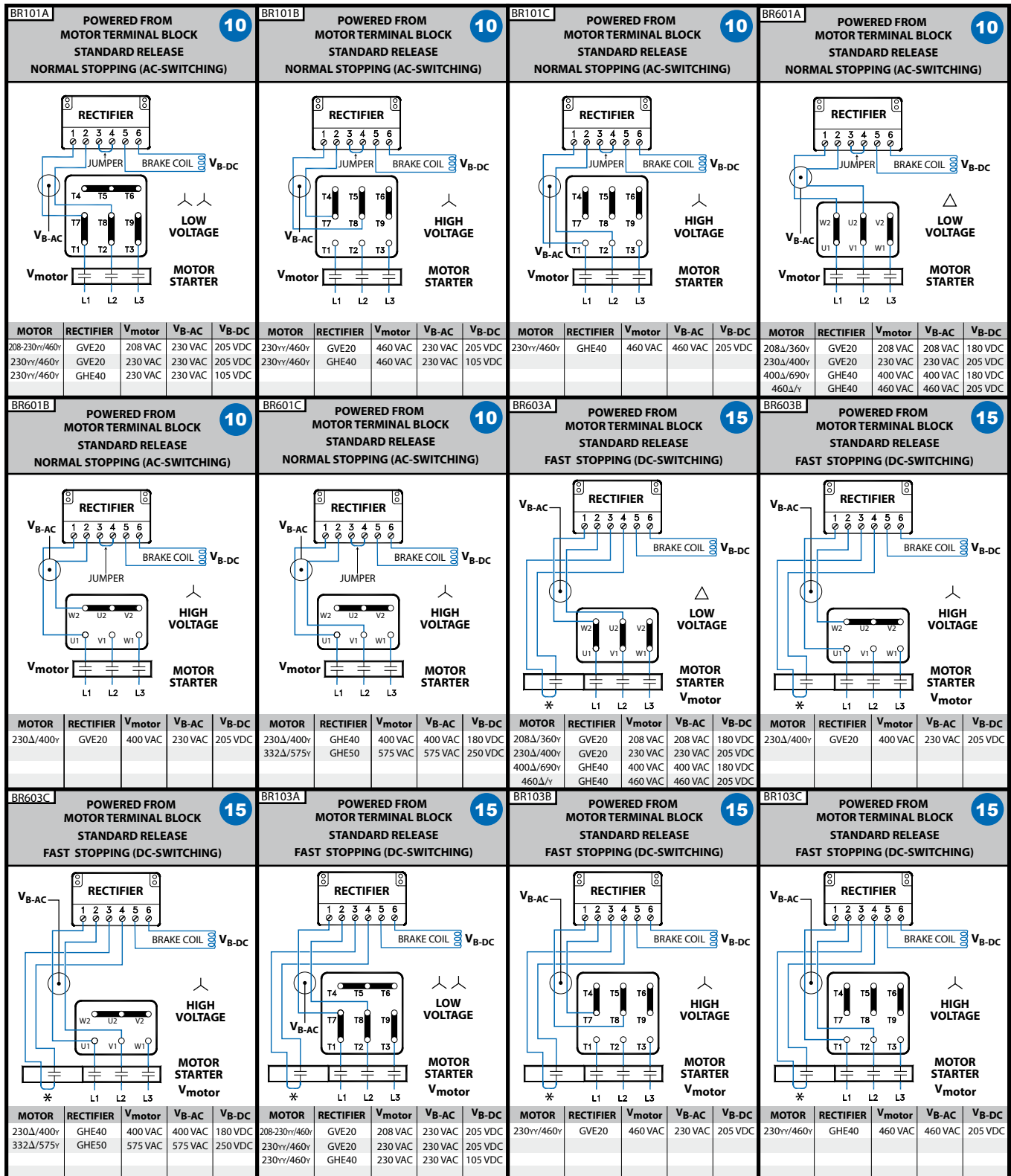
If the motor is connected to an AC drive, soft start, or is a two-speed motor, the AC power must be supplied to the brake rectifier separately from the motor power.

Figure 4.2: PMG 500 Braking Methods



Braking Method	Break Release (Start)	Brake Engage (Stop)	Power Source
30	Fast (Overexcitation)	Standard (AC Switching)	Motor terminals
35	Fast (Overexcitation)	Fast (DC Switching)	Motor terminals
45	Fast (Overexcitation)	Standard (AC Switching)	Separate power
50	Fast (Overexcitation)	Fast (DC Switching)	Separate power

Typical Connection Diagrams



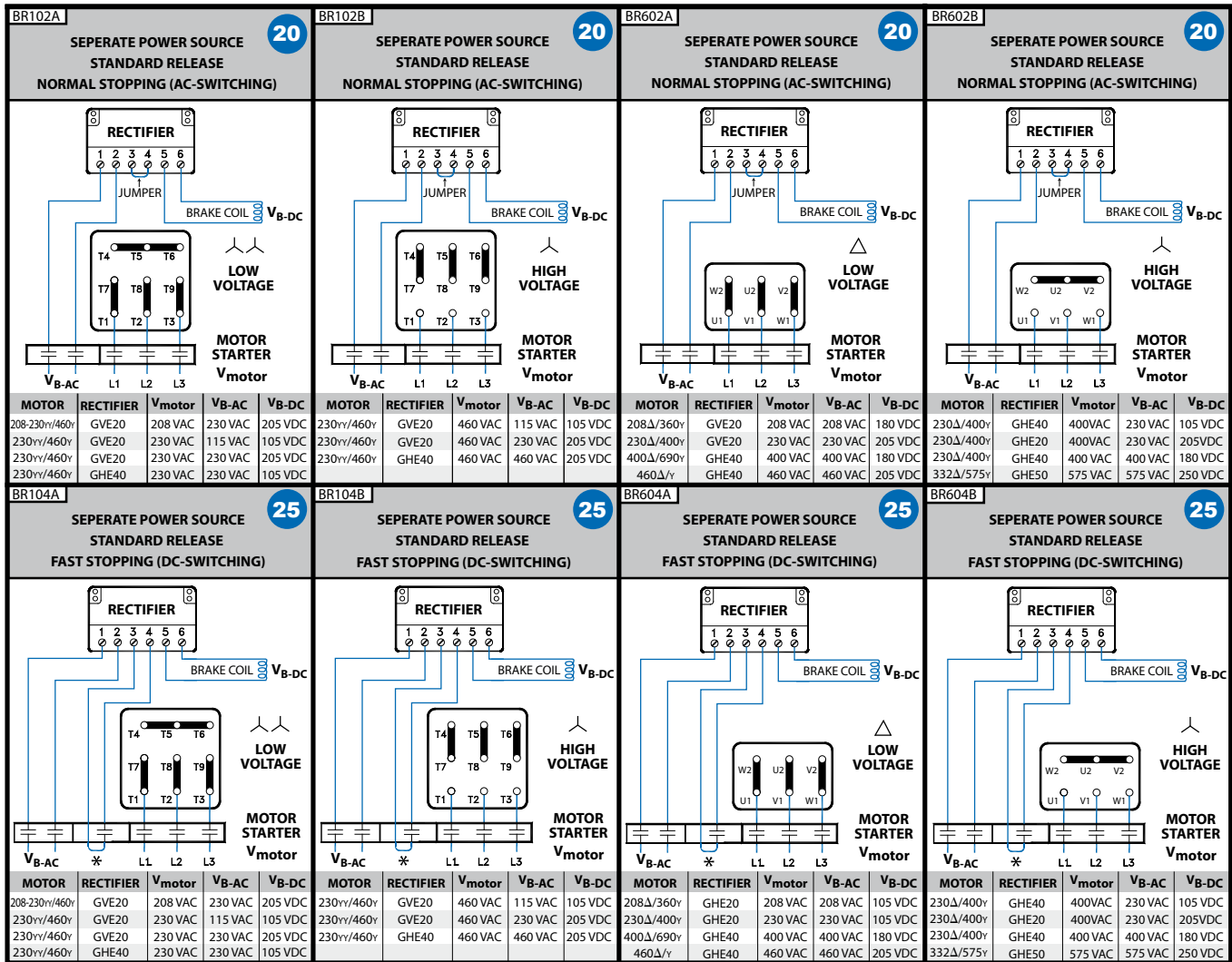
✱ The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.



= Braking Method

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Typical Connection Diagrams

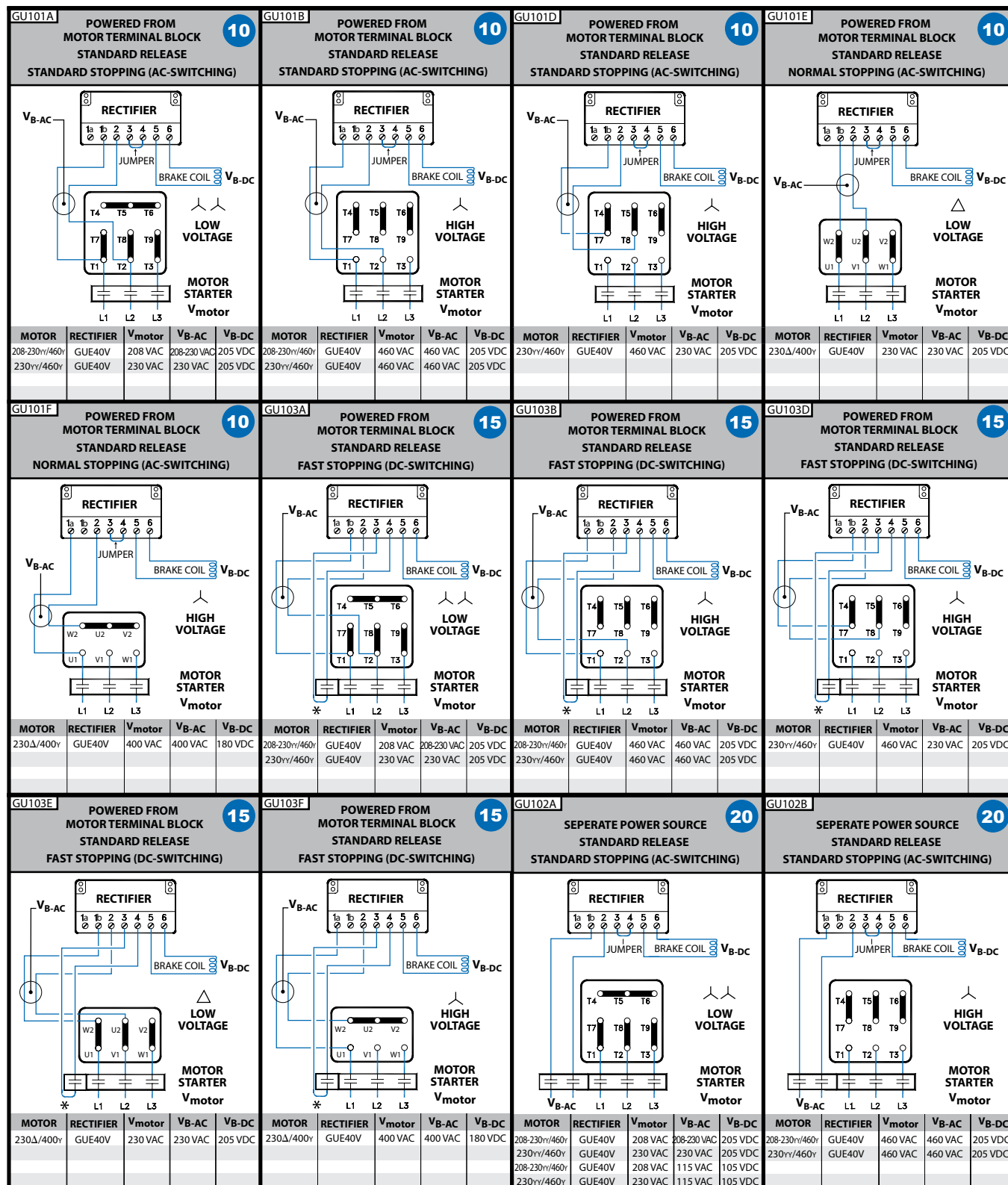
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* The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.

 = Braking Method

Typical Connection Diagrams



✱ The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.



= Braking Method



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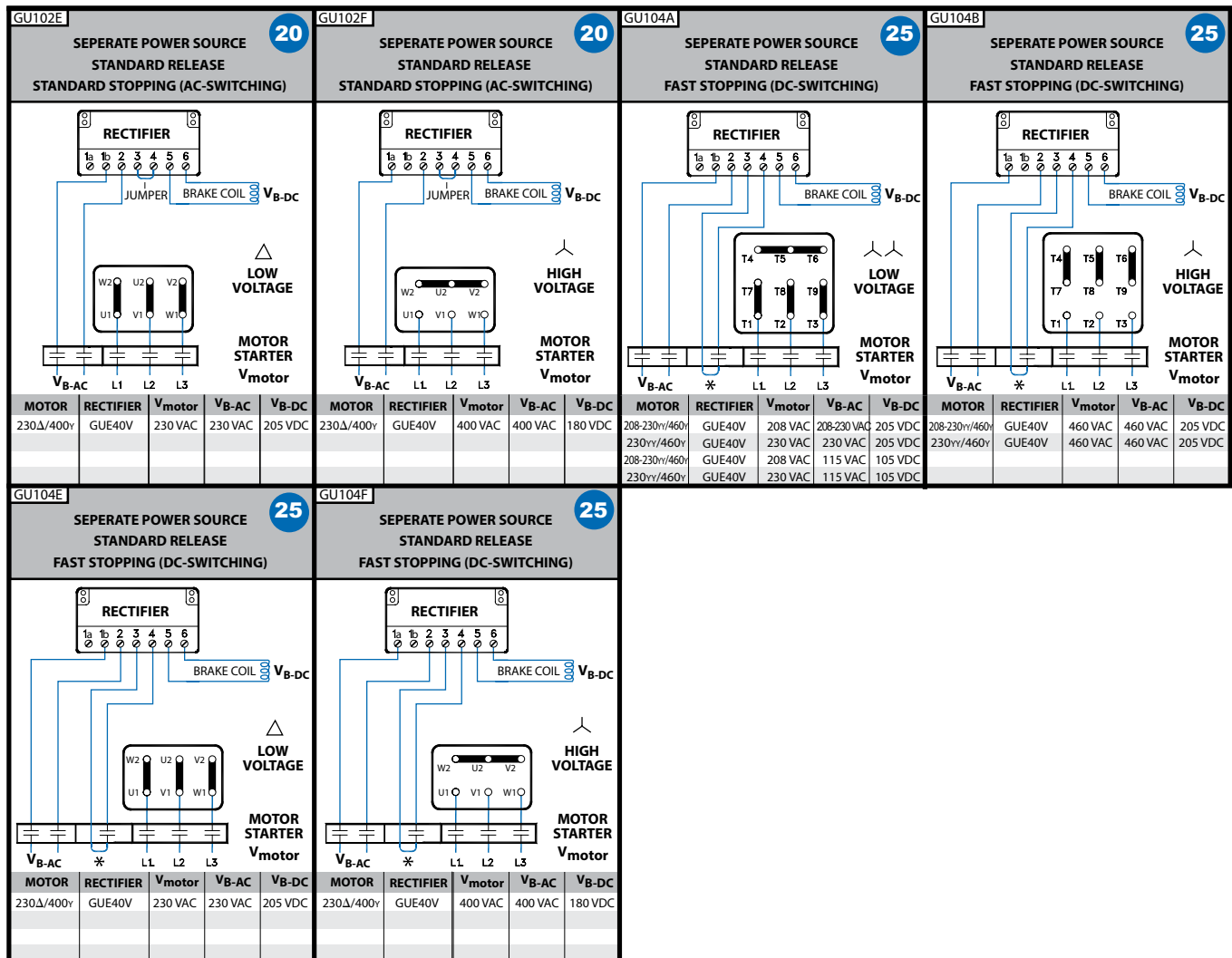
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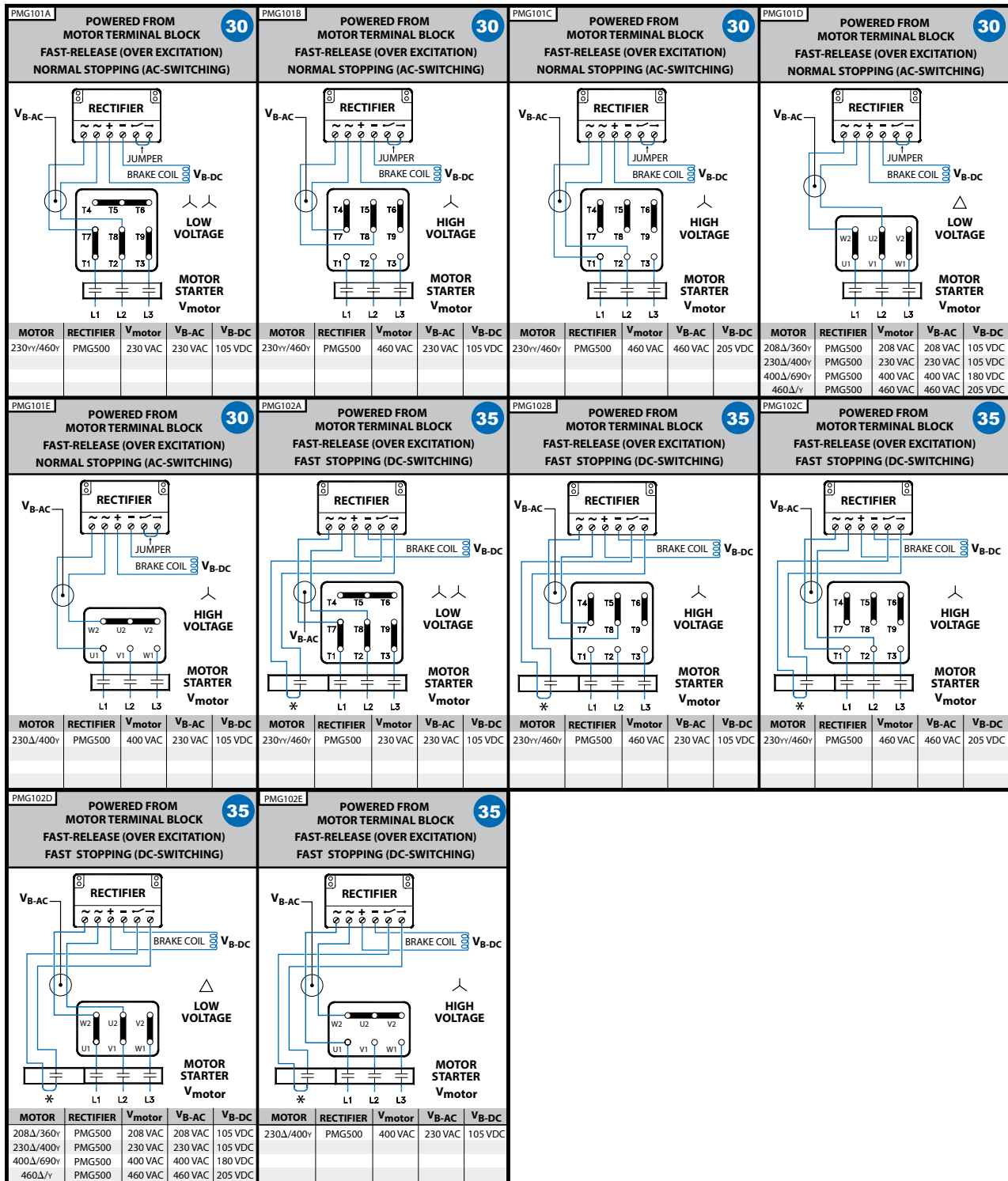
Typical Connection Diagrams



* The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.

= Braking Method

Typical Connection Diagrams

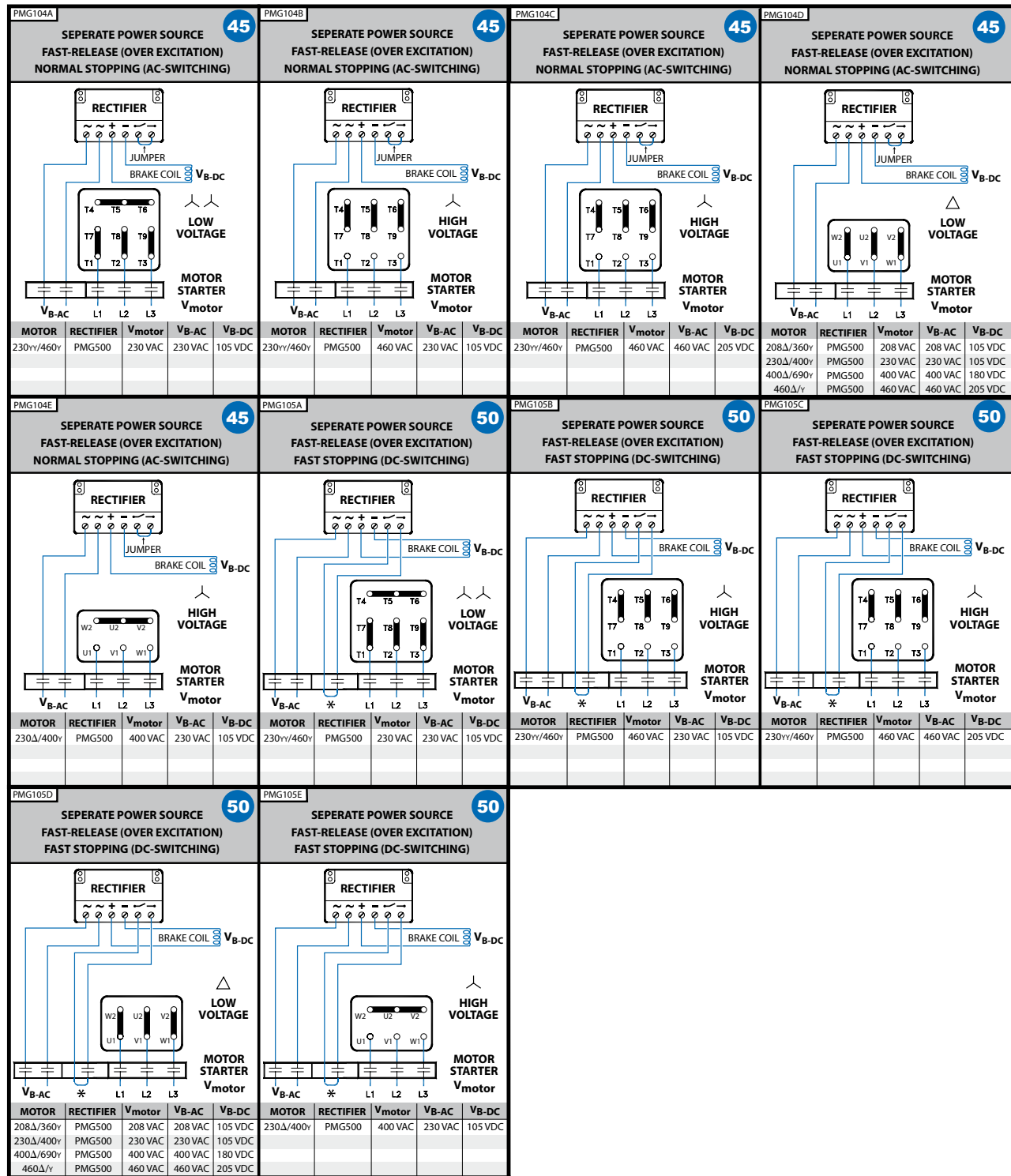


* The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.

