



# NABRICO

## DF-1 NS Electric Winch Owner's Manual

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# NABRICO

## DF-1-NS ELECTRIC MANUAL WINCH

### Owner's Manual

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## **SAFETY INFORMATION**

### **CAUTION**

Prior to installing and operating the winch, please read this manual thoroughly and carefully. Keep this manual and all other instructions accessible at all times.

The Occupational Safety and Health Act of 1970 states that it is the employer's responsibility to provide a workplace free of hazard. To this end, all equipment should be installed, operated and maintained in compliance with applicable trade, industrial, federal, state and local regulations. It is the equipment owner's responsibility to obtain copies of these regulations and to determine the suitability of the equipment for the equipment owner's intended use.

Although this manual will help you become familiar with the basic operation of the winch, it is by no means a substitute for proper training by your company in the safe use of winches, barge rigging and other marine equipment. This manual suggests methods of operation, but ultimately, the owners and operators of the equipment are responsible for determining whether a particular method of operation is safe and appropriate for the equipment being operated. Only individuals trained in the proper use of winches, barge rigging and other marine equipment should operate these winches.

The typical operating environment of barge and towboat winches often includes very high forces, and the potential hazards associated with these high forces should not be underestimated. Improper installation or incorrect or unsafe use could result in injury or death to persons or cause equipment failure or damage.

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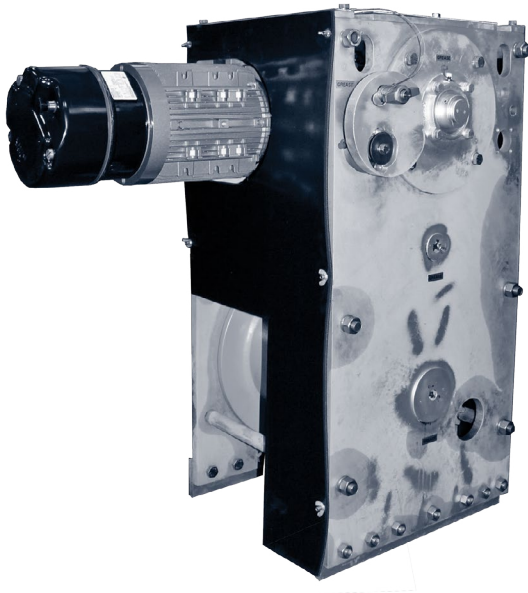
### **Recommended Information for Safe Operation:**

### **CAUTION**

- Check lubrication before use.
- Do not apply tension to the winch unless there are 5 complete wraps of rope on the drum.
- Do not operate the equipment unless you have a firm stance on a non-slippery surface.
- Do not wrap the wire rope around the load. This will damage the wire rope and could cause the load to escape. Rigging connectors are strongly recommended to secure the wire rope to the load.
- Keep fingers, loose clothing and any foreign objects away while operating the equipment.
- Do not divert attention away while operating the equipment. Stay alert to the possibility of accidents and try to prevent them from happening.
- Always remain to the side of the equipment while in operation.
- Never operate the equipment from the front or when bystanders are in front of it.
- Operators and bystanders should stay clear of any load and the wire rope while the equipment is operating.
- Avoid shock loads by starting and stopping the equipment smoothly. Shock loads can over load the equipment which may cause damage.
- Under no circumstances should any equipment be used to move, raise or lower a person(s) or equipment.
- Do not exceed a 15 minute duty cycle for the winch. To do so may result in equipment damage or failure.

<h3><b><u>NOTICE</u></b></h3>
Inspect the equipment carefully at least once a month for loose fasteners, worn gears and pawls, cracked welds and other damaged parts. If any worn, cracked or damaged parts are found, stop use immediately and remove equipment from service until all appropriate repairs are completely made.

## 1.1 GENERAL INFORMATION



### **DF-1 NS ELECTRIC WINCH Features & Specifications**

- Salt water package standard on all power winches.
- Hot-dipped galvanized.
- Stainless or silicon bronze fasteners.
- 3-ply conveyor belt covers (damage and corrosion resistant).
- 3-tooth locking dog with large release and fail-safe disc brake.
- NEMA motor design with helical-bevel gearbox.
- Heaviest winch in its class.
- Variable frequency drive option available. Amp draw limits, variable speeds, and motor protection.
- Made as one model adjustable to true right or left hand models for use in pairs.
- Over 100 fewer parts than other electric winches (no chain or sprockets).
- 30 Ton - 5 HP motor standard.
- 40 Ton - 7.5 HP motor standard.
- 65 Ton - 10 HP motor standard.

MODEL	HOLDING DOG & OR BRAKE	LINE PULL		LINE SPEED 1ST LAYER (FPM)	DRUM CAPACITIES (FT)				WEIGHT (LBS)
		@ RATED AMPS	@ MOTOR STALL		1/2"	5/8"	3/4"	1"	
DF-I-30	30 TONS	12,500	18,570	14	361	228	138	66	1700
DF-I-40	40 TONS	15,600	23,400	16	-	287	180	100	1800
DF-I-65	65 TONS	37,800	56,700	9	-	572	325	200	3200

## **1.2 INSTALLATION OF EQUIPMENT**

### **NOTICE**

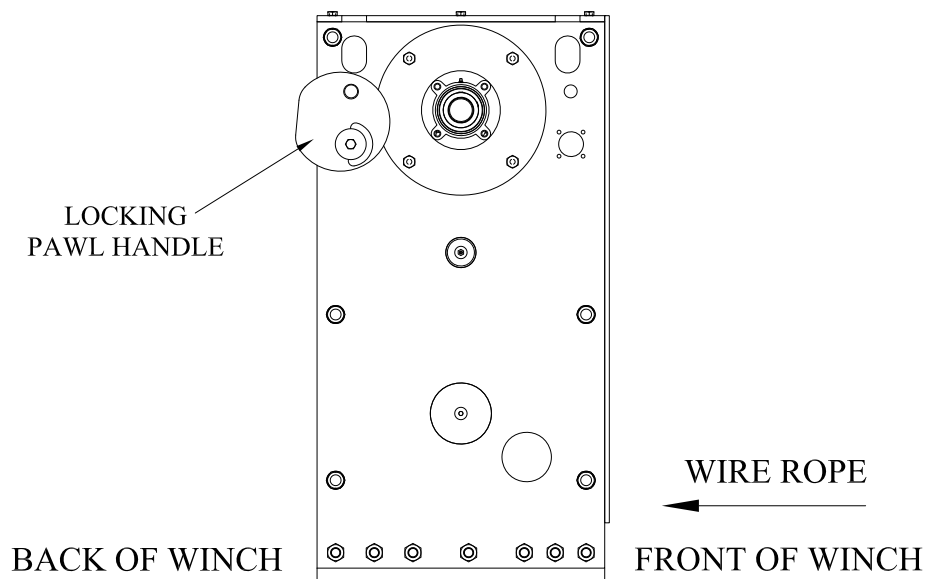
It is the responsibility of the customer, not the winch manufacturer, to properly locate and install the winch with regard to the safety of those operating the machinery.

### **CAUTION**

**Install the equipment in an area where there is ample room to operate the unit without the operator becoming entangled in the cable, lines, chains, winch mechanisms or other nearby equipment.**

- 1.2.1** All winches must be installed on a flat, rigid and non-slippery surface. Deck and structure must be strong enough to withstand the weight and holding capacity of the winch and ultimate capacity of the wire, and the forces likely to occur during operation. A qualified professional should inspect or design the foundation to insure that it will provide adequate support.
- 1.2.2** Locate the winch in a suitable area free of traffic and obstacles. The winch should also be visible during entire operation. Keep in mind that the winch needs to be accessible for proper lubrication, maintenance and operation.
- 1.2.3** Mounting direction must be in line with the desired direction of cable pull. The front of the winch must face in the direction from which the cable is reeled (see fig. #1). When the unit is powered up the drum should rotate so that it reels cable onto the bottom of the drum from the front of the winch.

**FIGURE #1 - MOUNTING POSITION**



- 1.2.4 Maintain a fleet angle no greater than 1-1/2 degrees from winch drum to lead sheave (see appendix 1). The proper fleet angle helps to minimize wire rope damage by assisting the wire rope to wind uniformly onto the drum.
- 1.2.5 Using sufficient tack welds, secure the base bars to the deck or doubler plate. This will prevent the winch from becoming misaligned from heat distortion during the application of the seal weld.
- 1.2.6 Next apply a seal weld to the mounting fixture to permanently secure it to the deck. The seal weld will prevent corrosion from occurring between the mounting fixture and mounting surface.
- 1.2.7 Inspect the winch immediately following installation. This inspection will give a good starting record of the winch condition so that future inspections can be compared.

<b><u>CAUTION</u></b>
-----------------------

<b>Remember that the weld has to be strong enough to withstand loads equal to or greater than the capacity of the winch and ultimate capacity of the wire.</b>
--

## **1.3 ELECTRIC POWER CONNECTION**

<b>CAUTION</b>
----------------

<b>All electrical work must be performed by a licensed electrician. Failure to do so could result in electric shock or poor equipment operation.</b>
--

- 1.3.1 All winches have been factory tested prior to shipment to insure proper operation.
- 1.3.2 All winches have been factory wired to accommodate power supplies as specified by the customer.
- 1.3.3 Make certain that equipment is grounded before electrical power is connected.
- 1.3.4 Refer to Appendix B.1 for typical connection between motor and control box.
- 1.3.5 Ensure that the correct power supply agrees with the motor rating before connecting power to the winch. Do not operate the winch until proper power is supplied to the motor.
- 1.3.6 Before operation of the winch, remove the plastic plug from the gearbox breather.
- 1.3.7 Test connections by operating the winch. The rotation of the drum must agree with the labels of the control device, and the motor must stop when the control is released. The drum must reel the wire rope onto the bottom of the winch drum when the "IN" button is depressed.



## **1.4 INSTALLATION OF WIRE ROPE**

- 1.4.1 To install wire rope, rotate the drum of the winch so that the U-bolt nuts are easily accessed through the round cut out located on the side of the winch (see fig. 2a).
- 1.4.2 Using a standard socket wrench with an extension, loosen the nuts.
- 1.4.3 If installing wire rope on a new winch, remove and discard the u-bolt spacer pipe. If replacing worn out wire rope, remove the wire rope from the U-bolt and dispose of properly.

### **CAUTION**

**Remember to always wear the proper protective equipment when handling the wire rope.**

- 1.4.4 Rotate the U-bolt so it is at the bottom of the winch and insert the new wire rope end under the winch drum and through the U-bolt from the front of the winch so that approximately 3 to 4 inches extend through the U-bolt.

### **NOTICE**

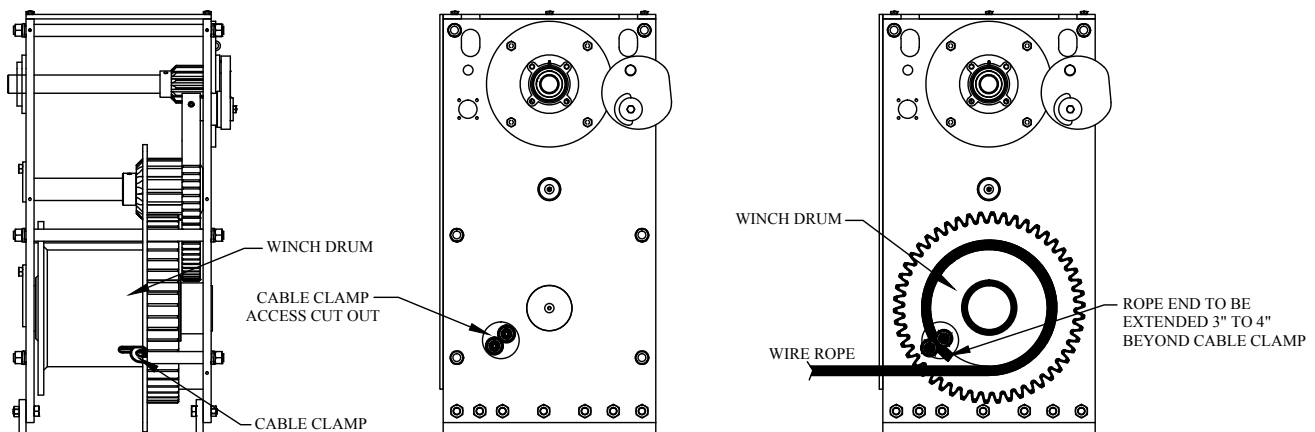
Breaking strength of new wire rope should be a least 3 times greater than the largest load placed on the winch. This minimum value may be greater depending on type of load and the method of moving the load.

- 1.4.5 Ensure that the wire rope remains in the U-bolt and rotate the drum around so the U-bolt aligns with the cable clamp access cut out (see fig. 2b).

### **CAUTION**

**The U-bolt nuts must be retightened periodically to insure that the wire rope end is held in place snugly against the drum flange. Over time and usage the rope will “crush” down at the U-bolt creating the possibility that the rope end will escape.**

**FIGURE #2 - INSTALLING THE WIRE ROPE**



A) LOCATING THE CABLE CLAMP

B) INSTALLING THE WIRE ROPE

- 1.4.6** Tighten the U-bolt nuts evenly to secure the wire rope to the winch drum. The U-bolt will act as a vise keeping the wire rope in place as the rest of the rope is reeled onto the winch.
- 1.4.7** Wind the wire rope onto the drum by operating the winch. Maintain tension on the wire rope to insure that the first coil lays snugly against the drum flange and each successive coil is snug against the previous coil. Make sure that the wire rope is being reeled in from the bottom on the winch drum.
- 1.4.8** Continue wrapping the wire rope until there are at least 5 complete wraps on the winch drum. These wraps serve as an anchor and must remain on the drum at all times.

**WARNING**

**In order for the winch to attain its full holding capacity, 5 complete wraps of the wire rope must be on the winch drum at all times. Also, make sure the rope is installed securely to the drum. A poorly secured wire rope could come loose from its anchor and allow the load to escape.**

**NOTICE**

Drum capacity depends on how tightly and evenly the wire rope is wound on the drum. Actual drum capacities are usually 25% to 30% less than values given in performance tables when the wire rope is loosely wound and overlapping. Also, line speed will increase with each additional layer of wire rope that is wound onto the drum.

## **2.1 OPERATING THE WINCH**

### **2.1.1 Powered Operation**

- 2.1.1.1** To reel the wire rope onto the winch drum, depress and hold the “IN” button located on the control box or remote operator station. Make certain that the locking pawl is disengaged by rotating the locking pawl handle to the up position and inserting the T handle locking pin to secure in place (see fig. #3a).
- 2.1.1.2** Observe the wire rope as it winds onto the winch drum. If it becomes loose, uneven or overlapped, stop the operation and rewind before continuing. Continued operation with undesirable wire rope lay can damage the rope and shorten its life.
- 2.1.1.3** To reel the wire rope off the winch drum, depress and hold the “OUT” button located on the control box or remote operator station. Some tension should be kept on the wire rope during unreeling to minimize rope fouling on the drum.

#### **CAUTION**

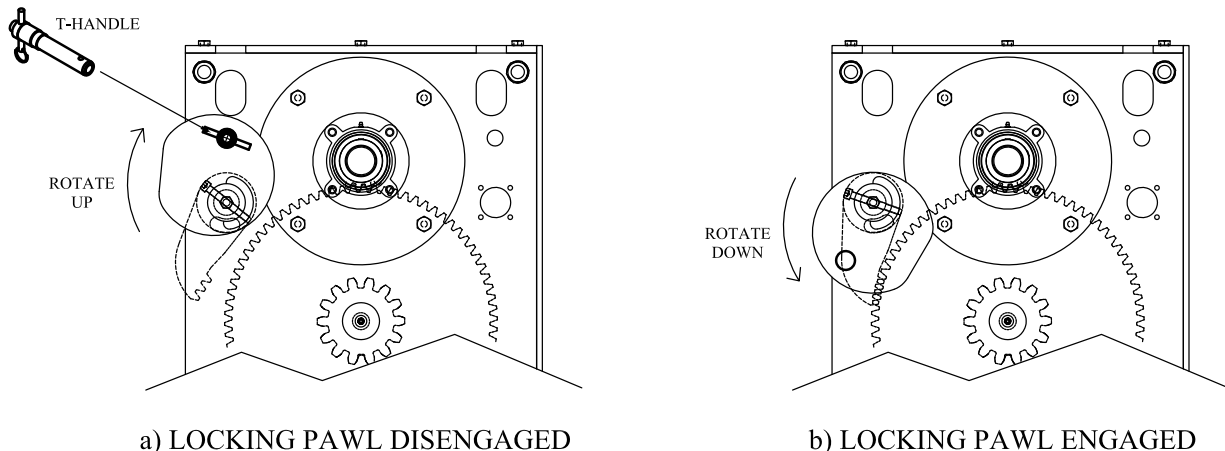
**Length of winch operation should not exceed the 15 minute duty cycle rating.**

#### **NOTICE**

Breaking in the winch occurs during the first 30 to 60 minutes. During break-in, mating surfaces become polished and clearances increase. This is desirable for efficient operation of the bearings and gears.

- 2.1.1.4** To stop the wire rope, release the “IN” or “OUT” button; this will automatically engage the electric brake located on the winch motor. As with any electric brake, there is a slight delay (approx. 0.03 seconds) between the “IN” or “OUT” button release and brake set.
- 2.1.1.5** After the winch is stopped and the brake is set, the locking pawl handle can be rotated down so the locking pawl is free to engage thus dogging the winch down (see fig. #3b).

### **FIGURE #3 - LOCKING PAWL DISENGAGE/ENGAGE**



## 2.1.2 Emergency Operation

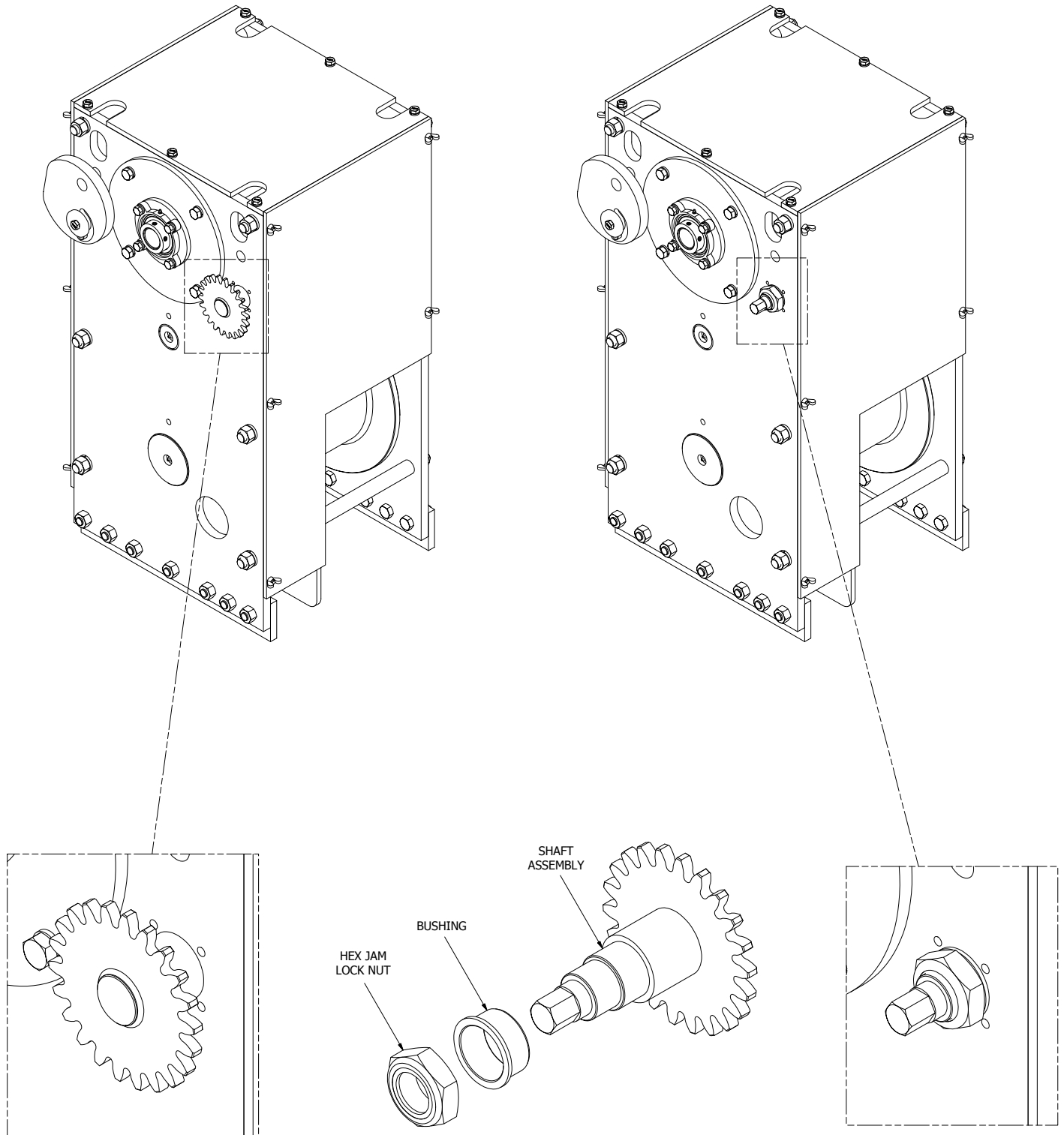
### **WARNING**

**Manual operation of an electric winch while under load is extremely dangerous and should only be performed in emergency situations. The extreme high tensions that are common in winch applications should not be underestimated.**

**To reduce the potential of electric shock, lock out and tag out procedures should be followed before initiating any type of manual operation of the winch**

- 2.1.2.1 In case of power failure, disconnect all power sources supplied to the winch.
- 2.1.2.2 Rotate the locking pawl handle down so the locking pawl is free to engage thus dogging the winch down (see fig. 3b).
- 2.1.2.3 Make sure safety precautions have been taken to secure the load and keep unnecessary personnel away from the winch while operating in manual mode.
- 2.1.2.4 Remove the rubber cover from the front of the winch.
- 2.1.2.5 Remove the Hex Jam Lock Nut (see fig. 4) from the Emergency Ratchet Add-on.
  - 2.1.2.5.1 DF-1-30 Emergency Ratchet P/N 101622
  - 2.1.2.5.2 DF-1-40 Emergency Ratchet P/N 101620
  - 2.1.2.5.3 DF-1-65 Emergency Ratchet P/N 101621
- 2.1.2.6 Remove the Shaft Assembly (see fig. 4) from the Stowed Position and reinstall inside the winch with the hex part of the shaft protruding through the winch.
- 2.1.2.7 Replace the Hex Jam Lock Nut on the outside of the winch in the Engaged Position.
- 2.1.2.8 Disengage the motor brake by turning the lever located on the outside of the brake 90 degrees. The locking pawl should now be holding the load applied to the winch.
- 2.1.2.9 While maintaining control of the brake release lever and manual crank, rotate the locking pawl handle up relieving the locking dog engagement (see fig. 3a). The winch should now be ready to be operated manually. It is recommended to have more than one person to operate the winch in manual mode.
- 2.1.2.10 Using a 15/16" ratchet, rotate the Emergency Ratchet Add-on until the tension on the wire rope reaches the desired level.
- 2.1.2.11 Once tensioning has been achieved, the locking pawl should be reengaged dogging the load down.
- 2.1.2.12 After all loads have been removed from the winch, remove the Emergency Ratchet Add-on and store in the Stowed Position.

