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OVIVO® 160' C3D-CMD CLARIFIER WITH C60LT DRIVE INSTALLATION, MAINTENANCE AND OPERATION MANUAL

PROJECT

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PROJECT: Wichita WWTP
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CUSTOMER

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OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation, Maintenance and Operation Manual

CUSTOMER NAME: Dondlinger & Sons Construction

PROJECT: Wichita WWTP

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|----------------|------------|---------------------------------|
| CSW1517-101 | (rev B) | General Arrangement |
| CSW1517-151 | (rev A) | General Erection |
| 697580 | (rev A) | Cage-to-Cage Connection Detail |
| 697584 | (rev B) | Cage-to-Drive Connection Detail |
| CSW1517-133 | (rev A) | C60LT Motor Drive Assembly |
| 115711 | (rev C) | C60LT General Arrangement |
| 115709 | (rev N) | C60LT Drive Assembly |
| 678850 | (rev D) | Worm Gear Assembly |
| 115759 | (rev Y) | Drive Control |
| CSW1517-102 | (rev A) | Drive Control Switch Settings |
| CSW1517-121 | (rev A) | Control Panel |
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| CSW1517-156 | (rev A) | Manifold Erection |
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| CSW1517-155 | (rev A) | Feedwell Erection |
| CSW1517-153 | (rev A) | Skimming Erection |
| 767657 | (rev C) | Skimming Device Assembly 6A |
| 1133808 | (rev C) | Flush Valve Arrangement |
| 1134047 | (rev F) | Flush Valve Assembly |
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8.0 ACCESSORIES

- Drive Submittal Data:TAB 1
- C60LT Drive Information
- Motor Drive Calculations
- Main Gear Rating
- Worm Gear Rating
- Main Bearing Rating

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Control Panel:TAB 5
(Ovivo USA, LLC Part No. CSW1517-121)
Component Cut Sheets

Nameplates:TAB 6

9.0 CHECKLIST

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GENERAL

1.0 GENERAL

1.1 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 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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OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation, Maintenance and Operation Manual

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Instruction No.: 02-AX6

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1.2 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.

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1.3 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

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1.4 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.

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1.5 STORAGE

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

1.5.1 Drive Equipment

Accessory Equipment

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

Drive Equipment

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

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.

1.5.2 Long Term Storage

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

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

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.

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.
- 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

- a. 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.
- b. When to Put a Motor in Storage:

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(1) 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.

(2) Out of service or in storage from one to six months:

Where possible, store indoors in a clean, dry area.

- a) 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.
- b) The storage area must be free from excessive vibration, which can cause bearing damage.
- c) 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.
- d) 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.
- e) 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.
- f) All motors must have the shaft rotated a few turns once a month to maintain a lubricant film on the bearing races.

(3) Out of service or in storage six months or more:

- a) Where possible, store indoors in a clean, dry area.
- b) 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.
- c) The storage area must be free from excessive vibration, which can cause bearing damage.
- d) Precautions must be taken to prevent rodents, snakes, birds or other small animals from nesting inside the motors. Insects should be prevented from

GENERAL

gaining access to the interior of the motor.

- e) 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.
- f) 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.
- g) All motors must have the shaft rotated a few turns once a month to maintain a lubricant film on the bearing races.
- h) 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.
- i) 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

- a. 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.
- b. For shop primed steel equipment, refer to the special "Paint Durability" precautions below.
- c. 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.
- d. 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.
- e. 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 sure that lubrication plates, **WARNING** and **CAUTION** signs, and the Ovivo nameplate are clearly visible and readable.

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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

1.6 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



DRIVE CONTROL WARNING:

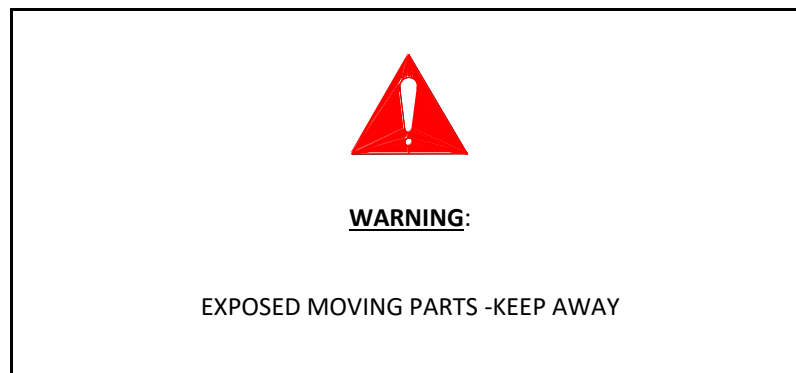
The primary drive control assembly must be properly installed and checked for operation, as specified in the General Drive Maintenance instructions, before the drive is operated. Electrical wiring (not by Ovivo) to the drive control and motor drive assembly must be installed, as specified. The drive 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

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.

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.

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GENERAL




WARNING:

LOCK OUT POWER BEFORE
PERFORMING MAINTENANCE

GENERAL

1.7 SYMBOLS

1.7.1 Warnings

| | |
|---|-----------------------------|
|  | Floor-level obstacle |
|---|-----------------------------|

| | |
|---|------------------------|
|  | General Warning |
|---|------------------------|

| | |
|--|------------------------------------|
|  | Warning; Automatic start-up |
|--|------------------------------------|

| | |
|---|-------------------------------|
|  | Warning; Crushing Hand |
|---|-------------------------------|

| | |
|---|--------------------------|
|  | Warning; Crushing |
|---|--------------------------|

| | |
|---|-----------------------------|
|  | Warning; Drop (fall) |
|---|-----------------------------|

| | |
|---|---------------------------|
|  | Warning; Flammable |
|---|---------------------------|

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Warning; Hot surface



Warning; Oxidizing Surface



Warning; Pressurized cylinder



Warning; Sharp



Warning; Slippery surface



Warning; Sudden loud noise



Warning; Toxic material

GENERAL

1.7.2 Mandatory Action



Check guard



Disconnect mains plug from electrical outlet



General mandatory action sign



Use footbridge



Wear ear protection



Wear eye protection



Wear head protection

GENERAL



Wear high-visibility clothing



Wear protective gloves



Wear safety footwear

1.7.3 Safety Signs



Do not alter the state of the switch



No heavy load



No reaching in



No stepping on surface

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1.8 LIFTING PRECAUTIONS

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.



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

1.8.1 Lifting Recommendations and CAUTIONS

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



WARNING: Stand clear as the equipment is lifted.

- a. Make sure the equipment being lifted and the lifting equipment cannot come into contact with overhead electrical cables, etc.
- b. Make sure the rigging and hoist equipment is of adequate capacity.
- c. Experienced personnel should do all rigging and lifting.
- d. 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.
- e. Use multiple point lifting whenever possible.
- f. 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.
- g. Make sure shop provided camber is maintained when lifting rake arms and superstructures.
- h. 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.
- i. Never move the equipment suddenly or in jerks and never allow it to strike the ground, tank or other equipment.

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- j. When lifting components use rubber belting, burlap or other padding between the lifting cables and the equipment to prevent damage to the protective covering.

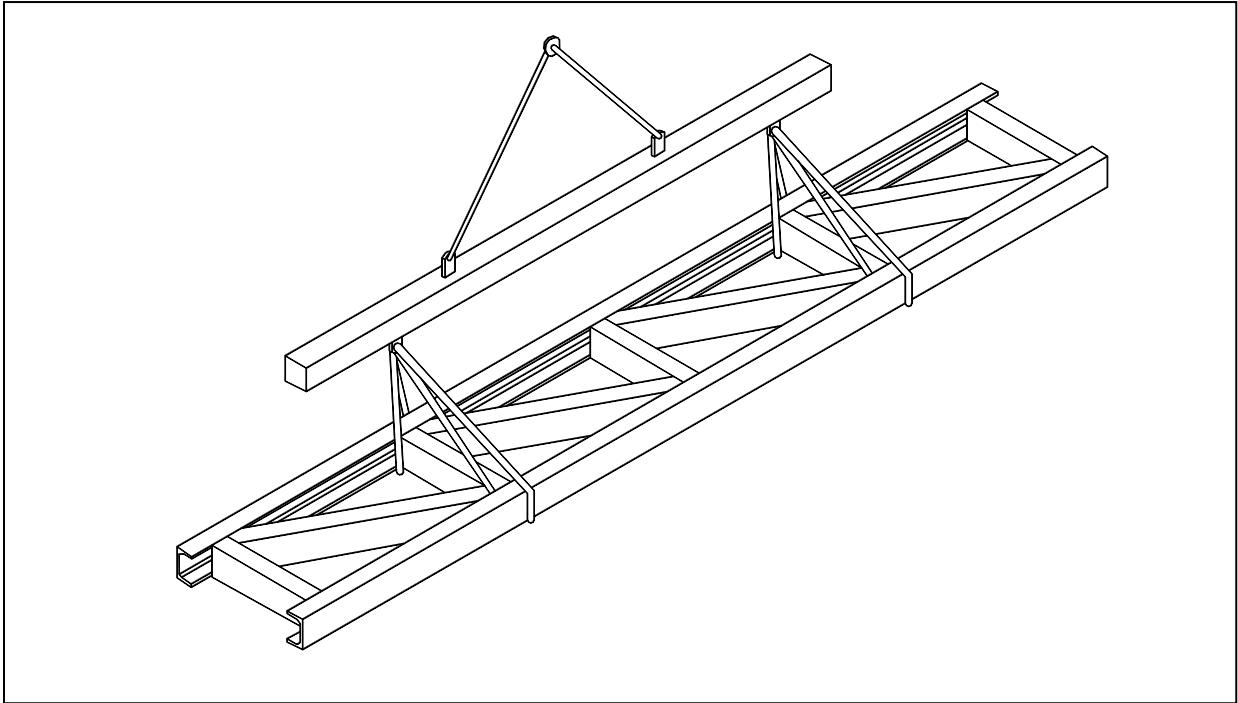


Figure 1.8a

1.8.2 Shipping Braces

- a. Shipping braces may be used to protect segmented superstructures, rake arms and cages from damage during shipping. Shipping braces are marked "Shipping Brace Only" in white painted letters or they are painted purple. This bracing must be removed.
- b. Burn the braces from the chords, angle braces or structural members, as required. Do not attempt to scarf braces as this may cause weakening of structural members.

GENERAL

1.9 WARRANTY



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

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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 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.

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1.10 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 **CSW0001517-01** when talking to a parts representative.

OVIVO USA, LLC

Attn: Aftermarket Parts 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

EPEC Water
Attn: M. Rudy
2250 N. Rock Road, Suite 118-253
Wichita, KS 67226
Telephone: 316.866.2888
Email: mrudy@epectwater.com

INSTALLATION

2.0 INSTALLATION

2.1 CHECK THE TANK

At this stage, the tank should be empty of all the existing components, with the components that will be reused set aside, ready for re-installation.