 = Braking Method

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Typical Connection Diagrams

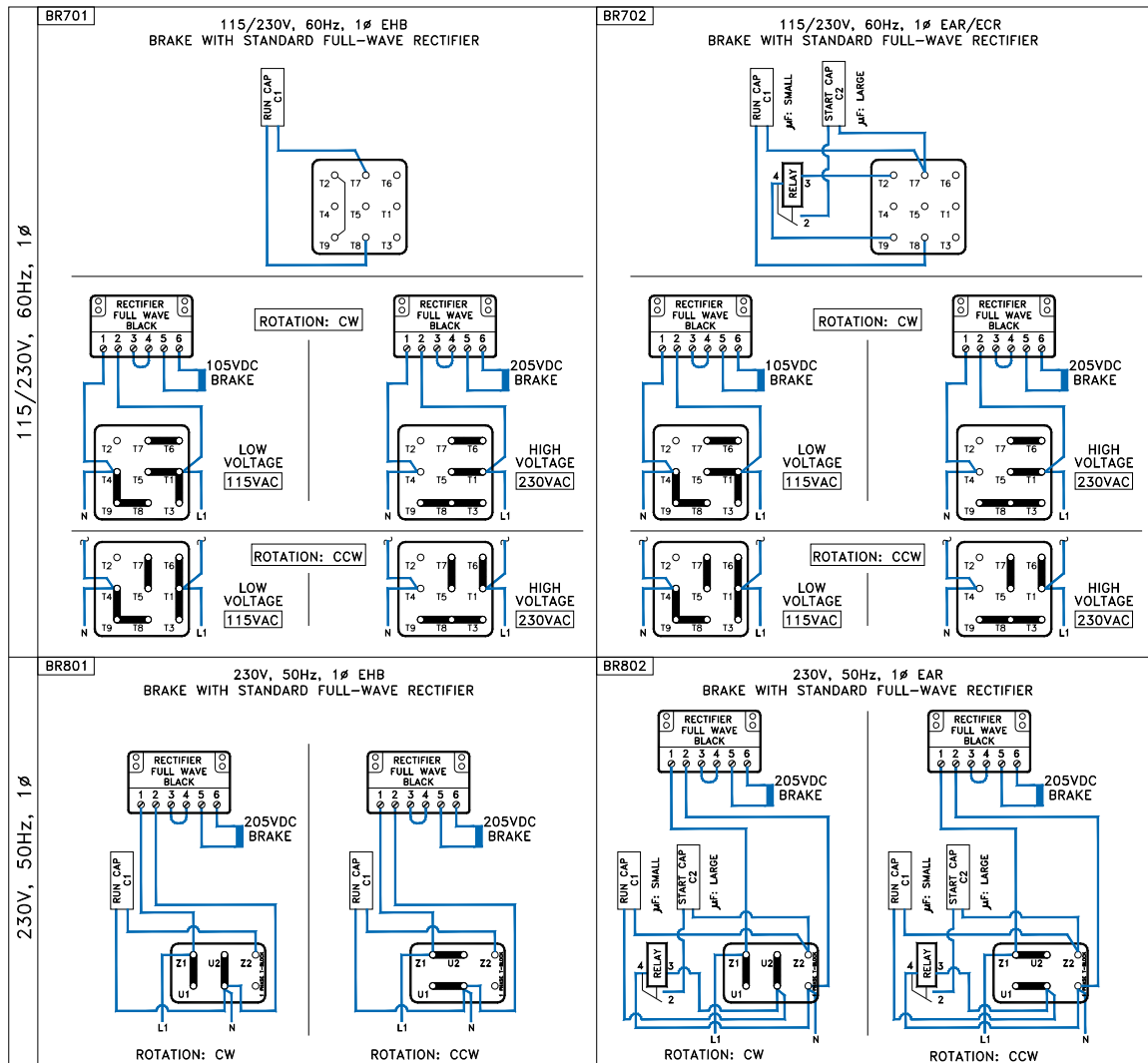
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* The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.

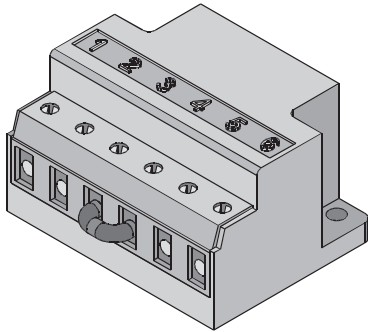
 = Braking Method

Typical Connection Diagrams - Single Phase Motors



Troubleshooting Information

Troubleshooting	Cause	Remedy
Brake doesn't release	Air gap too large	Check air gap and adjust
	Brake not receiving electrical power	Check electrical connection
	Failed rectifier	Replace rectifier
	Brake is getting too warm	Use fast response (FR) rectifier
	Voltage to brake coil too small	Check connection voltage of brake coil
	Rectifier supply voltage from inverter	Rectifier voltage must be from separate source. (Inverter output voltage varies)
Brake release is delayed	Air gap too large	Check air gap and adjust
	Voltage to brake coil too small	Check connection voltage of brake coil
Brake does not engage	Voltage to coil too large	Check connection voltages of brake windings
	Hand release is adjusted incorrectly	Adjust to correct air gap
	Anchor plate mechanically blocked	Remove mechanical blockage
Brake engagement is delayed	Voltage to coil too large	Check connection voltage of brake windings
	Brake is switched to AC side	Use DC switching



General Instructions

This manual provides general operating instructions for the "Fast Acting Brake Rectifiers" type "GPE, GPU, and PMG" that are commonly offered by NORD in addition to the standard brake control rectifiers. Please feel free to contact NORD with any questions concerning the supplied brake rectifiers and brake components.

Safety Notice

Only qualified personnel should attempt installation, operation and maintenance of NORD brakes and brake rectifiers. If you have a question about a procedure or are uncertain about any detail, seek clarification and DO NOT PROCEED.



DANGER

- This equipment contains high electrical voltage. Remove and lockout all power from the electric motor and brake before any work is completed on the brake.
- The user is responsible for conforming to all national and local electrical and safety codes. Wiring practices, proper grounding, disconnects, and over current protection, are of particular importance.
- Make certain the load is supported when servicing the brake. Removing power from the brake or removing the brake from the motor will release the load, which may cause severe injury or death.
- Failure to follow proper procedures and precautions may result in severe bodily injury or death.

Brake Control Rectifiers

NORD brake control rectifiers convert AC voltage to DC voltage. Rectifiers are used because most applications require AC voltage to power the motor, but DC power is required to power the brake and DC power is not typically available. NORD brakemotors typically include the rectifier located inside the terminal box.

Rectifier Advantages

- Individual power source for each brake.
- Compact size, mounted inside the terminal box.
- Multiple types, voltage options and release/engagement modes available.
- Mountable in a separate control cabinet.
- Integral protection against voltage spikes.

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Standard Rectifier Types

Full-Wave Rectifier

A rectifier in which both the positive and negative half-cycles of the AC input signal are rectified to produce a uni-directional DC current supply to the load or the brake. The output voltage is 90% of the input voltage ($V_{DC} = 0.90 \times V_{AC}$).

Half-Wave Rectifier

A rectifier in which only alternate half-cycles of the AC input signal are rectified to produce a uni-directional DC current supply to the load or the brake. The output voltage is 45% of the input voltage ($V_{DC} = 0.45 \times V_{AC}$).

Dual-Wave Rectifier

A rectifier that can be wired as either a full-wave rectifier or a half-wave rectifier depending upon how it is connected to the AC input signal.



IMPORTANT NOTE

This manual provides general operating instructions for NORD brakes with Fast-Acting brake Rectifiers. For additional brake and brake rectifier information please reference User Manual U35000.

Fast-Acting or Push-Hybrid Rectifiers [GPE, GPU & PMG]

A push-hybrid rectifier or fast-acting brake rectifier provides an initial "push" in the form of a timed full-wave brake-release function, which is then followed by a continuous half-wave brake-holding function. There are two ways to apply these rectifiers as follows:

- "Overexcitation" of the brake coil provides faster brake release or improved cycling capacity. The DC voltage of the brake coil is determined based upon using a half-wave rectifier. The output voltage is 45% of the input voltage ($V_{DC} = 0.45 \times V_{AC}$).
- "Reducer-Power Holding" of the brake coil maintains the brake in a released state by using only 25% of the power needed for the initial brake release. This results in very fast brake stopping. The DC voltage of the brake coil is determined based upon using a full-wave rectifier. The output voltage is 90% of the input voltage. ($V_{DC} = 0.90 \times V_{AC}$).

NOTICE

In order to prevent rapid wear, the PMG 500 rectifier is required when utilizing the larger 800 Nm (590 lb-ft) and 1200 Nm (885 lb-ft) twin-rotor brakes. The PMG500 rectifier is wired to "overexcite" the brake during its initial release.



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Push-Hybrid Rectifiers External DC Switching (GPE)

Like the standard NORD brake control rectifiers, NORD's fast acting brake control rectifiers convert AC voltage to DC voltage. The "Fast Acting Brake Rectifiers" are utilized to improve brake performance and are often recommended in order to provide shorter brake release times or to provide faster stopping times.

The fast acting rectifiers are a two-stage "push" design. When power is first applied these rectifiers operate like a full-wave rectifier and then after a relatively short period of time they act like a half-wave rectifier. The GPE type rectifiers start out in full-wave mode when power is first applied and then after approximately 250 ms they switch to half-wave mode.

GPE rectifiers were designed for external control of the brake's DC-switching. GPE rectifiers are primarily used in across-the-line applications where the brake power is supplied by the motor terminals but they may also be used in situations where the brake power is supplied separately to the brake rectifier.

There are two ways to apply the fast acting rectifiers:

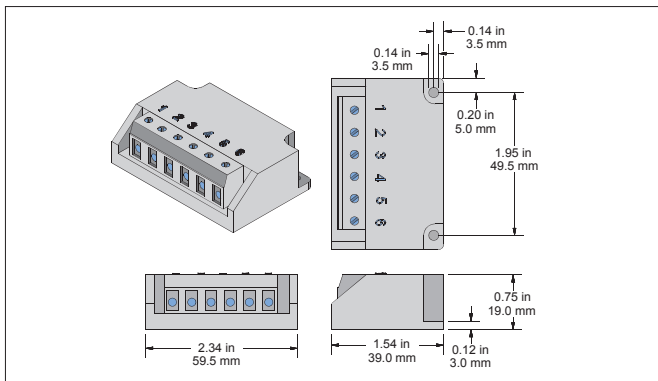
- The first method, known as "Overexcitation," provides fast brake release. The brake coil is selected like a half-wave system (45% of the AC supply voltage).
- The second method, known as "Reduced Power Holding," provides very fast brake stopping. The brake coil is selected like a full-wave system (90% of the AC supply voltage).



IMPORTANT NOTE

If the motor is connected to a frequency inverter, soft start, or is a two-speed motor, then separate AC power must be supplied to the brake rectifier.

GPE Rectifier Dimensions



Ratings & Part Numbers

Model Type	GPE20L	GPE40L
Part Number	19140230	19140240
Protection (electronics)	Coated	Coated
Color	Black	
Input Voltage (V _{AC})	200V-275V	380V-480V
Output Voltage (V _{DC})	(V _{DC} =0.45 x V _{AC}) - As Half-Wave (V _{DC} =0.90 x V _{AC}) - As Full-Wave	
Rated Current @ 40°C	0.7 A	0.7A
Rated Current @ 75°C	0.5 A	0.5A
Temperature Range	-20°C to 75°C	
DC-Switching via	External Contact or IR Relay	

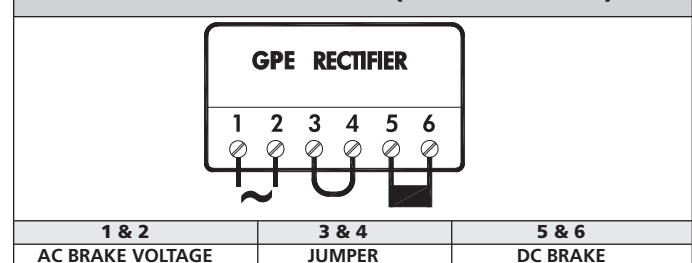
Braking Method

Braking Method	Break Release (Start)	Brake Engage (Stop)	Power Source
40	Standard	Very Fast (Reduced Power Holding)	Motor terminals
30	Fast (Overexcitation)	Standard (AC Switching)	Motor terminals
35	Fast (Overexcitation)	Fast (DC Switching)	Motor terminals

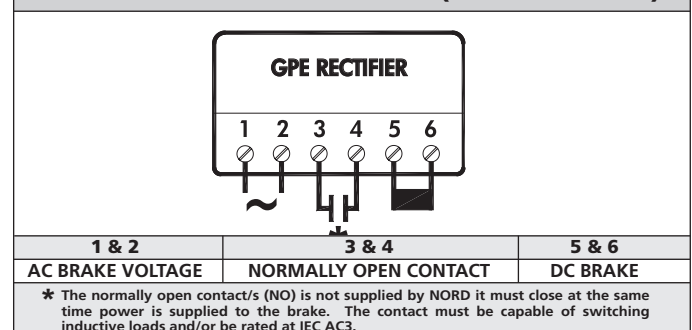
Basic Connection (AC & DC Switching)

The GPE brake system can be connected for standard stopping (AC-Switching), fast stopping (DC-Switching) and very fast stopping (Reduced power holding & DC-Switching). Fast brake release can also be achieved by selecting a different brake coil combination.

STANDARD STOPPING (AC-SWITCHING)



FAST & VERY FAST STOPPING (DC-SWITCHING)

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Push-Hybrid Rectifiers Integrated DC Switching (GPU)

Like the standard NORD brake control rectifiers, NORD's fast acting brake control rectifiers convert AC voltage to DC voltage. The "Fast Acting Brake Rectifiers" are utilized to improve brake performance and are often recommended in order to provide shorter brake release times or to provide faster stopping times.

The fast acting rectifiers are a two-stage "push" design. When power is first applied these rectifiers operate like a full-wave rectifier and then after a relatively short period of time they act like a half-wave rectifier. The GPU rectifiers start out in full-wave mode when power is first applied and then after approximately 250 ms they switch to half-wave mode.

GPU rectifiers were designed for integrated control of the brake's DC-switching and are voltage sensing. GPU rectifiers are primarily used in applications where there is a frequency inverter, soft start, or two-speed motor. Separate AC power must be supplied to the brake rectifier.

There are two ways to apply the fast acting rectifiers:

- The first method, known as "Overexcitation," provides fast brake release. The brake coil is selected like a half-wave system (45% of the AC supply voltage).
- The second method, known as "Reduced Power Holding," provides very fast brake stopping. The brake coil is selected like a full-wave system (90% of the AC supply voltage).



IMPORTANT NOTE

The GPU rectifier may also be utilized for across-the-line applications; however it must always be powered separate from the motor and have its own pair of contactors or starters. It is unadvisable to use the motor terminal block to supply the GPU rectifier's AC power due to the motor's slow energy dissipation when switched off.



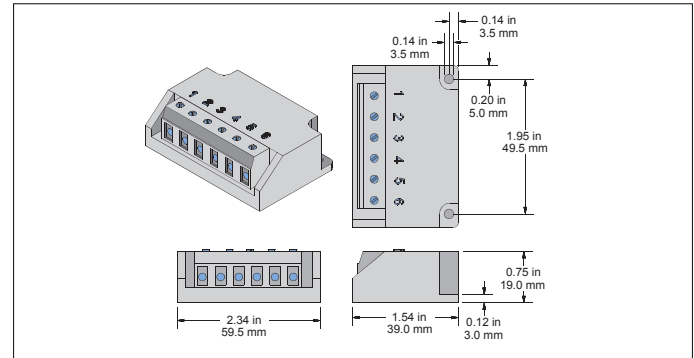
IMPORTANT NOTE

If the motor is connected to a frequency inverter, soft start, or is a two-speed motor, then separate AC power must be supplied to the brake rectifier.

Braking Method

Braking Method	Break Release (Start)	Brake Engage (Stop)	Power Source
55	Standard	Very Fast (Reduced Power Holding)	Separate power
45	Fast (Overexcitation)	Standard (AC Switching)	Separate power
50	Fast (Overexcitation)	Fast (DC Switching)	Separate power

GPU Rectifier Dimensions



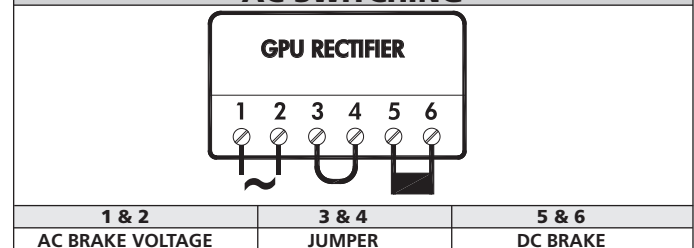
Ratings & Part Numbers

Model Type	GPU20L	GPU40L
Part Number	19140090	19140170
Protection (electronics)	Coated	Coated
Color	Black	
Input Voltage (V _{AC})	200V-275V	380V-480V
Output Voltage (V _{DC})	(V _{DC} =0.45 x V _{AC}) - As Half-Wave (V _{DC} =0.90 x V _{AC}) - As Full-Wave	
Rated Current @ 40°C	0.7A	0.7A
Rated Current @ 75°C	0.5A	0.5A
Temperature Range	-20°C to 75°C	
DC-Switching via	Internal Activation	

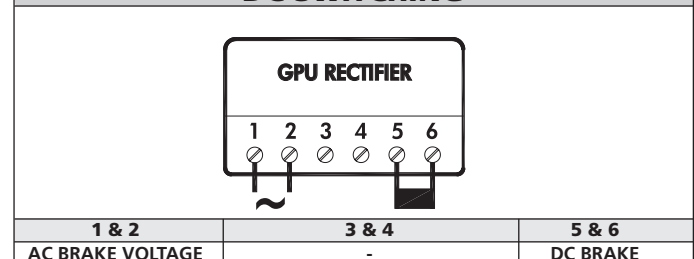
Basic Connection (AC & DC Switching)

The GPU brake system can be connected for standard stopping (AC-Switching), fast stopping (DC-Switching) and very fast stopping (Reduced power holding & DC-Switching). Fast brake release can also be achieved by selecting a different brake coil combination.

STANDARD STOPPING AC-SWITCHING



FAST & VERY FAST STOPPING DC-SWITCHING

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Push-Hybrid Rectifiers External DC Switching (PMG)

Like the standard NORD brake control rectifiers, NORD's fast acting brake control rectifiers convert AC voltage to DC voltage. The "Fast Acting Brake Rectifiers" are utilized to improve brake performance and are often recommended in order to provide shorter brake release times or to provide faster stopping times.

The fast acting rectifiers are a two-stage "push" design. When power is first applied these rectifiers operate like a full-wave rectifier and then after a relatively short period of time they act like a half-wave rectifier. The PMG type rectifiers start out in full-wave mode when power is first applied and then after approximately 250 ms they switch to half-wave mode.

PMG rectifiers were designed for external control of the brake's DC-switching. PMG rectifiers are primarily used in across-the-line applications where the brake power is supplied by the motor terminals, but they may also be used in situations where the brake power is supplied separately from the brake rectifier.

There are two ways to apply the fast acting rectifiers:

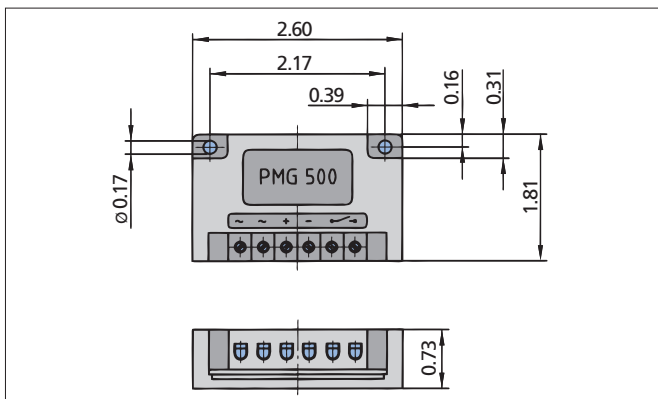
- The first method, known as "Overexcitation," provides fast brake release. The brake coil is selected like a half-wave system (45% of the AC supply voltage).
- The second method, known as "Reduced Power Holding," provides very fast brake stopping. The brake coil is selected like a full-wave system (90% of the AC supply voltage).



IMPORTANT NOTE

If the motor is connected to a frequency inverter, soft start, or is a two-speed motor, then separate AC power must be supplied to the brake rectifier.

PMG Rectifier Dimensions



Ratings & Part Numbers

Model Type	PMG 500
Part Number	19140200
Protection (electronics)	Coated
Color	Black
Input Voltage (V _{AC})	200-500V _{AC} +/- 10%
Output Voltage (V _{DC})	(V _{DC} =0.45 x V _{AC}) - As Half-Wave (V _{DC} =0.90 x V _{AC}) - As Full-Wave
Rated Current @ 40°C	4.0 A
Rated Current @ 75°C	2.8 A
Temperature Range	-15°C to 80°C
DC-Switching via	External Contact

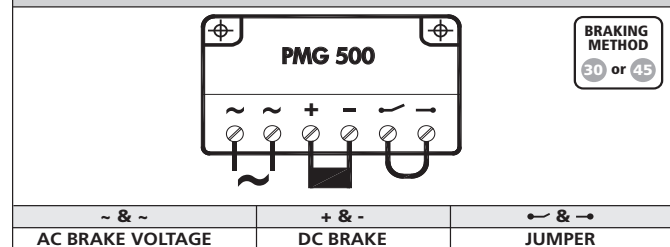
Braking Method

Braking Method	Break Release (Start)	Brake Engage (Stop)	Power Source
40	Standard	Very Fast (Reduced Power Holding)	Motor terminals
30	Fast (Overexcitation)	Standard (AC Switching)	Motor terminals
35	Fast (Overexcitation)	Fast (DC Switching)	Motor terminals
55	Standard	Very Fast (Reduced Power Holding)	Separate power
45	Fast (Overexcitation)	Standard (AC Switching)	Separate power
50	Fast (Overexcitation)	Fast (DC Switching)	Separate power

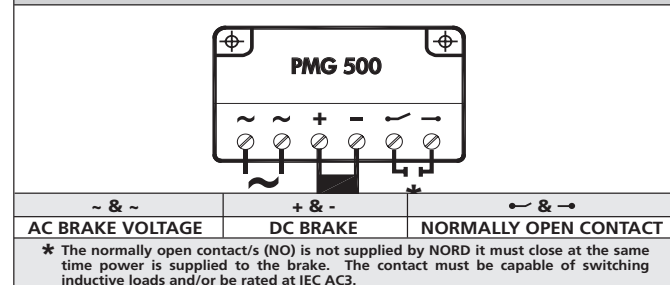
Basic Connection (AC & DC Switching)

The PMG brake system can be connected for standard stopping (AC-Switching), fast stopping (DC-Switching) and very fast stopping (Reduced power holding & DC-Switching). Fast brake release can also be achieved by selecting a different brake coil combination.