# FIGURE #4 - EMERGENCY OPERATION



STOWED POSITION  
SCALE 2" = 1'-0"

ENGAGED POSITION  
SCALE 2" = 1'-0"

## **3.1 EQUIPMENT INSPECTION**

### **NOTICE**

An inspection program should be started as soon as any equipment is put into service. A qualified person should be appointed the responsibility of regularly inspecting the equipment. Written records of inspections are recommended by the manufacturer.

### **3.1.1 Frequent Inspection**

- 3.1.1.1** Visually inspect the equipment before each use. Check the equipment for cracks, bending, wear, rust, corrosion and any other damage. If any problems are discovered, stop use immediately and remove the equipment from service until all appropriate repairs are completely performed.
- 3.1.1.2** **ENSURE THAT EQUIPMENT IS PROPERLY LUBRICATED.** Check the gearbox for signs of leakage and make sure it is filled with the proper lubricant.
- 3.1.1.3** Check to ensure that the foundation is in good condition. Make sure that mounting fasteners and other hardware are tightened securely.
- 3.1.1.4** Check electrical wiring and connections for wear, cuts, corrosion and other damage.
- 3.1.1.5** Ensure that the wire rope is installed correctly and anchored securely to the drum. Also, check to make sure the wire rope is in good condition.
- 3.1.1.6** While equipment is running, listen for unusual noises and look for signs of damage. Visually inspect the wire rope to ensure that it winds evenly onto the drum. Make sure the winch responds properly to control device(s) and that the brake operates correctly.

### **3.1.2 Periodic Inspection**

- 3.1.2.1** Periodic inspections should occur whenever equipment is returned to service from storage, every six months in service, more frequently if an inspection discovers any damage or poor operation or in any case where the winch may have been over loaded or operationally abused.
- 3.1.2.2** Visually inspect the equipment checking the finish for wear, flaking or other damage as listed in the frequent inspection plan. Disassembly is recommended in order to properly inspect individual components.
- 3.1.2.3** Check the gearbox oil for dirt, metal particles, water and other signs of contamination by draining a small amount into a clean container.
- 3.1.2.4** Ensure that the gearbox is properly lubricated and replenish if necessary to restore the proper level.
- 3.1.2.5** Check the winch drum by moving it with your hands. Check for excessive movement that may be the result of worn or loose gears, bearings or shafts. Some play is normal while excessive play may be the result of overloading.

- 3.1.2.6 Disconnect power and thoroughly inspect electrical equipment for signs of wear, cuts, corroded connections, moisture, burn marks and other damage.
- 3.1.2.7 Check the power supply at the motor to ensure that it is consistent with the motor rating.

### 3.1.3 Wire Rope Inspection

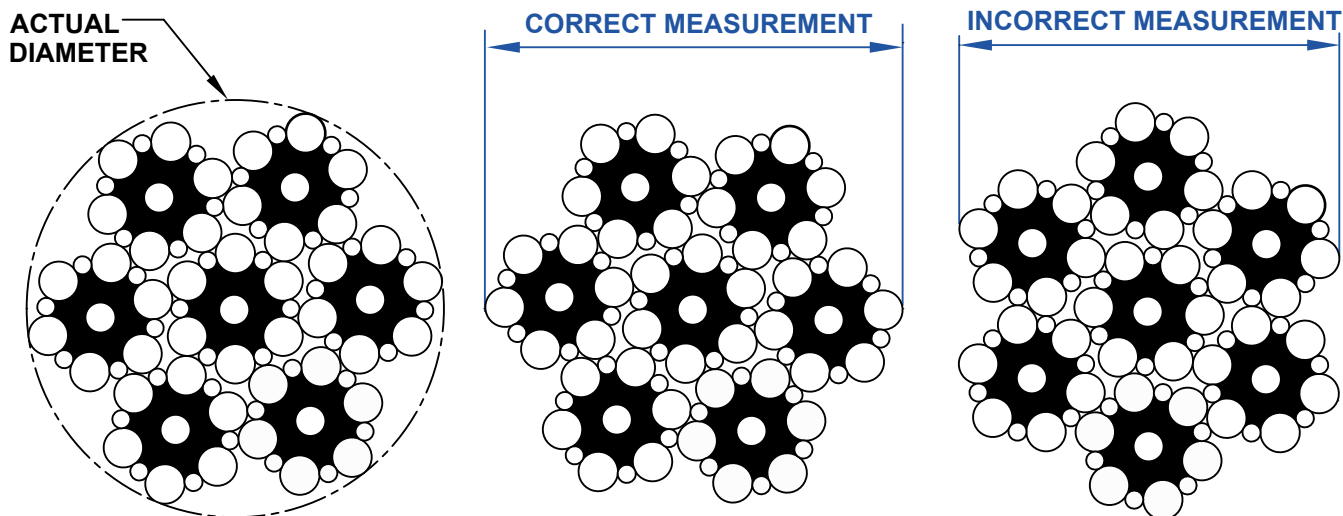
- 3.1.3.1 Wire rope inspection should be conducted according to the manufacturer's recommendations or accepted industry standards.

**CAUTION**

**Remember to always wear the proper protective equipment when handling the wire rope.**

- 3.1.3.2 Inspect the entire length of wire cable for bent or crushed areas, broken or cut wires, corrosion and other damage. If any defect or damage is found the cable must be replaced.
- 3.1.3.3 Inspect end connections and fittings for corrosion, kinking, crushing or other damage. If any corrosion or damage is found the cable must be replaced.
- 3.1.3.4 Check the wire rope diameter for signs of decreased area (see fig. 5). Diameter decrease may be signs of wear and internal degradation in the wire rope. Generally, wire ropes are manufactured larger than nominal diameter. When placed in service for the first time, diameter can reduce slightly. Minimum diameter specifications can be obtained from the rope manufacturer.

**FIGURE #5 - WIRE ROPE DIAMETER**



**THE WIRE ROPE MUST BE REPLACED IF THE DIAMETER MEASURES LESS THAN THE MINIMUM DIAMETER GIVEN BY THE ROPE MANUFACTURER**

**EXAMPLE - A  $\frac{3}{4}$ " WIRE ROPE HAS A MINIMUM DIAMETER OF  $\frac{45}{64}$ " (0.7031")**

## **3.2 EQUIPMENT LUBRICATION**

<b>WARNING</b>
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<b>Lubricate the spur gears before each operation, and periodically during operation. Failure to lubricate the gears will cause damage or deformation of gear teeth.</b>
--

- 3.2.1** All grease fittings should be lubricated using NABRICO's suggested lubricants or similar (See Appendix 2).
- 3.2.2** Drive shaft and drum shaft grease fittings should be lubricated at least once a month under normal conditions and at least once a day under adverse conditions. Lubricate while gears are rotating slowly.
- 3.2.3** Drive gear teeth should be coated at least once a month. Application with an aerosol can is recommended for uniform coverage. Graphite or other dry type lubricant should be used instead of gear grease when the winch is subjected to large amounts of foreign material such as coal dust. Always keep gear teeth as free of foreign material as possible.



## **3.3 CLEANING AND STORAGE**

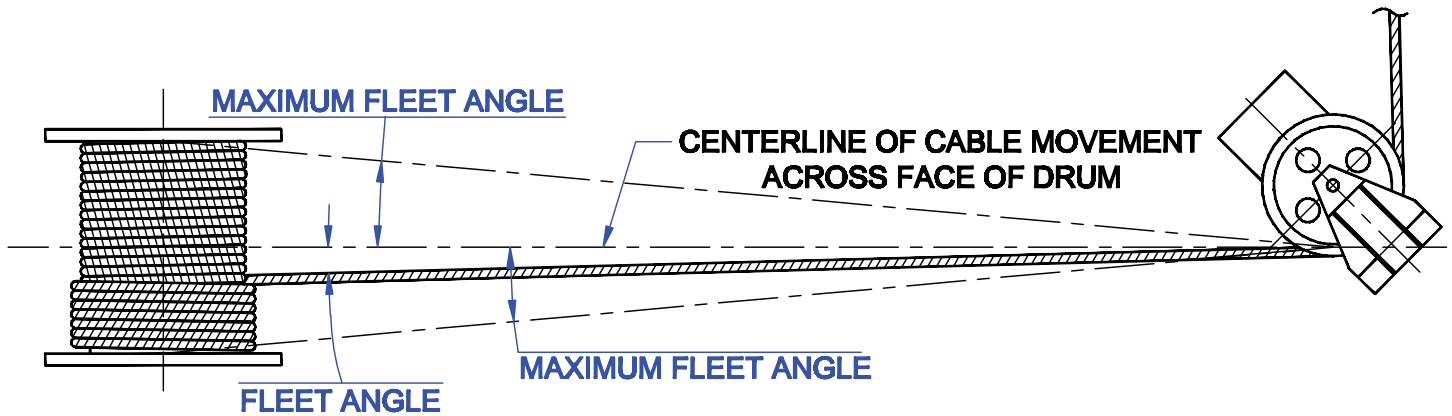
### **3.3.1 Cleaning the Equipment**

- 3.3.1.1** The equipment should be regularly cleaned to remove dirt and to help prevent rust and corrosion.
- 3.3.1.2** When cleaning, be sure to leave a light film of oil on all surfaces to protect them against the elements of nature. Wipe off excessive amounts of oil to avoid the accumulation of dirt.
- 3.3.1.3** Remove all unnecessary objects from the area surrounding the equipment to prevent hazardous situations from occurring.

### **3.3.2 Storing the Equipment**

- 3.3.2.1** Lubricate the equipment as necessary to help prevent rust and corrosion during storage. Add a rust preventive for long term storage.
- 3.3.2.2** Seal the equipment in plastic, if possible, to help prevent rust, corrosion and other damage.
- 3.3.2.3** Store the equipment upright in a cool clean place away from corrosive chemicals and moisture.
- 3.3.2.4** Rotate the drum periodically to keep bearing and gear surfaces from becoming lacquered.

## A.1 FLEET ANGLE



Fleet Angle:

In order to insure proper wrapping on the drum and no undue wear of the wire rope, the fleet angle should be kept as small as practical. This is important to consider during the planning of a winch installation. Sheaves and drums should be placed so that the fleet angle will be equal on each side of the centerline of rope travel.

For a smooth drum a maximum fleet angle of 1-1/2 degrees is recommended. When the drum is grooved to suit the wire rope, the fleet angle should not exceed 2 degrees.

### Example: Fleet Angle Calculation for 36" Chain Drive Barge Moving Winch

#### 36" Chain Drive Moving Winch

$a=18''$

$b=x$  (distance to be determined)

$A^\circ=1.5^\circ$  (minimum for a smooth drum)

$\tan A = a/b$

$\tan 1.5^\circ = 18''/x$

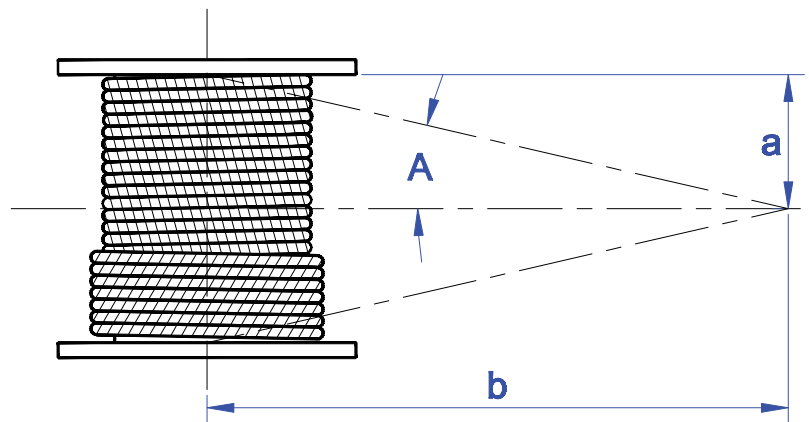
$.02619 = 18''/x$

$x = 18''/.02619$

$x \sim 688''$  (rounded up to next whole number)

$x \sim 688'' / 12$  (convert to feet)

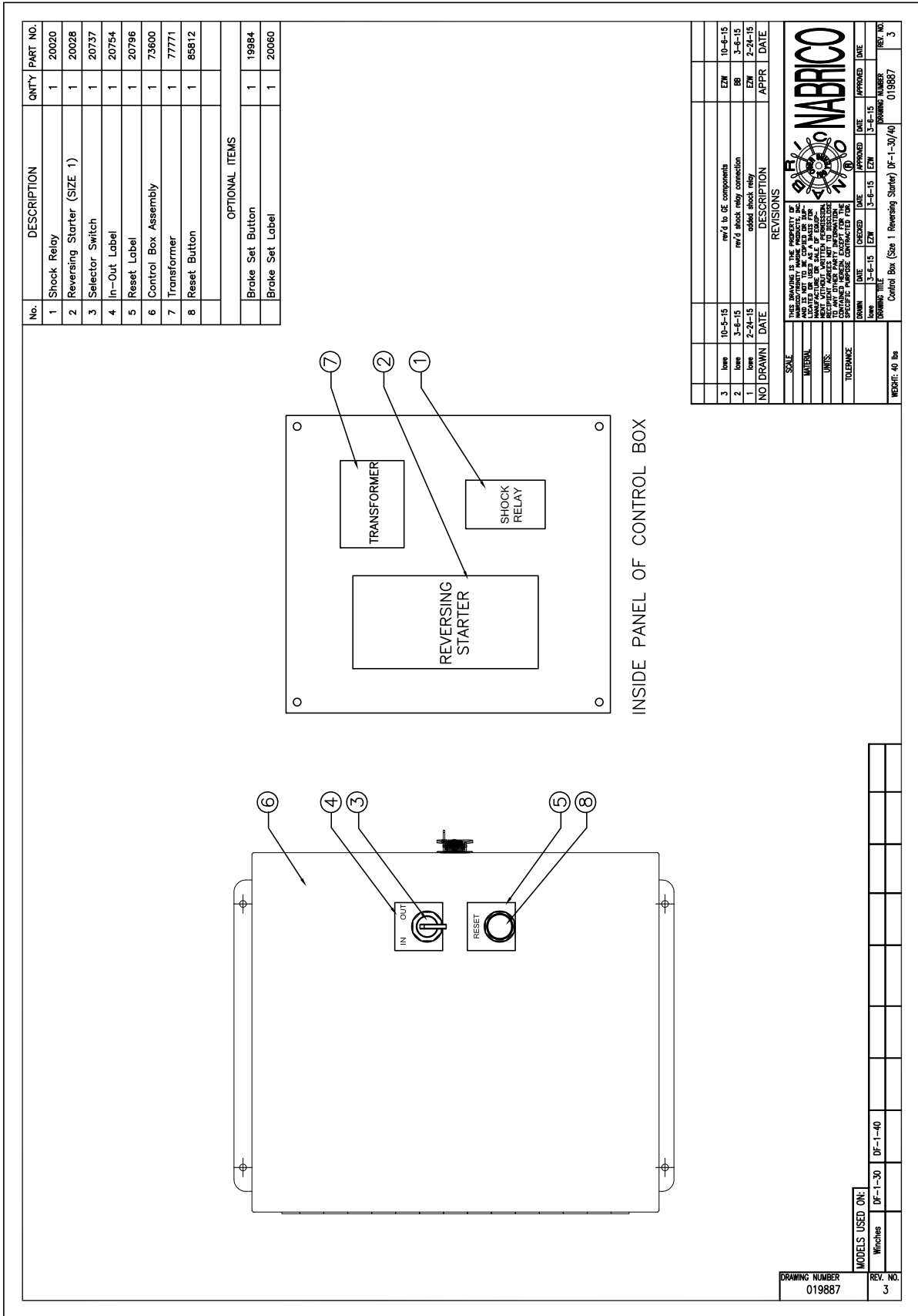
$x \sim 58'$

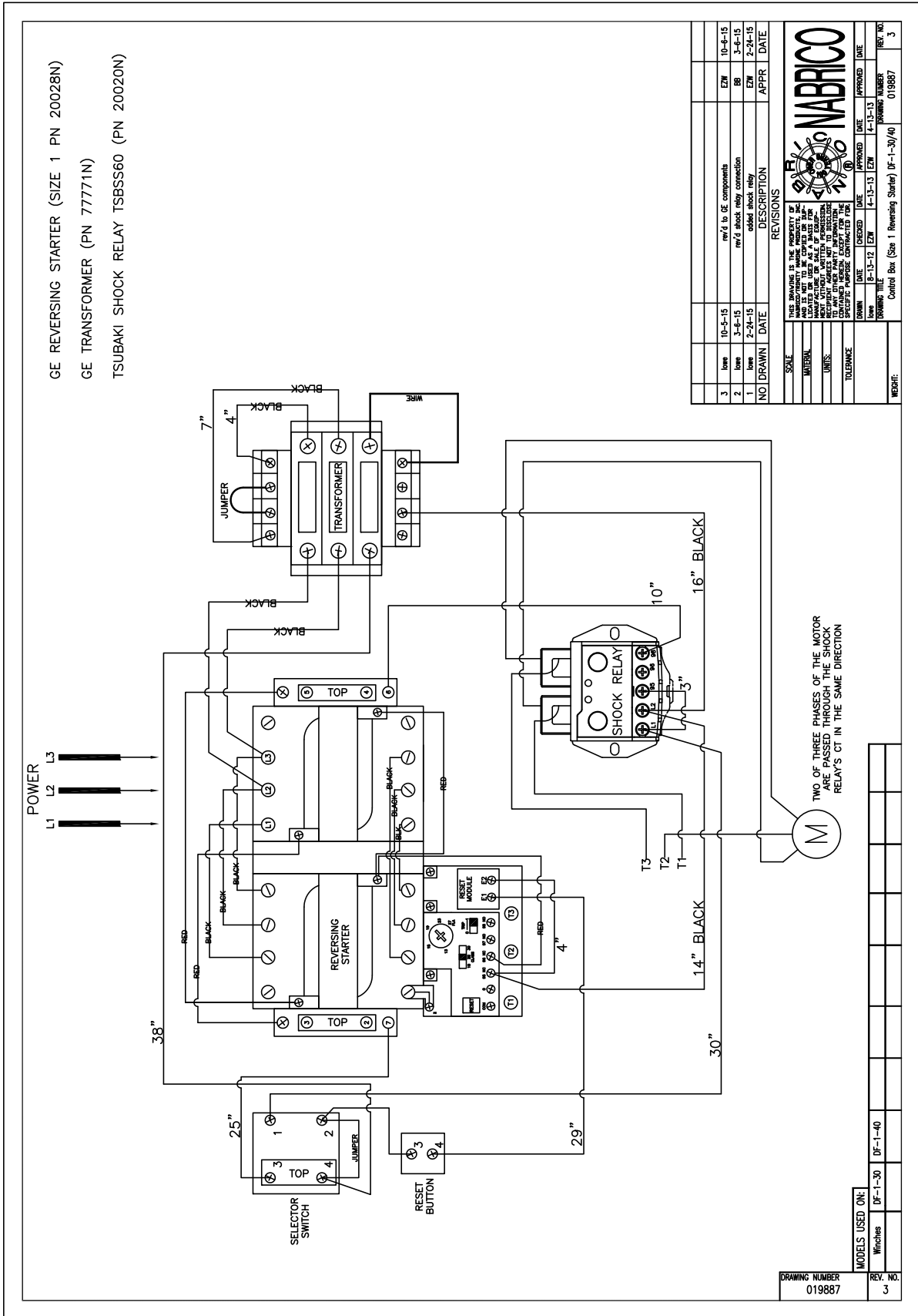


## **A.2 EQUIPMENT LUBRICATION**

<b>RECOMMENDED LUBRICANT FOR USE WITH NABRICO DECK MACHINERY</b>	
HYDRAULIC OIL (OPEN LOOP)	ENVIROLOGIC 3032
SPUR, HELICAL GEARS	ENDURATEX EP220
ALL WORM GEARS	ENDURATEX EP 220
OPEN GEARING (SPRAY CAN)	EUREKA FLUID FILM SPRAY
	MOBILTAC E
	LUBRIPLATE OPEN GEAR SHEILDING
GREASE FITTINGS	PEERLESS LLG #2
PRESERVATIVE TREATMENT	MOBILARMA 524
SUMITOMO, NORD AND SEW GEARBOXES	USE MANUFACTURER'S RECOMMENDATIONS
SLEWING BEARINGS / DF-559 WINCH	AQUA SHIELD
<p>Note: Lubricant manufacturers shown are not exclusive recommendations. Consult your lubricant source for more detailed information about oil selection.</p>	

## B.1 TYPICAL CONTROL BOX INFORMATION







EHFSA05.0601-4

# SHOCK RELAY TSBSA Series INSTRUCTION MANUAL



## WARNING

1. Make sure you read this instruction manual thoroughly before installing, wiring, operation and inspecting this SHOCK RELAY.
2. Please make sure that this instruction manual accompanies the SHOCK RELAY to the end user.
3. Product specification are subject to change for improvement without notice.
4. Disconnect power. Always lock out power switch before installing, removing, or servicing unit. Comply with Occupational Safety and Health Standards 1910. 147 "The Control of Hazardous Energy (Lock Out/Tag Out)."
5. Install in proper enclosure in accordance with NEMA 250-1991 "Enclosures for Electrical Equipment (1000Volts Maximum)" and NFPA496 1993 edition "Purged and Pressurized Enclosures for Electrical Equipment, 1993 Edition." When revisions of these standards are published, the updated edition shall apply.
6. Guards must be provided on all power transmission and conveyor applications in accordance with provisions of ASME B15.1-1996 "Safety Standards for Conveyors and Related Equipment, or other applicable standards. When revision of these standards are published, the updated edition shall apply.