The tank must conform to specifications in order to accommodate the mechanism. If the tank fails to meet these specifications, requiring any modifications of the equipment, Ovivo will not accept charges.

Check the tank as follows:

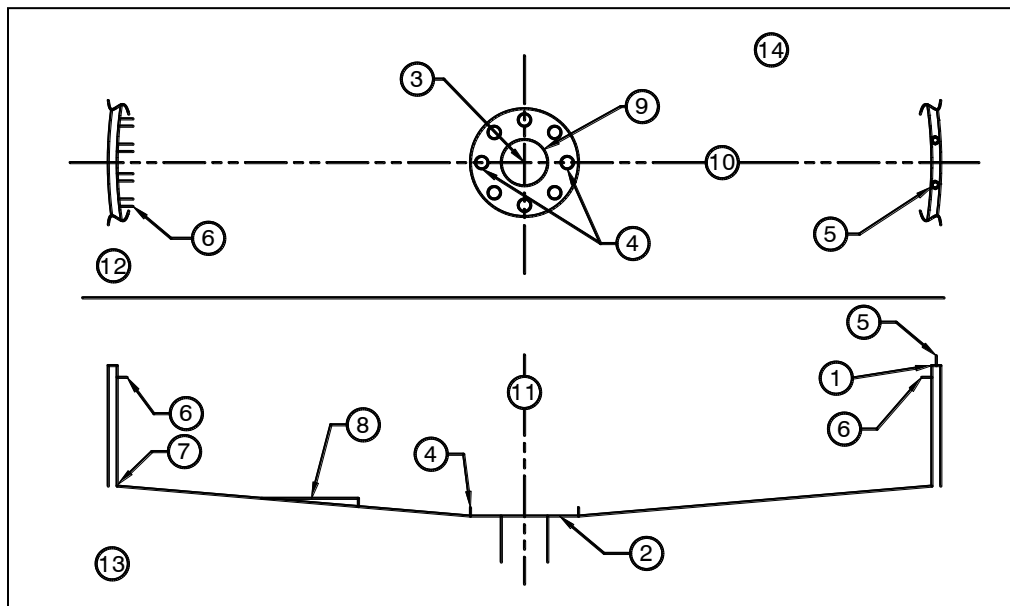


Figure 2.1a

| | |
|---|---|
| 1 - Top of Tank Wall | 8 - Tank Bottom Slope |
| 2 - Influent Column Base | 9 - Influent Opening |
| 3 - True Center | 10 - Walkway Centerline |
| 4 - Column Anchor Bolts | 11 - Tank Centerline |
| 5 - Existing Walkway Anchor Bolts | 12 - Plan View |
| 6 - Weir and Baffle Anchor Bolts (not by Ovivo) | 13 - Side View |
| 7 - Tank Bottom Corner | 14 - Locate two bolts on the walkway centerline |

CHECK the elevation at the influent column base at (2).

CHECK for true center at (3) in order to check the anchor bolts at location (4) and (5) and the wall

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circumference at (7).

CHECK that the anchor bolts at (4) are concentric with true center of the tank and that two bolts are located on the walkway centerline, as shown on the General Arrangement drawing.

CHECK all anchor bolts at location (4) and (5) for proper size, projection, elevation and orientation. Weir and baffle anchor bolts at (6), should be on a radial line with true center.

CHECK the tank bottom for specified diameter all around at (7) and for specified slope (8) at approximate 90° locations around the tank.

CHECK the influent opening (9) for proper diameter.

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2.2 CMD AND COUPLING INSTALLATION

1. Install leveling nuts (6) on the CMD epoxy anchor bolts (5), as shown on the General Arrangement drawings. Set the leveling nuts for the specified top of grout elevation.
2. Check all nuts for level at the specified top of grout elevation (3) using a combination straight edge and machinist's level or a surveyor's level (transit).
3. Place the coupling (2) on the sludge draw-off pipe (4).

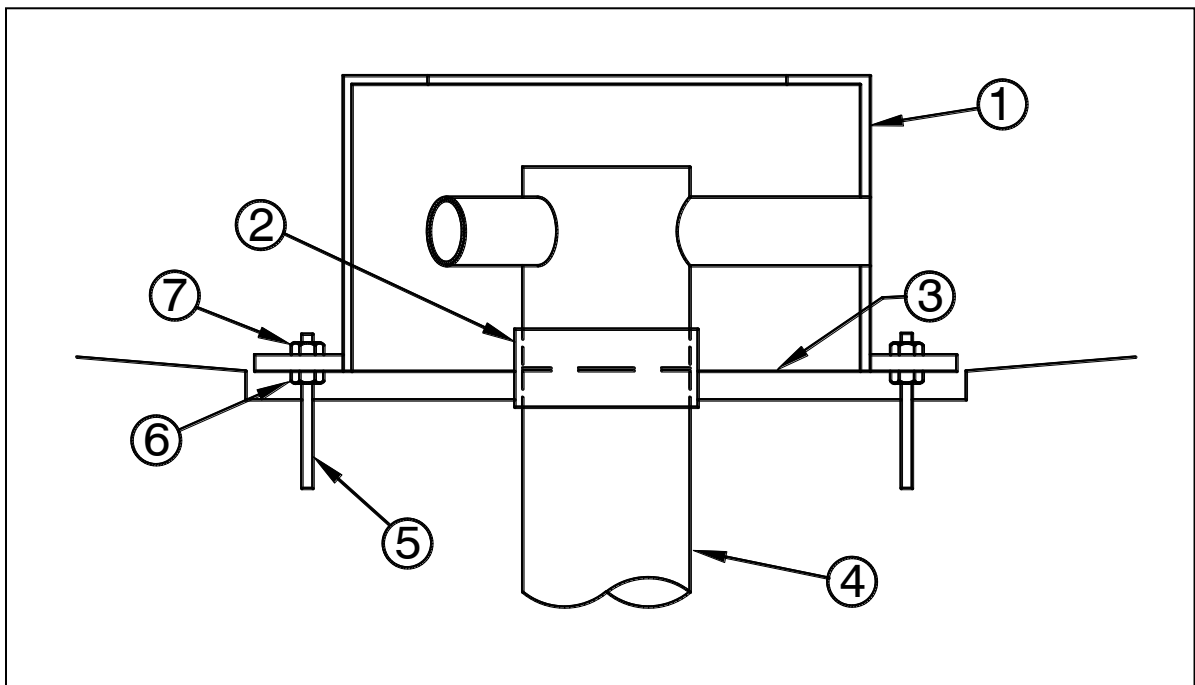


Figure 2.2a

| | | |
|-------------------------------|--------------------------|-----------------|
| 1 – CMD | 4 – Sludge draw-off pipe | 7 – Anchor nuts |
| 2 – Coupling | 5 – Epoxy anchor bolts | |
| 3 – Specified height of grout | 6 – Leveling nuts | |

4. Set the CMD (1) on the leveling nuts (6) with the “V” notch in the box in line with the centerline for the walkway. Then, snug the leveling nuts (6) against the flange. Install the upper anchor nuts (7) and tighten by slugging with a slug wrench.
5. Check the top surface of the CMD (1) for level in two directions (90° apart).
6. Adjust for level with the leveling nuts (6). Make sure the upper anchor nuts (7) are slugged after each adjustment.

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Note: Do not grout under the CMD. This will be done following final leveling of the drive.

Center the coupling (2) on the draw-off pipe (4) -to-CMD (1) connection and secure the coupling (2), using the clamps provided with the coupling.

INSTALLATION

2.3 INSTALL THE COLUMN

1. Construct a temporary dam for the grout (6) around the influent opening to hold back the grout during the grouting of the CMD, if not done previously.

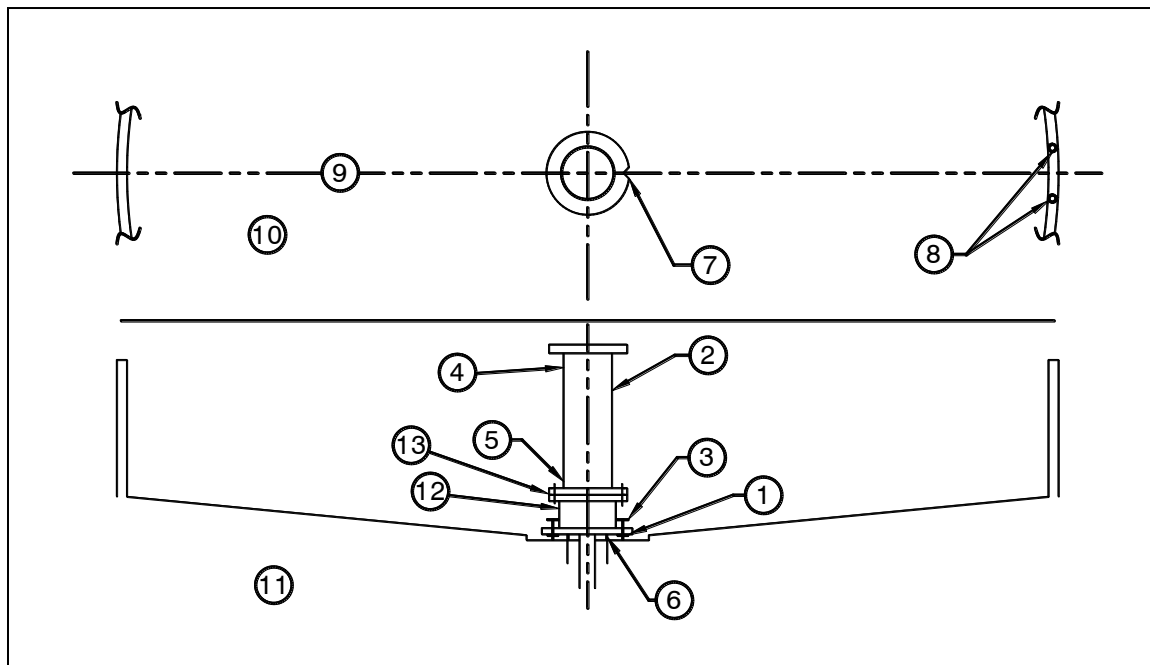


Figure 2.3a

| | | |
|-----------------------|------------------------------|---------------------|
| 1 – CMD leveling nuts | 6 – Temporary dam for grout | 11 – Elevation view |
| 2 – Influent column | 7 – V-notch | 12 – CMD |
| 3 – CMD anchor nuts | 8 – Walkway mounting surface | 13 – Sealant |
| 4 – Check for plumb | 9 – Walkway centerline | |
| 5 – Check for plumb | 10 – Plan view | |

2. Apply sealant (not by Ovivo) to the top surface of the CMD.
3. Set the column (2) on the CMD (12) with the “V” notch in the column flange in line with the walkway centerline and aligned with the “V” notch in the CMD. Install and secure the column flange-to-CMD fasteners, as shown on the General Erection drawing.
4. Check the column for plumb, using a plumb bob (not by Ovivo).

