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INSTALLATION, MAINTENANCE AND OPERATION MANUAL

Ovivo® C60P-S1 Drive with Adapter Ring

Serial No.: RSW0000933-01 A

For

PROJECT: Wichita STP #2

CUSTOMER: City of Wichita

Purchase Order No.: PO840306

Ovivo USA, LLC Order No.: RSW0000933

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5.0 PARTS LIST

RSW0000933-01 COMPLETE PARTS LIST

6.0 DRAWINGS

DRAWING NUMBER	REV. LEVEL	DESCRIPTION
RSW933-152	(rev A)	Adapter Steel Erection
RSW891-133	(rev A)	C60PS2 Motor Drive with Shear Pin
768353	(rev C)	C60PS2 Drive Assembly

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DRAWING NUMBER	REV. LEVEL	DESCRIPTION
115209	(rev O)	Worm Gear Assembly
115759	(rev Y)	Drive Control
295128	(rev B)	Suggested Wiring Diagram
114808	(rev F)	Torque Values

7.0 ACCESSORIES

Gearmotor: Nord..... TAB 1
 (Ovivo USA, LLC Part No. 699047B3)
 Reducer Operating & Maintenance Instructions
 Motor Overview (Manual)

Shear Pin: Martin..... TAB 2
 (Ovivo USA, LLC Part No. 678876A)
 Shear Pin Data Sheets

Drive Control Removal and Replacement Instructions: TAB 3

8.0 FINAL MECHANICAL CHECKLIST

General

GENERAL

Introduction

To ensure complete warranty coverage of the equipment thoroughly read and familiarize yourself with the instructions in this manual.

It is the sincere desire of Ovivo USA, LLC that this equipment will give dependable, efficient and economical operation throughout the entire period of service. To achieve this kind of performance and ensure full warranty coverage, it is important to thoroughly read and understand the contents of this manual before the unit is installed, adjusted, or operated.

The equipment, including the accessory equipment furnished but not built by Ovivo, must be stored, installed, operated and maintained according to these instructions to ensure the warranty coverage.

The instructions in this manual are based on information available at the time of issue of this manual; the right is reserved to make subsequent changes to the instructions without obligation to replace existing copies.

Documents, drawings, technical manuals and all other information contained in this manual, provided in conjunction with the purchase of Ovivo products and services, are the property of Ovivo, are confidential, and may not be made public or copied.

Ovivo will not furnish editable electronic copies of any data and/or drawings at any time.

Ovivo accepts no liability whatsoever for unauthorized changes and/or alterations to the data provided.

English is the governing language. When manuals are provided in both English and any language other than English, **THE NON-ENGLISH TRANSLATION IS PROVIDED ONLY AS A CONVENIENCE. Ovivo shall not be liable for damages caused by errors in translation.** The English translation will govern in case of minor discrepancies. In the event of major discrepancies, notify your Ovivo representative immediately. Refer to the Offices page in this manual for applicable address and telephone number.

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GENERAL

Pre-Erection Assistance

Before You Erect It Your Way

Let Us Show You Our Way-

Read the Instructions

These instructions are based on years of field experience. We selected the best procedures from that experience and put them together to give you our best-suggested method of erection. Consider them. They will save you time and money.

But -

- If you believe you have a better way, call us first anyway.
- If you want assistance or a pre-erection conference before you start, call us.
- If problems should occur, call us at once.

Contact your Ovivo representative, referring to the Offices page in this manual.

GENERAL**Special Instructions to Field Erectors**

Ovivo does not anticipate problems with the erection of this equipment. However, due to the nature of fabricated steel equipment, the erector may require a certain amount of field fit-up and adapting work. This is considered to be a normal part of erection, as well as the use of such tools as come-alongs, welding and cutting torches, and drift pins. However, in case of problems, the following will apply:

1. The AISC "Code of Standard Practice", latest edition, specifically states under "Correction of Errors" that cutting, reaming and use of drift pins are a part of standard erection practice:

"Normal erection operations include the correction of minor misfits by moderate amounts of reaming, chipping, welding or cutting, and the drawing of elements into line through the use of drift pins. Errors that cannot be corrected by the foregoing means or that require major changes in member configuration are reported immediately to the owner and fabricator by the erector. This is done in order to enable whoever is responsible either to correct the error or to approve the most efficient and economic method of correction to be used by others."

2. **Should a problem develop because of fabrication or engineering errors, Ovivo will not accept back charges unless they are authorized in advance and in writing by your Ovivo Project Manager. Before corrective work is started, the erector must obtain an Ovivo Field Work Order that must include a cost limitation. Payment may be refused for corrective work that is done without the above authorization.**

Authorized charges will be paid only on the basis of standard direct field labor hours, material, and variable overhead. Other charges will not be allowed.

3. Drawings and erection or installation instructions must be followed. The drawings will govern in case of minor discrepancies. In the event of major discrepancies, notify your Ovivo representative immediately, referring to the table of contents for the location of the Offices page.
4. If a protective coating (paint, rubber, etc.) is to be applied to the mechanism, it may need to be applied to some parts before they are installed. Parts that must be coated before installation are those that would be inaccessible after installation. Hold back paint 3" from all field welds. Study Erection drawings carefully and determine field welded areas in question before painting.



WARNING: The fumes given off during welding and cutting can be injurious to the operator's health. Some fumes, such as those produced when working with Zinc, Cadmium and painted surfaces can be toxic

GENERAL**Receiving and Inspection**

Although all possible precautions are taken to protect the equipment against damage or losses during shipment, before accepting the shipment check all items against the packing list for shortages and inspect for evidence of physical damage. In either case, immediately notify the carrier or note on the delivery ticket "Accepted subject to full inspection after unpacking". Notify Ovivo within 7 days (maximum) in case of shortages or discrepancies in the amounts received according to the packing list. If not notified, Ovivo will not be responsible for replacing those items.

Keep a record of all claims and correspondence. Photographs are recommended.

1. Packing Boxes and Covers

Do not remove protective covers unless there are indications of damage. Boxes opened for inspection and inventory should be carefully repacked to ensure protection of the contents or else the parts should be packaged and stored in a safe place. Examine all packing boxes, wrappings and covers for items attached to them, especially if they are to be discarded. Refer to the Storage Instructions.

2. Shipping Braces and Bars

All braces, bars, etc., that are required for shipment, but are not a part of the mechanism, should not be removed until necessary for installation or removal from the carrier. Shipping braces are marked "SHIPPING BRACE ONLY" with white painted letters or they are painted purple.

3. Storage

When the equipment is not to be installed immediately, refer to the storage instructions. These are important to ensure warranty protection.

4. Erection Bolts

Check these against the packing lists to avoid shortages later in assembly.

GENERAL

Storage

Equipment stored or out of use for more than 30 days must be protected against corrosion and damage.

1.5.1 Drive Equipment*1.5.1.1 Accessory Equipment*

For storage and maintenance of equipment furnished by Ovivo, refer to the manufacturer's instructions at the back of this manual.

1.5.1.2 Drive Equipment

Failure to comply with these storage instructions will void the Ovivo warranty.

1.5.1.3 Drive Shipped from Factory

The drives provided by Ovivo received in shipment can be stored as long as 24 months, taking into account the in transit time. No special precautions are required other than those listed below.

Note: All drive unit machined surfaces are coated with LPS #3 (or an equivalent product), which is a rust inhibitive agent good for approximately 24 months storage. No storage oil is required and, in fact, must not be used since LPS #3 will dissolve in oil or most other petroleum based products. Therefore, do not add oil etc. to the drive unit until it will be operated. If storage time is to exceed 24 months, contact Ovivo for long-term storage information.

- a. Store the drives in the normal operating position. If possible, store the drives indoors in a dry, well-ventilated place with a relatively constant temperature. Do not add oil. See note above.
- b. When drive equipment is not installed, but must be stored outdoors:
 - 1) Use wooden blocks, arranged for even and firm support, to elevate it above the ground. Shipping crates or skids will suffice. Make certain the storage area is not where water can collect.
 - 2) If protective covers have been removed or damaged, cover the equipment with canvas or protective tarpaulin, but allow adequate ventilation. Do not use space heaters.
 - 3) Whenever possible, store the equipment in a shaded area protected against the sun and wind. This should also be an area away from moving equipment.

GENERAL

Storage

1.5.2 Long Term Storage

- .1 Failure to comply with these storage instructions will void the Ovivo warranty.
- .2 The following precautions cover non-operation or shutdown periods that exceed two months. They apply to the Ovivo or accessory mechanical drive equipment that has been installed and operated. Keep records and schedules to ensure compliance with instructions.

Note: As LPS #3 will dissolve in and is compatible with oil, it is not necessary to remove it using solvents before adding oil.

1.5.2.1 Plan #1 - Power Available

When power is available, lubricate and operate the equipment about five minutes, or run it through a complete cycle once each week. Remove accumulated water from drives each month at drain plugs. Refer to the accessory equipment manufacturer's instructions for additional information.



WARNING: In climates where snow and ice might accumulate in the tank, do not operate the drive. Follow Plan #2.

1.5.2.2 Plan #2 - No Power Available

- a. Fill housing and gear cases with clean oil to maximum level. A rust inhibitive agent is recommended for adding to the oil. Check that all greased bearings are well lubricated. Cover seals, screws, chains and guides with heavy grease and cover breather caps with tape. Cover with tarpaulins, but allow ventilation. Space heaters or dehumidifiers must operate continuously.
- b. Once each month open drain plugs to remove accumulated water and return oil to maximum level. Check all greased items monthly for adequate covering. On variable speed drives, make certain condensate plugs are removed from the speed housing.

GENERAL

Storage

- c. When the storage period extends into seasonable warm or cold weather, drain all gear housings and flush them with oil to remove residual water after the storage period. Do not flush with solvents. Refill with oil up to normal operating level.



WARNING: Before the drive equipment is put into operation after storage, drain all oil and lubricate according to instructions. Re-lubricate all greased bearings and pump out old grease. Check motor windings. Refer to the accessory equipment manufacturer's instructions.

1.5.3 Motor Storage

- .1 If a motor is not put into immediate service (one month or less), or if it is taken out of service for a prolonged period, special storage precautions should be taken to prevent damage. The following schedule is recommended as a guide to determine storage needs.
- .2 When to Put a Motor in Storage:
- a. Out of service or in storage for less than one month – No special precautions, unless there are space heaters. Space heaters, if supplied, must be energized at any time the motor is not running.
- b. Out of service or in storage from one to six months –
- 1) Where possible, store indoors in a clean, dry area.
 - 2) If indoor storage is not possible, cover the motors with a tarpaulin. The cover should extend to the ground. Do not tightly wrap the cover, as this will restrict airflow, resulting in condensation. Care must be taken to protect the motor(s) from flood damage or any harmful chemical vapors.
 - 3) The storage area must be free from excessive vibration, which can cause bearing damage.
 - 4) Precautions must be taken to prevent rodents, snakes, birds or other small animals from nesting inside the motors. Insects should be prevented from gaining access to the interior of the motor.

GENERAL

Storage

- 5) Inspect the rust preventative coating on all external machined surfaces, including shaft extensions. If necessary, recoat the surfaces with a rust inhibitor, such as Rust Veto No. 342 or equivalent. The coating should be inspected periodically.
 - 6) To prevent moisture accumulation, some form of heating must be used to prevent condensation. The heating should maintain the winding temperature at a minimum of 5°C above ambient. If space heaters are supplied, they should be energized.
 - 7) All motors must have the shaft rotated a few turns once a month to maintain a lubricant film on the bearing races.
- c. Out of service or in storage six months or more –
- 1) Where possible, store indoors in a clean, dry area.
 - 2) If indoor storage is not possible, cover the motors with a tarpaulin. The cover should extend to the ground. Do not tightly wrap the cover, as this will restrict airflow, resulting in condensation. Care must be taken to protect the motor(s) from flood damage or any harmful chemical vapors.
 - 3) The storage area must be free from excessive vibration, which can cause bearing damage.
 - 4) Precautions must be taken to prevent rodents, snakes, birds or other small animals from nesting inside the motors. Insects should be prevented from gaining access to the interior of the motor.
 - 5) Inspect the rust preventative coating on all external machined surfaces, including shaft extensions. If necessary, recoat the surfaces with a rust inhibitor, such as Rust Veto No. 342 or equivalent. The coating should be inspected periodically.
 - 6) To prevent moisture accumulation, some form of heating must be used to prevent condensation. The heating should maintain the winding temperature at a minimum of 5°C above ambient. If space heaters are supplied, they should be energized.

GENERAL

Storage

- 7) All motors must have the shaft rotated a few turns once a month to maintain a lubricant film on the bearing races.
- 8) Bearing cavities must be completely filled with lubricant during long-term storage. Remove the drain plug and fill the cavity with grease at the grease inlet until it begins to purge from the drain hole, then replace the drain plug. Refer to the Lubrication section for a list of lubricants.
- 9) Every two months, a small quantity of grease should be injected into the grease fitting with the drain plug removed. Exiting grease should be inspected for moisture and contamination. If these are present, the motor bearings should be inspected and fresh grease installed.

1.5.4 Structural Storage Precautions

- .1 Inspect painted surfaces for deterioration of paint. Apply finish coats as soon as possible. When this is not possible, remove rust or corrosion and paint, as necessary.
- .2 For shop primed steel equipment, refer to the special "Paint Durability" precautions below.

Note: Shop primer paint durability

Shop primer paints are intended to serve only as a bonding coat between metal surfaces and protective finish or seal coats and act as a minimal protective finish. Ovivo will not be responsible for condition of primed or finish painted surfaces after equipment leaves its shops. Purchasers are invited to inspect painting in shops for proper preparation and application prior to shipment. Ovivo assumes no responsibility for field surface preparation or touch up of shipping damage to paint. Painting of fasteners and other touch up to painted surfaces will be by purchaser's painting contractor after mechanism erection.

- .3 Identification tags that are removed for painting prior to assembly must be reattached to the original components for correct identification. Assistance from Ovivo will be charged at the normal service rate.
- .4 Lubrication plates, **WARNING** and **CAUTION** signs, and the Ovivo nameplate must be masked off prior to field painting. Do not remove these signs/plates from the drive. After field painting is completed, make

GENERAL

Storage

sure that lubrication plates, **WARNING** and **CAUTION** signs, and the Ovivo nameplate are clearly visible and readable.



DRIVE UNIT VENT CAUTION:

Vent holes in vented pipe plugs and sight glass vent openings must be kept clear of dirt, paint or other foreign material.

GENERAL

Warnings

Failure to heed these warnings will VOID the drive warranty.

1.6.1 Warning Signs



LUBRICATION WARNING:

The drive unit is shipped from the factory without operating lubricant.



SANDBLASTING WARNING:

The main drive unit and motor drive must be fully covered or sealed off to protect against sand and dust when sandblasting in their vicinity. All external openings, including vents and oil fill plugs and the space between the rotating main gear and stationary base on the main drive, should be taped closed, covered with polyethylene film, or stuffed with oakum or rag waste. After sandblasting and before start-up, drain a portion of oil from the drive through nylon stocking to be sure grit has not penetrated the drive. Remove all covers.

Sand, dust and other foreign material must not enter into the drive mechanism.



WELDING WARNING:

The fumes given off during welding and cutting can be injurious to the operator's health. Some fumes, such as those produced when working with Zinc, Cadmium and painted surfaces can be toxic.

Use the piece being welded as the ground to prevent drive unit damage due to electrical circuit contact.



DRIVE DIRECTION OF ROTATION:

The drive must rotate in the direction specified on the drawings, unless a reverse rotation is specifically allowed.



REMOVE GEARMOTOR BREATHER PLUG!

If the plug was not removed during assembly, remove this plug before operating the gearmotor.

GENERAL

Warnings



DRIVE CONTROL WARNING:

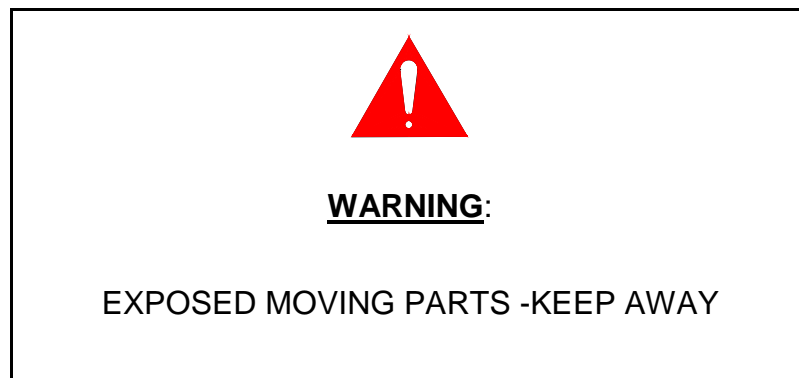
The load cell drive control assembly must be properly installed and checked for operation, as specified in the General Drive Maintenance instructions, before the drive is operated. Electrical wiring (not by Ovivo) to the drive control and motor drive assembly must be installed, as specified. The drive motor must be wired so an automatic restarting of the motor cannot occur after a drive control shutdown, following a torque overload. All interconnecting wiring must meet local electrical codes.

1.6.2 Safety Signs

1.6.2.1 Area Safety Signs

Safety signs should be installed to alert anyone entering dangerous areas. Several safety signs may be required and located so they can be seen from any direction the equipment might be approached.

- a. Suggested text for these signs in appropriate language would be:



- b. If personnel working with this equipment cannot readily read or understand English, warning signs on the equipment and procedures set forth in this manual must be translated and provided for their benefit in a language they understand. Multilingual signs may be needed.
- c. Location of signs will depend upon the specific design and placement of the equipment. They may be located above catwalks, for example, or affixed to walls adjacent to the equipment, or on the equipment itself. Make sure these signs are visible to the operator during operation and visible to persons approaching the area of the machine.

GENERAL

Warnings



WARNING:

LOCK OUT POWER BEFORE
PERFORMING MAINTENANCE

1.6.2.2 *Equipment Safety Signs (by Ovivo)*

- a. Safety and warning signs are shop mounted to the equipment.
- b. These signs must be kept clean and must not be covered up. Also, if these signs are damaged or deteriorated, replace them.

GENERAL

Lifting Precautions



WARNING: Do not pull, drag, push or dump the structural components off the carrier.

All structural components should be lifted and handled as covered below and/or in the installation instructions. Proper handling is necessary to protect special coatings or coverings and to ensure ease of assembly during equipment installation.

Ovivo will not accept charges for repair or replacement of equipment or materials damaged due to improper handling.

Lifting Recommendations and CAUTIONS

Observe these precautions when lifting or handling structural components furnished by Ovivo:



WARNING: Stand clear as the equipment is lifted.

1. Make sure the equipment being lifted and the lifting equipment cannot come into contact with overhead electrical cables, etc.
2. Make sure the rigging and hoist equipment is of adequate capacity.
3. Experienced personnel should do all rigging and lifting.
4. Before the equipment is removed from the carrier, check to be sure the blocking, bracing and banding securing it to the carrier have been removed and it is ready for moving.
5. Use multiple point lifting whenever possible.
6. When lifting structural members of this equipment, avoid twisting or bending the members. Use spreader beams, as necessary, to fully support the pieces as they are lifted.
7. Lift the equipment an inch or two off the carrier to be sure it is free to be moved and balanced correctly. Adjust as necessary.
8. Never move the equipment suddenly or in jerks and never allow it to strike the ground, tank or other equipment.

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Lifting Precautions

9. When lifting components that are special painted, use rubber belting, burlap or other padding between the lifting cables and the equipment to prevent damage to the protective covering.

GENERAL

Warranty QFORM 0115-02032



Equipment or parts manufactured by **Ovivo USA, LLC**, (“SELLER”), is backed by the following warranty:

Solely for the benefit of the original user, SELLER warrants that new equipment and parts manufactured by it and provided to the original user (collectively, “Products”) shall be free from defects in material and workmanship for the period of one (1) year from the date of Owner acceptance not to exceed eighteen (18) months from the date of shipment by Seller (the “Warranty Period”).

If any of SELLER’S Products fail to comply with the foregoing warranty, SELLER shall do one of the following:

- (a) repair or replace free of charge to original user, EX WORKS SELLER’S factories or other location that SELLER designates, any Product or parts thereof returned to SELLER, which examination shall show to have failed under normal use and service operation by the original user within the Warranty Period; provided, that if it would be impracticable for the Product or part thereof to be returned to SELLER, SELLER will send a representative to the original user’s job site to inspect the Product. If it is determined after inspection that SELLER is liable under this warranty to repair or replace the Product or part thereof, SELLER shall bear the transportation cost of (i) returning the Product to SELLER for inspection or sending its representative to the job site, and (ii) returning the repaired or replaced Products to the original user; however, if it is determined after inspection that SELLER is not liable under this warranty, SELLER’S customer or the original user shall pay those costs; or
- (b) at SELLER’S sole option, refund all or part of the purchase price allocable to the defective Product, or parts thereof.

For SELLER to be liable with respect to this warranty, the original user must make its claims to SELLER with respect to this warranty in writing no later than thirty (30) days after the original user discovers the basis for its warranty claim and in no event more than thirty (30) days after the expiration of the Warranty Period.

In addition to any other limitation or disclaimer with respect to this warranty, SELLER shall have no liability with respect to any of the following:

- (i) failure of the Products, or damages to them, due to the negligence or willful misconduct of SELLER’S customer or the original user, abuse or improper storage, installation, application or maintenance (as specified in any manuals or written instructions that SELLER provides to the original user);
- (ii) any Products that have been altered or repaired in any way without SELLER’S prior written authorization;
- (iii) the costs of dismantling and reinstallation of the Products;
- (iv) any Products damaged while in transit or otherwise by accident;
- (v) decomposition of Products by chemical action, erosion or corrosion or wear to Products caused by abrasive materials or due to conditions of temperature, moisture and dirt; or
- (vi) claims with respect to parts that are consumable and normally replaced during maintenance such as filter media, filter drainage belts and the like, except where such parts are not performing to SELLER’S estimate of normal service life, in which case, SELLER shall only be liable for the pro rata cost of replacement of those parts based on SELLER’S estimate of what the remaining service life of those parts should have been; provided, that failure of those parts did not result from any of the matters listed in clauses (i) through (v) above.

With regard to third-party parts, equipment, accessories or components not of SELLER’S design, SELLER’S liability shall be limited solely to the assignment of available third-party warranties.

It is the responsibility of SELLER’S customer or the original user to hire or retain engineers and other experts to determine the suitability of the Product for the original user’s use. SELLER shall not be liable for the design or suitability of any Products for any particular use (except to the extent that a warranty or guarantee with respect to such a matter is

GENERAL

Warranty QFORM 0115-02032

expressly set forth in a written document executed by an authorized representative of SELLER). In making interpretations of data, SELLER'S employees will give its customer the benefit of their reasonable professional judgment as to the correct interpretation, but SELLER cannot and does not guarantee the accuracy or correctness of these interpretations (except to the extent that a warranty or guarantee with respect to such a matter is expressly set forth in a written document executed by an authorized representative of SELLER).

SELLER'S quoted price for the Products is based upon this warranty. Any increase in warranty obligation may be subject to an increase in price.

THE PARTIES AGREE THAT ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY, WHETHER WRITTEN, ORAL OR STATUTORY, ARE EXCLUDED TO THE FULLEST EXTENT PERMISSIBLE BY LAW. ALL WARRANTIES AND OBLIGATIONS OF SELLER SHALL TERMINATE IF: (1) SELLER'S CUSTOMER OR ORIGINAL USER FAILS TO PERFORM ITS OBLIGATIONS UNDER THIS OR ANY OTHER AGREEMENT BETWEEN THE PARTIES; OR (2) SELLER'S CUSTOMER AND THE ORIGINAL USER FAIL TO PAY ANY CHARGES OTHERWISE DUE SELLER.

SELLER shall not be liable for any indirect, special, punitive, exemplary or consequential damages, including damages for lost production, plant shut-down, service interruptions, increased expense of operation, increased costs of power supply, loss of use of capital, lost revenue, lost product, lost profit or lost business opportunities, from any cause whatsoever, including the negligence of any person or entity.

GENERAL**Parts and Repair Orders / Offices**

To make sure the right replacement parts are received and to avoid undue delay, it is important to give the following information with each order:

1. Size and Type of Unit: These are found on the cover page of this manual and on the Parts List pages.
2. Serial Number: This is found on the unit nameplate and the Parts List. In case the S/N is omitted on the Parts List, use the Order number since it and the S/N are similar.
3. Part Number and Descriptions: Listed on Parts List.
4. Special Field Modifications: This is important if the original material or design has been changed. Include drawings and/or other descriptive information.

Please contact Ovivo for parts, repair orders, and/or equipment service. Specify order number **RSW0000933-01** when talking to a parts representative.

Ovivo USA, LLC

Attn: Aftermarket Representative
4246 Riverboat Road, Suite 300
Salt Lake City, Utah 84123
Telephone: 801-931-3000
Facsimile: 801-931-3090
Website: www.ovivowater.com

Local Service Representative

Haynes Equipment
Attn: Kevin Gabbert
15725 Pflumm Road
Olathe, KS 66062
Telephone: 913-782-4962
Email: kgabbert@haynesequip.com

Installation

INSTALLATION

Remove Existing Drive and Modify Existing Components



WARNING: Disconnect all electrical power to the drive.

1. Block the rake arms in position, then disconnect them from the cage.
2. Remove the walkway and platform. Retain the slide plates, if used.
3. Disconnect the cage from the drive unit and lower the cage to the tank bottom. Remove the drive mounting bolts.
4. Disconnect the drive from the column and remove the drive from the tank.
5. For replacement of the C54 drive - remove the specified area on the existing cage, referring to Figure 2.1a and drawing RSW933-152.

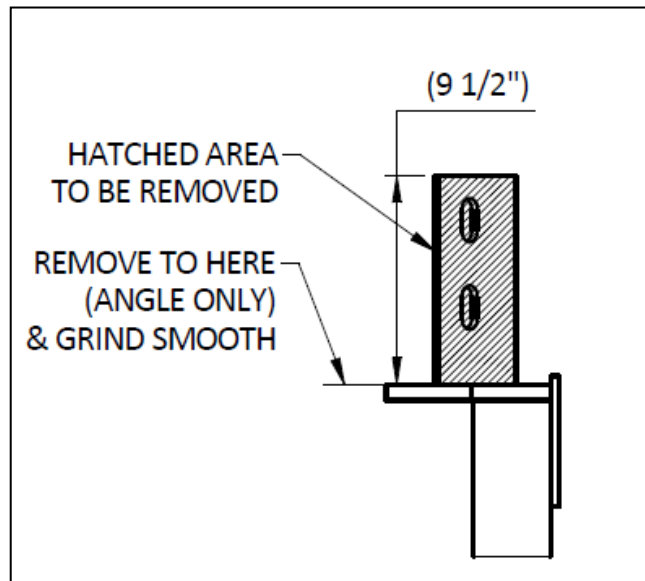


Figure 2.1a

6. After removal of the existing cage angles for the C54 drive cage, match drill six (6) 13/16" Ø holes and one (1) 1-1/8" Ø in the existing cage side and top plates using the cage adapter as a template. Use the supplied touch up paint on all cut, ground or drilled surfaces.
7. Clean the top surface of the column. Place the new column adapter on top of the specified column, making sure to align the v-notch in the adapter with the centerline of the walkway.

INSTALLATION

Remove Existing Drive and Modify Existing Components

8. The cage adapter will be installed with installation of the cage. The walkway will be modified prior to re-installation of the walkway.

INSTALLATION

Drive Installation

The drive unit is shipped fully assembled, including the drive control (overload cutout device). The main drive housing assembly to which the cage attaches is on the bottom, and the secondary drive and worm drive assemblies are on top.

2.2.1 Lift the Drive Unit

Lift and install the drive as a complete assembly, using the four lifting lugs located inside the main drive housing as shown in Figure 2.2a.

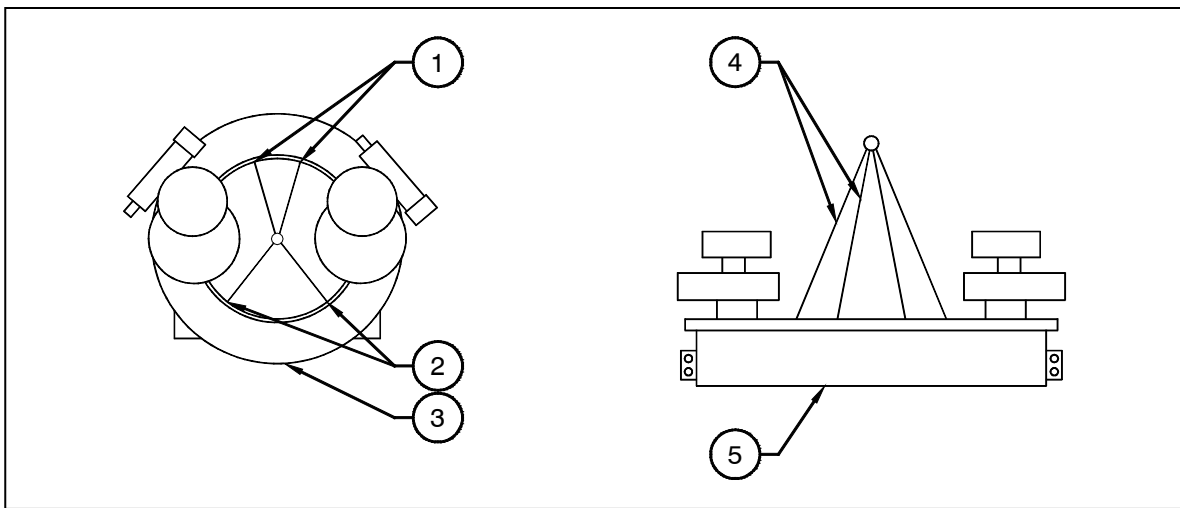


Figure 2.2a

1 - Lifting Lugs	3 - Rake Drive Assembly	5 - Drive
2 - Lifting lugs inside the main drive housing	4 - Lifting Cable to (4) Lifting Lugs	

2.2.2 Install the Drive

- .1 Check the mounting surface of the drive housing for foreign matter and the column mounting flange for spatter or other foreign matter. Remove as necessary for a clean flat surface.
- .2 Place the drive unit on the column, orienting as shown on the Motor Assembly and General Arrangement drawings. Insert but do not tighten the drive hold down bolts.

2.2.3 Level the Drive

- .1 At this point in the erection the drive will be adjusted for near level, using a carpenter's level and the leveling jackscrews. After installation of the arms

INSTALLATION

Drive Installation

and cage, the drive will be adjusted for final level by shimming.

- .2 Check the drive for level, using a 4' carpenter's level placed on the leveling surface of the main drive cover. Check in two directions (90°).
- .3 Remove, clean and lubricate the jackscrews in the drive base, then reinstall the jackscrews.
- .4 Adjust for level using the jackscrews.
- .5 After leveling, support the drive using shims at the jackscrews.
- .6 Install the drive hold-down bolts and snug tighten only. Do not torque.
- .7 Final leveling of the drive will follow installation of the rake arms.

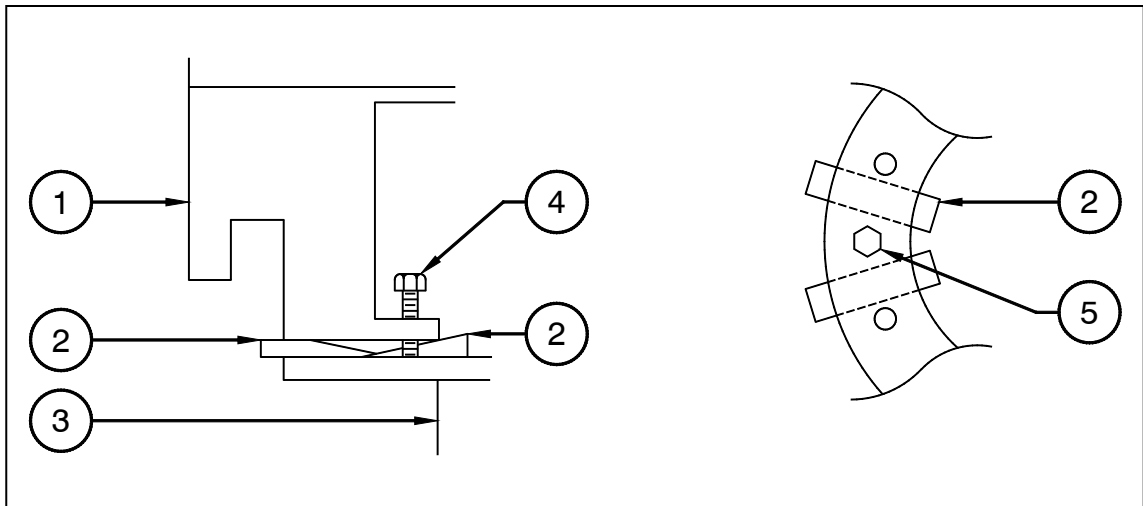


Figure 2.2b

1 - Drive	3 - Column	5 - Leveling Screw
2 - Shim	4 - Leveling Screw	



LUBRICATION WARNING:

The drive is shipped from the factory without operating lubricant.

INSTALLATION

Drive Installation



SANDBLASTING WARNING:

The main drive unit and motor drives must be fully covered or sealed off to protect against sand and dust when sandblasting in their vicinity. All external openings, including vents and oil fill plugs and the space between the rotating main gears and stationary bases on the main drive, should be taped closed, covered with polyethylene film, or stuffed with oakum or rag waste. After sandblasting and before start-up, drain a portion of oil from the drive through nylon stocking to be sure grit has not penetrated the drive. Remove all covers.

Failure to observe this **WARNING** will void the drive warranty.

2.2.5 Drive Lubrication and Rotation Warnings

- .1 Refer to the "Lubrication" instructions in this manual. Refer to the Table of Contents for Lubrication Instructions page numbers.
- .2 Incorrect rotation of the drive and in some cases, rotation of the drive without electrical power, will cause serious damage to the drive and possibly a dangerous buildup of torque.

Note: To rotate the arms without power, remove the gearmotor fan cover and turn the shaft with a drill.
- .3 Refer to the "Lubrication, Electrical Wiring, Drive Rotation and Drive Controls" instructions on a following page.
- .4 Do not attempt to operate or rotate the drive (rake arms) before you read those instructions.

INSTALLATION

Connect the Cage to the Drive

1. Referring to Figure 2.3a, attach the cage adapter to the drive gear cage attachment, using the vertical adjusting studs (6) and hex nuts (4).
2. Loosely install the capscrews with lock washers (9).
3. Raise the cage to its highest position and secure the hex nuts (4).
4. Using a carpenter's level, check the cage for plumb.
5. Adjust the cage for plumb using the adjusting studs (6) and hex nuts (4).

Note: A final check for plumb will follow drive leveling.

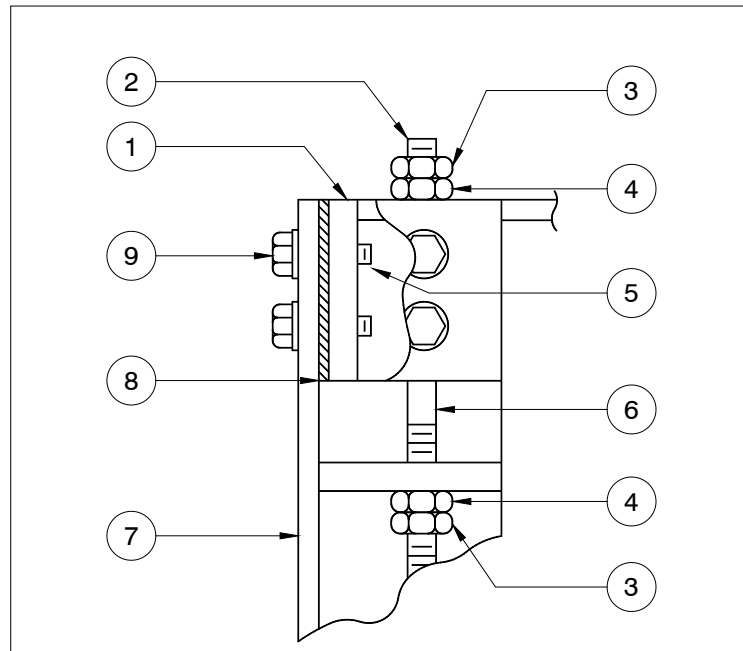


Figure 2.3a

1 - Drive gear cage attachment	6 - Adjusting stud
2 - Avoid unnecessary projection of stud	7 - Cage
3 - Jam nut	8 - Shim using the spacers provided for tight fit of cage
4 - Hex nut	9 - Capscrews with washer
5 - Tapped holes or welded nuts or loose nuts	

6. Check for any gaps between the cage and gear cage attachment at (1) and, if necessary, shim equally, using the spacers provided.

INSTALLATION

Connect the Cage to the Drive

7. Secure the capscrews with lock washers (9). Do not torque.
8. Install and secure the jam nuts (3).

INSTALLATION

Platform and Walkway Installation

1. Drill two (2) 7/8"Ø in the existing walkway angles where shown on the General Erection drawing, to allow for clearance of the studs in the drive top cover.
2. CHECK alignment of the mounting surfaces on the tank and the drive with relation to the centerline of the tank. The mounting surfaces must be level within the same relative planes.
3. If sliding plates and/or floating plates are used, install them in their former positions.
4. Set the walkway back in place on the drive and tank. Do not force the installation. Elongate the mounting holes in the walkway, if necessary. Check for lateral level and adjust by shimming.
5. Secure all mounting bolts. When sliding plates and/or floating plates are used, tighten the bolts at the end, where the plates are located, then loosen the nuts one half turn and lock in place.

Note: The 1/16" approximate clearance between the walkway and nuts, shown in Figure 2.5a, allows for contraction and expansion of the walkway during temperature changes.

6. Install the new drive cover handrail and the new handrail section to the existing walkway, using the supplied fasteners. Also, install the floor plates around the drive, if they were removed.
7. When dissimilar materials are used for the handrails, existing walkway and the floor plates, the surfaces must be separated by material that prevents galvanic reaction. Ovivo recommends a Bi-Metallic adhesive backed neoprene tape for all aluminum to steel connections.

INSTALLATION**Lubrication, Electrical Wiring, Drive Rotation and Drive Controls**

**LUBRICATION WARNING**

The drive is shipped from the factory without lubricating oil.

Prior to being operated, the drive and all accessory equipment components must be lubricated, referring to both the "Drive Lubrication" instructions and the accessory equipment manufacturer's instructions included in this manual. Refer to the Table of Contents for page numbers of the Drive Lubrication instructions and the accessory equipment manufacturer's instructions.

**GEARMOTOR CAUTION**

The gearmotor has been selected for the specified torque and output speed required for this mechanism. Neither gearmotor power nor output speed should be changed without consulting Ovivo for engineering evaluation and comments.

2.5.1 Connect Electrical Wiring

Refer to the drawings for connection of the wiring to the drive gearmotor, drive control, etc. Ovivo does not furnish, locate or install the interconnecting wiring. All interconnecting wiring must meet local electrical codes.

Note: An appropriate fitting and drain (not by Ovivo) must be used at the wiring (conduit) connection to the drive control to eliminate water condensation. The fitting and drain must comply with National Electrical Codes (N.E.C). specifications.

Note: The drive gearmotor must be wired so an automatic restarting of the gearmotor cannot occur after a drive control shutdown, following a torque load.

2.5.2 CAUTION when no power is available:

- .1 The drive can be rotated without power by removing the gearmotor fan cover and turning the shaft with a drill.
- .2 To rotate the rake arms for final leveling when no electricity is available, observe the following **WARNINGS**:
 - a. Direction of rotation - The worm shaft (driven sprocket) must be turned the direction of the rotation "arrow" on the cover guard

INSTALLATION

Lubrication, Electrical Wiring, Drive Rotation and Drive Controls

and the rake arms must turn clockwise, when viewed from above. (It is necessary to ensure warranty coverage). An air ratchet or hand crank can be used to turn the shaft, but the worm shaft should be protected against damage.

- b. Torque buildup - Watch the drive control arrow, during the rotation, to make sure it does not go above zero "0". If it does, immediately stop the rotation and refer to the "Drive Maintenance **WARNING**" in the Maintenance section.

2.5.3 Check Drive Rotation

- .1 The gearmotor must be connected for the direction of rotation specified on the drawing and shown by the arrow on the chain guard. If not, the drive warranty will be void, and Ovivo will not pay for damage.
- .2 Check the gearmotor for direction of rotation without the drive chain installed. Refer to the directional "arrow" on the chain guard or the Motor Drive Assembly drawing. Reinstall the chain.

2.5.4 Check Alignment of a Field Installed Gearmotor Drive

- .1 If the gearmotor was shipped separately from the main drive, install and align the sprockets as follows:
- .2 Set the driven sprocket on the worm shaft outward 1/8" from true alignment (with the drive sprocket). This is necessary since the worm shaft will move inward 1/8" under maximum running load. So this initial setting will be closer to true alignment with the displacement that occurs under normal load.
- .3 Adjust the chain for tension, referring to the instructions under Drive Maintenance.

2.5.5 Check the Drive Control for Operation

Refer to the parts list for the switch settings in checking the drive control. (Electricity is required for this check).

- a. Start the drive gearmotor. (Check the tank for obstructions or do this check while the chain is removed).
- b. Remove the cylindrical switch housing, unscrewing it from the base. Then manually actuate the cam switches by turning the camshaft (and pointer) with the set collar (end of camshaft). Slowly turn the pointer

INSTALLATION**Lubrication, Electrical Wiring, Drive Rotation and Drive Controls**

through a complete range to 100. This will simulate a mechanism full load condition. At the set points, the alarm should sound and the drive gearmotor should stop.

- c. If the drive control does not react correctly, check each switch individually. If none of the cam switches actuate, recheck the wiring to the drive control. Refer to the Manufacturer's Wiring Diagrams. If the wiring is correct, check the cams for proper setting and the camshaft for alignment. Contact your Ovivo representative in case of a problem.
- d. Replace the switch housing cover, being sure it goes on straight to avoid cross threading and to ensure a tight seal. Tighten the cover a minimum 1/2 turn after contacting the O-ring.

**DRIVE CONTROL CAUTION:**

The drive control is an overload cut out device to protect the drive. Since it is installed and adjusted at the factory for proper operation, do not tamper with it. If the original cam settings are not satisfactory for the conditions, contact your Ovivo Representative before attempting any adjustments. The gearmotor must not be able to restart automatically after a torque overload; see Electrical Wiring, above.



WARNING: If the drive unit stops due to an overload, do not attempt to restart it until the cause of the overload has been located and corrected. Refer to the Drive Maintenance **WARNING** instructions in this manual.

INSTALLATION

Rake Arm Installation

The rake arms were blocked in position and disconnected from the cage prior to removal of the old drive.

To prevent misalignment or damage to the cage or cage connection, the arms must be reinstalled in pairs. The connections to the cage must not be forced.

1. Make sure the rake arms are in alignment with their matching fittings on the cage. Adjust, if necessary.
2. Connect the arms to the cage at the bottom connection first. Do not force the connection. Then connect the upper connection.
3. Remove the blocking equally from each arm, beginning at the cage and working outward.
4. CHECK the arm blades for clearance with the tank bottom to be sure they Do Not touch. Final arm level will be checked later.
5. If it is necessary to adjust the arms, adjust them as a pair, or adjust one arm while supporting the opposite arm with blocking. This is to maintain equal weight on the cage.

INSTALLATION

Drive Final Leveling

2.7.1 Check for Level

- .1 The main bearing of the rake drive must be level for proper operation of the mechanism and maximum bearing life.
- .2 The drive will be checked for level by measuring the level of the drive at the end of a rake arm, at various points around the tank. It will then be shimmed for level.

Note: Checking and leveling must be done when the center column is a uniform temperature, such as the early morning or an overcast day.

- .3 The drive must be leveled within a maximum out-of-level tolerance of .005 inch per every 12 inches of arm distance. This tolerance will be measured on a large scale using one of the rake arms, rather than using the relatively small area of the drive cover.

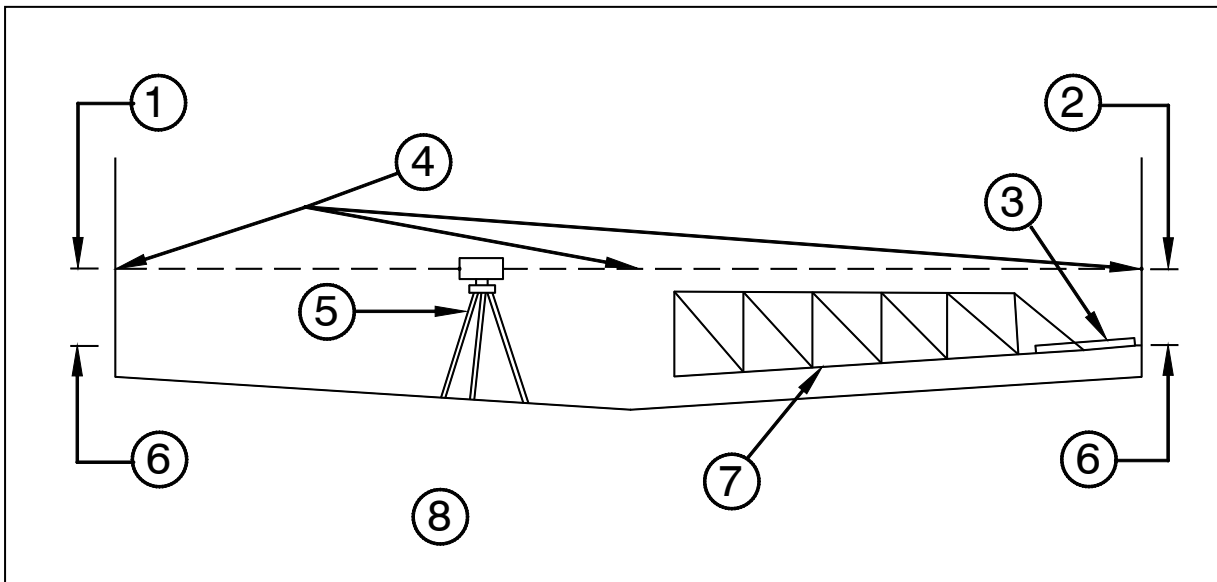


Figure 2.7a

1 - "d ₁ "	5 - Surveyor's level
2 - "d ₂ "	6 - Reference mark from rake arm
3 - Use carpenter level to reach from arm to tank wall	7 - Rake arm
4 - Level bench marks (4 places around the tank)	8 - Note: d ₁ and d ₂ are 180° opposite

- a. Set up a surveyor's level near the center of the tank. Using the level, mark four, level benchmarks on the tank wall at the same

INSTALLATION

Drive Final Leveling

height and spaced approximately 90° apart. See Figures 2.7a and 2.7b. Benchmarks should be in alignment with the jackscrews (drive leveling screws), as shown in Figure 2.7b.

- b. Rotate the drive and stop one (and the same) rake arm at each of the four level points marked around the tank, and using a carpenter's level as an extension from that arm to the tank wall, make the second marks. These are shown as the "Reference Marks" in Figure 2.7a.



WARNING: Refer to the "Warnings" on drive rotation and lubrication on a previous page under "Lubrication, Electrical Wiring, Drive Rotation and Drive Controls."

- c. Referring to Figures 2.7a and 2.7b, compare the difference in dimensions between the level marks and the rake arm reference marks at diametrically opposite sides of the tank (two directions, 90° apart).
- d. The difference between the two observed dimensions (d1 minus d2) must not exceed the maximum out-of-level dimension below:

<u>Mechanism Diameter</u>	<u>Maximum Out-Of-Level Tolerance (d1 minus d2)</u>
50' [15,240 mm] or less	1/4" [6.35 mm]
100' [30,480 mm] or less	1/2" [12.70 mm]
150' [45,720 mm] or less	3/4" [19.05 mm]
200' [60,960 mm] or less	1" [25.70 mm]
250' [76,200 mm] or less	1-1/4" [32.05 mm]

2.7.2 Shim for Level

- .1 Shimming may be necessary to level the drive. Maximum bearing life of the drive unit main bearing is dependent on proper leveling and shimming. Perfect final leveling is not practical; however, it should be as accurate as possible.
- .2 In making a final shimming adjustment, care should be taken to tighten the drive mounting capscrews equally and to support each drive mounting capscrew, as necessary, with the proper thickness of shim material.