## CAUTION

- If danger is expected from your application, take the necessary steps to ensure that it operates safely.
- If your Tsubaki Emerson product does not operate normally, take care to ensure that dangerous operating conditions do not occur.
- Wear suitable clothing and protective equipment (safety glasses, gloves, safety shoes, etc.)
- Keep your work place tidy and safe to prevent accidents.

TSUBAKI E&M CO.

2013.12. 1

## 1. Preface

Thank you for purchasing the Shock Relay TSBSA series.

This instruction manual describes everything from installation to adjustment.

Be sure to read this manual carefully before using your Shock Relay.

When delivering a device containing the Shock Relay, be sure that this instruction manual is included.

## 2. TSBSA and TSB2CT Model identification

### • Shock relay

TSB SA 05

		Current Range:	
	Series: SS series	<u>05</u>	<u>0.5 - 5 A</u>
		<u>10</u>	<u>1 - 10A</u>
Model: Shock Relay		<u>30</u>	<u>3 - 30 A</u>
		<u>60</u>	<u>5 - 60 A</u>

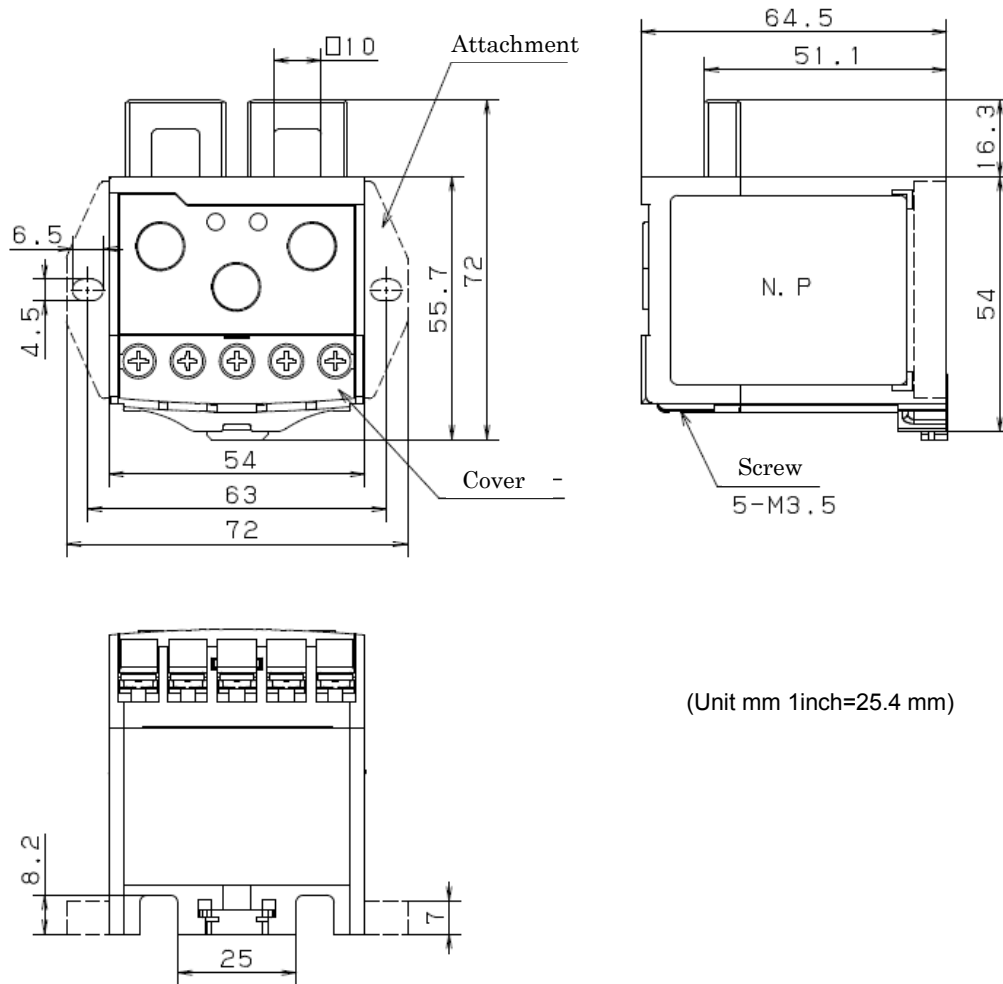
### • External 2-phase CT

TSB 2CT 100

		Rated primary current:	<u>100</u>	<u>100A</u>
			<u>200</u>	<u>200A</u>
	Series: 2-phase CT		<u>300</u>	<u>300A</u>
Model: Shock Relay				

### 3. Dimensions

#### • Shock relay



(Unit mm 1inch=25.4 mm)



## 4. Specifications

Series		TSB SA	
Current Setting * <sup>1</sup>	Type	Range	
	05	0.5 - 5A	
	10	1 - 10A	
	30	3 - 30A	
	60	5 - 60A	
Time Setting * <sup>1</sup>	Starting Trip Delay	Start Time	0.2 - 10s
	Trip Time	Shock Time	0.2 - 5s
Accuracy	Current	±10% (full scale)	
Control Power Supply	100~240VAC, 50/60Hz * <sup>2</sup>		
Rated Voltage	600VAC, 50/60Hz		
Current Sensing	2 Integral Current Transformer		
Output Relay	Mode	1-SPDT(1-C)	
	Rating	3A / 250VAC, Resistive	
	Minimum applicable load * <sup>3</sup>	DC10V, 10mA	
	Status	Normally De-Energized	
Expected Output Relay Life	Mechanical	10,000,000 Operations	
	Electrical	100,000 Operations	
Display	Monitor(MON,green), Over Current(OC,red)		
Reset	Auto Reset after 1s		
Ambient Environment	Temperature	Operating	-20 - +60°C (-4 - +158 F)
		Storage	-30 - +70°C (-22 - +176 F)
	Humidity	45 - 85% RH without Condensation	
Insulation	Between casing and circuit	Over 10MΩ with 500 VDC Megger	
Dielectric Strength	Between casing and circuit	AC 2000V, 5mA, 60Hz, 1min	
	Between contacts	AC 1000V, 5mA, 60Hz, 1min	
	Between circuits	AC 2000V, 5mA, 60Hz, 1min	
Power Consumption	115VAC	2.70 VA(0.35W)	
	230VAC	11.00 VA(1.2W)	
Material	Case	Upper:PA6, Bottom:PA66	
	Terminal cover	PA6	
Mounting	35mm DIN rail or Panel		
Dimension(WxHxD /Including Integral CT Windows)	54x60x65mm		
Weight	Less than 200g (0.445LBS) without External CT		

\*1 Current and time setting ranges can be set within the warranty range, but not the upper or lower level of setting volume.

\*2 When Shock Relay Is used with Inverter, the output frequency of Inverter should be from 30Hz to 60Hz.

\*3 When directly inputting output relay contact into the programmable controller (PLC), be aware that a minute electric current can cause contact failure. As for the input to PLC, it is commended to drive the relay coil for minute current by relay signal of Shock Relay at first, then input this relay contact to PLC.

## 5. Installation

### 1. Environmental specifications

Install the Shock Relay in the following environment.

- Temperature:  $-20$  to  $+60^{\circ}\text{C}$  not in direct sunlight.
- Humidity: 45~85% relative humidity without condensation and freezing.
- Place: Indoors, no water splash.
- Atmosphere: Free from dust, corrosion gas, and oil mist.
- Height: 2000m or less above sea level.
- Vibration:  $5.9\text{m/s}^2$  and under.

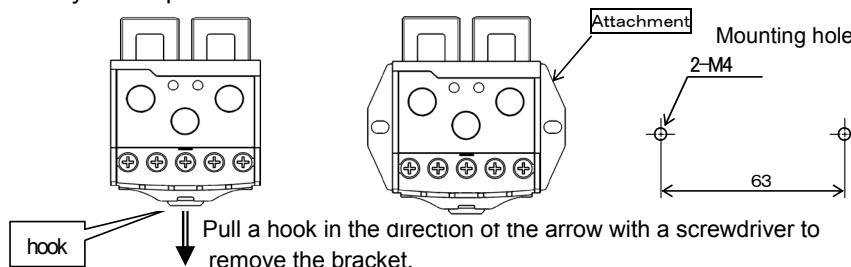
### 2. Installation to the panel

#### (1) Installation with DIN rail

While pulling the hook of Shock Relay to the arrow direction, install Shock Relay to 35mm DIN rail. When removal, put the hook to the arrow direction with flathead screwdriver.

#### (2) Installation with screw

Put the plate for installation at the both side of Shock Relay, and install Shock Relay to the panel



### 3. Installation to the DIN rail

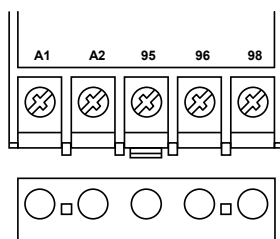
- (1) Pull the hook on the Shock Relay in the direction of the arrow to remove the mounting bracket.
- (2) Install the Shock Relay to the DIN rail.

## 6. Wiring

- (1) Connect 90–250VAC power source to the terminal A1, A2.
  - Never connect the output of an inverter or a servo driver to terminals A1-A2. Install an insulation transformer between the power line and terminals A1-A2 of the SHOCK RELAY when harmonic noise is included in the power line.
- (2) Check and correct the following items before turning the power on.
  - a. Is there any misconnection?
  - b. Have you forgotten to complete any connections?
  - c. Are there any abnormal conditions such as a short-circuit or ground fault?

	<b>WARNING</b>	<b>ELECTRICAL SHOCK AND BURN</b> Do not operate without the ground wire connected.
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## 7. Terminal Function



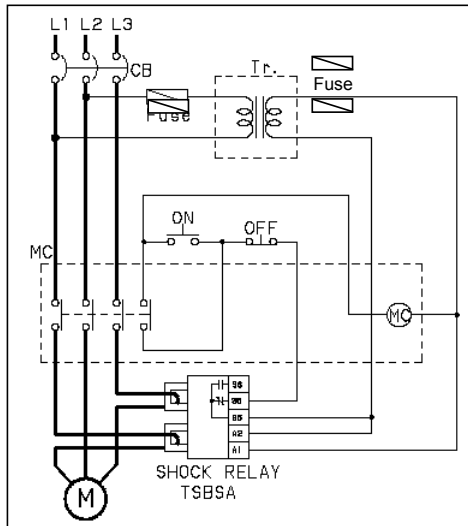
Terminal	Function	Contents.
A1	Power Supply	100 – 240VAC commercial power supply is wired
A2		
95	Output Relay	Common
96		Normally close (Tripped: open)
98		Normally open (Tripped: close)

## 8. Current Transformer

Select the number of wires passing through the CT (Current Transformer) by using the following table for best performance. When two motor leads pass through the CT, the current sensed by the CT is twice the motor current flowing through the motor lead.

AC 200 ~ 230 Volt Motor				AC 400 ~ 460 Volt Motor			
Motor Capacity (kW)	Motor Capacity (Hp)	TSBSS TYPE	Wires passing through CT	Motor Capacity (kW)	Motor Capacity (Hp)	TSBSS TYPE	Wires passing through CT
0.1	1/8	TSBSA05	4	—	—	—	—
0.2	1/4	TSBSA05	3	0.2	1/4	TSBSA05	4
0.4	1/2	TSBSA05	2	0.4	1/2	TSBSA05	3
0.75	1	TSBSA05	1	0.75	1	TSBSA05	2
1.5	2	TSBSA10	1	1.5	2	TSBSA05	1
2.2	3	TSBSA10	1	2.2	3	TSBSA05	1
3.7	5	TSBSA30	1	3.7	5	TSBSA10	1
5.5	7-1/2	TSBSA30	1	5.5	7-1/2	TSBSA30	1
7.5	10	TSBSA60	1	7.5	10	TSBSA30	1
11	15	TSBSA60	1	11	15	TSBSA30	1
—	—	—	—	15	20	TSBSA60	1
—	—	—	—	18.5	25	TSBSA60	1
—	—	—	—	22	30	TSBSA60	1

### Basic wiring diagram



M : THREE-PHASE MOTOR

MC : Magnetic contactor

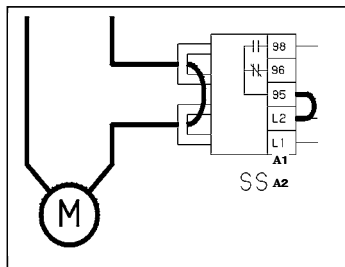
ON : Start switch

OFF : Stop switch

Fuse : Fuse

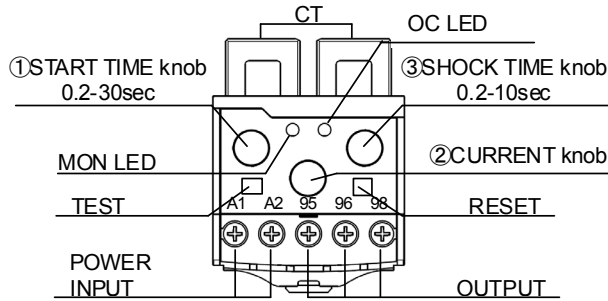
Tr : Transformer

1. A transformer may be required, depending on the voltage of Motor (i.e. over 250VAC)
2. Output relay is normally de-energized. When Shock Relay trips, the contacts change state.
3. Two of three phases of the motor are passed through the Shock Relay's CT in the same direction.
4. A fire might be happened as there is no protection circuit in main circuit.
5. Please select a fuse capacity depending upon capacity of a contactor MC to be connected.



M: SINGLE-PHASE MOTOR

## 10. construction



### Description

Two of three phases of the motor current are monitored by integral current transformers (External current transformers are required for current more than 60 Amps). The internal solid state circuitry compares the monitored motor (or load) currents with the preset current level.

When motor current exceeds the preset trip current level, the "OC" LED illuminates and indicates that an overload has been detected.

The relay will trip after the preset trip time (SHOCK TIME) and the "OC" LED remains illuminated indicating an overload trip has occurred.

When the motor currents decrease, the relay reverts after one second.

If the motor current drops back down below the preset current level before the preset trip time delay has elapsed, Shock Relay will return to normal condition.

MON lamp (green) shows monitor condition.

It is turned on under the normal monitor condition, and the relay turns off the lights while it is outputted.

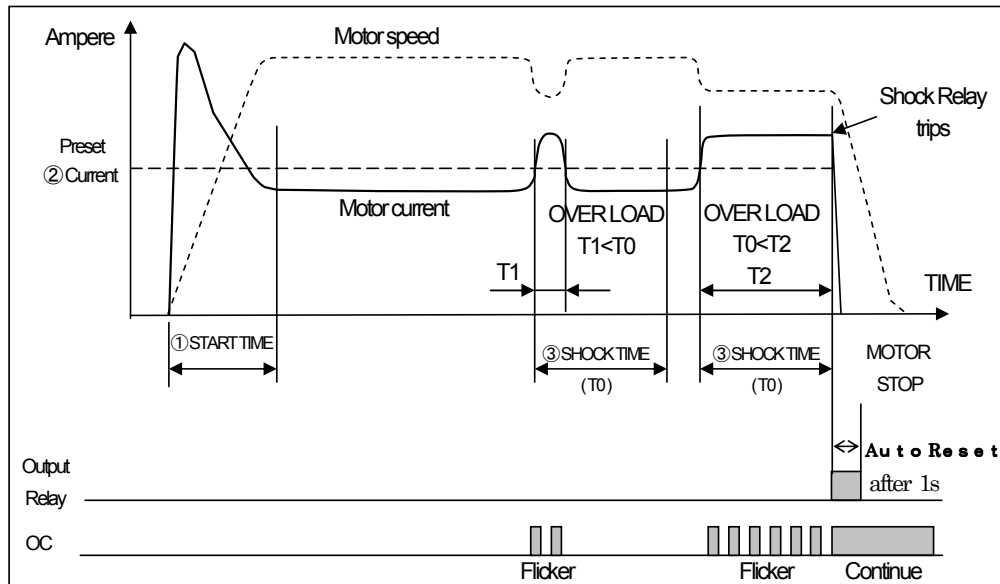
With the visual aid of the "OC" LED flashing when motor current becomes 100% of the preset current actual load current can be determined without aid of an ammeter.

The TEST button provides the means of testing service-worthiness and integrity.

Since the Shock Relay has definite time characteristics, the start trip delay may be adjusted with a minimum setting of 0.2 through a maximum of 10 seconds.

The trip time adjustment range is from 0.2 through 5 seconds. The relay may be used as an electronic shear-pin by setting the SHOCK TIME to minimum.

If the Shock Relay trips, always investigate to determine the cause and correct prior to restarting.



## 11. Set up

- 1) When installing, set the start delay timer (START TIME knob) to the known motor run-up time or the maximum if the time is not known.
- 2) Set the trip delay timer (SHOCK TIME knob) to the desired trip time.
- 3) Set the load current (CURRENT knob) at the rated full load or the desired value.
- 4) With connections made and control power on, depress the TEST button and hold.  
Verify that the red LED illuminates and the internal relay should switch contacts after the sum of start time and shock time.
- 5) Start the equipment and notice the run-up time, then slowly turn the CURRENT knob counter clock-wise until the LED flashes, This indicates 100% of the load current.  
Set the CURRENT knob to the desired trip setting. A setting of 110% of the running current is commonly used.
- 6) Reset the START TIME knob to match the normal run-up time.
- 7) Periodic testing by using the TEST button is suggested to ensure the full protection through preventive maintenance.

## 12. Troubleshooting

Symptom	Check	Result	Treatment
"MON" lamp isn't turned on.	Check the operation power supply wiring. (between terminals A1 and A2)	Incorrect wiring.	Wire correctly
	Measure the voltage of the operation power supply with a tester. (between terminals A1 and A2)	Not between 100~240VAC. Between 100~240VAC.	Set the voltage between 100 ~240VAC. Repair or replace.
Just after starting, the relay begins operating.	Check the value of START TIME.	Short	Set a longer.
		Long (It is obvious that relay is operating within the set time).	Repair or replace.
The relay output does not operate.	Examine the Current level setting.	The Current level setting is inappropriate.	Set to suitable level.
	Examine the SHOCK TIME setting.	Long.	Set a shorter.

## 13. Maintenance and testing

During performance of any maintenance or testing, be sure to go the following.

- (1) To prevent a fire hazard, keep the surrounding area clean and create a safe environment.
- (2) When performing tests on the Shock Relay mounting or connections, be sure that the power supply is disconnected, that the instrument is completely stopped, and that "MON" lamp isn't turned on. Also, make sure that the power supply cannot be accidentally reconnected.
- (3) Observe the guidelines listed in the Labor Safety and Health Regulation.

## 14. Daily check and periodic check

- (1) Confirm that there is no looseness in the installation of the Shock Relay and current transformer. Check the wiring connections every six months.
- (2) Regularly check the function of the output relay, terminal 95-96, terminal 97-98, by pressing the TEST button.
- (3) A typical life time of electrolytic capacitor mounted in the SHOCK RELAY is about 10 years at an average ambient temperature of 30°C, but this lifetime may vary with a different ambient environment and with the operating period when power is supplied. We recommend you to exchange the Shock Relay for a new one before trouble occurs.

## 15. Point for safe use

- (1) Take measures beforehand to prevent danger when using a TSUBAKI product.
- (2) If our product begins to operate improperly, be sure to take measures to prevent a dangerous situation from arising.

## 16. Guarantee.

### 1 Range of guarantee

With regard to any troubles happened to our products, replacement or repair of such troubled parts will be provided for free of charge during the effective period of guarantee, provided that installation and maintenance/management of said products have been performed properly pursuant to the description of this instruction manual and said products have been used under the condition described in the brochures or agreed separately through mutual consultations. The content of guarantee is limited only to the Shock Relay itself delivered to you and the judgment thereof will be made by our selection because such judgment pertaining to the range of guarantee is often complex.

### 2 Guarantee period

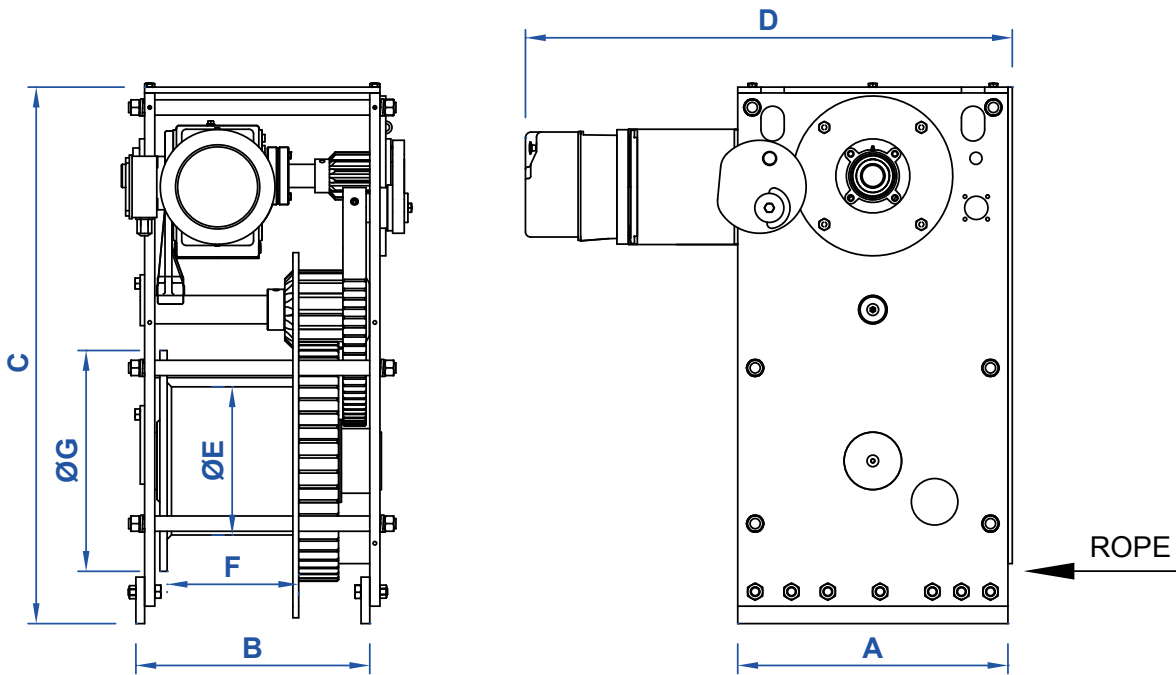
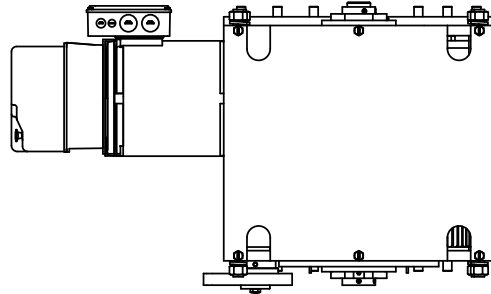
The guarantee period shall be either 18 months after shipment from our factory or 12 months after starting operation, whichever is shorter. Any and all inspection/repair undertaken by us after the above guarantee period has passed will be charged. Should questions arise, please do not hesitate to contact us or the dealer from whom you purchased.