Hang the plumb bob from the top flange. Measure the distance to the column shell, near the top and bottom of the column (points (4) and (5) in Figure 2.3a). Note this amount, then move the plumb bob 90° from the original measurement location and repeat. Reasonable allowance is 1/8" in 10' overall, that is (4) minus (5).

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

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5. Adjust for plumb with the CMD leveling nuts (1). Make sure the upper anchor nuts (3) are slugged after each adjustment.

Note: Do not grout under the CMD. This will be done following final leveling of the drive.

INSTALLATION

2.4 CAGE AND EDI INSTALLATION

The EDI (3) fits between and is assembled with the upper cage (4) and lower cage (1) sections. Since the cage sections are furnished in single pieces, they must be in place around the column (2) before the drive is installed.

1. Set the lower cage (1) over the column, and allow it to sit on the column base.
2. Mount the EDI supports (5) to the lower cage, using the specified fasteners.
3. Assemble the EDI sections (3) around the column (2), as shown on the General Erection drawing, and place the assembly on the EDI supports and lower cage (1). Maintain a 1" gap between the EDI and column. Connect the EDI sections to the supports and to each other using the supplied fasteners.
4. Check the upper rim of the EDI for alignment, then tighten the fasteners.
5. Set the upper cage (4) over the column (2) and on the EDI (3) and lower cage (1).

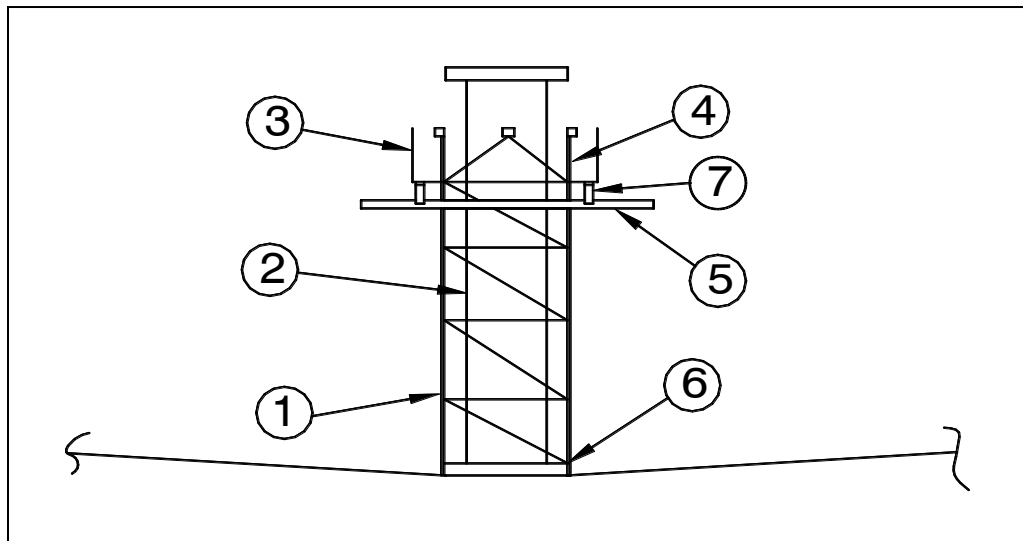


Figure 2.4a

| | | |
|---------------------|------------------------|--------------------------|
| 1 – Lower Cage | 4 – Upper Cage | 7 – EDI Support Brackets |
| 2 – Influent Column | 5 – Feedwell Support | |
| 3 – EDI | 6 – Cage Corner Braces | |

6. The cage sections can be (a) joined and mounted as a unit to the drive, after the drive is installed, or (b) installed one at a time, starting with the upper cage. Check the orientation of the EDI flow gates, referring to the General Erection drawing.
7. Check for alignment of the cage, preferably using a transit. Adjust the cage sections and EDI, if necessary, by shimming between the EDI and the flanges of the cage sections.

INSTALLATION

2.5 DRIVE INSTALLATION

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

2.5.1 Lift the Drive Unit

Lift and install the drive as a complete assembly, using the three lifting eyes located on the main gear cover as shown in Figure 2.5a.

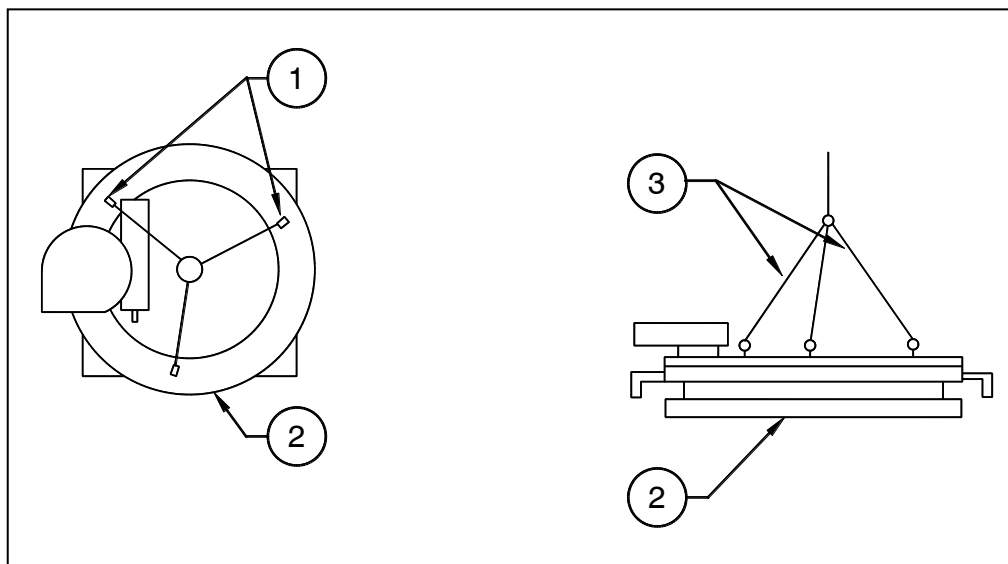


Figure 2.5a

| | | |
|------------------|-------------------------|---------------------------------------|
| 1 - Lifting eyes | 2 - Rake drive assembly | 3 - Lifting cable to (3) lifting eyes |
|------------------|-------------------------|---------------------------------------|

2.5.2 Install the Drive

- a. 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.
- b. Install the drive adapters to the top of the drive, using the supplied fasteners.
- c. Place the drive unit on the column, orienting as shown on the Motor Drive Package Assembly and General Arrangement drawings. Insert but do not tighten the drive hold down capscrews and nuts.
- d. After installation of the drive, remove the lifting eyes, since their location will interfere with installation of the platform and walkway.

INSTALLATION

2.5.3 Level the Drive

- a. 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 and cage, the drive will be adjusted for final level by shimming.
- b. 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°).

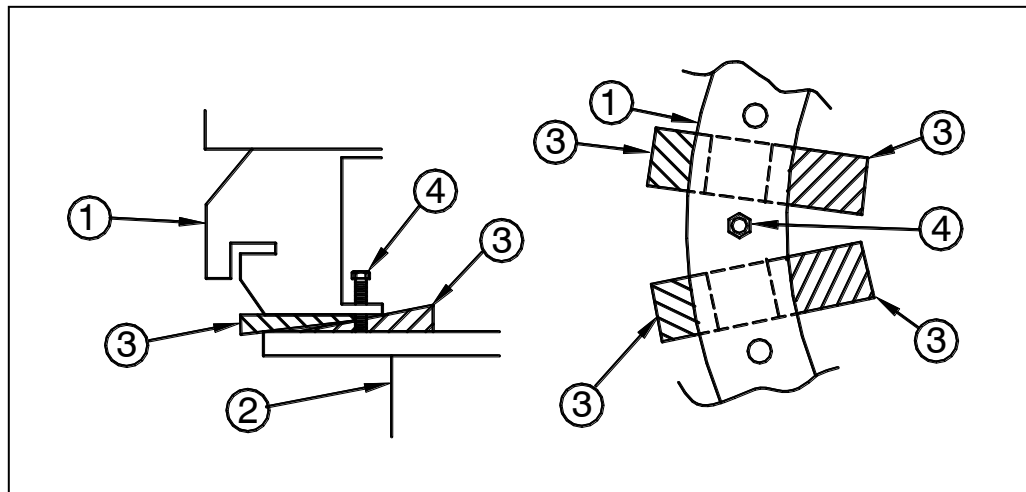



Figure 2.5b

| | |
|------------|--------------------|
| 1 – Drive | 3 – Wedge |
| 2 – Column | 4 – Leveling screw |

- c. Remove, clean and lubricate the jackscrews in the drive base, then reinstall the jackscrews. See Figure 2.5b.
- d. Adjust for level using the jackscrews.
- e. After leveling, support the drive using wedges (not by Ovivo) at the jackscrews.
- f. Snug tighten the drive hold-down capscrews. Do not torque.
- g. Final leveling of the drive will follow rake arm installation.

| | |
|---|--|
|  | <p><u>LUBRICATION WARNING:</u> The drive is shipped from the factory without operating lubricant.</p> |
|---|--|

INSTALLATION



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.

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

2.5.4 Drive Lubrication and Rotation Warnings

- a. Refer to the "Lubrication" instructions in this manual. Refer to the Table of Contents for Lubrication Instructions page numbers.
- b. Drive Rotation Warning
 - 1) 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 motor fan cover and turn the shaft with a drill.
 - 2) Refer to the "Lubrication, Electrical Wiring, Drive Rotation and Drive Controls" instructions on a following page.
 - 3) Do not attempt to operate or rotate the drive (rake arms) before you read those instructions.

INSTALLATION

2.6 RE-INSTALL EXISTING PLATFORM AND WALKWAY

Refer to the original installation manual for installation detail of the existing walkways and platform.

1. If sliding plates and/or floating plates are used, install them in their former positions.
2. Set the existing walkways and platform 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.
3. 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.
4. Field drill $\varnothing 1-1/6"$ holes in the bottom flange of the existing platform beam, using the drive adapter as a template.
5. Secure the platform to the drive adapters, using the supplied fasteners.

INSTALLATION

2.7 LUBRICATION, ELECTRICAL WIRING, DRIVE ROTATION AND DRIVE CONTROLS

LUBRICATION WARNING



The drive is shipped from the factory without lubricating oil and/or grease.

Prior to being operated, the drive, including all accessory equipment components, must be lubricated, referring to both the Ovivo 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.

MOTOR CAUTION



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

2.7.1 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 or control panels. 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.

2.7.2 CAUTION when no power is available

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

INSTALLATION

"Drive Maintenance **WARNING**" in the Maintenance section.