STANDARD STOPPING (AC-SWITCHING)



FAST & VERY FAST STOPPING (DC-SWITCHING)

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Brake Times & Electrical Selection

Brake timing performance is critical in selecting the optimal brake system. NORD brakes can provide exceptional performance in terms of the release (start) times and engagement (stop) times. Use the following guidelines in order to select the correct brake control components and connections.

- 1) Determine if the brake needs to be wired directly from the motor terminal block or powered by a separate source.
 - If you are using a frequency inverter, soft-start or a two speed motor you will need to supply the rectifier from a separate power source.
 - If the motor is powered direct across-the-line the rectifier power can be supplied from the motor's terminal block.
- 2) What type of performance do I need?
 - Is the standard brake performance OK?
 - Is a higher performance required for fast brake release or very fast brake stopping?
- 3) Determine the brake supply voltage and check the rectifier compatibility using the table on the page 6.

Selection Suggestions

When Fast or Very Fast Stopping is Recommended

Any applications that require quick stops and positive action at stand-still

Recommended Applications

- conveyors and inclined conveyors
- hoists and lifts
- bulk material handling equipment (bucket elevators, idler conveyor's).



WARNING

Hoisting (lifting/lowering) applications - must have the brake wired for fast response (DC-switching) Hoisting (lifting/lowering) applications must have the brake wired for fast response to protect against injury or damage to the equipment.

When Fast-Release is Recommended (Overexcitation)

Any application that is very high-cycling with frequent starts and stops. These applications require the brake to release very-quickly in order to avoid excessive heat build-up in the AC motor and brake coil.

Recommended Applications

- Index conveyors
- Diverters

Power Source	Brake Release (start)	Brake engagement (stop)	Braking Method *	Rectifier
Motor Terminal Block	Standard	Very Fast (Reduced power holding)	40	GPE or PMG 500
	Fast (Overexcitation)	Standard (AC switching)	30	GPE or PMG 500
	Fast (Overexcitation)	Fast (DC switching)	35	GPE or PMG 500
Seperate Power Source	Standard	Very Fast (Reduced power holding)	55	GPU or PMG 500
	Fast (Overexcitation)	Standard (AC switching)	45	GPU or PMG 500
	Fast (Overexcitation)	Fast (DC switching)	50	GPU or PMG 500

* Braking methods referenced in connection diagrams on pages 7-11.



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Rectifier Supply Voltage (VAC)	Brake Coil Voltage (VDC)	Braking Method	Rectifier Type	Rectifier P/N	BRE 5	BRE 10	BRE 20	BRE 40	BRE 60	BRE 100	BRE 150	BRE 250	BRE 400	BRE 800	BRE 1200
208 (200-208)	105	30	GPE20L	19140230	X	X	X	X							
	105	30	PMG500	19140200					X	X	X	X	X	X	X
	105	35	GPE20L	19140230	X	X	X	X							
	105	35	PMG500	19140200					X	X	X	X	X	X	X
	180	40	GPE20L	19140230	X	X	X	X	X	X	X				
	180	40	PMG500	19140200								X	X	X	X
	105	45	GPU20L	19140090	X	X	X	X							
	105	45	PMG500	19140200					X	X	X	X	X	X	X
	105	50	GPU20L	19140090	X	X	X	X							
	105	50	PMG500	19140200					X	X	X	X	X	X	X
	180	55	GPU20L	19140090	X	X	X	X	X	X	X				
230 (220-240)	105	30	GPE20L	19140230	X	X	X	X							
	105	30	PMG500	19140200					X	X	X	X	X	X	X
	105	35	GPE20L	19140230	X	X	X	X	X	X	X				
	105	35	PMG500	19140200								X	X	X	X
	205	40	GPE20L	19140230	X	X	X	X	X	X	X				
	205	40	PMG500	19140200								X	X	X	X
	105	45	GPU20L	19140090	X	X	X	X							
	105	45	PMG500	19140200					X	X	X	X	X	X	X
	105	50	GPU20L	19140090	X	X	X	X							
	105	50	PMG500	19140200					X	X	X	X	X	X	X
	205	55	GPU20L	19140090	X	X	X	X	X	X	X				
	205	55	PMG500	19140200								X	X	X	X
332	180	30	GPE40L	19140240	X	X	X	X	X	X	X				
	180	30	PMG500	19140200								X	X	X	X
	180	35	GPE40L	19140240	X	X	X	X	X	X	X				
	180	35	PMG500	19140200								X	X	X	X
	180	45	GPU40L	19140170	X	X	X	X	X	X	X				
	180	50	GPU40L	19140170	X	X	X	X	X	X	X				
400 (380-415)	180	30	GPE40L	19140240	X	X	X	X	X	X	X				
	180	30	PMG500	19140200								X	X	X	X
	180	35	GPE40L	19140240	X	X	X	X	X	X	X				
	180	35	PMG500	19140200								X	X	X	X
	180	45	GPU20L	19140090	X	X	X	X	X	X	X				
	180	45	PMG500	19140200								X	X	X	X
	180	50	GPU20L	19140090	X	X	X	X	X	X	X				
	180	50	PMG500	19140200								X	X	X	X
460 (440-480)	205	30	GPE40L	19140240	X	X	X	X	X	X	X				
	205	30	PMG500	19140200								X	X	X	X
	205	35	GPE40L	19140240	X	X	X	X	X	X	X				
	205	35	PMG500	19140200								X	X	X	X
	205	45	GPU40L	19140170	X	X	X	X	X	X	X				
	205	45	PMG500	19140200								X	X	X	X
	205	50	GPU40L	19140170	X	X	X	X	X	X	X				
	205	50	PMG500	19140200								X	X	X	X

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* The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.

= Braking Method

NORD Gear Limited

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DRIVESYSTEMS

Courtesy of:

SCREW CONVEYOR PARTS



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RETAIN FOR FUTURE USE

<div>GP103C</div> <div>POWERED FROM MOTOR TERMINAL BLOCK STANDARD RELEASE VERY FAST STOPPING (DC-SWITCHING + REDUCED POWER HOLDING)</div> <div>40</div>	<div>GP103D</div> <div>POWERED FROM MOTOR TERMINAL BLOCK STANDARD RELEASE VERY FAST STOPPING (DC-SWITCHING + REDUCED POWER HOLDING)</div> <div>40</div>	<div>GP104A</div> <div>SEPERATE POWER SOURCE FAST-RELEASE (OVER EXCITATION) NORMAL STOPPING (AC-SWITCHING)</div> <div>45</div>	<div>GP104B</div> <div>SEPERATE POWER SOURCE FAST-RELEASE (OVER EXCITATION) NORMAL STOPPING (AC-SWITCHING)</div> <div>45</div>																																																												
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<div>GP106A</div> <div>SEPERATE POWER SOURCE STANDARD RELEASE VERY FAST STOPPING (DC-SWITCHING + REDUCED POWER HOLDING)</div> <div>55</div>	<div>GP106B</div> <div>SEPERATE POWER SOURCE STANDARD RELEASE VERY FAST STOPPING (DC-SWITCHING + REDUCED POWER HOLDING)</div> <div>55</div>	<div>GP106C</div> <div>SEPERATE POWER SOURCE STANDARD RELEASE VERY FAST STOPPING (DC-SWITCHING + REDUCED POWER HOLDING)</div> <div>55</div>	<div>GP106D</div> <div>SEPERATE POWER SOURCE STANDARD RELEASE VERY FAST STOPPING (DC-SWITCHING + REDUCED POWER HOLDING)</div> <div>55</div>																																								
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<div>PMG102D</div> <div>POWERED FROM MOTOR TERMINAL BLOCK</div> <div>FAST-RELEASE (OVER EXCITATION)</div> <div>FAST STOPPING (DC-SWITCHING)</div> <div>35</div>	<div>PMG102E</div> <div>POWERED FROM MOTOR TERMINAL BLOCK</div> <div>FAST-RELEASE (OVER EXCITATION)</div> <div>FAST STOPPING (DC-SWITCHING)</div> <div>35</div>	<div>PMG103A</div> <div>POWERED FROM MOTOR TERMINAL BLOCK</div> <div>STANDARD RELEASE</div> <div>VERY FAST STOPPING</div> <div>(DC-SWITCHING + REDUCED POWER HOLDING)</div> <div>40</div>	<div>PMG103B</div> <div>POWERED FROM MOTOR TERMINAL BLOCK</div> <div>STANDARD RELEASE</div> <div>VERY FAST STOPPING</div> <div>(DC-SWITCHING + REDUCED POWER HOLDING)</div> <div>40</div>																																																							
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<div>PMG105B</div> <div>50</div> <div>SEPERATE POWER SOURCE FAST-RELEASE (OVER EXCITATION) FAST STOPPING (DC-SWITCHING)</div>	<div>PMG105C</div> <div>50</div> <div>SEPERATE POWER SOURCE FAST-RELEASE (OVER EXCITATION) FAST STOPPING (DC-SWITCHING)</div>	<div>PMG105D</div> <div>50</div> <div>SEPERATE POWER SOURCE FAST-RELEASE (OVER EXCITATION) FAST STOPPING (DC-SWITCHING)</div>	<div>PMG105E</div> <div>50</div> <div>SEPERATE POWER SOURCE FAST-RELEASE (OVER EXCITATION) FAST STOPPING (DC-SWITCHING)</div>																																																							
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Current Sensing Relay (IR)

[M Modify](#)

The current sensing relay, is used to achieve a fast brake engagement (stopping) without the use of external control equipment or additional wiring. The relay is mounted directly on the conduit box, and is powered from the motor's terminal block. The power leads for the relay replace one of the brass jumper bars on the terminal block of any single speed motor. The switch leads are connected to terminals 3 and 4 of the rectifier. When the power to the motor is shut off, the IR relay opens the brake circuit on the DC side which allows the brake to de-magnetize quickly.



IMPORTANT NOTE

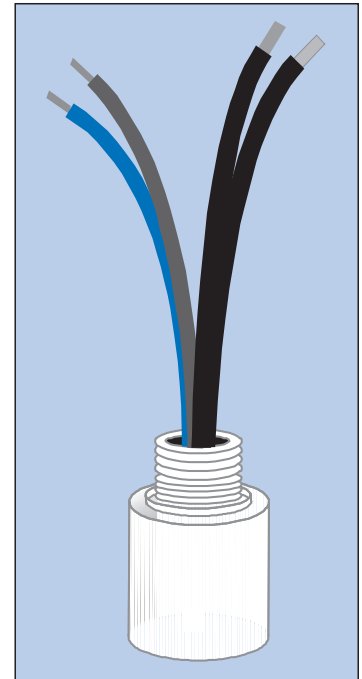
Current Sensing Relay Requirements

- Brake must be powered from the motor's terminal block (not separately powered)
- Motor must be single speed and should not be powered by a frequency inverter or soft starter.

Part number	18556010	18556020
Reissmann Part Number	RSR 25-46	RSR 50-46
Primary Current Rating (black/white wires)	25A _{AC}	50 A _{AC}
Maximum Primary Current (black/white wires)	75A _{AC}	150 A _{AC}
Maximum Time at Maximum Primary Current	0.2 s	0.2 s
Maximum Cycles per hour	500	500
Switching Voltage	42 - 550V _{DC}	42 - 550V _{DC}
Switching Current (red/blue wires)	1.0 A _{DC}	1.0 A _{DC}
Holding Current ❶	< 0.7 A _{AC}	< 0.7 A _{AC}
Delay Time ❷	18 ms	18 ms
Enclosure Rating	IP65	IP65
Ambient Temp.	- 25 to 90 °C (- 40 to 167 °F) - 25 to 90 °C (- 40 to 167 °F)	

❶ Relative to the distortion created by the magnetising current of the motor.

❷ Additional setting time delay added to the DC-setting time of the brake circuit.



IR Relay Wiring Diagram

	Rectifier			IR-Relay Wires to Rectifier	
	Model Type	Part Number	Design	Red	Blue
	GVE20L	1914000	Full-wave	4	3
	GHE40L	19141010	Half-wave	4	3
	GHE50L	19141020	Half-wave	4	3
	GPE20L	19140230	Push-hybrid	4	3
	GPE40L	19140240	Push-hybrid	4	3
	GUE40V	19140300	Dual Wave	4	3



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IR Relay Selection Table for 4-Pole Motors

Type	Efficiency	230/460 V 60 Hz	460V D 60 Hz	332/575V 60 Hz	208/360 V 60 Hz	230/400V 50 Hz	400/690V 50 Hz
63S/4	SE (IE1)	25A	-	25A	25A	25A	-
63SP/4	PE (IE3)	25A	-	25A	-	25A	-
63L/4	SE (IE1)	25A	-	25A	25A	25A	-
63LP/4	PE (IE3)	25A	-	25A	-	25A	-
71S/4	SE (IE1)	25A	-	25A	25A	25A	-
71SP/4	PE (IE3)	25A	-	25A	-	25A	-
71L/4	SE (IE1)	25A	-	25A	25A	25A	-
71LP/4	PE (IE3)	25A	-	25A	-	25A	-
80S/4	SE (IE1)	25A	-	25A	25A	25A	-
80SH/4	EE (IE2)	-	-	-	-	25A	-
80SP/4	PE (IE3)	25A	-	25A	-	25A	-
80L/4	SE (IE1)	25A	-	25A	25A	25A	-
80LH/4	EE (IE2)	25A	-	25A	-	25A	-
80LP/4	PE (IE3)	25A	-	25A	-	25A	-
90S/4	SE (IE1)	25A	-	25A	25A	25A	-
90SH/4	EE (IE2)	25A	-	25A	-	25A	-
90SP/4	PE (IE3)	25A	-	25A	-	25A	-
90L/4	SE (IE1)	25A	-	25A	25A	25A	-
90LH/4	EE (IE2)	25A	-	25A	-	25A	-
90LP/4	PE (IE3)	25A	-	25A	-	25A	-
100L/4	SE (IE1)	25A	-	25A	25A	-	25A
100LH/4	EE (IE2)	25A	-	25A	-	-	25A
100LP/4	PE (IE3)	25A	-	25A	-	-	25A
100LA/4	SE (IE1)	25A	-	25A	25A	-	25A
100AH/4	EE (IE2)	-	-	-	-	-	25A
100AP/4	PE (IE3)	-	-	-	-	-	25A
112M/4	SE (IE1)	-	-	-	-	-	25A
112MH/4	EE (IE2)	25A	-	25A	-	-	25A
112MP/4	PE (IE3)	25A	-	25A	-	-	25A
132S/4	SE (IE1)	25A	-	25A	25A	-	25A
132SH/4	EE (IE2)	25A	-	25A	-	-	25A
132SP/4	PE (IE3)	25A	-	25A	-	-	25A
132M/4	SE (IE1)	25A	-	25A	25A	-	25A
132MH/4	EE (IE2)	25A	-	25A	-	-	25A
132LH/4	EE (IE2)	-	-	-	-	-	25A
132MA/4	SE (IE1)	-	-	-	-	-	25A
132MP/4	PE (IE3)	25A	-	25A	-	-	25A

25 A (P/N 18556010) – IR Relay is rated for 25 Amp motor phase current.

50 A (P/N 18556020) – IR Relay is rated for 50 Amp motor phase current.

N/A – IR Relay option is not available.

*Observe the efficiency law requirements for the country that the motor will be utilized in.***NORD Gear Limited**

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IR Relay Selection Table for 4-Pole Motors Ctd.

Type	Efficiency	230/460 V 60 Hz	460V D 60 Hz	332/575V 60 Hz	208/360 V 60 Hz	230/400V 50 Hz	400/690V 50 Hz
160SH/4	EE (IE2)	-	-	-	-	-	25A
160SP/4	PE (IE3)	-	-	-	-	-	25A
160M/4	SE (IE1)	25A	-	25A	-	-	25A
160MH/4	EE (IE2)	25A	-	25A	-	-	25A
160MP/4	PE (IE3)	25A	-	25A	-	-	25A
160L/4	SE (IE1)	25A	-	25A	-	-	25A
160LH/4	EE (IE2)	25A	-	25A	-	-	50 A
160LP/4	PE (IE3)	25A	-	25A	-	-	50 A
180MX/4	SE (IE1)	50 A	-	25A	-	-	25A
180MH/4	EE (IE2)	50 A	-	25A	-	-	50 A
180MP/4	PE (IE3)	50 A	-	25A	-	-	50 A
180LX/4	SE (IE1)	50 A	-	50 A	-	-	25A
180LH/4	EE (IE2)	50 A	-	50 A	-	-	50 A
180LP/4	PE (IE3)	50 A	-	50 A	-	-	50 A
200LX/4	SE (IE1)	50 A	-	50 A	-	-	50 A
200XH/4	EE (IE2)	N/A	-	50 A	-	-	N/A
225RP/4	PE (IE3)	-	50 A	50 A	-	-	N/A
225SH/4	EE (IE2)	-	50 A	50 A	-	-	N/A
225SP/4	PE (IE3)	-	50 A	50 A	-	-	N/A
225MH/4	EE (IE2)	-	50 A	N/A	-	-	N/A
225MP/4	PE (IE3)	-	50 A	N/A	-	-	N/A
250WH/4	EE (IE2)	-	N/A	N/A	-	-	N/A
250WP/4	PE (IE3)	-	50 A	N/A	-	-	N/A
280SH/4	EE (IE2)	-	N/A	N/A	-	-	N/A
280SP/4	PE (IE3)	-	N/A	N/A	-	-	N/A
280MH/4	EE (IE2)	-	N/A	N/A	-	-	N/A
280MP/4	PE (IE3)	-	N/A	N/A	-	-	N/A
315SH/4	EE (IE2)	-	N/A	N/A	-	-	N/A
315SP/4	PE (IE3)	-	N/A	N/A	-	-	N/A
315MH/4	EE (IE2)	-	N/A	N/A	-	-	N/A
315MP/4	PE (IE3)	-	N/A	N/A	-	-	N/A
315RH/4	EE (IE2)	-	N/A	N/A	-	-	N/A
315RP/4	PE (IE3)	-	N/A	N/A	-	-	N/A
315LH/4	EE (IE2)	-	N/A	N/A	-	-	N/A
315LP/4	PE (IE3)	-	N/A	N/A	-	-	N/A

25 A (P/N 18556010) – IR Relay is rated for 25 Amp motor phase current.

50 A (P/N 18556020) – IR Relay is rated for 50 Amp motor phase current.

N/A – IR Relay option is not available.