### 3 Miscellaneous

- (1) Any matters described in this instruction manual are subject to change without notice.
- (2) We have tried our best in preparing the contents of this instruction manual. Should any mistake or oversight be found, we will be more than happy if you would advice us of them.

## C.1 DIMENSIONAL (SHAFT MOUNTED)

RIGHT HAND WINCH SHOWN  
LEFT HAND WINCH OPPOSITE



DF-1 Winch	Part Number	Length "A"	Width "B"	Height "C"	Overall Length "D"	Drum Dia. "E"	Drum Width "F"	Flange Dia. "G"	Weight
30 Ton		22"	19 <sup>3</sup> / <sub>8</sub> "	39"	37 <sup>1</sup> / <sub>2</sub> "	10 <sup>3</sup> / <sub>4</sub> "	11 <sup>1</sup> / <sub>4</sub> "	16"	
40 Ton		23 <sup>1</sup> / <sub>4</sub> "	20 <sup>1</sup> / <sub>8</sub> "	46 <sup>1</sup> / <sub>8</sub> "	44"	12 <sup>3</sup> / <sub>4</sub> "	11 <sup>1</sup> / <sub>4</sub> "	19"	
50 Ton		23 <sup>1</sup> / <sub>4</sub> "	20 <sup>1</sup> / <sub>8</sub> "	46 <sup>1</sup> / <sub>8</sub> "	45"	12 <sup>3</sup> / <sub>4</sub> "	11 <sup>1</sup> / <sub>4</sub> "	19"	
65 Ton		30"	23 <sup>3</sup> / <sub>8</sub> "	55 <sup>1</sup> / <sub>2</sub> "	47"	14"	10 <sup>5</sup> / <sub>8</sub> "	24"	





DF-1-40/50-NS Electric Winch Parts List		
Winch Parts		
Part Description	Qty	Part #s
Pipe Separator	6	69582
Drum Shaft	1	69795
Drum Pipe Spacer	1	69809
Drum Washer	1	69817
Intermediate Shaft	1	69922
Intermediate Shaft Collar	1	69930
Intermediate Gear Assembly (Hardened)	1	69950
Side Plate (keeper side)	1	70347
Side Plate (locking pawl side)	1	70348
Drum Assembly (Hardened)	1	82504
Pipe Separator Rod (SS)	6	84336
Drive Pinion	1	87629
Key (drive pinion) 1/2" SQ x 4-1/4"	1	87630
Base Bar	2	101501
Locking Pawl	1	101508
Locking Pawl Post	1	101510
Locking Pawl Sleeve	1	101511
Drive Shaft	1	101530
Locking Pawl Handle (Left Hand Winch)	1	101582
Locking Pawl Handle (Right Hand Winch)	1	101583
Cover Plate (side mount motor cut-out)	1	101603
Top Plate	1	101604
Keeper Plate (BIG)	1	101650
Keeper Plate (small)	1	101651
Cable Guard Plate	1	101656
Drive Shaft Collar	1	105006

Motor and Components		
Part Description	Qty	Part #s
Brake to Motor Adaptor	1	34450
Nord Gearmotor (shaft mount) 7.5 hp, 17.08 ratio	1	84998
Nord Gearmotor (shaft mount) 10 hp, 27.91 ratio	1	84999
Stearns Brake (75 ft/lbs, 220/460V)	1	398804
Stearns Brake Hub	1	398805

DF-1-40/50-NS Electric Winch Parts List		
Fasteners and Etc.		
Part Description	Qty	Part #s
Hex Nut 3/4" (SS)	14	421
Hex Head Bolt 1/2" x 2" (SS)	8	537
Hex Head Bolt 3/4" x 2-1/2" (SS)	14	538
Hex Nut 7/8" (SS)	12	539
Lock Washer 7/8" (SS)	12	540
Socket Head Cap Screw 3/8" x 1" (SS)	4	541
Locking Pawl Washer	1	542
Washer 9/16" ID x 2-1/2" OD (SS)	1	543
Lock Washer 5/8" (SS)	4	737
Hex Head Bolt 5/8" x 1"	2	11746
Socket Head Cap Screw 3/8" x 3" (SS)	1	14595
Hex Head Bolt 5/8" x 1-3/4" (SS)	4	70310
Hex Head Bolt 1/2" x 1" (SS)	7	70521
Lock Washer 1/2" (SS)	15	70584

Bushings and Bearings		
Part Description	Qty	Part #s
Intermediate Gear Bushing	1	69973
Drum Gear Bushing	1	82511
Ball Bearing	2	84662
Locking Pawl Sleeve Bushing	1	101512

Miscellaneous Components		
Part Description	Qty	Part #s
HH Bolt (GR8) 5/8" x 4-1/2"	1	404
Lock Washer (GR8) 5/8"	1	406
Hex Nut (GR8) 5/8"	1	407
Cover Mounting Stud 3/8" x 1-1/2"	10	549
Brass Wing Nut 3/8"	10	550
Protective Rubber Cover (solid)	1	80243
U-Bolt with Fasteners (1" Dia. Wire)	1	82570
Protective Rubber Cover (cut out)	1	83699
Torque Arm Spacer	1	83702
T-Handle (locking pawl handle)	1	101580

# C.3 GEARMOTOR TECHNICAL INFORMATION (SHAFT MOUNTED)



## GENERAL INSTRUCTIONS



RETAIN FOR FUTURE USE

U10000 - 1 of 2

### 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 detailed operating instructions

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.

- i. Record the serial number from your gearmotor, gear reducer, or motor nameplate, or record the serial number found on your order confirmation.
- ii. Go to [www.nord.com/docs](http://www.nord.com/docs) to download the appropriate operating instructions.

**EXAMPLE: [www.nord.com/docs](http://www.nord.com/docs)**

### Unit documentation

Gear unit installation and maintenance instructions can be found by entering the sales order number in the search field below. The sales order number can be found on the gear unit's nameplate (see illustration) or on the order confirmation.

Sales Order Number: 200836833-400  
 Model Type: SK9382AZSH-180MH4 TW RD VZ  
 Mounting Position: M4

Type	Name	Pages	Size
📄	U10000 - General Instructions	2	(51.97 KB)
📄	U10040 - Storage	1	(36.77 KB)
📄	U10060 - Unit Installation	2	(60.94 KB)
📄	U10270 - Keyed Hollow Shaft	2	(70.52 KB)
📄	U10750 - Helical and Bevel Reducer Lubrication	2	(75.96 KB)
📄	U11000 - Helical and Bevel Lubrication Types	2	(58.10 KB)
📄	U11900 - Lubrication Capacity - Clincher Shaft Mounted	1	(894.56 KB)
📄	U14200 - Oil Plug and Vent Locations - Clincher Parallel Shaft	1	(125.83 KB)
📄	U15200 - Parts List - Clincher Parallel Shaft	12	(619.50 KB)
📄	Complete Manual for 200836833-400 (PDF Format)	31	(2.25 MB)
📄	All Manuals for 200836833-400 (ZIP Format)		(2.01 MB)

### 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.



# GENERAL INSTRUCTIONS



DRIVESYSTEMS



RETAIN FOR FUTURE USE

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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.

 <b>WARNING</b> 
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.

**NORD Gear Limited**

Toll Free in Canada: 800.668.4378

08.08.12

**NORD Gear Corporation**

Toll Free in the United States: 888.314.6673

[www.nord.com/docs](http://www.nord.com/docs)



# SAFETY NOTES



RETAIN FOR FUTURE USE

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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
	<b>General Warning or Hazard</b> - 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.
	<b>Possible Harmful Situation</b> - Care must be taken to avoid the possibility of damaging the drive unit, driven machine, or the environment.
	<b>Important Note</b> - Useful note or tip to help assure trouble-free operation.
	<b>Material Disposal Note</b> - Important note concerning suggested material disposal.

## 2. Safety warnings

GENERAL WARNINGS

- 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

HARMFUL SITUATION

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

FOR GEAR LUBRICATION SEE MANUAL

120194630

- 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

Typ: SK **1**

No. **2**

i= **3**

n2= **4** min<sup>-1</sup>

0-1510 030

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, since the supplied lifting bolts are not designed for this purpose.

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.



# HELICAL & BEVEL REDUCER LUBRICATION



RETAIN FOR FUTURE USE

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## 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 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.



# HELICAL & BEVEL REDUCER LUBRICATION



RETAIN FOR FUTURE USE

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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.

STOP	<b>HARMFUL SITUATION</b>	STOP
<p>NORD suggests replacing the gear oil if oil analysis indicates any of the following:</p> <ul style="list-style-type: none"> <li>• Viscosity has changed by approximately 10% or more.</li> <li>• Debris particles (silicon, dust, dirt or sand) exceed 25 ppm.</li> <li>• Iron content exceeds 150-200 ppm.</li> <li>• Water content is greater than 0.05% (500 ppm).</li> <li>• 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.</li> </ul>		

## 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.*

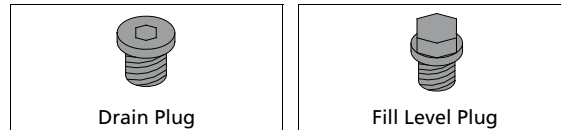
STOP	<b>HARMFUL SITUATION</b>	STOP
<p>Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level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

## 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.

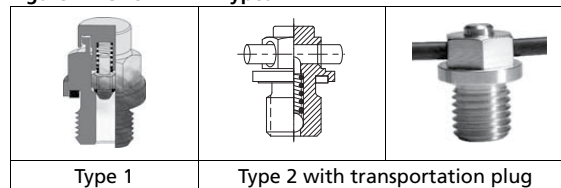


## 10. Vent plug locations

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.

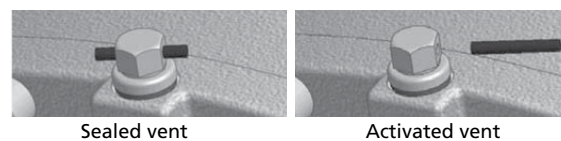
**AUTOVENT™** - The AUTOVENT™ helps prevent bearing and gear damage by behaving like a check valve to block the entry of foreign material (water, dust, corrosives, etc.). The breather opens at approximately 2-3 psi during operation and closes tightly as the gearbox cools. This option is perfect for humid conditions and wash-down environments, helping to maintain proper oil cleanliness, and reducing foaming and oxidation. NORD may choose to offer one of two style options as shown in Figure 1. The Type 2 AUTOVENT™ comes closed upon delivery with a transportation sealing plug (see Warning).

Figure 1 AUTOVENT™ Types



**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).

⚠	<b>WARNING</b>	⚠
<p>To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up.</p>		



**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.



# HELICAL & BEVEL REDUCER LUBRICATION TYPES



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	◆●
	PAO	-35 to 60°C (-31 to 140°F)	Mobil SHC630	◆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	-35 to 80°C (-31 to 176°F)	Mobil SHC 634	-
	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	-35 to 25°C (-31 to 77°F)	Mobil SHC629	-

### Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Type/Thickener	Ambient Temperature Range	Manufacturer Brand/Type	Notes
NLGI 2	Standard (Li-Complex)	-30 to 60°C (-22 to 140°F)	Mobil Grease XHP222	◆●
	High Temp (Polyurea)	-40 to 80°C (-40 to 176°F)	Mobil / Polyrex EP 2	◆②
	Food-Grade (Polyurea)	-30 to 40°C (-22 to 104°F)	Mobil SHC Polyrex 222	◆

◆ Stocked Lubricants

● Standard product on serviceable gear units

② Standard product on maintenance free gear units

**i**
**IMPORTANT NOTES**
**i**

- 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: 80-85 °C (176 – 180 °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 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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# HELICAL & BEVEL REDUCER LUBRICATION TYPES

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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 150	Alpha SP150	Renolin EP150	Klüberoil GEM 1-150N
	PAO-EP	-30 to 25 °C (-22 to 77 °F)	Mobilgear SHC150	Omala HD 150	Alphasyn EP150	Gearmaster SYN150/NA	Klübersynth EG 4-150
	PAO	-30 to 25°C (-22 to 77°F)	Mobil SHC629	Omala RL 150	Alphasyn T150	N/A	Klübersynth GEM 4-150N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	Tivela S150	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 220	Alpha SP220	Renolin EP220	Klüberoil GEM 1-220N
	PAO-EP	-30 to 60 °C (-22 to 140 °F)	Mobilgear SHC220	Omala HD220	Alphasyn EP220	Gearmaster SYN220/NA	Klübersynth EG 4-220
	PAO	-30 to 60°C (-22 to 140°F)	Mobil SHC630	Omala RL220	Alphasyn T220	N/A	Klübersynth GEM 4-220N
	PG	-25 to 60°C (-13 to 140°F)	Mobil Glygoyle 220	Tivela S220	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 460	Alpha SP460	Renolin EP460	Klüberoil GEM 1-460N
	PAO-EP	-20 to 80°C (-4 to 176°F)	Mobilgear SHC460	Omala HD460	Alphasyn EP460	Gearmaster SYN460/NA	Klübersynth EG 4-460
	PAO	-20 to 80°C (-4 to 176°F)	Mobil SHC 634	Omala RL460	Alphasyn T460	N/A	Klübersynth GEM 4-460N
	PG	-20 to 80°C (-4 to 176°F)	Mobil Glygoyle 460	Tivela S460	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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# 90.1 HELICAL-BEVEL FLANGED OIL FILL QUANTITIES



DRIVESYSTEMS

RETAIN FOR FUTURE USE

U12100 - 1 of 1

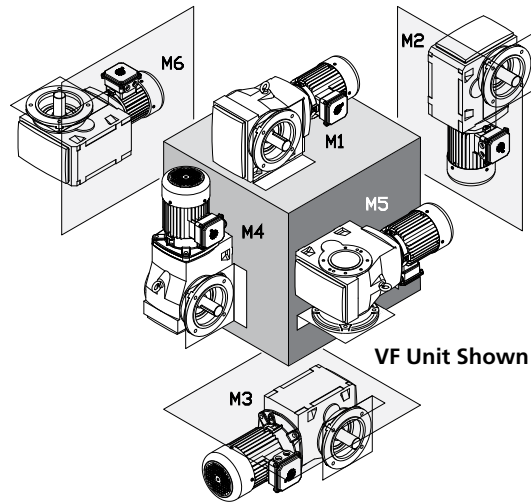
## 90.1 Helical-bevel flanged lubrication

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.

**STOP HARMFUL SITUATION STOP**

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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# 90.1 HELICAL-BEVEL OIL PLUG & VENT LOCATIONS



DRIVESYSTEMS

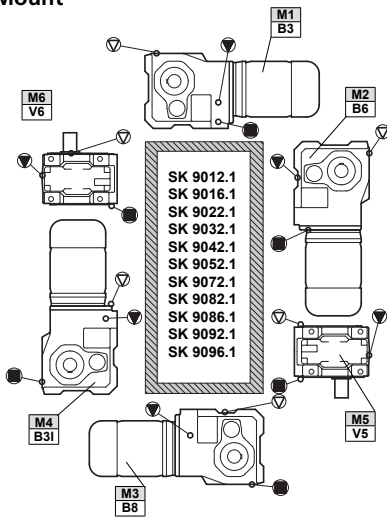
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U14400 - 1 of 1

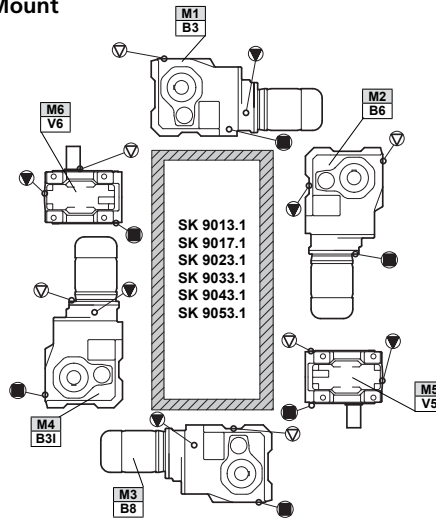
## Oil plug connections

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.*

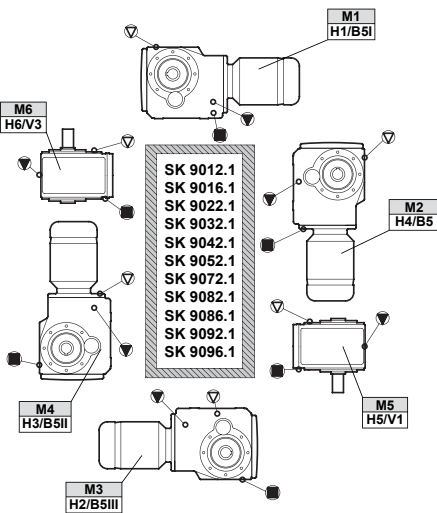
### Foot Mount



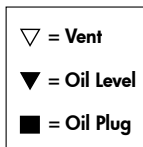
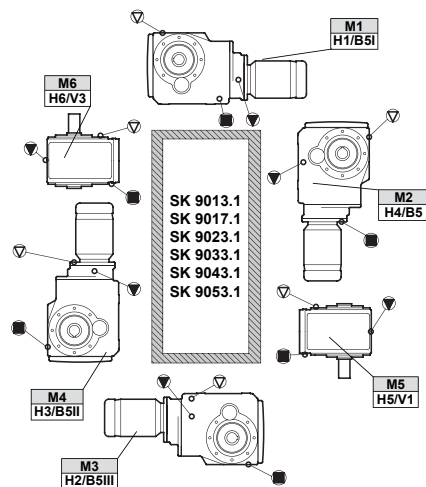
### Foot Mount



### Shaft/Flange Mount



### Shaft/Flange Mount



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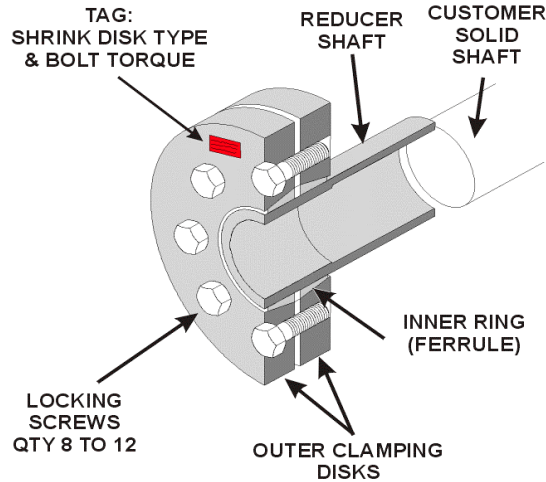
## Hollow Shrink Disc Shaft Installation and Maintenance Instructions

BIM 1001

USA

CDN

Retain These Safety Instructions For Future Use



### Installation Instructions:

1. Mating shaft tolerances are normally tighter for shrink discs due to the gripping forces needed. Customer shaft diameter has to be machined according to ISO h6 or f6 tolerances (f6 easier to machine but lower gripping forces as shown in catalog). Refer to Table 1 for h6 and f6 tolerances for customer shafts.
2. Remove transportation spacers (if provided) located between outer collars. Do not take the unit apart.
3. Lightly tighten locking screws until most play between outer collars and the conical inner ring (ferrule) is eliminated. You must be able to easily turn the ferrule with your fingers.
4. Lightly lubricate the bore of the ferrule, with grease, for easier mounting onto outside diameter of the reducer hollow shaft.
5. Slide the shrink-disc onto hollow shaft.
6. Wipe the reducer bore and the mating solid shaft clean of any lubricants and dirt. Only use solvent if the parts feel oily to the touch after wiping with a clean rag.
7. Slide the reducer onto the solid shaft until it is about half way through.
8. Lubricate the remaining portion of the solid shaft with a #2 grease, where it will be inserted into the hollow shaft.
9. Tighten the locking screws in a circular pattern. Refer to Table 2 for tightening torques. Initially, tighten locking screws finger tight to position outer collars. Then tighten 1/4

to 1/2 turn at a time until specified tightening torque (per table) is reached.

10. Continue tightening each bolt at rated torque until no further rotation is seen. This assures the shrink disc is fully seated.



**Warning:**

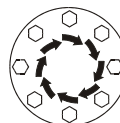
The surface area between the hollow shaft and the solid shaft must be free of lubricant or the connection may slip in service.



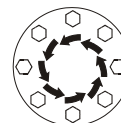
**Warning:**

Always tighten in a circular pattern. Never tighten bolts in a star pattern or connection may slip in service.