2.7.3 Check Drive Rotation

- a. The gearmotor must be connected for the direction of rotation specified on the drawing and shown by the arrow on the chain guard. If it is not, that will void the drive warranty and Ovivo will not pay for damage.
- b. 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.

2.7.4 Check Alignment of a Field Installed Gearmotor Drive

- a. If the gearmotor was shipped separately from the main drive, install and align the sprockets as follows:
- b. 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 5/8" under maximum running load. So this initial 1/8" setting will be closer to true alignment with the displacement that occurs under normal load.
- c. Adjust the chain for tension, referring to the instructions under Drive Maintenance.

2.7.5 Check the Drive Control for Operation

- a. Refer to the parts list for the switch settings in checking the drive control. Electricity is required for this check.
- b. Start the drive gearmotor. Check the tank for obstructions or do this check while the chain is removed.
- c. 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 gearmotor should stop.
- d. 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.
- e. 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.

Note: All guards and safety devices that are not furnished by Ovivo must meet all current local and national codes.

INSTALLATION

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 motor 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.



WARNING:

Do not operate this equipment if guards have not been installed, have been removed, or are damaged.

All guards must be properly installed and functional before operating this equipment.

INSTALLATION

2.8 CONNECT THE CAGE TO THE DRIVE

1. Referring to Figure 2.8a, attach the cage to the drive unit using the vertical adjusting studs (9) and adjusting nuts (7).
2. Loosely install the bolts and washers (2).
3. Using the adjusting nuts (7), raise the cage to its highest position. This will allow downward adjustment, if necessary.
4. Using a carpenter's level, check the cage for plumb in two directions.
5. Adjust the cage for plumb using the adjusting nuts (7).
6. Shim between the drive and cage (4) for a tight fit-up. Shim equally to keep the cage centered.
7. Tighten the bolts (2), but do not torque. Install the lock nuts (6), but do not lock in place on the adjusting nuts.

Note: Final check for plumb will follow drive leveling.

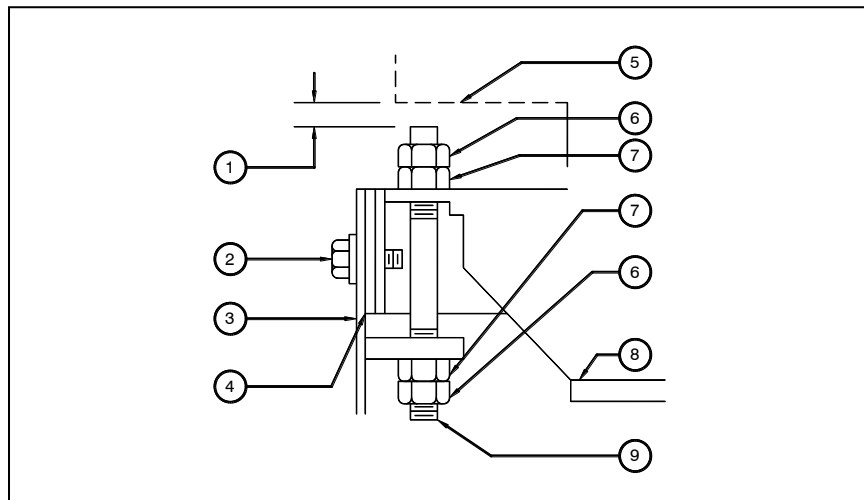


Figure 2.8a

| | |
|----------------------------------|----------------------------------|
| 1 - Keep projection to a minimum | 6 - Lock nut |
| 2 - Bolt And Washers | 7 - Adjusting Nut Adjusting Stud |
| 3 - Cage | 8 - Top of Column |
| 4 - Shim | 9 - Vertical Adjusting Stud |
| 5 - Drive Platform | |

INSTALLATION

2.9 MANIFOLD INSTALLATION

1. A temporary dam (3) should be constructed around the influent opening to hold back the grout during the grouting of the CMD, if not already constructed.
2. Grout under the CMD (1), manifold and the under and within the anchor ring using a non-shrinking type grout (4). Pack the grout by tamping. Grout not by Ovivo.

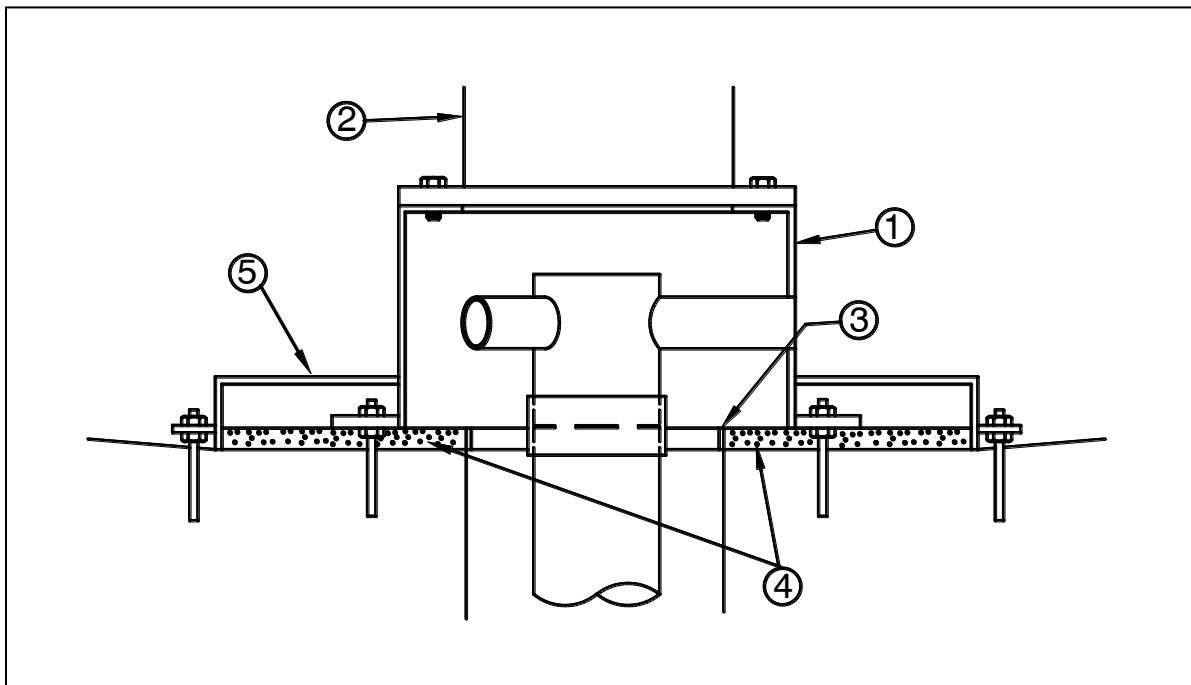


Figure 2.9a

| | | |
|---------------------|-------------------|-----------------|
| 1 – CMD | 3 – Temporary dam | 5 – Anchor Ring |
| 2 – Influent column | 4 – Grout | |

3. Assemble the sludge collection manifold, including the gaskets, in place around the base of the column.
4. Connect the manifold to the cage, making sure the flanges are aligned with the cage the rake arms, as shown on the Rake Arm Erection drawing. Adjust for specified elevation and level all around by shimming at the manifold to cage connections. In some cases, it may be necessary to raise or lower the cage, using the cage adjusting bolts. Do not weld at this time. Welding will follow final plumb of the cage.
5. Check the manifold for centering around and clearance with the column and CMD, adjust as necessary. It may be necessary to shim or elongate the mounting holes to allow for adjustments.
6. Set the anchor ring halves in place around the manifold and adjust for alignment with the manifold. Then, using the anchor ring as a template, locate and install the anchor bolts for the anchor ring.

INSTALLATION

Remove the anchor ring and install the leveling nuts on the anchor bolts.

7. Reinstall the anchor ring on the leveling nuts and adjust it for specified elevation and level all around. Secure the nuts.
8. Install the manifold to column seal using the clamps and overlapping the ends of the seal (1½” approximate overlap) so that the seams are 180° apart, as shown on Detail E on the Manifold Erection drawing. The seal must lie flat on the sealing surfaces. Note that the long (tapered) side of the seal is on the side that contacts the sealing surface on the manifold. Install the seal strip using the self-tapping screws.
9. Locate and install the self-tapping screws with washers, field drilling pilot holes through the band clamp and seal to ease installation of the screws. Refer to Figure 2.9b.

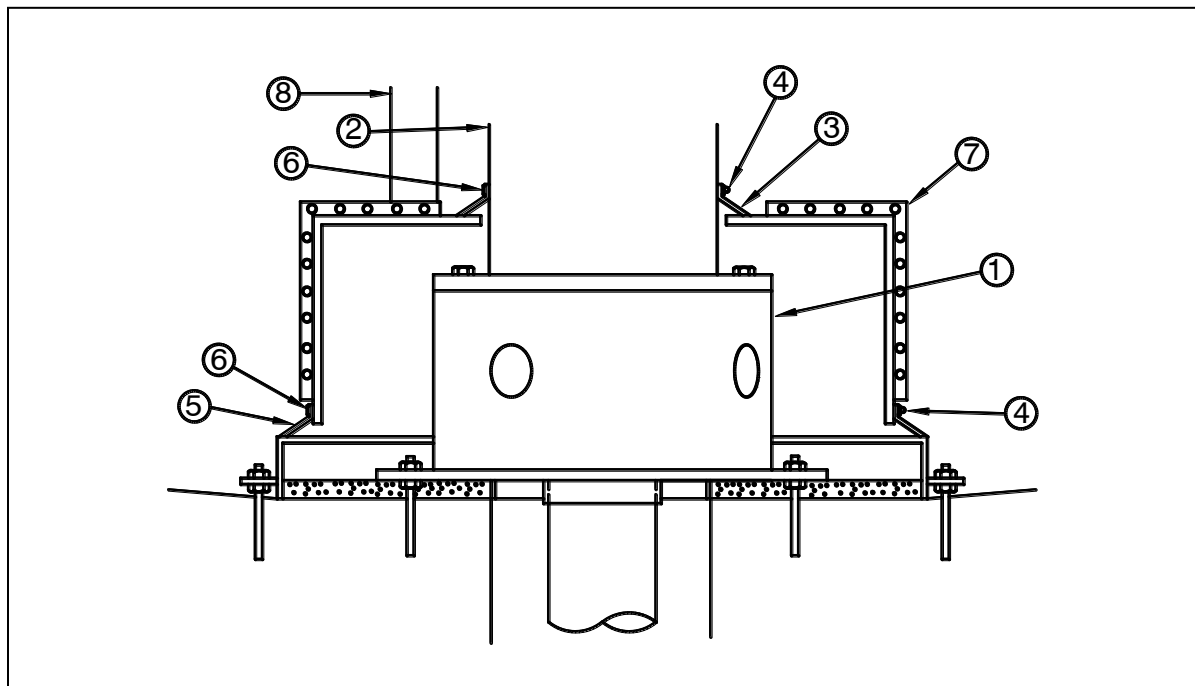


Figure 2.9b

| | | |
|-----------------------------|--------------------------------------|--------------------------|
| 1 – CMD | 4 – Clamp | 7 – Manifold with Gasket |
| 2 – Influent Column | 5 – Manifold-to-Anchor Ring Seal | 8 – Cage (ref.) |
| 3 – Manifold-to-Column Seal | 6 – Self-tapping screws with washers | |

INSTALLATION

2.10 INSTALL AND ADJUST THE RAKE ARMS

2.10.1 Install the Rake Arms

To prevent misalignment or damage to the cage during arm installation, the arm sections must be installed in pairs and the support blocking for the arms must be arranged such that the connections to the cage will not be forced.