INSTALLATION

Drive Final Leveling

Uneven tightening and shimming may cause deformation of the bearing race, causing shortened bearing life.

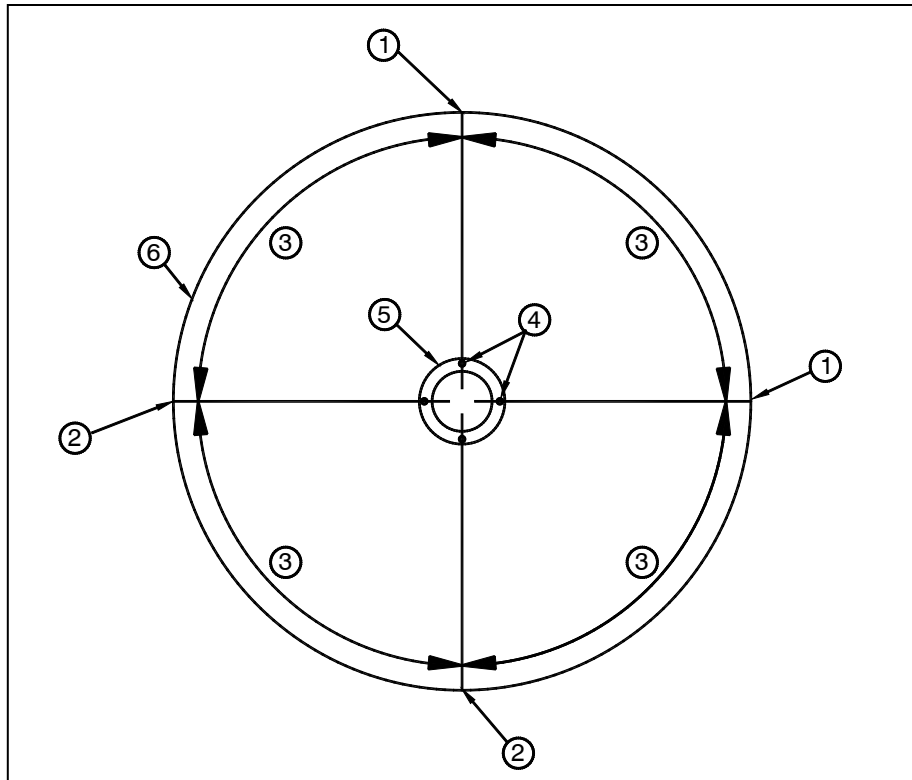


Figure 2.7b

1 - "d ₁ "	3 - 90°	5 - Column mounted drive unit
2 - "d ₂ "	4 - Jackscrews (drive leveling screws)	6 - Tank

2.7.2.1 Shims

Use only the stainless steel shims furnished by Ovivo and attached to the drive unit. They are provided in sizes and quantities to satisfy most requirements. If more shims are needed, contact the Ovivo Aftermarket Dept., referring to the telephone number on the Offices page in this manual and referring to the parts list for the shim package part number.

2.7.2.2 Shimming

- a. Use the jackscrews provided in the drive base to level the drive. Be sure to release the drive mounting capscrews (4).
- b. **CHECK** clearances between the drive base and column with a feeler gauge at each of the drive mounting capscrews. Mark

INSTALLATION

Drive Final Leveling

clearances on the drive base for ready reference.

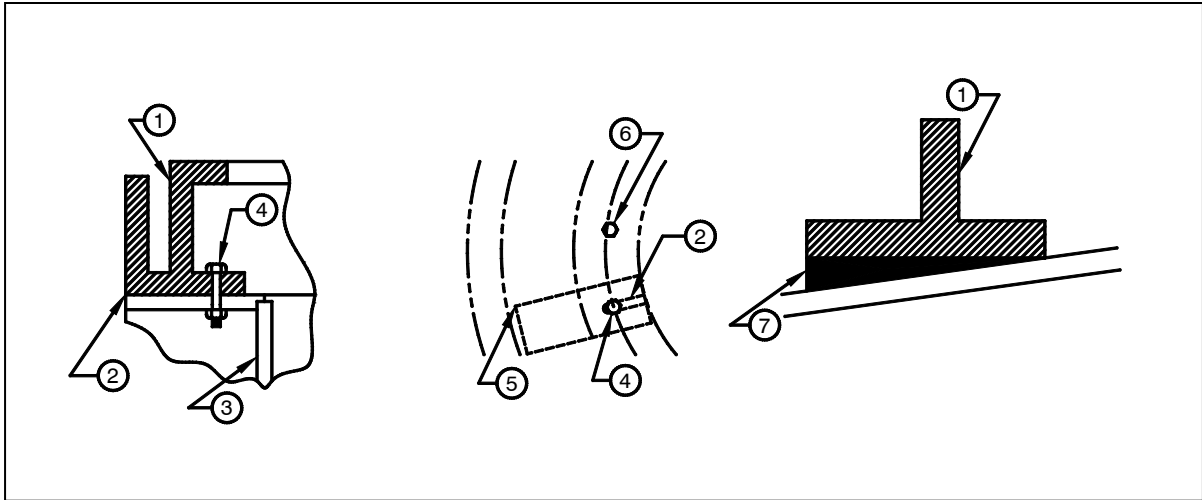


Figure 2.7c

1 - Drive base	5 - Shim completely in area of shim to within .005
2 - Shims	6 - Jackscrew
3 - Column	7 - Example of trimming shims for uneven column flange
4 - Drive mounting capscrew	

- c. Shim at the mounting capscrews, using the Ovivo furnished shims and referring to Figure 2.7c. Insert shims from the outside of the drive to the inside. Since the shims ensure the level of the drive for optimum service life of the main bearing, use only these stainless steel shims provided by Ovivo. Do not use any other type of shims or shim material.
- d. Back off the jackscrews so the drive is supported only by the shims. Recheck the level of the drive by rotating the arm to the level marks. Adjust as necessary until the drive is within specified level tolerance.
- e. Tighten the drive mounting capscrews. Make sure that no jackscrews are supporting the drive.

INSTALLATION

Check the Cage for Final Plumb

1. Check the cage for plumb with a surveyor's instrument.

Note: Checking and adjustment must be done when the steel is a uniform temperature, such as the early morning or an overcast day.

2. If it is necessary to adjust for plumb, loosen all capscrews (5) and jam nuts (8). Then adjust the cage for plumb using the adjusting nuts (7).

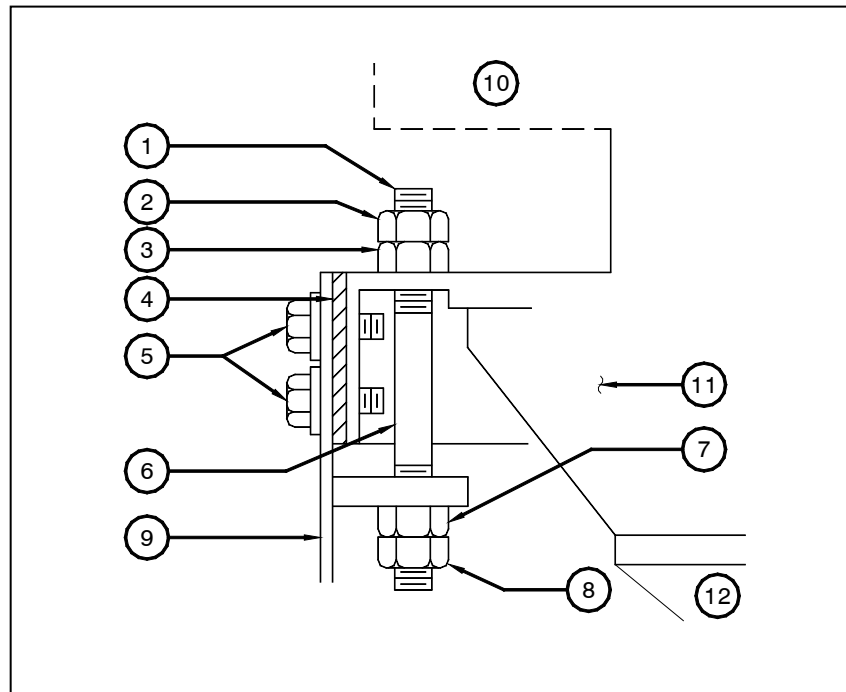


Figure 2.8a

1 - Avoid unnecessary projection of stud	7 - Adjusting Nut
2 - Jam Nut	8 - Jam Nut
3 - Adjusting Nut	9 - Cage (Ref)
4 - Shim as required for a tight fit	10 - Drive Platform or Upper Drive
5 - Capscrews and washers	11 - Drive
6 - Adjusting Stud	12 - Top of Column

3. Shim between the drive and cage at (4) for a tight fit, if necessary, and centering the cage around the drive.
4. Check the cage for centering around the drive.
5. Secure the stud jam nuts (8) when the cage is plumb. Tighten the capscrews at (5), but do not torque.

INSTALLATION

Check the Cage for Final Plumb

6. Check the arm blades for proper clearance with the tank bottom at the center of the mechanism, referring to the General Arrangement drawing. Raising or lowering the cage by means of the take-up studs and slotted connections between the drive and cage makes vertical adjustments. Use of jacks under the cage and arms for this adjustment is required. In this case, recheck the cage for plumb.

INSTALLATION

Final Level the Arms

The purpose of this check is to ensure that all arms have proper and equal clearance with the tank bottom so that each arm is loaded equally, thus preventing unbalanced loading on the mechanism.

This adjustment must follow final leveling of the drive unit.



CAUTION: Checking and leveling must be done when the steel is at a uniform temperature such as the early morning or an overcast day.

1. Check that the arms and blades sweep at the clearance specified with the tank bottom and in the same plane. Checking is done by means of reference devices on the tank bottom such as a pile(s) of sand. Adjust or mark the device for the specified clearance of the spiral blades from the tank floor.
2. Rotate each arm to the place of the checking device. Minor clearance adjustments can be made using the slotted holes at the blade-to-arm connections. If additional adjustment is needed, adjust the arm for the required clearance by adding or removing shims equally at either the upper or lower connections, as necessary to achieve equal arm level. Use a jack to lift the arms to assist in this adjustment. Block under the opposite arm before the arm being adjusted is raised or lowered.
3. Weld arm-to-cage connections, if required.



WELDING WARNING: Use the piece being welded as the ground to prevent damage to the drive unit bearings due to electrical circuit contact.

4. If shims are used at the arm-to-cage connection, weld must be enlarged so that the load will be transferred from the rake arms to the cage, not from arms to shims.

INSTALLATION

Final Mechanical Check

1. Final Mechanical Checklist

- a. At the completion of erection or installation of the equipment, an Ovivo Service Representative must complete a final field mechanical check of the equipment. Unless accepted and signed-off by the Service Representative at the completion, the warranty will not be in effect.
- b. Previous inspections will not count towards final acceptance unless a sign-off is obtained, in writing, from the Service Representative. Also, depending on any previous inspections, this final check may be an additional paid service call.

2. Arrangements for Service

- a. The "Final Mechanical Check List", included at the back of this manual, must be completed for each mechanism furnished before contacting your Ovivo representative to arrange for the final field mechanical check.
- b. Arrangements for field mechanical check should be made at least two weeks in advance with your Ovivo representative. Refer to the Offices page to contact him.

3. Do Not Fill the Tank with Water


The mechanical check cannot be done if the tank is filled with water. If the check cannot be performed, an additional paid service day will be charged.

Lubrication

LUBRICATION

Drive Lubrication


The drive is a combination of drive components manufactured by Ovivo, and accessory equipment (garmotors) purchased from others. These instructions apply only to the components manufactured by Ovivo. Refer to the Accessories section of this manual for equipment provided by others.

	<p><u>CAUTION:</u> Accessory equipment must be properly lubricated, as specified in the manufacturer's instructions, to maintain the equipment warranty. If you have any questions regarding proper lubrication of accessory equipment provided by Ovivo, contact your Ovivo representative referring to the Offices page.</p>
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Note: The drives are shipped without oil. **Fill each drive housing, initially, to the level indicated on the sight glass,** referring to "Oil Fill Procedure" below. Approximate oil quantities are listed below.

3.1.1 Drive Oil Quantities In Approximate U.S. Gallons

<u>MODEL</u>	<u>MAIN GEAR</u>	<u>WORM GEAR</u>
C60P-S1	46 gals	6 gals

	<p><u>CAUTION:</u> Oil quantities are approximate only. Fill the main drive housing and the upper bearing housing assembly to the level indicated on the housing sight glass</p>
---	---

Using the "Lubricant Number" specified (1, 2, or 3) determine the type of oil to be used in each drive housing. This will vary based on the "Ambient Temperature Range" to be expected at the equipment installation site. For temperatures outside of those ranges shown on the Lubrication Plate, contact the Ovivo Engineering Department. Refer to the Offices page.

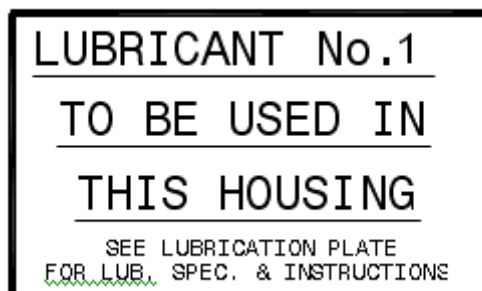


Figure 3.1a

LUBRICATION

Drive Lubrication


LUBRICATION PLATE					
www.ovivowater.com					
LUBRICANT SELECTION AND INSTRUCTIONS					
LUBRICANT NUMBER	LUBRICATION METHOD	AMBIENT TEMPERATURE RANGE	LUBRICANTS		AGMA NUMBER
			MINERAL OIL	SYNTHETIC OIL	
①	OIL BATH	-20°F TO 110°F	-	MOBIL SHC 634 MOBIL SHC Cibus 460 (NSF-H1 Food Grade)	7S 7S
		-0°F TO 50°F	MOBILGEAR 600, XP150	-	4EP
		50° TO 110° F	MOBILGEAR 600, XP460	-	7EP
②	OIL BATH	-20°F TO 110°F	-	MOBIL SHC 634 MOBIL SHC Cibus 460 (NSF-H1 Food Grade)	7S 7S
				MOBIL SHC 629	4S
③	OIL BATH	-20°F TO 110°F	-	MOBIL SHC Cibus 150 (NSF-H1 Food Grade)	4S
		-0°F TO 50°F	MOBILGEAR 600, XP68	-	2EP
		50° TO 110° F	MOBILGEAR 600, XP150	-	4EP
THE ABOVE ARE EXXONMOBIL CORPORATION PRODUCTS. FOR PRODUCT INFORMATION, CALL 1-800-662-4525 OR VISIT www.mobil.com/industrial					
<ul style="list-style-type: none"> ◆ OIL LEVEL TO BE MAINTAINED AT THE POINT INDICATED BY V-NOTCH OR INDICATING RING ON OIL GAUGE, ± 1/16 in. ◆ DRAIN AND REFILL GEAR DRIVES WITH CLEAN OIL AS REQUIRED WHEN INDICATED BY A QUALIFIED OIL ANALYSIS CONDUCTED AT A MINIMUM OF EVERY SIX MONTHS. SEE OPERATION MANUAL FOR OIL CHANGE INTERVALS IF OIL ANALYSIS IS NOT USED. ◆ SEE MAINTENANCE MANUAL FOR USED OIL CLEANLINESS SPECIFICATIONS. KEEP OIL CLEAN AND FREE FROM WATER AND OTHER CONTAMINANTS. DRAIN CONDENSATE FROM HOUSINGS ONCE EACH WEEK. ◆ VENDOR SUPPLIED EQUIPMENT SHOULD BE LUBRICATED ACCORDING TO MANUFACTURERS INSTRUCTIONS ◆ FOR TEMPERATURES OUTSIDE OF THOSE RANGES SHOWN ABOVE CONTACT OVIVO USA, LLC. SEE O&M MANUAL FOR CONTACT INFORMATION. 					
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Figure 3.1b

3.1.2 Check oil levels weekly.

- .1 A general oil level check can be made while the drive is operating, but to be more accurate, stop the drive a few minutes to allow the oil to settle. Adding oil in excess of the amount required could cause oil to over flow.
- .2 Drain condensate once a week. This will keep the oil free of water and other contaminants. Refill to operating level.

3.1.3 Clean the sight glass vent opening.

If the vent opening in the top screw plug is clogged or dirty, a sight glass will not show the correct oil level and it may not show an oil level at all. Check monthly.

LUBRICATION

Drive Lubrication



DRIVE UNIT VENT CAUTION:

Vent holes in vented pipe plugs must be kept clear of dirt, paint or other foreign material.

3.1.4 Replace the oil

If the oil is **not** tested by qualified oil analysis, then oil change intervals are as follows:

Initial Replacement: All gear housings should be drained and refilled with fresh oil, referring to "Oil Fill Procedure" below, after the first 500 operating hours.

Regular Oil Replacement: Mineral oil should be replaced each year, unless ambient temperatures dictate otherwise. Refer to the Lubrication Plate. Synthetic oil should be replaced every two years or as required by oil analysis.

Oil Fill Procedure: Stop the drive, then drain the housing and refill with fresh oil. At first, until the oil settles, a sight glass will not show an accurate oil level, due to settling time, trapped air and other factors. Allow the drive to sit at least 10-15 minutes after filling to check the oil level. Adding oil in excess of the amount required could cause oil to over flow.

3.1.5 Check the oil condition

- .1 Ovivo recommends that oil samples are sent to a commercial laboratory for analysis. This is not required.
- .2 Every six months, take an oil sample (100 ml, or 4 oz.) from the drain piping of each housing (worm gear and main gear), using a clean receptacle to collect each sample (allow the oil to flow from the drain until water and other settled contaminants are no longer present and the oil consistency is uniform). Refill the drive housings to operating level.

3.1.6 Drive chain - Lubricate monthly with spray-on chain lube (not by Ovivo), while the drive is running, using the access hole in the side of the chain guard.

LUBRICATION

Drive Lubrication

- 3.1.7 Sight Glass Replacement** - If the oil level sight glass is replaced, it must be notched to show the oil level. Do likewise for drives shipped without the oil level notched.

LUBRICATION

Lubricant Equivalents List

Contact your Ovivo representative before using a synthetic bearing and gear oil that is not listed as an equivalent. Physical characteristics of Mobil SHC® 600 series synthetic oils are listed below:

Physical Characteristics of Mobil SHC series oil	Mobil SHC 629	Mobil SHC 634
Product Number	60294-6	60291-2
ISO Viscosity Grade	150	460
Specific Gravity	0.866	0.867
Gravity, API	32.4	31.4
Pour Point, °C (°F) max, ASTM D 97	-45 (-49)	-42 (-44)
Flash Point, °C (°F) min, ASTM D 92	245 (473)	250 (482)
Viscosity, ASTM D445		
cSt at 40° C	142.8	436.4
cSt at 100° C	18.3	44.9
Viscosity Index, ASTM D 2270	144	159
Copper Corrosion 24 Hrs at 121° C, ASTM D130	1B	1B
Rust Protection ASTM D665A and 665B, Distilled and Synthetic sea water	Pass	Pass
FZG Scuffing, Fail stage, DIN 51534	13	13+
Color, ASTM D1500, Max	3.5	3.5
TOST Life, Hrs., ASTM D943-2	10,000+	10,000+

3.2.1 Recommended and Synthetic Oils

MANUFACTURER	SYNTHETIC OILS	
	AGMA EQUIVALENT NUMBER/VISCOSITY cSt AT 40°C	
	4 SYN/ISO150	7 SYN/ISO460
MOBIL	*SHC 629	*SHC 634
TRIBOL	800/150	800/460

* Synthesized Hydro Carbon

3.2.2 Petroleum Based and Food Grade Oils

MANUFACTURER	PETROLEUM BASED OILS		
	AGMA EQUIVALENT NUMBER/VISCOSITY cSt AT 40°C		
	2EP/ISO 68	4EP/ISO 150	7EP/ISO 460
MOBIL	Mobilgear 600, XP 68	Mobilgear 600, XP 150	Mobilgear 600, XP 460
AMOCO	Permagear EP #68	Permagear EP #150	Permagear EP #460
EXXON	Spartan EP-68	Spartan EP 150	Spartan EP 460
GULF OIL	EP Lubricant H.D. 68	EP Lubricant H.D. 150	EP Lubricant H.D. 460
TEXACO	Meropa 68	Meropa 150	Meropa 460
PHILLIPS	All Purpose Philgear (ISO Grade 68)	All Purpose Philgear (ISO Grade 150)	All Purpose Philgear (ISO Grade 460)


LUBRICATION

Lubricant Equivalents List

MANUFACTURER	PETROLEUM BASED OILS		
	AGMA EQUIVALENT NUMBER/VISCOSITY cSt AT 40°C		
	2EP/ISO 68	4EP/ISO 150	7EP/ISO 460
SHELL	Omala 68	Omala 150	Omala 460
STANDARD OF CALIFORNIA CHEVRON USA	Chevron Gear Compound NL68	Chevron Gear Compound NL150	Chevron Gear Compound NL460
SUN OIL	Sunep 68	Sunep 150	Sunep 460
KEYSTONE	Zeniplex - 2	Keygear 90	Keygear 140
LUBRICATION ENGINEERS	Monolec 300	Almasol 604	Almasol 608

MANUFACTURER	FOOD GRADE OILS		
	AGMA EQUIVALENT NUMBER/VISCOSITY cSt AT 40°C		
	2EP/ISO 68	4EP/ISO 150	7EP/ISO 460
MOBIL	CIBUS 68	CIBUS 150	CIBUS 460
ROYAL PURPLE	POLYGUARD FDA 68	POLYGUARD FDA 150	POLYGUARD FDA 460
SUMMIT	N/A	SYNGEAR 150	SYNGEAR 460

3.2.3 Grease Equivalents



CAUTION: Do not mix lubricant types without first verifying product compatibility. Contact your Ovivo representative. When changing to a product that is not compatible with existing lubricant, the existing lubricant (oil or grease) must be completely removed before the new lubricant type is installed.

MANUFACTURER	GREASE	MANUFACTURER	GREASE
	NLGI No. 2** EQUIVALENT		NLGI No. 2** EQUIVALENT
MOBIL	Mobilgrease XHP222 (mineral) Mobilgrease SHC200 (synthetic)		
AMOCO	Rykon #2	STANDARD OF CALIFORNIA CHEVRON USA	RPM Multimotive #2

** NLGI #2 antiwear (EP) lithium complex (high temperature) grease.

LUBRICATION

Lubricant Equivalents List

MANUFACTURER	GREASE	MANUFACTURER	GREASE
	NLGI No. 2** EQUIVALENT		NLGI No. 2** EQUIVALENT
EXXON	Ronnex MP		
GULF OIL	High Temperature Grease	SUN OIL	Sunaplex 992 EP
TEXACO	Multipak EP2	KEYSTONE	81 EP-2
PHILLIPS PET	Philube 2 EP	LUBRICATION ENGINEERS	Alma-Gard 3752

** NLGI #2 antiwear (EP) lithium complex (high temperature) grease.

Maintenance

MAINTENANCE

Maintenance and Operation Warnings

4.1.1 Safety Statement

No personnel, authorized or unauthorized, should depend wholly on safety devices to prevent accidents. Safety features and devices are meant only to supplement proper, careful, and safe practices on the part of the individual.



WARNING: If the safety procedures given in this manual are compromised or ignored, severe personal injury or death may occur. Safety practices accepted by the industry, as well as those dictated by the responsible regulatory agencies must be followed.



PERSONNEL SAFETY WARNINGS



WARNING: Use extreme care when working around rotating or other moving parts, to prevent injuries to yourself or others. Also, anyone entering the area of this equipment must be wearing adequate safety equipment such as safety glasses, safety shoes, hard hat, etc. Loose fitting clothing, uncovered long hair, or jewelry must not be worn when working around rotating or moving equipment.



WARNING: Keep foreign objects, hands, etc. away from moving parts. Do not operate this equipment if guards have been removed, or are damaged. All guards and safety devices must be properly installed and functional before operating this equipment.

MAINTENANCE**Maintenance and Operation Warnings**



WARNING: Lock-out power from electrical equipment using a manual breaker or disconnects switch before starting any work or maintenance on the equipment. Lock and tag disconnect switch so it cannot be closed.



WARNING: Before attempting any maintenance or adjustments on the drive, refer to the "Drive Maintenance Warning".



WARNING: Experience with and understanding of this equipment is essential for the safe disassembly and repair of the equipment. Therefore, in case of a question on how to safely proceed, contact Ovivo immediately.



WARNING: The fumes given off during welding and cutting can be injurious to the operator's health. Some fumes, such as those produced when working with Zinc, Cadmium and painted surfaces can be toxic.

4.1.2 Before Operation, Maintenance or Repair of this Equipment:

Read and understand the instructions in this manual.

- .1 As with any other mechanical equipment, there are safety concerns associated with the operation and maintenance of Ovivo supplied equipment. It is absolutely essential, therefore, that operators, maintenance personnel, and supervisors be instructed in safe working practices
- .2 Only personnel who have been trained in safety procedures for this equipment should be allowed around or in the area of the Ovivo equipment or its auxiliaries. Training can be done by your own safety personnel or it can be conducted by an Ovivo representative at your request. Contact Ovivo Engineering, Salt Lake City, Utah. Refer to the Offices page listed on the Table of Contents.

MAINTENANCE

Pre-Start-Up Check

4.1.3 Check Points Before Start-Up

Note: The drive and mechanism must be level and checked by an authorized Ovivo representative before start-up.

- .1 Remove any foreign matter from inside the tank. Remove any blocking or shoring used in the erection of the equipment.
- .2 Check the oil levels in the main drive and upper bearing housing assembly. Refer to Drive Lubrication Instructions. Check the motor drive, referring to the Manufacturer's Instructions.
- .3 Make sure the load cell drive control was checked for proper operation, referring to the General Drive Maintenance Instructions in this manual.
- .4 Make sure the drive platform and walkway are clean and free of oil, debris and tools. Make sure all drive cover guards are in place and secure.



WARNING: Do not operate this equipment if guards have been removed, or are damaged. All guards and safety devices must be properly installed and functional before operating this equipment.

- .5 Rotate the arms for at least 4 or 5 revolutions. Make all observations from outside the tank.

This procedure should be conducted when distortion from sunlight would be at a minimum, such as, early morning or an overcast day.

- .6 Watch for clearance of the rake arm blades and/or squeegees with the tank bottom. Check for loose parts, bolts and nuts.

MAINTENANCE

Maintenance Summary

MAINTENANCE PROCEDURE	FREQUENCY	LUBRICANT (IF APPLICABLE)	COMMENTS/ REFERENCES
Drive: Check oil level in both the upper bearing housing and main gear housing	Weekly	Refer to the lubrication plate mounted on the drive unit	Replace oil as necessary. Oil must be kept clean
Drain condensate from the main gear, and upper bearing housings	Weekly	Refer to the lubrication plates on the drive unit	Refill with oil as necessary
Make sure vent holes in vented pipe plugs and sight glass vent openings are clear	Monthly		Vent holes in vented pipe plugs (if used) and sight glass vent openings <u>must</u> be kept clear of dirt, paint or other foreign material.
Have samples of drive oil (all housings) checked for condition	After first 500 operating hours, then every 6 months thereafter		Refer to the Lubrication Instructions for "Used Oil Cleanliness Specifications"
Change oil – main gear and upper bearing housing	When indicated by a qualified oil analysis, or annually/bi-annually if oil analysis is not used	Refer to the lubrication plates on the drive unit	Replace oil as necessary; it must be kept clean. Refer to the lubrication Instructions
Check connections between the cage (not by Ovivo) and main gear	Monthly		Refer to the Cage Installation Instructions
Inspect gears & bearings for wear. Replace internal oil seals, if necessary (main gear and upper bearing housing assembly)	Yearly		Refer to the Manufacturer's Instructions

MAINTENANCE

General Drive Maintenance

4.4.1 Check Drive Rotation

- .1 Check the new motor for direction of rotation before the drive chain is installed, referring to the directional "arrow" on the drive cover, chain guard, and/or Motor Drive Assembly drawing.
- .2 If the drive unit is not turning in the proper direction of rotation, the drive unit warranty will be void and Ovivo will not accept costs for drive damage.

4.4.2 Check Drive Sprocket Alignment

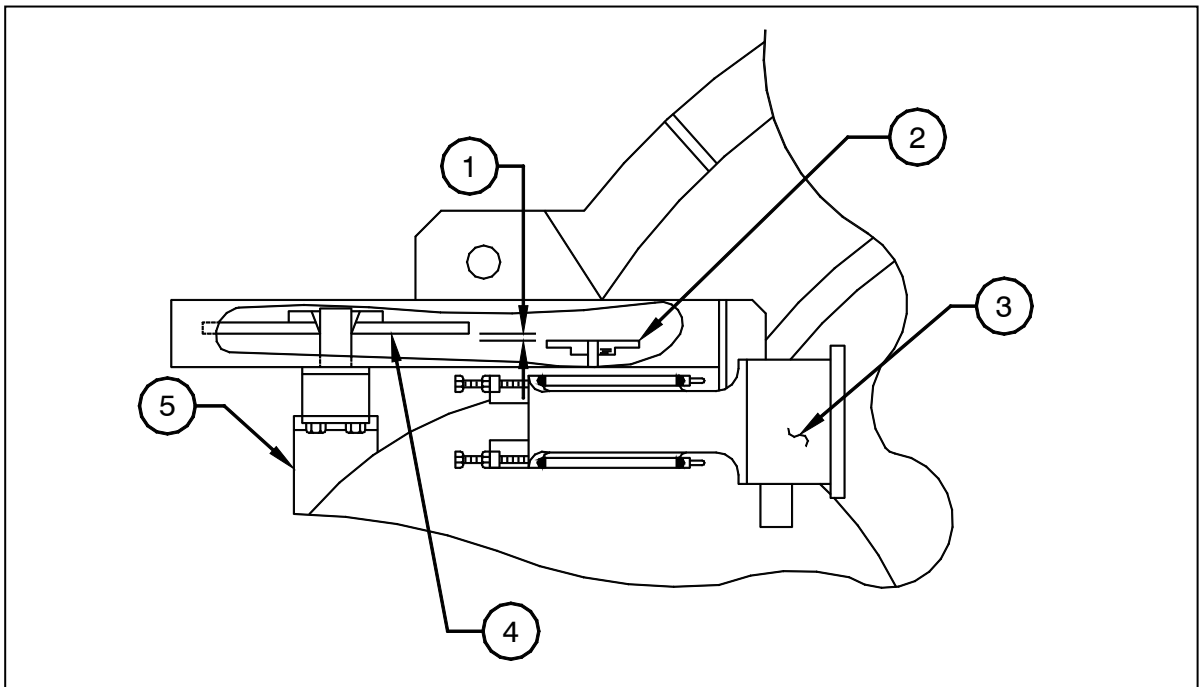


Figure 4.4a

1 - 1/8" offset at zero load	4 - Driven Sprocket
2 - Drive Sprocket	5 - Worm Drive
3 - Gearmotor	

Because the worm shaft and its driven sprocket (4) will be displaced inward under load, check that the driven sprocket (4) is offset 1/8" inward from true alignment with the motor's drive sprocket, as shown in Figure 4.4a. Adjust driven sprocket if out of alignment, referring to the Motor Drive Assembly drawing. This initial setting, then, will allow for near true alignment under normal load.

MAINTENANCE

General Drive Maintenance

4.4.3 Check Chain Tension

Proper chain tension is essential for maximum drive and chain life, as well as for smooth and quiet operation of the drive. Chains that are too tight can damage drive motor/reducer bearings, or cause broken chains. Loose chains will clatter and can come off the sprockets.

- .1 Chains should be installed with only a small amount of slack. New chains will loosen up slightly as the joints seat themselves, causing initial elongation of the chain.
- .2 After several weeks of operation, chain tension should be rechecked, and adjusted as necessary.
- .3 Refer to the Lubrication instructions for proper lubrication.

4.4.4 Drive Unit General Maintenance

- .1 These drive units consist of a main gear on the bottom, which is the main driving unit for the rake arms, and a worm gear assembly on top which drives the main gear with a pinion.
- .2 The worm gear drive is designed with a worm shaft that moves axially under loaded conditions of the drive unit. This movement is made possible by a thrust bearing with a sliding bearing seat arrangement on the loaded side of the worm.
- .3 The sliding bearing seat is held in place by a spring, and the compression of that spring, when the drive is under load, indicates the torque on the drive unit. When the spring compresses, its movement is transmitted by the movement of the bearing seat against an actuating pin screwed into the drive control actuator pointer. The spring is calibrated for load at the factory.

4.4.5 Drive Control General Maintenance

- .1 The drive control, which mounts to the worm housing, protects the drive unit and mechanism in case of overload, such as an excessive solids load on the rake arms.
- .2 Basically the drive control consists of the actuating pin in the actuator pointer, the scale, a camshaft and cams and switches. The actuating pin, which connects to the sliding bearing seat in the worm drive assembly, rotates the actuator pointer, which rotates the cam shaft, as the sliding seat moves when load is applied to the mechanism.

MAINTENANCE**General Drive Maintenance**

.3 The cams rotate with the camshaft and they actuate the switches at various load settings as they rotate. At the same time, the pointer shows the amount of torque on the drive on the scale, which is graduated, into percents from 0 to 100.

.4 CHECK the drive control once a year for condition and operation, as follows below:

Note: In areas with wide variations in temperature, at first check the drive control once a month for condensation and for operation until a reasonable inspection frequency can be determined.

.5 Start the motor drive.

.6 Remove the cylindrical switch housing, unscrewing it from the base. Then manually actuate the cam switches by turning the camshaft (and pointer) with the set collar (end of camshaft). Slowly turn the pointer through a complete range to 100. This will simulate a mechanism full load condition. At the set points the alarm should sound and the drive motor should stop.

.7 If the drive control does not react correctly, check each switch individually.

.8 If none of the cam switches actuate, as stated above, recheck the wiring (not by Ovivo) to the drive control. Refer to the Manufacturer's Wiring Diagrams.

.9 If the wiring is correct, check the cams for proper setting and check the actuation pin to be sure it is in position and not bent. Contact your Ovivo Representative if the problem cannot be determined.

.10 Replace the switch housing cover, being sure it goes on straight to ensure a tight seal. Tighten the switch housing cover a minimum of ½ turn after contacting the O-ring.

4.4.6 Electrical Equipment and Enclosures

.1 Electrical enclosures for the motor, drive control panels, etc. are listed on the drawings and Ovivo parts list.

.2 If any electrical equipment, including motors, is to be replaced, it must be of equal or better rating. Refer to the latest edition of the NEMA ICS (National Electrical Manufacturer's Association Industrial Control Standards) and NEMA MG 1 (N.E.M.A. Motors and Generators) for a description of those enclosure designations.

MAINTENANCE

General Drive Maintenance

DRIVE CONTROL CAUTION:



The drive control is the overload cutout device for the drive. Since it is installed and adjusted at the factory for proper operation, do not tamper with it. If the original cam settings are not considered satisfactory for the operating conditions, contact your Ovivo Representative before attempting any adjustment.



WARNING: If the drive unit stops due to an overload do not attempt to restart the unit until the cause of the overload has been located and corrected. Refer to the Drive Maintenance **WARNING** instruction in this manual.

MAINTENANCE

Shear Pin Sprocket

4.5.1 The Shear Pin Sprocket

The shear pin sprocket is furnished as a backup overload device to the drive control. For example, if the drive is not stopped by the drive control, during a high torque overload, the shear pin will fail and disconnect the motor drive from the drive unit.

4.5.2 Shear Pin Selection

- .1 The shear pin furnished with this drive has been selected for the torque required for this drive and mechanism. The torque limit of the shear pin sprocket depends on the size of shear pin. See Figure 4.5a. Do not replace the shear pin with any other material or other size pin.
- .2 In case of shear pin failure, first determine the cause of the failure and then replace the shear pin. The replacement pin must be identical to the pin that was furnished with the drive. Refer to the shear pin assembly number and shear pin neck size listed below.

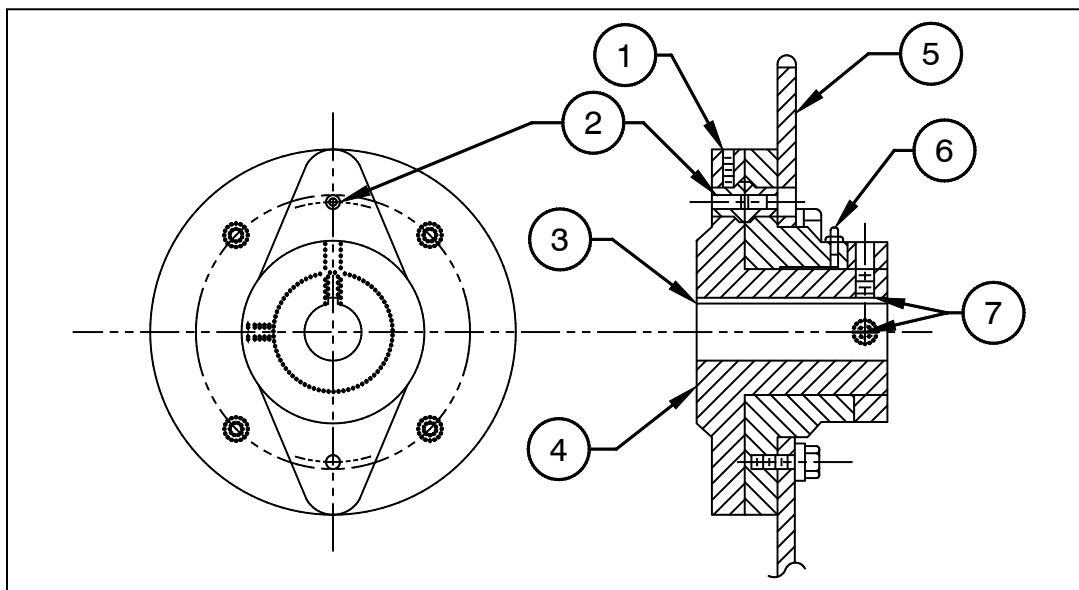


Figure 4.5a

1- Set Screw	4- Hub	7- Set Screw
2- Shear Pin	5- Sprocket	
3- Key	6- Grease Fitting	

SHEAR PIN ASSEMBLY – No. SP-22
 SHEAR PIN NECK DIA. – 9/64”

MAINTENANCE

Shear Pin Sprocket**4.5.3 Maintenance**

The shear pin assembly requires lubrication. Lubricate with Mobilgrease 1S XHP 222 (or equal) every 6 months.

Inject grease via the grease fitting using a grease gun (not by Ovivo).

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Drive Maintenance Warning

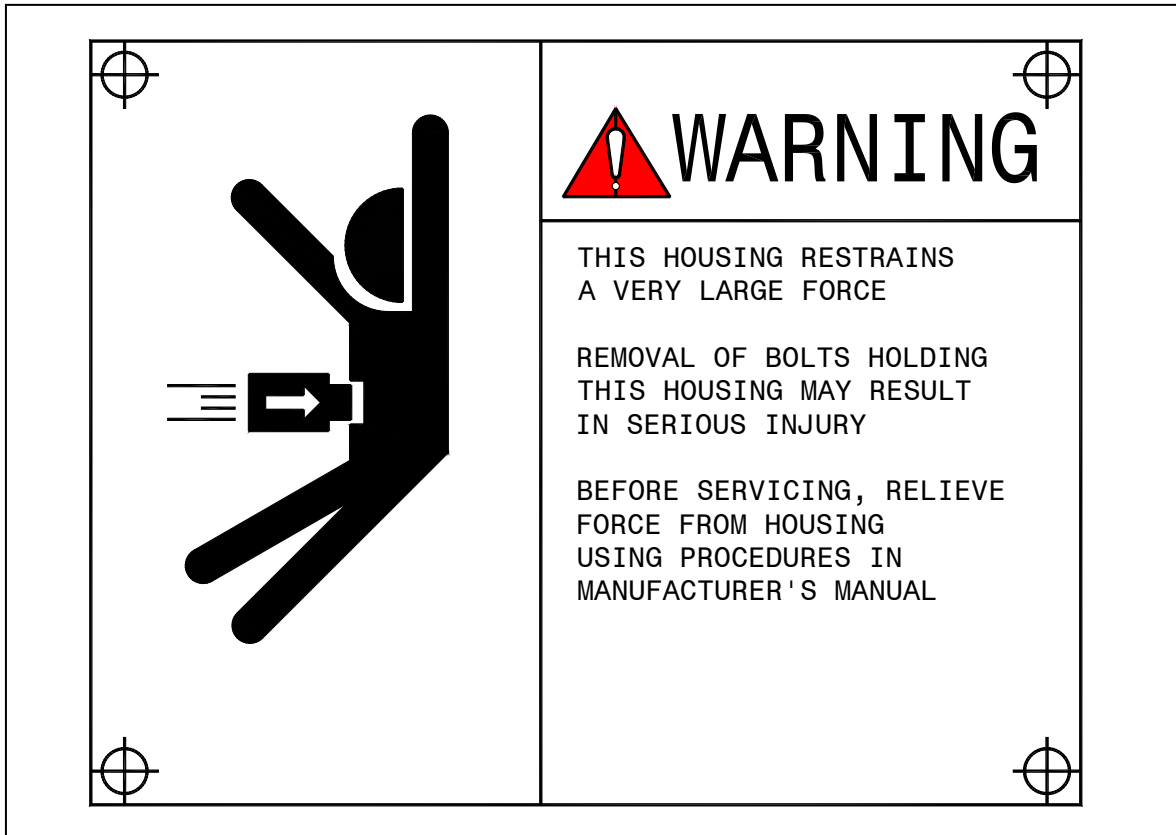


Figure 4.6a

This Drive High Torque Shutdown **WARNING** plate on the drive unit is there to warn you of possible danger before you service the drive.

When a raking mechanism drive shuts down due to high torque load, it might have stored spring force energy. This energy can be dangerous to those who service the drive unit in returning it to operation, if the energy is not relieved in a safe way.

The stored energy is most likely in two areas: (1) the torque control spring which is located in the worm drive housing and (2) the elastic deformation of the rake arms and rake cage, which is caused by the torsional load.

4.6.1 How to Check for Stored Energy:

Check the drive control. If the arrow indicates any torque above zero "0" as in Figure 4.6b, the drive assembly has stored energy. That is dangerous and must be relieved as covered below.

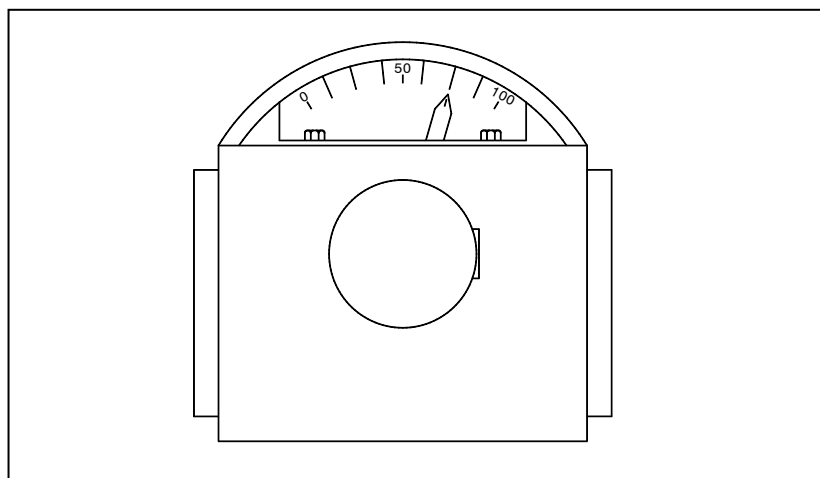


Figure 4.6b

The right-hand drive control is shown in Figure 4.6b. It shows dangerous stored energy in the amount of 70%.

4.6.2 How to Relieve Stored Energy:

The **only** safe way to relieve stored energy is to use the motor to reverse the drive unit. All other methods are hazardous.

Reversing the motor will require temporary alteration of the wiring so the motor can be jogged in reverse:

- .1 Exchange the motor leads as required for reversing motor direction of rotation per the motor manufacturer's instructions.

Note: The customer is responsible for altering his own plant wiring.

- .2 Close the torque control circuit.
- .3 Disconnect the "hold-in" circuit in the motor starter circuit so that only jogging can be done.
- .4 The pushbutton used for jogging must be located where the operator can watch the drive control arrow.
- .5 Reverse the motor in jogs of **only** 1-second duration to avoid drive damage. Watch the drive control indicator movement and progress towards relaxing the stored energy. Discontinue reverse jogging immediately when the drive control indicates zero torque, since a drive

MAINTENANCE

Drive Maintenance Warning

can damage itself and other components when running in reverse without torque control protection.

- .6 Now correct the cause of the shutdown/overload as required before proceeding.
- .7 Restore all wiring to its normal operating condition.

4.6.3 Dangerous Methods to Relieve Stored Energy

Do not attempt to reverse the drive unit to relieve stored energy by pulling the chain backwards, or, disconnecting the chain, as shown in Figure 4.6c. The worm shaft may spin suddenly, pulling in fingers and hands, or if a wrench or pry bar is used, it may be ejected violently.

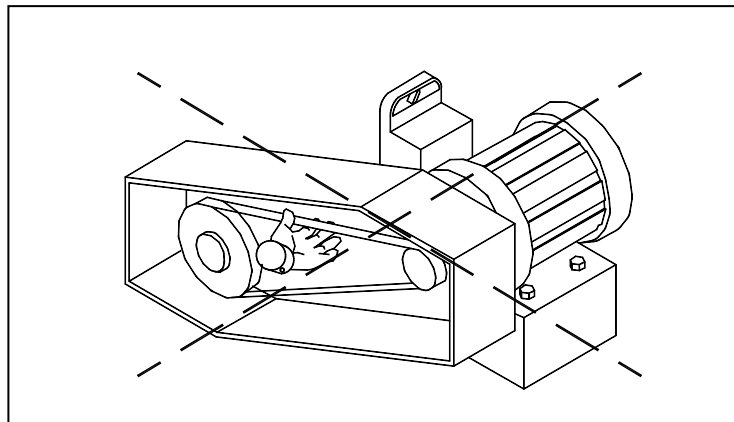


Figure 4.6c

DO NOT ATTEMPT

Do not disassemble a drive unit while there is stored energy, as shown in Figure 4.6d. Parts of it may release suddenly, when some of the fasteners are loosened, causing serious injuries and machine damage. This danger is greatest at the worm drive end cap where the spring is housed, which can burst away from the worm housing if the fasteners are unscrewed.

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Drive Maintenance Warning

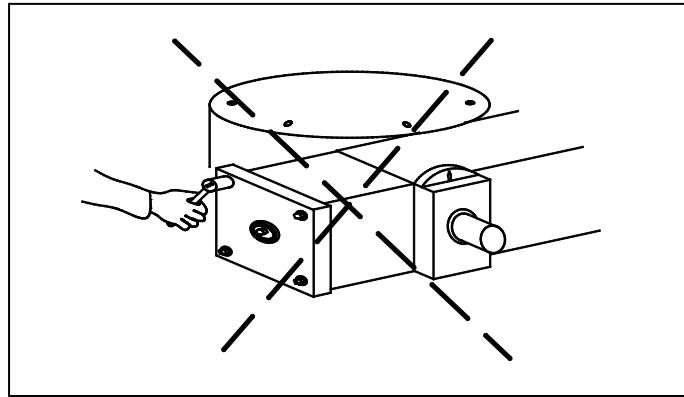


Figure 4.6d

DO NOT ATTEMPT

4.6.4 Safety Signs

Two signs are installed on the drive unit to warn personnel of unsafe practices:
(1) "**CAUTION**" sign 204181A on chain guards cautions personnel to follow the manufacturer's instructions.