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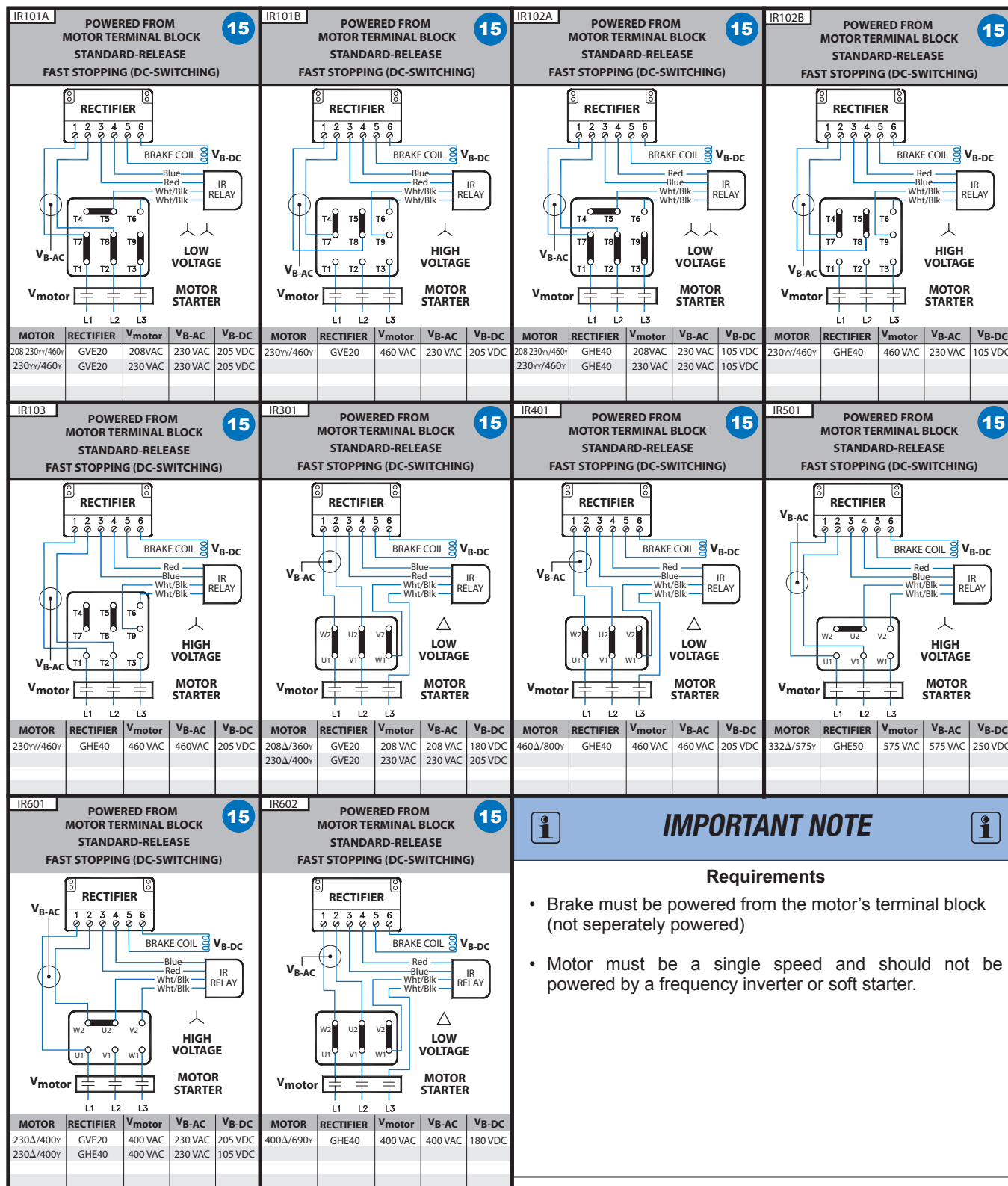
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IR Relay Typical Connection Diagrams



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U35200 - 5 of 5

IR Relay with GUE40V Dual Wave Rectifier

IR701A	POWERED FROM MOTOR TERMINAL BLOCK STANDARD-RELEASE FAST STOPPING (DC-SWITCHING)	15	IR701B	POWERED FROM MOTOR TERMINAL BLOCK STANDARD-RELEASE FAST STOPPING (DC-SWITCHING)	15	IR702A	POWERED FROM MOTOR TERMINAL BLOCK STANDARD-RELEASE FAST STOPPING (DC-SWITCHING)	15	IR702B	POWERED FROM MOTOR TERMINAL BLOCK STANDARD-RELEASE FAST STOPPING (DC-SWITCHING)	15								
MOTOR	RECTIFIER	V _{motor}	V _{B-AC}	V _{B-DC}	MOTOR	RECTIFIER	V _{motor}	V _{B-AC}	V _{B-DC}	MOTOR	RECTIFIER	V _{motor}	V _{B-AC}	V _{B-DC}	MOTOR	RECTIFIER	V _{motor}	V _{B-AC}	V _{B-DC}
208-230m/460v	GUE40V	208 VAC	230 VAC	205 VDC	208-230m/460v	GUE40V	460 VAC	460 VAC	205 VDC	208Δ/360v	GUE40V	208 VAC	208 VAC	180 VDC	230Δ/400v	GUE40V	400 VAC	400 VAC	180 VDC
230m/460v	GUE40V	230 VAC	230 VAC	205 VDC	230m/460v	GUE40V	460 VAC	460 VAC	205 VDC	230Δ/400v	GUE40V	230 VAC	230 VAC	205 VDC					

GPE Rectifier for External DC-Switching with IR Relay

IR151A	POWERED FROM MOTOR TERMINAL BLOCK FAST RELEASE (OVER EXCITATION) FAST STOPPING (DC-SWITCHING)					35	IR151B	POWERED FROM MOTOR TERMINAL BLOCK STANDARD-RELEASE FAST STOPPING (DC-SWITCHING)					35	IR152A	POWERED FROM MOTOR TERMINAL BLOCK STANDARD-RELEASE VERY FAST STOPPING (REDUCED POWER HOLD)					40	IR152B	POWERED FROM MOTOR TERMINAL BLOCK STANDARD-RELEASE VERY FAST STOPPING (REDUCED POWER HOLD)					40		
MOTOR	RECTIFIER	V _{motor}	V _{B-AC}	V _{B-DC}		MOTOR	RECTIFIER	V _{motor}	V _{B-AC}	V _{B-DC}		MOTOR	RECTIFIER	V _{motor}	V _{B-AC}	V _{B-DC}		MOTOR	RECTIFIER	V _{motor}	V _{B-AC}	V _{B-DC}		MOTOR	RECTIFIER	V _{motor}	V _{B-AC}	V _{B-DC}	
230vY/460v	GPE20L	230 VAC	230 VAC	105 VDC		230vY/460v	GPE20L	460 VAC	230 VAC	105 VDC		230vY/460v	GPE20L	230 VAC	230 VAC	205 VDC		230vY/460v	GPE20L	460 VAC	230 VAC	205 VDC		230vY/460v	GPE20L	460 VAC	230 VAC	205 VDC	



IMPORTANT NOTE



Requirements

- Brake must be powered from the motor's terminal block (not separately powered)
- Motor must be a single speed and should not be powered by a frequency inverter or soft starter.



= Braking Method

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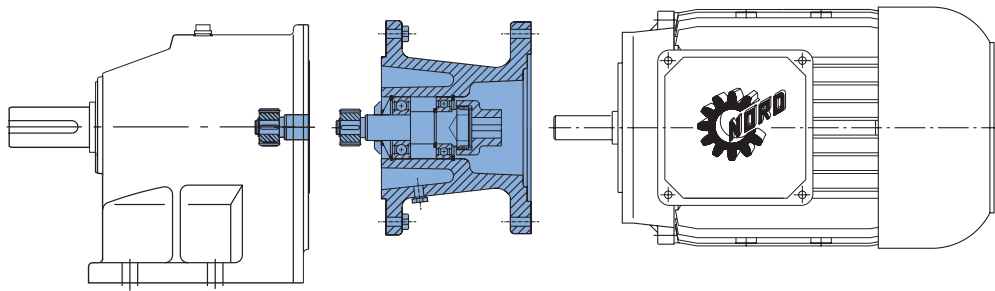
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WARNING

While working on the gear drive system, make sure the power from the prime mover is isolated or secured on "lock-out" to prevent accidental start-up and to safeguard against injury!

NEMA/ IEC Motor Adapters

Motor adapters allow for easy installation and removal of industry standard motors. Motor adapters consist of a coupling and an adapter housing that connects the motor to the gear reducer.

NORD Gear supplies a coupling that is to be mounted on the motor shaft. It is important that the coupling is properly positioned.

- For NEMA Input Adapters, follow the Motor Installation Instructions on pages 3-5.
- For IEC Input Adapters, the supplied coupling will mount directly against the motor shaft shoulder. No locating measurements need to be taken.



IMPORTANT NOTE

Some of the larger IEC inputs will have a coupling spacer included to help locate the coupling. Slide the spacer against the motor shaft shoulder, slide the coupling against the spacer and tighten set screw(s).



IMPORTANT NOTE

For the larger motor adapters (IEC160 / N250TC and larger), an Automatic Lubricator may be supplied. This will need to be activated at the time of startup. For operation and activation instructions, refer to user manual U45200. Motor adapter option AI and AN do not utilize an Automatic Lubricator and are lubricated for life.

NEMA/IEC Motor Weight Limits

When mounting a motor to a NORD NEMA C-face motor adapter it is important to consider the motor's weight. Following is a table that includes the maximum motor weight the NEMA adapter can support. If the motor exceeds the listed weight it must be externally supported. When a C-face mounted motor is externally supported care must be taken to ensure that the support system does not impose additional pre-loads on the NEMA motor adapter.

NEMA Motor Weight Limit

Motor FRAME	56C	140TC	180TC	210TC	250TC	280TC
Max Weight [lb]	66	110	176	221	441	551
Motor FRAME	320TC	360TC	400TC			
Max Weight [lb]	772	1544 ⁴⁾	1544			

IEC Motor Weight Limit

Motor FRAME	63	71	80	90	100	112	132
Max Weight [kg]	25	30	50 ¹⁾	50	80 ²⁾	80	100
Motor FRAME	160	180	200	225	250	280	315
Max Weight [kg]	250 ³⁾	250	350	500	1000	1000	1500

1) ≤ 40 kg SK 920072.1, SK 92072.1, SK 071.1, SK 0182.1

2) ≤ 60 kg SK 1382.1, SK 92372.1, SK 12063, SK 372.1, SK 371.1

3) ≤ 200 kg SK 42, SK 4282, SK 9042.1, SK 42125

4) ≤ 1103 lb SK 62, SK 72, SK 73, SK 83, SK 93, SK 9072.1, SK 6282, SK 7282, SK 7382, SK 8382, SK 9392

Couplings

Couplings are made with tough abrasion resistant materials, which resist most chemicals and petroleum products. They are electrically isolated (prevent metal to metal contact) and require no lubrication or maintenance. Depending upon the size of the input, NORD provides either a gear or a jawtype coupling.

NORD supplies three different types of couplings depending on the size of input: "J" style, "M" style and "Jaw" style coupling. Following are instructions on how to properly mount each type of coupling onto the motor.



DRIVESYSTEMS



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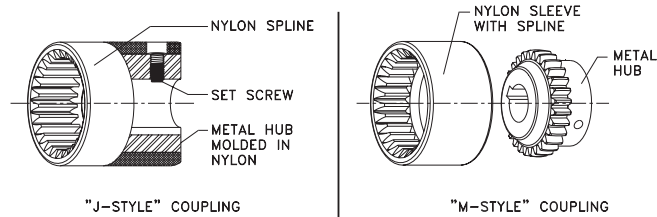
Couplings for the NEMA and IEC Adapters

Depending on the size of the input adapter to the gearbox, NORD Gear supplies two styles of couplings - BoWex® (gear tooth) and Rotex® (jaw) couplings.

BoWex® Couplings

NORD motor adapter input shafts have a machined spline on the end. NORD incorporates two styles of BoWex® couplings, the "J" and "M" styles. The "J" style is a one-piece coupling with a metal hub and nylon spline. The "M" style is a two-piece coupling - the metal hub and a nylon sleeve. Nylon and steel components allow them to operate in high ambient temperatures without lubrication or maintenance.

- Nylon sleeves resist dirt, moisture, most chemicals and petroleum products
- No lubrication required
- Operating Conditions: -22°F - 212°F (-30°C - 100°C)
- Higher temperature coupling sleeve available up to 250°F (120°C)
- Special bore available



BoWex® Couplings Mechanical Ratings "J" Style (NEMA & IEC)

Coupling Type	Rated Torque		Input Adapter Sizes	Bore Size
	Cont.	Peak		
BoWex® J14	44.3 lb-in 5 N-m	88.5 lb-in 10 N-m	N56C IEC63, IEC71	5/8" 11mm, 14mm
BoWex® J24	106 lb-in 12 N-m	212 lb-in 24 N-m	N56C, N140TC IEC80, IEC90	5/8", 7/8" 19mm, 24mm
BoWex® J28	398 lb-in 45 N-m	1,195 lb-in 135 N-m	N180TC IEC100, IEC112	1-1/8" 28mm

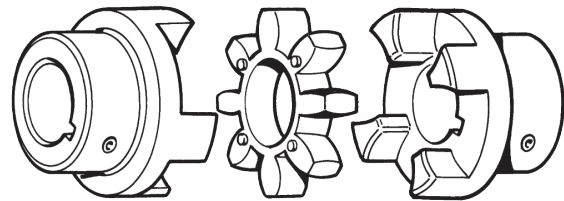
BoWex® Couplings Mechanical Ratings "M" Style (NEMA & IEC)

Coupling Type	Rated Torque		Input Adapter Sizes	Bore Size
	Cont.	Peak		
BoWex® M38	708 lb-in 80 N-m	2,124 lb-in 240 N-m	N180TC, N210TC IEC132	1-1/8", 1-3/8" 38 mm
BoWex® M42	885 lb-in 100 N-m	2,655 lb-in 300 N-m	N250TC IEC160	1-5/8" 42 mm
BoWex® M48	1,239 lb-in 140 N-m	3,717 lb-in 420 N-m	N280TC IEC180	1-7/8" 48 mm

Rotex® Couplings

The cast iron jaw type couplings have an integral urethane "spider" that provides smooth transmission of the motor torque. A set screw on the coupling prohibits axial movement along the motor shaft.

- Excellent shock and vibration dampening
- Excellent resistance to oils and most chemicals
- No metal-to-metal contact
- Operating Conditions: -22°F - 195°F (-30°C - 90°C)
- Higher temperature material (Hytrel) spider available up to 230°F (110°C)
- Low temperature materials available upon request
- Special bores available



Rotex® Couplings Mechanical Ratings "R" Style (NEMA & IEC)

Coupling Type	Rated Torque		Input Adapter Sizes	Bore Size
	Cont.	Peak		
Rotex® R42	3,983 lb-in 450 N-m	7,966 lb-in 900 N-m	AN250TC	1-5/8"
Rotex® R48	4,647 lb-in 525 N-m	9,294 lb-in 1,050 N-m	AN280TC AI160, AI180	1-7/8" 42, 42 mm
Rotex® R55	6,063 lb-in 685 N-m	12,126 lb-in 1,370 N-m	AN320TC AI200	2-1/8" 55 mm
Rotex® R65	8,319 lb-in 940 N-m	12,125 lb-in 1,880 N-m	N320TC, AN360TC ¹⁾ IEC200, AI200, IEC225	2-1/8", 2-3/8" 55, 55, 60mm
Rotex® R75	16,992 lb-in 1,920 N-m	33,954 lb-in 3,840 N-m	AN360TC ²⁾ , AN400TC AI250, AI280	2-3/8", 2-7/8" 70, 80 mm
Rotex® R90	31,860 lb-in 3,600 N-m	63,720 lb-in 7,200 N-m	N360TC IEC250, IEC280, IEC315, AI315	2-3/8" 70, 80, 85, 85 mm

1) AN360TC with R350 flange

2) AN360TC with R450 flange

Couplings for Servo Adapters

NORD Gear supplies Rotex® (jaw) couplings for SERVO adapter connections.

Rotex® Couplings Mechanical Ratings (Servo Adapter)

Coupling Type	Rated Torque		Input Adapter Sizes	Reducer Input Flange	Bore Size
	Cont.	Peak			
Rotex® R19 GS	150 lb-in 17 Nm	301 lb-in 34 Nm	-SEP100, -SEK100	160S	19 mm
Rotex® R24 GS	531 lb-in 60 Nm	1062 lb-in 120 Nm	-SEP130, -SEK130	160S, 250S	24 mm
Rotex® R28 GS	1416 lb-in 160 Nm	2832 lb-in 320 Nm	-SEP165, -SEK165, -SEP215, -SEK215	160S, 250S 250S	32 mm 38 mm
			-SEP215, -SEK215	300S	38 mm
Rotex® R48 GS	4647 lb-in 525 Nm	9293 lb-in 1050 Nm	-SEP300, -SEK300	300S	48 mm
			-SEP300, -SEK300	350	

SEP adapter couplings are for keyed motor shafts.

SEK adapter couplings are clamping style for shafts without key.

Alternate bores upon request.

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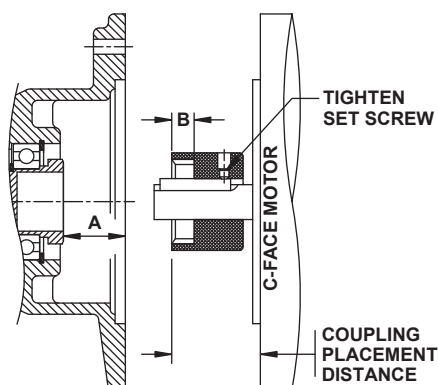
DRIVESYSTEMS



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"J" Style Coupling NEMA C-face Motor Installation

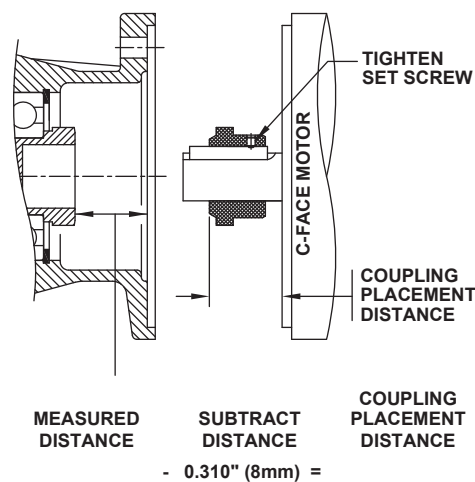
1. Measure the distance from the face of the input adapter to the face of the splined shaft and record that measurement as "A" in the equation below.
2. Measure depth of coupling engagement zone and record the measurement as "B" in the equation below.
3. Add "A" + "B" and subtract 0.08" (~2mm) from the distance. This needs to be done so that the coupling will not be preloaded after installation!
4. Use that measurement to locate the coupling from the face of the motor onto the shaft.
5. Once in place, tighten the set screw to lock the coupling in place. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.
6. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.



MEASURED DISTANCES		SUBTRACT DISTANCE		COUPLING PLACEMENT DISTANCE
A + B		- 0.080" (2mm)	=	
_____				_____

"M" Style Coupling NEMA C-face Motor Installation

1. Measure the distance from the face of the input adapter to the face of the splined shaft & record that measurement.
2. Subtract 0.31" (~8mm) from the distance. This needs to be done so that the coupling will not be preloaded after installation!
3. Use that measurement to locate the coupling from the face of the motor onto the shaft.
4. Once in place, tighten the set screw to lock the coupling in place. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.
5. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.



MEASURED DISTANCE		SUBTRACT DISTANCE		COUPLING PLACEMENT DISTANCE
		- 0.310" (8mm)	=	
_____				_____



DRIVESYSTEMS



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"Jaw" Style Coupling NEMA C-face Installation for Type N Adapters and Servo Adapters

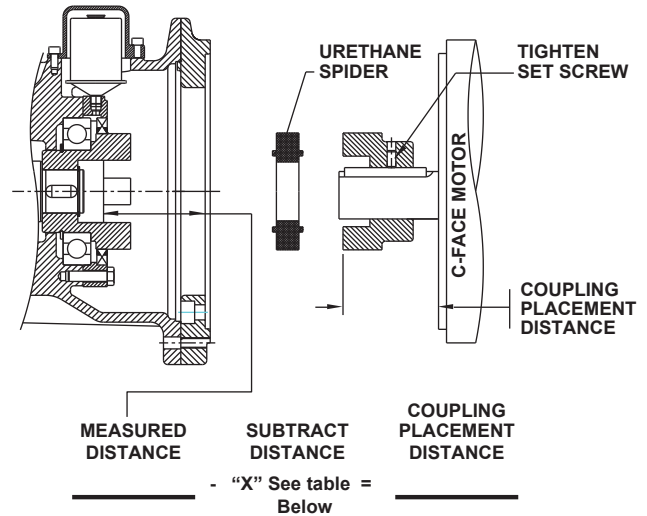
1. Measure the distance from the face of the input adapter to the face of the coupling as shown and record that measurement.
2. Subtract the "X" dimension from the measured distance. This needs to be done so that the coupling will not be preloaded after installation!
3. Use that measurement to locate the coupling from the face of the motor onto the shaft.
4. The metal portion of the coupling should be heated up prior to assembly, generally 250°F to 300°F (120°C to 150°C).



IMPORTANT NOTE

DO NOT HEAT THE URETHANE SPIDER.

5. Once in place, tighten the setscrew to lock coupling in place. Let the coupling cool down before placing the spider into the jaws. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.
6. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.



Coupling Size	"X" (Subtract this value from measured distance)
R14	0.06" (1.5 mm)
R19 & R24	0.08" (2.0 mm)
R28	0.10" (2.5 mm)
R38 & 42	0.12" (3.0 mm)
R48	0.14" (3.5 mm)
R55	0.16" (4.0 mm)
R65	0.18" (4.5 mm)
R75	0.20" (5.0 mm)
R90	0.22" (5.5 mm)



DRIVESYSTEMS



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"Jaw" Style Coupling NEMA C-face Installation for Type AN Adapters

1. Remove the motor shaft's key and replace with the key supplied with the adapter. Reference Motor Parallel Keys table below.



IMPORTANT NOTE

NORD SUPPLIES A SPECIAL MOTOR SHAFT KEY
DO NOT USE THE KEY SUPPLIED WITH THE MOTOR!

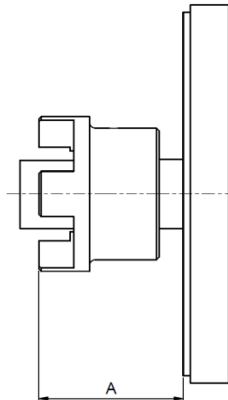
2. For the attachment of the coupling half, heat up the coupling half to approx. 212°F (100°C). Position the coupling half as follows:
 - Push AI160, AI180 and AI225 on to the spacer bushing.
 - Push AI200, AI250, AI280 and AI315 on to the motor shaft collar.
 - AN250TC–AN400TC until dimension A has been reached (reference Position of the Coupling Half on the NEMA Motor Shaft table below)



IMPORTANT NOTE

DO NOT HEAT THE URETHANE SPIDER.

2. Once in place, apply Loctite to the setscrew and tighten the setscrew to lock coupling in place. Let the coupling cool down before placing the spider into the jaws. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.
3. Attach the motor to the adapter. For the AN360TC and AN400TC adapters, attach the adapter flange to the motor first, then attach to the adapter.

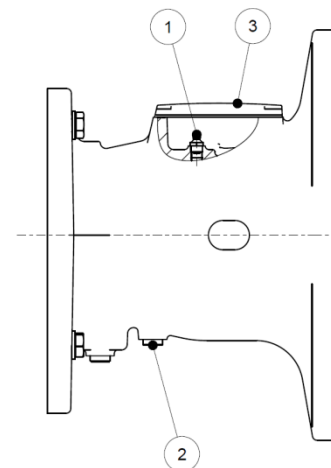


Coupling Half on the NEMA Motor Shaft

NEMA type	Coupling size	A [in]
N250TC R350	R42	3.26
N250TC 300S	R42	3.38
N280TC R350	R48	3.44
N280TC 300S	R48	4.03
N320TC	R55	3.58
N360TC/350	R65	4.98
N360TC/450	R75	5.92
N400TC	R75	6.47

Re-greasing Option for AI...BRG1 and AN...BRG1

For the IEC/NEMA adapters AI and AN with option BRG1, grease the outer roller bearing with approx. 20–25 g of grease at the grease nipple. The grease nipple is located under a bolt-on inspection cover. Before re-greasing, unscrew the grease drain screw so that the excess grease can drain off. Remove the excess grease on the motor adapter.



- 1 Conical grease nipple
- 2 Grease drain screw
- 3 Inspection cover

Motor Parallel Keys

IEC/NEMA Type	Coupling	Shaft ø	Motor Shaft's Key
AI 160	R42	42 mm	12x8x45 mm
AI 180	R48	48 mm	14x9x45 mm
AN 250	R42	1.625 in	3/8x3/8x1 1/2 in
AN 280	R48	1.875 in	1/2x1/2x1 1/2 in
AI 200	R55	55 mm	16x10x50 mm
AN 320	R55	2.125 in	1/2x1/2x1 1/2 in
AI 225	R65	60 mm	18x11x70 mm
AN 360 R350	R65	2.375 in	5/8x5/8x2 1/4 in
AI 250	R75	65 mm	18x11x70 mm
AI 280	R75	75 mm	20x12x70 mm
AN 360 R450	R75	2.375 in	5/8x5/8x3 1/8 in
AN 400	R75	2.875 in	3/4x3/4x3 1/4 in



DRIVESYSTEMS

Courtesy of:

**SCREW CONVEYOR
PARTS**

U45250 - 1 of 3

Automatic Lubricator

Some NORD gear units with NEMA (or IEC) adapters ranging in size from N250TC-N400TC (or IEC160-IEC315) are supplied with a factory-installed, field-activated, PERMA® Classic Automatic Lubrication Cartridge. The automatic lubricator is used to dispense lubricant to the outer most roller bearing of the input NEMA (or IEC) input assembly. The lubrication cartridge must be activated prior to commissioning the gear unit. (Figures 1 & 2)

Some newer versions of the NEMA (or IEC) adapters also include a grease purge. The grease purge area is sealed for transportation; however, it is recommended that the G1/4 sealing screw be removed and that the grease collection container provided by NORD be installed just prior to activating the automatic lubricant dispenser. (Figure 3)

Principle of Operation

First the activation screw is threaded into the lubrication canister. Then the ring-eyelet on top of the activation screw is tightened until its breaking point. This causes a zinc-molybdenum gas generator to drop into a citric acid liquid electrolyte, which is contained within an elastic bladder. An electrochemical reaction slowly releases small amounts of hydrogen gas and gradually pressurizes the bladder, pushing the piston towards the lubrication chamber.