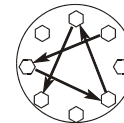
### BOLT TIGHTENING PATTERN



CLOCKWISE  
CIRCULAR  
PATTERN  
RIGHT



COUNTER  
CLOCKWISE  
CIRCULAR  
PATTERN  
RIGHT



STAR  
PATTERN  
WRONG

**Customer shaft diameter tolerance with Shrink Disc fit h6**  
Metric (mm)

- ≤ Ø 18 = +0.000/-0.011
- > Ø 18 ≤ Ø 30 = +0.000/-0.013
- > Ø 30 ≤ Ø 50 = +0.000/-0.016
- > Ø 50 ≤ Ø 80 = +0.000/-0.019
- > Ø 80 ≤ Ø 120 = +0.000/-0.022
- > Ø 120 ≤ Ø 180 = +0.000/-0.025

Inch

- ≤ Ø 0.750 = +0.0000/-0.0004
- > Ø 0.750 ≤ Ø 1.125 = +0.0000/-0.0005
- > Ø 1.125 ≤ Ø 2.000 = +0.0000/-0.0006
- > Ø 2.000 ≤ Ø 3.000 = +0.0000/-0.0007
- > Ø 3.000 ≤ Ø 4.750 = +0.0000/-0.0008
- > Ø 4.750 ≤ Ø 7.000 = +0.0000/-0.0010

Shaft finish to be 125 micro inches or smoother.

**Customer shaft diameter tolerance with Shrink Disc fit f6 (looser fit)**  
Metric (mm)

- ≤ Ø 18 = -0.016/-0.024
- > Ø 18 ≤ Ø 30 = -0.020/-0.029
- > Ø 30 ≤ Ø 50 = -0.025/-0.036
- > Ø 50 ≤ Ø 80 = -0.030/-0.043
- > Ø 80 ≤ Ø 120 = -0.036/-0.051
- > Ø 120 ≤ Ø 180 = -0.043/-0.061

Inch

- ≤ Ø 0.750 = -0.0006/-0.0011
- > Ø 0.750 ≤ Ø 1.125 = -0.0008/-0.0013
- > Ø 1.125 ≤ Ø 2.000 = -0.0010/-0.0016
- > Ø 2.000 ≤ Ø 3.000 = -0.0012/-0.0019
- > Ø 3.000 ≤ Ø 4.750 = -0.0014/-0.0023
- > Ø 4.750 ≤ Ø 7.000 = -0.0017/-0.0027

Shaft finish to be 125 micro inches or smoother

**Tightening Torques for Locking Screws**

Shrink Disk Type	Bore Size Inches (mm)	Locking Screws (Bolts)		
		Qty	Size	Torque in-lbs (Nm)
SNxx/35V	0.9375 - 1.000 (24 - 26)	8	M5X25	60 (7)
SNxx/40V	1.125 - 1.250 (28 - 32)	8	M6X35	110 (12)
SNxx/46V	1.3125 - 1.4375 (34 - 36)	10	M6X35	110 (12)
SNxx/55V	1.5625 - 1.75 (40 - 45)	8	M8X40	270 (30)
SNxx/62V	1.875 - 2.0625 (48 - 52)	10	M8X40	270 (30)
SNxx/76V	2.1875 - 2.5625 (55 - 65)	10	M10X50	520 (59)
SNxx/90V	2.5625 - 2.9375 (65 - 75)	10	M12X70	885 (100)
SNxx/108V	2.9375 - 3.375 (75 - 85)	12	M12X70	885 (100)
SNxx/128V	3.750 - 4.125 (95 - 105)	8	M16X70	2,210 (250)
SNxx/138V	4.125 - 4.500 (105 - 115)	8	M16X70	2,210 (250)
SNxx/158V	4.500 - 5.125 (115 - 130)	12	M16X80	2,210 (250)
SNxx/185V	5.3125 - 5.875 (135 - 150)	12	M16X80	2,210 (250)
SNxx/210V	6.250 (160)	12	M16X80	4,340 (490)
SNxx/230V	6.3125 - 7.500 (160 - 190)	12	M20X100	4,340 (490)

**Maintenance**

Shrink disks are maintenance free.

**Removal**

- Loosen locking screws in circular pattern as they were tightened, by approximately 1/4 to 1/2 turn at a time until finger tight. Do not remove locking screws completely.
- Loosen the outer collars from the tapered inner ring. This may require tapping the bolts with a soft faced hammer or prying lightly between the outer collars.
- Remove hollow-shaft reducer from solid shaft.

**Preparation for Re-Use:**

- Disassemble and thoroughly clean all parts. Wire brush to remove any excessive rust or dirt.
- Lubricate the taper of the outer collars and of the inner ring with Molycote G-Rapid plus (product of Dow Corning) or equivalent.
- Grease screw threads and head contact area with multipurpose grease.

**NORD Gear Corporation**

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Brampton, Ontario L6T 4A1  
Phone 905-796-3606  
Fax 905-796-8130



# RIGHT-ANGLE SHAFT-MOUNT WITH TORQUE ARM (D)



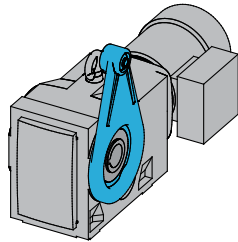
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U10600 - 1 of 2

## 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.

**HARMFUL SITUATION**

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.

**WARNING**

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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# TROUBLESHOOTING



RETAIN FOR FUTURE USE

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## 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
<b>Runs Hot</b>	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
<b>Runs Noisy</b>	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.
<b>Output shaft does not turn</b>	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.
<b>Oil Leakage</b>	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.





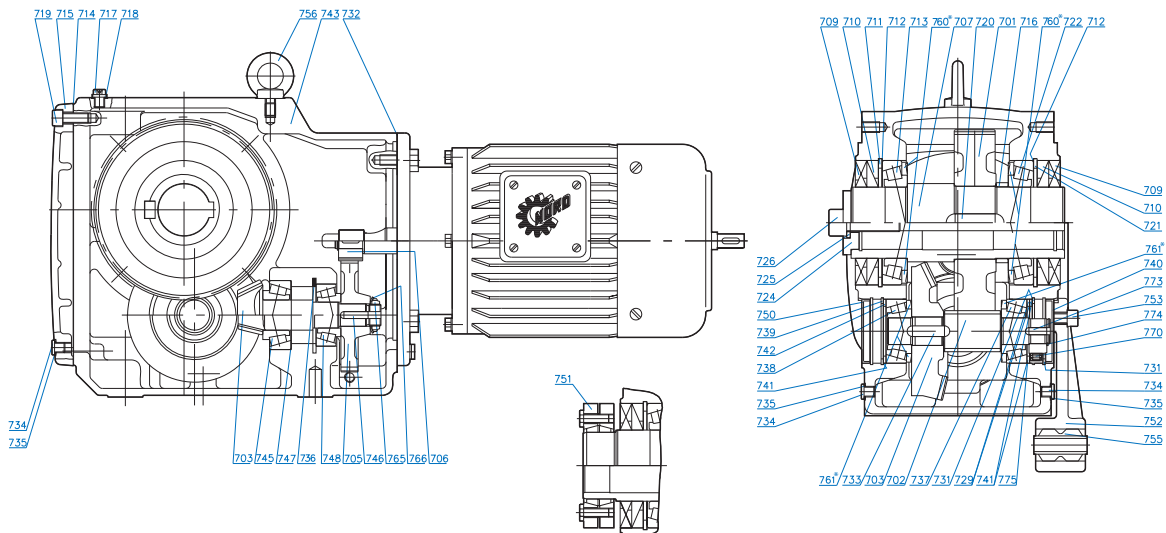


# 90.1 HELICAL-BEVEL PARTS LIST DRAWINGS



RETAIN FOR FUTURE USE

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## SK 9012.1 - SK 9096.1 - Shaft Mounted

701 Gear	722 Anti-Friction Bearing	746 Key
702 Pinion Shaft	724 Washer	747 Shim
703 Bevel Gearset	725 Lock Washer	748 Anti-Friction Bearing
705 Gear	726 Bolt	750 Bore Plug
706 Pinion	729 Thrust Washer	751 Shrink Disc
707 Output Shaft	731 Snap Ring	752 Torque Arm
709 Oil Seal	732 Gasket	753 Bolt
710 Oil Seal	733 Key	755 Rubber Buffer
711 Snap Ring	734 Oil plug	756 Flanged Eye Bolt
712 Shim	735 Gasket	760 Nilos Ring*
713 Anti-Friction Bearing	736 Snap Ring	761 Nilos Ring*
714 Gasket	737 Anti-Friction Bearing	765 Slotted Round Nut
715 Inspection Cover	738 Anti-Friction Bearing	766 Tab Lock Washer
716 Spacer	739 Snap Ring	770 Backstop*
717 Vent Plug	740 Bore Plug	773 Key (w/Backstop)
718 Seal	741 Shim	774 Snap Ring
719 Bolt	742 Thrust Washer	(w/Backstop)
720 Key	743 Gearcase	775 Thrust Washer
721 Snap Ring	745 Anti-Friction Bearing	(w/Backstop)

\* Conditionally used part

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06.09.09

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# MOTORS - AC INDUCTION, SINGLE & POLYPHASE

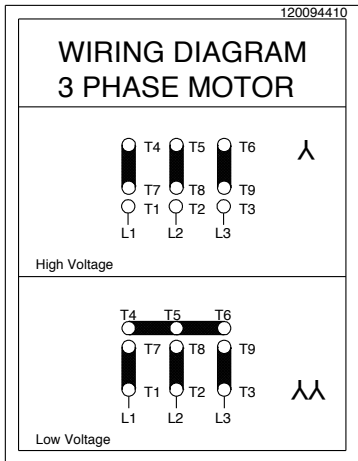


RETAIN FOR FUTURE USE

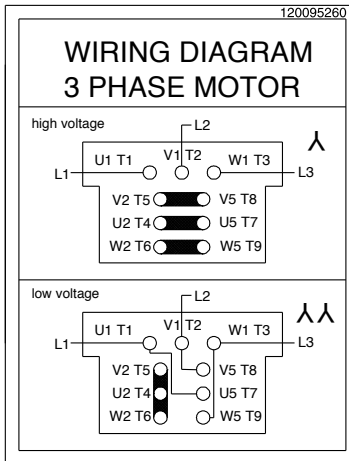
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## 15. Wiring Diagrams

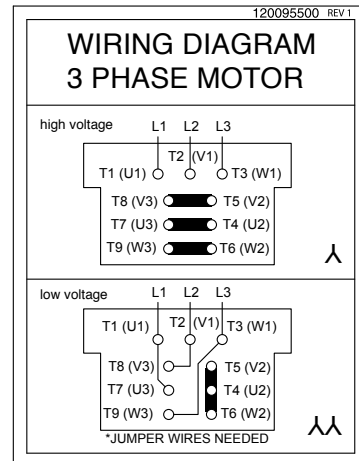
NORD Frames 63-225  
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø



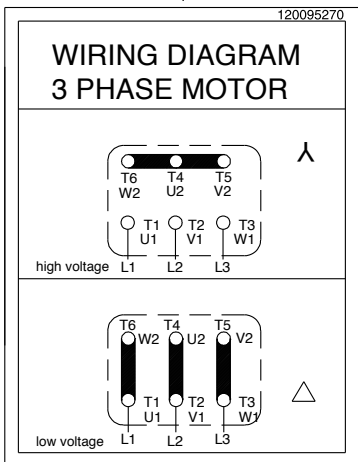
NORD mfg by Siemens - Frames 200 +  
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø  
190 / 380V, 60Hz, 3Ø



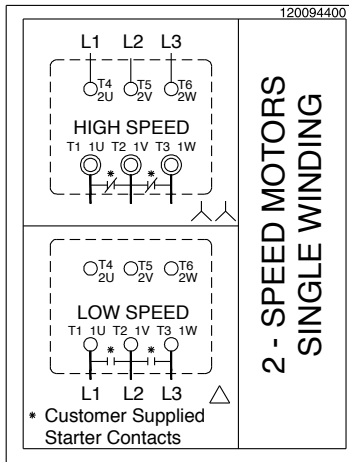
NORD mfg by Siemens - Frames 200 +  
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø  
190 / 380V, 60Hz, 3Ø



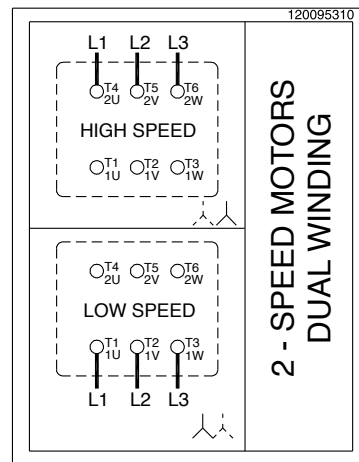
NORD Frames 63 - 225  
460 / 800V, 60Hz, 3Ø | 230 / 400V, 50Hz, 3Ø  
208 / 360V, 60Hz, 3Ø | 400 / 690V, 50Hz, 3Ø  
332 / 575V, 60Hz, 3Ø



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



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





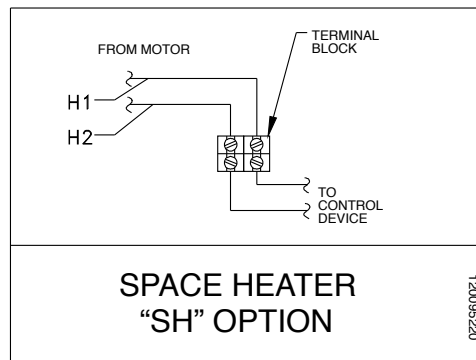
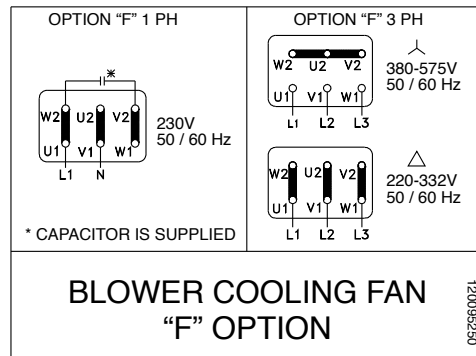
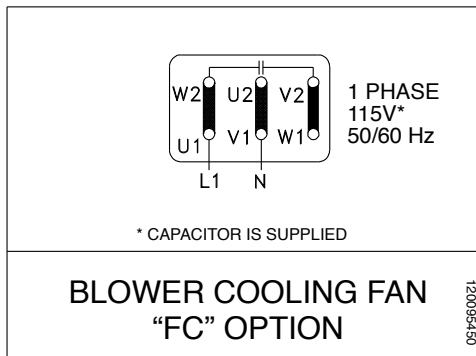
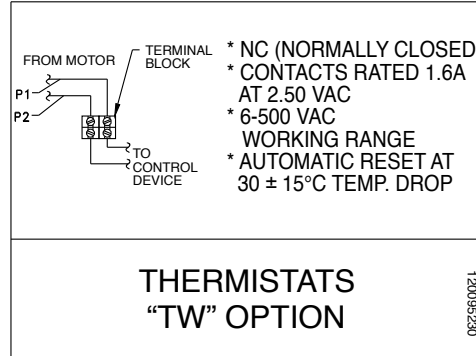
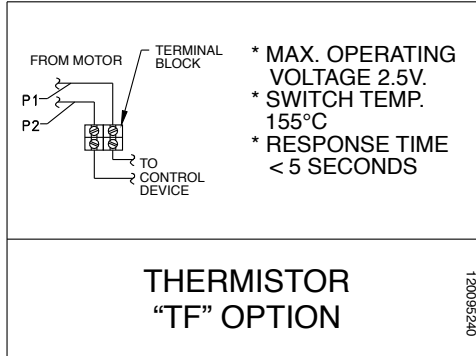
# MOTORS - AC INDUCTION, SINGLE & POLYPHASE



RETAIN FOR FUTURE USE

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## 15. Wiring Diagrams Ctd.



# D.1 STEARNS MODEL# 1-087-064-00 TECHNICAL INFORMATION

## Series 87,000 and 87,100 Mounting Face: NEMA 182TC - 256TC/UC

The 87,X00\*\* Series have the following design features:

- Self-Adjusting Design
- Splined Hub
- Lead Wire Length: 24 inches
- Maximum Speed:  
Horizontal 4000 rpm  
Vertical 3600 rpm (modification required for vertical mounting), see SAB Modification Section.
- Coil Insulation: Standard Class B Optional  
Class H (Class H standard on 87,800)
- Certified: CSA File LR-6254
- ABS Type Approval Certified

\*\* Does not include 87,300 and 87,700 Series brakes.

### Engineering Specifications

Nominal Static Torque  lb-ft (Nm)	No. of Friction Discs	Coil Size	Maximum Solenoid Cycle Rate <sup>①</sup>  Cycles/min	Thermal Capacity <sup>②</sup>  hp-sec/min (watts)	Inertia (Wk <sup>2</sup> )  lb-ft <sup>2</sup> (kgm <sup>2</sup> x 10 <sup>-4</sup> )		
					87,000	87,100	87,700
6 (8)	1	5	30	17.5 (218)	.048 (20.34)	—	—
10 (14)	1	5	30	17.5 (218)	.048 (20.34)	—	.078 (32.76)
15 (20)	1	6	25	17.5 (218)	.048 (20.34)	—	.078 (32.76)
25 (34)	1	6	25	17.5 (218)	.048 (20.34)	—	.078 (32.76)
35 (47)	1	8	20	17.5 (218)	.048 (20.34)	—	.078 (32.76)
50 (68)	2	6	25	17.5 (218)	.089 (37.40)	.108 (45.36)	.108 (45.36)
75 (102)	2	8	20	17.5 (218)	.089 (37.40)	.108 (45.36)	.108 (45.36)
105 (142)	3	8	20	17.5 (218)	.129 (54.45)	.145 (60.90)	.145 (60.90)
125 (169)	3	8	20	20.0 (248)	—	.129 (54.45)	—

- ① Maximum solenoid cycle rate is based on ambient temperature of 72°F (22°C) with 50% duty cycle. Does not relate to brake cycle rate (see Thermal Capacity).
- ② Thermal capacity rating is based on ambient temperature of 72°F (22°C), stop time of one second or less, with no heat absorbed from motor. Derate thermal capacity by 25% for vertical mounting. Refer to Selection Procedure Section.  
87,800 Thermal capacity is 14 hp-sec/min (174 watts).

### Current Ratings (amperes)

Solenoid Coil Size	AC Current	Voltage: 60 Hz					Voltage: 50 Hz			Voltage: DC				
		115	200	230	400	460	575	110	220	380	24	95	115	230
5	inrush	7.5	4.3	3.7	2.2	1.9	1.5	5.4	4.0	1.9	38.0	8.4	5.6	3.2
	holding	.5	.3	.2	.1	.1	.09	.3	.3	.1	.5	.1	.08	.04
6	inrush	13.0	7.5	6.5	3.7	3.2	2.6	9.4	5.6	3.2	42.8	11.7	8.5	3.7
	holding	.6	.4	.3	.2	.2	.1	.5	.3	.2	.61	.16	.13	.06
8	inrush	17.6	10.3	8.8	5.0	4.2	3.5	15.4	7.7	4.2	43.1	11.4	9.3	4.6
	holding	1.2	.7	.6	.3	.3	.3	1.0	.5	.3	.8	.2	.2	.09

### Motor Frame Adapters/Special Endplate

To Adapt to NEMA Frame Size	in. (mm)	Reg. No.	Adapter Stock Number	Additional Shaft Length Required in. (mm)
56C, 143TC, or 145TC 182TFC, 184TFC	4.50 (114.30)	-05	Brake endplate is modified for 4.50 in AK. Adder below*	— (—)
			5-55-7043-00 List \$1,300.00	.56 (14.22)
284TC 286TC	10.50 (266.70)	-11	5-55-7055-00 List \$450.00	.81 (20.64)
metric	—	-10	Endplate modified for 130mm register (AK) & 165mm bolt circle (AJ). Add: Brake w/aluminum endplate \$725.00 includes adder for cast iron endplate. Brake with cast iron endplate: \$340.00	—
324TC, 326TC, 364TC, 365TC, 404TC or 405TC	12.50 (317.50)	-13	5-55-7046-00 List \$875.00	.88 (22.22)
	—	-07	Endplate modified to provide a 6.75" male register (AK) and 7.19" bolt circle (AJ). Adder below*	—
182TC/184TC, 213TC, 215TC, 254TC/256TC	8.5 (215.90)	-03	Extended endplate. Adder below*	.625 (15.88)

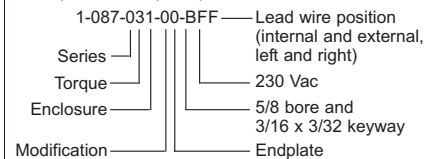
\*Brakes with aluminum endplate: \$725.00 (includes adder for cast iron endplate)  
\*Brakes with cast iron endplate: \$340

For motor frame adapters: Series 87,000 through 87,800 see Technical Data

### Ordering and Identification Information

The following example and tables provide information for selecting the appropriate three-letter suffix when ordering a Stearns Brake.

Example of a complete part number:



### Hub Selection

Character	Bore (in.)	Keyway** (in. x in.)
A*	5/8	1/8 x 1/16
B*	5/8	3/16 x 3/32
C*	3/4	3/16 x 3/32
D	7/8	3/16 x 3/32
E	1-1/8	1/4 x 1/8
F	1-1/4	1/4 x 1/8
G	1-3/8	5/16 x 5/32
H	1-5/8	3/8 x 3/16
I*	1-3/4	3/8 x 3/16
J*	1-7/8	1/2 x 1/4
K*	1/2	1/8 x 1/16
L*	1	1/4 x 1/8
M*	1-1/2	3/8 x 3/16
N*	9/16	1/8 x 1/16
O*	11/16	3/16 x 3/32
P*	1-1/16	1/4 x 1/8
Q*	1-7/16	3/8 x 3/16
R*	13/16	3/16 x 3/32
S*	15/16	1/4 x 1/8
T*	1-3/16	1/4 x 1/8
U*	1-5/16	5/16 x 5/32
Z	.600	pilot bore

### Standard AC Voltage Ratings

Character	Voltage	Hz
B	115	60
D	110	50
E	200	60
F	230	60
	190	50
H	220	50
L	460	60
	380	50
M	415	50
N	575	60
O	110/220	50
P	115/230	60
Q	230/460	60
	190/380	50
R	200/400	60

Maximum allowable bore 1.875. For thru-shaft applications 1.625 is maximum.

\*These bores are non-standard. Add \$250.00 to list price.