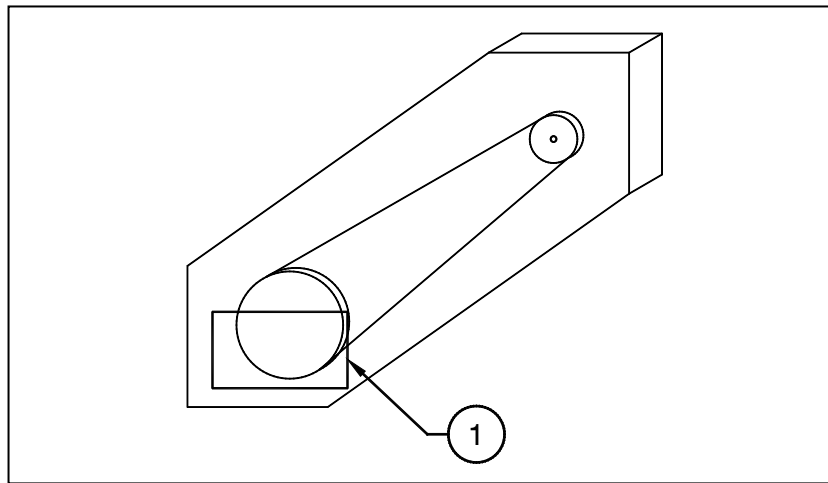


Figure 4.6e

1 - **CAUTION** Sign Installation- Typical for chain guard. Sign 204181A

"**WARNING**" sign 49045A on the torque control spring end cap (shown previously) warns about relieving the spring energy before attempting to remove the end cap.

MAINTENANCE

Drive Maintenance Warning

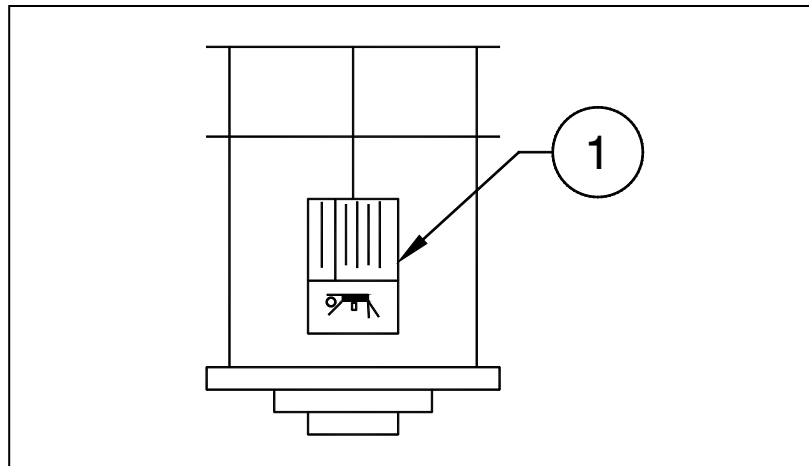


Figure 4.6f

2 - **WARNING** Sign Installation- Most common end cap shown. Sign 49045A

MAINTENANCE

Worm Gear Disassembly and Reassembly



WARNING: Check the drive for torque, referring to the preceding "Drive Maintenance **WARNING**" before starting disassembly. Make sure the power to the drive has been disconnected to prevent it being accidentally started.

4.7.1 Removal of the Worm Drive

- .1 Remove the guards and then disconnect all gearmotors



CAUTION: Refer to the Caution in the "Drive Maintenance" instructions

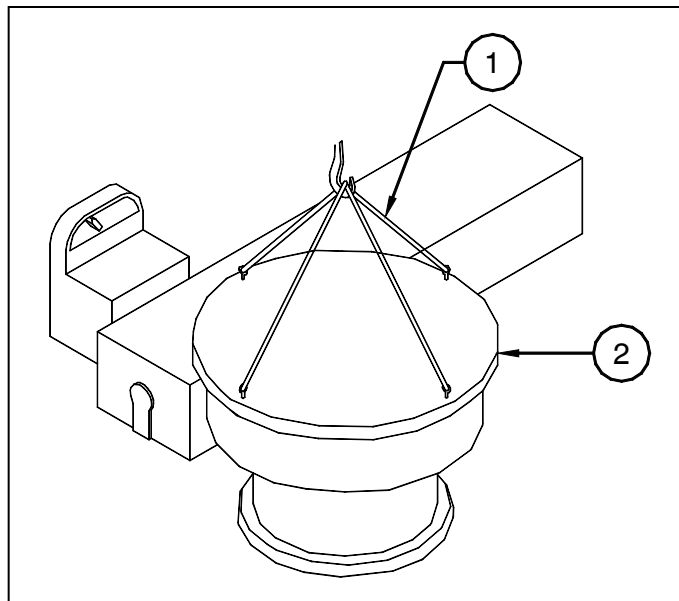


Figure 4.7a

1 - Lifting cables	2 - Worm gear drive assembly
--------------------	------------------------------

- .2 Drain the oil from the worm housing.
- .3 Remove the capscrews (28), connecting the worm housing (21) to the secondary drive (refer to Figure 4.7c).
- .4 Lift the worm gear drive assembly from the lower drive, referring to the

MAINTENANCE

Worm Gear Disassembly and Reassembly

lifting illustration. See Figure 4.7a. Place four (4) eye bolts symmetrically through the upper cover screw holes into the housing and lift with cables. If shims are in place between the worm housing and lower drive, match mark them so they can be returned to their original positions.



CAUTION: Use care when removing the unit from the secondary gear to prevent damage to the drive control, pinion, secondary main gear and bearings.

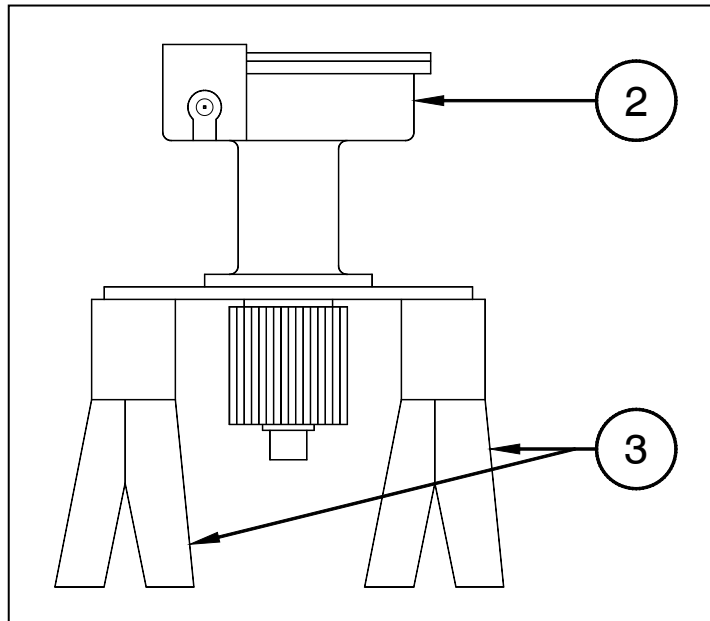


Figure 4.7b

2 - Worm gear assembly

3 - Support

- .5 Place the worm gear unit on saw-horse type supports as shown in Figure 4.7b. Make sure this device will support the weight of the worm gear unit.

4.7.2 Disassembly of the Worm Drive

- .1. Remove the switch cover and switch bracket with limit switch from the end cap. Remove the boot and hose clamps, if used. Remove the cam and jam nut from the end of the actuator rod.

MAINTENANCE

Worm Gear Disassembly and Reassembly

- .2 Remove the capscrews and end cap (6). Remove the spring seat (7) and the spring (8). Remove the "Centering Device", as used, from the stop rod (Refer to the Worm Gear Assembly drawing).

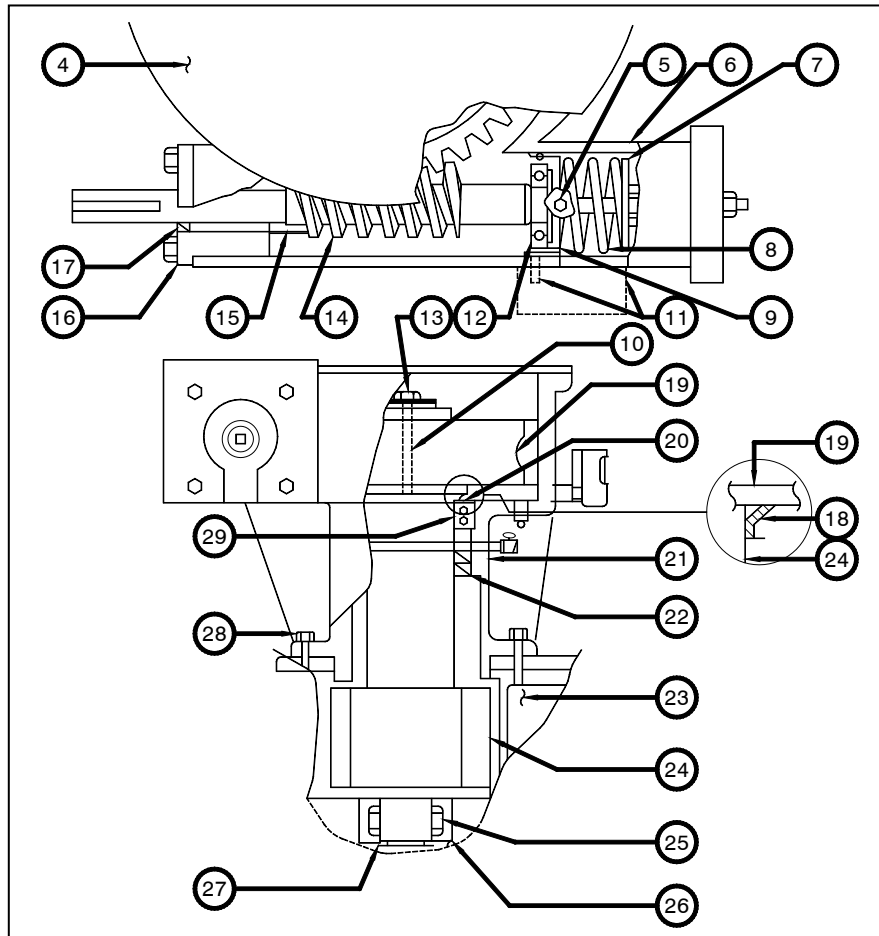


Figure 4.7c

4 - Housing cover	13 - Lock nut and lock washer	22 - Oil seals
5 - Pipe Plug, if furnished	14 - Worm shaft	23 - Secondary drive (Reference)
6 - End cap	15 - Reverse thrust sleeve (or bearing)	24 - Pinion
7 - Spring seat	16 - Bushing housing	25 - Bearing race
8 - Spring (with centering device, if used)	17 - Oil seals	26 - Outer race
9 - Sliding bearing seat	18 - Disc spring & spacer	27 - Retaining ring
10 - Key	19 - Worm gear	28 - Capscrew
11 - Drive control pin	20 - Retaining ring	29 - Pinion bearing
12 - Bearings	21 - Worm housing	

MAINTENANCE**Worm Gear Disassembly and Reassembly**

- .3 Remove oil seals (17), capscrews and bushing housing (16).
- .4 Remove the drive control and drive control pin (11).
- .5 Remove the worm shaft (14) reverse thrust sleeve (or bearing) (15) and bearings (12) with sliding bearing seat and stop rod (9) by turning the worm shaft so that the worm moves to the non-drive end. Do not remove the actuator rod from the end of the stop rod, if used.
- .6 Remove the housing capscrews and cover (4).
- .7 Place blocking under the pinion (24) to prevent it from falling out of the drive when the lock nut (13) and washer (13) are removed. Remove the gear lock nut (13), lock washer (13) and the key (10) (the 3/8 UNC tapped hole on the top of the key is to help in removing the key). Remove the worm gear (19) and the spring disc and spacer (18).
- .8 Support the pinion (24) (using an eyebolt in the top of the pinion) and lower it down through the housing as the blocking is removed.
- .9 Remove the bearing retaining ring (20). Remove the pinion bearing (29) using a puller. Remove the oil seals (22).
- .10 Remove the retaining ring (27) and the bearing race (25) from the end of the pinion. Remove the outer race (26) from the bottom of the main gear housing.
- .11 Remove the reverse thrust sleeve (15) sliding bearing seat (9), and bearing (12) from the worm shaft (14). Use a bearing puller if necessary.

Note: Some drive units have a thrust bearing in place of the thrust sleeve (15).

4.7.3 Inspection

- .1 Inspect the teeth of the worm gear and pinion and the worm for the following:
 - a. **ABRASIVE WEAR:** Wear will show at random spacing across the gear teeth and worm. This is normally caused by dirt or other foreign material in the lube oil.
 - b. **SCORING:** This is shown by vertical scratches and/or grooves running from the pitch line (approx. center of tooth) to the top of

MAINTENANCE**Worm Gear Disassembly and Reassembly**

- the tool or worm. It can result from improper lubrication or abrasive materials in the lubricant.
- c. **PITTING:** It is evident in large or numerous pits in the gear teeth and worm. Note that small pits may occur during run-in of a new gear, but these will smooth out as the gear wears in. It is caused by overload, poor lubrication or improper lubricant.
 - d. **GALLING:** This condition appears as numerous deep grooves or gouges and it is caused by overload of gearing for the lubricant used.
 - e. **NORMAL WEAR:** Eventually all gears and worms wear out due to long use and/or prolonged overload. Replacement should be considered based on the condition of the gearing and extent of the wear.
- .2 Depending on the condition of the worm gear, replacement may be required depending on the severity of the condition and the affect that a breakdown would have on the operation. Small scratches can be removed by repolishing the surface but if the scratches are large or deep, such as galling, replacement of the worm may be necessary, since the operating life would be limited. Would failure cause damage to the components? Cause production stoppage?
- .3 Inspect the bearing balls for pitting or scoring. If there is any question about the condition of a bearing, it should be replaced.
- .4 All parts should be cleaned with a solvent, and then coated with a light oil for inspection. Never rotate a dry bearing.

4.7.4 Reassembly of the Worm Drive

CAUTION: Gaskets in the drive unit are not to be used, except where specified on the assembly drawings and parts list.

Notes:

- (a) Take care to prevent dirt or foreign matter from getting into the worm assembly. All parts must be cleaned with a solvent before assembly and then blown dry. Coat the bearings and seals with a film of oil.

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Worm Gear Disassembly and Reassembly

- (b) Inspect all parts for damage or wear and replace as necessary.
 - (c) Check all bearings for pitting, roughness of rotation or scoring. Replace all bearings on a shaft if one is defective.
 - (d) Coat all bearings and bushings liberally with grease or oil before they are installed.
 - (e) Oil seals are subject to deterioration and should be replaced with new seals when the unit is reassembled, even though the deterioration may not show.
- .1 Mount the inner pinion bearing race (25) on the pinion shaft (24) and install the retaining ring (27). Install the outer race (26) into the main drive housing.
 - .2 Install the oil seals (22) inside the worm housing (21), referring to Figure 4.7d. The oil seals must be installed as shown with the lips facing upwards.
 - .3 Pull the pinion (24) up through the worm housing (21) with an eye bolt and cable and support the pinion from below with blocking. First cover the keyway with tape to prevent it from cutting the seals.

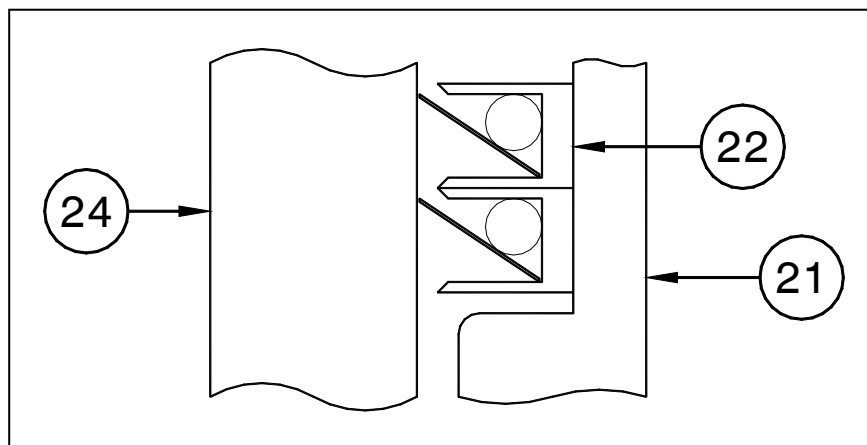


Figure 4.7d

21 - Worm housing	22 - Oil seal	24 - Pinion
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- .4 Install the bearing (29) over the shaft. Tap the bearing (29) in as necessary to seat, using a tubular driver. Install the retaining ring (20).

MAINTENANCE


Worm Gear Disassembly and Reassembly

- .5 Set the spacer and disc spring (18) in place in that order. Mount the worm (19) on the pinion shaft and install the keys (10) with the tapped hole located on top. Set the lock washer (13) on the worm gear, and then start the lock nut (13) onto the pinion (24).

Using a nut spanner (spanner wrench), tighten the nut one complete revolution. Do not bend the locking tabs on the lock washer at this time.

Note: A special nut spanner can be purchased from Ovivo. Refer to parts and repair orders.

- .6 Place the bearings (12) in the sliding bearing seat (9), as shown in Figure 4.7e



CAUTION: The bearings must be installed as shown to take the thrust towards the spring. Improper assembly will cause bearing failure

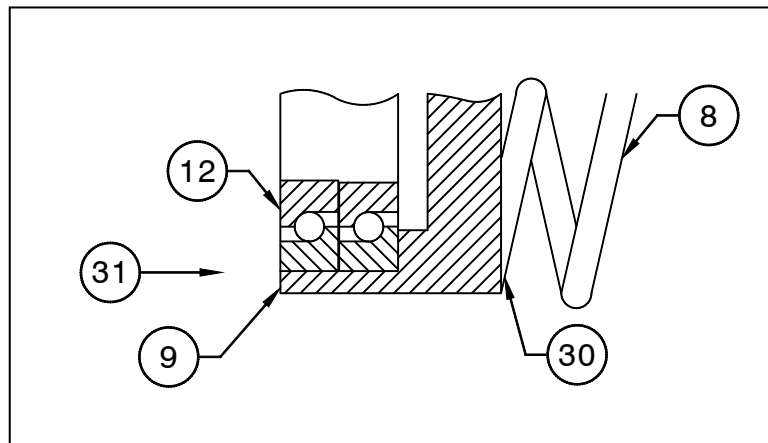


Figure 4.7e

8 - Spring	12 - Bearings	30 - Spring side of sliding bearing seat
9 - Slide bearing seat	31 - Thrust	

- .7 Mount the sliding bearing seat (9) and bearings (12) on the worm shaft (14). The bearing must seat against the worm shoulder. Use a tubular drive or place the end of the worm on a block of wood and drive on the bearing housing, using a block of wood and hammer.

MAINTENANCE

Worm Gear Disassembly and Reassembly

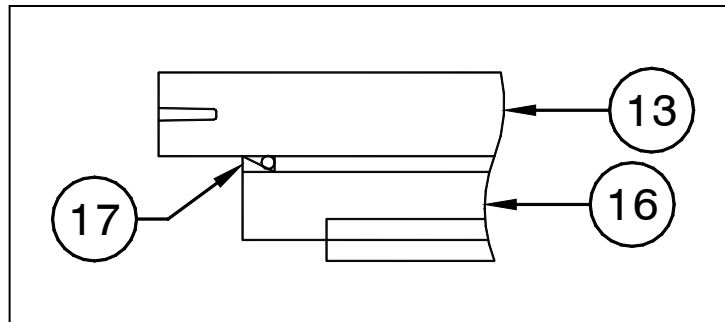


Figure 4.7f

13 - Worm shaft	16 - Bushing housing	17 - Oil seal
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- .8 Using a tubular driver, install the reverse thrust sleeve (15) or bearing as used. Seat it against the worm.

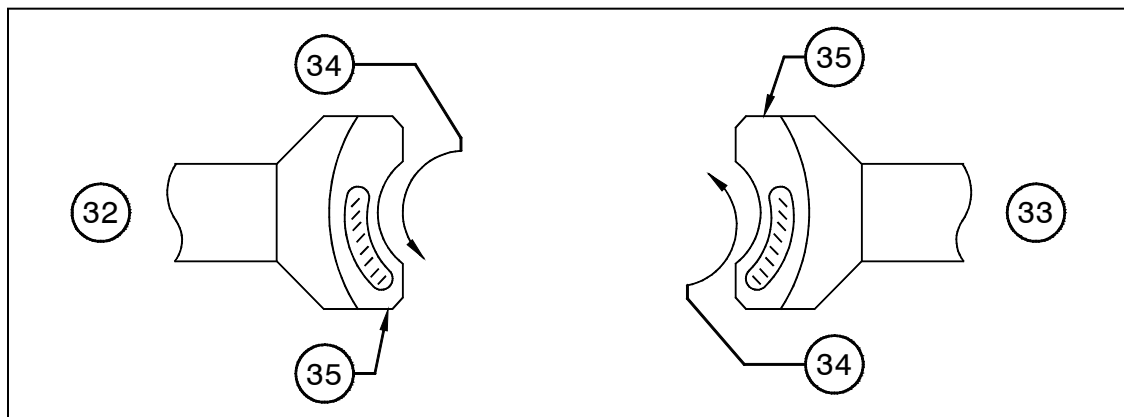


Figure 4.7g

32 - Right hand assembly	34 - Direction of worm rotation
33 - Left hand assembly	35 - Contact pattern

- .9 Insert the worm into the gear housing (from the non-drive end), turning it as necessary to mesh with the worm gear threads. (Coat the worm with oil.)
- .10 Coat both ends of the housing with Ultra Blue RTV-Silicone. Place the "Centering Device", if used, and the spring (8) over the shaft and install the spring seat (7) and end cap (6). Make sure the end cap is installed with the warning sign visible. Secure the bolts.

MAINTENANCE**Worm Gear Disassembly and Reassembly**

- .11 Place the bushing housing (16) over the shaft and install the capscrews. Turn the bolts equally when tightening.

Note: If the bushing was replaced, make sure it is flush with the inside face of the housing.

- .12 First, cover the keyway with tape to prevent the seal being cut, then install the oil seal (17) with the lip facing out, as shown in Figure 4.7f.

- .13 If removed, screw the actuating pin into the drive control assembly, referring to Figure 4.7c. Torque the pin to 20-25 ft. lbs.

Note: On older drives, the drive control pin fits in the slot of the sliding bearing seat.

- .14 Install the drive control, referring to "Drive Control Installation" on a following page.

- .15 Turn the worm by hand to be sure all parts are properly installed.

- .16 Check for proper pattern between the worm shaft (14) and gear teeth (19) as follows:

- a. Coat the gear teeth (19) with Prussian blue.
- b. Rotate the worm in the proper operating direction and observe the tooth contact pattern on the gear through the 1 3/4" pipe plug hole in the housing, using a flashlight.
- c. Compare the actual tooth contact pattern with the correct contact pattern shown in Figure 4.7g.

Note: The contact pattern must be as shown with the contact on the side of the teeth where the worm leaves the gear.

- .17 If the actual pattern on the gear teeth is not as shown in Figure 4.7g, adjust for correct pattern by tightening or loosening the lock nut (13) to raise or lower the worm gear.

- .18 After any adjustment to the nut (13) coat the gear teeth with Prussian blue and recheck tooth contact pattern.

- .19 After the adjustments for tooth contact are complete, bend the locking tabs of the lock washer (13) to secure the nut (13).

MAINTENANCE**Worm Gear Disassembly and Reassembly**

- .20 Apply Ultra Blue RTV-Silicone to the worm gear housing lower mounting face. Lift the worm gear assembly, referring to the lifting instructions, and set it in position on the lower drive. Align the gear housing with the lower drive referring to the Drive Assembly drawing for orientation.

Note: If shims were used between the worm housing and the lower drive, return them to their original positions.

- .21 Install the cover (4), using Ultra Blue RTV-Silicone to provide a liquid tight seal between the cover and housing, and secure the capscrews.
- .22 Lubricate the drive referring to the Lubrication Instructions.
- .23 Install motors, reducers, belts, torque arms, sheaves and guards.



CAUTION: The motor/reducer assembly must be blocked in position until the torque arm is installed.



WARNING: Do not operate this equipment if guards have been removed, or are damaged. All guards and safety devices must be properly installed and functional before operating this equipment.

- .24 Mount the jam nut and cam on the actuator rod. Install the limit switch and switch bracket. Adjust the secondary control device setting, referring to the instructions on the Secondary Control Assembly drawing. Install the boot and hose clamps, if used. Install the switch cover.
- .25 Reconnect the electrical wiring and check for proper drive rotation.

4.7.5 Drive Control Installation

- .1 Referring to Figure 4.7h, run a bead of Ultra Blue RTV-silicone around pin slot in the worm housing. Install the mounting plate (37), using the capscrews provided, centering the slot in the mounting plate (37) over the slot in the worm housing. Torque the capscrews to 50-60 ft-lbs.
- .2 Set the drive control in place on the mounting plate (37), and then install (but do not secure) the drive control mounting capscrews (39) with washer plates (40).

MAINTENANCE

Worm Gear Disassembly and Reassembly

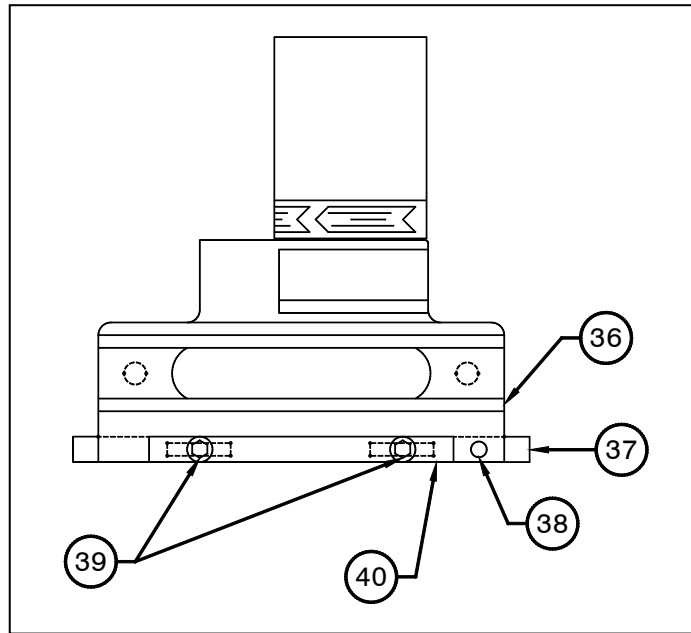


Figure 4.7h

36 - Drive control housing	39 - Mounting capscrews
37 - Mounting plate	40 - Washer Plates
38 - Alignment hole in housing must line up with matching hole in mounting plate, and then install capscrew.	

- .3 Adjust the drive control by sliding it until the alignment hole in the drive control housing lines up with the matching hole in the mounting plate. Refer to Figure 4.7h. The drive control pointer should indicate "zero". Install the alignment capscrew (38) in the alignment hole(s). Secure the drive control mounting capscrews (39).
- .4 Check the drive control for activation, referring to the Drive Maintenance Instructions.

MAINTENANCE**Main Gear Disassembly and Reassembly**



WARNING: Check the drive for torque, referring to the preceding “Drive Maintenance WARNING” before starting disassembly. Make sure the power to the drive has been disconnected to prevent it being accidentally started.

4.8.1 Preparation for Drive Removal

- .1 Disconnect all electrical power at its source. Flag or tag all breakers as a precaution.
- .2 Drain all oil from the drive unit assembly.
- .3 Block the rake arms in position. If the unit has a scum skimmer, shoring should be used to keep it upright. Disconnect the arms from the cage.
- .4 Disconnect the cage from the drive unit and lower the cage free of the drive.
- .5 Remove the walkway. Retain the slide plates and mounting plates, and match mark for return to original positions.

4.8.2 Main Gear Removal and Bearing Replacement

If possible, the drive base should **not** be removed from the column during the disassembly of the drive. If the drive is removed from the column, it will have to be checked and adjusted for final level, referring to the Installation instructions, following reinstallation.

- .1 Remove the worm gear assembly, referring to the Worm Gear Disassembly and Reassembly Instructions.
- .2 Remove the main gear cover plate.
- .3 Remove the socket head capscrews (3), and remove the gear cage attachment (4) from the main gear. Refer to Figure 4.8a.
- .4 Remove the lip seals and band clamps (5), if worn, cut or deteriorated.
- .5 Using a socket head wrench, remove the capscrews (1).
- .6 Remove the main gear (6). Set it upside down on a clean, level working area.

MAINTENANCE

Main Gear Disassembly and Reassembly

- .7 Remove the socket head capscrews (2) to remove the bearing (7) from the gear (6), if the bearing or gear will be replaced.

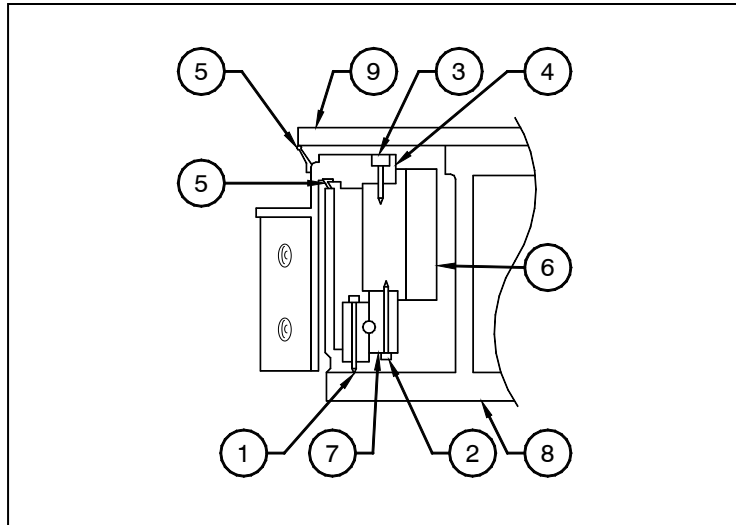


Figure 4.8a

1 - Socket Head Capscrew	4 - Gear Cage Attachment	7 - Bearing
2 - Socket Head Capscrew	5 - Lip Seal and Band Clamp	8 - Drive Base
3 - Socket Head Capscrew	6 - Main Gear	9 - Cover Plate

4.8.3 Inspection

1. Clean the gear, bearing and housing with solvent or kerosene and blow dry. Coat the bearing with light oil if it may be reused.
2. Inspect the teeth of the main gear for the following:
 - a. **ABRASIVE WEAR:** The wear on the teeth will show at random spacing across the teeth. This is normally caused by dirt or other foreign material in the lube oil.
 - b. **SCORING:** This is shown by vertical scratches and/or grooves running from the pitch line (approx. center of tooth) to the top of the tooth. It can result from improper lubrication.
 - c. **PITTING:** It is evident in large or numerous pits in the gear teeth. Note that small pits may occur during run-in of a new gear, but these will smooth out as the gear wears in. It is caused by overload on the gear or poor lubrication.

MAINTENANCE**Main Gear Disassembly and Reassembly**

- d. **GALLING:** This condition appears on the gear teeth as numerous deep grooves and it is caused by overload of the gear for the lubricant used.
 - e. **NORMAL WEAR:** Eventually all gears wear out due to long use and/or prolonged overload. Replacement should be considered based on the condition of the gearing and extent of the wear.
- .3 Replace the gear, as necessary, depending on the severity and extent of these conditions and, in some cases, the period of time to the next complete maintenance.
 - .4 Inspect the bearing by rotating the top bearing race by hand (bearing must be lubricated with light oil). Check for smooth, noiseless operation. Depending on the smoothness, the bearing may or may not need to be replaced. If the bearing will not rotate freely, or is rough in rotation, it must be replaced.

4.8.4 Installation of the Main Bearing and Gear:

- .1 Make sure all parts are clean, including the housing, before installing the bearing. Remove any gasket material.
 - a. Prevent dirt or foreign matter from getting into the drive assembly.
 - b. Gears and housing must be cleaned with a solvent and blown dry or wiped clean.
 - c. The bearing must be cleaned in light oil and covered with light oil.
 - d. Seals and gaskets should be replaced, if they appear worn, damaged or deteriorated, whenever the unit is disassembled.
- .2 Set the bearing (7) in place on the main gear (6), while the gear is upside down.
- .3 Install the capscrews (2) hand tight.
- .4 Secure the capscrews (2) in two stages and in a cross-diameter sequence to avoid bearing warpage. The final torque on all capscrews (2) must be 200 ft. lbs. lubricated (plus or minus 10 ft. lbs.). Rotate the bearing and check for smooth, noiseless operation.

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Main Gear Disassembly and Reassembly

- .5 Cover the loading plug bore I.D. groove with Ultra Blue RTV-Silicone to provide an oil tight seal.
- .6 Set the main gear (6) with bearing (7) in place in the base housing, lining up the bolt holes in the bearing with those in the main gear base, and orienting the loading plug as specified on the Drive Assembly drawing. Take care to prevent damage to the bearing.
- .7 Install and secure the capscrews (1) following the instruction above under items #3 and #4. Same capscrews as (2).
- .8 Install the drive housing to gear cage attachment lip seal if removed, as follows:
 - a. Thoroughly clean the seal mounting surfaces. These surfaces must be free of dirt, grease, or any foreign matter.
 - b. Measure a seal for cutting by laying it in position on the housing or gear mounting surface, where it will be located. The sealing surface must be oriented as shown on the Drive Assembly drawing. Make a square cut on the end of the seal, leaving a slight overlap. Refer to the Assembly drawing and Figure 4.8b.
 - c. Apply sealant (bonding agent) (Part No. 88899A) over the mounting surfaces where the seals will be installed.
 - d. Referring to Figure 4.8b, set the lip seal in place, except the last 12 inches of one end of the seal, making sure the seal lip is facing in the direction shown on the Drive Assembly drawing. Since bonding will take place within 45 seconds of contact, take care in setting the seal in place.
 - e. Bring the uncemented end together with the opposite end. Mark and cut the end of the seal for a square, butt fit against the opposite end.
 - f. Apply the sealant (bonding agent) to both square ends and set the seal in place. Press the ends together until a firm bond is made.
 - g. Apply sealant (bonding agent) to the inside angle of the seal at the splice, for about 3" on both sides of the splice. Glue a 4" long piece of wire rope (part no. 88951C) in place, as shown in Figure 4.8b, centered on the splice.

MAINTENANCE

Main Gear Disassembly and Reassembly

- h. Allow the bonding agent to harden, and then use additional bonding agent to seal (encapsulate) the piece of wire rope in position.

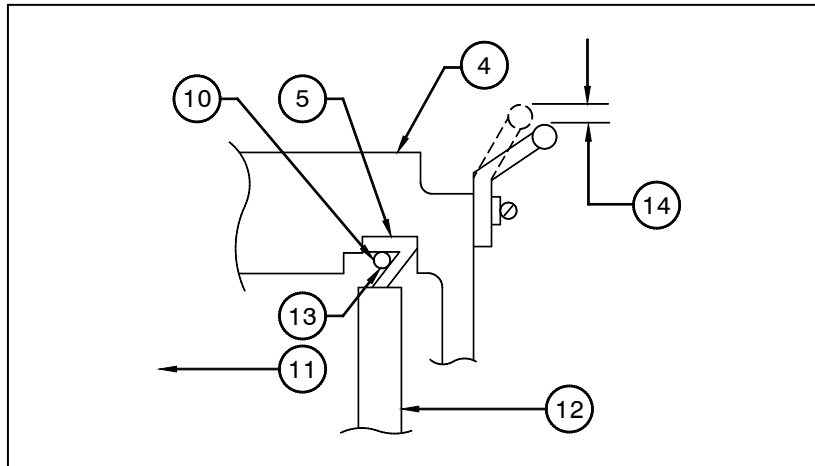


Figure 4.8b

4 - Gear cage attachment	11 - Main bearing and oil side	14 - 1/8" prior to installation of main gear cover
5 - Oil seal	12 - Drive housing	
10 - 4" piece of wire (part no. 88951C)	13 - Sealant (part no. 88899A)	

- .9 Install the gear cage attachment (4) on the main gear. Secure the cap screws (3) in two stages and in a cross-diameter sequence. The final torque on all cap screws (3) must be 200 ft. lbs. lubricated (plus or minus 10 ft. lbs.).
- .10 Install the gear cage attachment to main gear cover plate lip seal with the band clamp, locating it on the gear cage attachment as shown in Figure 4.8b and the Drive Assembly drawing.
- .11 Install the main gear cover plates, using Ultra Blue RTV-Silicone at the joints and between the cover plates and base for a liquid tight seal.
- .12 Install the worm gear assembly following the respective instruction.
- .13 Lubricate the drive assembly referring to the lubrication instructions.
- .14 Reinstall the cage, rake arms and walkway referring to the respective installation instructions in this manual.
- .15 Reinstall the motor drive assembly, but leave the chain off.

MAINTENANCE

Main Gear Disassembly and Reassembly

- .16 Connect the electrical wiring and check for proper drive rotation.
- .17 Reinstall the drive chain referring to the instructions in this manual.

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Oil Seal Installation Procedure

Careless installation is one of the most common reasons for seal problems. The installation mechanic can prevent these problems by reviewing and following these instructions.

4.9.1 Seal Components

Seals are made up of the following basic components, each performing a particular function, such as:

- .1 Outer Shell (Case). The outer, cup-shaped, rigid structure of the lip seal assembly. Acts as a protective cover for the head of the sealing element.
- .2 Inner Shell (Case). A rigid cup-shaped component of a seal assembly, which is placed inside the outer seal case. It can function as a reinforcing member, shield, and spring retainer or lip clamping device.
- .3 Sealing Element. The normally flexible elastomeric component of a lip seal assembly, which rides against the shaft

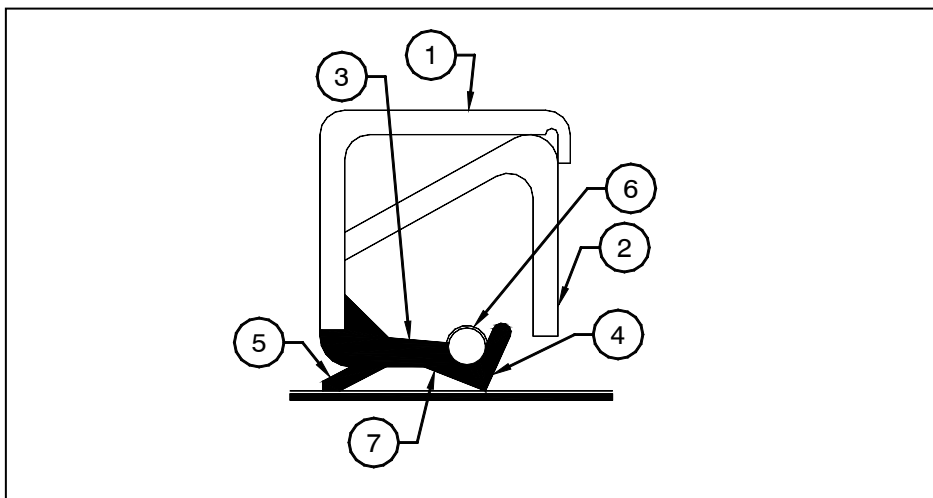


Figure 4.9a

1 - Outer Shell (Case)	5 - Secondary Lip (Auxiliary Lip)
2 - Inner Shell (Case)	6 - Garter Spring
3 - Sealing Element	7 - Head Section
4 - Primary Lip	

- .4 Primary Lip. The flexible elastomeric component of a lip seal which contacts the rotating surface.

MAINTENANCE

Oil Seal Installation Procedure

- .5 Secondary Lip (Auxiliary Lip). A short, non-spring loaded lip, which is located at the outside, seal face of a radial lip seal. Used to exclude contaminants.
- .6 Garter Spring. A coiled wire spring with its ends connected. It is used for maintaining a sealing force between the sealing element and sealing surface.

4.9.2 Proper Installation Procedures

The seal is ready to be installed in the bore once the old seal has been removed, and the shaft and bore have been checked and cleaned. The seal should be pre-lubricated before installation.

4.9.3 Pre-Lubrication

Pre-lube the lip of the seal now before the seal is installed. This step is important because pre-lubrication provides a film on which the seal rides until there is ample lubricant in the seal cavity.

The best pre-lube to use is the lubricant being used in the drive unit. Refer to the Lubrication Instructions.

4.9.4 Tools

A hydraulic press that applies uniform pressure against the seal is recommended. However, if a press is not available or not practical, a round tool, such as a bearing cup, is excellent. The installation tool must follow the seal into the bore, and it should be slightly smaller than the outside diameter of the seal. An O.D. ten thousandths of an inch smaller than the bore is ideal. For best results, the center of the tool should be open so pressure is applied only at the outer edge of the seal case.

The tools used to install seals can often affect seal performance. For instance, a screwdriver may easily cut the seal lip or bend the case and cause the seal to leak. Even blunt-end drifts can damage the seal case or distort the seal from its proper working position.

CAUTION: Sealing damage may result when:

- .1 Using a steel hammer,
- .2 Using a drift or punch,
- .3 Using a chisel or screwdriver,
- .4 Using direct hammer blows on the face of the seal, or
- .5 Starting seal into bore at an angle (cocked)

MAINTENANCE

Oil Seal Installation Procedure

4.9.5 Hammering

- .1 Use a soft-faced or dead-blow hammer or mallet against an installation tool when installing seals (see Figure 4.9b). This type of tool, like a block of wood, absorbs the shock wave created by the tool's impact. A hammer blow without any material to absorb the shock wave can dislodge the garter spring from its proper operating position. Once the spring is out of position, the seal will fail. The spring can even interfere with the action of the seal lip, or find its way into the bearing.

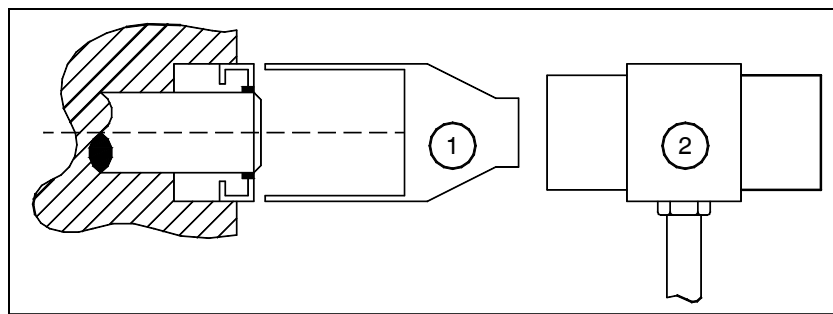


Figure 4.9b

1 - Tool	2 - Soft Faced Mallet
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- .2 Whatever tool is used, remember that seating force must be applied and spread out around the entire circumference of the seal. A direct blow on one side of the seal distorts the case and can cause the lip to be pressed against the shaft. This action produces increased friction between the lip and the shaft surface.
- .3 If installation pressure is applied to the seal's inside diameter, the case is forced upward, lifting the lip from the shaft surface. If the seal is cocked -- not perpendicular to the shaft and bore -- the result will be too much contact on one side, and not enough on the other. The seal will leak as the shaft is deflected by shaft-to-bore misalignment or run-out. Seals must be seated up against the bore shoulder to achieve perpendicularity of sealing lip to shaft.
- .4 Sealing lips must not be painted. Coating the seal case is acceptable after installation. Shaft seal surfaces including those seal surfaces that move axially must be free from paint, nicks, scratches, etc. in the area where the seals are to function.

MAINTENANCE

Process Performance

1. The process performance of the equipment referred to in these instructions is dependent upon many factors, including influent or feed quality and quantity, additives required, time, temperature, rates of change, sizing criteria used, operating conditions, etc. Therefore, unless a written Process Performance Warranty has been included, Ovivo cannot assume any liability or responsibility for performance results that the user of the equipment is expecting or has predicted.
2. Should assistance be required in the operation of the equipment, due to unexpected conditions, or should accessory or add on components or changes be required to meet your performance needs, Ovivo can, at additional cost, provide the service of experts to assist you in determining what actions must be taken.

MAINTENANCE

Troubleshooting

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
1. Overload alarm sound-or, drive operates at high torque for several days	a. Torque build up on drive and mechanism	(1) Reduce solids feed to clarifier and check for operating problem. Refer to Operating Instructions
2. Drive stops	a. Loss of electrical power	(1) Check power source (2) Check control fuse
	b. Drive control cutout	(1) If pointer on control is at maximum cutout, drain tank to locate problem <u>Do not</u> by pass control (2) If pointer is <u>not</u> at maximum torque, check control. See Maintenance Instructions
	c. Motor drives cutout	(1) Check for overheating refer to manufacturer's instructions (2) Check for broken chain or shear pin

Parts List

GLV Indented Current BOM Report

Table of Contents

ITEM	DESCRIPTION	PAGE
RSW0000933-01	C60P-S1 Clarifier Drive Unit (1)	1
RSW933-01M1	DRIVE,C60PS2 DRIVE (MASTER)	2
RSW933-132	DRIVE,C60PS2 (160K) (COMPLETE)	3
RSW891-133	ASSY,C60PS2 MOTOR DRIVE w/SHEAR PIN	6
768353	ASSY,C60PS2 DRIVE (CAST BASE)	9
768389	ASSY,WORM GEAR,C60P w/OUT SEC. DRIVE	14
204382A1A	CAP,END,CI ASTM A48,CLASS 40A,(cp)	18
L202316	ASSY,HOUSING,BUSHING,CI(922)	19
202315A1A	HOUSING,BUSHING,CI (MACHINING)**	20
L203243-3	ASSY,WORM GEAR RH (695)(cp)	21
204060A1A	RIM,WORM GEAR,W21P, BRZ-SELL w/ASSY ONLY	22
204230A1A	HUB,WORM,CI 21-1/2(SELLw/ASSY ONLY)(cp)	23
L115759-1	DRIVE CONTROL,4SPDT,RH,w/o POT	24
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RSW933-152	COLUMN/CAGE ADAPTERS & HANDRAIL	32

GLV Indented Current BOM Report

BOM NUMBER: RSW0000933-01
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: C60P-S1 Clarifier Drive Unit (1)

DRAWING NUM: RSW0000933-01

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
0	RSW0000933-01	C60P-S1 Clarifier Drive Unit (1)	1.0	1.00	LOT	0.00		RSW0000933-01	A	1
1	RSW933-01M1	DRIVE,C60PS2 DRIVE (MASTER)	1.0	1.00	EA	0.00	1	RSW933-01M1	A	2
1	RSW933-01M4	COLUMN/CAGE ADAPTERS & HANDRAIL	1.0	1.00	EA	0.00	4	RSW933-01M4	A	228
1	NOTES	SPECIFICATIONS & INSTRUCTIONS	1.0	1.00	EA	0.00 LB	998	N/A		250

Jobmatl Notes

ONE (1) NEW C60PS2 DRIVE UNIT & ADAPTER STEEL TO REPLACE A C60BHT DRIVE UNIT ORIGINALLY INSTALLED UNDER SERIAL NO. 1356-A OR A C54B DRIVE UNIT ORIGINALLY INSTALLED UNDER SERIAL NO. 1462-A.