- a. Set the inner arm sections (3) in position at the cage, supported by blocking (9) for the clearance with the tank bottom specified plus the amount of camber (6) specified. Refer to the Figure 2.10a. Adjust the inner arm sections so that they are square with the cage and with the arm connections adjacent to their matching holes at the cage.
- b. Make sure the arms are straight and square with the centerline of the arm. If necessary, pull them into square alignment while they are held secure.
- c. Connect the inner arm sections to the cage and snug tighten the bolts.

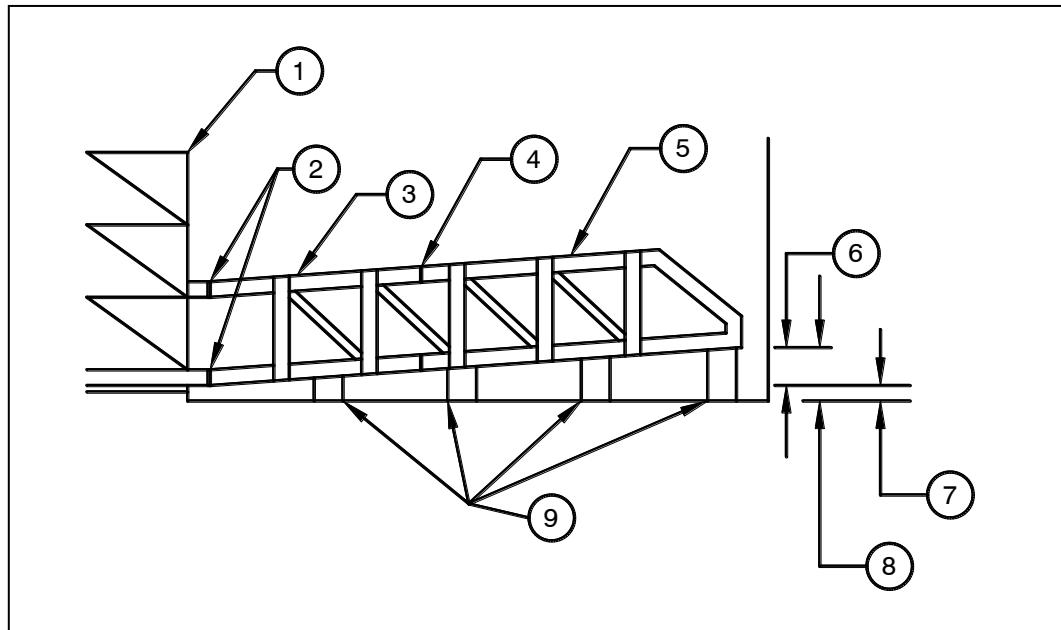


Figure 2.10a

| | | |
|---|-----------------------|--------------------|
| 1 - Cage | 4 - Splice | 7 - Clearance |
| 2 - Arm-To-Cage Connection (shim as needed) | 5 - Outer Arm Section | 8 - Total Blocking |
| 3 - Inner Arm Section | 6 - 3/4" Camber | 9 - Blocking |

- d. Shim (2) at the two lower connections as necessary for arm alignment. Draw the bolts up snug.

INSTALLATION

If there is a gap at one of the two upper connections, shim (2) as necessary for a tight fit. Tighten all bolts, but do not force a connection in order to close a gap since this will put a twist in the arm or cause damage to the arm-to-cage connection. Close remaining gaps by shimming at the cage to arm connections. Shims are not by Ovivo.

Note: Do not weld at this time. Welding will be done after final arm adjustment.

- e. Install the outer arm sections (5), setting up the blocking for the amount of camber specified and for engagement of the connection fittings. The connections can be shimmed, if necessary, for alignment. Connect the splice diagonal(s).
- f. Remove the blocking (9) equally from each arm, beginning at the cage and working outward. Check the arm blades for clearance with the tank bottom to be sure they do not touch. (Final arm level will be checked later.)
- g. If arm adjustment is necessary, use jacks placed near the outer ends of the arms for lifting. Shim equally at either the bottom or top connections to adjust for elevation and alignment.
- i. The sludge ducts will be installed after the cage is final plumbed. The squeegees will be installed after tank grouting.

2.10.2 Clearance Adjustment

If it is necessary to level the arms, adjust them as a pair or adjust one arm while supporting the opposite arm with blocking in order to maintain equal weight on the cage.

INSTALLATION

2.11 FINAL LEVEL THE DRIVE

2.11.1 Check for Level

- a. The main bearing of the rake drive must be level for proper operation of the mechanism and maximum bearing life.
- b. 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.

- c. 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.

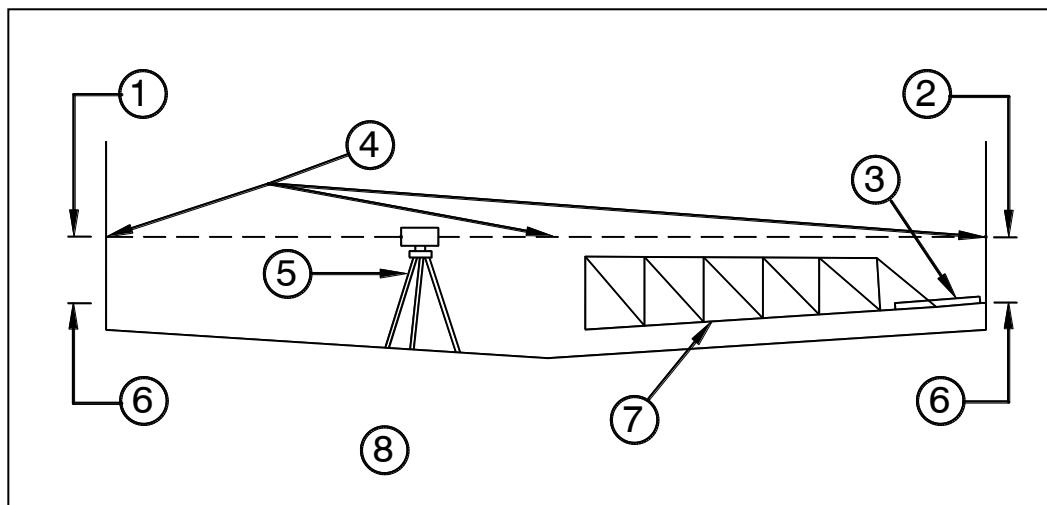



Figure 2.11a

| | |
|--|---|
| 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 |

- d. 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 height and spaced approximately 90° apart. See Figures 2.11a and 2.11b. Benchmarks should be in alignment with the jackscrews (drive leveling screws), as shown in Figure 2.11b

INSTALLATION

- e. 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 2.11a.



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

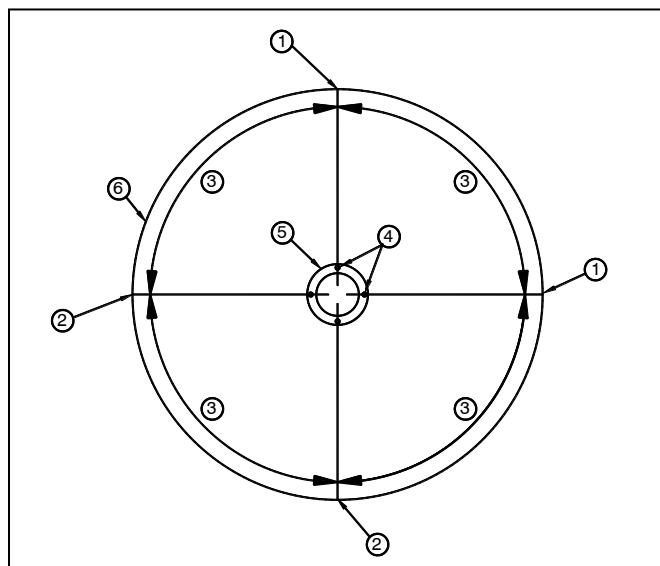


Figure 2.11b

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

- f. Referring to Figures 2.11a and 2.11b, 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).
- g. 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> |
| 160' | 1" |

INSTALLATION

2.11.2 Shim for Level

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

2.11.3 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.

2.11.4 Shimming

- a. Use the jackscrews provided in the drive base to level the drive. Be sure to release the drive mounting capscrews (4).

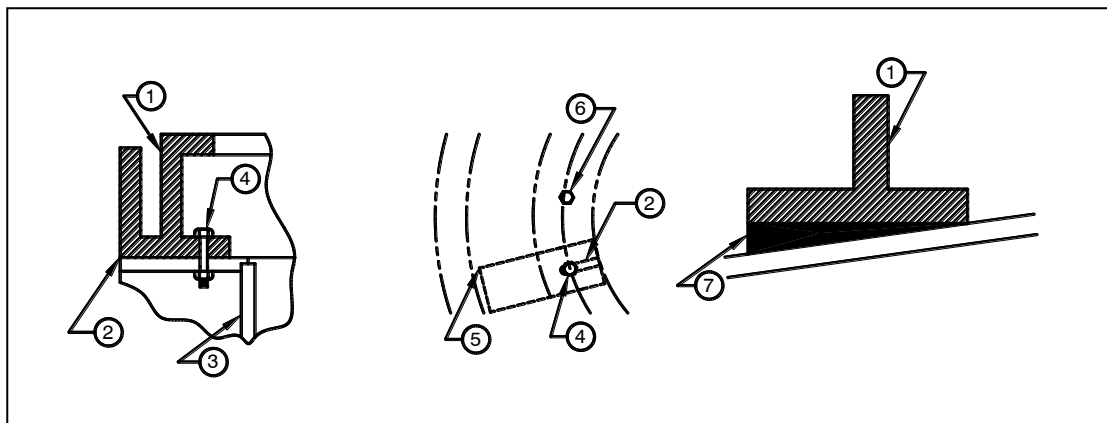


Figure 2.11c

| | |
|-----------------------------|--|
| 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 | |

- b. CHECK clearances between the drive base and column with a feeler gauge at each of the drive mounting capscrews. Mark clearances on the drive base for ready reference.