Grease is continuously injected into the lubrication point until the bearing cavity is full. Any back pressure from the bearing will cause the system to neutralize. The bladder inside the canister will continue to slowly build pressure so that once the equipment resumes normal operation; the lubricator will also resume its normal function.

The lubricator contains approximately 120 cm³ or 120 ml (4.8 oz) of grease. For reference, a single stroke of a typical grease gun delivers approximately 1.0-1.2 cm³ (0.03-0.04 oz) of grease. This means the canister contains approximately 100 strokes of grease. See Figure 1 for a detailed view of the PERMA® Lubricator.

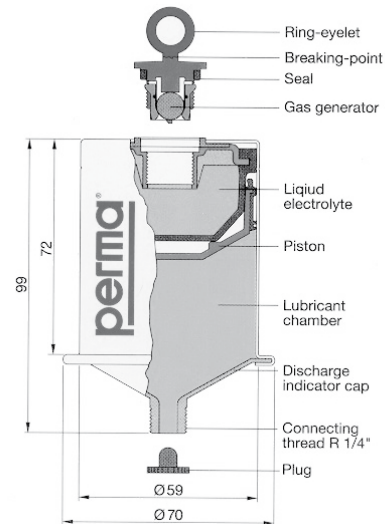


Figure 1 - PERMA® Automatic Lubrication Canister

NOTICE

- To prevent premature bearing failure, the lubrication dispenser must be activated prior to commissioning the gear reducer.
- The lubricator must only be used once and should never be opened or taken apart or permanent damage will result.
- Never unscrew the PERMA® canister from the lubrication point after activation or during the discharge period. This would cause a permanent pressure loss in the lubricator and would justify replacing the lubricator.



WARNING

- Avoid swallowing the gas generator, the liquid electrolyte, and the lubricant.
- Avoid contact of, the liquid electrolyte, and the lubricant with the eyes, skin or clothing.
- Observe all applicable MSDS sheets.
- Follow applicable local laws and regulations concerning waste disposal.

PERMA® Automatic Lubricator Options Supplied by NORD

NORD Part Number	28301000	28301010
Lubrication Option	Synthetic (standard)	Food Grade (optional)
PERMA® Classic Temperature Range ♦	0 to 40 °C (32 to 104 °F)	0 to 40 °C (32 to 104 °F)
Lubrication Volume	120 cm ³ or 120 ml (4.8 oz)	120 cm ³ or 120 ml (4.8 oz)
Grease Lubrication Mfg. / Type	Klüber / Petamo GHY 133	Lubriplate / FGL1
Lubrication Temperature Range ♦	-30 to 120 °C (-22 to 248 °F)	-18 to 120 °C (0 to 248 °F)

♦ The temperature range values shown do not apply to other components and/or lubricants within the gear reducer.

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Lubricator Service Interval

The Automatic lubricator should be inspected approximately every 6 months. At the end of the lubrication period the piston becomes clearly visible through the clear nylon discharge indicator cap located at the bottom of the PERMA® canister (Figure 1); this helps indicate that the lubricant has been fully discharged at which time the lubricator should be replaced. When operating the gear unit 8 hours/day or less a replacement interval of 12 months or 1 year is possible. Ambient temperature will influence the discharge rate and may extend or shorten the replacement interval.

Ambient Considerations

The grease discharge rate is affected by the ambient temperature. PERMA® indicates that the lubricator contents will dispense for a 12 month period when the average temperature is 20 °C (68 °F). Grease dispensing rates depend primarily on average ambient conditions and not extreme highs and lows. Lower ambient temperatures will lead to slower dispensing rates and higher ambient temperatures will lead to faster dispensing rates.

Average Ambient Temperature	Discharge Period Months ♦
0 °C (32 °F)	>18
10 °C (50 °F)	18
20 °C (68 °F)	12
30 °C (86 °F)	6
40 °C (104 °F)	3

♦ Values are approximate.

Discharge can also be influenced by type of lubricant, vibration, and by the mating connecting parts in the lubrication system.

Activating the Automatic Lubricator

1. Loosen and remove the M8x16 assembly socket head cap screws (1251).
2. Carefully remove the protective cover (1252) installed over the automatic lubricator (1250-1).
3. Screw the activation screw (1250-2) into the automatic lubricator (1250-1) and twist the ring-eyelet until it reaches its breaking point.
4. Re-fit the cartridge cover (1252) and re-install and tighten the assembly screws (1251).
5. Mark the activation date on the adhesive label that is provided.

Figure 2 - Activating the Automatic Lubricator

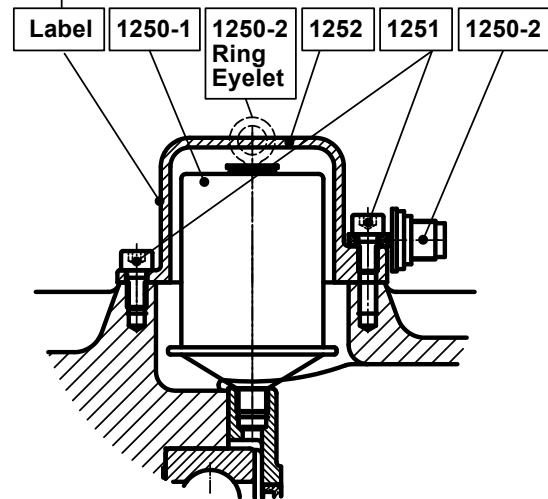
Attention!

Screw in the activation screw until the lug breaks off before commissioning the gear unit.

Dispensing time: 12 Months

Activation Date

Month	Year
1 2 3 4 5 6 7 8 9 10 11 12	11 12 13 14 15



- 1250-1 Automatic Lubricator
 1250-2 Activation Screw
 1251 Socket Head Cap Screws
 1252 Protective Cover



DRIVESYSTEMS

Courtesy of:

**SCREW CONVEYOR
PARTS**

U45250 - 3 of 3

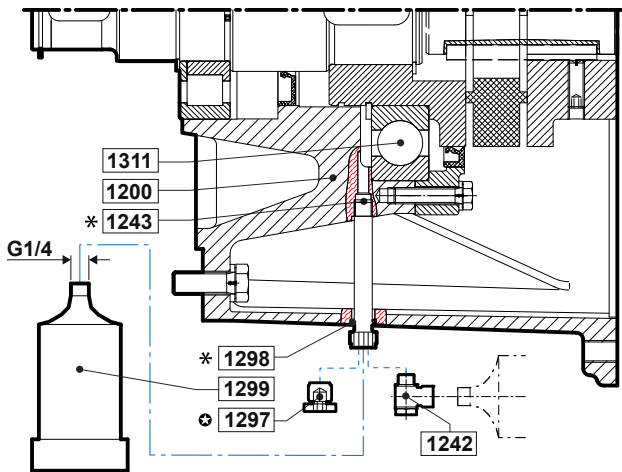
Grease Purge and Grease Drain Cup

Some versions of the NEMA (or IEC) adapters also include a grease purge and a grease drain cup (1299) for collecting old grease. The grease purge area is sealed for transportation.

It is recommended that the G1/4 sealing screw (1297) be removed and that the grease drain cup be installed after the automatic lubricant dispenser is activated.

The swivel fitting (1242) that NORD supplies allows the grease cup to be positioned at a 90° angle from its typical mounting. The swivel fitting allows the grease cup to be rotated so that it remains clear of any gear unit mounting obstructions.

Figure 3 – Grease Purge and Grease Cup Assembly



1200	NEMA or IEC Input Cylinder
1242	Swivel Fitting (P/N) 22006359)
1243	Extension*
1297	Screw Plug ⚙
1298	Seal Ring*
1299	Grease Drain Cup (P/N 28301210)
1311	Bearing

* Supplied on certain input assembly sizes as needed.

⚙ Remove the screw plug to install either the grease drain cup or the swivel fitting with the grease drain cup.

Grease Cup Servicing

NORD suggests that with every second replacement of the automatic lubricator, the grease collection cup (NORD Part No. 28301210) should be emptied or replaced with a new one. Follow the steps below to service the grease cup.

1. Unscrew the grease drain cup (1299) from either the outlet port of the NEMA or IEC input cylinder or from the extension (1243) that is secured to the NEMA or IEC input cylinder.
2. To empty the grease drain cup (1299) insert a stiff rod through the hole in the grey cap-end of the drain cup and push the internal plunger towards the thread-end of the drain cup. Please note that the dark gray end cap is bonded into place and cannot be removed.
3. Collect and properly dispose of the grease being pushed out of the drain cup. Due to the design of the container a residual amount of grease may remain in the container.
4. After emptying and cleaning the grease cup it can be fitted back onto the grease outlet port of the NEMA or IEC adaptor.
5. In the event the grease cup becomes damaged it should be replaced with a new container. Consider replacing the grease cup (P/N 28301210) with every second replacement of the automatic lubricator.

Replacing the Automatic Lubricator

A new automatic lubricator can be ordered from NORD by specifying the appropriate Part Number from the table at the bottom of Page 1 of this manual. Reference Figure 2 and follow the steps below to replace the automatic lubricator.

1. Loosen and remove the M8x16 socket head cap screws (1251) holding the protective cover (1252) in place.
2. Unscrew the automatic lubricator (1250-1) from the bearing cover area of the NEMA or IEC input cylinder.
3. Install the new automatic lubricator and activate per the instructions on page 2.
4. Re-install the protective cover (1252) and the assembly screws (1251).
5. Note the activation date of the newly installed automatic lubricator



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U45255 - 1 of 1

Application

NORD gear units listed in the table below that are supplied with a NEMA 250TC or IEC 160 and larger input adapter, may be supplied with an external grease fitting. The grease fitting allows the user to service the outboard bearing of the reducer's input assembly

Helical Inline	SK62, SK72, SK73, SK82, SK83, SK92, SK93, SK102 and SK103
Parallel-Shaft CLINCHER™	SK6282, SK7282, SK7382, SK8282, SK8382, SK9282, SK9382, SK10282, SK10382, SK11282, SK11382 & SK12382
90.1 Series Helical-Bevel	SK9072.1, SK9082.1, SK9086.1, SK9092.1 & SK9096.1

The grease fitting is an option which must be specified upon ordering, otherwise NORD will normally supply a PERMA Automatic Lubricator (See User Manual U45250).

Factory Supplied Grease

The bearing grease applied at the factory is as follows:

Brand	Mobil, Mobilith SHC220
Thickener	LI-Complex
NLGI Grade	2
Temperature Range	40°C to 120°C (-40°F to 250°F)



IMPORTANT NOTE

It is the user's responsibility to ensure that if replacement grease is used, that it is fully compatible with the factory supplied grease.

Service Instructions



WARNING

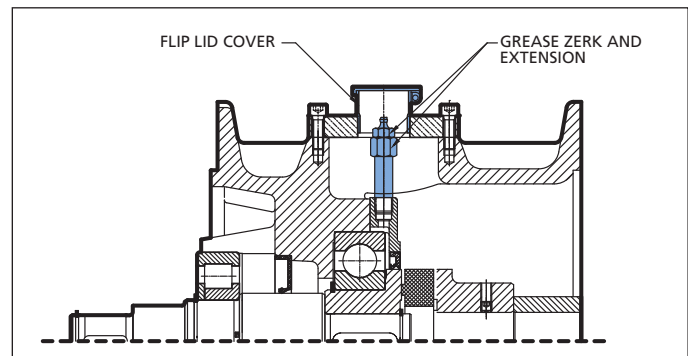
- While working on the gear drive system, make sure the power from the prime mover is isolated or secured on "lock-out" to prevent accidental start-up and to safeguard against injury!
- Surfaces of motors and gear units may become hot during operation or shortly after start-up. In some instances additional protection against accidental contact may be necessary. Use caution to avoid burns or serious injury!

1. It is best to re-grease the bearing within a short period after the gear unit was operational because the old grease will be more viscous and will flow easier.
2. Ensure that the grease gun contains the right lubricant for the bearing to be re-greased.
3. Open the protective flip cover and clean the areas around the grease fitting to ensure that contaminants are not introduced into the bearing cavity.
4. Using a grease gun, apply 0.75 ounces (20-25 grams) of compatible bearing grease every 2,500 service hours.



IMPORTANT NOTE

Re-greasing should be carried out while the bearing is still warm from operation and/or while rotating (if it is safe).

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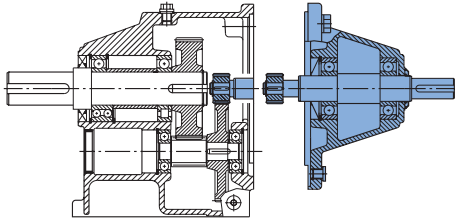
**SCREW CONVEYOR
PARTS**

U45300 - 1 of 3

RETAIN FOR FUTURE USE

1. Solid Input Shaft (W)

The shaft will be inch or metric, depending on how the unit was ordered. Measure and verify the shaft before mounting anything on the shaft. Below are the tolerances used for the solid shafts.



2. Solid shaft diameter tolerance

Reducer input shaft extensions have a diameter tolerance as specified in Table 1.

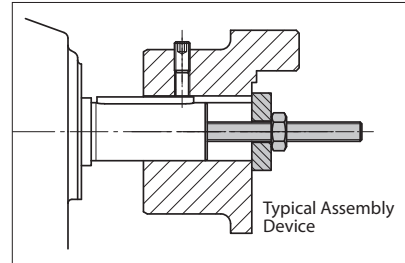
Table 1: Solid Shaft Diameter Tolerance

Above ø (in)	To & Including ø (in)	Tolerance (in)	
0.375	1.750	+0.0000 / -0.0005	
1.750	2.750	+0.0000 / -0.0010	

Above ø (mm)	To & Including ø (mm)	Tolerance (mm)	ISO 286-2 Fit Class
10	18	+0.012 / +0.001	k6
18	30	+0.015 / +0.002	k6
30	50	+0.018 / +0.002	k6
50	70	+0.030 / +0.011	m6

3. Fitting drive elements onto the reducer solid shaft

Solid input shaft extensions are provided with a drill and tap feature as indicated in Table 2. When installing drive elements such as coupling hubs, pulleys, sprockets, or gears, NORD recommends using the threaded hole in the end of the shaft, along with a suitable assembly device fitted into the threaded hole.

**Table 2: Solid Input Shaft End - Threaded Holes**

Above ø (in)	To & Including ø (in)	Tap size & Depth (in)
0.375	0.500	10-24 x 0.43 in
0.500	0.875	1/4-20 x 0.59 in
0.875	0.938	5/16-18 x 0.71 in
0.938	1.100	3/8-16 x 0.87 in
1.100	1.300	1/2-13 x 1.10 in
1.300	1.875	5/8-11 x 1.42 in
1.875	2.750	3/4-10 x 1.73 in

Above ø (mm)	To & Including ø (mm)	Tap Size & Depth (mm)
10	13	M4 x 10 mm
13	16	M5 x 12.5 mm
16	21	M6 x 16 mm
21	24	M8 x 19 mm
24	30	M10 x 22 mm
30	38	M12 x 28 mm
38	50	M16 x 36 mm
50	70	M20 x 42 mm

NOTICE

DO NOT DRIVE or **HAMMER** the coupling hub, pulley, sprocket, or gear into place. An endwise blow to the reducer shaft can generate damaging axial forces and cause damage to the reducer housing, bearings or internal components.



WARNING

To avoid serious injury the user must provide suitable safety guards for all rotating shafts and shaft components such as couplings, chain drives, belt drives, etc. All guarding must adhere to local regulations and safety standards.

4. Installing interference-fit hubs to the reducer shaft

Prior to installing any interference-fit hubs to the reducer shaft, consult with the manufacturer to determine proper assembly and fit. Interference-fits usually require heating the coupling, sprocket or gear hub, per the manufacturer's recommendations. Coupling hub installation typically follows ANSI/AGMA 9002-A86. Always make sure the reducer shaft seals are protected from the heat source. Apply uniform heat to the drive element hub to prevent distortion. NORD does not recommend heating the drive element hub beyond 212°F to 275°F (100°C to 135° C).



WARNING

When using heat to mount a drive element hub, do not use open flame in a combustible atmosphere or near flammable materials. Use suitable protection to avoid burns or serious injury.



IMPORTANT NOTE

When using external chain or belt drives, make sure the reducer is sized so that the shaft and bearings have adequate capacity. To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, etc.) so that the applied load center is as close to the gear housing as possible and check component alignment and tension of any belts or chains per the manufacturer's recommendation. Do not over tighten the belts or chains.

5. Coupling installation

The performance and life of any coupling depends upon how well it is installed. Coupling hubs are typically mounted flush with the shaft ends, unless specifically ordered for overhung mounting. Shaft couplings should be installed according to the coupling manufacturer's recommendations for gap, angular and parallel alignment. To help obtain critical shaft alignment coupling hubs may be installed to the machine shafts prior to final shimming or tightening of the foundation bolts. Proper coupling alignment allows for thermal and mechanical shaft movement during operation and ensures that only torque (no radial load) is transmitted between the mating shafts.

Coupling gap and angular alignment

The shaft gap must be sufficient to accommodate any anticipated thermal or mechanical axial movement. When setting the coupling gap, insert a spacer or shim stock equal to the required spacing or gap between the coupling hub faces. Measure the clearance using feeler gauges at 90-degree intervals, to verify the angular alignment.

Parallel (or offset) alignment

Mount a dial indicator to one coupling hub, and rotate this hub, sweeping the outside diameter of the other hub. The parallel or offset misalignment is equal to one-half of the total indicator reading. Another method is to rest a straight edge squarely on the outside diameter of the hubs at 90° intervals and measure any gaps with feeler gauges. The maximum gap measurement is the parallel or offset misalignment.

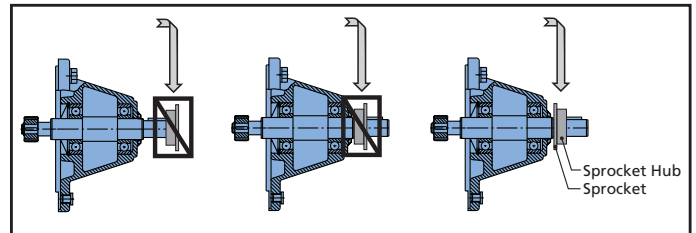
Check alignment

After both angular and parallel alignments are within specified limits, tighten all foundation bolts securely and re-check critical alignment. If any of the specified limits for alignment are exceeded, realign the coupling.

6. Installing sheaves (pulleys), sprockets and gears

To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, gears, etc.) so that the applied load center is as close to the gear housing as possible, as shown in Figure 2.

Figure 2: Pulley or Sprocket Mounting



Align the driver sheave or sprocket with the driven sheave or sprocket by placing a straight-edge length-wise across the face of the sheaves or sprockets. Alignment of bushed sheaves and sprockets should be checked only after bushings have been tightened. Check horizontal shaft alignment by placing one leg of a square or a level vertically against the face of the sheave or sprocket.

Always check component alignment and tension any belts or chains per the manufacturer's recommendation. The ideal belt or chain tension allows proper wrap of the driver and driven wheels, while maintaining the lowest possible tension of the belts or chain, so that no slipping occurs under load conditions. Check belt or chain tension frequently over the first 24 to 48 hours of operation.



IMPORTANT NOTE

When using external chain or belt drives, make sure the reducer is sized so that the shaft and bearings have adequate capacity. To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, etc.) so that the applied load center is as close the gear housing as possible and check component alignment and tension of any belts or chains per the manufacturer's recommendation. Do not over tension the belts or chains.



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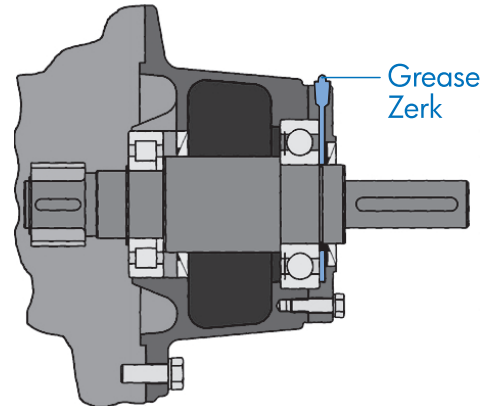
**SCREW CONVEYOR
PARTS**

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7. Service Guidelines for W-Shaft Input with Grease Fitting

On some solid shaft input (Type W) gear units, the outer roller bearing needs to be re-greased at regular service intervals. This is necessary for double-stage gearboxes sizes SK62 or SK6282 and larger, and triple-stage gearboxes from size SK73, SK7382 or SK9072.1 and larger.

To lubricate the bearing of the input shaft, approximately 0.75 to 1.0 ounces (20-25 grams) grease should be added by the grease fitting approximately after every 2,500 hours of service or at least every 6 months. The W-shaft input is factory assembled with the proper amount and type of grease. The type of grease supplied depends upon the type of oil specified at time of order.



Bearing Grease Options

Reducer Oil Type	NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type
MIN-EP	NLGI 2	Li-Complex	MIN	-30 to 60°C (-22 to 140°F)	Mobil Grease XHP222
PAO	NLGI 2	Li-Complex	PAO	-40 to 80°C (-40 to 176°F)	Mobil / Mobilith SHC 220
FG or FG-PAO	NLGI 2	Polyurea	FG-PAO	-30 to 80°C (-22 to 176°F)	Mobil SHC Polyrex 222

NOTICE

Grease compatibility depends upon the type of thickener or soap complex used, the base oil type suspended within the thickener, and the type of additives used. The user should check with the lubrication supplier before making substitutions in brand and type in order to assure compatibility and to avoid causing damage to the extended bearing.