ADDITIONAL ITEMS REQUIRED FOR BOTH DRIVE CONVERSIONS WERE PROVIDED ON ORDER RSW0000891-01

1	ECO	ENGINEERING CHANGE ORDER	1.0	1.00	EA	0.00	999	N/A	A	251
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Jobmatl Notes

ECO-S-012535 (REV A) - INITIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: RSW933-01M1
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: DRIVE,C60PS2 DRIVE (MASTER)

DRAWING NUM: RSW933-01M1

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
2	DRAWINGS	ASSEMBLY & REFERENCE	1.0	1.00	EA	0.00 LB	0	N/A		3
	Jobmatl Notes									
	RSW933-01M1 - C60PS2 DRIVE (MASTER)									
2	RSW933-132	DRIVE,C60PS2 (160K) (COMPLETE)	1.0	1.00	EA	0.00	2	RSW933-132	A	4
2	ECO	ENGINEERING CHANGE ORDER	1.0	1.00	EA	0.00	999	N/A	A	227
	Jobmatl Notes									
	ECO-S-012535 (REV A) - INITIAL RELEASE									

GLV Indented Current BOM Report

BOM NUMBER: RSW933-132
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: DRIVE,C60PS2 (160K) (COMPLETE)

DRAWING NUM: RSW933-132

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq	
3	DRAWINGS	ASSEMBLY & REFERENCE	1.0	1.00	EA	0.00 LB	0	N/A		5	
	Jobmatl Notes										
	RSW933-132 - C60PS2 DRIVE COMPLETE (160K)										
	115713 - DRIVE CONTROL INST.										
	114808 - TORQUE SPEC										
	ES0001 - WORKMANSHIP STANDARD										
	588768 - DRIVE OIL TEST										
	295128 - SUGGESTED WIRING DIAGRAM										
3	RSW891-133	ASSY,C60PS2 MOTOR DRIVE w/SHEAR PIN	2.0	2.00	EA	0.00	8	RSW891-133	A	6	
3	768353	ASSY,C60PS2 DRIVE (CAST BASE)	1.0	1.00	EA	0.00	9	768353	C	37	
3	L115759-1	DRIVE CONTROL,4SPDT,RH,w/o POT	2.0	2.00	EA	18.00 LB	10	115759	Y	154	
3	48806A	PIN,ACTUATING,2.69",STL/SB	2.0	2.00	EA	0.15 LB	11	48806	K	216	
3	204394M	SPRING,HELICAL/COMPRSN (11,214# NOM)	2.0	2.00	EA	15.05 LB	12	204394	L	217	
3	204395D	CENTERING DEVICE,NEOPRENE	2.0	2.00	EA	0.46 LB	13	204395	E	218	
3	560104	NAMEPLATE,PATENT NUMBER(See IM Notes)	1.0	1.00	EA	0.00	14	560104	T	219	
3	RSW933-136	NAMEPLATE,C60PS2 DRIVE	1.0	1.00	EA	0.00	15	RSW933-136	A	220	
3	678805	INSTRUCTIONS,PREP/PAINT DRIVE (SP-6/73)	1.0	1.00	EA	0.00	16	678805	B	221	

GLV Indented Current BOM Report

BOM NUMBER: RSW933-132
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: DRIVE,C60PS2 (160K) (COMPLETE)

DRAWING NUM: RSW933-132

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
3	582723	PLATE,LUBRICANT WARNING,RED VINYL	3.0	3.00	EA	0.00	17	582723	E	222
3	RSW891-139	MODIFICATION,C60PS2 MAIN GEAR COVER	1.0	1.00	EA	397.00 LB	18	RSW891-139	A	225
3	RSW891-165	ATTACHMENT,GEAR CAGE,STL (MACHINING)	1.0	1.00	EA	988.00 LB	19	RSW891-165	A	226
3	NOTES	SPECIFICATIONS & INSTRUCTIONS	1.0	1.00	EA	0.00 LB	998	N/A		224
Jobmatl Notes										
NOTES:										
1. ALL COMPONENTS TO BE MANUFACTURED IN COMPLIANCE WITH WORKMANSHIP STANDARD ES0001.										
2. INSTALL ITEMS 14 & 15 ONTO CHAIN GUARD.										
3. DRIVE CONTROL SWITCH SETTINGS:										
#1 - 55%, #2 - 50% , #3 - 100% #4- 100%										
4. ASSEMBLE AND TEST RUN PRIOR TO SHIPMENT. PERFORM OIL SEAL TEST OF WORM ASSEMBLY PER INSTRUCTIONS - DRAWING 588768.										
5. COAT ALL MACHINED SURFACE WITH LPS #3.										
6. PROTECT ALL SEAL SURFACES AS REQUIRED BEFORE FINAL PAINT.										
7. THE WORM SHAFT AREA THAT PASSES THROUGH THE WORM SHAFT SEAL IS TO BE CLEANED TO ALLOW FOR 3/4" WORM SHAFT TRAVEL. COAT THIS AREA WITH LPS # 3 OR GREASE.										
8. PACKAGE AS REQUIRED FOR SAFE SHIPMENT.										
9. DRIVE DATA:										
0.0156 RPM , (2) 3/4 HP, 160K TORQUE										
SHEAR PINS SET TO SHEAR AT 106,716 FT-LBS (53,358 EACH) 67%										
10. ATTACH ITEM 17 "LUBE WARNING TAG" TO DRIVE OIL FILL PLUGS. - ONE ON EACH WORM AND MAIN GEAR HOUSING.										
11. MAIN GEAR COVER (ITEM 3 ON DRAWING # 768353) TO BE MODIFIED ACCORDING TO DRAWING NO. RSW891-139 (ITEM 18).										
12. GEAR CAGE ATTACHMENT (ITEM 2 ON DRAWING # 768353) TO BE REPLACED WITH PART NO. RSW891-165 (ITEM 19). ORIGINAL GEAR CAGE ATTACHMENT TO BE RETURNED TO INVENTORY.										
3	ECO	ENGINEERING CHANGE ORDER	1.0	1.00	EA	0.00	999	N/A	A	223

GLV Indented Current BOM Report

BOM NUMBER: RSW933-132
TOP PARENT: RSW0000933-01
REQ QTY - 1

DESCRIPTION: DRIVE,C60PS2 (160K) (COMPLETE)

DRAWING NUM: RSW933-132

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
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Jobmatl Notes

ECO-S-012535 (REV A) - INITIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: RSW891-133
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60PS2 MOTOR DRIVE w/SHEAR PIN

DRAWING NUM: RSW891-133

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
4	DRAWINGS	ASSEMBLY & REFERENCE	1.0	2.00	EA	0.00 LB	0	N/A		26
	Jobmatl Notes									
	RSW891-133 - C60PS2 MOTOR DRIVE ASSEMBLY w/SHEAR PIN SPROCKET									
4	699047B3	GEARMOTOR,3/4 HP,20 RPM,SK573.1	1.0	2.00	EA	0.00	1	699047	A	7
4	1108491-01	GUARD,CHAIN,STL/GALV 18 GA,C/W COVER-922	1.0	2.00	EA	25.00 LB	4	1108491	K	8
4	86143H	SPROCKET,16T,T/L 4.220D/3.845P w/o BSHG	1.0	2.00	EA	0.00 LB	5	86143	F	9
4	85844U	BUSHING,TAPER-LOCK,1-3/8B, 5/16x5/32KST	1.0	2.00	EA	1.00 LB	6	85844	C	10
4	678876A	SPROCKET,SHEAR PIN ASSY,54T (SP22)	1.0	2.00	EA	0.00	7	678876	B	11
4	F24337	CAPSCREW,HX HD,304 1/2-13X1	14.0	28.00	EA	0.00 LB	9	N/A	_+	27
4	F50474	WSHR,PLN TYPE A-N,304 1/2	14.0	28.00	EA	0.00 LB	10	N/A	_+	28
4	591914	PLUG,PIPE,VENTED,2" NPT,304 SS	1.0	2.00	EA	0.00	11	591914	B	29
4	F24599	CAPSCREW,HX HD,304S/S,1/2-13x1-1/4	2.0	4.00	EA	0.00 LB	12	N/A	_+	30
4	F50473	NUT,HX,304S/S,1/2-13	7.0	14.00	EA	0.00 LB	13	N/A	_+	12

GLV Indented Current BOM Report

BOM NUMBER: RSW891-133
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60PS2 MOTOR DRIVE w/SHEAR PIN

DRAWING NUM: RSW891-133

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
4	560128	PLATE,LUBRICATION,SPECS & INSTR.(922)	1.0	2.00	EA	0.00	14	560128	H	20
4	204181A	SIGN,CAUTION,SS(FOLLOW_I NSTRUCTIONS)	1.0	2.00	EA	0.18 LB	15	204181	B	19
4	F50573	RIVET POP #44 1/8"x.188-.250 AL	14.0	28.00	EA	0.50 LB	16	N/A		21
4	84640A	PLATE INSTRUCTION SS (ARROW)(922)	1.0	2.00	EA	1.00 LB	17	84640	C	17
4	F17171	CAPSCREW,HX HD,304 1/2-13X1 3/4	4.0	8.00	EA	0.00 LB	18	N/A	_+	31
4	F50473	NUT,HX,304S/S,1/2-13	4.0	8.00	EA	0.00 LB	19	N/A	_+	13
4	86603H	CHAIN,ROLLR,#60,3/4P RIVETD(160 LNKS/BX)	83.0	166.00	LNK	10.50 LB	20	86603	C	15
4	86605H	LINK,CONNECTING,STL,#60 3/4P/COTTER(922)	1.0	2.00	EA	0.06 LB	21	86605	C	16
4	852263A	NAMEPLATE,INSTRUCTION, (WARNING)(922)	1.0	2.00	EA	0.00 LB	22	852263	B+	18
4	678876-05	PIN,SHEAR,9/64	12.0	24.00	EA	0.00	23	678876	B	14
4	699115A	MOUNT,GEARMOTOR (DRIVE),304SS	1.0	2.00	EA	14.00 LB	24	699115	D	32
4	699115B	MOUNT,GEARMOTOR (R57 & R67 RDR),304SS	1.0	2.00	EA	6.00 LB	25	699115	D	33

GLV Indented Current BOM Report

BOM NUMBER: RSW891-133
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60PS2 MOTOR DRIVE w/SHEAR PIN

DRAWING NUM: RSW891-133

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
4	F50443	CAPSCREW,HX HD,304 3/8-16X1	4.0	8.00	EA	0.00 LB	26	N/A	_ +	35
4	F12042	NUT,HX,304S/S,3/8-16	4.0	8.00	EA	0.00 LB	27	N/A		24
4	F50468	WASHER PLN TYPE A-N 3/8" 304SS	8.0	16.00	EA	0.00 LB	28	N/A		23
4	766886	TAG,OVERFILL LUBRICANT WARN,YELLOW VINYL	1.0	2.00	EA	0.00	29	766886	B	34
4	F50443	CAPSCREW,HX HD,304 3/8-16X1	4.0	8.00	EA	0.00 LB	30	N/A	_ +	22
4	F50468	WASHER PLN TYPE A-N 3/8" 304SS	4.0	8.00	EA	0.00 LB	31	N/A		36
4	ECO	ENGINEERING CHANGE ORDER	1.0	2.00	EA	0.00	999	N/A	A	25

Jobmatl Notes

ECO-S-011845 (REV A) - INITIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: 768353
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60PS2 DRIVE (CAST BASE)

DRAWING NUM: 768353

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
4	DRAWINGS	ASSEMBLY & REFERENCE	1.0	1.00	EA	0.00 LB	0	N/A		38
	Jobmatl Notes									
	768353 - C60PS2 DRIVE ASSEMBLY (CAST BASE)									
4	766661	BASE,C60P1D/P2D,CI ASTM A48 (MACH.-CAST)	1.0	1.00	EA	2,612.00 LB	1	766661	B	39
4	115762A	CAGE ATTACH,GEAR,C60P/C60B2P (MACHINE)**	1.0	1.00	EA	1,677.00 LB	2	115762 + L115228-1	D	40
	Item Notes									
	WORK WITH / L115228-1 QTY. 1 CAGE ATTACH,GEAR,WELD									
4	768342	COVER,MAIN GEAR w/CAST PEDESTAL,STL**	1.0	1.00	EA	400.00 LB	3	768342	C	49
	Item Notes									
	(C60P1D/P2D) (MACHINING)									
4	115066H	BEARING,PRECISION,C60P,4P NT (988),(cp)	1.0	1.00	EA	700.00 LB	4	115066	U	50
4	766160	GEAR,MAIN (HARD),STL(MACH) (C60P/C60B2P)	1.0	1.00	EA	1,668.00 LB	5	766160	B	51
4	F12352	CAPSCREW,SKT HD ALLOY 5/8-11X4 1/4	80.0	80.00	EA	0.42 LB	6	N/A		52
4	88683C	SEAL LIP/FT NEOP/PARAFFIN	20.0	20.00	FT	0.12 LB	7	88683	F	53
4	F12351	CAPSCREW,SKT HD ALLOY 5/8-11X1 3/4	40.0	40.00	EA	0.00	8	N/A		54

GLV Indented Current BOM Report

BOM NUMBER: 768353
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60PS2 DRIVE (CAST BASE)

DRAWING NUM: 768353

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
4	88721C	SEAL,LIP,NEOPRENE/PARAFFIN (922)	20.0	20.00	FT	1.00 LB	9	88721	G	55
4	88556C	CLAMP,BAND,1/2x.017xFT,SS(922)	20.0	20.00	FT	0.03 LB	10	88556	F	56
4	F50245	CLAMP WORM DRIVE,300/400,3/8**	4.0	4.00	EA	0.06 LB	11	N/A		57
4	84640A	PLATE INSTRUCTION SS (ARROW)(922)	1.0	1.00	EA	1.00 LB	12	84640	C	58
4	903155A	PLATE,LUBRICATION,1x2,STL (#1)	1.0	1.00	EA	0.20 LB	13	903155	D	59
4	F13749	SCREW U-DRIVE 18-8 # 4x1/4 SST (936)	4.0	4.00	EA	0.00 LB	14	N/A		60
4	M019191	NIPPLE,SCH40,304SS,1-1/2MPT xCLOSE	2.0	2.00	EA	0.00	15	N/A	_+	61
4	766634	TEE,PIPE,1-1/2x1-1/2x1/2" FPT,304 SS	1.0	1.00	EA	0.00	16	N/A		62
4	85779K	COCK,SQ HD,SCWD,1-1/2x4,125PSI,BRZ(922)	1.0	1.00	EA	3.50 LB	17	85779	D	63
4	M012666	NIPPLE,SCH 40,316S/S,1/2MPTx3	1.0	1.00	EA	1.00	18	N/A	_+	64
4	M015786	CPLG,RDCR,304 SS,1/2x3/8"FPT	1.0	1.00	EA	0.00	19	N/A		65
4	767333	GAUGE,OIL,STRAIGHT,BRASS	1.0	1.00	EA	0.00	20	767333	C	66

GLV Indented Current BOM Report

BOM NUMBER: 768353
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60PS2 DRIVE (CAST BASE)

DRAWING NUM: 768353

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
4	M022457	CAPSCREW,HX HD,1"-12 UNFx2" LG,GR8 STL	4.0	4.00	EA	0.00	21	N/A		67
4	766649	CAPSCREW,SKT FLT HD,3/4"-10UNCx3",304 SS	20.0	20.00	EA	0.00	22	N/A		68
4	F60146	BEARING,CYL RLR,UNMTD,95MM ID(cp)	2.0	2.00	EA	15.85 LB	23	N/A		72
4	46767BX	RING,RETAINING,STL,3.750 (EXT) (922)	2.0	2.00	EA	1.00 LB	24	46767	S	73
4	591914	PLUG,PIPE,VENTED,2" NPT,304 SS	3.0	3.00	EA	0.00	25	591914	B	74
4	M023812	PLUG,PIPE,SQ HD,SOLID,304 SS,1-1/2MPT	2.0	2.00	EA	0.00	26	N/A	_ +	75
4	767875	RING,SNAP (5/8"),ZINC PLATED STEEL	2.0	2.00	EA	0.00	28	767875	A	133
4	768387	PLATE,ADAPTER,A36 STEEL (WR GR TO BASE)	2.0	2.00	EA	57.00 LB	29	768387	A	70
4	768389	ASSY,WORM GEAR,C60P w/OUT SEC. DRIVE	2.0	2.00	EA	0.00	30	115209	A	76
4	203507A	COVER,WORM GEAR,STL,C40**	2.0	2.00	EA	60.00 LB	31	203507	F	138

Item Notes

(WELD CPLG ON THE FRONT OF COVER)

GLV Indented Current BOM Report

BOM NUMBER: 768353
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60PS2 DRIVE (CAST BASE)

DRAWING NUM: 768353

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
4	F24337	CAPSCREW,HX HD,304 1/2-13X1	18.0	18.00	EA	0.00 LB	32	N/A	_ +	139
4	F50474	WSHR,PLN TYPE A-N,304 1/2	18.0	18.00	EA	0.00 LB	33	N/A	_ +	140
4	M016688	CAPSCREW,HX HD,304 3/4-10X2 1/2	8.0	8.00	EA	0.00 LB	34	N/A	A	141
4	F11747	NUT,HX,304SS,3/4-10 UNC	16.0	16.00	EA	0.00	35	N/A		69
4	F16762	CAPSCREW,HX HD,304 5/8-11X1 3/4	16.0	16.00	EA	0.00 LB	36	N/A	_ +	71
4	F15751	WASHER,PLN,A-N,304SS,5/8	16.0	16.00	EA	0.00 LB	37	N/A	_ +	142
4	88931J	GAUGE,OIL,EL,BRS 3/8NPT,3-1/2"SIGHT(922)	2.0	2.00	EA	0.28 LB	38	88931	C	144
4	768199	BUSHING,HX,1/2MPTx3/8 FPT,304 SS	2.0	2.00	EA	0.00	39	N/A		145
4	F10804	NIPPLE,SCH 40,1/2"MPTx3"LG,304 SS	2.0	2.00	EA	1.00 LB	40	N/A	A	146
4	M012291	ELL,90,STD,HDG 1/2FPT	2.0	2.00	EA	1.00 LB	41	N/A	_ +	147
4	M028690	NIPPLE,SCH 40,304 SS,1/2MPTX6	2.0	2.00	EA	0.00 LB	42	N/A	-	148
4	24557A365A	VALVE,BALL (CAPRI),1/2" NPT,BRONZE	2.0	2.00	EA	0.00	43	24557A365	D	149
4	M020452	PLUG,PIPE,SQ HD,SOLID, 304SS,3/4MPT	2.0	2.00	EA	0.00	44	N/A	_ +	150

GLV Indented Current BOM Report

BOM NUMBER: 768353
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60PS2 DRIVE (CAST BASE)

DRAWING NUM: 768353

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
4	87549D	BOLT,DROP FORGED EYE,6-11/16",CS	2.0	2.00	EA	2.42 LB	45	87549	D	151
4	F10867	NUT,HEX,3/4-10,GR5	2.0	2.00	EA	0.00 LB	46	N/A	A	152
4	M025704	WSHR,PLN TYPE A-N,304 SS,1"	2.0	2.00	EA	0.00	47	N/A	A +	153
4	88427D	SPACER,316 SS,11GAx3-3/4x7-1/4	16.0	16.00	EA	0.89 LB	100	88427	B	134
4	88427F	SPACER,316 SS,16GAx3-3/4x7-1/4	16.0	16.00	EA	0.46 LB	101	88427	B	135
4	88962A	SEALANT ULTRA BLUE	1.0	1.00	EA	1.00 LB	102	88962	A	143
4	49115F	SHIM PACKAGE,C60P/C60B2P	1.0	1.00	EA	15.30 LB	103	49115	C	136
4	ECO	ENGINEERING CHANGE ORDER	1.0	1.00	EA	0.00	999	N/A	A	137

Jobmatl Notes

ECO-S-011317 (REV A) - INITIAL RELEASE

ECO-S-012222 (REV B) - REVISED P/N OF BUBBLE #36 (WAS P/N F50535; QTY. 16; IS NOW P/N F16762; QTY. 16)

ECO-S-012256 (REV C) - ADDED WORM HOUSING PLUMBING, EYE BOLTS BUBBLE #'s 38 - 47 & ADDED VIEW 'D' TO DRAWING & REVISED P/N OF C60P MAIN GEAR (WAS 114933F4A; QTY. 1; IS NOW P/N 766160; QTY. 1)

GLV Indented Current BOM Report

BOM NUMBER: 768389
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,WORM GEAR,C60P w/OUT SEC. DRIVE

DRAWING NUM: 115209

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq	
5	DRAWINGS	ASSEMBLY & REFERENCE	0.0	0.00	EA	0.00 LB	0	N/A		100	
	Jobmatl Notes										
	115209 - WORM GEAR ASSY										
	115713 - DRIVE CONTROL INSTALL & ADJUSTMENT										
5	111663B5A	HSG,WORM GEAR,CI, 21-1/2"P.D.,(cp)	1.0	2.00	EA	276.00 LBS	1	111663-5	N	78	
	Jobmatl Notes										
	/ (1) P/N 111663B, DWG NO. 111663 HOUSING,WORM GEAR,B50,CASTING,CI										
5	204382A1A	CAP,END,CI ASTM A48,CLASS 40A,(cp)	1.0	2.00	EA	53.00 LB	2	204382-1	D	83	
	Jobmatl Notes										
	/ (1) P/N 204382A, DWG NO. 204382 END CAP,ASTM A48,CAST,CI										
5	L202316	ASSY,HOUSING,BUSHING,CI(9 22)	1.0	2.00	EA	24.32 LB	3	202316	F	114	
5	204169A	SEAT,BRG,SLIDING,STL (922)	1.0	2.00	EA	9.88 LB	5	204169	D	81	
5	L203243-3	ASSY,WORM GEAR RH (695) (cp)	1.0	2.00	EA	226.00 LB	8	203243	N	120	
5	697489	PINION,MAIN & SHAFT,C60P w/OUT SEC.	1.0	2.00	EA	222.00 LBS	10	697489	A	82	
5	202306A	WORM & SHAFT,STL 21 1/2PD(cp)	1.0	2.00	EA	37.00 LB	11	202306	H	79	
5	48686F	ROD,STOP,STL	1.0	2.00	EA	2.20 LB	13	48686	F	90	
5	F60073	BEARING,BALL,UNMTD,ANG CONT SGL(922)**	1.0	2.00	EA	0.70 LB	14	N/A		110	

GLV Indented Current BOM Report

BOM NUMBER: 768389
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,WORM GEAR,C60P w/OUT SEC. DRIVE

DRAWING NUM: 115209

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
5	88887A	SCREW,SPRING ADJUSTING,C&W,STL	1.0	2.00	EA	3.34 LB	15	88887	D	95
5	86213A	SCREW,STOP,STL(922)	1.0	2.00	EA	0.46 LB	16	86213	G	93
5	86196A	SEAT,SPRING,STL (922)(cp)	1.0	2.00	EA	4.00 LB	17	86196	G	92
5	86223A	PLUG,STL,5/8NF(922)	2.0	4.00	EA	0.12 LB	19	86223	C	94
5	8997A	PLATE,COVER,304 SS 10 GA,12/21-1/2(922)	1.0	2.00	EA	0.25 LB	20	8997	E	97
5	88890A	GUIDE,BEARING,STL	1.0	2.00	EA	0.68 LB	21	88890	B	96
5	903155C	PLATE,LUBRICATION,1x2,STL (#2)	1.0	2.00	EA	0.01 LB	23	903155	D	99
5	49045A	NAMEPLATE,END CAP,WARNING SIGN(922)	1.0	2.00	EA	0.08 LB	24	49045	C	91
5	8998A	GASKET,COVER PLATE,NEOPRENE,1/16(922)	1.0	2.00	EA	0.02 LB	27	8998	D	98
5	203725M	RING, STL 3.36X.32	1.0	2.00	EA	0.84 LB	28	203725	AA	80
5	40463E	KEY,SQ,3/8-16 TAP, C1018, 3/4x3-5/8(922)	1.0	2.00	EA	0.56 LB	29	40463	D	85
5	46758AR	SEAL,OIL,3.001"OD 2-3/16" SHAFT (922)	2.0	4.00	EA	0.10 LB	33	46758	W	86
5	46763K	SEAL,OIL,1/2 X 5.381 O.D.(922)	2.0	4.00	EA	0.55 LB	34	46763	P	87

GLV Indented Current BOM Report

BOM NUMBER: 768389
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,WORM GEAR,C60P w/OUT SEC. DRIVE

DRAWING NUM: 115209

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
5	F60045	BRNG,BALL,UNMTD ANG CONT SGL RW,45MM(cp)	2.0	4.00	EA	3.88 LB	37	N/A		109
5	F60131	BEARING,BALL,UNMTD ANG CONT ID(922)(cp)	1.0	2.00	EA	6.75 LB	38	N/A		112
5	F60129	BRNG,NDL RLR,UNMTD, INR RACE,3.25ID(cp)	1.0	2.00	EA	1.56 LBS	39	N/A		111
5	F60148	BRNG,NDL RLR,UNMTD, OTR RACE,3.75ID(cp)	1.0	2.00	EA	2.85 LBS	40	N/A	A	113
Jobmatl Notes										
THIS IS ACTUALLY PART OF ITEM 39.										
5	46766BD	RING,RETAINING,STL,6.000"(I NTERNAL)(922)	1.0	2.00	EA	0.14 LB	42	46766	K	88
5	46767BP	RING,RETAINING,STL,3.250(E XTERNAL)(922)	1.0	2.00	EA	0.06 LB	43	46767	S	89
5	F10943	PLUG,PIPE,SQ HD,MS, 1/2MPT,SOLID(922)	1.0	2.00	EA	0.00 LB	46	N/A	A	104
5	F10948	PLUG,PIPE,SQ SKT,MS, 1-1/2MPT,SOLID(922)	2.0	4.00	EA	0.46 LB	48	N/A	A	105
5	F17031	CAPSCREW,SKT FLT HD ALLOY 1/2-13X1	1.0	2.00	EA	0.00	54	N/A	_+	107
5	F10084	CAPSCREW,HX HD,GR5, 3/4-10x9-1/2	4.0	8.00	EA	0.00 LB	56	N/A		101

GLV Indented Current BOM Report

BOM NUMBER: 768389
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,WORM GEAR,C60P w/OUT SEC. DRIVE

DRAWING NUM: 115209

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
5	F10224	CAPSCREW,HX HD,GR5, 3/4-10x2-1/4	4.0	8.00	EA	0.00 LB	57	N/A		102
5	F10257	CAPSCREW,HX HD,GR5, 1/2-13x3/4	2.0	4.00	EA	0.07 LB	59	N/A		103
5	F13749	SCREW U-DRIVE 18-8 # 4x1/4 SST (936)	6.0	12.00	EA	0.00 LB	61	N/A		108
5	F11055	SETSCRW,SKT-HDLS-CP-PT, ALLOY,1/2-13x3/4	1.0	2.00	EA	0.00	62	N/A		106
5	F11851	WASHER,FLAT,THRU HDN,F436,3/4 STD	8.0	16.00	EA	0.04 LB	63	N/A		132
5	86953AT	KEY,SQ,C1018/1035 1/2X4	1.0	2.00	EA	0.25 LB	64	86953	D	131
		Jobmatl Notes TAPE TO WORM SHAFT FOR SHIPPING								
5	ECO	ENGINEERING CHANGE ORDER	1.0	2.00	EA	0.00	999	N/A	A	77
		Jobmatl Notes ECO-S-011845 (REV A) - INITIAL RELEASE								

GLV Indented Current BOM Report

BOM NUMBER: 204382A1A
TOP PARENT: RSW0000933-01
REQ QTY - 1

DESCRIPTION: CAP,END,CI ASTM A48,CLASS 40A,(cp)

DRAWING NUM: 204382-1

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
6	204382A	END CAP,ASTM A48,CASTING	1.0	2.00	EA	54.00 LB	1	204382	E	84

GLV Indented Current BOM Report

BOM NUMBER: L202316
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,HOUSING,BUSHING,CI(922)

DRAWING NUM: 202316

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
6	DRAWINGS	ASSEMBLY & REFERENCE	1.0	2.00	EA	0.00 LB	0	N/A		115
	Jobmatl Notes									
	202316 - BUSHING HOUSING ASSEMBLY									
6	202315A1A	HOUSING,BUSHING,CI (MACHINING)**	1.0	2.00	EA	24.00 LB	1	202315-1	H	118
6	80115A	BUSHING,WORM SHAFT BRZ,2-3/4(922)	1.0	2.00	EA	3.00 LB	2	80115	F	117
6	ECO	ENGINEERING CHANGE ORDER	1.0	2.00	EA	0.00	999	N/A	A	116

Jobmatl Notes

EN 95-5551 (REV A) - REVISED
 EN 12685 (REV B) - REVISED NOTE 1
 EN 26299 (REV C)
 EN 14322 (REV C) - RELEASED INTO EBOM
 EN 34813 (REV D) - UPDATED TITLE BLOCK
 ECO-S-004143 (REV E) - ASSEMBLY DRAWING & BOM REVISED TO REVISION LEVEL E (DRAWING WAS CONVERTED TO INVENTOR)
 ECO-S-009337 (REV F) - UPDATED TITLE BLOCK

GLV Indented Current BOM Report

BOM NUMBER: 202315A1A
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: HOUSING,BUSHING,CI (MACHINING)**

DRAWING NUM: 202315-1

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
7	202315A	HOUSING,BUSHNG,CI,ASTM A48 CLASS 30A 34#	1.0	2.00	EA	34.00 LB	1	202315	D	119

GLV Indented Current BOM Report

BOM NUMBER: L203243-3
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,WORM GEAR RH (695)(cp)

DRAWING NUM: 203243

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
6	DRAWINGS	ASSEMBLY & REFERENCE	1.0	2.00	EA	0.00 LB	0	N/A		121
	Jobmatl Notes									
	203243 - WORM GEAR ASS'Y									
6	204060A1A	RIM,WORM GEAR,W21P, BRZ-SELL w/ASSY ONLY	1.0	2.00	EA	91.00 LB	1	204060-1	D	123
6	204230A1A	HUB,WORM,CI 21-1/2(SELLw/ASSY ONLY)(cp)	1.0	2.00	EA	100.00 LB	2	204230-1	F	128
6	F10102	CAPSCREW,HX HD,GR5, 5/8-11x2-1/2	6.0	12.00	EA	0.26 LB	3	N/A		127
6	F50568	WASHER,FL,THRU HDN, CLIPPED,F436,5/8	12.0	24.00	EA	0.02 LB	4	N/A		126
6	F10871	NUT,HX,GR5,5/8-11	6.0	12.00	EA	0.00 LB	5	N/A		125
6	NOTES	SPECIFICATIONS & INSTRUCTIONS	0.0	0.00	EA	0.00 LB	997	N/A		130
	Jobmatl Notes									
	SHOP ASSEMBLE - DO NOT FURNISH INDIVIDUAL PARTS AS REPLACEMENT OR SPARE PARTS.									
6	ECO	ENGINEERING CHANGE ORDER	1.0	2.00	EA	0.00	999	N/A	A	122
	Jobmatl Notes									
	D/R 6040,6446,6954,6982									
	EN 96-3159 (REV K) - ADDED ITEM 8; CHANGED QTY FROM 12 TO 6 ON ITEM 7.									
	EN 26299 (REV L) -									
	EN 14464 (REV L) - MOVED TO EBOM									
	EN 35915 (REV M) - CHANGED ITEM 7 WAS M038402 NOW F50568 & UPDATED TITLE BLOCK									
	ECO-S-009430 (REV N) - UPDATED TITLE BLOCK									

GLV Indented Current BOM Report

BOM NUMBER: 204060A1A
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: RIM,WORM GEAR,W21P, BRZ-SELL w/ASSY ONLY

DRAWING NUM: 204060-1

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
7	204060A	RIM,WORM GEAR,CAST,W21P,BRZ 21 1/2	1.0	2.00	EA	152.00 LB	1	204060	B	124

GLV Indented Current BOM Report

BOM NUMBER: 204230A1A
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: HUB,WORM,CI 21-1/2(SELLw/ASSY ONLY)(cp)

DRAWING NUM: 204230-1

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
7	204230A	HUB,WORM GEAR,CASTING,CI**	1.0	2.00	EA	138.00 LB		204230	D	129

Item Notes

ASTM A48 CLASS 40A

GLV Indented Current BOM Report

BOM NUMBER: L115759-1
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: DRIVE CONTROL,4SPDT,RH,w/o POT

DRAWING NUM: 115759

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq	
4	DRAWINGS	ASSEMBLY & REFERENCE	0.0	0.00	EA	0.00 LB	0	N/A		183	
	Jobmatl Notes										
	115759 REV. Y = DRIVE CONTROL WEATHER PROOF ENCLOSURE ASSY										
	115713 = DRIVE CONTROL INSTALLATION AND CALIBRATION INSTRUCTIONS										
4	L48929-2	COVER,DRIVE CONTROL,WELD/MACH(435)	1.0	2.00	EA	0.00 LB	1	48929	E	201	
4	115595A2A	HOUSING,DRIVE CONTROL,MACH,CAST ALUM	1.0	2.00	EA	8.20 LB	2	115595-2	E	158	
4	204163A	HOUSING,INDICATOR,DC,ACR YLIC (CLEAR)	1.0	2.00	EA	0.30 LB	3	204163	B	159	
4	48993A1A	PLATE,MNTG,ALUM 380 (MACH.)(DR CNTRL)	1.0	2.00	EA	4.00 LB	5	48993-1	E	161	
4	906433A	INDICATOR POINTER DRIVE CONTROL	1.0	2.00	EA	0.00 LB	7	906433	C	160	
4	L49080-1	ASSY,SHAFT	1.0	2.00	EA	0.00 LB	9	49080	C	194	
4	88932A	CAM,DRIVE CONTROL,PHENOLIC (435)	4.0	8.00	EA	0.00	10	88932	C	173	
4	88966A	PLATE,MOUNTING,SWITCH,P HENOLIC,3/16(435)	2.0	4.00	EA	0.00	11	88966	C	176	
4	88825A	SEPARATOR,INS,FISH PAPER,CONTROL	9.0	18.00	EA	0.00	13	88825	B	168	
4	88753A	PLATE,WASHER,DRIVE CONTROL,AL(435)	2.0	4.00	EA	0.00	14	88753	A	165	

GLV Indented Current BOM Report

BOM NUMBER: L115759-1
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: DRIVE CONTROL,4SPDT,RH,w/o POT

DRAWING NUM: 115759

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
4	M031655	STUD,THRD,BRS,#10-24x2 (435)	1.0	2.00	EA	0.00	15			206
4	M010848	NUT,HX,BRS,#10-24, (435)	3.0	6.00	EA	0.00	16			207
4	88845A	COLLAR,SET,303 SS (435)	1.0	2.00	EA	0.00 LB	19	88845	A	169
4	904311A	WSHR,NYLON,.75"ODx.385"IDx .062"THK(435)	5.0	10.00	EA	0.00	20	904311	A	181
4	88965A	BUSHING,FLANGED,BRZ,1/4(4 35)	1.0	2.00	EA	0.00	21	88965	0	175
4	F60004	BEARING,NDL RLR,UNMTD,.625ID(cp)(435)	1.0	2.00	EA	0.16 LB	23			193
4	88964A	WASHER,DC,NYLON,1"OD(435)	2.0	4.00	EA	0.10	25	88964	0	174
4	88819A	SWITCH MICRO DRIVE CONTROL 15AMP(435)	4.0	8.00	EA	0.06 LB	27	88819,	B	167
4	N/R6	NOT REQUIRED THIS ASSY	1.0	2.00	EA	0.00 LB	31	NOT REQUIRED	_ +	208
4	N/R7	NOT REQUIRED THIS ASSY	1.0	2.00	EA	0.00 LB	32	NOT REQUIRED	_ +	209
4	88925C	CAP,VINYL,RED,.172" (435)	2.0	4.00	EA	0.00	34	88925	B	172
4	88925A	CAP,VINYL,RED,.125" (435)	4.0	8.00	EA	0.00	35	88925	B	171
4	88859A	O-RING,BUNA N(435)	1.0	2.00	EA	0.01 LB	37	88859	0	170

GLV Indented Current BOM Report

BOM NUMBER: L115759-1
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: DRIVE CONTROL,4SPDT,RH,w/o POT

DRAWING NUM: 115759

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
4	89015A	ROD,THD,DRIVE CONTROL,316 (435)	2.0	4.00	EA	0.00	38	89015	0	177
4	89015C	ROD,THD,DRIVE CONTROL,316(435)	2.0	4.00	EA	0.00	39	89015	0	178
4	88584A	INHIBITOR,CORROSION	1.0	2.00	EA	0.01 LB	40	88584	A	179
4	85692A	SPRING EXT COIL SS 2L HEAVY WIRE (435)	1.0	2.00	EA	0.02 LB	41	85692	0	180
4	88754A	WASHER,RTNR,SPRING,DC,316 (435)	1.0	2.00	EA	0.06 LB	42	88754	B	166
4	N/R8	NOT REQUIRED THIS ASSY	1.0	2.00	EA	0.00 LB	43	N/A	_ +	210
4	86665S	PLUG,PIPE,1-1/4,INDEF PLASTIC(435)	1.0	2.00	EA	0.00	44	86665	E	164
4	82045R	CAPLUG,TYPE T,PE-RED,#6	4.0	8.00	EA	0.00	45	82045	F	163
4	M023596	WSHR,PLN TYPE A,316SS,#8X7/16X.049(435)	1.0	2.00	EA	0.00	47	N/A	_ +	214
4	591916	SCREW,SHOULDER,SOC HD,18-8 SS,3/16" X 1"	1.0	2.00	EA	0.00	48	591916	A	156
4	F14464	CAPSCREW,HX HD,316SS,1/4-20x1/2(435)	1.0	2.00	EA	0.00	49	N/A		187
4	M020654	WSHR,TYPE A-N,316,#10X9/16X.049(435)	1.0	2.00	EA	0.00	50	N/A		190

GLV Indented Current BOM Report

BOM NUMBER: L115759-1
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: DRIVE CONTROL,4SPDT,RH,w/o POT

DRAWING NUM: 115759

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
4	M023595	NUT,HEX,#8-32,316 SS (435)	1.0	2.00	EA	0.00	51	N/A	_ +	157
4	F14596	SHLD SCR,SKT HD ALLOY, 5/16x1-1/4(435)	1.0	2.00	EA	0.00	52			188
4	N/R9	NOT REQUIRED THIS ASSY	1.0	2.00	EA	0.00 LB	53	NOT REQUIRED	_ +	211
4	F16740	CAPSCREW,HX HD,316SS, #10-24x1(435)	2.0	4.00	EA	0.00	55			191
4	F50466	CAPSCREW,SKT HD,304,3/8-16x1(435)	4.0	8.00	EA	0.00	56			185
4	F14984	CAPSCREW,SKT BTN HD,1/2-13x1-1/4 (435)	2.0	4.00	EA	0.00	59	N/A		189
4	F10894	NUT,HX,316,#10-24, (435)	6.0	12.00	EA	0.00	63			184
4	F21594	NUT,HX,316 SS,#6-32 (435)	8.0	16.00	EA	0.00	64	N/A		192
4	F11204	WSHR,PLN,A-W,316SS,#10 (435)	2.0	4.00	EA	0.00	65	N/A		186
4	M012464	WASHER,PLN,TYPE A-N,316S/S,#6(435)	4.0	8.00	EA	0.00	66			199
4	F11204	WSHR,PLN,A-W,316SS,#10 (435)	2.0	4.00	EA	0.00	68	N/A		212
4	88937A	NAMEPLATE,DRV-CONTROL,T AG	1.0	2.00	EA	0.00	75	88937	E	215
4	905163A	NAMEPLATE,DRIVE CONTROL,MYLAR	1.0	2.00	EA	0.00	77	A586199	D	182

GLV Indented Current BOM Report

BOM NUMBER: L115759-1
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: DRIVE CONTROL,4SPDT,RH,w/o POT

DRAWING NUM: 115759

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
4	49067A	NAMEPLATE,,DR,3M MYLAR (435)	1.0	2.00	EA	0.00	78	49067	A	162
4	F50466	CAPSCREW,SKT HD,304,3/8-16x1(435)	1.0	2.00	EA	0.00	79			213
Jobmatl Notes										
TO BE USED TO LOCK THE DRIVE CONTROL TO THE MOUNTING PLATE AFTER ADJUSTING PER DRAWING 115713. SHOP DRILL AND TAP TOP OF MOUNTING PLATE AT OPEN HOLE IN DRIVE CONTROL 3/8-16UNC AND INSERT THIS SCREW.										
4	NOTES	SPECIFICATIONS & INSTRUCTIONS	0.0	0.00	EA	0.00 LB	98	N/A		200
Jobmatl Notes										
SHOP PAINTING INSTRUCTIONS: PAINT EXTERIOR OF BUBBLES 1 & 2 ONLY. PROTECT ALL THREADS AS REQUIRED. SURFACE PREP. SSPC-SP1 (SOLVENT CLEAN) SHOP PAINT ONE COAT OF TNEMEC 161-33GR WITH A MIN DRY FILM THICKNESS OF 4.0 TO 6.0 MILS.										
4	ECO	ENGINEERING CHANGE ORDER	1.0	2.00	EA	0.00	999	N/A	A	155

GLV Indented Current BOM Report

BOM NUMBER: L115759-1
TOP PARENT: RSW0000933-01
REQ QTY - 1

DESCRIPTION: DRIVE CONTROL,4SPDT,RH,w/o POT

DRAWING NUM: 115759

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
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Jobmatl Notes

D/R 6655,6683,6769,6781,6786,6876,6919,7007
 EN 96-1044 (REV G) - SEE EN.
 EN 96-4293 (REV H) - ITEM 25 QTY WAS 6
 EN 97-2912 (REV J) - ITEM 65 P/N F10894 AND 66 P/N M012464 ADDED TO PART LIST.
 EN 98-0686 (REV K) SEE EN.
 EN 98-2982 (REV L) SEE EN. ITEM 20 QTY 5 WAS 2, ITEM 25 QTY 2 WAS 5.
 EN 13242 (REV M) - CHANGE ITEM 41 FROM 901749A TO 85692A. ADD ITEM 40.
 EN 14464 (REV N) - MOVED TO EBOM
 EN 18754 (REV O) - ITEM 7 WAS 204217A
 EN 19858 (REV P) - ADDED ITEM 40
 EN 20301 (REV Q) - SEE EN. ITEM 13 QTY 9 WAS 8, ITEM 63 QTY 6 WAS 10, ADDED ITEMS 1,15,16,17,18,28,29,30,31,32,43,53,68 & 79; ITEM 56 WAS F11133.
 ECO-S-000065 (REV R) - BOM HAD BUBBLE ITEMS #48 & 51 ADDED; BOM HAD BUBBLE ITEM #56 CHANGED; DRAWING HAS BEEN REVISED TO "U" REVISION WITH NOTE #2 BEING REVISED AND NOTE #20 BEING DELETED.
 ECO-S-003511 (REV V) - BOM MATCHES THE DRWG AS REV V; ADDED BUBBLE #47; CHANGING P/N BUBBLE #50 (WAS F14988; IS NOW M020654)
 ECO-S-004143 (REV W) ADDED BUBBLE ITEMS 80, 81, 82, & 83 TO THE BOM; REVISED THE DRAWING ALSO. REMOVED BUBBLE ITEM #75 (P/N 88937A-NAMEPLATE,DRV-CONTROL,TAG).
 ECO-S-005382 (REV Y) DELETED BUBBLE ITEMS 80, 81, 82, & 83 FROM THE BOM; REVISED THE DRAWING ALSO.