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- c. Shim at the mounting capscrews, using the Ovivo furnished shims and referring to Figure 2.11c. 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

2.12 FINAL PLUMB THE CAGE AND MANIFOLD

1. Check the cage for plumb using 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. Use the adjusting nuts (3) to correct for plumb, if necessary. Be sure to release all bolts (5) and the lock nuts (8) on the adjusting studs (6).
3. After each adjustment, tighten the bolts (5) equally to keep the cage centered about the drive. Shim, if necessary, between the drive and cage (4) for a tight fit. Do not torque the bolts at (5).
4. Secure the lock nuts (2) on the adjusting stud (6) when the cage is plumb.

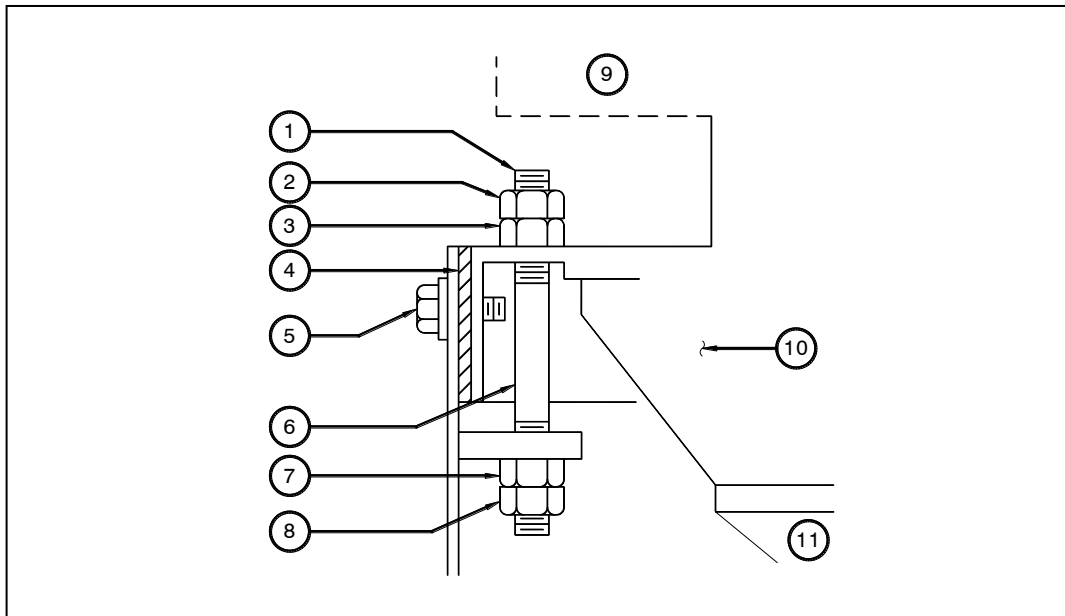


Figure 2.12a

| | |
|--|-----------------------------------|
| 1 - Avoid unnecessary projection of stud | 7 - Adjusting Nut |
| 2 - Locking Nuts | 8 - Lock Nut |
| 3 - Adjusting Nuts | 9 - Drive Platform or Upper Drive |
| 4 - Shim As Required for tight fit | 10 - Drive |
| 5 - Bolt. And Washer | 11 - Top of Center Column |
| 6 - Adjusting Stud | |

5. 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

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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.

8. Check the manifold for centering around and for clearance with the influent column.
9. Weld the cage to the manifold, as specified on the General Erection drawing.



WELDING WARNING:

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

INSTALLATION

2.13 SLUDGE DUCT INSTALLATION

1. Assemble the sludge ducts in place under the rake arms. Include the gaskets at each connection and the duct flange at the manifold flange. The duct blade should be in line with the centerline of the arm, as shown in Figure 2.13a. The duct supports will not be installed at this point.
2. Place blocking under the duct and rake arm, during installation, for support, equal clearance with the tank bottom and camber when the duct will be attached. Similarly block the opposite rake arm for support and camber. Do not remove this blocking until the duct is attached. The cambers will settle out when the blocking is removed.

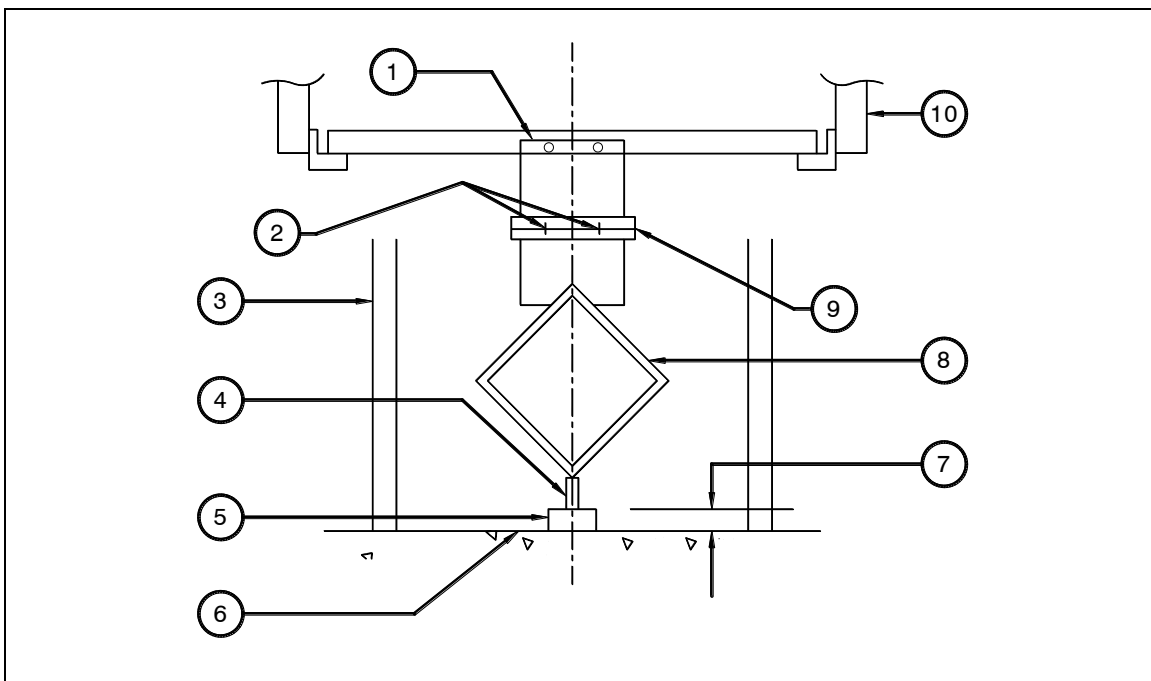


Figure 2.13a

| | |
|-------------------------------|--|
| 1 - Duct Support (adjustable) | 6 - Tank Bottom (top of grout elevation) |
| 2 - Channel Clamps | 7 - Specified clearance plus camber (squeegee not installed) |
| 3 - Arm Blocking (both sides) | 8 - Sludge Duct |
| 4 - Blade | 9 - Weld as specified |
| 5 - Duct Blocking | 10 - Rake Arm |

3. The sludge duct must be in alignment at the manifold. The bottom of the sludge duct (blade) must be in line with the centerline of the arm, although the top of the duct may not always appear to be in line with the arm. Adjust the duct as necessary on the blocking.

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4. Install the duct supports with the fasteners specified at the rake arm lower chord members as shown on the General Arrangement drawing. Adjust the supports for contact with the sludge duct.
5. Install the ducts to the duct support flanges, using the fasteners specified.
6. Secure the duct supports on the rake arm, using the fasteners specified. Do not weld at this time. Welding will follow final arm adjustment.
7. Remove the blocking from under the duct, starting at the manifold and working out to the end of the arm.
8. Rotate the arms to be sure the duct blades do not contact the tank bottom. Adjust duct position, if necessary, using the duct support channel clamps.

Note: After the duct and skimmer assemblies have been installed, the arm camber will settle out of the arms. Therefore, the duct supports to rake arms and the duct flange must not be welded at this time, as the duct may require a final adjustment to allow for this arm settling.

INSTALLATION

2.14 FEEDWELL INSTALLATION



WIND CAUTION:
If high winds are possible during the course of the erection or after erection, make sure that the tank is filled with water. If it is not, the lower rim of the feedwell frame must either be secured against the cage cage/tank bottom or else the fiberglass panels should be installed later, just before the tank is filled.

2.14.1 Installation

Note: The existing feedwell supports will be reused. The contractor is to remove the supports from the existing walkway and relocate them to support the new feedwell frame.

- a. CHECK the feedwell supports for level (supports were installed when the cage was assembled). All supports must be level within the same plane. Adjust them for level if necessary.

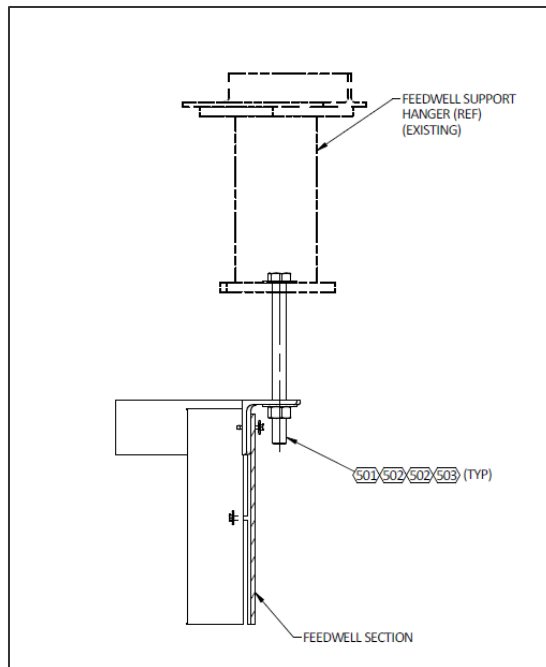


Figure 2.14a

| | | |
|-------------------------------|--------------------------|------------------------|
| 501 – Hex HD Full Thread Bolt | 502 – Plain Washer, ¾ OD | 503 – Hex Nut ¾-10 IMC |
|-------------------------------|--------------------------|------------------------|

- b. Install the feedwell frame sections, using shoring from the tank bottom if required to support the sections. Check orientation and adjust for alignment of the sections and upper rim. Secure all connections.

INSTALLATION

- c. CHECK the feedwell frame for elevation and all around level. Adjust if necessary.
- d. Install the fiberglass panels:
 - 1) Cut the panels to size if required and notch them to clear any fasteners on the frame assembly.
 - 2) Fasten the panels to the top and bottom horizontal framing at 2' centers, using the self-tapping screws.
 - 3) Overlap the panel joints at least (2) corrugations.
 - 4) Fasten the panels together at 12" centers to the top and bottom horizontal framing members with the capscrews, neoprene washers (2 - one each side) and nuts. Field drill as required and locate to miss the vertical framing. Fasteners must compress the washers, but not be so tight they distort, smash or cut the washers.