\*\*Keyseats made to ANSI B17.1 standard.

### Direct Current

Character	Voltage
T	12
U	24
V	36
W	48
X	95
Y	115
Z	230

Consult factory if other DC voltage is needed.

Modifications are available—see SAB Modification Section

Dimensional drawings are on the pages following.

**Series 87,000**

**Mounting Face: NEMA 182TC 184TC, 213TC, 215TC, 254TC, and 256TC**

**(Note: for 182TFC and 184TFC mounting, add a -05- register)**

**8.5" AK, 7.25" AJ**

**Static Torque:** 6 through 105 lb-ft

**Enclosure Material:** IP 23 - Sheet Metal Housing, Aluminum Endplate. IP 54 & 55 - Cast Iron Housing and Endplate. IP 54 & 55 also available in sheet metal housing, aluminum endplate.

**Enclosure Protection:** IP 23, 54 & 55 (formerly referred to as NEMA 2, 4 & 4X\* respectively) \*BISCC Certified

**Release Type:** Pull Release Knob, maintained with automatic reset. Vertical above IP 54 & 55 supplied with side manual release lever; and all Cast Iron IP 54 & 55 brakes supplied with side manual release lever.

**Installation, Service and Parts List:** P/N 8-078-928-01 Rev. B brakes

**Mounting:** Horizontal, unless modified for vertical. Vertical mounting is defined as 15° or more from horizontal. Vertical above requires modification. Vertical below requires modification on 50-105 lb-ft brakes. Vertical above IP 54/55 includes side manual release. See SAB Modification Section for list price adders.

Fangard-mounted brakes requiring IP 54 or IP 55 protection may require additional sealing measures beyond seals provided with the brake - Refer to Installation & Service Instruction sheets.

**Specifications including bore sizes/voltages:** Page 17

**Modifications:** Pages 51-60 Including New Manual Adjust Option

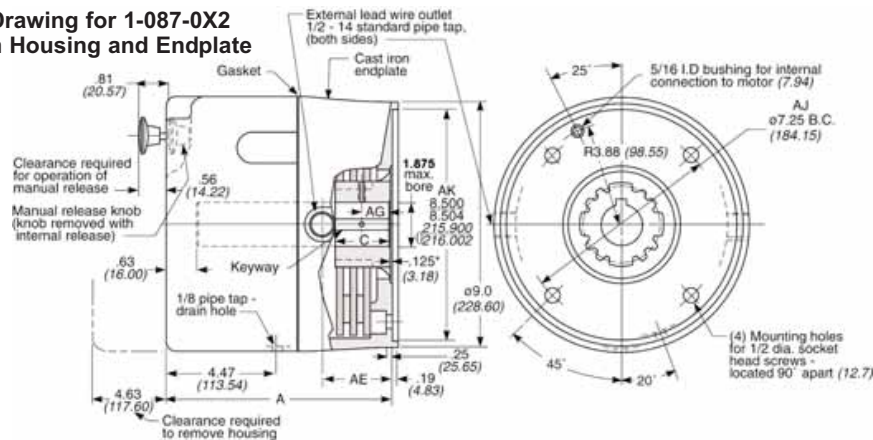
[BACK TO SPECIFICATION PAGE](#)



Brake set and release times in milliseconds, when brake and motor are switched separately (for T1/T2 definitions, see page 98):

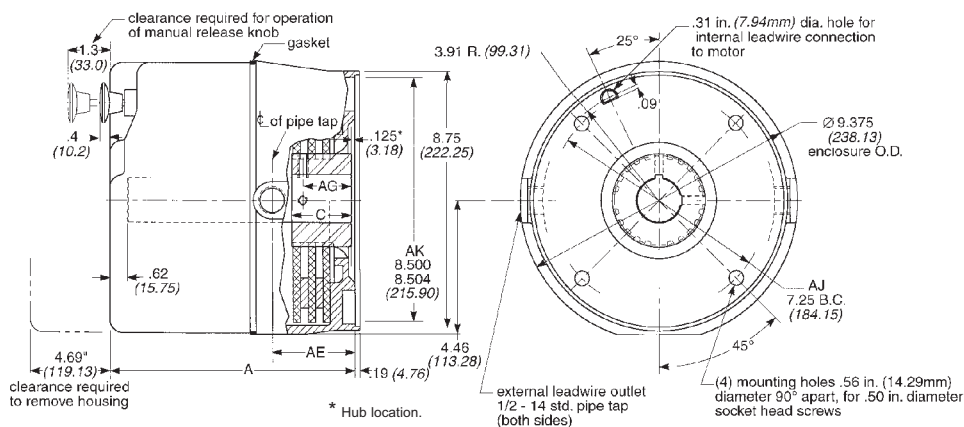
Static Torque	Coil Size	T1	T2
10, 15, 25, 50	5 & 6	42	20
35, 75, 105	8	48	20

**Outline Drawing for 1-087-0X2  
Cast Iron Housing and Endplate**



\* Hub location.  
Dimensions for estimating only. For installation purposes request certified prints.

**Outline Drawing for 1-087-0X1 and 1-087-0X4  
Sheet Metal Housing, Aluminum Endplate**



**Series 87,000 Dimensional Data**

[BACK TO SPECIFICATION PAGE](#)

**IP 23 Enclosure - aluminum & steel**

Nominal Static Torque lb-ft (Nm)	Basic Model Number and List Price*				Dimensions in Inches (Dimensions in Millimeters)				Wt. lbs (kg)**	Discount Symbol
	AC	AC List Price*	DC	DC List Price*	A	AE	AG	C Hub Width		
6 (8)	1-087-001-00	\$925.00	1-087-005-00	\$1,495.00	7.38 (187.32)	1.81 (46.04)	.68 (17.29)	1.00 (25.40)	20 (9.0)	B2
10 (14)	1-087-011-00	925.00	1-087-015-00	1,495.00					20 (9.0)	B2
15 (20)	1-087-021-00	975.00	1-087-025-00	1,545.00					22 (10.0)	B2
25 (34)	1-087-031-00	1,050.00	1-087-035-00	1,620.00					22 (10.0)	B3
35 (47)	1-087-041-00	1,200.00	1-087-045-00	1,770.00					24 (11.0)	B3
50 (68)	1-087-051-00	1,500.00	1-087-055-00	2,070.00	7.88 (200.02)	2.31 (58.74)	.97 (24.64)	1.50 (38.10)	22 (10.0)	B3
75 (102)	1-087-061-00	2,000.00	1-087-065-00	2,570.00					27 (12.2)	B3
105 (142)	1-087-081-00	2,700.00	1-087-085-00	3,270.00	8.38 (212.72)	2.81 (71.44)	.97 (24.64)	2.00 (50.80)	33 (15.0)	B3

**IP 54 and IP 55 Enclosure - CAST IRON**

Nominal Static Torque lb-ft (Nm)	Enclosure	Basic Model Number and List Price*				Dimensions in Inches (Dimensions in Millimeters)				Wt. lbs (kg)**	Discount Symbol
		AC	AC List Price*	DC	DC List Price*	A	AE	AG	C Hub Width		
6 (8)	IP 54	1-087-002-00	\$1,525.00	1-087-006-00	\$2,095.00	7.56 (192.09)	1.81 (46.04)	.68 (17.29)	1.00 (25.40)	44 (20.0)	B2
	IP 55	1-087-002-B0	\$1,780.00	1-087-006-B0	\$2,350.00						
10 (14)	IP 54	1-087-012-00	1,525.00	1-087-016-00	2,095.00					44 (20.0)	B2
	IP 55	1-087-012-B0	1,780.00	1-087-016-B0	2,350.00						
15 (20)	IP 54	1-087-022-00	1,575.00	1-087-026-00	2,145.00					46 (21.0)	B2
	IP 55	1-087-022-B0	1,830.00	1-087-026-B0	2,400.00						
25 (34)	IP 54	1-087-032-00	1,650.00	1-087-036-00	2,220.00					46 (21.0)	B3
	IP 55	1-087-032-B0	1,905.00	1-087-036-B0	2,475.00						
35 (47)	IP 54	1-087-042-00	1,800.00	1-087-046-00	2,370.00					48 (21.7)	B3
	IP 55	1-087-042-B0	2,055.00	1-087-046-B0	2,625.00						
50 (68)	IP 54	1-087-052-00	2,100.00	1-087-056-00	2,670.00	8.06 (204.79)	2.31 (58.74)	.97 (24.64)	1.50 (38.10)	51 (23.0)	B3
	IP 55	1-087-052-B0	2,355.00	1-087-056-B0	2,925.00						
75 (102)	IP 54	1-087-062-00	2,600.00	1-087-066-00	3,170.00	52 (24.0)	B3				
	IP 55	1-087-062-B0	2,855.00	1-087-066-B0	3,425.00						
105 (142)	IP 54	1-087-082-00	3,300.00	1-087-086-00	3,870.00	8.56 (217.49)	2.81 (71.44)	.97 (24.64)	2.00 (50.80)	56 (25.4)	B3
	IP 55	1-087-082-B0	3,555.00	1-087-086-B0	4,125.00						
125 <sup>1</sup> (169)	IP 54	1-087-092-00	3,800.00	1-087-096-00	4,370.00	8.56 (217.49)	2.81 (71.44)	.97 (24.64)	2.00 (50.80)	56 (25.4)	B3
	IP 55	1-087-092-B0	4,055.00	1-087-096-B0	4,625.00						

**IP 54 and IP 55 Enclosure - Lightweight ALUMINUM & STEEL**

Nominal Static Torque lb-ft (Nm)	Enclosure	Basic Model Number and List Price*				Dimensions in Inches (Dimensions in Millimeters)				Wt. lbs (kg)**	Discount Symbol
		AC	AC List Price*	DC	DC List Price*	A	AE	AG	C Hub Width		
6 (8)	IP 54	1-087-004-00	\$1,125.00	Contact factory	7.43 (188.59)	1.81 (46.04)	.68 (17.29)	1.00 (25.40)	19 (8.6)	B2	
	IP 55	1-087-004-B0	\$1,425.00								
10 (14)	IP 54	1-087-014-00	1,125.00	Contact factory					19 (8.6)	B2	
	IP 55	1-087-014-B0	1,425.00								
15 (20)	IP 54	1-087-024-00	1,175.00	Contact factory					20 (9.0)	B2	
	IP 55	1-087-024-B0	1,475.00								
25 (34)	IP 54	1-087-034-00	1,250.00	Contact factory					20 (9.0)	B3	
	IP 55	1-087-034-B0	1,550.00								
35 (47)	IP 54	1-087-044-00	1,400.00	Contact factory					22 (10.0)	B3	
	IP 55	1-087-044-B0	1,700.00								
50 (68)	IP 54	1-087-054-00	1,700.00	Contact factory	7.93 (201.28)	2.31 (58.74)	.97 (24.64)	1.50 (38.10)	23 (10.4)	B3	
	IP 55	1-087-054-B0	2,000.00								
75 (102)	IP 54	1-087-064-00	2,200.00	Contact factory	23 (10.4)	B3					
	IP 55	1-087-064-B0	2,500.00								
105 (142)	IP 54	1-087-084-00	2,900.00	Contact factory	8.43 (213.97)	2.81 (71.44)	.97 (24.64)	2.00 (50.80)	24 (11.0)	B3	
	IP 55	1-087-084-B0	3,200.00								

\* Subtract \$45.00 for brake ordered less hub.

\*\* Foot mounting adds 7 lbs. (3.2 kg) to weight.

<sup>1</sup> These model numbers and list prices include non-standard friction discs.

For high inertia or overhauling loads, it is recommended that 81,000 or 82,000 series brakes be used, as these brakes have substantially higher thermal capacities (50% higher for 81,000 series and 150% higher for 82,000 series).

## SELECTION - Solenoid Actuated Brakes

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**NOTE:** For overhauling/high inertia loads, to stop in a specified time/distance, or for brakes combined with variable frequency drives, please refer to [Application Engineering Section](#).

Stearns Solenoid Actuated Brakes can be easily selected from Table 1 and 2.

Given motor data:

1. Horsepower (hp)
2. Speed (RPM)
3. NEMA C-face frame size

Determine:

1. Static torque rating of the brake (lb-ft)

2. Brake series

**Step 1** – Given the motor horsepower and speed, select the brake torque from Table 1. Torque in table 1 is calculated using formula:

$$T_s = \frac{5,252 \times P}{N} \times SF$$

Where,  $T_s$  = Static torque, lb-ft

$P$  = Motor horsepower, hp

$N$  = Motor full load speed, rpm

SF = Service Factor

5,252 = constant

*Example:* Given a 5 hp, 1800 RPM motor, the selected brake is 20 or 25 lb-ft.

**Step 2** – Given the NEMA C-face motor frame size, select the brake series from Table 2.

*Example:* Given the 5 hp, 1800 RPM motor in Step 1 with a NEMA 184TC frame, Series 87,000; 87,300 or 87,700 Brakes can be selected to mount directly to the motor.

**Table 1 – Torque Selection**

*In this table, brake torque ratings are no less than 140% of the motor full load torque.*

Motor hp	Brakemotor Shaft Speed (RPM)						
	700	900	1200	1500	1800	3000	3600
	Static Torque Rating of Brake (lb-ft)						
1/6	3	1.5	1.5	1.5	0.75	0.5	0.5
1/4	3	3	3	1.5	1.5	0.75	0.5
1/3	6	3	3	3	1.5	1.5	0.75
1/2	6	6	3	3	3	1.5	1.5
3/4	10	6	6	6	6	3	3
1	15	10	6	6	6	3	3
1-1/2	20	15	10	10	10	6	3
2	25	20	15	10	10	6	6
3	35	25	20	15	15	10	6
5	75	50	35	25	20 or 25	15	10
7-1/2	105	75	50	50	35	25	15
10	105	105	75	50	50	25	25
15	175	125	105	75	75	50	35
20	230	175	125	105	105	50	50
25	330	230	175	125	105	75	50
30	330	330	230	175	125	75	75
40	440	330	330	230	175	105	105
50	550	440	330	330	230	*	*
60	750	500	440	330	330	*	*
75	1000	750	500	440	330	*	*
100	—	1000	750	500	440	*	*
125	—	1000	1000	750	500	*	*
150	—	—	1000	750	500	*	*
200	—	—	—	1000	1000	*	*
250	—	—	—	—	1000	*	*

\*See catalog pages for maximum rpm by series. Thermal capacity must be considered in load stops over 1800 rpm.

**Table 2 – Brake Series Selection by NEMA Frame Size**

Torque Range (lb-ft)	Brake Series	C-Face Motor Frame Size											
		48C	56C	143TC 145TC	182TC 184TC	213TC 215TC	254TC 254UC 256TC 256UC	284TC 284UC 286TC 286UC	324TC 324UC 326TC 326UC	364TC 364UC 365TC 365UC	404TC 404UC 405TC 405UC	444TC 444UC 445TC 445UC	504UC 504SC 505C 505SC
<b>Manually-Adjusted Brakes (require periodic adjustment to compensate for friction disc wear)</b>													
1.5-6	48,100	①											
1.5-25	56,000		①										
10-25	56,500			①	②	②	②						
<b>Self-Adjusting Brakes (automatically compensate for friction disc wear)</b>													
6-105	87,000		③	③	①	①	①	②	②	②	②		
50-105	87,100							①					
125-230	81,000				②	②	②	②	①	①	①	②	
125-440	82,000				②	②	②	②	①	①	①	②	
500-1000	86,000							②	②	②	②	①	
500-1000	86,100												①
<b>Division I Hazardous Location Brakes (for atmospheres containing explosive gases or ignitable dusts) / Motor Mounted</b>													
1.5-15	65,300		①	①	②	②	②						
10-105	87,300				①	①	①	②	②	②	②		
125-330	82,300				②	②	②	②	①	①	①	②	
<b>Division I Hazardous Location Brakes (for atmospheres containing explosive gases or ignitable dusts) / Foot Mounted</b>													
10-105	87,300				④	④	④						
125-330	82,300								④	④	④		
<b>Division 2 Hazardous Location Brakes</b>													
1.5-25	56,800		①	①	②	②	②						
6-105	87,800		③	③	①	①	①	②	②	②	②		
<b>Double C-Face Brake Couplers (for direct coupling a C-face motor to a C-face gear reducer)</b>													
1.5-25	56,700		①	①	①	①	①						
10-105	87,700												

- ① Brake mounts directly to motor C-face.
- ② Adapter required to mount brake to motor C-face. Refer to brake specifications for adapter information.
- ③ Brake endplate modified for direct mounting to motor C-face without an adapter.
- ④ Brake is foot mounted for coupling to a hazardous-location motor.

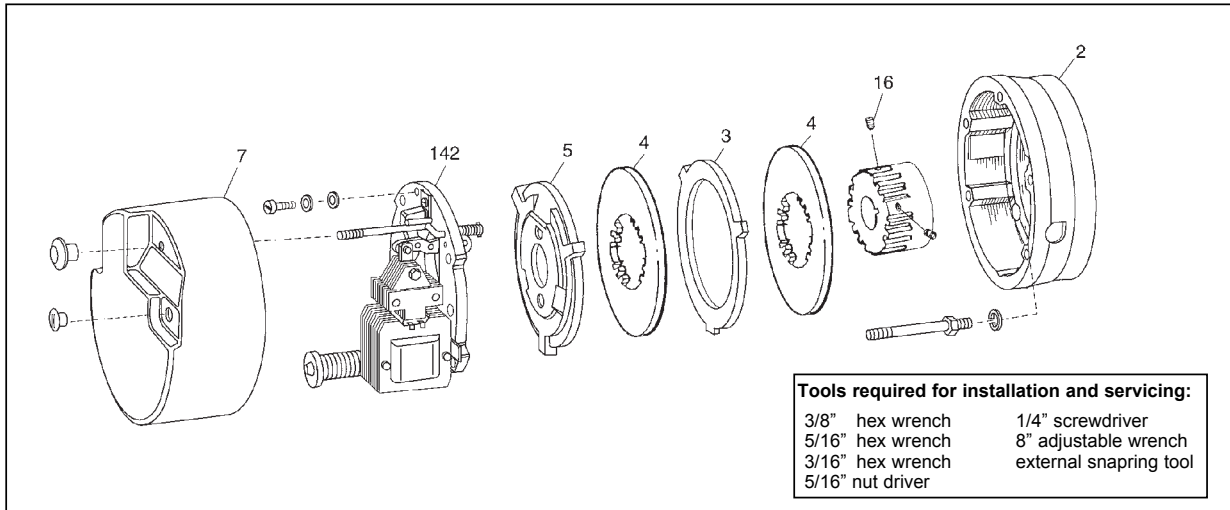


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P/N 8-078-928-01  
effective 12/16/09

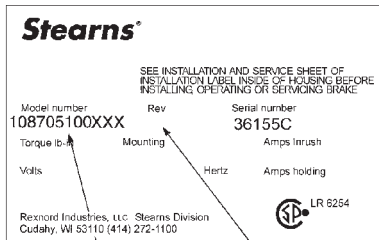
# Stearns® Spring-Set Disc Brakes

## Installation and Service Instructions for 87,000 & 87,100 Series Self-Adjust Brakes (rev. B)



**Typical Nameplate**  
**Important**

Please read these instructions carefully before



Note:  
MODEL NUMBER Refer to actual nameplate on brake for additional information  
REVISION CONTROL (if applicable) and brake serial number

installing, operating, or servicing your Stearns Brake. Failure to comply with these instructions could cause injury to personnel and/or damage to property if the brake is installed or operated incorrectly. For definition of limited warranty/liability, contact Rexnord Industries, LLC, Stearns Division, 5150 S. International Dr., Cudahy, WI 53110, (414) 272-1100.

**Caution**

1. Installation and servicing must be made in compliance with all local safety codes including Occupational Safety and Health Act (OSHA). All wiring and electrical connections must comply with the National Electric Code (NEC) and local electric codes in effect.
2. Use of this brake in atmospheres containing explosive gases and dusts must be in accordance with NEC article 501. This brake is not suitable for use in certain atmospheres containing explosive gases and dusts. **HazLoc** inspection authorities are responsible for verifying and authorizing the use of suitably designed and installed **HazLoc** equipment. When

questions arise consult local **Authority Having Jurisdiction (AHJ)**.

3. To prevent an electrical hazard, disconnect power source before working on the brake. If power disconnect point is out of sight, lock disconnect in the *off* position and tag to prevent accidental application of power.
4. Make certain power source conforms to the requirements specified on the brake nameplate.
5. Be careful when touching the exterior of an operating brake. Allow sufficient time for brake to cool before disassembly. Surfaces may be hot enough to be painful or cause injury.
6. Do not operate brake with housing removed. All moving parts should be guarded.
7. Installation and servicing should be performed only by qualified personnel familiar with the construction and operation of the brake.
8. For proper performance and operation, only genuine Stearns parts should be used for repairs and replacements.
9. After usage, the brake interior will contain burnt and degraded friction material dust. This dust must be removed before servicing or adjusting the brake.  
DO NOT BLOW OFF DUST using an air hose. It is important to avoid dispersing dust into the air or inhaling it, as this may be dangerous to your health.
  - a) Wear a filtered mask or a respirator while removing dust from the inside of a brake.
  - b) Use a vacuum cleaner or a soft brush to remove dust from the brake. When brushing, avoid causing the dust to become airborne. Collect the dust in a container, such as a bag, which can be sealed off.
10. **Caution!** While the brake is equipped with a manual release to allow manual shaft rotation, the motor should not be run with

the manual release engaged, to avoid overheating the friction disc(s).

**General Description**

These series of brakes are spring-set, electrically released. They contain one or more rotating friction discs (4) driven by a hub (16) mounted on the motor or other shaft.

**Note:** Fan-guard mounted brakes requiring IP54 & IP55 protection may require additional sealing measures beyond seals provided with this brake. Pressurized sprays aimed at the fan and brake hub surfaces can result in fluid migration along the motor shaft and keyway, and into the brake. The use of an appropriate sealant such as *RTV* or a *forsheda* seal is advised.

**Operating Principle**

These series contain one or more friction discs (4) assembled alternately between the endplate (2) friction surface, stationary disc(s) (3) and pressure plate (5). The stationary components are restrained from rotating by being keyed into the endplate. With the brake released, all disc pack components are free to slide axially and the friction disc(s) to rotate.