GLV Indented Current BOM Report

BOM NUMBER: L49080-1
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: ASSY,SHAFT

DRAWING NUM: 49080

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq	
5	DRAWINGS	ASSEMBLY & REFERENCE	1.0	2.00	EA	0.00 LB	0	N/A		196	
	Jobmatl Notes										
	49080 - SHAFT ASS'Y, CERTIFIED										
5	49042C	SHAFT,304S/S,.375x7.31"LG,32-FINSH	1.0	2.00	EA	0.00 LB	1	49042	E	197	
5	F60000	BEARING,NDL RLR,UNMTD,INNER,.375ID	1.0	2.00	EA	1.00 LB	2			198	
5	REVISION	ENGINEERING CHANGES	1.0	2.00	EA	0.00 LB	99	N/A	-	195	
	Jobmatl Notes										
	EN 14389 (REV A) MOVED TO EBOM										
	REV C - REV'D UP TO MATCH DRWG FOR SL-7, 9-14-05 (LL)										

GLV Indented Current BOM Report

BOM NUMBER: RSW933-01M4
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: COLUMN/CAGE ADAPTERS & HANDRAIL

DRAWING NUM: RSW933-01M4

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq	
2	DRAWINGS	ASSEMBLY & REFERENCE	1.0	1.00	EA	0.00 LB	0	N/A		229	
	Jobmatl Notes										
	RSW933-01M4 - DRIVE CONVERSION STEEL (MASTER)										
	ES0001 - WORKMANSHIP STANDARDS										
	678805 - SURFACE PREP & PAINT NOTES										
	538300 - TAGGING INSTRUCTIONS										
2	RSW933-152	COLUMN/CAGE ADAPTERS & HANDRAIL	1.0	1.00	EA	0.00	1	RSW933-152	A	230	
2	88439A	TAG,SHIPPING IDENTIFICATION,TYVEK(WHITE)	10.0	10.00	EA	0.00	2	88439	G	248	
2	ECO	ENGINEERING CHANGE ORDER	1.0	1.00	EA	0.00	999	N/A	A	249	

Jobmatl Notes
 ECO-S-012535 (REV A) - INITIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: RSW933-152
 TOP PARENT: RSW000933-01
 REQ QTY - 1

DESCRIPTION: COLUMN/CAGE ADAPTERS & HANDRAIL

DRAWING NUM: RSW933-152

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq	
3	DRAWINGS	ASSEMBLY & REFERENCE	1.0	1.00	EA	0.00 LB	0	N/A		231	
	Jobmatl Notes										
	RSW933-152 - C60BHT TO C60PS2 DRIVE CONVERSION (GE)										
3	RSW891-171	ADAPTER,COLUMN,A36 STEEL	0.0	0.00	EA	502.00 LB	1	RSW891-171	A	232	
3	RSW891-172	ADAPTER,CAGE,A36 STEEL	0.0	0.00	EA	36.00 LB	2	RSW891-172	A	233	
3	RSW891-162	HANDRAIL,DRIVE COVER MOUNTED,ALUM.	1.0	1.00	EA	0.00	3	RSW891-162	A	243	
3	F50473	NUT,HX,304S/S,1/2-13	8.0	8.00	EA	0.00 LB	4	N/A	_+	234	
3	766665	ROD,ALL THRD,1"-8 UNC x20" LG,304 SS	4.0	4.00	EA	0.00	5	N/A	A	239	
3	F50536	NUT,HX,304SS,1-8	16.0	16.00	EA	0.00	6	N/A		240	
3	F50537	NUT,HX,JAM,304 1-8	8.0	8.00	EA	0.00	7	N/A	_+	241	
3	88427D	SPACER,316 SS,11GAx3-3/4x7-1/4	8.0	8.00	EA	0.89 LB	8	88427	B	238	
3	591145	CAPSCREW,HX HD,1-1/8"-7 UNCx2",304 SS	16.0	16.00	EA	0.00	9	N/A		236	
3	591144	WASHER,FLAT,TYPE A-W.1-1/8",304 SS	16.0	16.00	EA	0.00	10	N/A		237	
3	F11747	NUT,HX,304SS,3/4-10 UNC	0.0	0.00	EA	0.00	11	N/A		235	

GLV Indented Current BOM Report

BOM NUMBER: RSW933-152
 TOP PARENT: RSW0000933-01
 REQ QTY - 1

DESCRIPTION: COLUMN/CAGE ADAPTERS & HANDRAIL

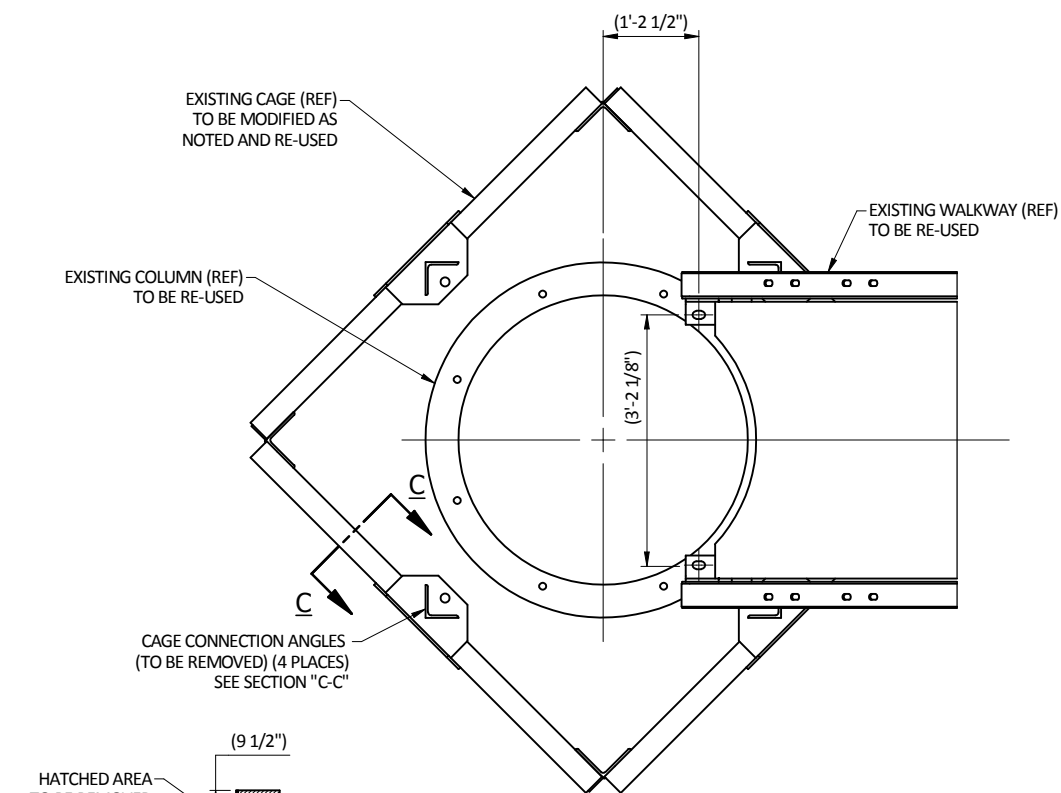
DRAWING NUM: RSW933-152

Lvl	Item	Description	Base QTY	Total Qty	U/M	Weight	Bub.	Drawing	Rev	Seq
3	F50535	CAPSCREW,HX HD,3/4-10x1-3/4" LG,304 SS	0.0	0.00	EA	0.00 LB	12	N/A	A	244
3	F50534	CAPSCREW,HX HD,304SS,3/4-10x2-3/4	0.0	0.00	EA	0.00	13	N/A	_ +	245
3	M024589	WASHER,PLN TYPE,A-W,3/4,304 SS	0.0	0.00	EA	0.00 LB	14	N/A		246
3	M017137	NUT,HX,304 SS,1-1/4-7	0.0	0.00	EA	0.00 LB	15	N/A	_ +	247
3	ECO	ENGINEERING CHANGE ORDER	1.0	1.00	EA	0.00	999	N/A	A	242

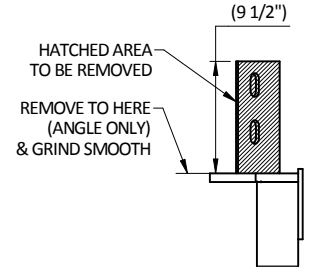
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ECO-S-012535 (REV A) - INITIAL RELEASE

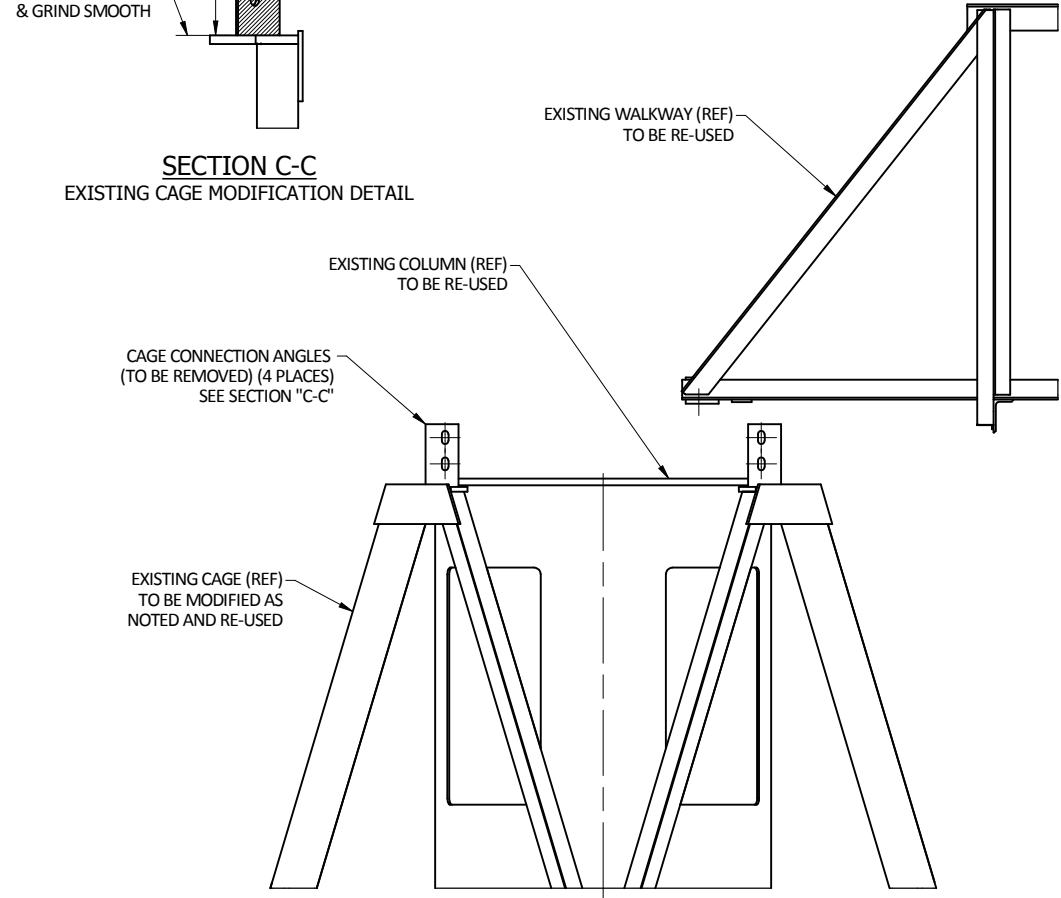
Drawings



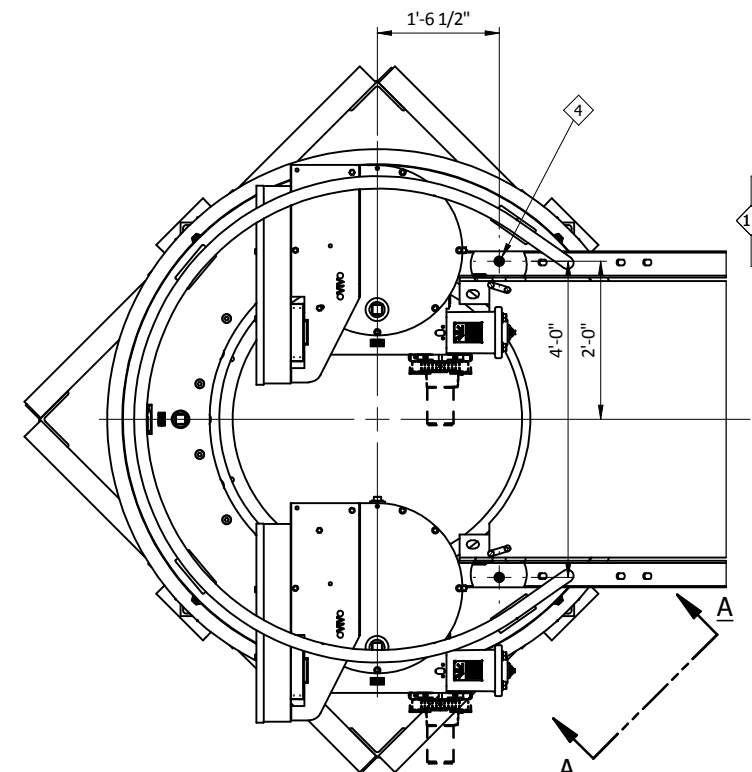
EXISTING CONDITIONS - PLAN VIEW
(DRIVE NOT SHOWN FOR CLARITY)



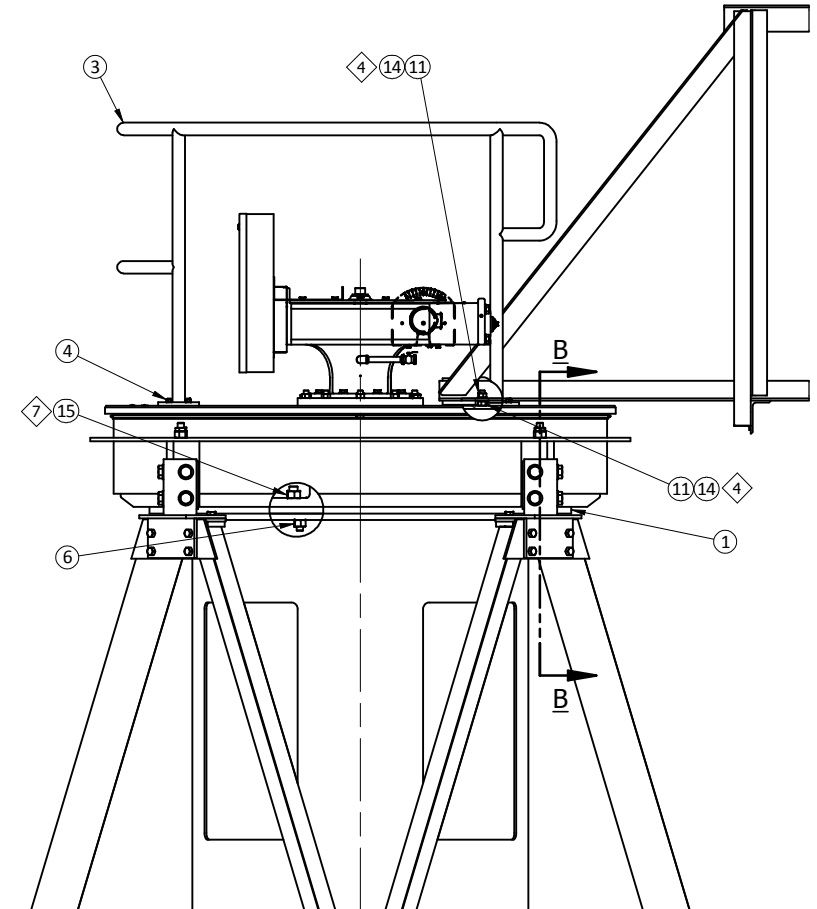
SECTION C-C
EXISTING CAGE MODIFICATION DETAIL



EXISTING CONDITIONS - ELEVATION VIEW
(DRIVE NOT SHOWN FOR CLARITY)

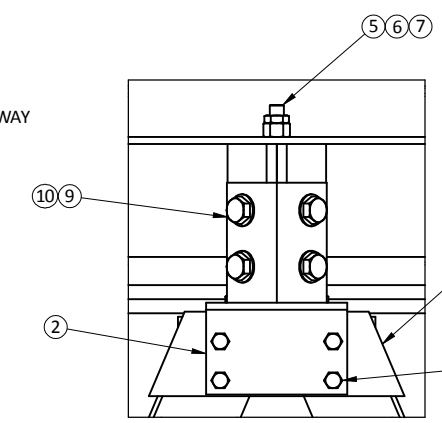


INSTALLED CONDITIONS - PLAN VIEW

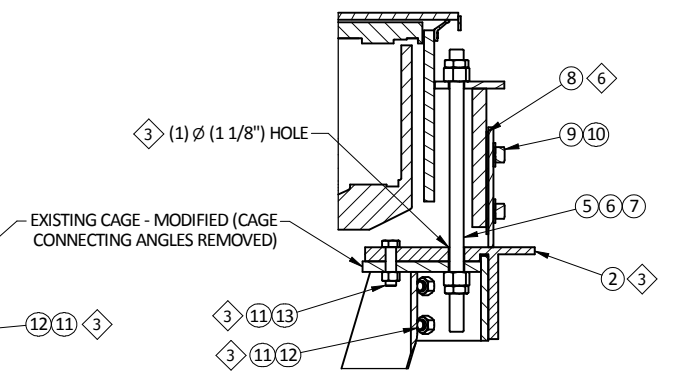


INSTALLED CONDITIONS - ELEVATION VIEW

ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER	DRAWING NO.	TOTAL WEIGHT
1	REF.	COLUMN ADAPTER	A36 STL	RSW891-171	RSW891-171	502
2	REF.	CAGE ADAPTER (C54B TO C60PS2)	A36 STL	RSW891-172	RSW891-172	143
3	1	HANDRAIL, DRIVE COVER	Aluminum-6061	RSW891-162	RSW891-162	33
4	8	HEX NUT 1/2"-13 UNC	304 SS	F50473	N/A	0
5	4	THREADED ROD, (ALL THREAD), 1"-8 UNC x 20" LG.	304 SS	766665	N/A	18
6	16	NUT, HEX 1"-8 UNC	304 SS	F50536	N/A	8
7	8	NUT, HEX JAM, 1"-8 UNC	304 SS	F50537	N/A	2
8	8	SPACER, CAGE TO DRIVE	316 SS	88427D	88427	1
9	16	CAPSCREW, HEX HD, 1 1/8"-7 UNC x 2" LG	304 SS	591145	N/A	17
10	16	WASHER, PLAIN, TYPE A-N, 1 1/8"	304 SS	591144	N/A	2
11	REF.	HEX NUT 3/4"-10 UNC	304 SS	F11747	N/A	4
12	REF.	CAPSCREW, HX HD, 3/4"-10UNC x 1 3/4" LG.	304 SS	F50535	N/A	6
13	REF.	CAP SCREW, HEX HD, 3/4"-10UNC x 2 3/4"	304 SS	F50534	N/A	4
14	REF.	WASHER, TYPE A-W 3/4"	304 SS	M024589	N/A	0
15	REF.	NUT, HEX, 1 1/4"-7 UNC	304 SS	M017137	N/A	9



SECTION A-A
CAGE ADAPTER ASSEMBLY (4 PLACES)



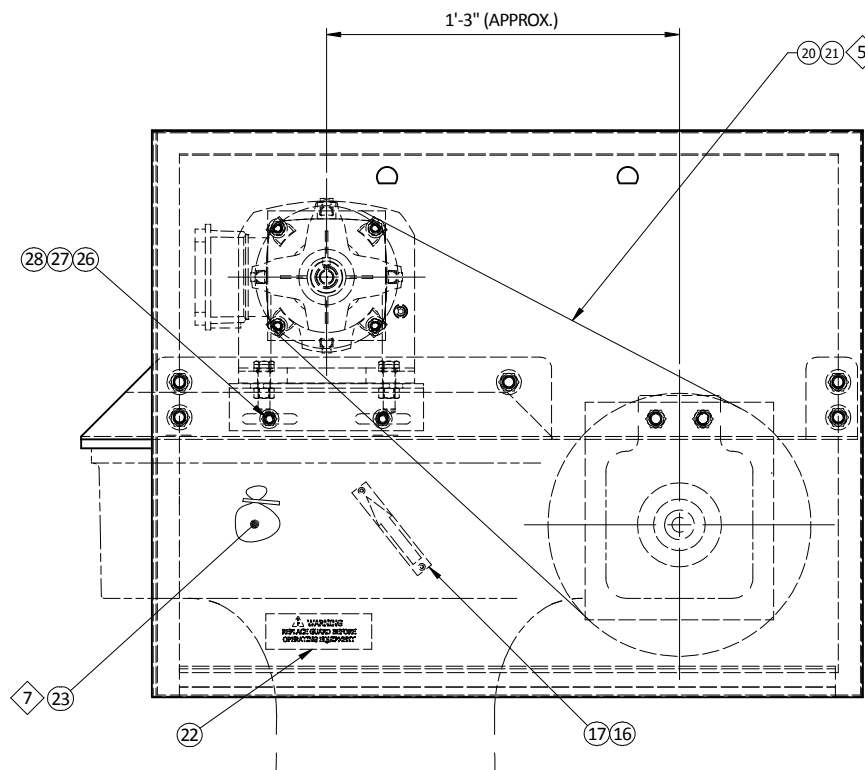
SECTION B-B
DRIVE TO CAGE ADAPTER TO MODIFIED CAGE (4 PLACES)

NOTES:

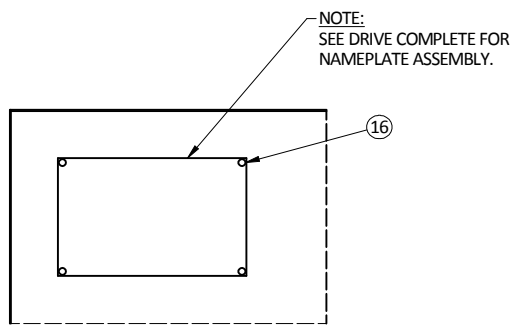
- THIS ERECTION DRAWING DEPICTS THE REPLACEMENT OF A C54B WITH A C60PS2 DRIVE UNIT.
- CUTTING, DRILLING & GRINDING OF THE WALKWAY & CAGE ARE NECESSARY.
- AFTER THE REMOVAL OF CAGE CONNECTING ANGLES (SEE SECTION "C-C"), MATCH DRILL (6) Ø13/16" HOLES, AND (1) Ø1 1/8" HOLE IN EXISTING CAGE SIDE AND TOP PLATES USING CAGE ADAPTER (ITEM 2) AS A GUIDE TO ALLOW FOR ATTACHING CAGE ADAPTERS (ITEM 2) USING SUPPLIED FASTENERS (ITEMS 11-13). (4 PLACES). USE TOUCH-UP PAINT ON ALL CUT, GROUND, OR DRILLED SURFACES. (TOUCH-UP PAINT WAS PROVIDED ON DRAWING RSW891-151)
- DRILL (2) Ø7/8" HOLES IN EXISTING WALKWAY ANGLES WHERE SHOWN TO ALLOW FOR CLEARANCE OF THE STUDS IN DRIVE TOP COVER. USE FASTENERS SUPPLIED (ITEMS 11 & 14) TO ATTACH WALKWAY TO DRIVE COVER. NOTE: A NUT AND WASHER ARE TO BE USED ON BOTH THE TOP AND BOTTOM OF THE WALKWAY ANGLE AS SHOWN.
- THE INSTALLATION, OPERATION, AND MAINTENANCE INSTRUCTIONS MANUAL MUST BE STUDIED PRIOR TO THE ERECTION OF THIS EQUIPMENT.
- USE DRIVE TO CAGE EAR SHIMS (ITEM 8) BETWEEN EXISTING CAGE AND DRIVE CAGE EAR.
- USE SHIMS THAT CAME WITH THE DRIVE ASSEMBLY FOR LEVELING THE DRIVE UNIT. FOLLOW DIRECTIONS FOR LEVELING THE DRIVE UNIT INCLUDED IN THE INSTALLATION MANUAL.
- ALL FASTENERS ARE TO BE TIGHTENED PER THE TORQUE METHOD DESCRIBED ON THE BOLT TORQUE CHART, DRAWING No. 114808.
- TO PREVENT GALLING, AN ANTI-SIEZE COMPOUNT IS REQUIRED TO BE USED ON ALL STAINLESS STEEL FASTENERS. (ANTI-SIEZE COMPOUNT IS NOT BY OVIVO).
- ISOLATION MUST BE PROVIDED FOR ALL ALUMINUM TO STEEL CONTACT SURFACES. (ISOLATION MATERIAL AND LABOR ARE NOT BY OVIVO).
- ITEMS 1, 2, AND 11 THRU 15 WERE PROVIDED ON ORDER RSW0000891-01, AND ARE SHOWN FOR REFERENCE ONLY ON THIS DRAWING. REFER TO DRAWING RSW891-151 PROVIDED ON THAT ORDER FOR THE CONVERSION AND ITEMS NECESSARY FOR THE CONVERSION OF A C60BHT TO A C60PS2 DRIVE UNIT.

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REF. FROM	RSW891-152	DO NOT SCALE PRINTS		GENERAL ERECTION C54B TO C60PS2 DRIVE CONVERSION 180'-0" DIA. CLARIFIER	
DATE	6/7/2018	WORKMANSHIP STANDARD ES0001 APPLIES			
DRAWN	MSS	ORIGINAL S.O.	DWG. NO.	RSW933-152	SHEET 1 OF 1
CHECK'D	CHH	RSW0000933-01			REV A

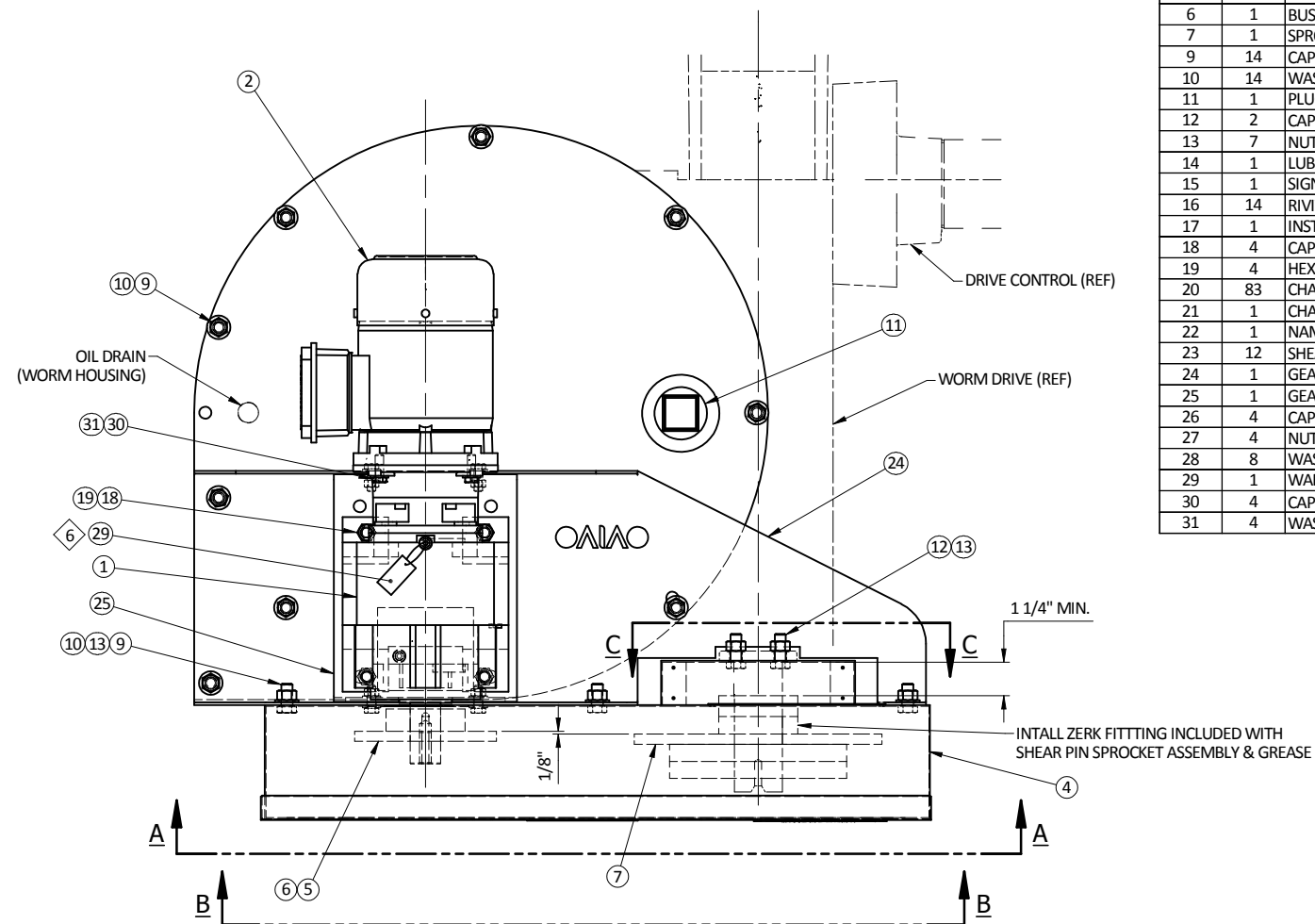
INITIAL RELEASE	EN/ECO	BY	CHECK'D	DATE	REV
					A
REVISION DESCRIPTION	EN/ECO	BY	CHECK'D	DATE	REV



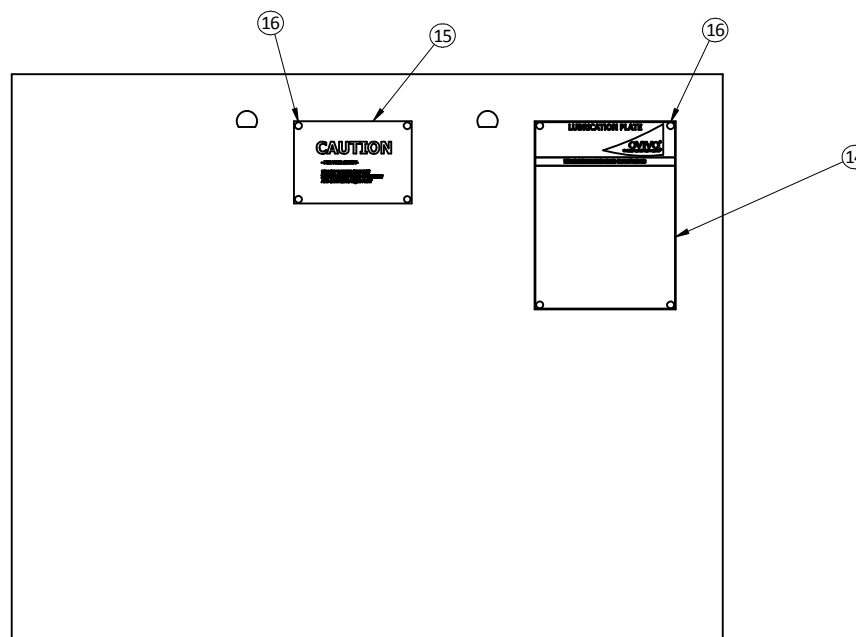
VIEW A-A



SECTION C-C
(GUARD DETAIL - BACK)



VIEW B-B (GUARD DETAIL - FRONT)

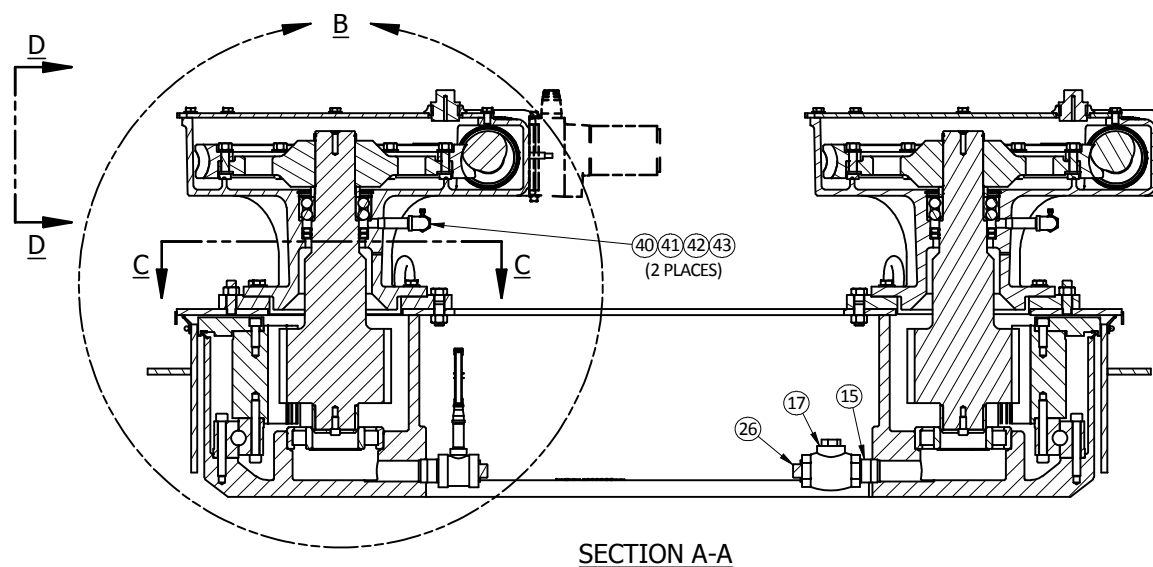
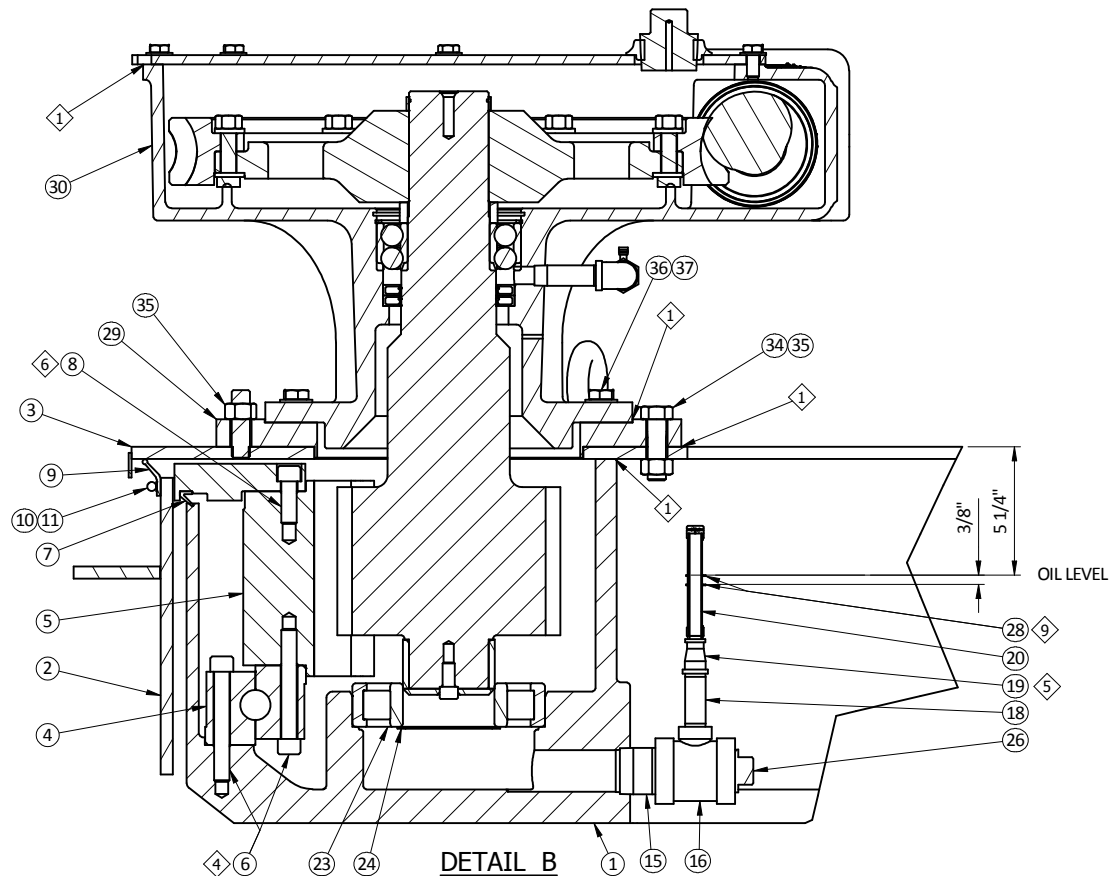
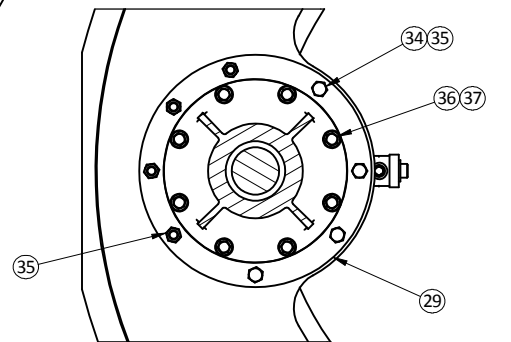
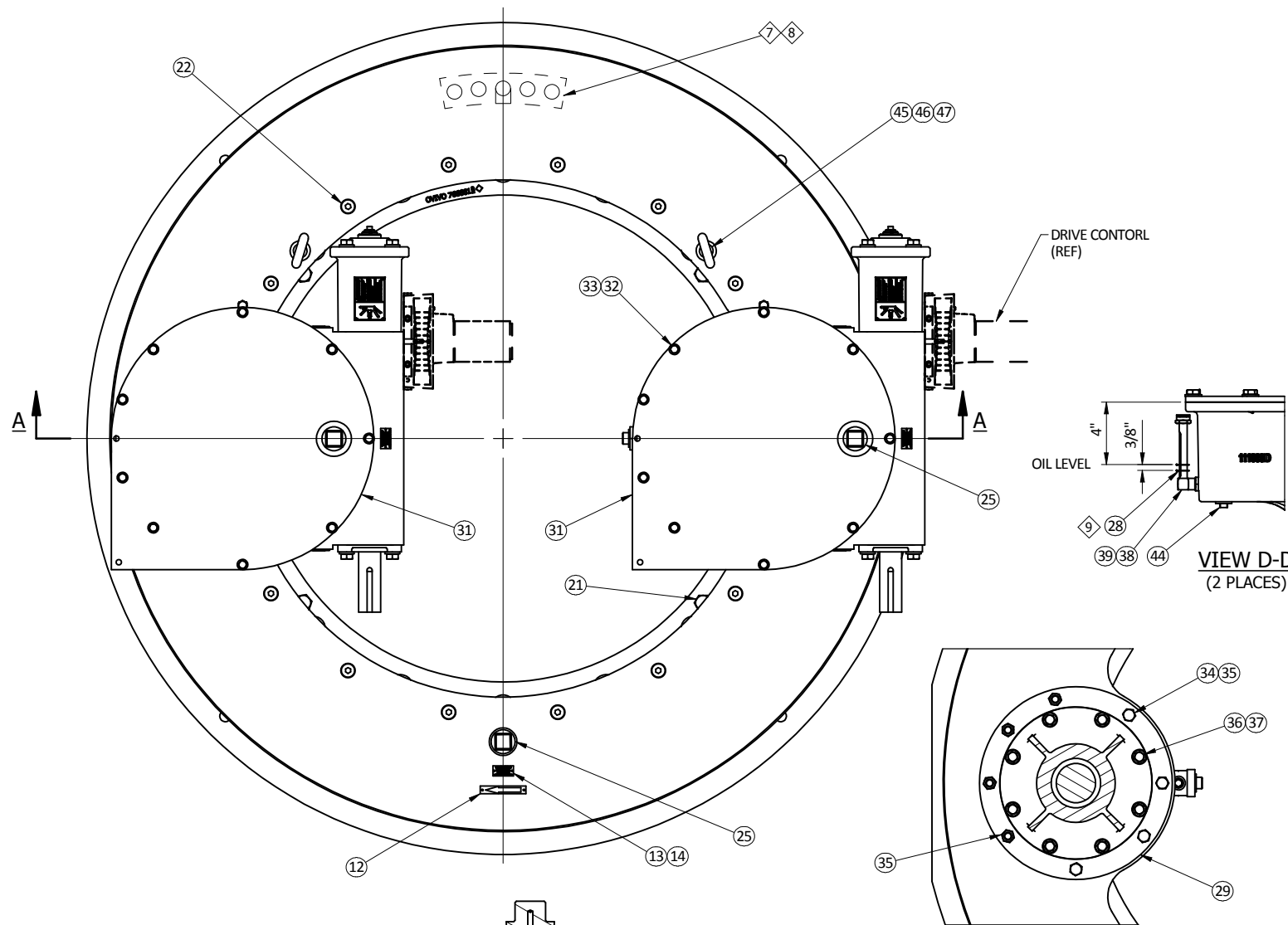


ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER	DRAWING NO.
1	1	GEARMOTOR, 20 RPM, 3/4 HP *NORD SK573.1*	-	699047B3	699047
4	1	GUARD, CHAIN, SHEAR-PIN, 18 GA.	Galvanized Steel	1108491-01	1108491
5	1	SPROCKET, 16T, ASA 60, TAPER-LOCK	STEEL	86143H	86143
6	1	BUSHING, TAPER-LOCK, 1-3/8" BORE, (1610)	STEEL	85844U	85844
7	1	SPROCKET, 54T, ASA 60, SHEAR PIN	STEEL	678876A	678876
9	14	CAPSCREW, HX HD, 1/2-13UNCx1	304 SS	F24337	N/A
10	14	WASHER, TYPE A-N, 1/2x1.062x.095	304 SS	F50474	N/A
11	1	PLUG, PIPE, VENTED, 2" NPT	304 SS	591914	591914
12	2	CAPSCREW, HX HD, 1/2-13UNCx1-1/4	304 SS	F24599	N/A
13	7	NUT, HEX, 1/2-13 UNC	304 SS	F50473	N/A
14	1	LUBE PLATE, SPEC. & INSTRUCTION	Stainless Steel	560128	560128
15	1	SIGN, CAUTION	Stainless Steel	204181A	204181
16	14	RIVIT, POP #44, 1/8 x 0.188-250	ALUMINUM	F50573	N/A
17	1	INSTRUCTION PLATE	Stainless Steel	84640A	84640
18	4	CAPSCREW, HX HD, 1/2"-13UNC x 1 3/4" LG.	304 SS	F17171	N/A
19	4	HEX NUT 1/2"-13 UNC	304 SS	F50473	N/A
20	83	CHAIN, ROLLER, ASA 60	STEEL	86603H	86603
21	1	CHAIN, ROLLER, ASA 60, CONNECTING LINK	STEEL	86605H	86605
22	1	NAMEPLATE, INSTRUCTION WARNING	PLASTIC	852263A	852263
23	12	SHEAR PIN, SPARE, 9/64" DIA.	-	678876-05	678876
24	1	GEARMOTOR MOUNT (DRIVE)	304 SS	699115A	699115
25	1	GEARMOTOR MOUNT (REDUCER)	304 SS	699115B	699115
26	4	CAPSCREW, HX HD, 3/8"-16UNC x 1" LG.	304 SS	F50443	N/A
27	4	NUT, HEX, 3/8"-16 UNC	304 SS	F12042	N/A
28	8	WASHER PLAIN, TYPE A-N 3/8"	304 SS	F50468	N/A
29	1	WARNING TAG, LUBE	-	766886	766886
30	4	CAPSCREW, HX HD, 3/8"-16 UNC x 1"	304 SS	F50443	N/A
31	4	WASHER, PLN, TYPE A-N, 3/8"	304 SS	F50468	N/A

NOTES:

- DRIVE CONFIGURATION AS SHOWN FOR ILLUSTRATION ONLY. REFER TO THE BASIC DRIVE ASSEMBLY FOR WORM GEAR ORIENTATION.
 - BOLT THE MOTOR MOUNT, ITEM (24), TO WORM COVER, ITEM (3). POSITION CHAIN GUARD, ITEM (4), AND MATCH DRILL MOUNTING HOLES IN CHAIN GUARD IF NEEDED.
 - BOLT REDUCER, ITEM (1), & CHAIN GUARD, ITEM (4), TO THE MOTOR MOUNT, ITEMS (24) & (25). INSTALL SPROCKETS & BUSHINGS, ITEMS (5), (6), (7), AND (8), AND ALIGN AS SHOWN. INSTALL CHAIN, ITEMS (20), AND (21).
 - PLACE ITEM (17) (ARROW PLATE) AND ITEM (22) (WARNING TAG) INSIDE OF CHAIN GUARD IN OBVIOUS POSITION (NOT ON GUARD COVER).
- ◇ CHAIN TENSION: SET SLACK TO 1 1/4" - 1 1/2" AT MID-SPAN.
- ◇ ATTACH LUBE WARNING TAG, ITEM (29), TO GEARMOTOR BREATHER.
- ◇ BAG AND PLACE SPARE SHEAR-PINS (ITEM 23) INTO GUARD & SECURE WITH TAPE.

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		<p>C60PS2 MOTOR DRIVE ASSEMBLY (SHEAR-PIN SPROCKET)</p>	
<p>REF. FROM RSW771-133</p> <p>DATE 12/21/2017</p>	<p>DO NOT SCALE PRINTS</p> <p>WORKMANSHIP STANDARD ES0001 APPLIES</p>	<p>DRAWN MSS</p> <p>CHECK'D CHH</p>	<p>ORIGINAL S.O.</p> <p>RSW0000891-01</p>
<p>INITIAL RELEASE</p> <p>REVISION DESCRIPTION</p>	<p>-</p> <p>EN/ECO</p>	<p>-</p> <p>BY</p>	<p>-</p> <p>CHECK'D</p>
<p>-</p> <p>DATE</p>	<p>-</p> <p>REV</p>	<p>-</p>	<p>-</p>
<p>DWG. NO. RSW891-133</p>	<p>SHEET 1 OF 1</p>	<p>REV A</p>	<p>NO.</p>

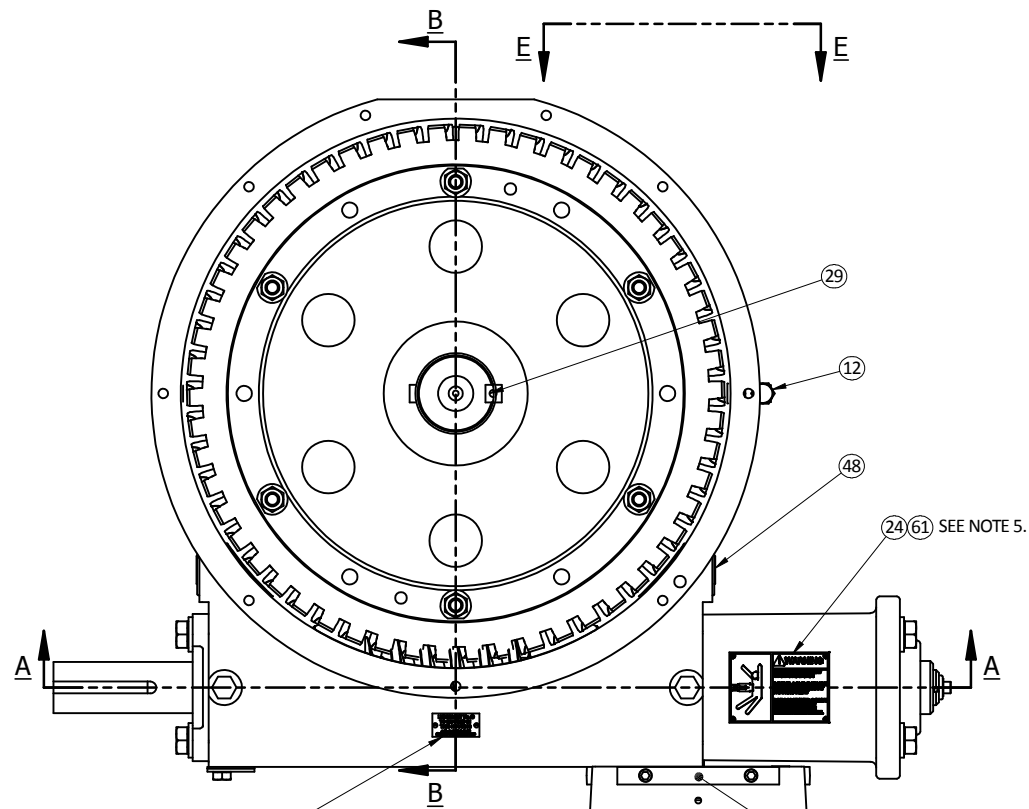


ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER	DRAWING NO.	TOTAL WEIGHT
1	1	CAST BASE, C60P1D/P2D, MACHINING	CAST IRON	766661	766661	2612
2	1	GEAR CAGE ATTACHMENT, C60P & C60B2P	STEEL	115762A	115762	988
3	1	COVER PLATE, C60P1D/P2D DRIVE UNIT	STEEL	768342	768342	395
4	1	BEARING, PRECISION, C60P, 4 POINT CONTACT	STEEL	115066H	115066	623
5	1	MAIN GEAR, C60P, HARDENED	Steel, High Strength Low Alloy	766160	766160	1534
6	80	CAPSCREW, SKT HD, 5/8"-11 UNC x 4 1/2" LG.	ALLOY STEEL	F12352	N/A	39
7	20	LIP SEAL	NEOPRENE (CC)	88683C	88683	1
8	40	CAPSCREW, SKT HD, 5/8-11 UNC x 1 3/4" LG.	ALLOY STEEL	F12351	N/A	10
9	20	LIP SEAL	NEOPRENE (CC)	88721C	88721	3
10	20	CLAMP - BAND	Stainless Steel	88556C	88556	0
11	4	CLAMP WORM DRIVE, 300/400, 3/8	Stainless Steel	F50245	N/A	0
12	1	INSTRUCTION PLATE	SS	84640A		0
13	1	LUBRICANT PLATE	SS	903155A	903155	0
14	4	SCREW, U DRIVE, 18-8, #4x1/4"	304 SS	F13749	N/A	0
15	2	NIPPLE, PIPE, SCH 40, 1-1/2MPTXCLOSE	304 SS	M019191	N/A	1
16	1	TEE, PIPE, 1-1/2x1-1/2x1/2"FPT	304 SS	766634	N/A	2
17	1	COCK, SQ. HEAD, 1-1/2" x 125 PSI	BRONZE	85779K	85779	7
18	1	NIPPLE, SCH 40, 1/2" MPT x 3" LG.	316 SS	M012666	N/A	0
19	1	COUPLING, PIPE, REDUCING, CL150, 1/2" x 3/8" FPT	304 SS	M015786	N/A	0
20	1	GAUGE, OIL, 3 17/32 SIGHT OPENING	BRASS	767333	767333	0
21	4	CAPSCREW, HX HD, 1"-12 UNF x 2" LG.	GR8 STL	M022457	N/A	3
22	20	CAPSCREW, SKT FLAT HD, 3/4"-10UNC x 3" LG.	304 SS	766649	N/A	9
23	2	BEARING, CYL RLR, UNMTD, 95MM I.D.	---	F60146	N/A	3
24	2	RING, RETAINING, STL, 3.75", EXTERNAL	STEEL	46767BX	46767	0
25	3	PLUG, PIPE, VENTED, 2" NPT	304 SS	591914	591914	7
26	2	PLUG, PIPE, SQ HD, SOLID, 1-1/2"	304 SS	M023812	N/A	1
28	6	SNAP RING, 5/8"	ZINC	767875	767875	0
29	2	ADAPTER PLATE, C60PS2	A36 STL	768387	768387	114
30	2	WORM GEAR ASSY, C60P W/OUT SECONDARY DRIVE UNITS, RH	---	768389	115209	1656
31	2	COVER, WORM GEAR, C40LT/HT	A36 STL	203507A	203507	120
32	18	CAPSCREW, HEX HD, 1/2-13UNC x 1" LG.	304 SS	F24337	N/A	2
33	18	WASHER, PLAIN TYPE A-N, 1/2"	304 SS	F50474	N/A	0
34	8	CAPSCREW, HX HD, 3/4-10 UNC x 2 1/2" LG.	304 SS	M016688	N/A	4
35	16	HEX NUT 3/4"-10 UNC	304 SS	F11747	N/A	2
36	16	CAPSCREW, HX HD, 5/8"-11UNC x 1 3/4" LG.	304 SS	F16762	N/A	4
37	16	WASHER, PLAIN, TYPE A-N, 5/8"	304 SS	F15751	N/A	1
38	2	GAUGE, OIL, EL, 3/8"MPTx3-1/2"SIGHT	BRASS	88931J	88931	1
39	2	BUSHING, HX, 1/2MPTx3/8FPT	304 SS	768199	N/A	0
40	2	NIPPLE, SCH 40, 1/2" MPT x 3" LG.	304 SS	F10804	N/A	0
41	2	ELL, 90, STD, 1/2"FPT	304 SS	M012291	N/A	1
42	2	NIPPLE, SCH 40, 1/2MPTx6	304 SS	M028690	N/A	1
43	2	BALL VALVE, 1/2"NPT	BRONZE	24557A365A	24557A365	1
44	2	PLUG, PIPE, SQ HD, 3/4"MPT, SOLID	304 SS	M020452	N/A	0
45	2	BOLT, LIFTING, EYE, 1"x2 1/2"	STEEL	87549D	87549	4
46	2	NUT, HEX, 1"-8 UNC	GR5 STEEL	F10869	N/A	1
47	2	WASHER, PLAIN, TYPE A-N, 1"	304 SS	M025704	N/A	0
100	16	SPACER, 11 GA. (0.120), (DRIVE TO CAGE)	316 SS	88427D	88427	0
101	16	SPACER, 16 GA. (0.060), (DRIVE TO CAGE)	316 SS	88427F	88427	0
102	1	SEALANT, RTV, LOCTITE, ULTRA BLUE	---	88962A	88962	0
103	1	SHIM PACKAGE (DRIVE TO COLUMN), C60P DRIVES	304 SS	49115F	49115	0

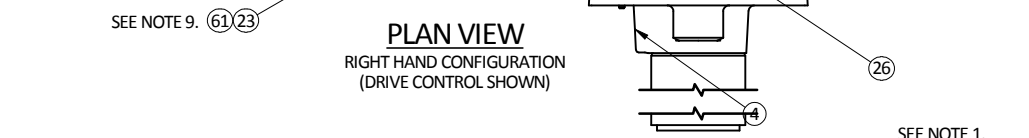
- NOTES:
- APPLY RTV SEALANT (ITEM 102) TO CONNECTIONS INDICATED OBTAIN A WATER TIGHT SEAL PER DRAWING 768222.
 - BAG SHIMS (ITEMS 100, 101) TOGETHER & LABEL "DRIVE TO CAGE SHIMS" & ATTACH TO DRIVE BEFORE SHIPMENT TO THE CUSTOMER.
 - LABEL SHIM PACKAGE (ITEM 103 "DRIVE TO COLUMN SHIMS" & ATTACH TO DRIVE BEFORE SHIPMENT TO CUSTOMER
 - SOCKET HEAD CAPSCREWS (ITEM 6) ARE TO BE TIGHTENED IN TWO STAGES AND IN A CROSS DIAMETER SEQUENCE TO AVOID BEARING WARPAGE. FINAL TIGHTNESS IS TO BE 200 FT/LBS PLUS OR MINUS 10 FT/LBS (LUBRICATED). FOLLOW PROCEDURE ON DWG 904365.
 - APPLY PIPE THREAD SEALANT TO ALL PIPE JOINTS.
 - TORQUE TIGHTEN SOCKET HEAD CAPSCREWS (ITEM 8) TO 200 FT/LBS PLUS OR MINUS 10 FT/LBS. FOLLOW PROCEDURE ON 904365.
 - AT ASSEMBLY OF MAIN BALL BEARING, ORIENT THE LOADING PLUG AS SHOWN IN PLAN VIEW.
 - PROVIDE OIL TIGHT SEAL AT LOADING PLUG ON PRECISION BEARING BY COVERING THE LOADING PLUG BORE I.D. GROOVE WITH ULTRA BLUE RTV-SILICONE.
 - USE SNAP RINGS (ITEM 28) ON SIGHT GLASS METAL CASING OF ITEMS 20 & 38 AT INDICATED OIL LEVEL.