Note: Neoprene washers are required to prevent damage to the fiberglass.

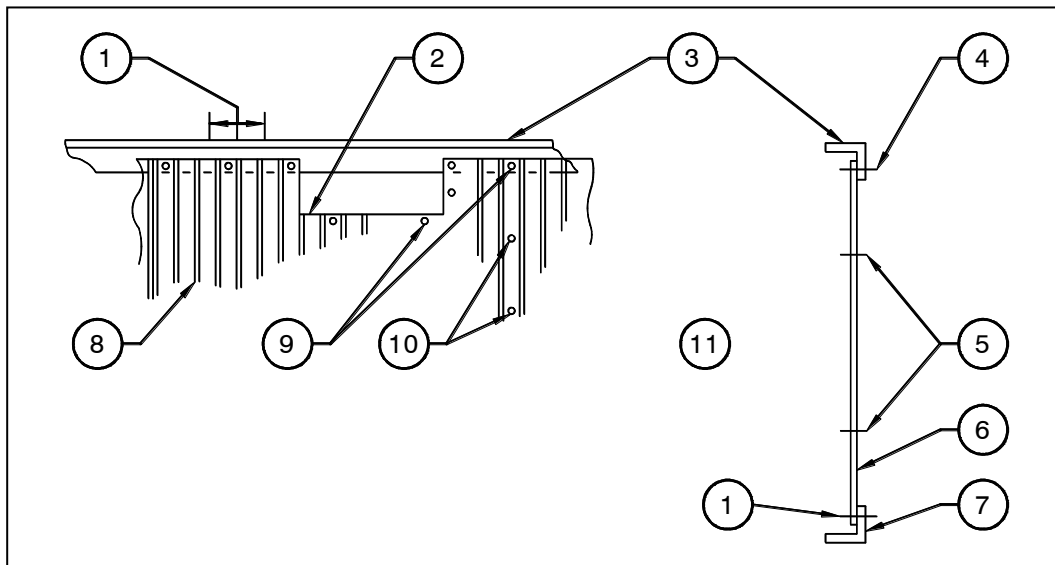


Figure 2.14b

| | |
|--|---|
| 1 - Overlap 2 Corrugations | 7 - Bottom Frame |
| 2 - Field Cut For Scum Port | 8 - Panel |
| 3 - Upper Frame | 9 - Self tapping screws at scum ports and top and bottom frames |
| 4 - Fasten at 2'-0" centers top and bottom framing | 10 - Fasten at 1" center |
| 5 - Capscrews Washers (2) and Nuts | 11 - Notch to clear frame fasteners (if necessary) |
| 6 - Panel | |

INSTALLATION

- 5) Fasten the panels together at 24" centers to the vertical framing members with the capscrews, neoprene washers (2 - one each side) and nuts. Field drill as required and locate to miss the vertical framing. Fasteners must compress the washers, but not be so tight they distort, smash or cut the washers.
- 6) At the scum ports, field cut the fiberglass panels around the opening in the frame sections. Use self- tapping screws at the scum ports (4 at each port) to secure the panels in place. Adjust the scum port baffles to the angle required.
- 7) Apply resin to any field cut edges to prevent delamination of the fiberglass.


2.14.2 Adjustment

- a. CHECK the feedwell for elevation and all around level. Adjust if necessary.

Note: The bottom of the scum outlet openings should not be higher than the bottom of the weir V-notches.

- b. Check the bottom of the EDI for level and adjust, if necessary, using temporary shoring from the tank bottom.

2.14.3 Lifting Procedures



CAUTION: Do not attach the lifting cables or chains to the ends of the feedwell section. This will cause bending of the rim angle and feedwell plate, changing the radius and preventing proper fit-up of the sections.

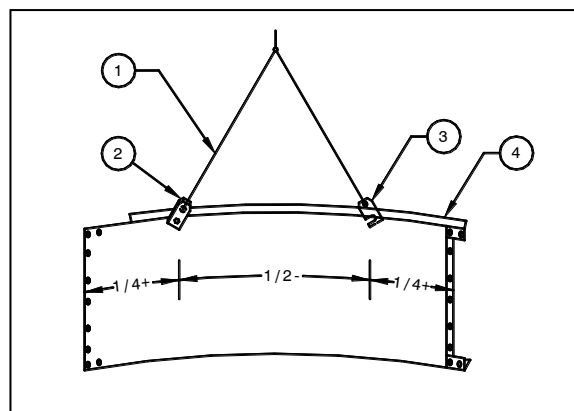


Figure 2.14a - Lifting Rigid Sections

| | |
|---|----------------------------------|
| 1 - Lifting Cables or Chains (not by Ovivo) | 3 - Lifting Clamp (not by Ovivo) |
| 2 - Lifting Lug (not by Ovivo) | 4 - Feedwell Section |

INSTALLATION

When lifting the feedwell sections, care must be taken to prevent changing the radius (curve) of the sections.

Lift the feedwell sections as follows:

- a. Mount lifting lugs (not by Ovivo) or equivalent, to the predrilled holes located just below the rim angle at approximately $\frac{1}{4}$ + the total length of the feedwell section from each end of the section. Refer to Figure 2.14a. If lifting lugs are not used, attach the lifting cables or chains with lifting clamps to the feedwell section at the rim angle at this same distance ($\frac{1}{4}$ +) from each end of the feedwell section.

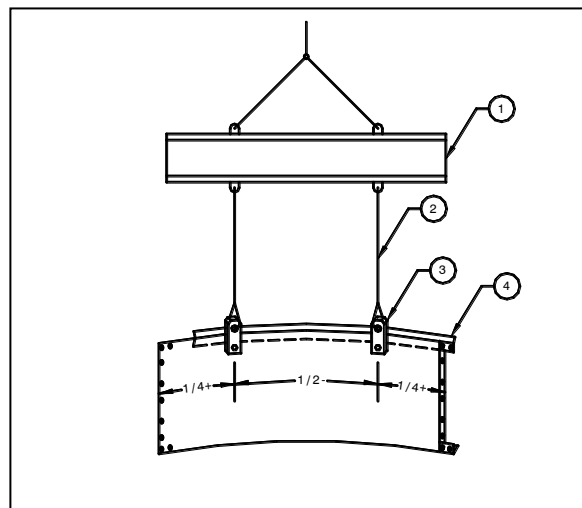


Figure 2.14b - Lifting Less Rigid Sections

| | |
|---|--------------------------------|
| 1 - Spreader Beam (not by Ovivo) | 3 - Lifting Lug (not by Ovivo) |
| 2 - Lifting Cables or chains (not by Ovivo) | 4 - Feedwell Section |

- b. When lifting large, less rigid, feedwell sections, a spreader beam (shown in Figure 2.14b) should be used to provide a vertical lift.
- c. Remove the lifting lugs, if used, after the feedwell section is in place. The mounting holes for the lifting lugs may be closed, if desired, using round headed bolts and nuts (the bolt heads must be on the outside of the feedwell), or by plug welding and grinding (not by Ovivo) for a smooth surface (both sides).

Note: Leaving the holes open will not affect the process performance of this equipment.

INSTALLATION

2.15 INSTALL THE WEIRS, BAFFLES AND SCUM BOX

2.15.1 Weirs

- a. Install the weirs with clamps and/or washers in position on the anchor bolts. Center them in their mounting holes and snug the nuts. Application of a mastic sealer during the installation is recommended to prevent leakage between the weirs and the launder. Mastic sealer is not by Ovivo.

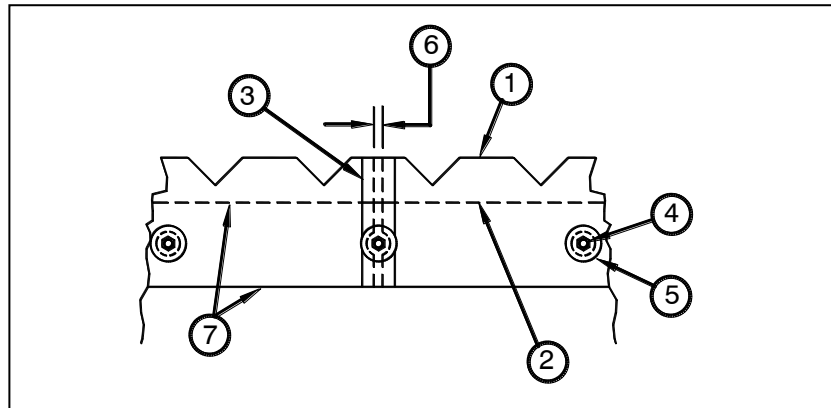


Figure 2.15a

| | | |
|--------------------|-------------------------------|----------------------------------|
| 1 – Weir | 4 – Anchor bolt | 7 – Mastic sealer (not by Ovivo) |
| 2 – Top of launder | 5 – Washer | |
| 3 – Splice plate | 6 – Approximate ¼" (max.) gap | |

- b. If the weirs are installed during cold weather, a ¼" (maximum) gap should be left between the weir plates to allow for thermal expansion of the weir material at higher ambient temperatures. The butt plate (or overlap, as used) will cover the gap and prevent leakage of water between the plates.
- c. The weirs must be level. Check them with a surveyor's level. Adjust for level as necessary and secure all fasteners. Final level may also be made later with water in the tank. In that case, set all weirs equal distance from the water level when there is no flow.

2.15.2 Baffles

- a. Mount the lower baffle support angles to the tank wall, centering the anchor bolts in the slotted mounting holes, and secure the anchor nuts. Mount the upper support angles to the lower support angles and, using the slotted mounting holes, adjust them according to the specified dimensions. Snug the fasteners.

Note: The straight baffle section (not by Ovivo) is provided for use at the scum box. This baffle is field installed to the scum box and must extend downwards.

INSTALLATION

- b. Install the baffles, mounting them to the upper support angle with the fasteners provided. Adjust for specified elevation and spacing, using the slotted mounting holes in the baffle support angles, and secure the fasteners.