Brake release occurs when the solenoid coil is electrically energized, causing the solenoid plunger to travel a specified distance and through a lever system, overcoming the pressure spring force. This action releases the clamping force on the disc pack, thereby allowing the friction disc(s) and brake hub to rotate.

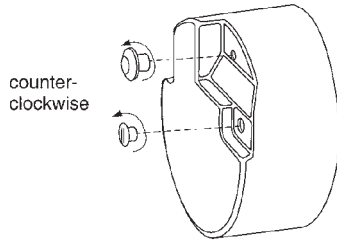
Brake sets and torque is produced when electric current to the solenoid coil is interrupted, thereby collapsing the solenoid magnetic field. The solenoid plunger returns to its original de-energized position allowing the lever arm to move forward by virtue of the compressed torque springs. This action compressed the disc pack components which applies a retarding torque to the brake hub and ultimately restores the brake to a spring-set static condition.



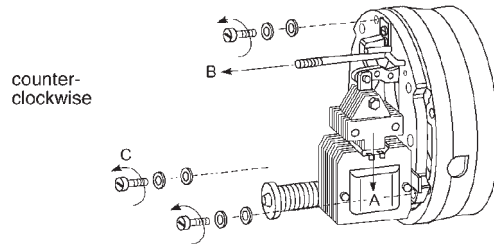
**BRAKE MOUNTING**

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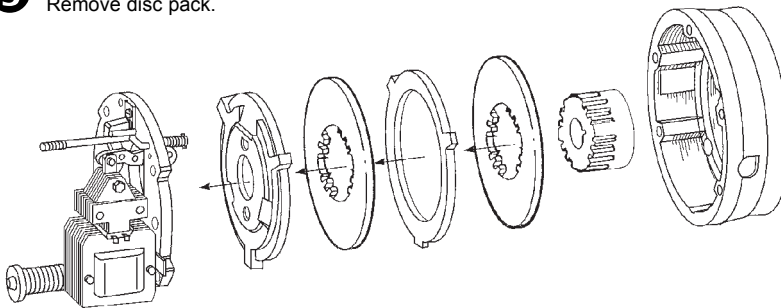
- 1** Remove manual release knob.  
Remove housing screws.  
Remove housing.



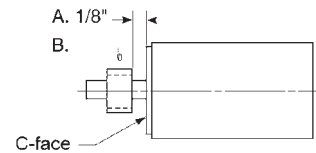
- 2** A. Push plunger down.  
B. Pull manual release to hold plunger.  
C. Remove support plate screws.



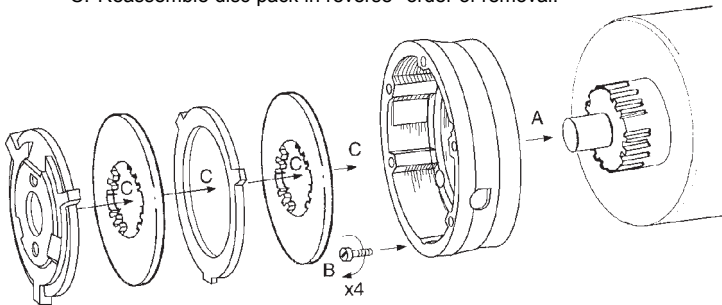
- 3** Lift off support plate.  
Remove disc pack.



- 4** A. Position hub on shaft as shown.  
B. Tighten set screws to motor shaft.  
Torque to: 5/16" - 156 in-lb;  
3/8" - 288 in-lb;  
1/2" - 625 in-lb.

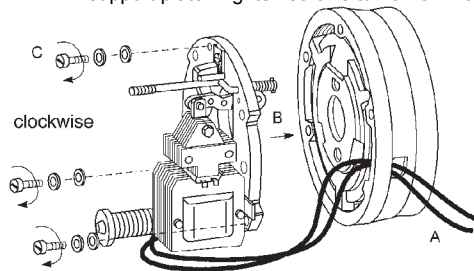


- 5** A. Position endplate on motor register.  
B. Insert four mounting bolts and tighten.  
C. Reassemble disc pack in reverse\* order of removal.



\*For vertical brakes, refer to Figure 2, page 3.

- 6** A. Route lead wires through conduit hole.  
B. Position support plate on endplate.  
C. Position conical washer under the screw head, with the flat washer\* against the support plate. Tighten screws to 75-78 in-lb.



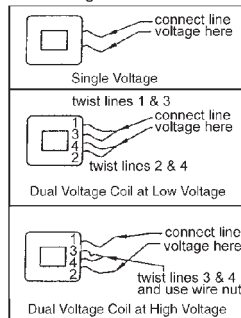
\*Cast iron support plates do not require a flat washer.

- 7** AC coils are 50/60 Hz, single phase rated. Power supply to coil must not have current or frequency limiting output that is less than the coil requirement.

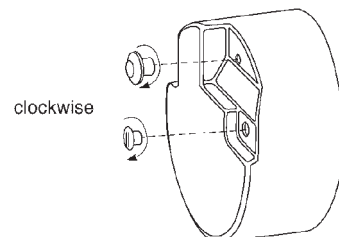
- Connect leadwires to power source. Verify voltage rating\* per nametag on coil.
- Keep wiring away from pinch points and moving components.

\* For DC voltages see Sheet 8-078-950-00

**Coil Wiring**



- 8** Replace housing.  
Tighten housing screws and release knob to 50-55 in-lb.



**Installation Notes:**

**Note 1:** If motor is to be ceiling mounted after assembly, entire brake will have to be rotated 180° or "upside down" so it will be positioned with solenoid plunger (29) above frame when final assembly is mounted on ceiling. Similarly, for horizontal wall mounting, rotate 90°.

**Note 2:** The brake nameplate states mounting position; "horizontal, vertical above or vertical below." The brake must be mounted in that position. Horizontal brakes rated 35 lb-ft and less do not require modification to be mounted vertical below.

**Note 3:** A dimple drilled into the motor shaft for the hub set screw (16S), 90° from the key is recommended for vertical mounting.

**General Maintenance**

**Warning!** Any mechanism or load held in position by the brake should be secured to prevent possible injury to personnel or damage to equipment before any disassembly of the brake is attempted or before the manual release knob or lever is operated on the brake. Observe all cautions listed at the beginning of this manual.

**Note 1:** To obtain correct replacement parts for the Series 87,000 Marine Duty, obtain brake serial number and consult factory.

**Note 2:** Replace friction disc in single disc brakes when wear surface area is one-half the original disc thickness. In multiple disc brakes, replace all friction discs when throat of lever arm (17) is within 1/16" of touching teeth of pinion (32).

**Troubleshooting**

**A. If brake does not stop properly or overheats, check the following:**

1. Is manual release engaged, and is motor energized?
2. Friction discs may be excessively worn, charred or broken.
3. Hub may have become loose and shifted on shaft.
4. Are controls which govern start of braking cycles operating properly?
5. On vertically mounted brakes, are springs in place in disc pack?
6. Is solenoid air gap adjusted correctly? See *Air Gap Adjustment*, Page 4.
7. Solenoid lever stop (22) must be in place on support plate.
8. Solenoid may not be energizing and releasing the brake. Check voltage at the coil and compare to the coil and/or nameplate voltage rating.
9. Check that heads of mounting bolts do not extend above wear surface of endplate.
10. If stopping time is more than two seconds, the brake torque rating may be insufficient. If the brake stops high inertial loads and/or brake stops more than five times per minute, check thermal requirements of application versus thermal capacity rating of brake.

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11. Use Loctite® 242 to secure link screw nut (13N) to link screw (13C) if vibration causes nut to loosen.

12. Check pressure spring length to insure correct compressed height. Original spring lengths are given in the following Table so that correct setting may be verified and corrected if necessary. With worn friction discs, add amount of wear to the approximate spring length shown.

Color	Torque (lb-ft)	Compressed Spring Length
Black	10	3-1/4"
White	15	3-1/4"
Orange	25 & 50	3-1/4"
Purple	35, 75 & 105	3-1/4"

13. If a heater is supplied and excess rusting has occurred in brake, check power source to heater to be sure it is operating and that heater is not burned out.

**B. If brake hums, solenoid pulls in slowly, or coil burns out, check the following:**

1. Voltage supply at coil versus coil rating.
2. Is solenoid air gap excessive? See *Air Gap Adjustment*, Page 4.
3. Solenoid frame and plunger may be excessively worn.
4. Solenoid mounting screws may have become loose, causing frame to shift and plunger to seat improperly.

**Vertical Spring Assembly**

**Note:** For vertical brakes refer to Figure 2 for proper stationary disc positioning. Discs must be inserted spring side first. Also refer to instruction sheet 8-078-937-06.

For brakes with brass stationary components, refer to instruction sheet 8-078-937-07.

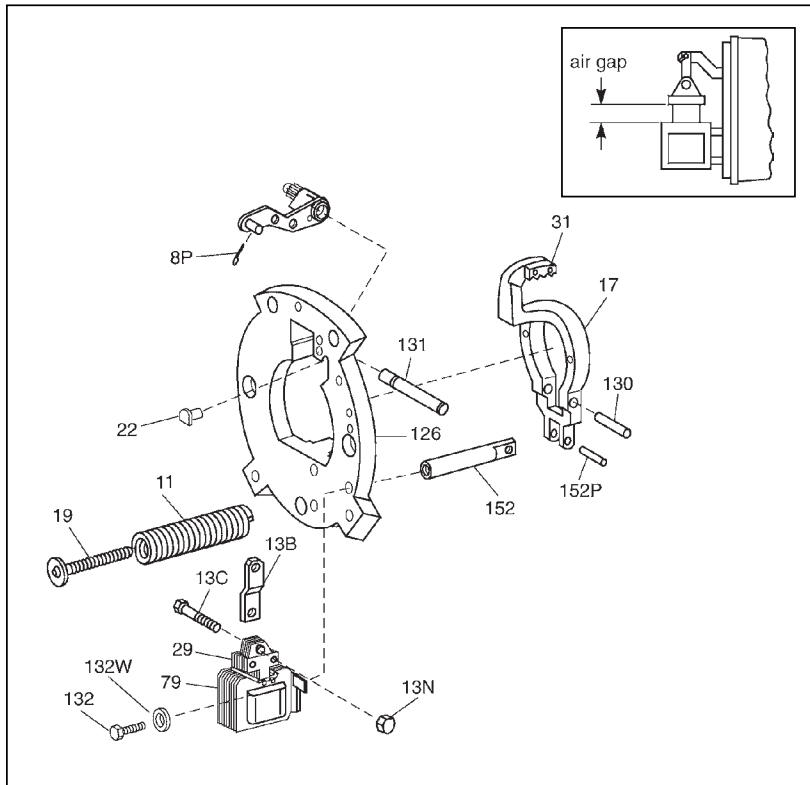


Figure 1

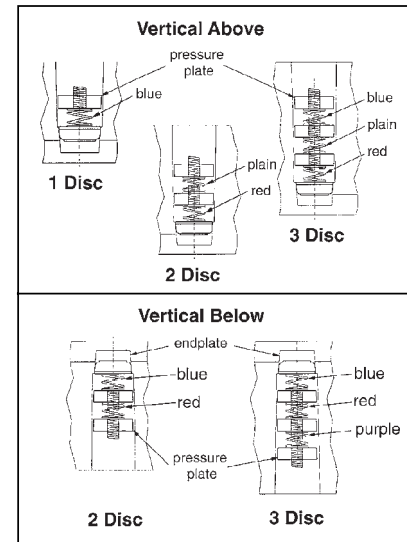
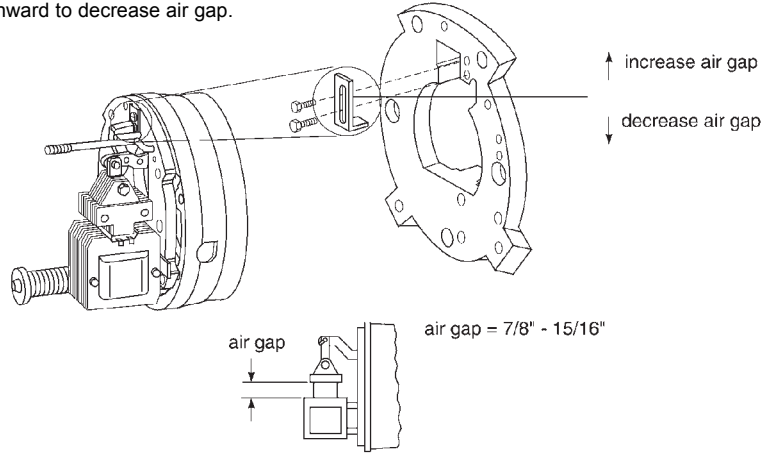
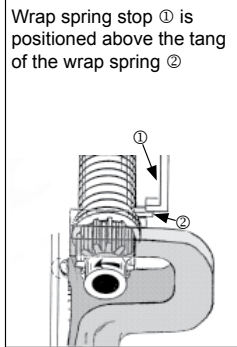


Figure 2

## AIR GAP AJUSTMENT

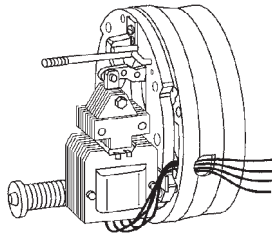
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- 1 Loosen two locking screws.  
Slide bracket outward to increase or inward to decrease air gap.  
Tighten screws to 45-55 lb-in.

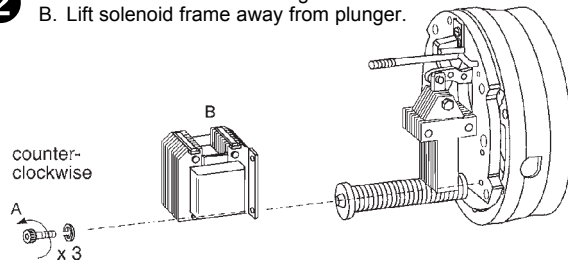


## COIL REPLACEMENT

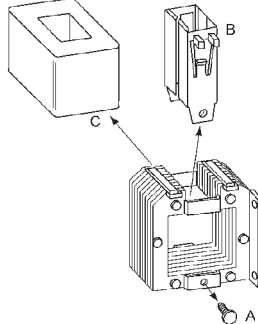
- 1 Disconnect coil lead wires from power source and pull them out of the brake.



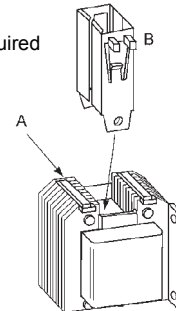
- 2 A. Remove solenoid mounting screws.  
B. Lift solenoid frame away from plunger.



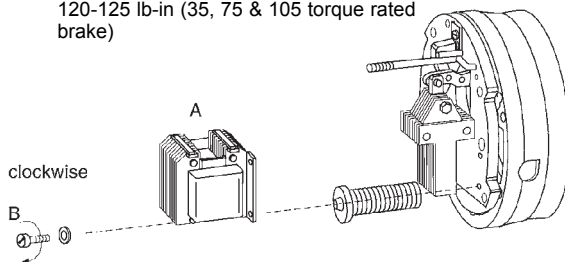
- 3 A. Remove guide screws, if used.  
B. Lift guides out of coil.  
C. Push coil out of frame.



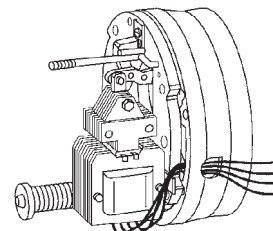
- 4 A. Insert new coil.  
B. Press plunger guides into place.  
C. (Guide screws are no longer required with plastic guides.)



- 5 A. Slide coil assembly onto plunger.  
B. Insert mounting screws and tighten:  
70-75 lb-in (10-25 & 50 torque rated brake)  
120-125 lb-in (35, 75 & 105 torque rated brake)



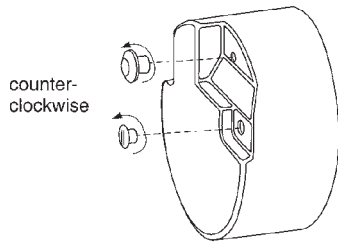
- 6 Reroute coil wires and reconnect to power supply.



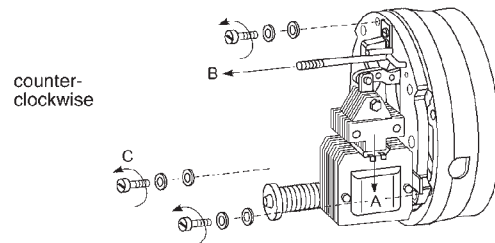
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## FRICION DISC REPLACEMENT

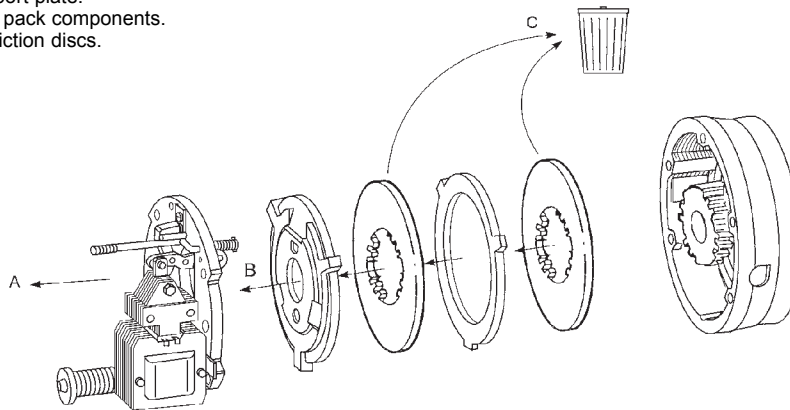
- 1** Remove manual release knob.  
Remove housing screws.  
Remove housing.



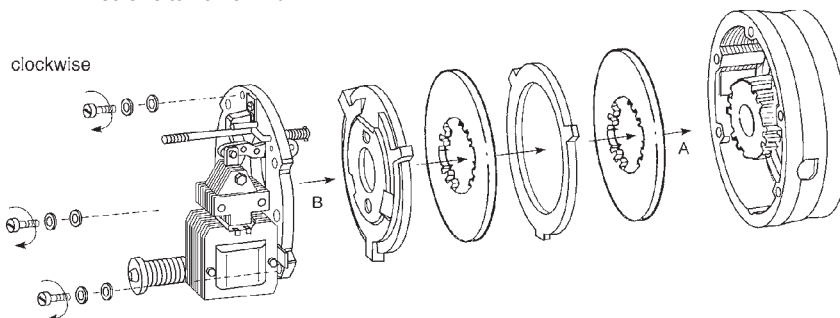
- 2** A. Push plunger down.  
B. Pull manual release to hold plunger.  
C. Remove support plate screws.



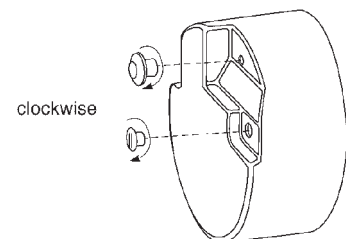
- 3** A. Remove support plate.  
B. Remove disc pack components.  
C. Discard old friction discs.



- 4** A. Install new friction discs and reassemble in reverse order of disassembly.\*  
B. Positioned conical washer under the screw head, with the flat washer against the support plate. **(Cast iron support plates do not require a flat washer)**. Tighten screws to 75-78 in-lb.



- 5** Replace housing.  
Tighten housing screws to 50-55 in-lb. Hand tighten release knob.



\* For vertical brake assembly refer to Figure 2, page 3.

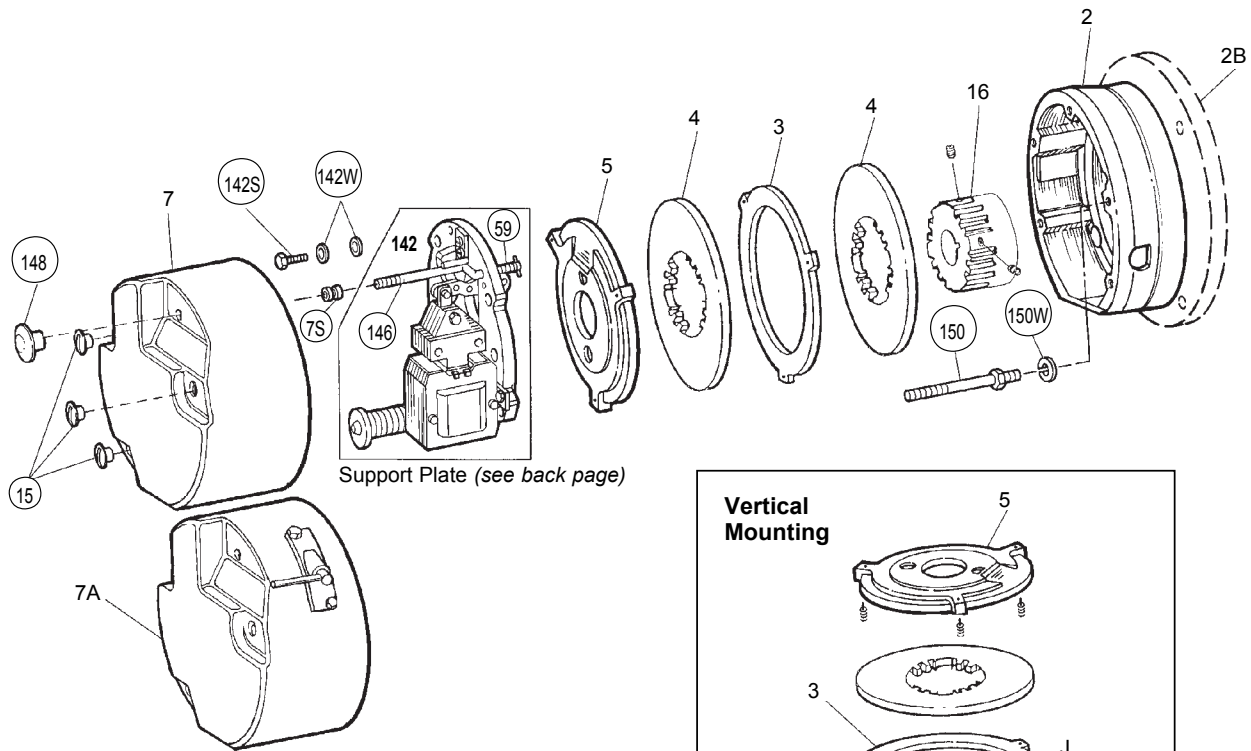
**Information required when ordering replacement parts:**

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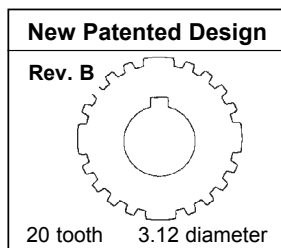
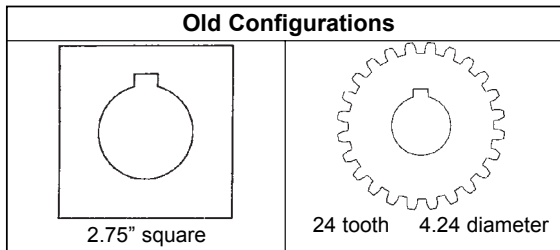
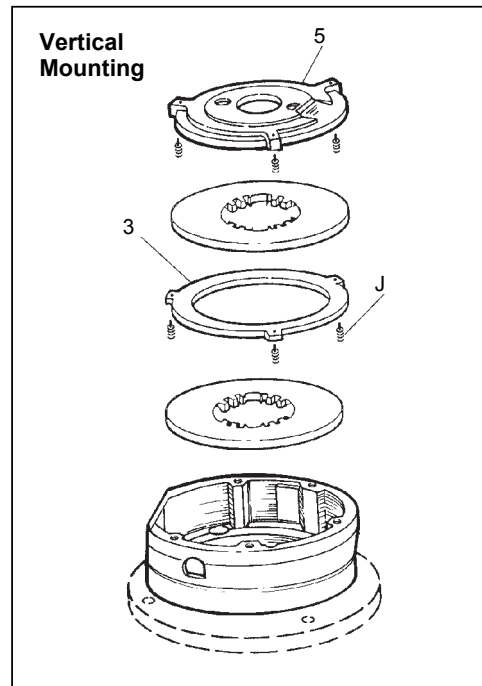
- Give part number of parts or kits needed, brake model number, and brake serial number. The brake model and serial number may identify special brakes not covered by this parts list.
- Description items in ***CAPITALIZED BOLD ITALICS*** are recommended spare parts. One set per 5 brakes in service is recommended.
- For 87,100 Series see Table 2.