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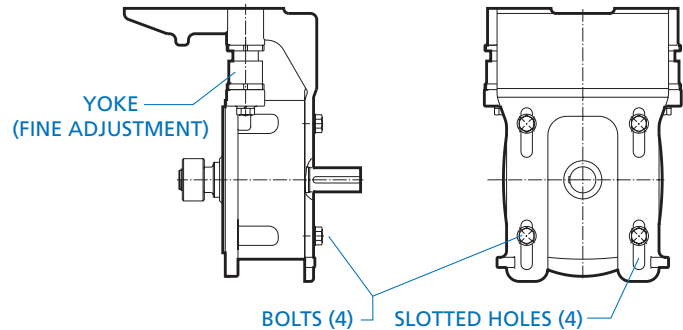
U45400 - 1 of 1

Motor Mount Platform (MK)

For proper installation of the belt drive, consult the manufacturer. NORD MK motor mounts are adjustable in two ways. Slotted holes are provided at the input cylinder for the initial height adjustment. There are two fine adjustments at the yoke to increase/decrease tension. Two spanner head wrenches will be needed to tighten/loosen the fine adjustments. The four bolts holding the motor platform to the input cylinder must be loosened in order to use the fine adjustments.

The motor mounting platform has tapped holes to accept the foot pattern of the standard footed NEMA or IEC motor. All MK mounting input shaft diameters are metric.

Align the sheaves or sprockets square and parallel by placing a straight edge across their faces. Alignment of bushed sheaves and sprockets should be checked after bushings have been tightened. Check horizontal shaft alignment by placing a level vertically against the face of the sheave or sprocket. Adjust belt or chain tension per the manufacturer's specified procedure. After a period of operation, recheck alignment and adjust as required.



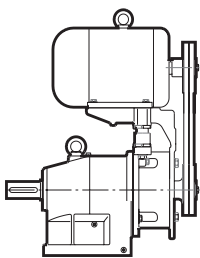
CAUTION

NORD Gear does not furnish the safety guards for the belt drive. It is the responsibility of the customer to install a safety guard to conform to OSHA standards.

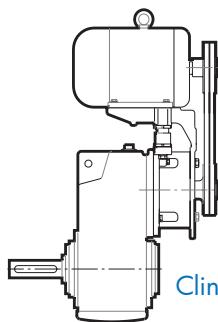


IMPORTANT NOTE

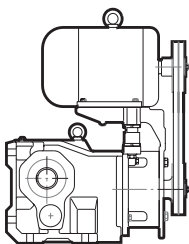
When using external chain or belt drives, make sure the reducer is sized so that the shaft and bearings have adequate capacity. To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, etc.) so that the applied load center is as close to the gear housing as possible and check component alignment and tension of any belts or chains per the manufacturer's recommendation. Do not over tighten the belts or chains.



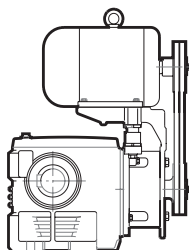
In-Line Unit



Clincher™ Unit



Bevel Unit



Worm Unit

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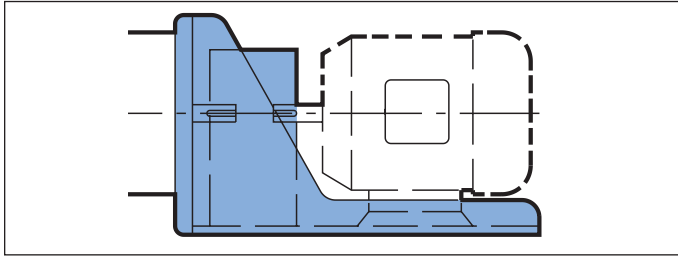
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U45500 - 1 of 1

Sugar Scoop



Each scoop bracket includes the coupling for the motor and the coupling guard.

- NORD's standard supplied coupling is the jaw-type coupling with elastomeric spider element.
- The reducer-side (driven) coupling hub is mounted by NORD.
- The motor-side (driver) coupling hub must be mounted by the party responsible for supplying or mounting the motor.
- The supplied coupling guard must be mounted after coupling installation.

Coupling Mounting Instructions

1. Make sure that the motor shaft is clean and free of burrs or defects.
2. Check the motor shaft, coupling hub bores, key and key seat dimensions to make sure they are the proper dimensions.
3. Mount the coupling onto the motor by placing the coupling so that the inside face is flush with the end of the motor shaft and tightening the set screws to hold it in place (Figure 1).

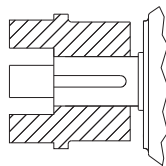


Figure 1. Place coupling flush with end of motor shaft and tighten setscrew.



IMPORTANT NOTE

Heating the coupling hub slightly, up to 176°F (80°C) will help facilitate installation onto the motor shaft.



WARNING

Wear appropriate safety gloves to handle the heated coupling hubs to avoid serious burns or injury.

NOTICE

DO NOT DRIVE or HAMMER coupling hubs into place. An end-wise blow to the reducer or motor shaft can generate damaging axial forces and cause damage to the reducer or motor housing, bearings, or internal components.

4. Let the coupling cool down before mounting the spider into the jaws. The spider should not be under axial compression when installed.
5. Place the motor onto the scoop and engage the couplings together. The scoop has slotted holes to help accommodate axial alignment. Secure the motor to the scoop bracket but do not completely tighten the fasteners.



IMPORTANT NOTE

Before tightening the motor to the scoop bracket, the alignment of the coupling must be checked. Shimming of the motor feet may be needed to properly align the couplings. Careful coupling alignment extends the life of not only the coupling but all the components of the drive train.

6. Check the parallel alignment by placing a straight edge or level across the two coupling hubs, and measure the maximum offset at various points around the circumference of the coupling, without rotating the coupling. The maximum parallel alignment should not exceed 0.015 inches (4 mm).
7. Check the angular alignment of the coupling without rotating the hubs. The maximum angular displacement should not exceed 1.0°.
8. After both angular and parallel alignment is within specified limits, tighten all motor mounting hardware to the appropriate torque specification.
9. Re-check the critical alignment and repeat steps 6 and 7 if needed.
10. Mount the coupling guard to the scoop.



CAUTION

It is the customer responsibility to properly guard the rotating shaft and coupling connection and make sure the system meets all local safety regulations.



IMPORTANT NOTE

After a period of operation, it is suggested that the system be checked to make sure coupling alignment is being maintained.

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U65100 - 1 of 2

RETAIN FOR FUTURE USE

Items included in the touch-up kit

- I. No Rinse Alodine® Touch-N-Prep pen.
- II. Color matched sealer pen

**IMPORTANT NOTE**

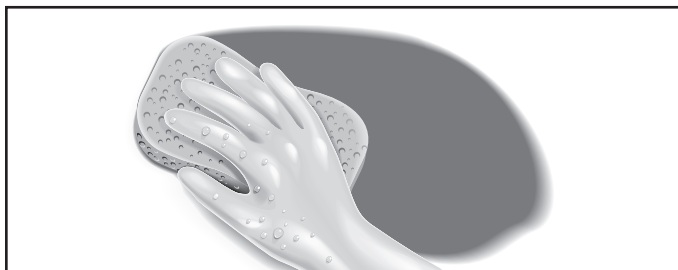
- Always wear Personal Protective Equipment (PPE), including gloves and safety glasses with side shields.
- When opening individual pens, pull safety caps straight out from pen. Do not twist or torque the cap to avoid damaging the applicator assembly.
- Do not use fingers to prime the applicator tip. Priming takes 15-30 seconds.
- Make sure the surface is clean and dry.

**IMPORTANT NOTE**

- I. Metal temperature must be above 50° F
- II. Do not excessively use abrasive pad while removing surface oxidation. Oxidation only needs to be removed from areas with exposed aluminum.
- III. Use enough product to wet surface but avoid pooling.
- IV. Do not rinse or wipe Alodine coating before the product is allowed to dry.
- V. Allow to air dry or use a blow dryer. Do not use a heat gun. Maximum drying temperature is 140°F.
- VI. Dry color will appear opaque.

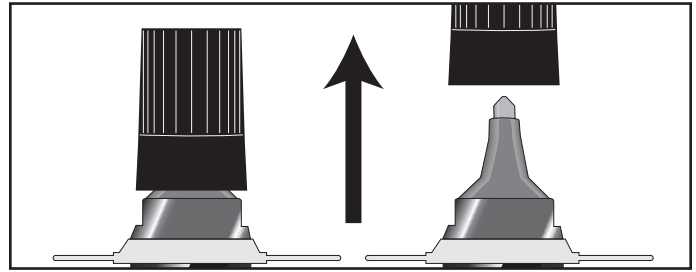
Part I: Alodine® 871 Touch-N-Prep® Pen Instructions

Touch-N-Prep® pens are designed for easy and safe repair of clean, bare, or previously painted aluminum surfaces. It is a non-rinse, dry-in-place application that can be applied using the following steps:

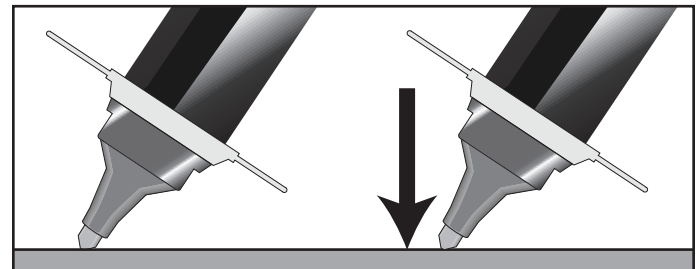
1. Surface Preparation

Before applying the coating, the treated surface must be cleaned using the following process:

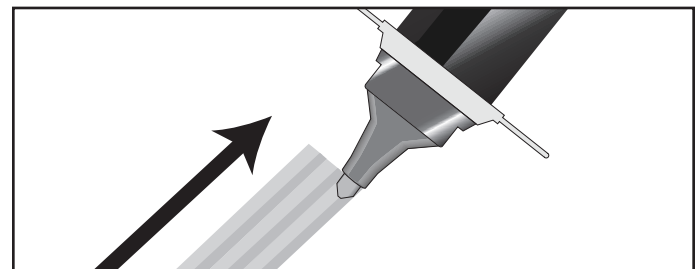
- If the scratch is more than 24 hours old use a moistened abrasive pad to remove oxides from the surface of the metal.
- Wipe substrate with a damp lint-free cloth to ensure complete removal of soils and dislodged oxides generated from the previous step.
- Allow Surface to dry before Touch-N-Prep® application.

2. Prime Applicator Tip

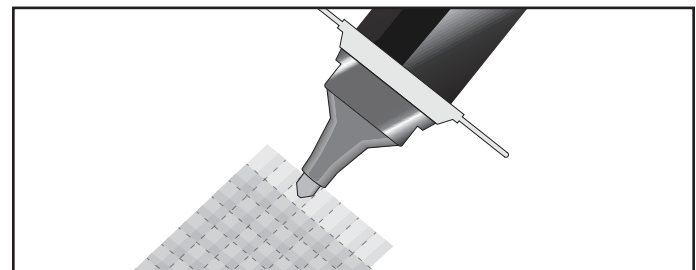
To activate, hold the Touch-N-Prep® pen upright and pop off the cap. Do not twist or turn to remove the cap, since this may result in the pen leaking. Hold the pen tip down onto a clean surface to begin the flow of solution to the tip.

3. Application

Press the pen tip down on the surface until solution fills the pen tip. Apply the Alodine® 871™ solution to the metal surface with firm, smooth, even strokes, covering all of the edges. Overlap each stroke and allow to dry.



Frequent short jabs to re wet the application rip are preferred to maintain constant coating weights and avoid over-wetting the felt tip.

4. Re-Application

Within 5 minutes of the first coat, apply a second coat at a 90° angle to the first coat with the same smooth, firm stroke.

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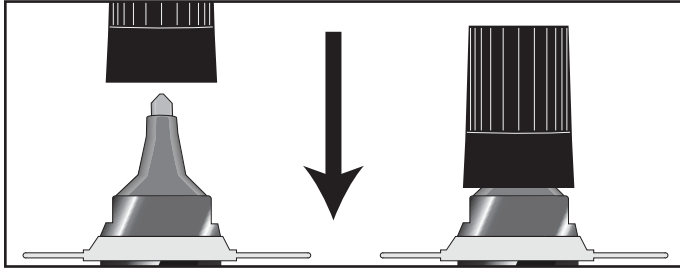
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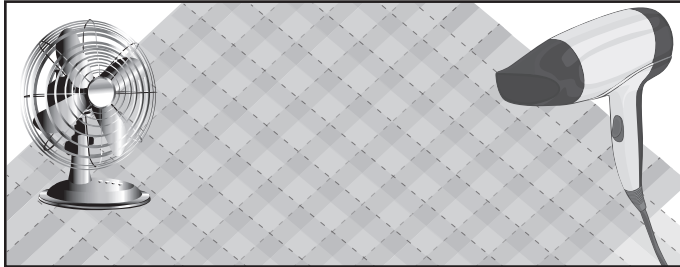
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5. Prepare the Pen for Storage



Always immediately replace the cap when not in use to avoid evaporation and contamination.

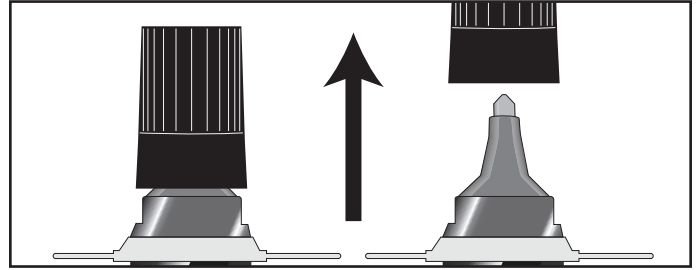
6. Drying



Allow the Alodine Touch-N-Prep® coating to air dry thoroughly.

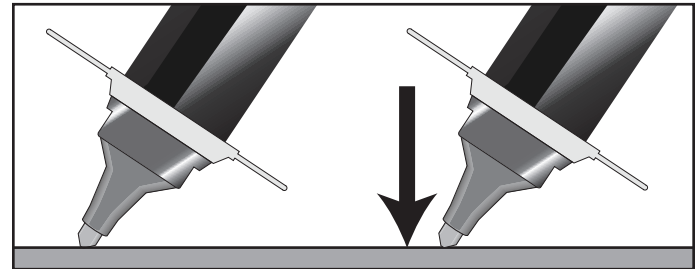
Part II: Sealer Application

1. Prime Applicator Tip



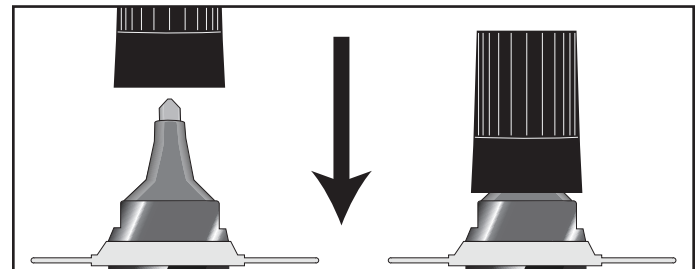
To activate, hold the pen upright and pop off the cap. Do not twist or turn to remove the cap, since this may result in the pen leaking. Hold the pen tip down onto a clean surface to begin the flow of solution to the tip.

2. Application



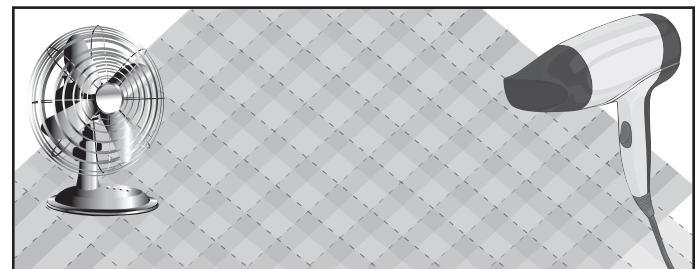
Press the pen tip down on the surface until solution fills the pen tip. Apply the sealer pen solution to the metal surface with firm, smooth, even strokes, covering all of the edges. Overlap each stroke and allow to dry.

3. Prepare the Pen for Storage



Always immediately replace the cap when not in use to avoid evaporation and contamination.

4. Drying



Allow the sealer pen coating to air dry thoroughly.



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**SCREW CONVEYOR
PARTS**



DRIVESYSTEMS

CONDITIONS OF SALE

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1. CONTRACT

Any contract between Nord Gear Corporation, hereinafter designated as Seller, and the Buyer is subject to the terms and conditions of sale hereinafter set forth. Any deviation from such terms and conditions must be specifically set forth in writing and consented to by Seller. Accordingly, the Buyer and Seller acknowledge and agree that the terms and conditions set forth below and on the face hereof shall govern Buyer's purchase of the goods described on the face hereof and shall take precedence over and represents the final agreement between Buyer and Seller, notwithstanding any inconsistent, contradictory or other prior or further conditions contained in any oral or written request or purchase order issued by Buyer or any other document furnished by Buyer in connection with its purchase of the Goods, regardless of whether such document or documents are exchanged simultaneously with this Invoice or prior or subsequent thereto. Any additional or different terms or conditions which may appear in any communication, oral or written, from Seller, its officers, employees, agents or representatives, are hereby expressly rejected and shall not be effective or binding upon the Seller, unless specifically hereafter agreed to in writing by Seller and no such additional or different terms or conditions in any document submitted to Seller by Buyer shall become part of the contract between Buyer and Seller, unless such written acceptance by Seller specifically recognizes and assents to their inclusion. Any objection by Buyer to the terms and conditions hereof shall be ineffective unless Seller is advised in writing thereof within two (2) days of the date of this Invoice.

2. CONFIRMATION

An order shall be deemed accepted only when duly confirmed by Seller, at Nord Gear Corporation's home office in Waukegan, Wisconsin, and upon such confirmation the order shall become a contract binding upon the parties hereto, their successors and assigns.

3. PRICES

Prices shown are list prices and may be subject to applicable discounts. Unless otherwise agreed upon in writing, prices are FOB factory Waukegan, Wisconsin. Prices and discounts are subject to change without notice until order is accepted. Seller's prices do not include cost of any inspection permits required.

4. LIMITED WARRANTY

Seller hereby warrants that the goods sold hereunder shall be free from material defects in material and workmanship, if properly installed and used under normal operating conditions, for a period of twelve (12) months from the date of installation or eighteen (18) months from date of shipment, whichever comes first (the "Warranty Period"). With respect to gears and housings only, the Warranty Period is extended to thirty-six (36) months from the date of invoice or twenty-four (24) months from the date of installation, whichever comes first. The limited warranty shall not apply to any components or parts which are subject to normal operational wear and tear, including, but not limited to, belts and traction discs. Should any goods fail to comply with the foregoing limited warranty, Buyer shall provide written notice to Seller of the claimed defect and all relevant details within thirty (30) days of Buyer's discovery of the claimed defect. Buyer shall return the allegedly defective goods to Seller at its facilities in Waukegan, Wisconsin or to such other location within the USA as may be designated by Seller in its sole discretion, with all shipping and transportation charges prepaid by Buyer. Seller shall then examine the returned goods to determine if the claimed defect is covered by the limited warranty. If the claimed defect is covered by the limited warranty, Buyer's sole and exclusive remedy shall be to have Seller repair or replace, at Seller's option, the defective goods or components in accordance with the terms of this limited warranty. Seller shall have a commercially reasonable time to make such repairs or replacements and may use new or reconditioned components. Any repair or replacement shall not extend the Warranty Period unless otherwise agreed by Seller. Buyer shall pay all shipping costs and any costs of removal and re-installation of goods or components.

The foregoing limited warranty shall not apply with respect to any goods or components (i) which are not installed, used, operated, serviced or maintained in accordance with manufacturer's instructions or which are otherwise not properly installed, used, operated, serviced or maintained, or (ii) which are misused, neglected, damaged, altered, repaired, reconfigured or incorrectly wired. Seller makes no representations as to the specifications, capacity or performance of the goods sold hereunder, except as may be specifically set forth in the invoice's written specifications, and any such representations are expressly conditioned upon the accuracy and completeness of the data and information furnished by the buyer and upon the goods being properly installed, used, serviced and maintained by Buyer. Any description or model of the goods is for identification or illustrative purposes only and shall not be deemed to create any warranty, express or implied.

THE FOREGOING LIMITED WARRANTY SHALL EXTEND SOLELY TO BUYER AND NOT TO ANY OTHER PARTY. THE FOREGOING LIMITED WARRANTY IS IN LIEU OF ANY AND ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED. SELLER HEREBY EXCLUDES AND DISCLAIMS ANY AND ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IF BUYER SHALL FAIL TO PAY WHEN DUE ANY PORTION OF THE PURCHASE PRICE OR ANY OTHER PAYMENT REQUIRED FROM BUYER TO SELLER UNDER THIS CONTRACT, ALL WARRANTIES AND REMEDIES SET FORTH HEREIN SHALL BE DEEMED NULL AND VOID, AB INITIO. THE PARTIES ACKNOWLEDGE AND AGREE THAT THE EXCLUSIVE REMEDY UNDER THE FOREGOING LIMITED WARRANTY SHALL NOT HAVE FAILED OF ITS ESSENTIAL PURPOSE (AS THAT TERM IS USED IN THE UNIFORM COMMERCIAL CODE) PROVIDED THAT SELLER REMAINS WILLING TO REPAIR OR REPLACE DEFECTIVE GOODS WITHIN A COMMERCIALY REASONABLE TIME. BUYER SPECIFICALLY ACKNOWLEDGES AND AGREES THAT THE PRICE CHARGED BY SELLER FOR THE GOODS IS BASED UPON THE LIMITATIONS OF SELLER'S WARRANTY OBLIGATIONS AND OTHER LIABILITIES AS SET FORTH HEREIN.

LIMITATION OF LIABILITY. NOTWITHSTANDING ANY OTHER PROVISION HEREOF, IN NO EVENT SHALL SELLER BE LIABLE TO BUYER OR TO ANY OTHER PARTY FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, LOST PROFITS, OR FOR ANY LOSSES, CLAIMS OR DAMAGES RELATING TO OR ARISING FROM THE USE OR OPERATION OF THE GOODS, AND IN NO EVENT SHALL ANY CLAIM OR RECOVERY OF ANY KIND EXCEED THE PURCHASE PRICE OF THE GOODS IDENTIFIED IN THE RELATED INVOICE.