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		ASSEMBLY DRAWING C60PS2 DRIVE UNIT (CAST BASE)	
REF. FROM DATE: 7/20/2017	DO NOT SCALE PRINTS WORKMANSHIP STANDARD ES0001 APPLIES	DWG. NO. 768353	SHEET 1 OF 1

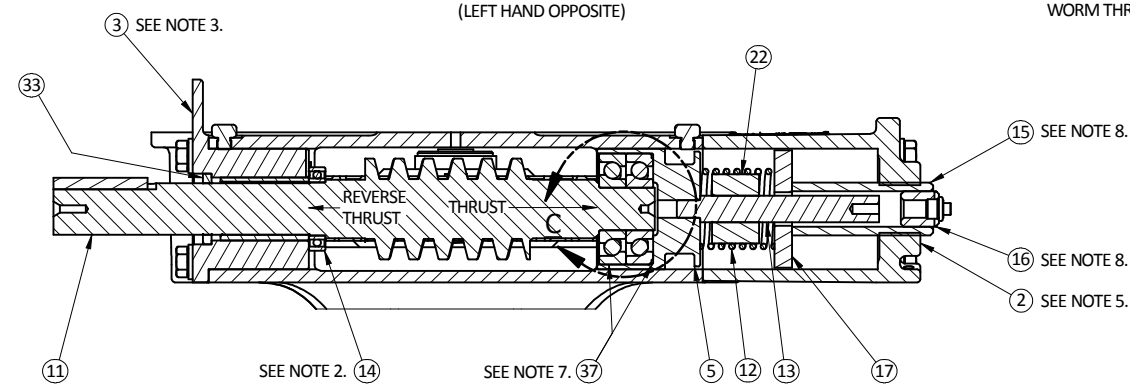
REVISION DESCRIPTION	EN/ECO	BY	CHECK'D	DATE	REV
ADDED WORM HOUSING PLUMBING, EYE BOLTS, & VIEW "D"	S-012256	MSS	CHH	4/12/18	C
CHANGED ITEM 36 FROM 3/4-10UNC TO 5/8-11UNC	S-012222	MSS	CHH	4/4/18	B
INITIAL RELEASE	-	-	-	-	A



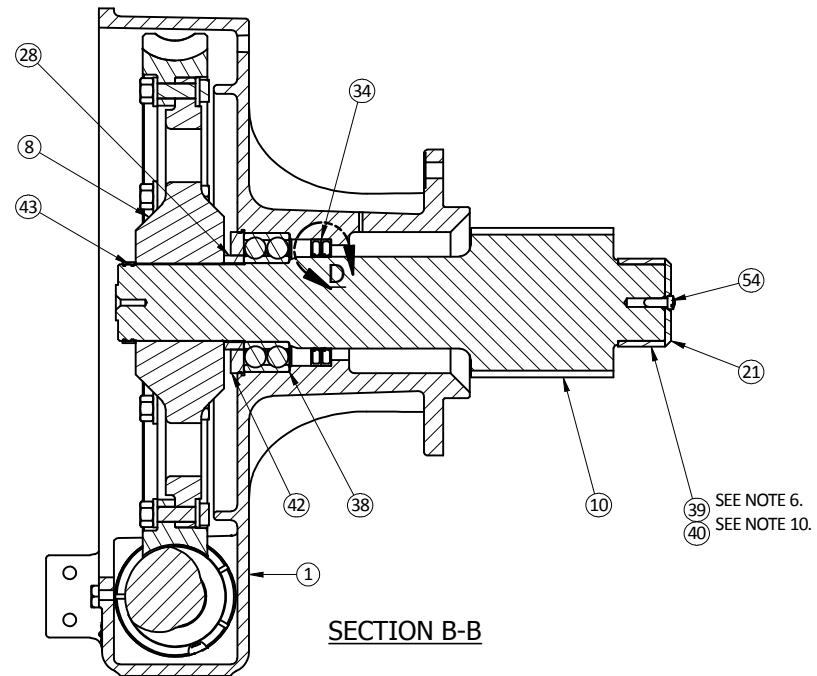
PLAN VIEW
RIGHT HAND CONFIGURATION
(DRIVE CONTROL SHOWN)



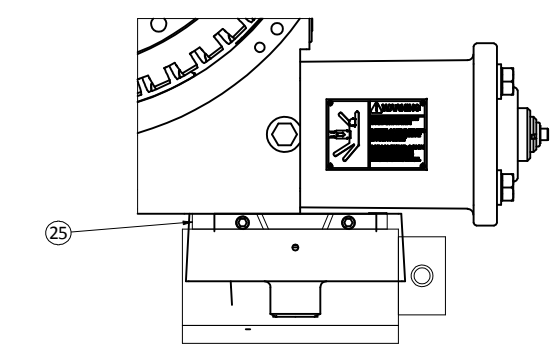
RIGHT HAND CONFIGURATION
SHOWN ABOVE AND BELOW
WITHOUT DRIVE CONTROL
(LEFT HAND OPPOSITE)



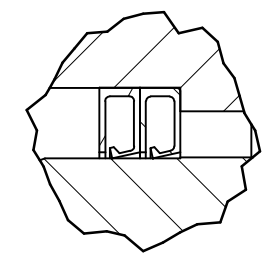
SECTION A-A



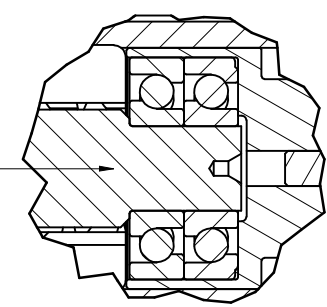
SECTION B-B



ITEM 25, FOR OLD STYLE DRIVE CONTROL ONLY

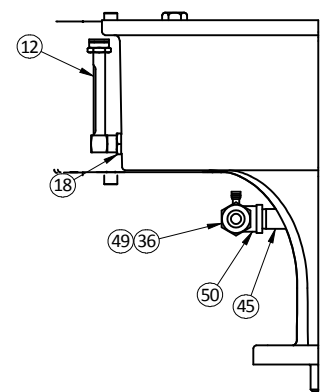


DETAIL D
SHOWING CORRECT ORIENTATION
OF SEALS, ITEM 34.



DETAIL C

NOTE CAREFULLY HOW THRUST BEARINGS
ARE ASSEMBLED IN HOUSING TO TAKE
THRUST TOWARD SPRING. IMPROPER
INSTALLATION WILL CAUSE BEARINGS
TO FAIL.



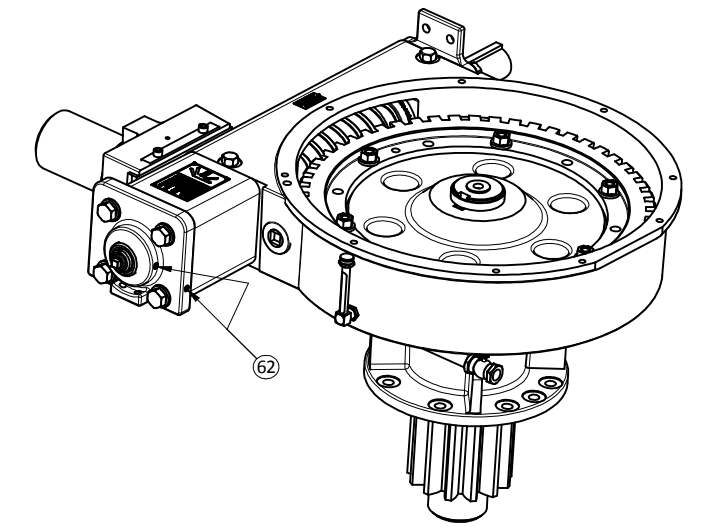
VIEW E-E

NOTES:

- INSTALL AND ADJUST DRIVE CONTROL PER FABRICATION DRAWING 115713.
- NOTE CAREFULLY HOW REVERSE THRUST BEARING IS INSTALLED IN HOUSING TO TAKE REVERSE THRUST TOWARD BUSHING HOUSING. IMPROPER INSTALLATION WILL CAUSE BEARING FAILURE.
- BUSHING HOUSING, ITEM 3, IS TO BE ASSEMBLED SO THAT THE CHAIN GUARD ATTACHMENT IS ON TOP, AS SHOWN.
- APPLY ULTRA BLUE RTV-SILICONE TO CONNECTIONS INDICATED TO OBTAIN A LIQUID TIGHT SEAL.
- BEFORE ATTACHING END CAP TO WORM GEAR HOUSING, THE FOLLOWING MUST BE DONE:
A) DRILL (4) .104 DIA. HOLES THRU ONE (1) WALL ONLY OF END CAP AND ATTACH ITEM 24 USING ITEM 61.
B) REMOVE ALL BURRS, CHIPS, ETC FROM INSIDE THE END CAP.
- BEARING, ITEM 39, TO BE A PRESS FIT ONTO SHAFT OF MAIN PINION, ITEM 10.
- BEARINGS, ITEM 37, ARE TO BE A PRESS FIT ONTO SHAFT OF WORM AND SHAFT, ITEM 11, AND A SLIP FIT INTO SLIDING BEARING HOUSING, ITEM 5.
- APPLY THREAD SEALANT TO THREADS OF ITEMS 15, 16, AND 46. USED IN END CAP, ITEM 2, PRIOR TO ASSEMBLY FOR LEAK PROOF JOINTS.
- DO NOT DRILL THRU. DRILL 1/4 DEEP MIN AND 5/16 DEEP MAX.
- ITEM 40 TO BE PRESSED INTO DRIVE BASE PRIOR TO INSTALLATION OF WORM GEAR HOUSING. *PROTECT FROM CORROSION, CONTAMINATION, AND DAMAGE AS REQUIRED BEFORE WORM GEAR HOUSING INSTALLATION.

SELECTION TABLE			
DRIVE UNIT	DRIVE CONFIGURATION	PARTS LIST W/ DRIVE CONTROL	PARTS LIST W/O DRIVE CONTROL
C40HT	RIGHT HAND	L115209-1	NOT REQUIRED
C40HT	RIGHT HAND	L115209-2	NOT REQUIRED
C60R	RIGHT HAND	L115209-3	NOT REQUIRED
C40LT	RIGHT HAND	L115209-1	NOT REQUIRED
C40LT/HT	RIGHT HAND	L115209-4	NOT REQUIRED
C60HT	RIGHT HAND	L115209-5	NOT REQUIRED
C60LT/HT	RIGHT HAND	L115209-6	NOT REQUIRED
C60LT/HT (EXTENDED PINION, 8.5")	RIGHT HAND	L115209-7	NOT REQUIRED

SEE D/R 6147
SEE D/R 6147
SEE D/R 6147
SEE D/R 6401
SEE D/R 6401
SEE D/R 6401



PARTS LIST: SEE SELECTION TABLE

REVISION		
D/R	DATE	
-	7021	5/20/94
J	7021	5/20/94
I	6593	5/5/89
H	6559	2/9/89
G	6401	5/1/87
F	6277	7/25/86
E	6147	5/16/85
D	6140	5/3/85
C	6113	2/22/85
B	6059	9/19/84
A	5835	2/17/83

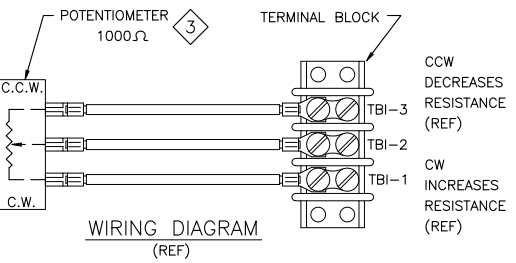
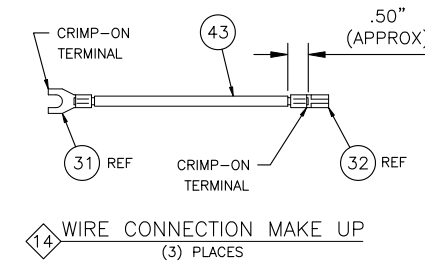
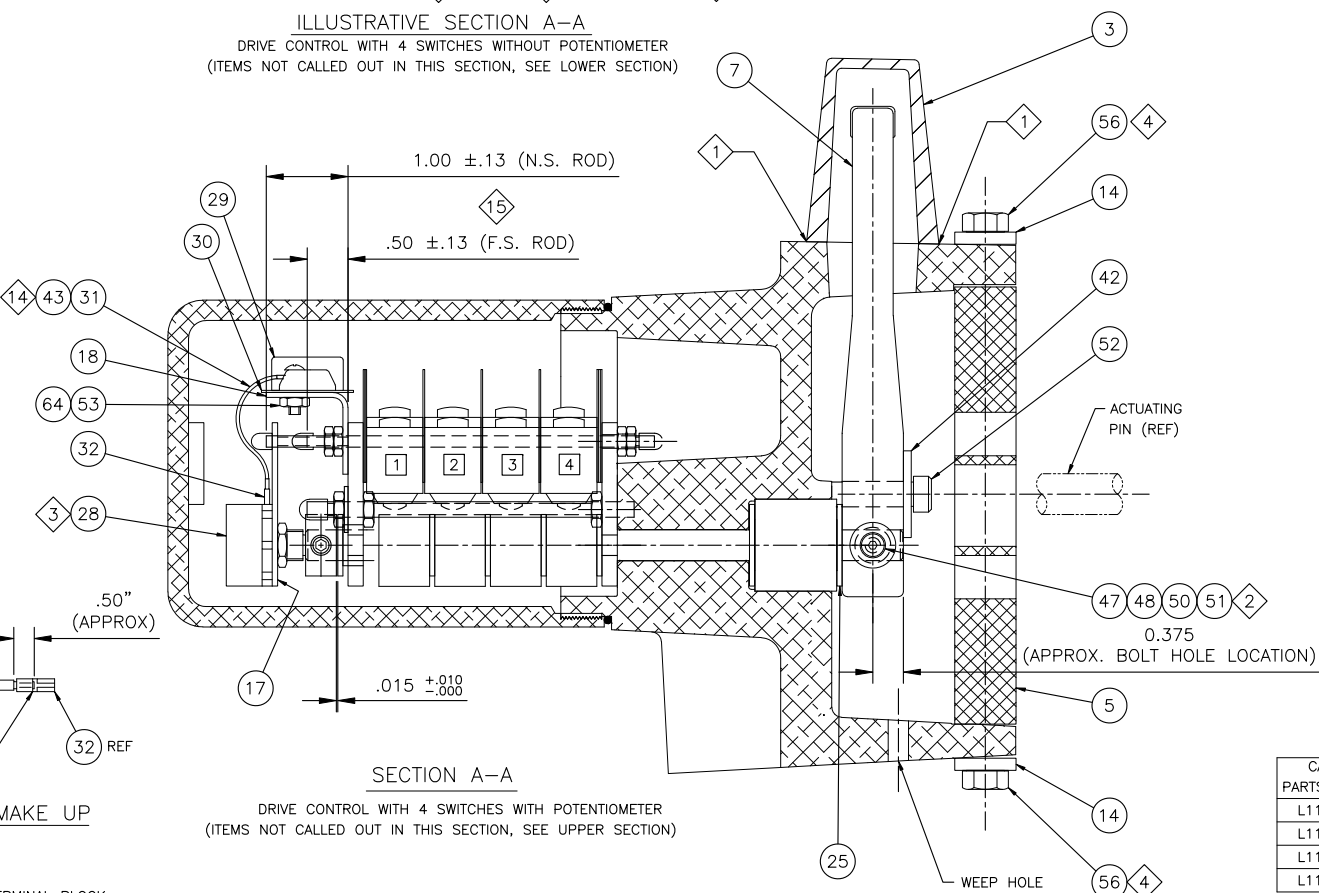
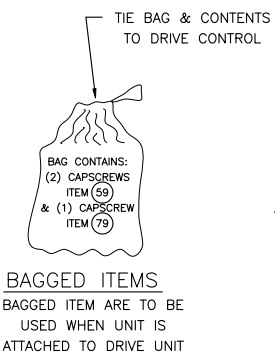
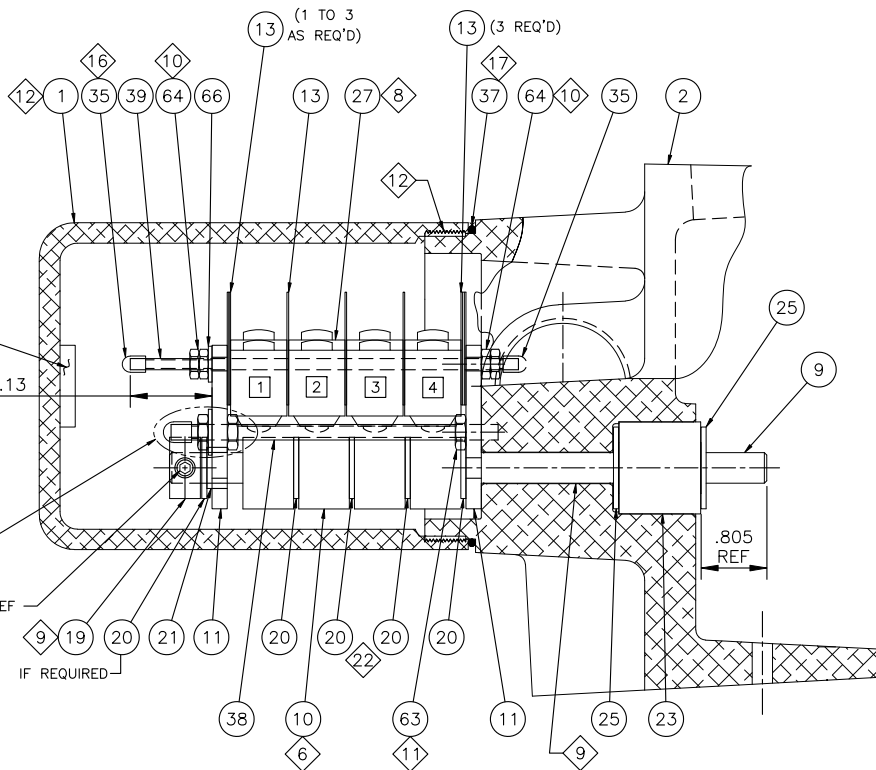
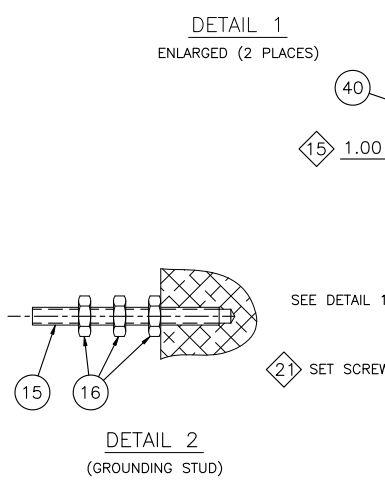
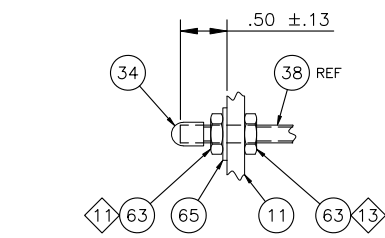
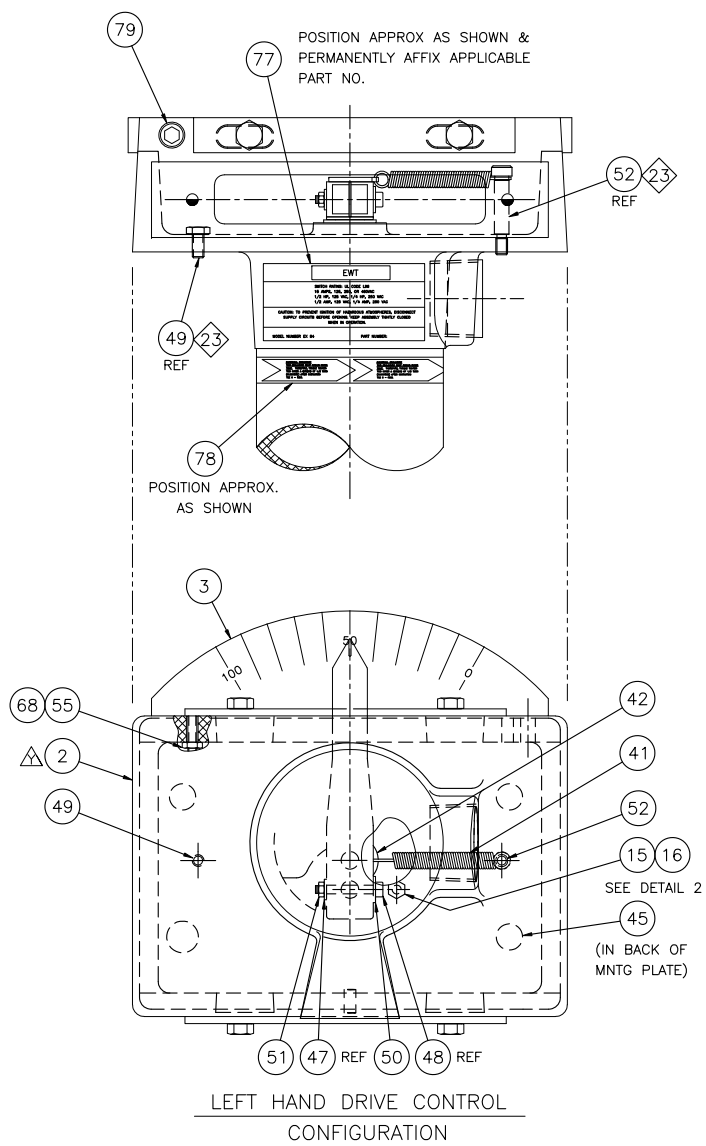
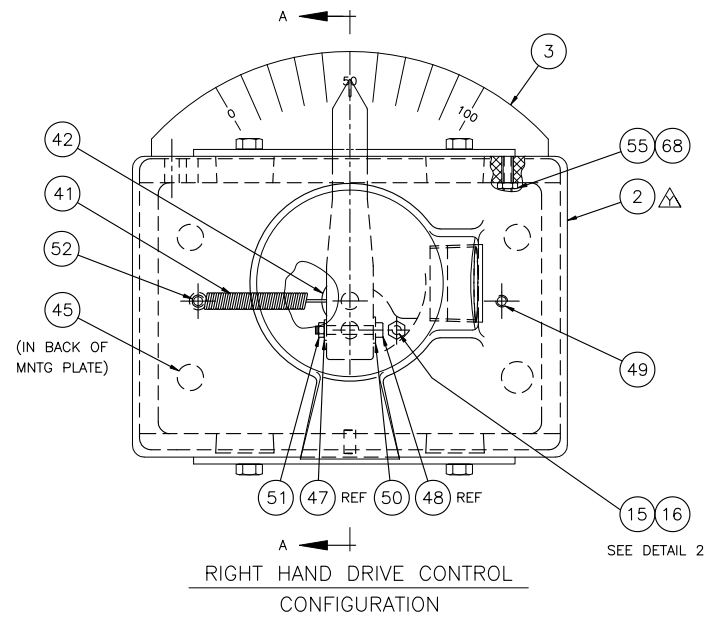
REVISION DESCRIPTION	EN/ECO	BY	CHECK'D	DATE	REV
UPDATED TITLE BLOCK	S-009430	SCF	RJB	8/3/2016	O
ADDED PARTS LIST L115209-7 (EXTENDED PINION, 8.5")	S-008859	MSS	CHH	4/1/16	N
ADDED OIL PLUMBING, VIEW "E-E"	S-006285	MSS	CHH	7/28/14	M
REDRAWN IN INVENTOR	S-001469	ZSS	MAN	9/22/11	L
UPDATED TITLEBLOCK	34813	MDW	KB	1/7/09	A
ADDED ITEM 23, 61, & FLAGNOTE 9	EN26299	N/A	N/A	10/12/05	1
	97-1628	SW	RWK	5/15/97	K

REF. FROM	DATE	DATE	DATE	DATE	DATE
-	11/16/1982				

OVIVO
Worldwide Experts in Water Treatment

WORM GEAR ASSEMBLY

DWG. NO. **115209** SHEET **1** OF **1**



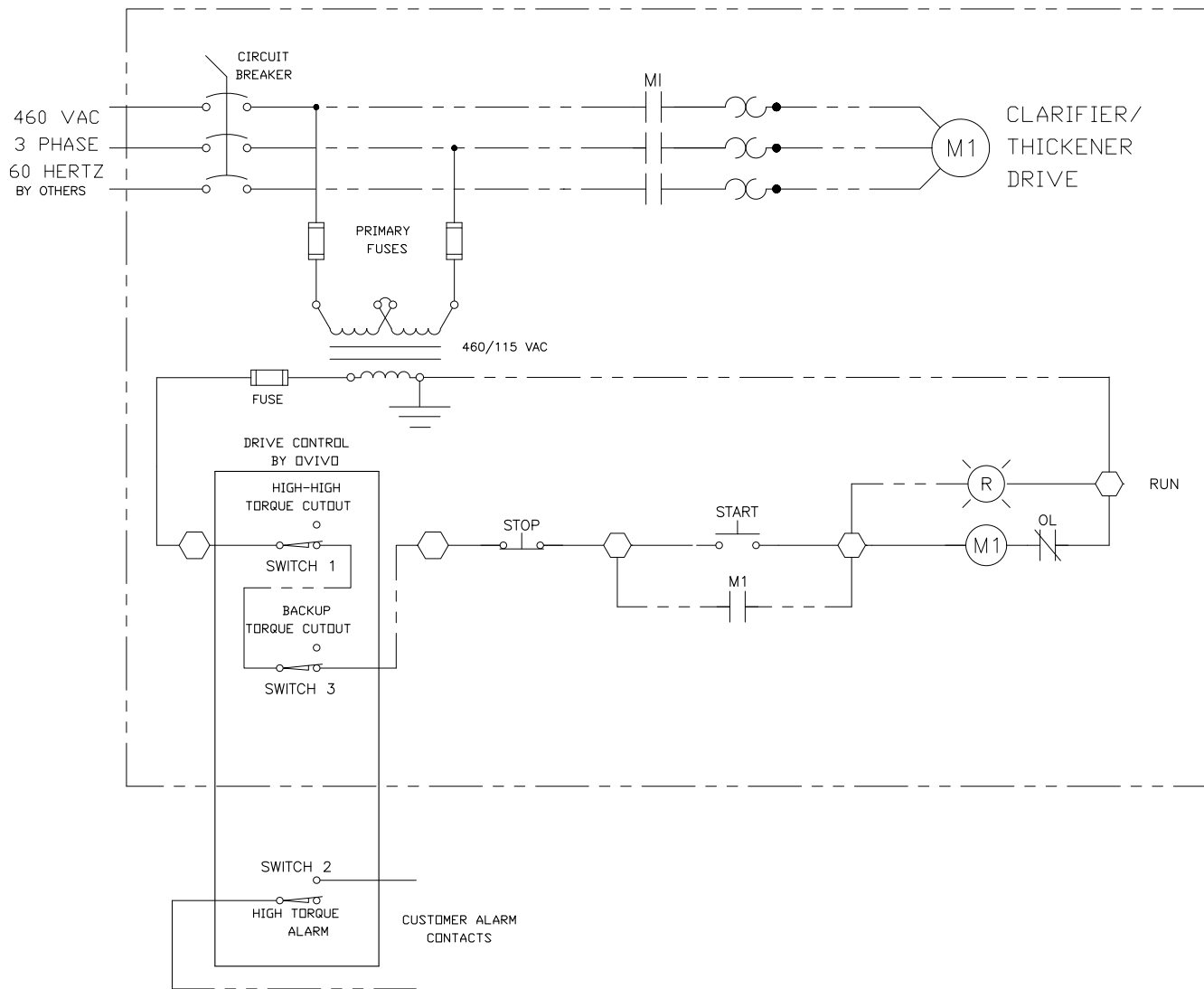
NOTES:

- 1 SURFACE PREPARATION AND PAINT PER DWG. 88747 (CAST ALUMINUM DRIVE CONTROL ONLY). Δ
- 2 PRE-ASSEMBLE AND MATCH DRILL THRU ITEMS 7 AND 9 USING A #10 TWIST DRILL. ENSURE THAT HOLE CENTERLINE COINCIDES WITH THAT OF THE SHAFT, ITEM 9. AFTER DRILLING, DISASSEMBLE AND DE-BURR NEW HOLES BEFORE FINAL ASSEMBLY.
- 3 ADJUST POTENTIOMETER FOR 500 ± 15 OHMS AT 0% INDICATION FROM POINTER.
- 4 APPLY ANTI-SEIZE COMPOUND TO THREADS OF ITEM 56 WHERE SPECIFIED.
- 5 INSERT PLUG, ITEM 44 INTO OPEN END OF ITEM 2 Δ
- 6 CAMS ITEM 10 ARE TO BE SET WHEN DRIVE CONTROL IS ASSEMBLED TO DRIVE UNIT - SEE SPECIFIC S.O. PARTS LIST FOR CAM SETTING.
- 8 MARK SWITCHES. ITEM 27 AS SHOWN.
- 9 APPLY ANTI-SEIZE COMPOUND TO SHAFT & BORE IN HSG & BSHG WHERE INDICATED
- 10 TORQUE TIGHTEN ITEM 64 TO 20 ± 2 IN.LBS. NON-LUBRICATED. LOCK IN PLACE WITH LOCTITE "THREADLOCKER NO. 290". APPLY TO THREADS OF ITEMS 39 & 64.
- 11 TORQUE TIGHTEN ITEM 63 TO 22 ± 5 IN.LBS. NON-LUBRICATED. (ONLY WHERE INDICATED WITH 11) LOCK IN PLACE WITH LOCTITE "THREADLOCKER NO. 290". APPLY TO THREADS OF ITEMS 38 & 63.
- 12 APPLY ANTI-SEIZE COMPOUND TO THREADS.
- 13 EXTREME CARE SHOULD BE USED SO THAT BINDING DOES NOT OCCUR BETWEEN MOUNTING PLATE & SHAFT. THEREFORE, ADJUST NUT, ITEM 63 SO THAT FLANGED BUSHING ITEM 21 DOES NOT BIND SHAFT, ITEM 9.
- 14 WIRING POTENTIOMETER: MAKE UP CONNECTION WIRES AS SHOWN. SLIP QUICK DISCONNECT END OVER TERMINALS OF POTENTIOMETER, ITEM 28 ATTACH FORK TONGUE END ON TERMINAL BLOCK, ITEM 29 AS SHOWN ON WIRING DIAGRAM. ENSURE THAT WIRES DO NOT INTERFERE WITH CORROSION INHIBITOR, ITEM 40.
- 15 THREADED ROD USED FOR POTENTIOMETER BRACKET RESTRAINT TO EXTEND TO 1.00 & ADJACENT THREADED ROD TO EXTEND TO 0.50 AS SHOWN.
- 16 TRIM VINYL CAP (ITEM 34) AS SHOWN, AFTER POSITIONING OF THREADED ROD, ITEM 39.
- 17 THE O-RING IS TO KEEP WATER OUT OF THE SWITCH ASSEMBLY AREA. THEREFORE THE COVER MUST BE TORQUE TIGHTENED SO THAT THE O-RING BECOMES TIGHTLY COMPRESSED.
- 18 THE 1 1/4" NPT ENTRY MUST BE WATER TIGHT. THEREFORE, THE PIPE PLUG THREADS MUST BE TEFLON COATED & THEN MUST BE TORQUE TIGHTENED SO THAT A POSITIVE SEAL OCCURS.
- 21 SETSCREW IN SET COLLAR, ITEM 19 TO ALIGN WITH HOLE IN SHAFT, ITEM 9 WHEN POTENTIOMETER IS REQ'D. DO NOT ALIGN SETSCREW WITH HOLE IN SHAFT WHEN NO POTENTIOMETER IS REQ'D. SECURE SETSCREW TO SET COLLAR WITH LOCTITE "GENERAL PURPOSE RETAINING COMPOUND NO. 609".
- 22 APPLY ANTI-SEIZE COMPOUND TO THREADS OF SETSCREWS & OVER SOCKET AREA AFTER SETSCREWS ARE INSTALLED.
- 23 APPLY LOCTITE "THREADLOCKER NO. 290" TO THREADS.

CAST SS PARTS LIST NO.	EP. COATED AL. PARTS LIST NO.	NO. SPDT SWITCH	DRIVE CONTROL CONFIGURATION
L115759-5	L115759-1	4 (W/O POTENTIOMETER)	RIGHT HAND
L115759-6	L115759-2	4 (W/O POTENTIOMETER)	LEFT HAND
L115759-7	L115759-3	4 (W/ POTENTIOMETER)	RIGHT HAND
L115759-8	L115759-4	4 (W/ POTENTIOMETER)	LEFT HAND

PARTS LIST: SEE SELECTION TABLE

REVISION	EN/ECO	BY	CHECK'D	DATE	D	THIRD ANGLE PROJECTION	DRIVE CONTROL (WEATHER PROOF ENCLOSURE)	DWG. NO.	SHEET 1 OF 1	REV. Y
REMOVE CONDENSATE DRAIN AND PIPE FITTINGS	S-005382	MAN	ZSS	10/11/13	D COPYRIGHT 2010 OVO ALL RIGHTS RESERVED - REV E	THIRD ANGLE PROJECTION	OVIVO Bringing water to life	115759	1	Y
ADD CONDENSATE DRAIN AND PIPE FITTINGS	S-004143	MAN	ZSS	11/9/12						
ADDED CAST SS OPTIONS TO SELECTION TABLE	S-003511	MAN	ZSS	4/12/12	THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION OF OVIVO, AND ITS AFFILIATES, AND IS NOT TO BE DISCLOSED NOR TO BE USED EXCEPT FOR EVALUATING PROPOSALS OF OVIVO OR INSTALLING, OPERATING OR MAINTAINING OVIVO EQUIPMENT, UNLESS OTHERWISE AUTHORIZED IN WRITING BY OVIVO. UNCONTROLLED COPY IF PRINTED					
REVISED ITEM 56 AND NOTE 2, DELETED NOTE 20, ADD 48, 51	S-000065	BBC	SKS	9/29/09	REF. FROM:	DO NOT SCALE PRINTS				
Removed Eimco symbols on Pointer. System will not accept Rev.S	35415	JDR	WBB	4/3/09	DATE (mm/yyyy)	2/21/89	WORKMANSHIP STANDARD ES001 APPLIES			
UPDATED TITLEBLOCK	34813	MDW	KB	1/6/09	DRAWN	DMC	ORIGINAL S.O.			
MOVED TO CAD	EN26299	DSB	LKS	10-12-05	CHECK'D	S. DEAN				



NOTES:

1. POWER REQUIREMENTS:
 DRIVE UNIT 230/460 VAC 60 HZ 3 PHASE
 CONTROL CIRCUIT 115 VAC 60 HZ 1 PHASE
2. SWITCH 2 IN THE DRIVE CONTROL MAY BE USED BY CUSTOMER FOR HIGH TORQUE ALARM.
3. THIS IS A SUGGESTED WIRING DIAGRAM ONLY. THE CUSTOMER MAY USE ANY CONTROL SCHEME DESIRED - PROVIDED THE DRIVE CONTROL SWITCHES ARE FUNCTIONAL AS SHOWN. PROVISIONS FOR AUTOMATIC RESTART AFTER HIGH TORQUE SHUTDOWN OR DELAY TIMERS ARE NOT TO BE UTILIZED.
4. ALL CONTROLS ARE NOT BY OVIVO EXCEPT DRIVE CONTROL - TORQUE MONITOR.

COMBINATION STARTER NOT BY OVIVO

<p style="text-align: center;">C © 2018 OVIVO. ALL RIGHTS RESERVED.</p>					<p style="text-align: center;">THIRD ANGLE PROJECTION</p>		<p style="font-size: 24pt; font-weight: bold;">OVIVO</p> <p style="font-weight: bold;">Worldwide Experts in Water Treatment</p>		
<p style="font-size: 8pt;">THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION OF OVIVO, AND ITS AFFILIATES, AND IS NOT TO BE DISCLOSED NOR TO BE USED EXCEPT FOR EVALUATING PROPOSALS OF OVIVO OR INSTALLING, OPERATING OR MAINTAINING OVIVO EQUIPMENT, UNLESS OTHERWISE AUTHORIZED IN WRITING BY OVIVO.</p>					<p style="font-size: 8pt;">UNCONTROLLED COPY IF PRINTED</p>		<p style="font-weight: bold;">CLARIFIER/THICKENER SUGGESTED WIRING DIAGRAM W/ BACKUP SWITCH</p>		
UPDATE TITLE BLOCK	S-010585	RJB	CHH	4/18/17	REF. FROM:	-	DO NOT SCALE PRINTS		
UPDATE TITLE BLOCK TO CAD STANDARD	34696	ELP	ABA	12/10/08	DATE (mm/dd/yyyy)	12-18-96	WORKMANSHIP STANDARD ES0001 APPLIES		
REDRAWN ON CAD	14261	DGZ	SRR	5/9/01	DRAWN	GGG	ORIGINAL S.O.	DWG. NO.	295128
INITIAL RELEASE	-	-	-	--/--	CHECK'D	DGZ	STANDARD	SHEET	1 OF 1
REVISION	EN/ECO	BY	CHECK'D	DATE				REV	B

STANDARD TORQUE VALUES FOR METAL INDUSTRIAL FASTENERS (FT.-LBS.) ** (75% OF PROOF LOAD)

GRADE MARKING/ DESCRIPTION	SPECIFICATION	MATERIAL	SIZE RANGE	PROOF LOAD (PSI)	TENSILE STRENGTH MINIMUM (PSI)	SCREW OR BOLT DIAMETER																						
						4	6	8	10	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 3/4	2	2 1/4	2 1/2	
CAPSCREW	ASTM A-307 SAE 2 STEEL	LOW CARBON STEEL	1/4 - 2 1/2	33,000	60,000					6 (5)	11 (10)	19 (17)	30 (27)	45 (40)	66 (59)	93 (84)	150 (135)	202 (182)	300 (270)	474 (427)	659 (593)	884 (796)	1057 (951)	1884 (1696)	2722 (2450)	3117 (2805)	4380 (3942)	
CAPSCREW	SAE 3 STEEL	MEDIUM CARBON STEEL	1/4 - 2 1/2	70,000	100,000					9 (8)	17 (15)	30 (27)	47 (42)	69 (62)	103 (93)	145 (130)	234 (211)	372 (335)	551 (496)	872 (785)	1211 (1090)	1624 (1462)	1943 (1749)	3463 (3117)	5427 (4884)	7226 (6503)	8049 (7244)	
CAPSCREW	ASTM A-449 SAE 5 STEEL	MEDIUM CARBON STEEL QUENCHED TEMPERED	1/2 - 1 1 1/8 - 1 1/2 1 3/4 - 2 1/2	85,000 74,000 55,000	120,000 105,000 90,000					9 (8)	18 (16)	31 (28)	50 (45)	75 (67)	110 (99)	150 (135)	250 (225)	378 (340)	583 (525)	782 (704)	1097 (987)	1461 (1315)	1748 (1573)	3114 (2803)	4504 (4054)	6497 (5847)	7144 (6430)	
CAPSCREW	SAE 6 STEEL	MEDIUM CARBON STEEL QUENCHED TEMPERED	1/4 - 1 1/2	105,000	133,000					13 (12)	24 (22)	43 (39)	69 (62)	106 (95)	150 (135)	209 (188)	350 (315)	550 (495)	825 (743)	1304 (1174)	1815 (1634)	2434 (2191)	2913 (2622)					
CAPSCREW	SAE 7 STEEL	MEDIUM CARBON ALLOY STEEL QUENCHED TEMPERED	1/4 - 1 1/2	105,000	133,000					13 (12)	24 (22)	43 (39)	69 (62)	106 (95)	150 (135)	209 (188)	350 (315)	550 (495)	825 (743)	1304 (1174)	1815 (1634)	2434 (2191)	2913 (2622)					
CAPSCREW	SAE 8 STEEL	MEDIUM CARBON ALLOY STEEL QUENCHED TEMPERED	1/4 - 1 1/2	120,000	150,000					13 (12)	28 (25)	46 (41)	75 (67)	115 (104)	165 (149)	225 (203)	370 (333)	591 (532)	893 (804)	1410 (1269)	1964 (1768)	2633 (2370)	3150 (2835)					
BOLT	ASTM A-325	LOW TO MEDIUM CARBON STEEL QUENCHED TEMPERED	1/2 - 1 1 1/8 - 1 1/2	85,000 74,000	120,000 105,000									100 (90)		200 (180)	355 (320)	525 (473)	790 (711)	1060 (954)	1495 (1346)	1960 (1764)	2600 (2340)					
CAPSCREW	ASTM 354BB	ALLOY STEEL QUENCHED TEMPERED	1/4 - 2 1/2	80,000	105,000					9 (8)	18 (16)	31 (28)	50 (45)	75 (67)	110 (99)	150 (135)	250 (225)	378 (340)	583 (525)	782 (704)	1097 (987)	1461 (1315)	1748 (1573)	3114 (2803)	4504 (4054)	6497 (5847)	7144 (6430)	
CAPSCREW	ASTM A-354-BC STEEL	ALLOY STEEL QUENCHED TEMPERED	1/4 - 2 1/2	105,000	125,000					11 (10)	20 (18)	34 (31)	54 (49)	81 (73)	119 (107)	167 (150)	269 (242)	427 (384)	644 (580)	1002 (902)	1392 (1253)	1868 (1681)	2234 (2011)	3982 (3584)	5749 (5174)	8308 (7477)	9255 (8330)	
BOLT	A-354-BD A-490	ALLOY STEEL QUENCHED TEMPERED	1/4 - 1 1/2	120,000	150,000									55 (50)	90 (81)	138 (124)	198 (178)	270 (243)	444 (400)	709 (638)	1071 (964)	1692 (1523)	2360 (2124)	3159 (2843)	3780 (3402)			
SOCKET CAPSCREW	SOCKET HEAD CAP SCREW	HIGH CARBON ALLOY STEEL QUENCHED TEMPERED		140,000	160,000					14 (13)	30 (27)	50 (45)	81 (73)	121 (109)	176 (158)	240 (216)	395 (356)	629 (566)	964 (868)	1523 (1371)	2120 (1908)	2843 (2559)	3402 (3062)	6063 (5457)	8751 (7876)	12645 (11381)	17503 (15753)	
SOCKET SETSCREW	SOCKET SET SCREW	HIGH CARBON ALLOY STEEL QUENCHED TEMPERED		N/A	212,000					9 (8)	16 (14)	30 (27)	70 (63)	140 (126)	18 (16)	29 (26)	43 (39)	63 (57)	100 (90)	146 (131)								
CAP/MACH. SCREW	STAINLESS STEEL	18-8		30,000 YIELD	75,000 (MIN)					3 (3)	6 (5)	10 (9)	15 (13)	36 (32)	74 (66)	11 (10)	17 (16)	27 (24)	38 (35)	53 (48)	94 (85)	152 (136)	227 (205)	322 (290)	454 (409)	703 (633)		
CAP/MACH. SCREW	STAINLESS STEEL	304 / 316		30,000 YIELD	90,000					3 (3)	6 (5)	10 (9)	15 (13)	36 (32)	74 (66)	11 (10)	17 (16)	27 (24)	38 (35)	53 (48)	94 (85)	152 (136)	227 (205)	322 (290)	454 (409)	732 (659)		
CAP/MACH. SCREW	YELLOW BRASS ALLOY 270	Cu 63% Zn 37% Pb 0.1% Fe 0.07%		30,000 YIELD	60,000					4 (4)	8 (7)	16 (14)	19 (17)	60 (54)	107 (96)	16 (14)	26 (23)	35 (32)	47 (42)	76 (68)	102 (92)	156 (140)	212 (191)	318 (286)	394 (355)	575 (518)		
CAP/MACH. SCREW	SILICON BRONZE GRADE 661	Cu 94% (Min) Si 2.8 - 3.5% Mn 1.5% (Max) Pb 0.2 - 0.8%		30,000 YIELD	70,000					4 (3)	7 (6)	12 (11)	17 (16)	42 (38)	86 (77)	13 (11)	20 (18)	31 (28)	45 (40)	62 (56)	110 (99)	177 (159)	240 (216)	361 (325)	447 (402)	651 (586)		
CAP/MACH. SCREW	ALUMINUM 2024-T4	Cu 3.8 - 4.9 % Mg 1.2 - 1.8 % Mn 0.3 - 0.9 %		30,000 YIELD	55,000					3 (3)	5 (4)	11 (10)	14 (13)	39 (35)	80 (72)	12 (11)	19 (17)	26 (23)	34 (31)	60 (54)	80 (72)	125 (113)	166 (149)	251 (226)	308 (277)	450 (405)		
CAP/MACH. SCREW	MONEL	Ni 67 % Cu 30 % Fe 1.4 %		82,000						5 (4)	10 (9)	20 (18)	26 (23)	85 (77)	149 (134)	22 (20)	35 (32)	49 (44)	65 (59)	110 (99)	149 (134)	229 (206)	310 (279)	470 (423)	575 (518)	840 (756)		
SEMS/MACH. SCREW	HEAT TREATED STEEL	SAE 5.1		85,000	120,000					7 (6)	14 (13)	25 (23)	35 (32)	85 (77)	195 (176)	27 (24)												
				STRESS AREA	COARSE	.00604	.00909	.01400	.01750	.0318	.0524	.0775	.1063	.1419	.1820	.2260	.3340	.4620	.6060	.7630	.9690	1.155	1.405	1.90	2.50	3.25	4.00	
				FINE	.00661	.01015	.01474	.02000	.0364	.0580	.0878	.1187	.1599	.2030	.2560	.3730	.5090	.6630	.8560	1.073	1.315	1.581						

DATA IS FROM "PROPOSED STANDARD TORQUE VALUES FOR INDUSTRIAL FASTENERS (METAL)" WHICH IS LOCATED IN THE M&I STANDARDS DEPT.

** = BOXED TORQUE VALUES ARE EXPRESSED IN IN.-LBS.

- USE NON-BRACKETED TORQUE FIGURES DIRECTLY WHEN USING STANDARD INDUSTRIAL FASTENERS AS FURNISHED BY THE MANUFACTURER (NON-PLATED FASTENERS). USE THE BRACKETED () TORQUE VALUES WHEN LUBRICANTS OF HIGH STRESS ABILITY, SUCH AS NEVER-SEEZ COMPOUND, GRAPHITE AND OIL, MOLYBDENUM DI-SULPHITE, COLLOIDAL COPPER OR WHITE LEAD, ARE USED.
- MULTIPLY THE TORQUE VALUES IN THE CHART BY THE FACTOR 0.90 WHEN CAPSCREWS ARE ZINC PLATED. MULTIPLY BY 0.80 WHEN NUTS AND BOLTS ARE ZINC PLATED.
- THE STANDARD FOR FASTENERS OF EWT DRIVES AND LIFTS IS SAE GRADE 5 CAPSCREWS. HOWEVER, WHEN THE JOINTS ARE OF CAST IRON, USE THE A-307 (SAE 2) TORQUE VALUES UNLESS SPECIFIED OTHERWISE.
- FOR STUDS, USE TORQUE VALUES CORRESPONDING TO THE SAME SIZE AND GRADE OF CAPSCREWS.