Circled items are contained in kit Item A, Table 4.

For installation and service instructions, see P/N 8-078-937-06.  
Detailed service instruction sheet is included with each kit.



Support Plate (see back page)



<b>Stearns®</b>	
SEE INSTALLATION AND SERVICE SHEET OR INSTALLATION LABEL INSIDE OF HOUSING BEFORE INSTALLING, OPERATING OR SERVICING BRAKE.	
Model number 108705100EQB	Rev. B
Torque lb-ft	Mounting
Volts	Hertz
	Amps holding
	Amps inrush
LR 6254 Revnord Industries, LLC, Stearns Division Cudahy, WI 53110 (414) 272-1100	

**Note:**  
**MODEL NUMBER** will appear on brake nameplate.  
**REVISION CONTROL** (if applicable) and brake serial number



[BACK TO PRODUCT PAGE](#)

TABLE 3: Components of Support Plate and Coil Assembly

Item	Description	Part Number	Torque				
			6 10	15	25 50	35 75 105	
126	Support plate and bearing assembly Support plate and bearing assembly	5-26-7007-00 5-26-7008-00	1	1	1	1	
8	<b>SOLENOID LEVER AND PINION KIT</b>	5-66-7371-00	1	1	1	1	
17	Lever arm kit	5-66-7271-00	1	1	1	1	
19 & 152	Pressure spring tube kit	5-66-7471-00	1	1	1	1	
11	Pressure spring kit - black Pressure spring kit - white Pressure spring kit - orange Pressure spring kit - purple	5-66-3072-00 5-66-3074-00 5-66-3076-00 5-66-3078-00	1	1	1	1	
AC Brakes							
U	<b>NO. 5 SOLENOID KIT</b> <b>NO. 6 SOLENOID KIT</b> <b>NO. 8 SOLENOID KIT</b>	5-66-5051-00 5-66-5061-00 5-66-5081-00	1	1	1	1	
13B	Solenoid link Solenoid link	8-013-703-00 8-013-704-00	1	1	1	1	
13C	Solenoid link cap screw Solenoid link cap screw Solenoid link cap screw	8-157-701-00 8-157-702-00 8-157-703-00	1	1	1	1	
V	<b>No. 5 Coil kit</b> <b>60 Hz</b>	115/230 Vac 230/460 Vac 115 Vac 230 Vac 460 Vac 575 Vac	5-66-6507-33 5-66-6509-33 5-66-6501-33 5-66-6502-33 5-66-6504-33 5-66-6505-33	1	1	1	1

Item	Description	Part Number	Torque				
			6 10	15	25 50	35 75 105	
V	<b>No. 6 Coil kit</b> <b>60 Hz</b>	115/230 Vac	5-66-6607-33	1	1	1	
		230/460 Vac	5-66-6609-33	1	1	1	
		115 Vac	5-66-6601-33	1	1	1	
		230 Vac	5-66-6602-33	1	1	1	
		460 Vac	5-66-6604-33	1	1	1	
		575 Vac	5-66-6605-33	1	1	1	
	<b>No. 8 Coil kit</b> <b>60 Hz</b>	115/230 Vac	5-66-6807-33			1	
		230/460 Vac	5-66-6809-33			1	
		115 Vac	5-66-6801-33			1	
		230 Vac	5-66-6802-33			1	
		460 Vac	5-66-6804-33			1	
		575 Vac	5-66-6805-33			1	
XX	Brake release interlock switch	5-57-5528-00	1	1	1	1	
DC Brakes							
W	Electronic DC Switch Kit	24/28 Vdc 115 Vdc 230 Vdc	5-57-5712-07 5-57-5716-07 5-57-5717-07	1	1	1	1
W	<b>No. 5 Coil assembly</b>	115 Vdc	5-96-6516-33	1			
		230 Vdc	5-96-6517-33	1			
		115 Vdc	5-96-6517-33	1	1	1	
	<b>No. 6 Coil assembly</b>	115 Vdc	5-96-6616-33		1	1	
		230 Vdc	5-96-6617-33		1	1	
	<b>No. 8 Coil assembly</b>	115 Vdc	5-96-6816-33				1
		230 Vdc	5-96-6817-33				1

Solenoid and Coil

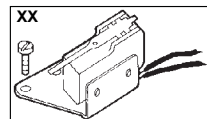
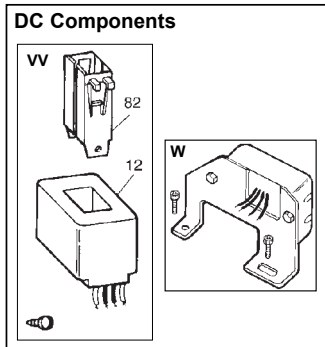
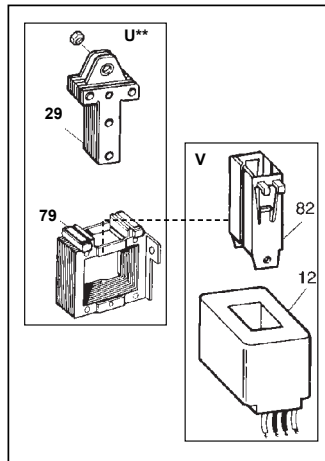


TABLE 4: Contents of Kits and Assemblies (contents may vary)

Item	Kit Description	Item	Kit Description
A	Hardware kit (5-66-1007-01) 2 - External lead wire plugs 1 - Wrap spring stop 2 - Wrap spring stop screws 1 - Solenoid lever stop 3 - Support plate screws 3 - Support plate conical spring washers 3 - Support plate flat washers 3 - Housing studs 3 - Housing stud lock washers 3 - Housing nuts 1 - Release rod 1 - Release rod spring 1 - Release spring retainer 1 - Housing grommet 1 - Release knob	17	Lever arm kit (5-66-7271-00) 1 - Lever arm assembly 1 - Lever arm pivot pin 1 - Spring tube pivot pin
3	Gasket and seal kit (5-66-1271-0X) 1 - Endplate oil seal 1 - Housing seal 3 - Housing nut gaskets 1 - Housing to endplate gasket 3 - Endplate rubber plugs (-01 only) 1 - Manual release gasket (-01 only)	19 & 152	Pressure spring tube kit (5-66-7471-00) 1 - Pressure spring tube 1 - Pressure spring screw 1 - Spring tube pivot pin
4	Stationary disc kit (5-66-8372-00) 1 - Stationary disc (horizontal or vertical)	11	Pressure spring kit (5-66-307X-00) 1 - Pressure spring
5	Friction disc kit - splined (5-66-8483-00) 1 - Friction disc - splined	U	Solenoid kit (5-66-50X1-00) 1 - Plunger 1 - Frame 3 - Solenoid mounting screws 3 - Solenoid mounting conical spring washers 1 - Solenoid link nut
J	Pressure plate kit (5-66-8571-00) 1 - Pressure plate (horizontal or vertical)	V	Coil kits (5-66-6XXX-33) AC coils 1 - Coil 2 - Plunger guides 3 - Solenoid mounting screws
8	Vertical spring kit (5-66-317X-00) 15 - Vertical above mounting springs	VV	Coil assembly (5-96-6XXX-33) DC coils 1 - Coil 2 - Plunger guides 4 - Wire fasteners 3 - Solenoid mounting screws
8	Solenoid lever and pinion kit (5-66-737X-00) 1 - Solenoid lever & pinion assembly 1 - Cotter pin 1 - Solenoid lever pivot pin 1 - Pivot pin retaining ring	W	DC switch kit (5-57-57XX-07) 1 - Switch 1 - Mounting bracket 2 - Support plate mounting screws 2 - Switch mounting screws 2 - Nuts 3 - Crimp connectors
		XX	AC switch assembly (5-57-5528-00) 1 - Microswitch 1 - Mounting bracket 2 - Lead wire assemblies 2 - Mounting bracket screws 2 - Nuts 2 - Support plate screws 1 - Actuator arm 1 - Actuator arm mounting bolt 1 - Actuator arm nut



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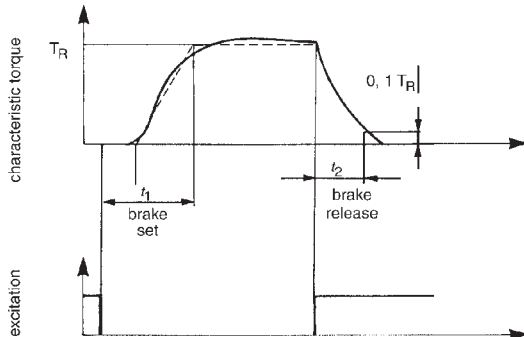


### Set and Release Times

The models listed below were tested for typical set and release times. Times listed below are defined as follows:

T1 = Total set time to 80% of rated static torque      T2 = Release time, measured as the time from when the power is applied to the brake to the time that the solenoid plunger or armature is fully seated.

**NOTE: Times will vary with the motor used, and brakes tested with factory-set air gap. The times shown should be used as a guide only.**



#### SAB T1/T2 Time in Milliseconds

Series	Static Torque lb-ft	Coil Size	T1 AC	T2 AC
56,000	1 1/2 - 25	K4, K4, K4+, M4+	25	14
87,000	10,15, 25,50	5 & 6	42	20
87,000	35,75,105	8	48	20
81,000 82,000	All	9	56	27

Brake and motor are switched separately.  
All brakes tested in horizontal position.  
Coil is energized for >24 hours before testing.  
Ambient temperature 70°F at time of test.

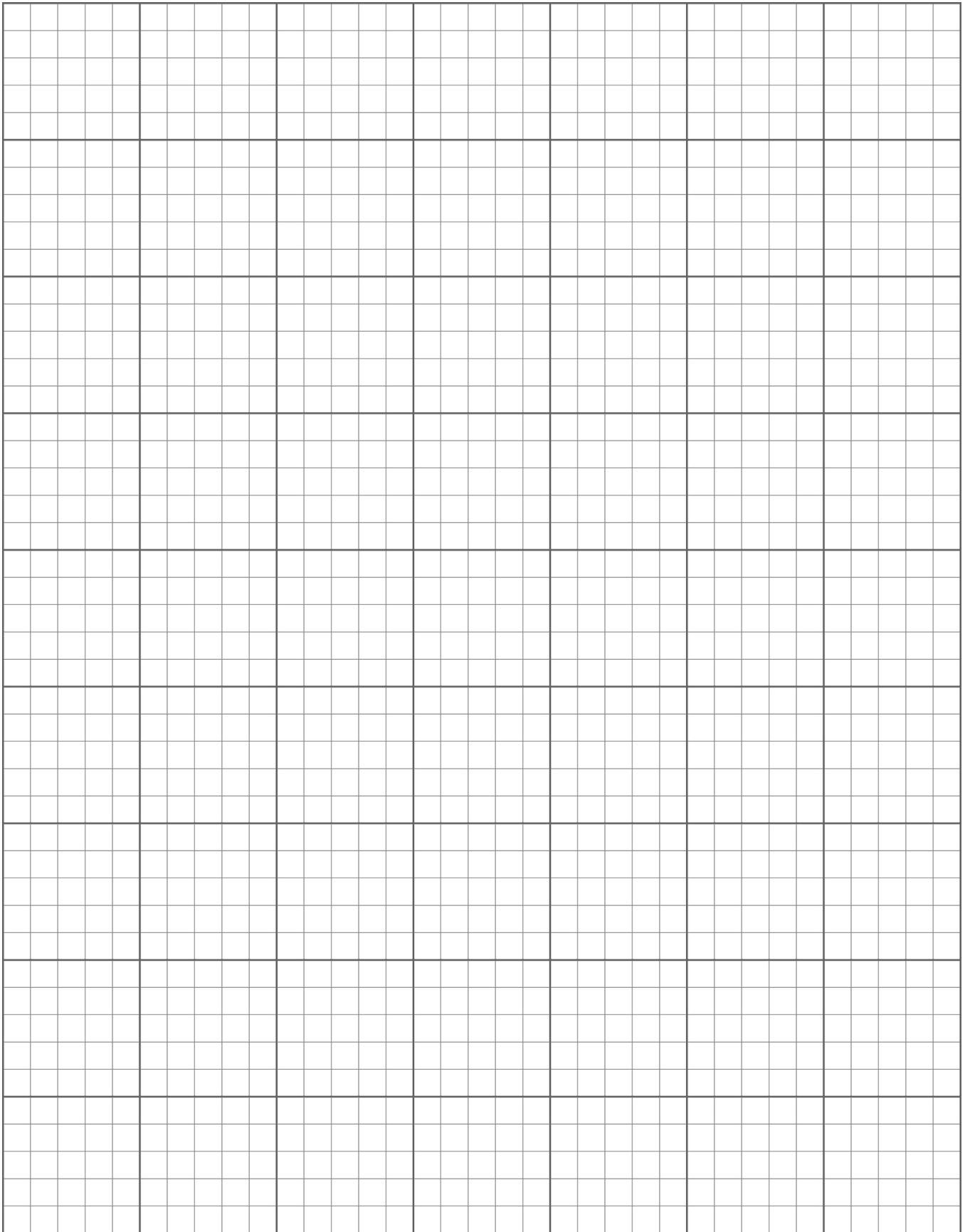
#### AAB Series 310/311/320/321 Times in Milliseconds

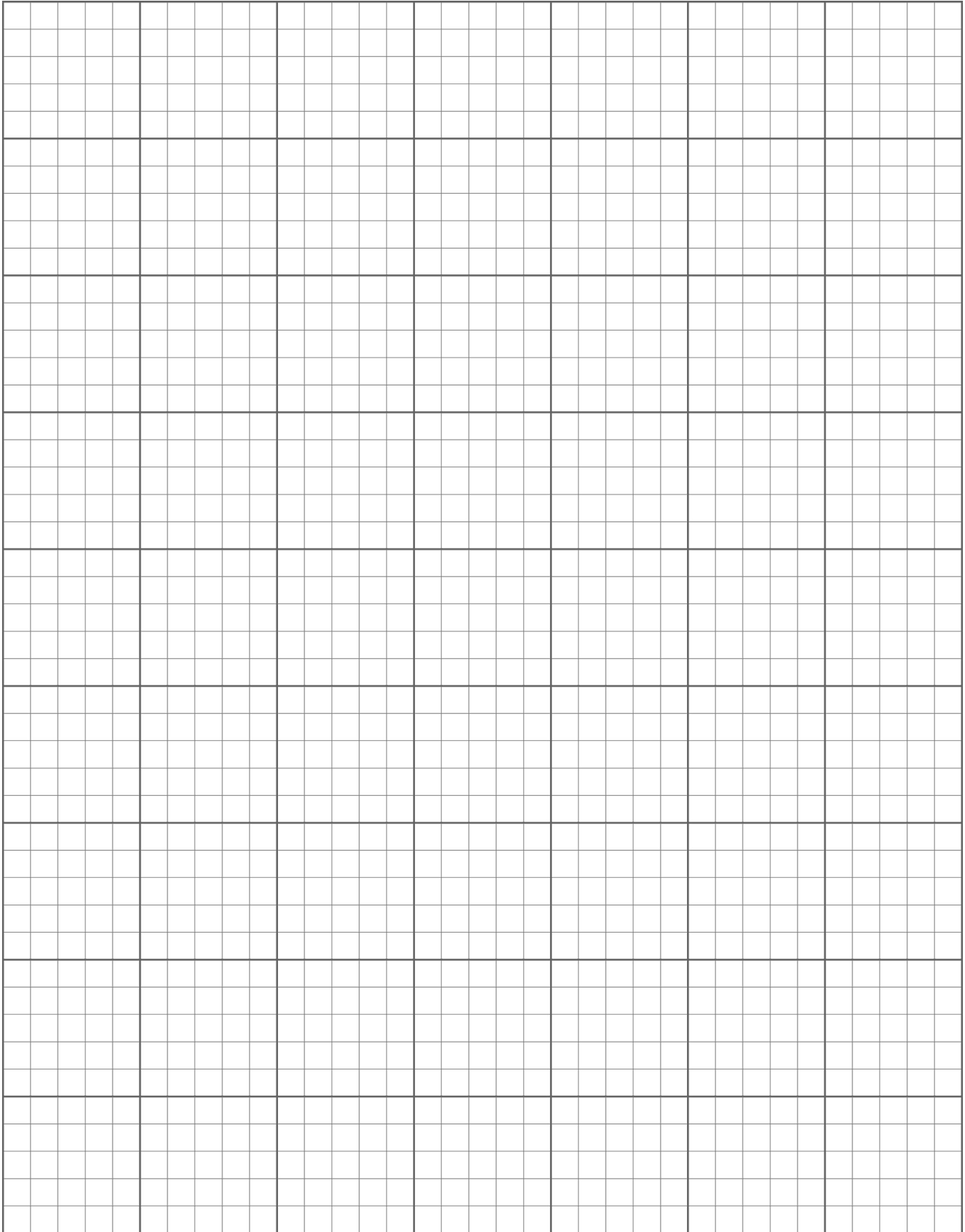
Series	310 DC Side Switching				
Size	1.79	2.0	2.87	3.35	5.0
T1	3	6	9	14	22
T2	20	43	48	110	195
Series	311 DC Side Switching				
Size	3.38	4.75	5.0		
T1	43	48	96		
T2	12	74	35		
Series	320 DC Side Switching				
Size	1.2	1.8	2.0	2.8	
T1	14	43	16	27	
T2	24	26	35	34	
Series	320 Full wave rectifier/AC Side Switching				
Size	1.2	1.8	2.0	2.8	
T1	31	97	52	78	
T2	27	29	40	42	
Series	321 DC Side Switching		321 AC Side Switching		
Size	1.2	1.8	2.8	1.2	1.8
T1	13	16	20	45	77
T2	18	27	49	16	25

#### AAB Series 333 Times in Milliseconds

Size	Applied Voltage/Type of Switching	T1	T2
72	DC side switching	23	35
	230 Vac/ac side switching/full wave	103	39
	460 Vac/ac side switching/half wave	98	34
90	DC side switching	19	73
	230 Vac/ac side switching/full wave	113	72
	460 Vac/ac side switching/half wave	114	73
	230 Vac connected across motor full wave	357	72
	230 Vac connected across motor /quickset	42	72
112	DC side switching	155	39
	230 Vac/ac side switching/full wave	547	43
	460 Vac/ac side switching/half wave	501	54
132	DC side switching	119	100
	230 Vac/ac side switching/full wave	833	101
	460 Vac/ac side switching/half wave	803	106
145	DC side switching	185	186
	230 Vac/ac side switching/full wave	999	192
	460 Vac/ac side switching/half wave	1007	209
	230 Vac connected across motor full wave	1689	192
	230 Vac connected across motor /quickset	368	192
	460 Vac/ac side switching/half wave/With air gap shim	629	223
170	DC side switching	129	163
	230 Vac/ac side switching/full wave	1130	174
	460 Vac/ac side switching/half wave	1140	175
196	DC side switching	96	263
	230 Vac/ac side switching/full wave	920	264
	460 Vac/ac side switching/half wave	957	274
230	DC side switching	131	264
	230 Vac/ac side switching/full wave	1299	236
	460 Vac/ac side switching/half wave	1303	276
	Tor-Ac 230 Vac/ac side switching/full wave	169	295
	Tor-Ac 230 Vac/ac side switching/full wave/With air gap shim	122	327
	230 Vac connected across motor quickset/quickrelease/with air gap shim	122	145
278	DC side switching	182	388
	230 Vac/ac side switching/full wave	1807	389
	460 Vac/ac side switching/half wave	1689	366







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**Dimensions.** All dimensions shown in this catalog are in feet and inches. Weights are in English pounds. Capacities are in short tons of 2,000 pounds. Please note that dimensions and weights are nominal and are subject to standard variations. Maximum test pressure on hatches, doors, and enclosures is 2 PSI unless advised in writing by NABRICO of a higher allowance. Product details and specifications are subject to change without notice.

# NABRICO



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ROLLER BUTTON

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