5. SHORTAGE AND NONCONFORMITY

Any claim of shortage or that the goods do not conform with the specifications of the order or model must be made in writing within ten (10) days after delivery of the goods (as to which such claim is made) to Buyer or its nominees, but in no event shall the claim be later than within the time limit provided by the carrier or insurance company, otherwise such claim shall be deemed waived. Buyer may not return any goods claimed to be in non-conformity without Seller's prior written authorization. Goods returned without permission will not be accepted, including for credit, and will be returned to Buyer, F.O.B. Seller's plant. Any claim based on the receipt of damaged Goods must be filed with the carrier which delivered the goods. The samples, measurements, dimensions and weights contained in the Seller's catalogs, sales manuals, photographs and drawings constitute only an approximate guide. The Seller reserves the right to make any change which the Seller, in its absolute discretion, considers necessary. While the goods will be delivered principally according to specifications or standards or quantities agreed upon, insignificant deviations or insignificant changes in construction are permissible. The same applies to partial deliveries. In the event that Buyer has a verified claim of shortage or nonconformity of the goods to the specifications of the order or the model, and if such claim has been submitted within the required time limit as set forth above, the Seller shall, at its own expense, make up for the shortage of the goods, or replace or repair the goods, as the case may be, but in no event shall Seller be or become liable to Buyer or to any other person or persons for any loss in damage, direct or indirect, arising out of or caused by such incidents or for the loss of profits, business or good will. The liability of the Seller to Buyer, if any hereunder, for breach of warranty, contract, negligence or otherwise, shall in no event exceed the amount of the purchase price of the goods sold with respect to which any damages are claimed. Shipping dates are estimates unless parties expressly agree on time of the essence.

6. FORCE MAJEURE

The obligation of the Seller shall be modified or excused, as the case may be, for reasons of Acts of God, war, governmental law regulations, strikes or lock-outs, fire, breakdown of machinery, whether in its own business enterprise, or if for any other cause beyond Seller's control, the goods cannot be delivered or their delivery becomes delayed in whole or in part. In the above instances time for delivery shall be extended for the period of the delay caused, with the proviso, however, that either party may cancel in writing the undelivered portion of the order or contract if the delay exceeds six (6) months from the delivery date originally confirmed by Seller. In no event shall Seller become liable in the aforesaid instances to Buyer or any third party for consequential damages or business loss.

7. SHIPMENT AS UNIT

Each shipment by Seller shall be treated as a separate and distinct unit with respect, but only with respect to forwarding, terms of payment, and the making of claims by the Buyer: provided, however, that if the Buyer defaults in the payment of any obligation to Seller or any installments thereof, under any agreement between Buyer and Seller, or if Buyer refuses to accept any goods when tendered for delivery, the Seller may, on fifteen (15) days written notice to the Buyer, without prejudice to Seller's other lawful remedies, either defer further performance until the defaulted payments are made in full, or make future deliveries for cash in advance only, or treat the entire contract or contracts with Buyer as breached by the Buyer and pursue its remedies for breach.

8. BUYER'S REFUSAL OF DELIVERY

If Buyer refuses to accept delivery of any goods tendered for delivery, then Seller, without prejudice to Seller's other lawful remedies, may either store or cause such goods to be stored in a warehouse, for buyer's account and at Buyer's cost, risk and expense, or sell such goods (without notice) to any purchaser at public or private sale, and hold the Buyer liable for any difference between (a) the contract price of the goods, and (b) the price at which goods are resold less the costs and expense of such resale including brokerage commissions, or restocking charges.

9. GOODS IN TRANSIT

If prior to delivery or while the goods are in transit, Buyer or Seller becomes bankrupt or insolvent, or any petition in bankruptcy or for the reorganization or for a state court receivership is filed against Buyer or Seller, as the case may be, then the other party hereto may forthwith terminate this contract by giving written notice of such termination. Such termination shall not affect any claim for damages available to the Buyer, provided that if Buyer is then indebted to Seller, the amount of any such damage claim shall be abated to the extent that the indebtedness of Buyer to Seller, as actually paid in money, is abated by any order of judgement entered or any plan adopted in any bankruptcy, reorganization, receivership, or similar proceeding. Such termination shall not prejudice the Seller's rights to any amounts then due under the contract. If Buyer becomes bankrupt or insolvent or any petition in bankruptcy or for reorganization or if a state court receivership is filed against Buyer, then, at its option Seller may take possession of any goods theretofore sold to Buyer, in connection with which the full purchase price has not been paid, analogous to the terms and provisions set forth in Paragraphs 11 and 12 hereinafter.

10. DELIVERY

(a) Any indicated dates of delivery are approximate only, but NORD Gear will attempt to meet them whenever possible. (b) NORD Gear will not be liable for any penalty clauses contained in any specifications or order submitted unless agreed to in writing by an authorized officer of NORD Gear Corporation. (c) Unless otherwise agreed, delivery of the goods to any carrier shall constitute delivery to the Buyer, and thereafter the risk of loss or damage to the goods shall be upon the Buyer. (d) If the Buyer does not give delivery instructions to the Seller at least (10) days prior to the delivery date ex factory confirmed by the Seller, the Seller may deliver the goods to a carrier of its own choosing, at Buyer's cost and risk, or, at Seller's option, may store the goods on the pier or any warehouse, at Buyer's cost and risk. Any purchase price in such event becomes due and payable within ten (10) days of such storage.

11. PAYMENT OF PURCHASE PRICE

Time of payment is of the essence under the contract. Unless otherwise provided, terms of payment are 30 days net from the date of invoice with a 1% discount if paid within 10 days of date of invoice. Upon default in any of the terms of the contract, or failure to comply with any of the conditions thereof, or upon seizure of the property under execution or other legal process, or if the Buyer becomes bankrupt or insolvent, or any petition for reorganization or for a state court receivership is filed against Buyer, or if the Buyer makes any assignment for the benefit of its creditors or otherwise sells, encumbers or disposes of the goods, or if for any other reason the Seller should deem itself insecure, the full amount of the purchase price then remaining unpaid shall at once become due and payable at the option of the Seller.

12. BUYER'S DEFAULT

Upon the Buyer's default, the Seller may dispose of the merchandise in any manner that it deems fit and, if it desires to resell same, may do so at private or public sale, with or without notice, and with or without the property being at the place of sale, subject, however, to applicable laws. The Seller or its assigns shall have the right to bid at such sale and may become the purchaser of the property. The proceeds of the sale shall first be applied to the expenses incurred in retaking, repairing, storing and selling the goods, reasonable attorney's fees included, and then shall be applied to the payment of the balance due under the contract. Any surplus amount shall be paid to the Buyer. If a deficiency results after the resale, the Buyer agrees to pay such forthwith, together with reasonable attorney's fees, for the recovery of the goods incurred by the Seller. If upon the Buyer's default, the Seller elects not to resell any goods which it may repossess, then the cost of repossession, including reasonable attorney's fees, shall forthwith be due and payable from Buyer to Seller. Buyer agrees to pay all reasonable costs and reasonable attorney's fees incurred by Seller in enforcing Seller's rights against Buyer, including Seller's right to payment of the purchase price of the goods and Buyer's payment of all other amounts owing to Seller required under this Invoice and Conditions of Sale.

13. SECURITY INTEREST AND TITLE

In states and localities which are governed by the Uniform Commercial Code, this contract shall serve as security agreement, reserving in Seller a security interest until full payment of purchase price. The provisions of the Uniform Commercial Code regarding security interest shall have preference and apply if inconsistent with other terms of the conditions of sale. In states and localities where the Uniform Commercial Code does not apply, title to the goods shall remain in the Seller or its assigns until full payment of the purchase price. Buyer agrees to execute forthwith any and all documents in such a way and form as Seller may need for filing or recording the security interest under the Uniform Commercial Code with the proper registers or offices, or for filing or recording the conditional sales contract.

14. SALES AND USE TAX

Buyer agrees to bear and pay any sales or use tax in connection with the purchase herein, and to hold the Seller harmless from payment. At the option the Seller, Buyer shall give evidence of payment or of exemption certificate.

15. INSURANCE

The Buyer shall keep the goods insured against damage by fire, water or other casualty as required by Seller, with a company acceptable to Seller, with loss payable to Seller for the total purchase price until the Seller is fully paid. Seller, if it so elects, may place said insurance at Buyer's expense; Seller may cancel such insurance at any time and without notice and may receive the return premium, if any.

16. MODIFICATION BY SELLER

Any contract may be assigned or transferred by the Seller, or the time for the making of any payment due by Buyer may be extended by Seller without derogation of any of the rights of the Seller or its assigns. Waiver by any party of any default shall not be deemed a waiver of any subsequent default.

17. RETURNED GOODS

No goods will be accepted for return unless authorized in writing by Seller. In all cases, transportation and restocking charges will be borne by Buyer.

18. PACKING

The Buyer will be charged for export packaging or other special packing desired. Cost for cartage to ship or transfer express will be added to the invoice. No credit will be allowed if no packing is required.

19. CHANGES/CANCELLATION

NORD Gear will not accept changes in specifications to a confirmed order unless such changes are requested in writing and confirmed back in writing. In addition, the purchaser must to agree to any additional charges that may arise from the change. Placing orders on hold or cancellation of orders require Seller's written approval, and are subject to cancellation and/or restocking charges.

20. BUYER'S RESPONSIBILITY AS TO MAINTENANCE

Buyer shall use and shall require its employees and agents to use all safety devices and guards and shall maintain the same in proper working order. Buyer shall use and require its employees and agents to use safe operation procedures in operating the equipment and shall further obey and have its employees and agents obey safety instructions given by Seller. If Buyer fails to meet the obligations herein, Buyer agrees to defend, indemnify and save Seller harmless from any liability or obligation with regard to any personal injuries or property damages directly or indirectly connected with the operation of the equipment. Buyer further agrees to notify Seller promptly and in any event not later than ten (10) days after notice or knowledge of any accident or malfunction involving Seller's equipment which has caused personal injury or property damages and to cooperate fully with Seller in investigating and determining the causes of such accident and malfunction. In the event that Buyer fails to give such notice to Seller or to cooperate with Seller, Buyer shall be obligated to defend, indemnify and save Seller harmless from any such claims arising from such accident.

21. MISCELLANEOUS PROVISIONS

(a) If for any reason a provision of a contract is legally invalid, then in such event the rest of the contract shall remain in full force and effect, except that the parties shall try to replace such invalid provision closest to their original mutual intentions. (b) This Invoice and these Conditions of Sale constitute the entire agreement between the parties regarding the subject matter hereof and supercedes all prior agreements, understandings and statements, whether oral or written, regarding such subject matter. No modification to, change in or departure from, the provisions of this Invoice and Conditions of Sale shall be valid or binding on Seller, unless approved in writing by Seller. No course of dealing or usage of trade shall be applicable unless expressly incorporated into this Invoice and Conditions of Sale. Any amendments to any contract or contracts between the parties shall be valid only upon the written consent of both parties.

22. NON ASSIGNMENT BY BUYER

Contract or contracts may not be assigned by the Buyer without prior written consent of the Seller.

23. APPLICABLE LAW AND VENUE

All contracts and their interpretation are governed by the applicable, substantive laws of the State of Wisconsin. Any litigation brought by the Buyer regarding this Invoice or goods purchased hereunder may only be brought in the Circuit Court for Dane County, Wisconsin.

NORD Gear Corporation

Toll Free in the United States: 888.314.6673

09.29.14

Nord Gear Company Terms 09/14

www.nord.com



DRIVESYSTEMS

Courtesy of:



**SCREW CONVEYOR
PARTS**



TERMS & CONDITIONS OF SALE

WWW.NORD.COM

1. CONTRACT

Any contract between Nord Gear Limited, hereinafter designated as "Seller", and the party or parties accepting these terms and conditions of sale and any agent, officer, servant, employee or subcontractor of such party or parties, hereinafter designated as "Buyer", is subject to the terms and conditions of sale hereinafter set forth. Any deviation from such terms and conditions must be specifically set forth in writing and consented to by Seller.

2. CONFIRMATION

An order shall be deemed accepted only when duly confirmed by Seller, at Nord Gear Limited's home office in Brampton, Ontario, and upon such confirmation the orders shall become a contract binding upon the parties hereto, their successors and assigns.

3. PRICES

Prices shown are list prices and may be subject to applicable discounts. Unless otherwise agreed upon in writing, prices are FOB factory Brampton, Ontario. Prices and discounts are subject to change without notice until the order is accepted. Seller's prices do not include cost of any inspection permits required.

4. LIMITED WARRANTY

Seller warrants the goods sold hereunder to be free from defects in material and workmanship under normal use and service not arising from misuse, negligence, or accident, including but not limited to the use, installation, and transportation of the goods by Buyer, its agents, servants, employees, or by carriers. This warranty shall pertain to any part or parts of any goods to which Buyer or its assigns has within one year from date of delivery given written notice of claimed defects to Seller. Buyer shall be required to furnish Seller with details of such defects and this warranty shall be effective as to such goods which Seller's examination shall disclose to its satisfaction to have been defective and which at Seller's option shall promptly thereafter be returned to Seller or its nominees. EXCEPT FOR THE EXPRESS WARRANTIES SET FORTH ABOVE, SELLER HAS MADE NO WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, AS TO THE GOODS SOLD HEREUNDER, INCLUDING, BUT NOT LIMITED TO THEIR MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. ANY DESCRIPTION OR MODEL OF THE GOODS IS FOR IDENTIFICATION OR ILLUSTRATIVE PURPOSES ONLY AND SHALL NOT BE DEEMED TO CREATE AN EXPRESS WARRANTY. The Buyer's exclusive remedy for claims arising from defective or nonconforming goods shall be limited to the repair or replacement thereof at the Seller's sole option. THE SELLER SHALL NOT BE RESPONSIBLE OR LIABLE FOR CONSEQUENTIAL DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE SALE, DELIVERY, USE, PERFORMANCE, OR SERVICE OF THE GOODS SOLD UNDER THIS AGREEMENT. SELLER SHALL NOT BE LIABLE FOR ANY LOST PROFITS OR FOR ANY CLAIM OR DEMAND AGAINST SELLER BY ANY PARTY. IN NO EVENT WILL SELLER BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, EVEN IF SELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. SELLER'S AGGREGATE LIABILITY FOR DAMAGES UNDER THIS AGREEMENT, WHETHER ARISING FROM OR BASED UPON BREACH OF WARRANTY, BREACH OF CONTRACT, TORT OR OTHER CAUSE OF ACTION, SHALL IN NO CASE EXCEED THE PURCHASE PRICE THAT BUYER PAYS FOR THE PARTICULAR GOODS INVOLVED. Seller shall in no event be liable to any person or firm (including any assignee or Buyer) except Buyer and its successors. Unless specifically authorized by Seller in writing, Seller shall not become responsible for any repair work done by Buyer or any other party on any goods sold. Any costs of the return of such goods to Seller shall be borne by Buyer. Goods sold but not manufactured by Seller are being warranted as to defects in material and workmanship consistent with the limited warranty policy of the original manufacturer of the goods and if there is not such a limited warranty policy, the warranty shall be limited to the provisions of Article 4 herein. Standards for the operating characteristics of the gearboxes and the gear motors are in conformity with Seller's tests. THIS WARRANTY IS IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE SELLER DOES NOT ASSUME, NOR DOES IT AUTHORIZE ANY PERSON TO ASSUME, ON ITS BEHALF, ANY OTHER OBLIGATION OR LIABILITY.

5. SHORTAGE AND NONCONFORMITY

Any claim of shortage or that the goods do not conform with the specifications of the order or model must be made in writing within ten (10) days after delivery of the goods (as to which such claim is made) to Buyer or its nominees, but in no event shall the claim be later than within the time limit provided by the carrier or insurance company, otherwise such claim shall be deemed waived. The samples, measurements, dimensions and weights contained in Seller's catalogs, sales manuals, photographs and drawings constitute only an approximate guide. Seller reserves the right to make any changes which Seller, in its absolute discretion, considers necessary. While the goods will be delivered principally according to specifications of standards or quantities agreed upon, insignificant deviations or insignificant changes in construction are permissible. The same applies to partial deliveries. In the event that Buyer has a verified claim of shortage or nonconformity of the goods to the specifications of the order or the model, and if such claim has been submitted within the required time limit as set forth above, Seller shall, at its own expense, make up for the shortage of the goods, or replace or repair the goods, as the cause may be, but in no event shall Seller be or become liable to Buyer or to any other person or persons for any loss in damage, direct or indirect, arising out of or caused by such incidents or for the loss of profits, business of good will. Shipping dates are estimates unless parties expressly agree on time of the essence.

6. FORCE MAJEURE

The obligation of Seller shall be modified or excused, as the case may be, for reasons of Acts of God, war, governmental law regulations, strikes or lock-outs, fire, breakdown of machinery, whether in its own business enterprise, or if for any other cause beyond Seller's control, the goods cannot be delivered or their delivery becomes delayed in whole or in part. In the above instances time for delivery shall be extended for the period of the delay caused, with the proviso, however, that either party may cancel in writing the undelivered portion of the order of contract if the delay exceeds six (6) months from the delivery date originally confirmed by Seller. In no event shall Seller become liable in the aforesaid instances to Buyer or any third party for consequential damages or business loss.

7. SHIPMENT AS UNIT

Each shipment by Seller shall be treated as a separate and distinct unit with respect, but only with respect to forwarding, terms of payment, and the making of claims by Buyer; provided, however, that if Buyer defaults in the payment of any obligation to Seller or any installments thereof, under any agreement between Buyer and Seller, or if Buyer refuses to accept any goods when tendered for delivery, Seller may, on fifteen (15) days written notice to Buyer, without prejudice to Seller's other lawful remedies, either defer further performance until the defaulted payments are made in full, or make future deliveries for cash in advance only, or to treat the entire contract or contracts with Buyer as breached by Buyer and pursue its remedies in breach.

8. BUYER'S REFUSAL OF DELIVERY

If Buyer refuses to accept delivery of any goods tendered for delivery, then Seller, without prejudice to Seller's other lawful remedies, may either store or cause such goods to be stored in a warehouse, for Buyer's account and at Buyer's cost, risk and expense, or sell such goods (without notice) to any purchaser at public or private sale, and hold Buyer liable for any difference between (A) the contract price of the goods, and (B) the price at which goods are resold less the costs and expense of such resale including brokerage commissions, or restocking charges.

9. GOODS IN TRANSIT

If prior to delivery or while the goods are in transit, Buyer or Seller becomes bankrupt or insolvent, or any petition in bankruptcy or for the reorganization or for appointment of a receiver is filed against Buyer or Seller, as the case may be, then the other party hereto may forthwith terminate this contract by giving written notice of such termination. Such termination shall not affect any claim for damages available to Buyer, to Seller, as actually paid in money, is abated by any order of judgment entered or any plan adopted in any bankruptcy, reorganization, receivership, or similar proceeding. Such termination shall not prejudice Seller's rights to any amounts then due under the contract. If Buyer becomes bankrupt or insolvent or any petition in bankruptcy or for reorganization or if a state court receivership is filed against Buyer, then, at its option, Seller may take possession of any goods theretofore sold to Buyer, in connection with which the full purchase price has not been paid, analogous to the terms and provisions set forth in Paragraphs 11 and 12 hereinafter.

10. DELIVERY

(A) Unless otherwise agreed, delivery of the goods to any carrier shall constitute delivery to Buyer, and thereafter the risk of loss or damage to the goods shall be upon Buyer. (B) If Buyer does not give delivery instructions to Seller at least ten (10) days prior to the delivery date ex factory confirmed by Seller, Seller may deliver the goods to a carrier of its own choosing, at Buyer's cost and risk, or, at Seller's option may store the goods on the pier or on any warehouse at Buyer's cost and risk. Any purchase price in such event becomes due and payable within ten (10) days of such storage.

11. PAYMENT OF PURCHASE PRICE

Time of payment is of the essence under the contract. Upon default in any of the terms of the contract, or failure to comply with any of the conditions thereof, or upon seizure of the property under execution or other legal process, or if Buyer becomes bankrupt or insolvent, or any petitions for reorganization or for appointment of a receiver is filed against Buyer, or if Buyer makes any assignment for the benefit of its creditors or otherwise sells, encumbers or disposes of the goods, or if for any other reason Seller should deem itself insecure, the full amount of the purchase price then remaining unpaid shall at once become due and payable at the option of Seller. Interest on the delinquent payment from the due date thereof until paid shall be at a rate of two (2%) percent per month.

12. BUYER'S DEFAULT

Upon Buyer's default, Seller may dispose of the merchandise in any manner that it deems fit and, if it desires to resell same, may do so at private or public sale, with or without notice, and with or without the property being at the place of sale, subject, however, to applicable laws. Seller or its assigns shall have the right to bid at such sale and may become the purchaser of the property. The proceeds of the sale shall first be applied to the expenses incurred in retaking, repairing, storing and selling the goods; reasonable solicitor's fees included, and then shall be applied to the payment of the balance due under the contract. Any surplus amount shall be paid to Buyer. If a deficiency results after the sale, Buyer agrees to pay such forthwith, together with reasonable solicitor's fees, for the recovery of the goods incurred by Seller. If upon Buyer's default, Seller elects not to resell any goods which it may repossess, then the cost of repossession, including reasonable solicitor's fees, shall forthwith be due and payable from Buyer to Seller.

13. SECURITY INTEREST AND TITLE

In provinces which are governed by a Personal Property Security Act, this contract shall serve as a security agreement, reserving in Seller a security interest until full payment of the purchase price. The provisions of the Personal Property Security Act regarding security interest shall have preference and apply if inconsistent with other terms of the conditions of sale herein. In provinces where a Personal Property Security Act does not apply, title to the goods shall remain in the Seller or its assigns until full payment of the purchase price. Buyer agrees to execute forthwith any and all documents in such a way and form as Seller may need for filing or recording the security interest under a Personal Property Security Act with the proper registers or offices, or for filing or recording the Conditional Sales Contract herein.

14. SALES AND USE TAX

Seller's prices do not include sales, use, excise or other taxes payable to any governmental authority in respect of the sale of Seller's goods. Buyer shall pay, in addition to Seller's price, the amount of any such taxes or shall reimburse Seller for the amount thereof that Seller may be required to pay. At the option of Seller, Buyer shall give evidence of payment or of exemption certificate.

15. INSURANCE

Buyer shall keep the goods insured against damage by fire, water or other casualty as required by Seller, with a company acceptable to Seller, with loss payable to Seller for the total purchase price until Seller is fully paid. Seller, if it so elects, may place said insurance at Buyer's expense; Seller may cancel such insurance at any time and without notice and may receive the return premium, if any.

16. MODIFICATION BY SELLER

Any contract may be assigned or transferred by Seller, or the time for the making of any payment due by Buyer may be extended by Seller without derogation of any of the rights of Seller or its assigns. Waiver by any party of any default shall not be deemed a waiver of any subsequent default.

17. RETURNED GOODS

No goods will be accepted for return unless authorized in writing by Seller. In all cases, transportation and restocking charges will be borne by Buyer.

18. PACKING

Seller does not charge for standard packaging for domestic shipment. Buyer will be charged, however, for export packaging or other special packing desired. Cost for cartage to ship or transfer express will be added to the invoice. No credit will be allowed if no packing is required.

19. EXPORT ORDER

Export orders are to be accompanied by a confirmed irrevocable Letter of Credit in Seller's favor, in Canadian currency, with an accredited Canadian bank, subject to Seller's draft, with shipping documents attached.