HIGH STRENGTH (H.S.) BOLTS (ASTM A325) MUST BE USED WHERE SHOWN AND SPECIFIED. ASSEMBLY INSTRUCTIONS. TURN-OF-NUT METHOD.

ALL JOINT SURFACES SHALL BE FREE OF LOOSE MILL SCALE, BURRS, AND FOREIGN MATERIAL. ENOUGH BOLTS SHALL BE BROUGHT TO A "SNUG TIGHT" CONDITION TO INSURE THAT THE PARTS OF THE JOINT ARE PROPERLY COMPACTED, I.E., BROUGHT INTO FULL CONTACT WITH EACH OTHER. SNUG TIGHT SHALL BE DEFINED AS THE TIGHTNESS ATTAINED BY A FEW IMPACTS OF AN IMPACT WRENCH OR THE FULL EFFORT OF A MAN USING AN ORDINARY SPUD WRENCH. FOLLOWING THE INITIAL TIGHTENING, BOLTS SHALL BE PLACED IN ANY REMAINING HOLES IN THE CONNECTION AND BROUGHT TO SNUG TIGHTNESS. ALL BOLTS IN THE JOINT SHALL BE TIGHTENED ADDITIONALLY BY THE APPLICABLE AMOUNT OF NUT ROTATION SPECIFIED BELOW, WITH TIGHTENING PROGRESSING SYSTEMATICALLY FROM THE MOST RIGID PART OF THE JOINT TO ITS FREE EDGES.

Bolt Length (as measured from underside of head to extreme end of point)	Disposition of Outer Faces of Bolted Parts		
	Both faces normal to bolt axis	One face normal to bolt axis and other face sloped not more than 1:20 (beveled washers not used)	Both faces sloped not more than 1:20 from normal to bolt axis (bevel washers not used)
Up to and including 4 diameters	1/3 turn	1/2 turn	2/3 turn
Over 4 diameters but not exceeding 8 diameters	1/2 turn	2/3 turn	5/6 turn

NUT ROTATION IS ROTATION RELATIVE TO BOLT, REGARDLESS OF THE ELEMENT (NUT OR BOLT) BEING TURNED. TOLERANCE ON ROTATION: 30° OVER OR UNDER. FOR OTHER THAN TURN-OF-NUT METHOD, FOLLOW PROCEDURES OUTLINED IN LATEST EDITION OF THE AISC STEEL CONSTRUCTION MANUAL.

DRY TORQUE (IN IN.-LBS.) = (SAFETY FACTOR) * (PROOF LOAD) * (STRESS AREA) * (BASIC MAJOR DIA.) * (MECH. EFF.)
 SAFETY FACTOR = 0.75
 MECH. EFF. = 0.200 (FOR DRY APPLICATION - NO LUBRICANTS)
 LUBRICATED TORQUE = (0.90) * (DRY TORQUE)

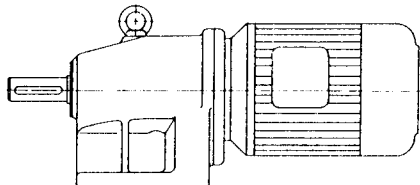
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			D COPYRIGHT © 2008 BY GLV ALL RIGHTS RESERVED - REV D
THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION OF EIMCO WATER TECHNOLOGIES AND IS NOT TO BE DISCLOSED NOR TO BE USED EXCEPT FOR EVALUATING PROPOSALS OF EIMCO WATER TECHNOLOGIES OR INSTALLING, OPERATING OR MAINTAINING EIMCO WATER TECHNOLOGIES EQUIPMENT, UNLESS OTHERWISE AUTHORIZED IN WRITING BY EIMCO WATER TECHNOLOGIES.			TOTAL WT: -
ADDED THE NUT TURN CHART			35895
TITLE BLOCK UPDATE			35052
ADDED 304 STAINLESS TO THE LIST			34901
REVISED TO UPDATE TITLE BLOCK AND REMOVE NOTES			34709
INITIAL RELEASE			
REVISION			ECO BY CHECK'D DATE
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DATE			1/8/81
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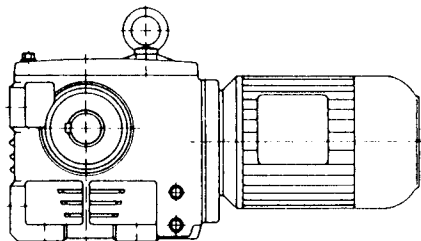
Accessories

TAB 1

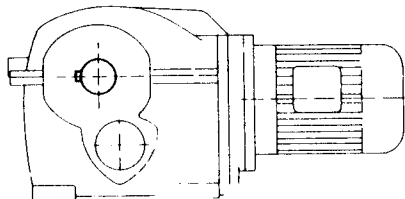
OPERATING & MAINTENANCE INSTRUCTIONS



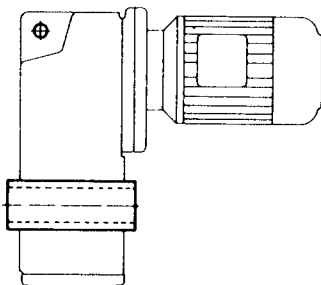
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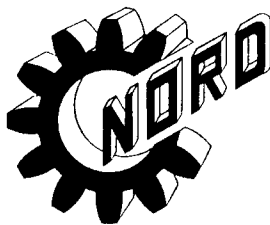
HELICAL-WORM



BEVEL-HELICAL



SHAFT MOUNT



NORD GEAR CORPORATION

800 Nord Drive
P.O. Box 367
Waunakee, WI 53597-0367

Phone (608)849-7300
TWX 910-286-2704
FAX 608-849-7367





GENERAL INSTRUCTIONS



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 to download the appropriate operating instructions.

EXAMPLE: 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-180MH/4 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	(75.66 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	(519.50 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.



5. Notes concerning warranty and liability

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

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



WARNING



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

6. Checklist for installation and operation

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



SAFETY NOTES

RETAIN FOR FUTURE USE



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

2. Safety warnings

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
	7 MTG POS <small>1210094630</small>

FOR GEAR LUBRICATION SEE MANUAL **UNIGASE™**

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

European Nameplate

Getriebebau NORD
GrbH&Co KG
D - 22934 Bargteheide

DRIVESYSTEMS

Type SK 1	
No. 2	
i= 3	
n2= 4	min ⁻¹

Siehe Wartungsanleitung
See maintenance instructions
Voir instructions d'entretien

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

4. Transportation and handling

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

WARNING

Do not attach other machinery or loads to the NORD assembly, 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.



SAFETY NOTES



7. DISPOSAL

	<i>MATERIAL DISPOSAL</i>	
<p>Properly dispose of all used gear units and internal parts in accordance with all local regulations. In particular, all lubricants must be properly collected and disposed.</p>		

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

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



STORAGE & COMMISSIONING



1. Storage

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

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

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

2. Commissioning

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

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

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

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

3. Long-Term Storage

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

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

4. Commissioning After Long-Term Storage

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



UNIT INSTALLATION



1. Installation site

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

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

2. Mounting position

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

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

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

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

Straightness: Based upon the length of the corresponding line.
Flatness: Based upon the longer lateral surface or the diameter of the circular surface.

STOP
HARMFUL SITUATION
STOP

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

STOP
HARMFUL SITUATION
STOP

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

3. Reducer mounting

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

4. Steel foundation

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

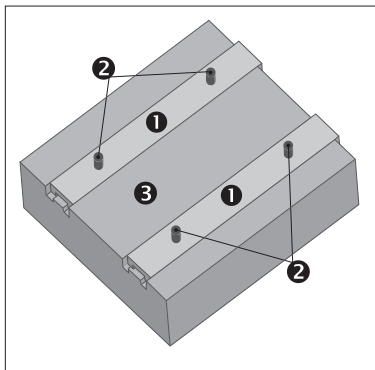
STOP
HARMFUL SITUATION
STOP

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

5. Concrete foundation

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

Figure 1: Concrete Foundation



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

6. Bolt connections for footed & flange mounted units

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

Table 2A: Tightening Torque for Inch Reducer Mounting Bolts

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

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

Table 2B: Tightening Torque for Metric Reducer Mounting Bolts

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

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

7. Mounting the prime mover

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

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



IMPORTANT NOTE



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

1. Solid shaft diameter tolerance

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

Table 1: Solid Shaft Diameter Tolerance

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

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

2. Fitting drive elements onto the reducer solid shaft

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

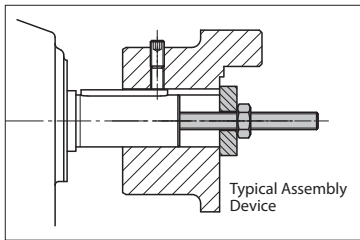


Table 2: Solid Shaft End - Threaded Holes

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

Above ø (mm)	To & Including ø (mm)	Tap Size & Depth (mm)
10	13	M4 x 10 mm
13	16	M5 x 12.5 mm
16	21	M6 x 16 mm
21	24	M8 x 19 mm
24	30	M10 x 22 mm
30	38	M12 x 28 mm
38	50	M16 x 36 mm
50	85	M20 x 42 mm
85	130	M24 x 50 mm
130	190	M30 x 60 mm

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HARMFUL SITUATION



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



WARNING



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

3. Installing interference-fit hubs to the reducer shaft

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



WARNING



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



HARMFUL SITUATION



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

4. Coupling installation

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

Coupling gap and angular alignment

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

Parallel (or offset) alignment

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

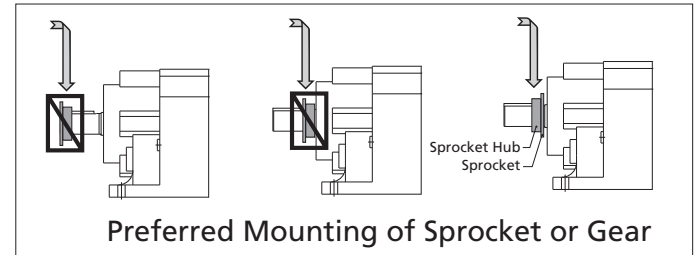
Check alignment

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

5. Installing sheaves (pulleys), sprockets and gears



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

Figure 2: Sprocket or Gear Mounting



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

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

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

6. Outboard pinion gear alignment

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



REDUCER MOUNTING FOOTED & FLANGE MOUNT GEAR UNITS



1. Foot-mounted reducers

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

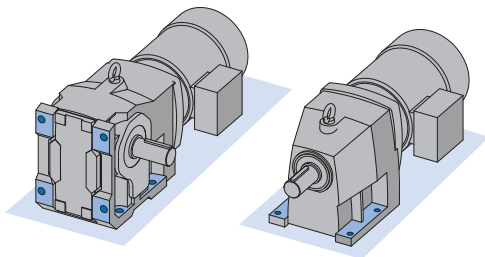


Table : Flange Pilot Tolerance

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

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

i
IMPORTANT NOTE
i

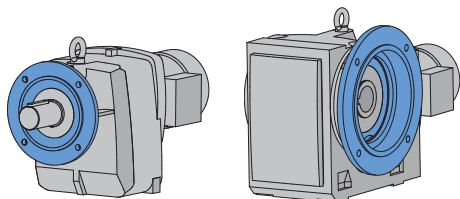
Gear units may be subjected to radial loads or side pull, caused by external chain drives or belt drives. In these instances it is recommended that the mounting base be designed with a slide-plate adjustment to accommodate extra slack in the chain or the belt after the feet are loosened. When using an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

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

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

2. Flange-mounted reducers (with B5 flange)

When using the B5 flange to mount the gear unit, the bulk head plate must be engineered to minimize buckling distortions and support the cantilevered weight of the gear reducer or gearmotor. On the B5 mounting flange NORD provides a pilot register or and the flange pilot tolerance as listed per Table 1. When the mating hole is designed with the proper fit, the flange pilot tenon provides a means of accurately positioning the reducer while the hold-down bolts are properly secured; once the reducer is secured, the tenon helps prevent movement of the reducer and it helps locate the center of the reducer output shaft.



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

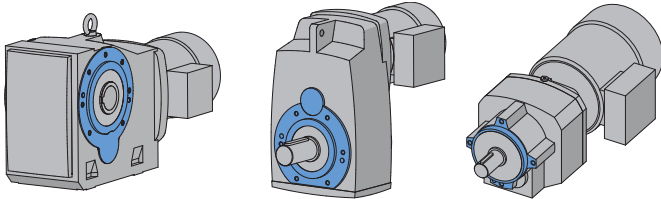


REDUCER MOUNTING FOOTED & FLANGE MOUNT GEAR UNITS



3. Flange-mounted reducers (with B14 flange)

When using the B14 flange to mount the gear unit, the bulk head plate must be engineered to minimize buckling distortions and support the cantilevered weight of the gear reducer or gearmotor. When properly installed, the output flange of the reducer housing is designed to enable the permissible torques and radial forces to be reliably transmitted by the bolt connections.

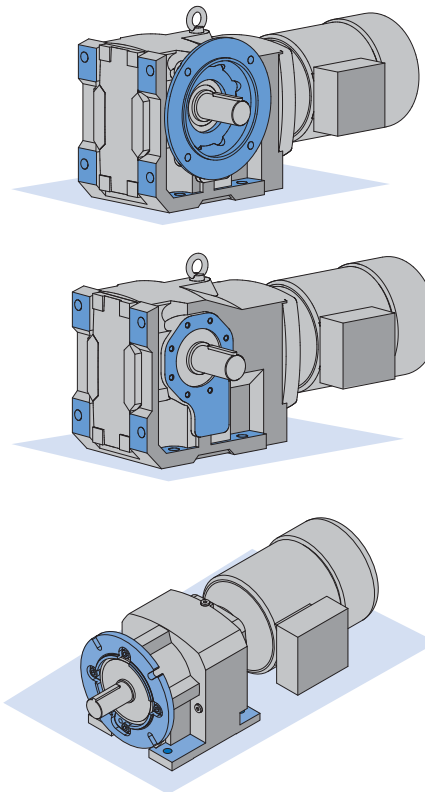


	IMPORTANT NOTE	
<p>When using the B14 flange-face for mounting, if dowel pin holes are provided in addition to the threaded holes, then it is advisable to also use the proper dowel pins, to help control flange movement or flange rotation and relieve the mounting bolts from this additional stress. This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

4. Foot & flange reducer housings

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

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





HELICAL & BEVEL REDUCER LUBRICATION



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.



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	HARMFUL SITUATION	STOP
<p>NORD suggests replacing the gear oil if oil analysis indicates any of the following:</p> <ul style="list-style-type: none"> • Viscosity has changed by approximately 10% or more. • Debris particles (silicon, dust, dirt or sand) exceed 25 ppm. • Iron content exceeds 150-200 ppm. • Water content is greater than 0.05% (500 ppm). • The total acid number (TAN) tests indicate a significant level of oxidative break-down of the oil, and a critical reduction in performance; If the TAN number measured changes by more than 5% over the new oil, then an oil change would be recommended. 		

7. Mounting position and oil fill quantity

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

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

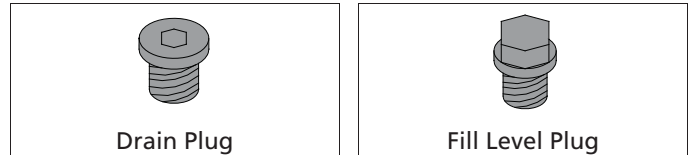
STOP	HARMFUL SITUATION	STOP
<p>Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15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

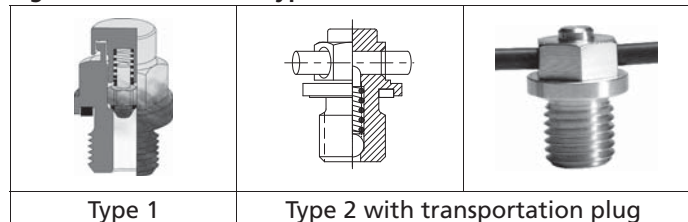


10. Vent plug locations

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.

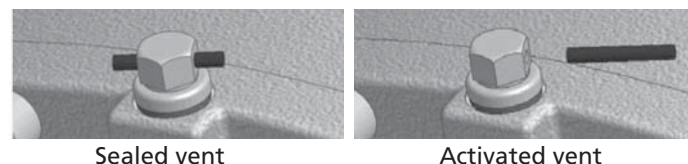
AUTOVENT™ - The AUTOVENT™ helps prevent bearing and gear damage by behaving like a check valve to block the entry of foreign material (water, dust, corrosives, etc.). The breather opens at approximately 2-3 psi during operation and closes tightly as the gearbox cools. This option is perfect for humid 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).

⚠	WARNING	⚠
<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	♣①
	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	♣①
	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

① Standard product on serviceable gear units

② Standard product on maintenance free gear units

	IMPORTANT NOTES	
<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> √ 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



DRIVESYSTEMS

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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.

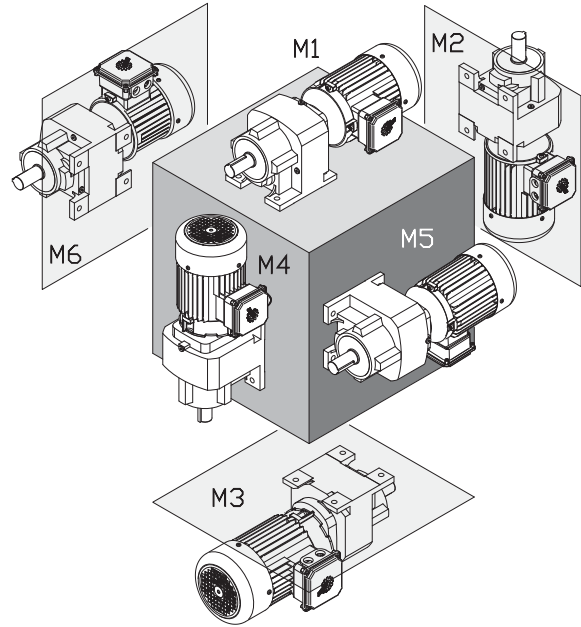


NORDBLOC®.1 FOOTED OIL FILL QUANTITIES



NORDBLOC®.1 footed lubrication

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



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 072.1	0.169	0.160	0.338	0.320	0.222	0.210	0.243	0.230	0.190	0.180	0.210	0.200
SK 172.1	0.285	0.270	0.624	0.590	0.444	0.420	0.529	0.450	0.338	0.320	0.412	0.390
SK 372.1	0.480	0.450	1.11	1.05	0.790	0.750	1.06	1.000	0.630	0.600	0.690	0.650
SK 373.1	0.480	0.450	1.11	1.05	0.791	0.750	1.06	1.000	0.630	0.600	0.690	0.650
SK 572.1	0.790	0.750	2.01	1.90	1.59	1.50	2.11	2.00	1.16	1.10	1.22	1.15
SK 573.1	0.790	0.750	2.00	1.90	1.59	1.50	2.11	2.00	1.16	1.10	1.22	1.15
SK 672.1	1.16	1.10	2.75	2.60	2.27	2.15	2.85	2.70	1.64	1.55	1.74	1.65
SK 673.1	1.16	1.10	2.75	2.60	2.27	2.15	2.85	2.70	1.64	1.55	1.74	1.65
SK 772.1	1.22	1.15	3.86	3.65	2.38	2.25	3.33	3.15	1.43	1.35	2.27	2.15
SK 773.1	2.06	1.95	3.70	3.50	3.38	3.20	3.06	2.90	2.38	2.25	3.12	2.95
SK 872.1	2.75	2.60	8.45	8.00	5.60	5.30	7.40	7.00	2.96	2.80	4.86	4.60
SK 873.1	4.28	4.05	8.03	7.60	7.24	6.85	6.92	6.55	5.28	5.00	6.92	6.55
SK 972.1	4.76	4.50	13.63	12.90	8.56	8.10	13.42	12.70	4.86	4.60	8.24	7.80
SK 973.1	7.82	7.40	12.89	12.20	11.73	11.10	12.26	11.60	8.45	8.00	11.52	10.90



NORDBLOC®.1 FLANGED OIL FILL QUANTITIES



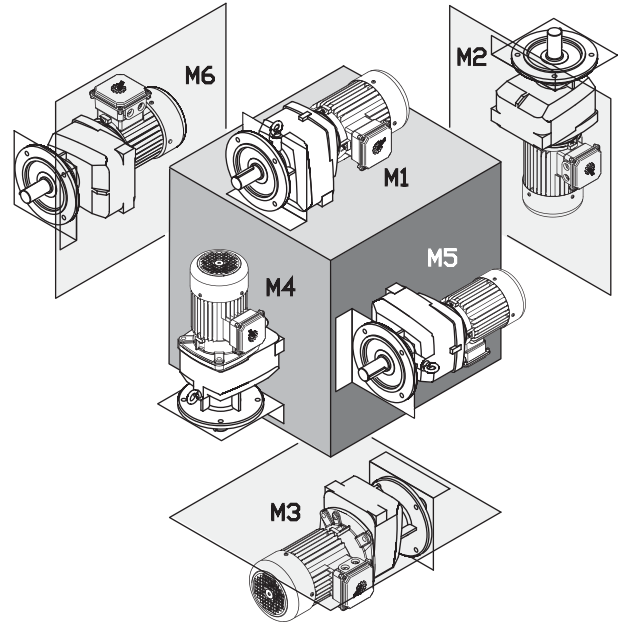
DRIVESYSTEMS

RETAIN FOR FUTURE USE

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NORDBLOC®.1 flanged lubrication

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



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 072.1 F	0.169	0.160	0.338	0.320	0.222	0.210	0.243	0.230	0.190	0.180	0.210	0.200
SK 172.1 F	0.285	0.270	0.624	0.590	0.444	0.420	0.529	0.450	0.338	0.320	0.412	0.390
SK 372.1 F	0.480	0.450	1.11	1.05	0.790	0.750	1.06	1.000	0.630	0.600	0.690	0.650
SK 373.1 F	0.480	0.450	1.11	1.05	0.791	0.750	1.06	1.000	0.630	0.600	0.690	0.650
SK 572.1 F	0.790	0.750	2.01	1.90	1.59	1.50	2.11	2.00	1.16	1.10	1.22	1.15
SK 573.1 F	0.790	0.750	2.00	1.90	1.59	1.50	2.11	2.00	1.16	1.10	1.22	1.15
SK 672.1 F	1.16	1.10	2.75	2.60	2.27	2.15	2.85	2.70	1.64	1.55	1.74	1.65
SK 673.1 F	1.16	1.10	2.75	2.60	2.27	2.15	2.85	2.70	1.64	1.55	1.74	1.65
SK 772.1 F	1.22	1.15	3.86	3.65	2.38	2.25	3.33	3.15	1.43	1.35	2.27	2.15
SK 773.1 F	2.06	1.95	3.70	3.50	3.38	3.20	3.06	2.90	2.38	2.25	3.12	2.95
SK 872.1 F	2.75	2.60	8.45	8.00	5.60	5.30	7.40	7.00	2.96	2.80	4.86	4.60
SK 873.1 F	4.28	4.05	8.03	7.60	7.24	6.85	6.92	6.55	5.28	5.00	6.92	6.55
SK 972.1 F	4.76	4.50	13.63	12.90	8.56	8.10	13.42	12.70	4.86	4.60	8.24	7.80
SK 973.1 F	7.82	7.40	12.89	12.20	11.73	11.10	12.26	11.60	8.45	8.00	11.52	10.90



NORDBLOC®.1 OIL PLUG & VENT LOCATIONS



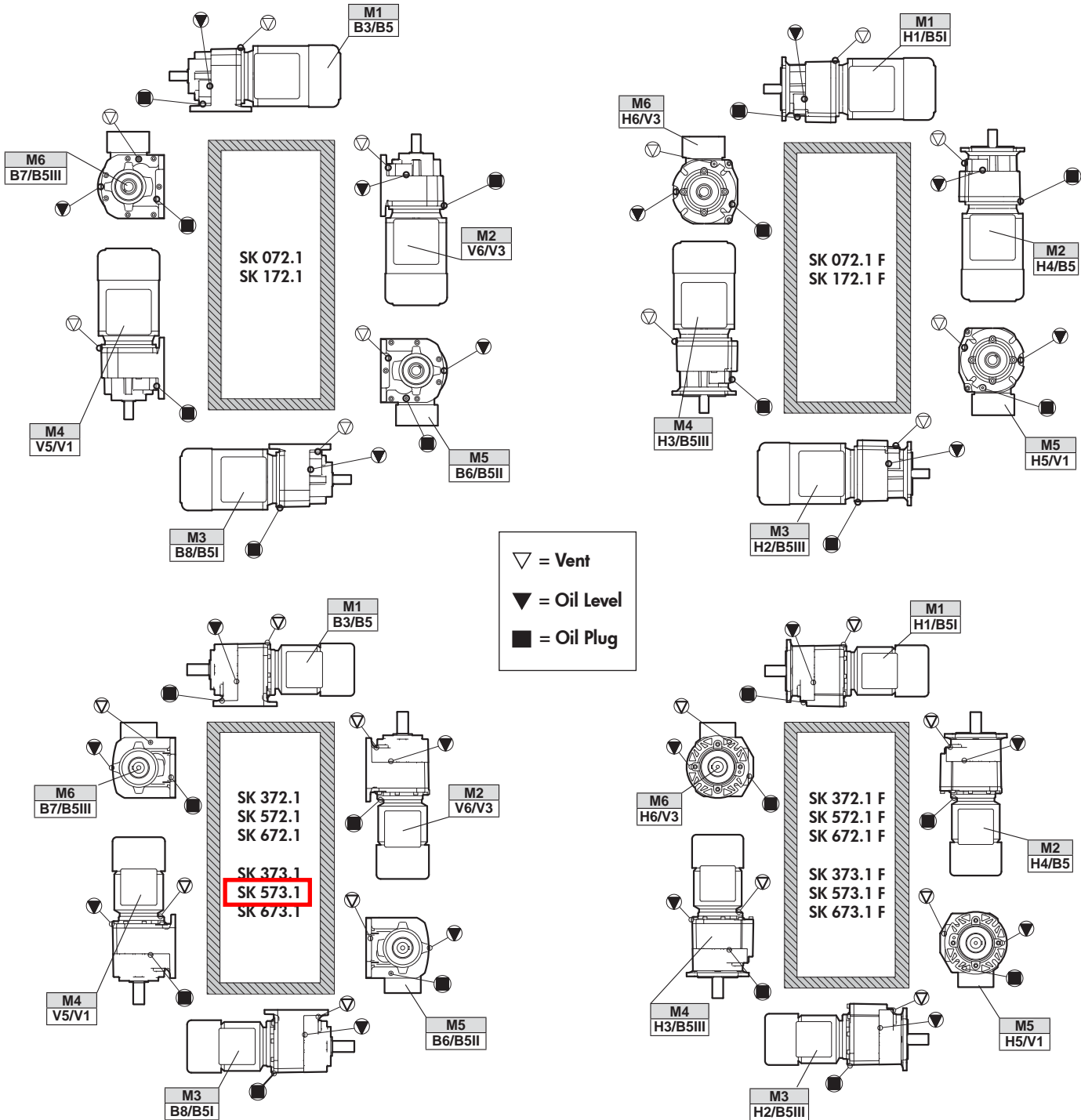
DRIVESYSTEMS

RETAIN FOR FUTURE USE

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Oil plug connections

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





NORDBLOC®.1 OIL PLUG & VENT LOCATIONS



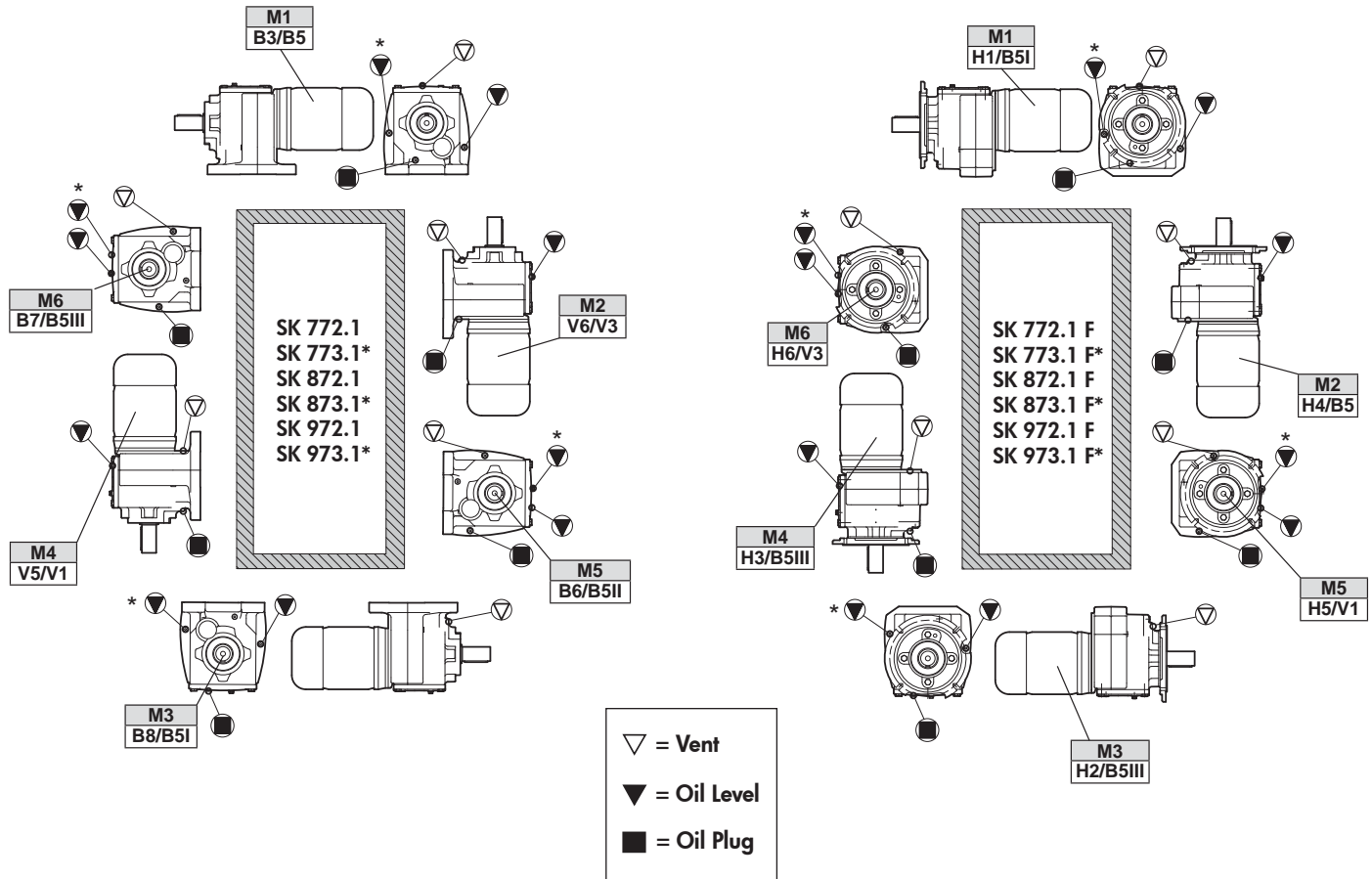
DRIVESYSTEMS

RETAIN FOR FUTURE USE

U14700 - 2 of 2

Oil plug connections

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



* Oil fill level for three stage gear units.



MOTORS - AC INDUCTION, SINGLE & POLYPHASE



1. Overview

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

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

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

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

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

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

2. Motor Types

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

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

3. Enclosure Types

Totally enclosed fan cooled (TEFC).

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

Totally enclosed, non-ventilated (TENV)

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

Totally enclosed, blower cooled (TEBC)

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

4. Voltage and Frequency Variation

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

NEMA and CSA Labeled Motors

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

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

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

CE Labeled Motors

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

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

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



MOTORS - AC INDUCTION, SINGLE & POLYPHASE



DRIVESYSTEMS

RETAIN FOR FUTURE USE

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5. Motor Nameplate Information

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

www.nord.com

0851278

Type SK 1

2 ~ Mot. No. 3

INS 5 NEMA IP 6 7 AMB 8 °C 9 DP

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

EFF 17 CODE 18 EFF 17 CODE 18

SF 19 SF 20 A SF 19 SF 20 A

21 V 21 V

22 A/SF 23 22 A/SF 23

24 25 26

www.nord.com

085500-0

Mtr 1

No. 3

PH 2 SF 19 NEMA DUTY 6 IP 7

INS 5 EFF 17 % PF 14 FR 15

AMB 8 ° ENCL 9 DP CODE 18

16 rpm 10 Hz 16 rpm 10 Hz

11 V 11 V

12 A 12 A

Brake 24 Nm 25 VAC 26 VDC

www.nord.com

0851278

Type SK 1

2 ~ Mot. No. 3

INS 5 NEMA IP 6 7 AMB 8 °C 9 DP

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

EFF 17 CODE 18 EFF 17 CODE 18

SF 19 SF 20 A SF 19 SF 20 A

21 V 21 V

22 A/SF 23 22 A/SF 23

24 25 26

www.nord.com

085511-4

Mtr 1

No. 3

PH 2 SF 19 NEMA DUTY 6 IP 7

INS 5 EFF 17 % PF 14 FR 15

AMB 8 °C ENCL 9 DP CODE 18

16 rpm 10 Hz 16 rpm 10 Hz

11 V 11 V

12 A 12 A

Brake 24 Nm 25 VAC 26 VDC

www.nord.com

0851278

Type SK 1

2 ~ Mot. No. 3

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

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

COS φ 14 16 min⁻¹ COS φ 14 16 min⁻¹

21 V 21 V

22 A 22 A

17 18

24 25 26

www.nord.com

085020-0

Type SK 1

2 ~ Mot. Nr 3

Th Cl 5 F IP 6 S 7

EN 60034 (H)

11 v 12 A

kW 16 1/min

COS φ 14 10 Hz

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

Table 1. Nameplate Data

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

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

NORD Gear Limited
Toll Free in Canada: 800.668.4378

NORD Gear Corporation
Toll Free in the United States: 888.314.6673



MOTORS - AC INDUCTION, SINGLE & POLYPHASE



DRIVESYSTEMS

RETAIN FOR FUTURE USE

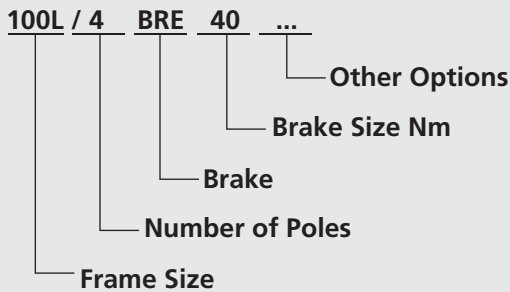
U30000 - 3 of 17

6. Motor Options And Nomenclature

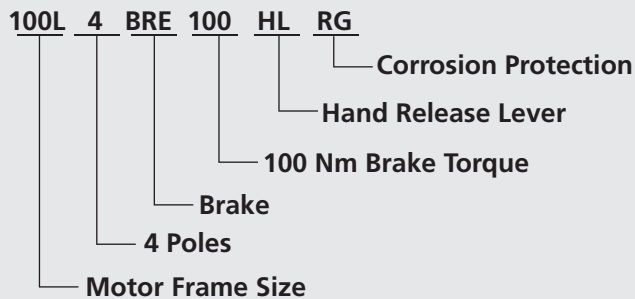
NORD offers many options for its motors. The option code will be shown in the motor nomenclature. Below are commonly used options.

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

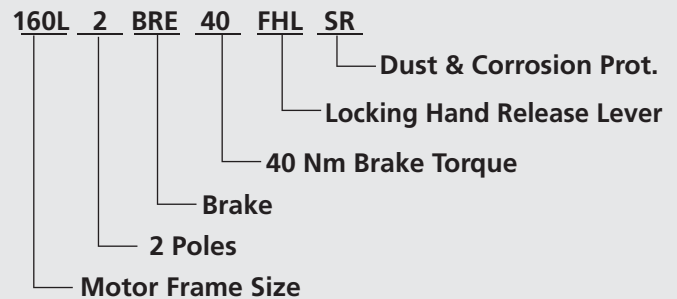
Motor Nomenclature



Ordering Examples



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



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



MOTORS - AC INDUCTION, SINGLE & POLYPHASE



7. Application Conditions

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

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

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

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

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

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

8. Transportation

During transportation observe the following:

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

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



9. Storage

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

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

10. Safety Considerations

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

Five Safety Rules

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

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

Qualified Personnel

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

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

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



MOTORS - AC INDUCTION, SINGLE & POLYPHASE



10. Safety Considerations Ctd.

General Warnings and Cautions

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

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

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

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

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

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

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

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



MOTORS - AC INDUCTION, SINGLE & POLYPHASE



11. Checking the Insulation

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

	WARNING	
During and directly after measurement the motor connection terminals carry hazardous voltages.		

A. Control

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

B. Measurement

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

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

C. Verification

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

12. Bearing Lubrication

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

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

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

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

Table 3 – Motor Bearing Maintenance Guidelines

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

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

13. Mechanical Installation

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

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

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

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

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

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



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14. Electrical Connections

WARNING

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

IMPORTANT NOTE

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

WARNING

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

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

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

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

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

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

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

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



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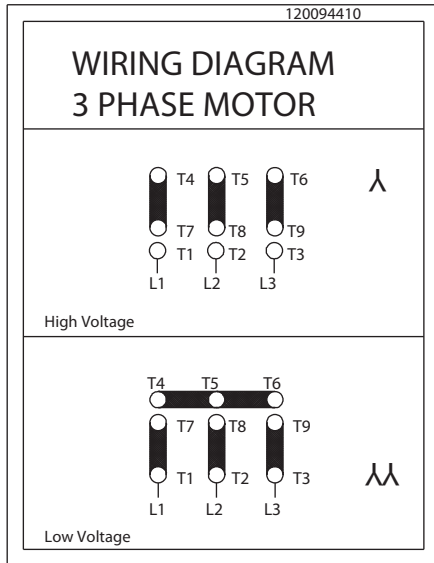
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15. Wiring Diagrams

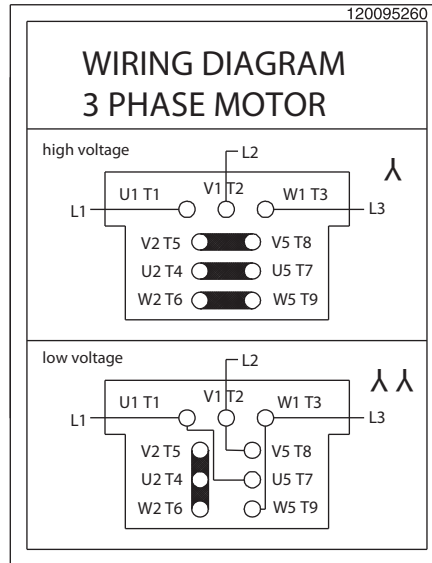
Frames 63-132

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



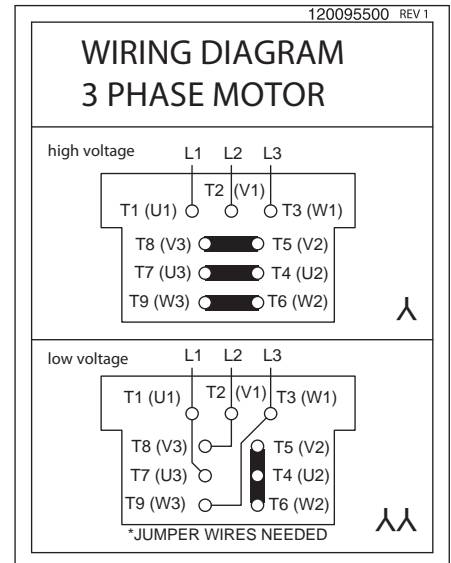
Frames 160 +

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

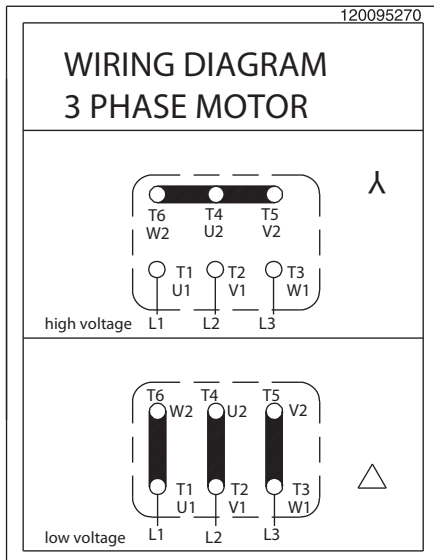


Frames 160 +

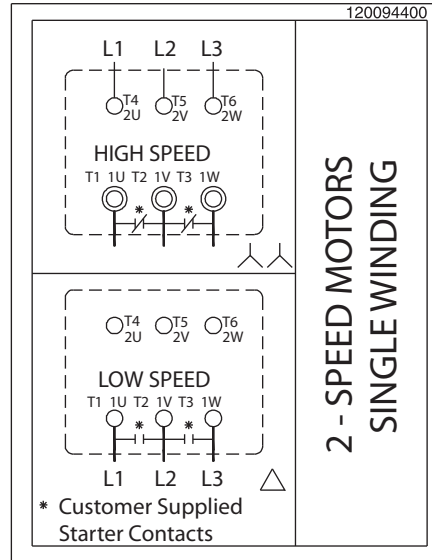
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø
190 / 380V, 60Hz, 3Ø



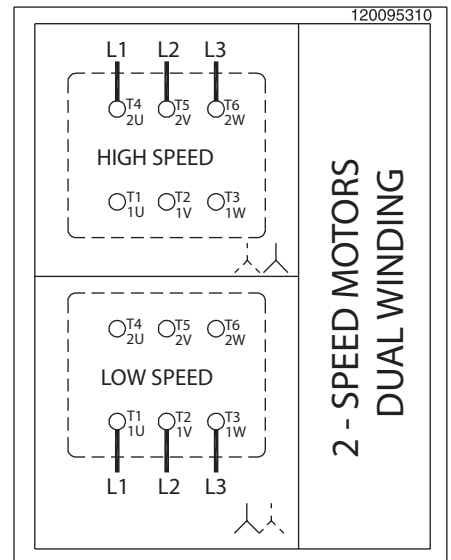
460 / 800V, 60Hz, 3Ø | 230 / 400V, 50Hz, 3Ø
208 / 360V, 60Hz, 3Ø | 400 / 690V, 50Hz, 3Ø
332 / 575V, 60Hz, 3Ø



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



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





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15. Wiring Diagrams Ctd.

FROM MOTOR
P1
P2
TERMINAL BLOCK
TO CONTROL DEVICE

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

**THERMISTOR
"TF" OPTION**

120095240

FROM MOTOR
P1
P2
TERMINAL BLOCK
TO CONTROL DEVICE

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

**THERMISTATS
"TW" OPTION**

120095230

W2 U2 V2
U1 V1 W1
L1 N

1 PHASE
115V*
50/60 Hz

* CAPACITOR IS SUPPLIED

**BLOWER COOLING FAN
"FC" OPTION**

120095450

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

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

W2 U2 V2
U1 V1 W1
L1 L2 L3
220-332V
50 / 60 Hz

* CAPACITOR IS SUPPLIED

**BLOWER COOLING FAN
"F" OPTION**

120095250

FROM MOTOR
H1
H2
TERMINAL BLOCK
TO CONTROL DEVICE

**SPACE HEATER
"SH" OPTION**

120095220



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16. Motor Accessories

Blower Cooling Fan (Option F & FC)

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

Option F – 3ph & 1ph 220-575V 50/60Hz

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

Option FC – 115V 50/60Hz 1ph

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

Table 6 – Option F & FC



MOTORS - AC INDUCTION, SINGLE & POLYPHASE



16. Motor Accessories Ctd.

Thermostats (Option TW and Option 2TW)

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

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

Thermistors (Option TF)

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

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

⚠	WARNING	⚠
Thermostats and Thermistors will automatically reset.		

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

Space Heaters (Option SH)

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

Table 5. Space Heater Data

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

Encoder (Option IG)

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



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17. Inspection

Inspect the motor after every 500 operating hours.



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

Table 8 - Inspection Guidelines

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



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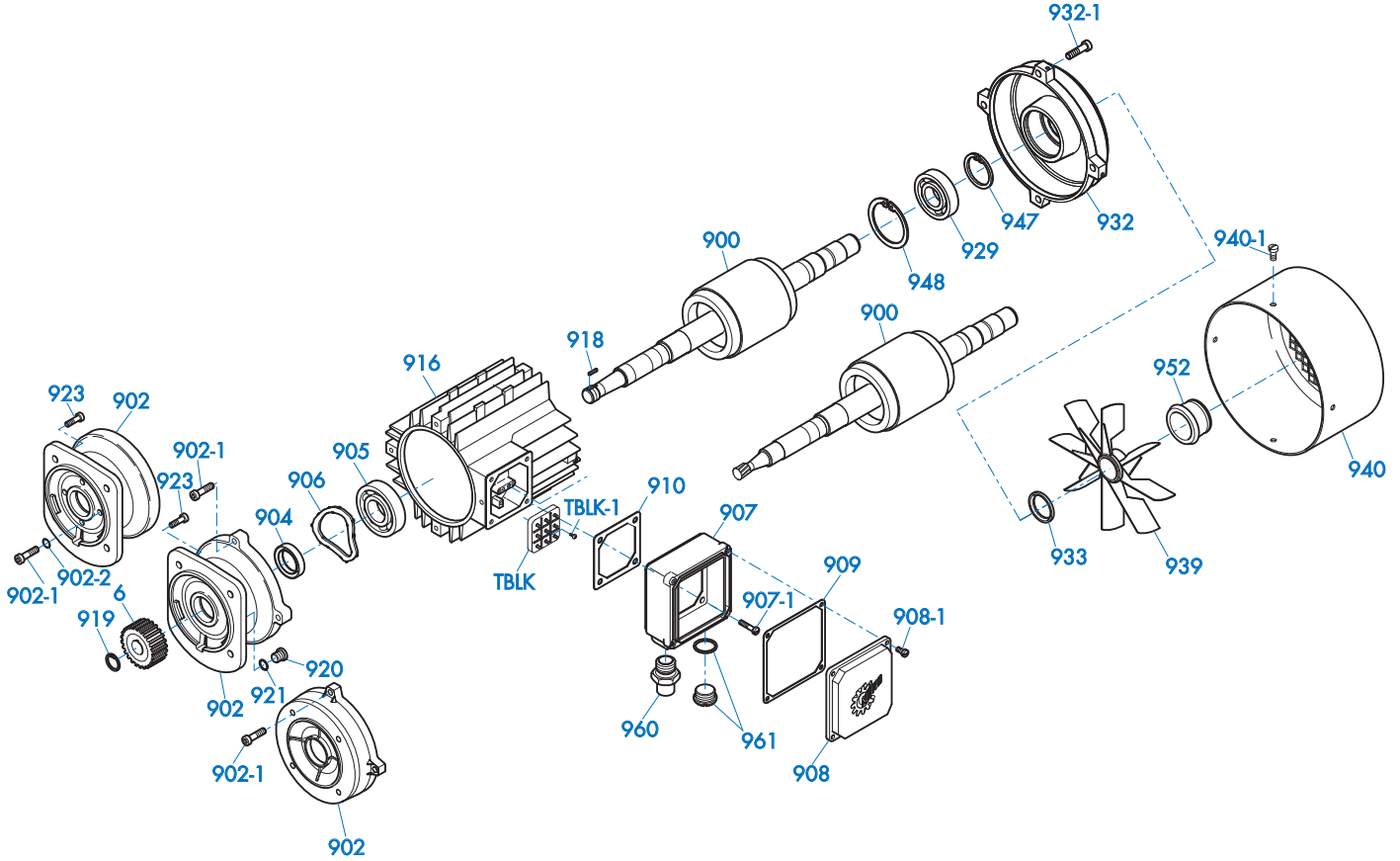
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18. Parts List

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



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

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

NORD Gear Limited
Toll Free in Canada: 800.668.4378

NORD Gear Corporation
Toll Free in the United States: 888.314.6673



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19. Repair

Reference the parts list drawing on page 14 for clarification.