20. CANCELLATION

Placing orders on hold or cancellation of orders require Seller's written approval, and are subject to cancellation and/or restocking charges.

21. BUYER'S RESPONSIBILITY AS TO MAINTENANCE

Buyer shall use and shall require its employees and agents to use all safety devices and guards and shall maintain the same in proper working order. Buyer shall use and require its employees and agents to use safe operating procedures in operating the equipment and shall further obey and have its employees and agents obey safety instructions given by Seller. If Buyer fails to meet the obligations herein, Buyer agrees to indemnify and save Seller harmless from any liability or obligation with regard to any personal injuries or property damages directly or indirectly connected with the operation of the equipment. Buyer further agrees to notify Seller promptly and in any event not later than ten (10) days after notice or knowledge of any accident or malfunction involving Seller's equipment which has caused personal injury or property damages and to cooperate fully with Seller in investigating and determining the causes of such accident and malfunction. In the event that Buyer fails to give such notice to Seller or to cooperate with Seller, Buyer shall be obligated to indemnify and save Seller harmless from any such claims arising from such accident.

22. MISCELLANEOUS PROVISIONS

(A) If for any reason a provision of a contract is legally invalid, then in such event the rest of the contract shall remain in full force and effect, except that the parties shall try to replace such invalid provision with a provision closest to their original mutual intentions. (B) Any amendments to any contract or contracts require the consent in writing by both parties. Headings in this document are for ease of reference only.

23. NON ASSIGNMENT BY BUYER

Contract or contracts may not be assigned by Buyer without prior written consent of Seller.

24. APPLICABLE LAW

This agreement shall be governed by the laws of the Province of Ontario and the applicable laws of Canada. Buyer and Seller agree that any judicial proceeding with respect to this agreement must be brought and maintained in the City of Toronto, in the Province of Ontario.

25.

This instrument sets forth the entire understanding and agreement of the parties hereto in respect of the subject matter hereof, and all prior undertaking between the parties hereto, together with all representations and obligations of such parties in respect of such subject matter, shall be superseded by and merged into this instrument.

26.

The provisions of this agreement shall bind and ensure to the benefit of the parties hereto and their respective heirs, executors, administrators, successors and (subject to any restrictions or assignment herein above set forth) assigns, as the case may be.

27.

The parties acknowledge that they have requested this document and all notices or other documents relating thereto be drafted in the English language.

Les parties reconnaissent qu'ils ont requis que ce contrat et tous les avis ou autres documents qui s'y rapportent soient rédigés en langue anglaise.

Terms and Conditions in French available upon request.

NORD Gear Limited

Toll Free in Canada: 800.668.4378

09.29.14

NORD Gear Corporation

Toll Free in the United States: 888.314.6673

www.nord.com



Gear Units



DuoDrive Integrated Gear Motor
Catalog: G5010
Flyer: S5010



Helical Inline
Catalog: G1000



NORDBLOC.1® Helical Inline
Catalog: G1013



CLINCHER™ Parallel Shaft
Catalog: G1020



Screw Conveyor Package (SCP)
Catalog: G1129



Overhead Conveyor Drives
Catalog: G1043



2-Stage Right Angle Helical Bevel
Catalog: G1014



Right Angle Helical Bevel
Catalog: G1000

Worm Gear Units



FLEXBLOC® Worm - SI
Catalog: G1035
Flyer: F1033

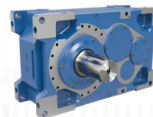


MINICASE™ Worm - SMI
Catalog: G1035
Flyer: F1033



Right Angle Helical Worm
Catalog: G1000

Industrial Gear Units



MAXXDRIVE® Industrial Gear Units (Parallel, Right Angle)
Catalog: G1050
Flyer: F1050



MAXXDRIVE® XT Industrial Gear Units (Parallel)
Catalog: TI60-0011
Flyer: S1055

Motors & Brakemotors



VFD/AC Vector Duty Motors
Catalog: M7000



IE4/IE5+ Premium Efficiency Motors
Catalog: M5000
Flyer: S9012



Smooth Body Motors
Catalog: M7010

Variable Frequency Drives



NORDAC® START Motor Starter - SK 135E
Catalog: E3000
Flyer: F3015



NORDAC® BASE VFD - SK 180E
Catalog: E3000
Flyer: F3018



NORDAC® FLEX VFD - SK 200E
Catalog: E3000
Flyer: F3020



NORDAC® LINK VFD & Motor Starters
Catalog: E3000
Flyer: F3025



NORDAC® PRO Cabinet VFD - SK 500E
Catalog: E3000
Flyer: F3050



NORDAC® PRO Decentralized VFD - SK 500P
Catalog: E3000
Flyer: F3060



NORDAC® ON/ON+ Decentralized VFD
Catalog: E3000
Flyer: S9013



Our customer-first approach means we take extra care to support our customers throughout the entire buying process and beyond. In addition to phone support, we offer myNORD online customer tools where customers can select, order, and track their products 24/7.

NORD is also ready to support you in the event of a breakdown, whether the product is ours or not. We can quickly provide you with replacement parts, components, or complete units to get you back up and running fast. NORD 365-day breakdown support includes:

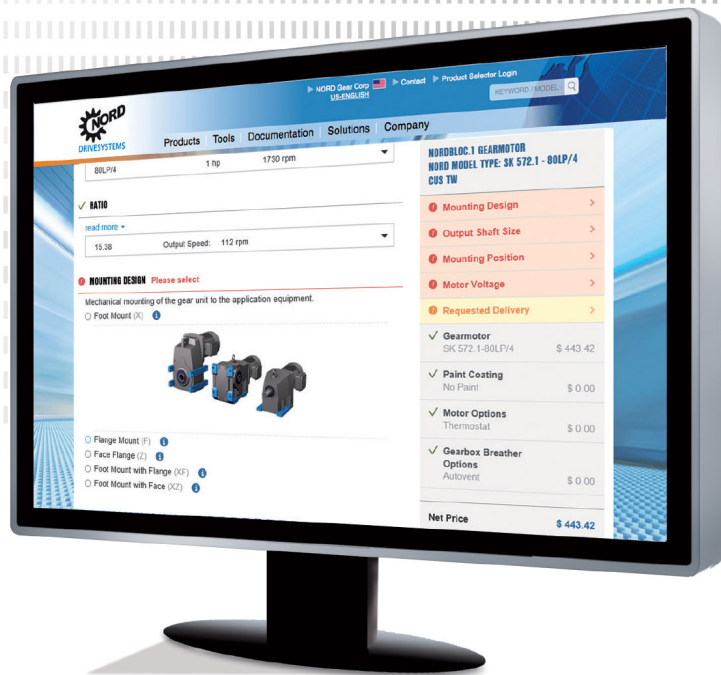
- Immediate live support to get your replacement product within hours
- Basic troubleshooting and customer support
- Ordering of spare parts, components, or replacement units
- Competitor interchange - use our myNORD online configuration tool to specify a comparable NORD unit, call us and we can assemble and ship it to you in as little as 24 hours

Order spare parts quickly and conveniently with our online Parts Shop!

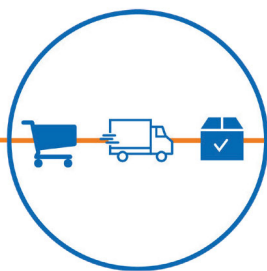


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- ▶ Obtain drawing files direct from quote configuration
- ▶ Effortlessly select & configure customized drive solutions
- ▶ Create quotes with account-specific net pricing
- ▶ Order-specific documentation
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SCP MASTER SEAL SCREW CONVEYOR SHAFT SEAL

SCP MASTER SEAL DESCRIPTION

Screw Conveyor Shaft Seal, SCP Master Seal, Stainless Steel (316SS) Cover Plates, UHMW Body, Teflon Rotor Cups, Silicon Elastomer.

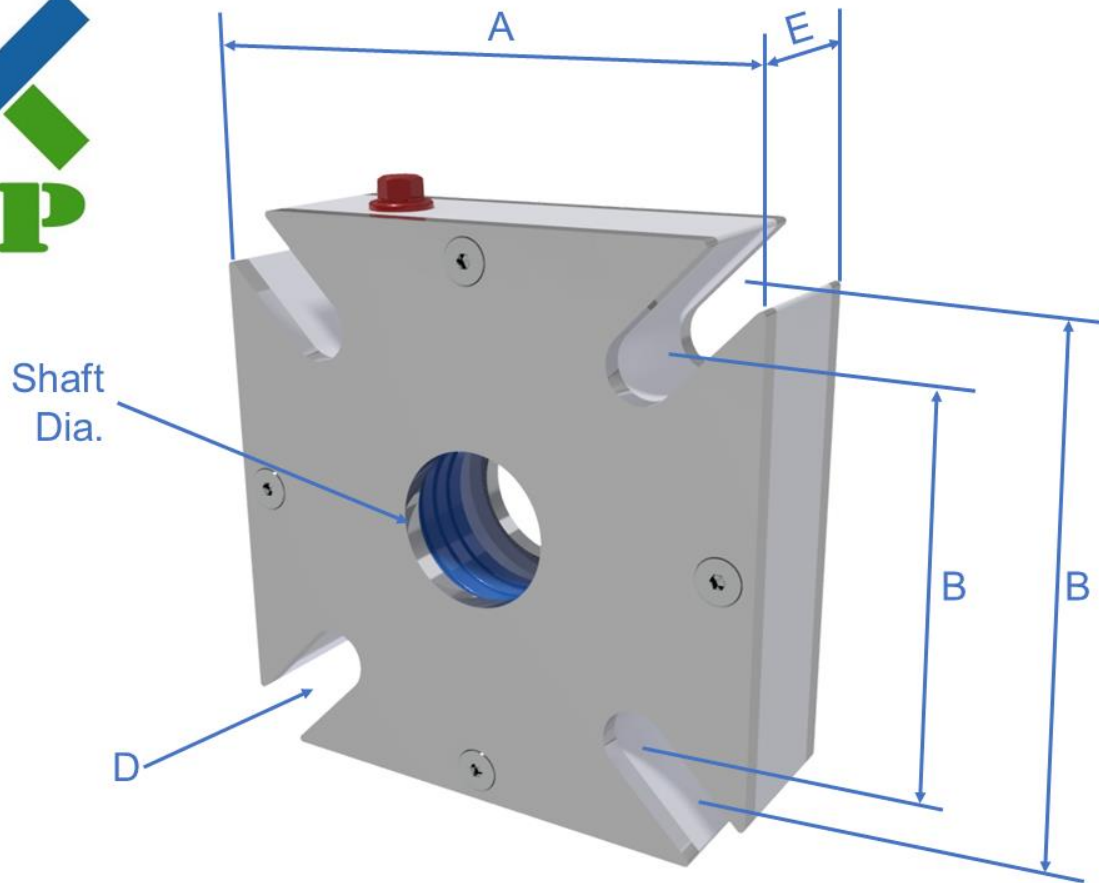
ADVANTAGES OF THE SCP MASTER SEAL:

1. This is a fully mechanical screw conveyor shaft seal with Teflon rotors cups sealing against 316SS face plates. This sealing mechanism eliminates the traditional Teflon rope against the conveyor shaft leading to premature seal and shaft failure.
2. Optional air purge keeps the sealing surfaces clean of contaminants and increases screw conveyor shaft seal life, even in the most abrasive products such as sand, coal dust, minerals and metal recyclables.
3. This mechanical screw conveyor shaft seal takes the place of traditional waste pack and plate seals meaning a superb sealing option is available without the need for costly upgrades to existing and new-build screw conveyors.
4. With a housing made of 316 Stainless Steel and UHMW, this seal is well suited for any environment and will usually outlast the conveyor it is attached to.
5. This seal is completely rebuildable without needing to be removed from the shaft. Over time abrasive products can take their toll on any seal so easy to install rebuild kits are available and can be installed in as little as 30m.



Screw Conveyor Parts, LLC
PO Box 470187, Fort Worth, TX 76147
(682) 231-1228 GetHelp@ScrewConveyorParts.Com
www.ScrewConveyorParts.com

6. Affordability – For a few hundred bucs over the cost of a waste pack seal, these seals will pay for them selves over and over.



Shaft Dia.	A (SQ.)	B – Min (SQ.)	B – Max (SQ.)	D (Bolts)	E
1 1/2"	5 3/8"	4"	4 1/8"	1/2"	1 5/8"
2"	6 1/2"	4 3/8"	5 1/8"	5/8"	1 5/8"
2 7/16"	7 3/8"	5 3/8"	5 5/8"	5/8"	1 5/8"
3"	7 3/4"	6"	6"	3/4"	1 5/8"
3 7/16"	9 1/4"	6 3/4"	7"	3/4"	1 5/8"

Dimensionally the same as a std Waste Pack Seal

INSTALLATION INSTRUCTIONS

1. The Seal is shipped in its final assembled configuration.
2. Loosen spring tension ring two 360* turns via the adjustment port.
3. Slide seal along shaft and position seal at vessel end wall. If resistance is present, lubricate with dissipating solution, (eg) soapy water.
4. Test perpendicularity with square, seal must be square to the shaft within 1/16".
5. Secure seal with mounting bolts using torque wrench at 20-25 foot pounds of torque. DO NOT OVER TIGHTEN.
6. Once seal is secured in position, retighten spring tension ring the two 360* turns, or three finger tight. DO NOT OVER TIGHTEN.
7. Install air purge gauge at either of the two ports, set the purge pressure at 5-10 psi above any internal vessel pressure. Purge should be detectable at the lip of the 316SS mounting plate, if no purge detected, increase the purge pressure or loosen the spring tension ring, at 1/4 turn increments. Use clean dry air, or silicone based grease.
8. If any product leakage is detected, adjust the spring tension ring, at 1/4 turn increments, or increase air purge.
9. Test Seal for any heat at the outboard endplate, if heat is present loosen spring tension ring and check perpendicularity of seal to shaft.

Routine checks of seal is suggested, as the rotor assembly will seat itself upon operation. This will be evidenced by a slight flaking of the Teflon rotor cup. The spring tension ring should be adjusted at 1/4 turn increments. This will compress the silicone elastomer slightly causing it to spread laterally, maintaining correct pressure / tension between the stationary and rotating faces.



Screw Conveyor Parts, LLC (SCP) Terms and Conditions of Sale

DEFINITIONS: "SCP" shall refer to the Screw Conveyor Parts, LLC. "Customer" shall refer to the legal entity whom paid for, is using, is going to use, or who will at any time have possession of portion or whole of the parts, equipment and services supplied by Screw Conveyor Parts, LLC. "Equipment" shall refer to all parts, pieces, equipment, components and any other items or services sold through or by Screw Conveyor Parts, LLC. "Supplier" shall refer to and legal entity who supplies any parts, pieces, equipment, components and any other items or services sold through or by Screw Conveyor Parts, LLC

TERMS OF PAYMENT: All invoices are due and payable in Tarrant County, Texas. All credit sales are due in full within thirty (30) days from the date of invoice, unless otherwise agreed to in writing or stated in the invoice. No discount is allowed for earlier payment unless authorized by SCP in writing. Accounts past due shall accrue interest at the highest rate allowed by applicable law.

LIMITED WARRANTY: Equipment sold by SCP and manufactured by others is not warranted in any way by SCP and carries only the manufacturer's warranty, if any. SCP MAKES NO OTHER WARRANTY OF ANY KIND AND HEREBY DISCLAIMS ALL WARRANTIES EXCEPT THE LIMITED WARRANTY HEREBY STATED, BOTH EXPRESS AND IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. All warranty claims must be submitted to SCP within ten (10) days of discovery of defects or shall be deemed waived, without prior approval in writing.

LIMITATIONS OF LIABILITY: It is expressly understood that SCP's liability is limited to that of the original manufacturer's warranty as described above. SCP SHALL NOT BE LIABLE, UPON WARRANTIES OR OTHERWISE, FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES FOR ANY DAMAGES ARISING FROM THE USE OF EQUIPMENT. Thus, SCP is not liable for any other expense, loss or damage including, but not limited to loss of profits, production, increased cost of operation, spoilage arising in connection with the sale or use of, or inability to use the purchased equipment or products for any reason, except as herein provided.

JURISDICTION AND VENUE: It is expressly understood that this sale of products or equipment was negotiated, executed, consummated and is otherwise performable in Tarrant County, Texas, and shall be governed, construed and interpreted as to validity, enforcement and in all other respects in accordance with the laws of the State of Texas, and the laws of the United States of America, as applicable. SCP has its principal place of business in Tarrant County, Texas, which county shall be the proper place of venue to enforce payment or performance. Purchasers irrevocably agree that any legal proceeding arising out of or in connection with this sale shall be brought in the state courts of Tarrant County, Texas, or the United States District Court for the judicial district in which Tarrant County is located.

SAFETY DEVICES: SCP will supply only such safety devices as are specified in writing by the customer. Any additional safety measures or devices which may be required by law, or which the customer wishes to add, are to be furnished by the customer or, at the customer's written request, the safety devices will be furnished by SCP at additional cost to the customer. The aforementioned safety devices include, but are not limited to; interlocks, limit switches, overflow relief switches, shear pins, emergency stop switches, emergency stop pull cables and point-of-operation switches.

User Training: Customer agrees that it assumes sole responsibility and liability for training of its employees, contractors, agents, and other end users in the safe operation of the SCP sold equipment. Customer agrees that it has not retained nor paid SCP to provide safety training, operational training, or best-practices advice or input regarding the operation of any SCP sold equipment, or the types of safety devices best suited for the customer's usage of the purchased equipment. Customer acknowledges that it has superior information and control over the manner in which the SCP sold equipment will be incorporated as a component part into customer's processes, and that the customer is in a superior position to specify appropriate safety devices and to design safety training protocols to conform to equipment usage. Customer releases, indemnifies, and holds harmless SCP, or any of its suppliers, for any claims related to the safe operations of its equipment.

Indemnity: Customer agrees to defend, indemnify and hold harmless SCP for any liability arising out of any injuries, damage, or casualty loss of any kind whatsoever experienced by customer, its employees, contractors, or assigns arising out of or involving in any way customer's utilization or operation of SCP sold equipment or any component part thereof. Such defense and indemnity obligation includes any and all claims arising out of any allegation of SCP's own alleged negligence or any alleged manufacturing, design, or warning defect or deficiency asserted against SCP, or its suppliers.

Arbitration: Customer agrees that any claim or dispute of any kind whatsoever arising out of the terms of the sale and purchase of SCP's sold equipment, any injuries, damage, or loss associated therewith, or any claim asserted on behalf of customer, its employees, agents, or assigns arising out of the operation or utilization thereof will be resolved solely through mandatory binding arbitration as the parties' exclusive remedy.

SAFETY WARNING LABELS: All equipment sold by SCP has warning labels affixed in many easily seen locations. Additional safety stickers are available upon request from the Conveyor Equipment Manufacturer's Association (CEMA – www.cemanet.org). Please refer to CEMA Safety Program, along with Warning and Safety Reminders for Screw, Drag and Bucket Elevator Conveyors, CEMA Safety Label Placement Guide and CEMA Safety Labels documents for further information. SCP's suppliers will supply standard safety warning labels as recommended by CEMA or equivalent industry standards. Customer acknowledges that it has superior information regarding the manner in which the SCP sold equipment will be incorporated into customer's manufacturing processes, and the skill level and language abilities of customer's employees who may interface with the equipment. Customer agrees that it is solely responsible for any additional safety signage, warnings, or other safety requirements particular to its employees or utilization of the SCP sold equipment, and customer hereby releases, indemnifies, and holds harmless SCP and its suppliers for any liabilities arising out of same.

CONTRACTS: All contracts are made and accepted in Fort Worth, Texas, and are not valid until written and signed acknowledgement from SCP. It is the intent and purpose of SCP to surrender title to the sold equipment when final payment is made, including shipping charges. Possession may be given before final payment is due, and to protect SCP against default in payment or in the event of an execution or attachment is levied on the customer's property, it is hereby expressly agreed:

- (A) The title and right of possession to the sold equipment shall remain with SCP until full and final payment is made, including shipping charges;
- (B) No part of the sold equipment shall be considered a fixture or incorporated into the realty by virtue of its attachment to real estate and any part may be separated from such real estate for the purpose of re-possession by SCP or by its agents in the event of a default by purchaser;
- (C) SCP shall have the right to elect a claim of mechanic's lien against the property upon which this material is situated and waive its rights to re-possess under Paragraphs (A) and (B) above any time before expiration of the time fixed by law for filing a mechanic's lien;
- (D) Acceptance or acknowledgement of any order, quotation or contract is with the express understanding that a "no lien agreement" has not been filed.

DELIVERY: Delivery or shipment lead times or dates represent only the best estimate of the time required to complete the work and ship the material from the SPC supplier or office. All orders are accepted with the understanding that shipping dates are approximate and subject to change because of, but not limited to factory conditions, fires, strikes, material shortages, civil or military authority, mandatory priority and/or other causes beyond the knowledge or control of SCP.

CANCELLATION: Orders received by SCP are not subject to cancellation and no cancellations will be accepted except upon terms that will INDEMNIFY SCP against loss. Accepted order cancellations will include a 15% charge and/or charges for any work performed prior to written notification, whichever is greater.

SHIPPING: All orders are made F.O.B. Fort Worth, Texas, or the location of the supplier unless otherwise indicated. All shipping charges are subject to a minimum 15% mark-up. SCP responsibility ceases when delivery has been made to the transportation company. All equipment shall be checked for damage immediately upon arrival by the customer. If there are shortages or evidence of damage upon delivery, the customer should insist on the transportation agent making notations on the shipping documents before signing the receipt. SCP will cooperate with customers, when desired, in obtaining adjustments from the transportation company due to loss or damage. If assistance is required of SCP, written notification must be received from the customer by SCP within 24 hours of receipt of the equipment and have been documented on the transportation company's receipt. Do not attempt to install damaged component equipment. Claims for errors or shortages existing prior to delivery of the equipment to the carrier will be considered only when made known to SCP within 24 hours of receipt of equipment.

RETURNED GOODS: No material will be accepted for return unless such return is first authorized in writing by SCP. Accepted returns will include a 15% charge plus any restocking fees assessed to SCP. Customer will pay all shipping charges to return the equipment.

SPECIAL TAXES: Any federal, state or city sales tax or other manufacturers' or processors' tax, if any when assessed, will be added to the invoice.

PAINTING: SCP sold equipment will be shipped with one coat of standard shop paint to all outside accessible unfinished surfaces, and a protective coat to all machine-finished surfaces. This coating is meant to prevent major corrosion. This coating is not cosmetic and minor scratches, scuffs, surface rust and wear are to be expected. This coating is not meant to be protective for any period beyond the shipping process. This protective coating is not covered under any warranty hereby stated, both express or implied.