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

20. Removing and Replacing Integral Motors

Reference the parts list on Page 14 for clarification.

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

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

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

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

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

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

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

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



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

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

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

22. Testing



IMPORTANT NOTE



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

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

Record and date all measurements taken.

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

Static Testing

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

Dynamic Testing

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



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23. Troubleshooting

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

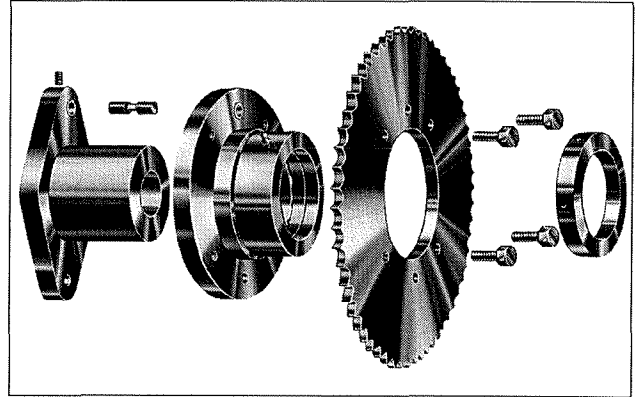
TAB 2

Bolt-On Shear Pin Sprockets

Shear pin sprockets provide simple, dependable protection against expensive machinery damage caused by overloads or jamming. Torque is transmitted by a single pin, necked to shear when the safe load is exceeded. When an overload occurs, the pin shears, disconnecting the drive immediately.

The Bolt-on Shear Pin Adapter converts any plate sprocket into a stock Shear pin sprocket allowing immediate delivery of stock shear pin sprockets..

Selection guide on page E8 gives complete procedure to select the proper shear pin assembly.



Stock Shear Pin Assemblies

Shear Pin Assembly Number	Hub Bore Range	Shear Pin Hub	Shear Pin Adapter
		Catalog Number	Catalog Number
SP-17	1" & UNDER	SPH-17	SPA-17
SP-18	1 $\frac{1}{8}$ "-1 $\frac{1}{4}$ "	SPH-18	SPA-18
SP-19	1 $\frac{1}{2}$ "-1 $\frac{3}{4}$ "	SPH-19	SPA-19
SP-20	1 $\frac{3}{8}$ "-1 $\frac{3}{4}$ "	SPH-20	SPA-20
SP-21	1 $\frac{3}{16}$ "-2"	SPH-21	SPA-21
SP-22	2 $\frac{1}{8}$ "-2 $\frac{1}{2}$ "	SPH-22	SPA-22
SP-23	2 $\frac{3}{8}$ "-2 $\frac{1}{2}$ "	SPH-23	SPA-23
SP-24	2 $\frac{3}{16}$ "-2 $\frac{3}{4}$ "	SPH-24	SPA-24
SP-25	2 $\frac{3}{8}$ "-3"	SPH-25	SPA-25
SP-26	3 $\frac{1}{8}$ "-3 $\frac{1}{2}$ "	SPH-26	SPA-26
SP-27	3 $\frac{1}{16}$ "-4"	SPH-27	SPA-27
SP-28	4 $\frac{1}{8}$ "-4 $\frac{1}{2}$ "	SPH-28	SPA-28
SP-29	4 $\frac{3}{8}$ "-5"	SPH-29	SPA-29
SP-30	5 $\frac{1}{8}$ "-5 $\frac{1}{2}$ "	SPH-30	SPA-30
SP-31	5 $\frac{3}{8}$ "-6"	SPH-31	SPA-31

Notes on Pricing:

Shear Pin Hub List Price includes any finished bore within the stated range, standard keyway and setscrew, hardened steel shear pin bushing.

Shear Pin Adapter List Price includes the shear pin bushing, grease fitting.

Complete Assembly List Price includes all components of the shear pin assembly as described above. Total list price of any shear pin sprocket is the complete assembly list price plus the list price of the desired plate sprocket (from tables of stock sprocket list prices).

Replacement Sprockets should be priced as altered stock sprockets directly from List Price and Alteration Charge tables.

Shear Pin Components may be ordered separately and will be treated as stock items when conforming to standard specifications and descriptions above.

Pricing Examples:

1. Stock Shear Pin Sprocket

To price a 35 tooth shear pin sprocket for 160 chain (160SP35) using SP-26 shear pin assembly with 3 $\frac{3}{16}$ " bore, standard keyway and setscrew:

SP-26 Assembly List Price
160A35 List Price
Total List Price

See List
Price Sheet

2. Shear Pin Adapter and Sprocket for Existing Hub

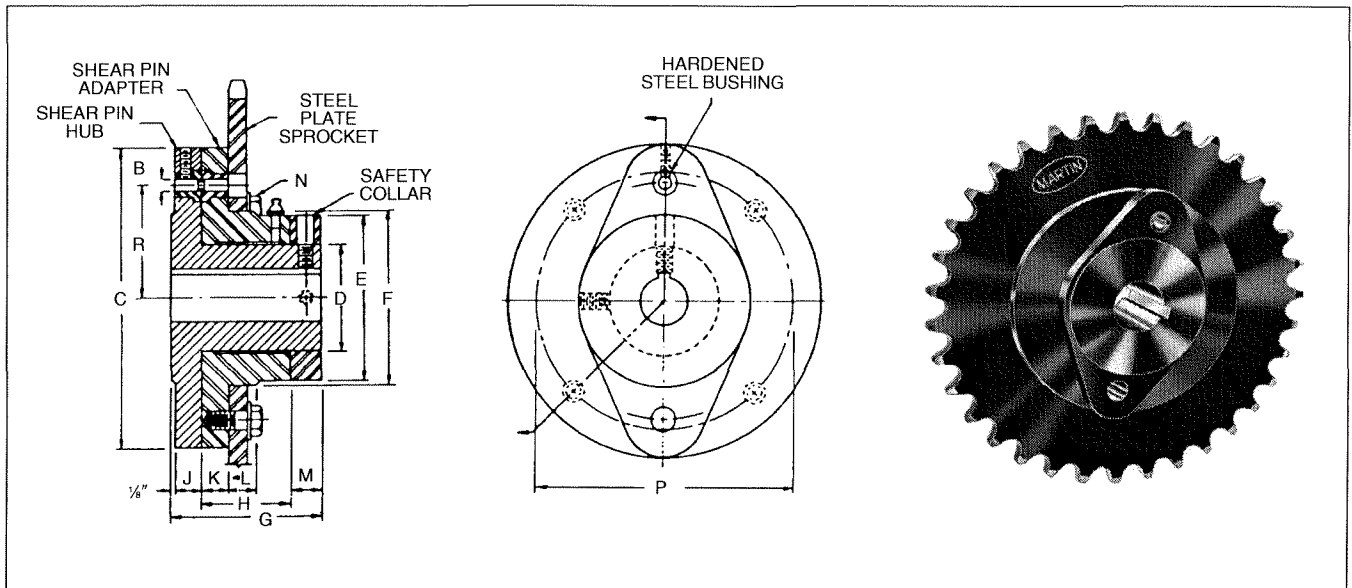
To price a "Bolt-on" shear pin adapter and sprocket to replace the sprocket part of existing 50SP40 using SP-19 hub:

SPA-19 Adapter List Price
50A40 List Price
Total List Price

See List
Price Sheet

Shear Pin Sprockets can also be furnished in other standard styles or made to customer's specifications. Price on application.

It is important that torque requirement for selected hub be checked in torque rating table on page E-8 and neck dia. of shear pins be specified.



Shear Pin Assembly Dimensions (Inches)

Shear Pin Assembly Number	Shear Pin		Diameters				Length Thru			Hub Flange Thickness	Adapt. Flange Thickness	Sprocket Seat Width	Bolts		Weights (lbs.)	
	Radius	Pin Dia.	Flange	Shear Pin Hub	Adapt. Hub & Collar	Sprocket Seat	Shear Pin Hub	Adapt.	Collar				Number & Size	Bolt Circle	Shear Pin Hub	Shear Pin Adapt.
	R	B	C	D	E	F	G	H	M				J	K	L	N
SP-17	1 ¹ / ₁₆	1/4	5 ¹ / ₄	1 ¹ / ₄	2 ¹ / ₁₆	2 ¹ / ₁₆	2 ¹ / ₁₆	1 ¹ / ₁₆	3/8	3/16	3/16	3/16	4-3/8"	4	2.7	3.2
SP-18	2 ¹ / ₁₆	1/4	6	2 ¹ / ₄	3 ¹ / ₁₆	3 ¹ / ₁₆	2 ¹ / ₁₆	1 ¹ / ₁₆	1/2	3/16	3/16	3/16	4-3/8"	4	4.6	4.7
SP-19	2 ¹ / ₁₆	5/16	6 ¹ / ₄	2 ¹ / ₄	4	4 ¹ / ₁₆	3 ¹ / ₁₆	2 ¹ / ₁₆	5/8	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	4-1/2"	5 ¹ / ₂	7.2	7.6
SP-20	3	3/8	7 ¹ / ₄	3 ¹ / ₄	4 ¹ / ₁₆	4 ¹ / ₁₆	4 ¹ / ₁₆	2 ¹ / ₁₆	3/4	3/16	3/16	1 ¹ / ₁₆	4-1/2"	6 ¹ / ₂	11.0	11.9
SP-21	3 ¹ / ₁₆	7/16	8 ¹ / ₄	3 ¹ / ₄	5 ¹ / ₁₆	5 ¹ / ₁₆	4 ¹ / ₁₆	2 ¹ / ₁₆	7/8	3/16	3/16	1 ¹ / ₁₆	4-5/8"	7	16.2	16.9
SP-22	3 ¹ / ₁₆	1/2	9 ¹ / ₄	4 ¹ / ₄	6 ¹ / ₁₆	6 ¹ / ₁₆	5 ¹ / ₁₆	3	1	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	4-5/8"	8	23.3	24.5
SP-23	4	1/2	10	4 ¹ / ₄	6 ¹ / ₁₆	6 ¹ / ₁₆	5 ¹ / ₁₆	3 ¹ / ₁₆	1	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	4-5/8"	8 ¹ / ₂	26.3	27.7
SP-24	4 ¹ / ₁₆	9/16	11 ¹ / ₂	5	7	7 ¹ / ₁₆	6 ¹ / ₁₆	3 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	4-5/8"	9 ¹ / ₄	40.4	38.6
SP-25	4 ¹ / ₁₆	5/8	12 ¹ / ₂	5 ¹ / ₄	8	8 ¹ / ₁₆	6 ¹ / ₁₆	4 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	6-5/8"	10 ¹ / ₂	52.6	53.6
SP-26	5 ¹ / ₁₆	11/16	13 ¹ / ₂	6 ¹ / ₄	8 ¹ / ₁₆	8 ¹ / ₁₆	7 ¹ / ₁₆	4 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	6-5/8"	11 ¹ / ₄	66.7	66.8
SP-27	6 ¹ / ₁₆	3/4	15 ¹ / ₂	7	10	10 ¹ / ₁₆	8 ¹ / ₁₆	5 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	6-5/8"	12 ¹ / ₂	96.5	100.0
SP-28	6 ¹ / ₁₆	3/4	16 ¹ / ₄	7 ¹ / ₄	10 ¹ / ₁₆	10 ¹ / ₁₆	9 ¹ / ₁₆	6 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	6-3/4"	13 ¹ / ₂	125.0	115.0
SP-29	7 ¹ / ₁₆	7/8	17 ¹ / ₂	8 ¹ / ₄	12	12 ¹ / ₁₆	10 ¹ / ₁₆	7	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	6-1"	14 ¹ / ₂	160.0	150.0
SP-30	8 ¹ / ₁₆	1	20 ¹ / ₄	9 ¹ / ₄	13 ¹ / ₁₆	13 ¹ / ₁₆	11 ¹ / ₁₆	7 ¹ / ₁₆	2	2 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	6-1"	17	215.0	207.0
SP-31	8 ¹ / ₁₆	1 ¹ / ₁₆	22 ¹ / ₄	10 ¹ / ₄	15	15 ¹ / ₁₆	12 ¹ / ₁₆	8 ¹ / ₁₆	2 ¹ / ₁₆	2 ¹ / ₁₆	1 ¹ / ₁₆	1 ¹ / ₁₆	6-1"	18 ¹ / ₂	318.0	265.0

Sprocket Sizes For Stock Shear Pin Assemblies

NOTE: Shear Pin "Pin" length equals 2 x "J" dimension.

Shear Pin Assembly Number	Hub Bore Range	Minimum Number of Teeth for Single Sprockets													
		Chain Number													
		35	41	40	50	60	80	100	120	140	160	180	200	240	
SP-17	1" & UNDER	48	37	37	30	26	—	—	—	—	—	—	—	—	
SP-18	1 ¹ / ₁₆ -1 ¹ / ₂	55	42	42	34	29	23	—	—	—	—	—	—	—	
SP-19	1 ¹ / ₁₆ -1 ¹ / ₂	61	46	47	38	32	25	21	—	—	—	—	—	—	
SP-20	1 ¹ / ₁₆ -1 ¹ / ₂	69	53	53	43	36	28	23	—	—	—	—	—	—	
SP-21	1 ¹ / ₁₆ -2	78	59	59	48	41	31	26	22	19	—	—	—	—	
SP-22	2 ¹ / ₁₆ -2 ¹ / ₄	86	65	66	53	45	34	28	24	21	19	17	—	14	
SP-23	2 ¹ / ₁₆ -2 ¹ / ₄	89	67	67	55	46	35	29	25	22	19	18	16	14	
SP-24	2 ¹ / ₁₆ -2 ¹ / ₄	101	76	77	62	52	40	33	28	24	22	20	18	16	
SP-25	2 ¹ / ₁₆ -3	110	83	83	67	56	43	35	30	26	23	21	19	17	
SP-26	3 ¹ / ₁₆ -3 ¹ / ₂	—	98	98	72	61	46	38	32	28	25	23	20	18	
SP-27	3 ¹ / ₁₆ -4	—	102	102	82	69	53	43	36	32	28	25	23	20	
SP-28	4 ¹ / ₁₆ -4 ¹ / ₂	—	107	107	86	72	55	45	38	33	29	26	24	21	
SP-29	4 ¹ / ₁₆ -5	—	—	—	92	77	59	48	40	35	31	28	26	22	
SP-30	5 ¹ / ₁₆ -5 ¹ / ₂	—	—	—	106	89	68	55	46	40	35	32	29	25	
SP-31	5 ¹ / ₁₆ -6	—	—	—	—	98	75	61	51	44	39	35	32	27	

Bolt-On Shear Pin Sprockets



Shear Pin Sprocket Selection

- The shear pin assembly required is determined by the shaft size. Select the smallest shear pin assembly which will accommodate the required bore. Table on page E-7 contains the bore ranges and minimum sprocket sizes which allow chain clearance over the shear pin assembly flange.
- Using one of the following formulas, compute the torque load the pin must transmit and enter the torque rating table below to obtain the proper shear pin neck diameter.

$$T = \frac{HP \times 63,000 \times 1.5}{RPM} \quad \text{or} \quad T = \frac{D \times CP \times 1.5}{2}$$

or T = Output of reducer x speed ratio of chain drive x 1.5

Where: T = Torque in pound inches
 HP = Horsepower at Sprocket
 RPM = Sprocket Speed
 D = Pitch Diameter of Sprocket
 CP = Chain pull in pounds
 1.5 = Safety factor for starting load

Example:

- Determine the shear pin assembly and pin neck diameter to transmit 20 horsepower at 67 RPM with a 45 tooth, No. 100 sprocket on a 2¹/₁₆" shaft.

(1) Referring to Table I, shear pin assembly SP-25 is required for a 2¹/₁₆" bore. The 45 tooth sprocket is well above the minimum size.

(2) Torque and neck diameter:

$$T = \frac{HP \times 63,000 \times 1.5}{RPM}$$

$$T = \frac{20 \times 63,000 \times 1.5}{67} = 28,200 \text{ lb. in.}$$

Referring to Table II under SP-25, a pin necked to ³/₈" shows a torque rating of 29,810 lb. in., which exceeds the 28,200 lb. in. required.

(3) Order: 100SP45, SP-25 assembly with 2¹/₁₆" bore and ³/₈" pin neck diameter.

Shear Pin Torque Ratings

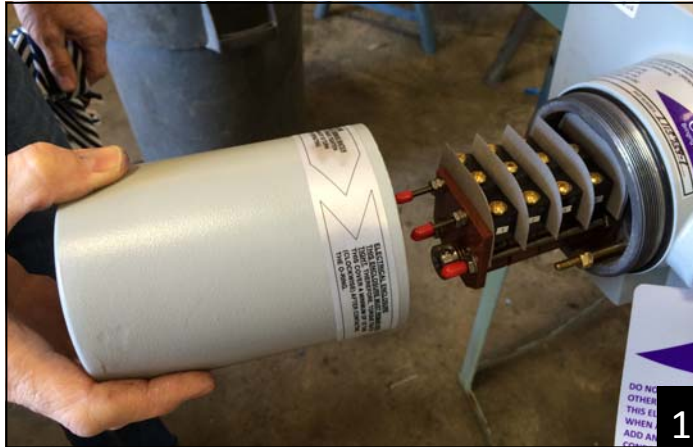
Shear Pin Neck Diameter (inches)	TORQUE RATING — POUND INCHES																				
	Shear Pin Hub Number																				
	SP17	SP18	SP19	SP20	SP21	SP22	SP23	SP24	SP25	SP26	SP27	SP28	SP29	SP30	SP31						
³ / ₃₂	728	875	1022	1204	1323	1556	1603														
¹ / ₁₆	1248	1500	1752	2064	2268	2616	2748														
⁵ / ₃₂	1976	2375	2774	3268	3591	4142	4351	4750													
³ / ₁₆	2808	3375	3942	4944	5103	5886	6183	6750	7317												
⁷ / ₃₂	3848	4625	5402	6364	6993	8066	8473	9250	10027												
¹ / ₈	5200	6250	7300	8600	9450	10900	11450	12500	13550	15200	17300	18400									
⁹ / ₃₂			9052	10664	11718	13516	14198	15500	16802	18848	21452	22816									
⁵ / ₁₆			11096	13072	14364	16568	17403	19000	20596	23140	26296	27968	30932								
¹¹ / ₃₂				15824	17388	20056	21068	23000	24932	27968	31832	33856	37440								
³ / ₈				18920	20790	23980	25190	27500	29810	33440	38060	40480	44770	51040							
¹³ / ₃₂					24570	28340	29170	32500	35230	39520	44980	47840	52910	60320							
⁷ / ₁₆					28350	32700	34350	37500	41650	45600	51900	55200	61050	69600							
¹⁵ / ₃₂						37060	38930	42500	46070	51680	58820	62560	69190	78880							
¹ / ₄						42728	44884	49000	53116	59584	67816	72128	79772	90944							
¹⁷ / ₃₂								55000	59620	66880	76120	80960	89540	102080							
⁹ / ₁₆								62000	67280	75392	85808	91264	100936	115072							
¹⁹ / ₃₂									73220	82080	93420	99360	109890	125280	136890						
⁵ / ₈									82800	92720	105530	112240	124135	141520	154635						
²¹ / ₃₂										103360	117640	126120	138380	157760	172380						
¹¹ / ₁₆										112480	128020	136160	150590	171680	187590						
²³ / ₃₂											138400	147200	162800	185600	202800						
³ / ₄											152240	161920	179080	204160	223080						
²⁵ / ₃₂														195360	222720	243360					
¹³ / ₁₆															211640	241280	263640				
²⁷ / ₃₂															227920	259840	283920				
⁷ / ₈															244200	278400	304200				
²⁹ / ₃₂																296960	324480				
¹⁵ / ₁₆																	301600	329550			
³¹ / ₃₂																		338720	370110		
1																			371200	405600	
1 ¹ / ₁₆																				446160	
1 ¹ / ₈																					507000

TAB 3

OVIVO DRIVE CONTROL REMOVAL AND REPLACEMENT INSTRUCTIONS

REMOVAL OF DRIVE CONTROL

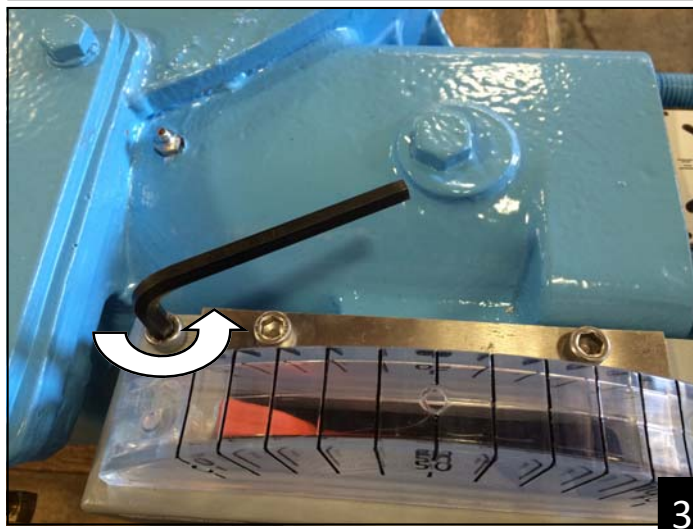
DISABLE ALL POWER TO DRIVE CONTROL AND DRIVE GEAR MOTOR.
REMOVE ROUND SWITCH COVER FROM DRIVE CONTROL.



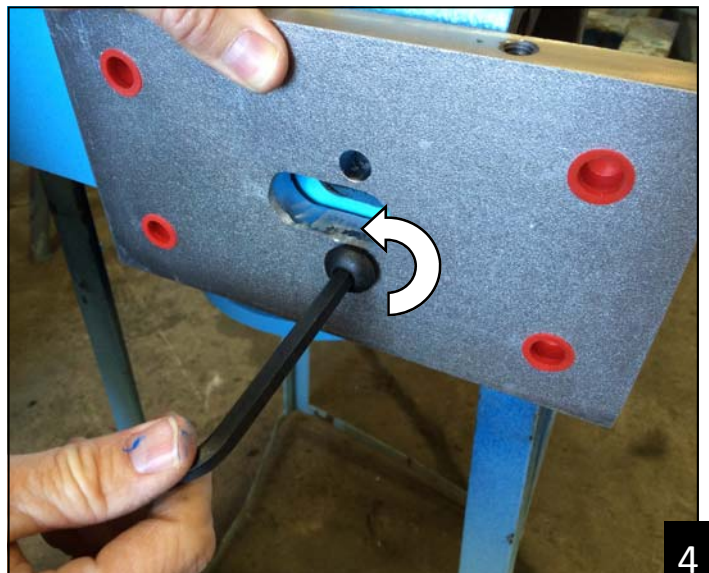
LABEL AND DISCONNECT SWITCH WIRES. DISCONNECT CONDUIT FROM DRIVE CONTROL HOUSING.



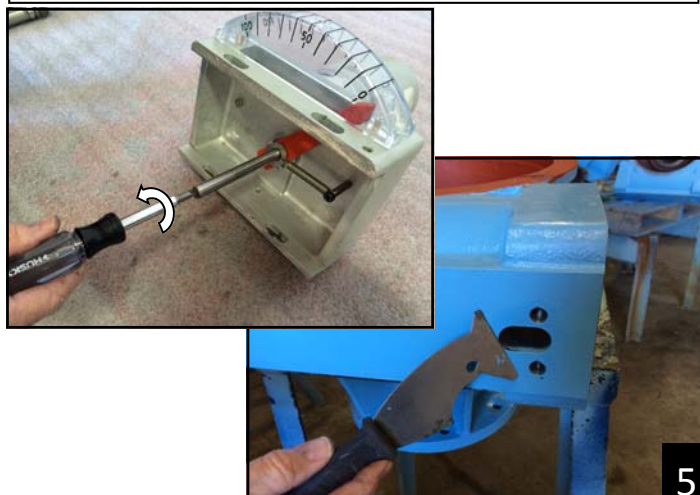
REMOVE (5) SOCKET CAP SCREWS, INCLUDING THE DOWEL SCREW, FROM DRIVE CONTROL, THEN REMOVE DRIVE CONTROL.



REMOVE (2) BOLTS FROM MOUNTING PLATE, THEN REMOVE PLATE.



REMOVE ACTUATING PIN FROM OLD DRIVE CONTROL POINTER, THEN CLEAN SURFACE OF WORM GEAR HOUSING AND REMOVE ANY RESIDUAL SEALANT.



INSTALLATION OF DRIVE CONTROL

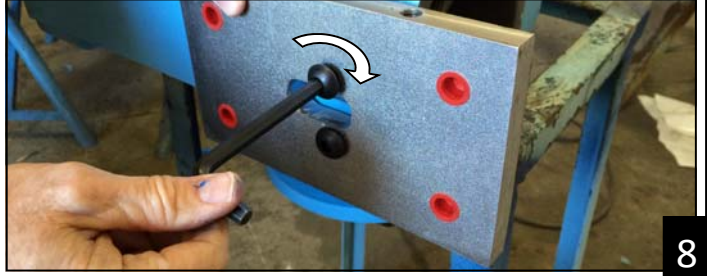
SEPARATE NEW DRIVE CONTROL FROM MOUNTING PLATE BY REMOVING (4) SOCKET CAP SCREWS AND DISASSEMBLE AS SHOWN.



APPLY RTV SEALANT AROUND SLOT IN WORM GEAR HOUSING AS SHOWN.



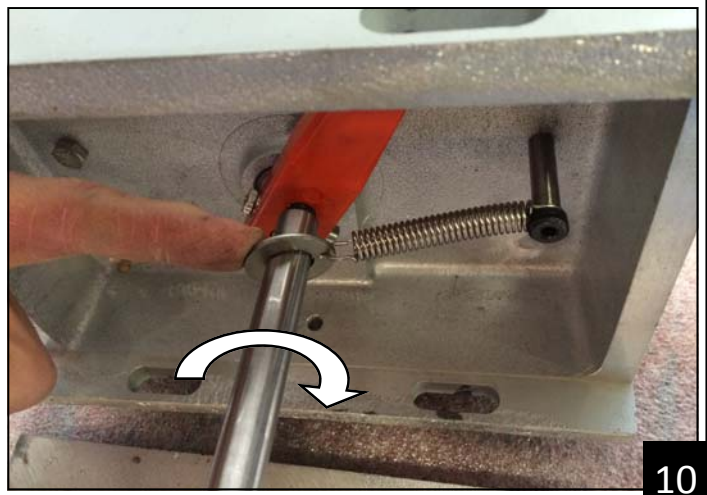
APPLY RTV SEALANT TO (2) 1/2-13NCx1-1/4" BUTTON HEAD CAP-SCREW THREADS. INSTALL MOUNTING PLATE AND TORQUE FROM 50-60 FT-LBS. SLOT IN PLATE MUST LINE UP WITH HOUSING.



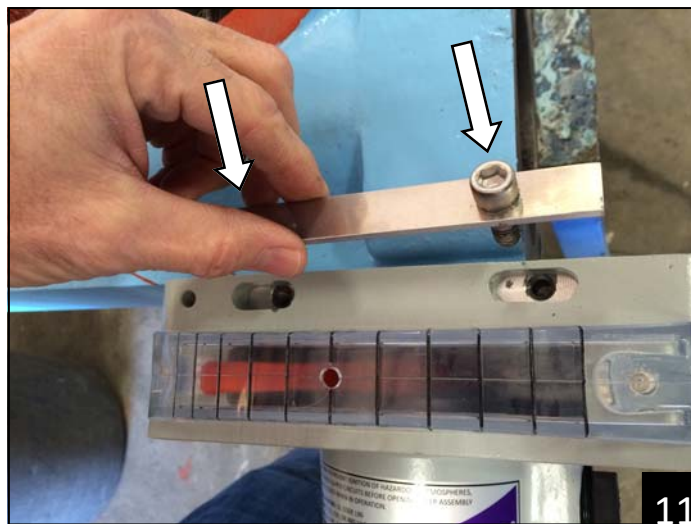
PLACE OLD ACTUATING PIN THROUGH WASHER ON NEW DRIVE CONTROL.



THREAD ACTUATING PIN INTO DRIVE CONTROL POINTER. TIGHTEN SNUG, DO NOT OVERTIGHTEN. KEEP WASHER CLEAR FROM THREADS UNTIL TIGHT.



INSTALL DRIVE CONTROL ON MOUNTING PLATE USING (4) 3/8 SOCKET CAP-SCREWS WITH PLATE WASHERS. (DO NOT TIGHTEN)



ZERO POSITION THE DRIVE CONTROL BY MOVING IT SIDWAYS UNTIL THE POINTER INDICATES ZERO.



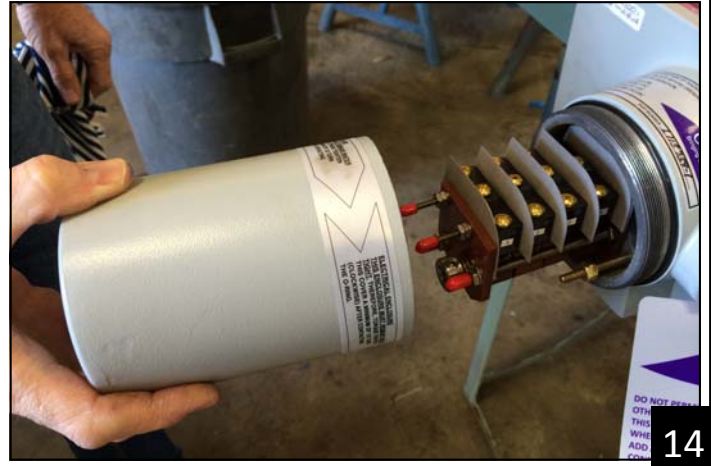
LOCK IN PLACE BY TIGHTENING THE (4) CAP-SCREWS AS NOTED IN STEP 11. SNUG TIGHT, DO NOT OVER TORQUE.



13

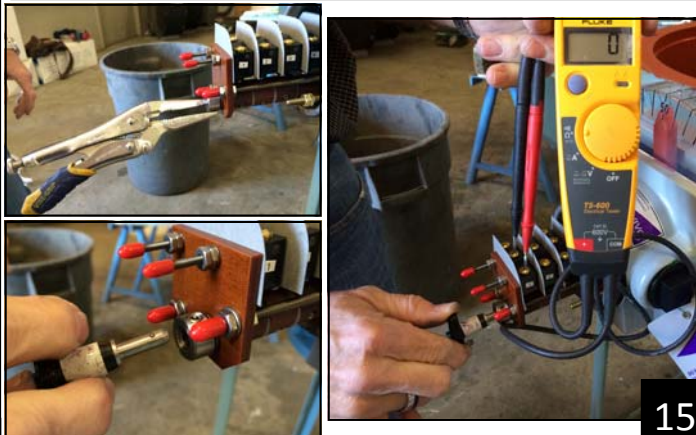
DRIVE CONTROL SWITCH INSTRUCTIONS

REMOVE ROUND SWITCH COVER TO EXPOSE SWITCHES (AND POTENTIOMETER WHEN USED).



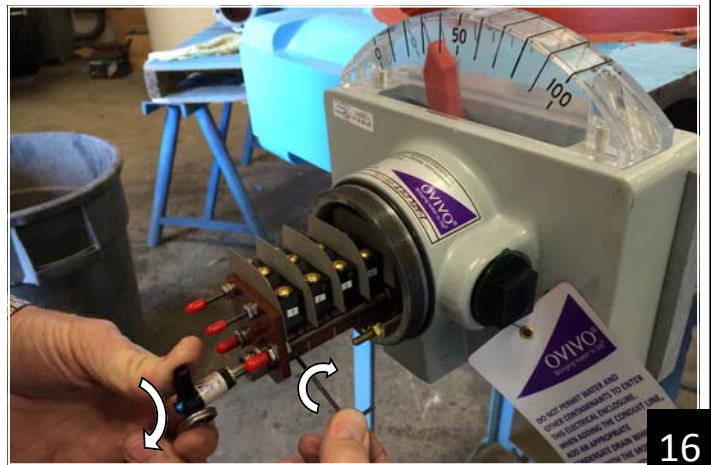
14

INSERT KEY OR USE PLIERS, AND ROTATE POINTER TO INDICATED PERCENT OF TORQUE, AS SPECIFIED IN THE O/M MANUAL, FOR NUMBER 1 SWITCH. HOLD POINTER WHILE ROTATING CAM NUMBER 1 UNTIL SWITCH TRIPS. REFER TO PICTURE 16. (LISTEN FOR CLICK WHEN SWITCH IS ACTIVATED, OR USE CONTINUITY TESTER).



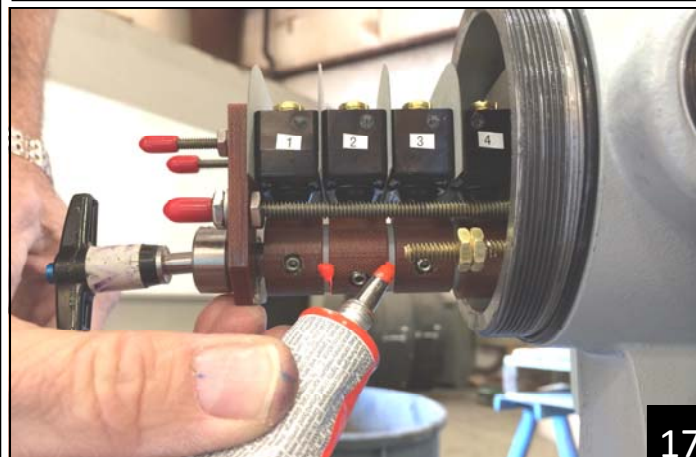
15

SECURE CAM SETTING BY APPLYING MINIMUM TORQUE TO SET SCREW. (DO NOT TORQUE AS TO INDENT PIVOT SHAFT, MAKING MINIMUM ADJUSTMENT DIFFICULT). REPEAT STEPS 15-16 FOR REMAINING CAMS.



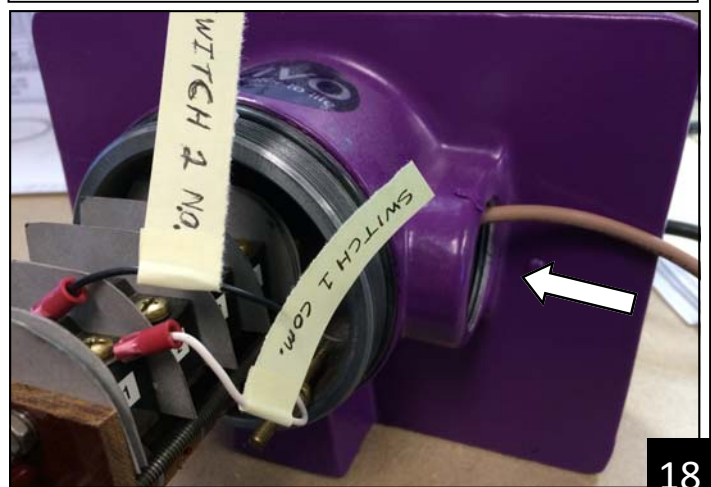
16

AFTER SETTINGS ARE ASSURED AND INSPECTED, SNUG ALL SET SCREWS AND RE-CHECK EACH CAM. BETWEEN EACH CAM, ADD TORQUE LOCK OR QUICK DRYING LACQUER TO ASSURE NO TAMPERING AFTER FINAL SETTING.



17

FEED SWITCH AND POTENTIOMETER WIRES INTO DRIVE CONTROL. ATTACH CONDUIT TO DRIVE CONTROL HOUSING. RECONNECT SWITCH WIRES IN SAME ORDER AS REMOVED.



18

POTENTIOMETER CALIBRATION INSTRUCTIONS

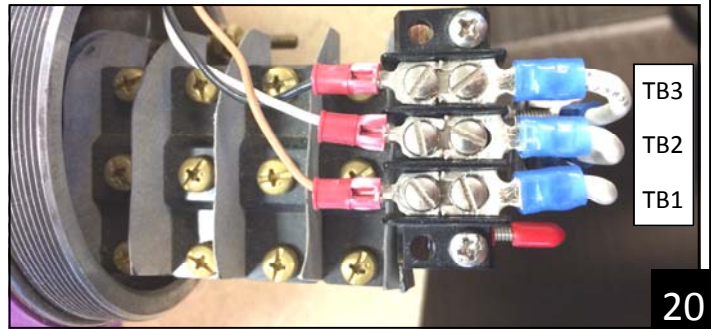
IF POTENTIOMETER IS NOT USED, SKIP TO STEP 24.

OBJECTIVE: AS THE TORQUE INDICATOR (POINTER) MOVES FROM 0% TO 100% THE POTENTIOMETER OUTPUT MUST START AT 500 OHMS AT 0% AND INCREASE TO APPROXIMATELY 725 OHMS AT 100%. THE POTENTIOMETER IS FACTORY SET AND SHOULD NOT REQUIRE ADJUSTMENT. TO OBTAIN 500 OHMS AT 0% TORQUE, THE POTENTIOMETER SHAFT MUST BE FREE TO ROTATE; THEREFORE, DO NOT TORQUE-TIGHTEN THE SETSCREW AGAINST THE POTENTIOMETER SHAFT UNTIL PROPER READINGS ARE OBTAINED.

19

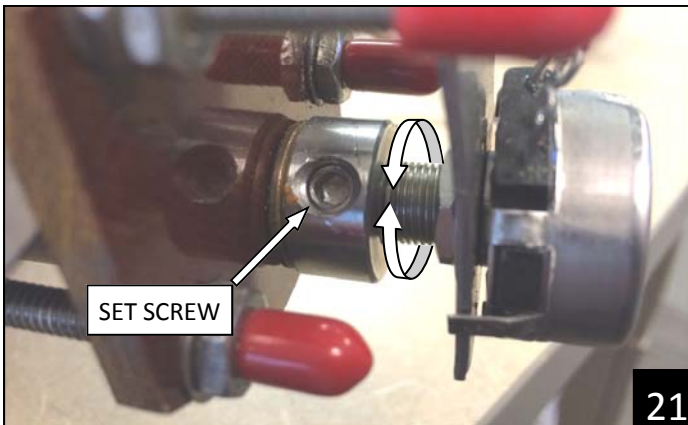
PROCEDURE: ATTACH OHMMETER TO APPLICABLE POTENTIOMETER TERMINALS MARKED TB1 AS SHOWN IN TABLE BELOW.

OHMMETER TEST LEADS	TERMINAL IDENTIFICATION	
	RH DRIVE CONTROL	LH DRIVE CONTROL
BLACK	TB1-2	TB1-2
RED	TB1-3	TB1-1



20

IF THE OUTPUT IS NOT AT 500 ± 25 OHMS AT 0% TORQUE, LOOSEN SET SCREW AND REMOVE POTENTIOMETER. ROTATE POTENTIOMETER UNTIL 500 OHMS IS ACHIEVED. SET POINTER AT 0% TORQUE AND REINSTALL POTENTIOMETER. SECURE THIS SETTING BY APPLYING A SMALL AMOUNT OF TORQUE TO SET SCREW.

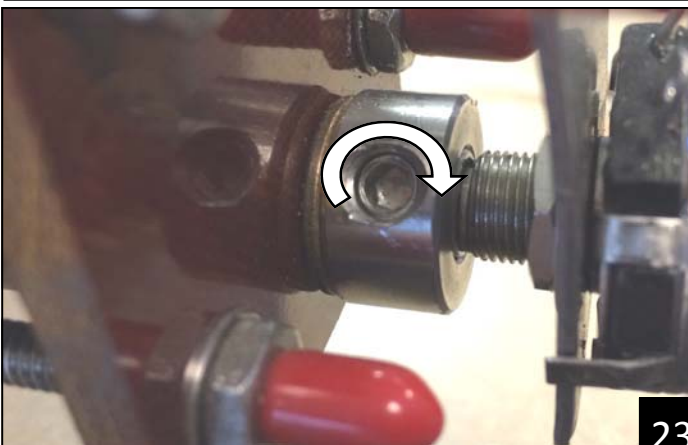


21

ROTATE DRIVE CONTROL PIVOT SHAFT TO 100% TORQUE INDICATION. POTENTIOMETER OUTPUT SHOULD BE $725 \text{ OHMS} \pm 25 \text{ OHMS}$.

22

RETURN TORQUE INDICATOR (POINTER) TO 0% TORQUE AND VERIFY THE POTENTIOMETER OUTPUT IS 500 OHMS AT 0%. IF NOT, REPEAT STEPS 22 AND 23. AFTER SETTINGS ARE OBTAINED, TIGHTEN SET SCREW TO SECURE SETTING.



23

REPLACE ROUND SWITCH COVER AND HAND TIGHTEN SO THE O-RING IS COMPRESSED, PROVIDING A LIQUID TIGHT SEAL.



24

Checklist

FINAL MECHANICAL CHECKLIST

DRIVE SERIAL NUMBER: RSW0000933-01 A

Sign off by initialing and dating each check made. When the drive final mechanical check is completed, the installer/erector must sign and date this check list and return one copy of this check list for each drive unit furnished to the Ovivo USA, LLC Project Management Department to ensure warranty coverage.

CHECK	REFERENCE	INSTALLER SIGN OFF	DATE
Check that the existing cage has modified as specified	General Erection drawing, parts list, and the Drive Installation instructions in the Installation section of the Ovivo instruction manual		
Check the cage adapter for proper installation	General Erection drawing, parts list, and the Drive Installation instructions in the Installation section of the Ovivo instruction manual		
Check the cage adapter connection fasteners are secure	General Erection drawing, parts list, and the Drive Installation instructions in the Installation section of the Ovivo instruction manual		
Check the column adapter for proper installation to the existing column	General Erection drawing, parts list, and the Drive Installation instructions in the Installation section of the Ovivo instruction manual		
Check the column adapter connection fasteners are secure	General Erection drawing, parts list, and the Drive Installation instructions in the Installation section of the Ovivo instruction manual		
Check that the walkway has been modified as specified	General Erection drawing, parts list, and the Drive Installation instructions in the Installation section of the Ovivo instruction manual		
Check the handrails for proper installation to the drive cover and existing walkway	General Erection drawing, parts list, and the Drive Installation instructions in the Installation section of the Ovivo instruction manual		
Check the walkway connection fasteners are secure	General Erection drawing, parts list, and the Drive Installation instructions in the Installation section of the Ovivo instruction manual		

FINAL MECHANICAL CHECKLIST

CHECK	REFERENCE	INSTALLER SIGN OFF	DATE
Check drive-to-column adapter connection for specified fasteners	General Erection drawing, parts list, and the Drive Installation instructions in the Installation section of the Ovivo instruction manual		
Check main gear has been filled with oil to specified level (marked on sight glass)	Drive Assembly drawing and Drive Lubrication instructions in the Ovivo instruction manual		
Check worm gear have been filled with oil to specified level (marked on sight glass)	Drive Assembly drawing and Drive Lubrication instructions in the Ovivo instruction manual		
Check main gear has been filled with specified oil type/viscosity	Drive Lubrication instructions in the Ovivo instruction manual		
Check worm gear have been filled with specified oil type/viscosity	Drive Lubrication instructions in the Ovivo instruction manual		
Check gearmotor oil level. The gearbox has been overfilled with oil for long term storage. Drain oil down to the proper level, which is at the halfway mark in the sight glass, before start-up.	Manufacturer's instructions in the Accessory Equipment section of the Ovivo instruction manual		
Check motor bearings grease lubrication	Manufacturer's instructions in the Accessory Equipment section of the Ovivo instruction manual		
Check chain lubrication	Ovivo Drive Lubrication instructions in the Ovivo instruction manual		
Check shear pin sprocket for grease lubrication	Shear Pin Sprocket instructions in the Maintenance section and the manufacturer's instructions in the Accessory Equipment section of the Ovivo instruction manual		
Check main drive gear, worm gear and gearmotor oil for penetration of grit due to sandblasting	WARNING page in the general instruction section of the Ovivo instruction manual		
Check drive and driven sprockets for specified alignment	Installation and Maintenance instructions in the Ovivo instruction manual		
Check drive chain for proper tension	Maintenance instructions in the Ovivo instruction manual		
Check motor wiring	Manufacturer's instructions in the Accessory Equipment section of the Ovivo instruction manual, and Wiring Diagrams in the Ovivo instruction manual. All interconnecting wiring must meet local electrical codes.		

FINAL MECHANICAL CHECKLIST

CHECK	REFERENCE	INSTALLER SIGN OFF	DATE
Check drive motor is wired so an automatic restarting of the motor cannot occur after a drive control shutdown, following a torque load	Wiring Installation instructions in the Installation instruction section of the Ovivo instruction manual		
Check drive control wiring	Wiring Diagrams and/or Control Panel Schematics, if furnished, in the Ovivo instruction manual		
Check wiring connection to the drive control to be sure it includes an appropriate fitting and drain (not by Ovivo) to eliminate water condensate	Wiring Installation instructions in the Installation instruction section of the Ovivo instruction manual		
Check drive control for operation (Does alarm work? Does pointer move freely and return to zero torque?)	Maintenance instructions in the Ovivo instruction manual		
Check drive control cover is properly installed and secure	Maintenance instructions in the Ovivo instruction manual		
Check gearmotor for specified direction of rotation	Maintenance instructions in the Ovivo instruction manual and Motor Drive Assembly drawing		
Check drive unit for specified direction of rotation WARNING: Tank must be cleared of debris, and drive, cage, rake arms and other moving parts free of obstructions before rotating the drive! Observe from outside the tank!	Maintenance instructions, Motor Drive Assembly and General Arrangement drawings in the Ovivo instruction manual		
Check drive for maximum out-of-level tolerance of .005 inch in 12 inches distance, using one rake arm	Drive Final Leveling instructions in the Installation section of the Ovivo instruction manual		
Check specified shims were used to final level the drive unit	Drive Final Leveling instructions in the Installation section of the Ovivo instruction manual		
Check drive-to-column adapter mounting bolts are secure	Drive Final Leveling instructions in the Installation section of the Ovivo instruction manual		
Check drive jackscrews are not supporting the drive	Drive Final Leveling instructions in the Installation section of the Ovivo instruction manual		
Check cage-to-drive connection for specified fasteners	General Erection drawing, parts list, and the Cage Installation instructions in the Installation section of the Ovivo instruction manual		
Check cage for plumb	Cage Check For Final Plumb instructions in the Installation section of the Ovivo instruction manual		

FINAL MECHANICAL CHECKLIST

CHECK	REFERENCE	INSTALLER SIGN OFF	DATE
Check cage-to-drive connection fasteners are secure	Cage Check For Final Plumb instructions in the Installation section of the Ovivo instruction manual		
Check rake arms for final level	Rake Arm Final Leveling instructions in the Installation section of the Ovivo instruction manual		
Check chain guards are properly installed and secure	Motor Drive Assembly drawing in the Ovivo instruction manual		
Check WARNING and CAUTION signs are properly installed and clearly visible and readable	Drive Maintenance Warning instructions and Motor Drive Assembly drawing in the Ovivo instruction manual		
Check Lubrication Plate and Lubricant Plate are properly installed and clearly visible and readable	Drive Lubrication instructions, Drive Assembly drawing and Motor Drive Assembly drawing in the Ovivo instruction manual		
Check drive for specified final painting. Inspect painted surfaces for deterioration of paint	Storage Precautions in the general instruction section of the Ovivo instruction manual		
Check drive seals for paint contamination			
Check all protective coverings applied for sandblasting and/or painting have been removed from the drive and motor drive assemblies			
Check all necessary gearmotor breathers are correctly installed	Manufacturer's instructions in the Accessory Equipment section of the Ovivo instruction manual		
Check the gearmotor plug has been removed prior to start up	Warnings in the General section of the Ovivo instruction manual		
<p><u>NOTES AND COMMENTS:</u></p>			

CUSTOMER: City of Wichita
PROJECT: Wichita WWTP – STP #2
C60P-S1 Drive Rebuild
RSW0000933-01 Installation, Maintenance and Operation Manual

Section: Checklist
Revision: 1
Date: 8/17/2018

FINAL MECHANICAL CHECKLIST

Page 5 of 5

(Installer/Erector)

(Date)

Receipt of Completed Checklist Acknowledged by Ovivo:

(Ovivo Service Representative)

(Date)