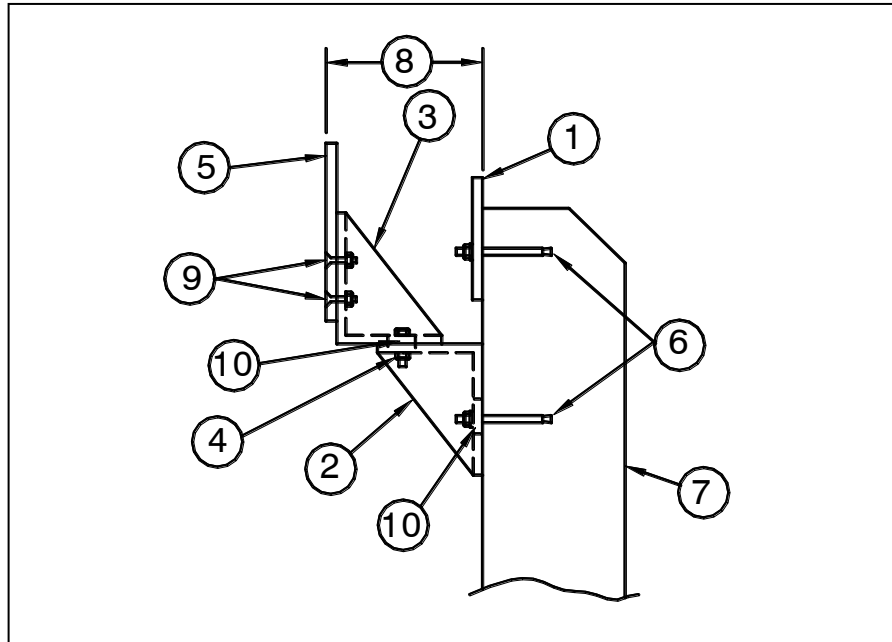


Figure 2.15b

| | | |
|--------------------------------|--------------------------|---------------------------------------|
| 1 – Weir | 5 – Baffle | 9 – Baffle-to-support angle fasteners |
| 2 – Lower baffle support angle | 6 – Anchor bolts | 10 – Slotted mounting holes |
| 3 – Upper baffle support angle | 7 – Tank wall or launder | |
| 4 – Support angle fasteners | 8 – Specified dimension | |

- c. Revolve the rake arms until the outer end of the skimmer arm (pipe) is over the scum box. Measure the horizontal distance from the end of the skimmer arm (pipe) to the scum baffle. Revolve the machine and adjust the baffle assemblies, using the slotted mounting holes, to obtain this same horizontal distance adjustment for concentricity. Secure all fasteners.

2.15.3 Scum Box

In most cases the baffles should be installed ahead of the scum box, but the adjustments should be made at the same time.

- a. Slip the flexible coupling over the end of the discharge pipe (not by Ovivo) before the scum box is installed.
- b. Locate and install the scum box anchor bolts, referring to the dimensions listed on the General

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Arrangement drawing.

c. Mount the scum box supports to the anchor bolts, and then mount the scum box to the supports.

d. Adjust the scum box for elevation and level referring to the drawings. When the skimming device is installed, adjust the box for concentricity with the device and recheck elevation and level. Adjust the scum box as follows:

Radial Adjustment:

Slots in scum box

Vertical Adjustment:

Slots in supports

Level Adjustment:

Shim between scum box supports and wall, and baffle adjustments

e. Field drill the $\varnothing 11/16$ " mounting holes in the baffles, using the scum box as a template. Then, connect the scum box to the baffle using the bolts, nuts and washers specified.

f. Secure all fasteners. Then connect scum box nozzle to the discharge piping, as specified on the Skimming Erection drawing.

INSTALLATION

2.16 SKIMMING DEVICE INSTALLATION

1. Place temporary blocking under the rake arms for support. Field drill $\varnothing 9/16''$ mounting holes on the skimmer arms for installation to the skimmer blades.
2. Mount the vertical skimmer supports to the rake arms using the skimmer support brackets and fasteners, as shown on the Skimming Erection drawings.
3. Adjust the skimmer supports for position on the rake arms referring to the Skimming Erection drawing for dimensions. Adjust the skimmer support for plumb, shimming as required (shims not by Ovivo). Then secure the clamps.

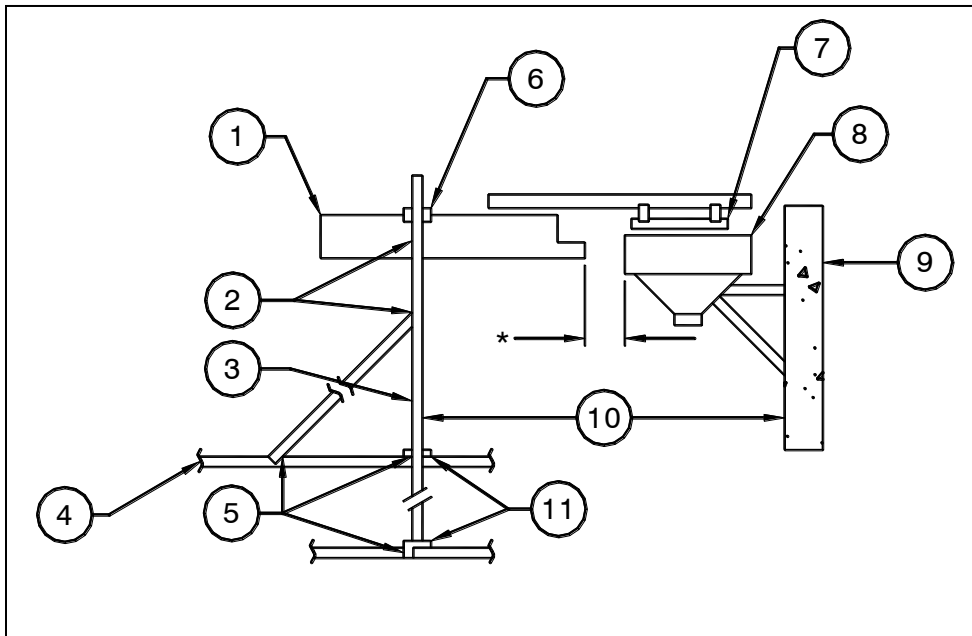


Figure 2.16a

| | | |
|--|---------------------|--------------------------|
| 1 - Skimmer arm assembly | 5 - Weld | 9 - Tank Wall |
| 2 - Weld | 6 - Channel Clamp | 10 - Dimensions as shown |
| 3 - Vertical Skimmer Support | 7 - Skimming Device | 11 - Clamp |
| 4 - Rake Arm | 8 - Scum Box | |
| *The distance from the scum box to the skimmer (dimension*) is approximately 4" ±. | | |

4. Mount the skimming device parts to the skimmer arm referring to the Skimming Device Assembly drawings.
5. Mount the skimmer arm assembly (with skimmer device) to the vertical skimmer support using the channel clamps. The skimmer arm must be parallel to the rake arm centerline. Position the skimming

INSTALLATION

device on the arm so the end wiper is just touching the baffles and so that the bottom wiper is approximately 3" below water level.

6. Secure the skimmer supports to the rake arms, as specified on the drawings. Field locate and install the skimmer support brace to the rake arms and vertical supports using the supplied fasteners.
7. Adjust the skimmer arm for level, and elevation if necessary, using the U-bolt. Adjust the skimmer arm alignment, as required, to align the scum skimmer parallel to the scum box discharge leading drop edge, as shown in Figure 2.16b. Then secure the skimmer arm to the vertical support.
8. Install and tension the springs as specified on the skimming device assembly.

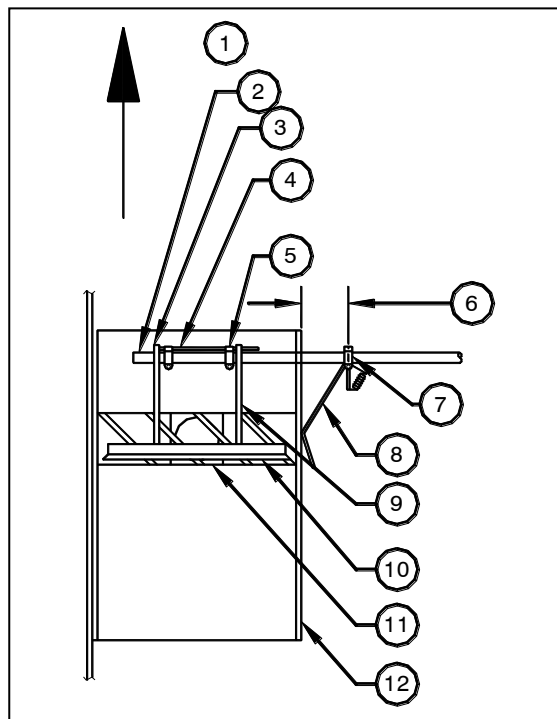


Figure 2.16b

| | | |
|---------------------------------|--------------------------------------|--|
| 1 - Direction of skimmer travel | 5 - Collar | 9 - Scraper arm |
| 2 - Skimmer arm | 6 - 6" [nominal] allowed adjustment | 10 - Scum skimmer aligned parallel to scum box discharge leading drop edge |
| 3 - Arm clevis W/set screw | 7 - Hinged skimmer support w/ collar | 11 - Scum box discharge leading "drop" edge |
| 4 - Stop rod | 8 - Hinged skimmer (vertical) | 12 - Scum Box |

9. Assemble the skimmer blade sections together referring to the part numbers on the Skimming Erection drawing and using the specified fasteners.

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10. CHECK the rake arms for final level before the skimmer blade is installed. Refer to the Rake Arm Final Adjustment Instructions.
11. Install the skimmer blade referring to the Skimming Erection drawings and Figure 2.16c. Adjust the skimmer blade for level at the elevation specified and for the 6" clearance with the feedwell. If necessary, trim the blade where it extends past the feedwell connection (Figure 2.16c).

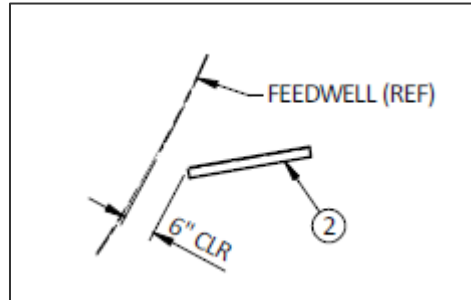


Figure 2.16c

1 - Feedwell

12. Install the mid-span skimmer braces using the brackets and fasteners provided. Refer to the Skimming Erection drawing.
13. Refer to the Skimmer Arm Assembly Maintenance and Adjustment Instructions for final adjustment and maintenance procedures.

INSTALLATION

2.17 FLUSH VALVE INSTALLATION

1. Mount the neoprene diaphragm to the flush lever, as shown on the Flush Valve Assembly drawing and Figure 2.17a, using the specified pan head machine screws, washers and nuts.
2. Locate the 2½" hole in the side of the scum box, and apply a ¼" bead of the specified sealant to the scum box around the hole to produce a seal between the scum box and the seal plate. Refer to the Flush Valve Assembly and Flush Valve Erection drawings.
3. Place the pan head machine screws through the mounting holes in the scum box, orienting them as shown on the Flush Valve Assembly drawing. Place the seal plate into position over the pan head screws and against the side of the scum box. Verify that the seal plate will lie flat before installation. Remove any burrs that may cause unevenness.

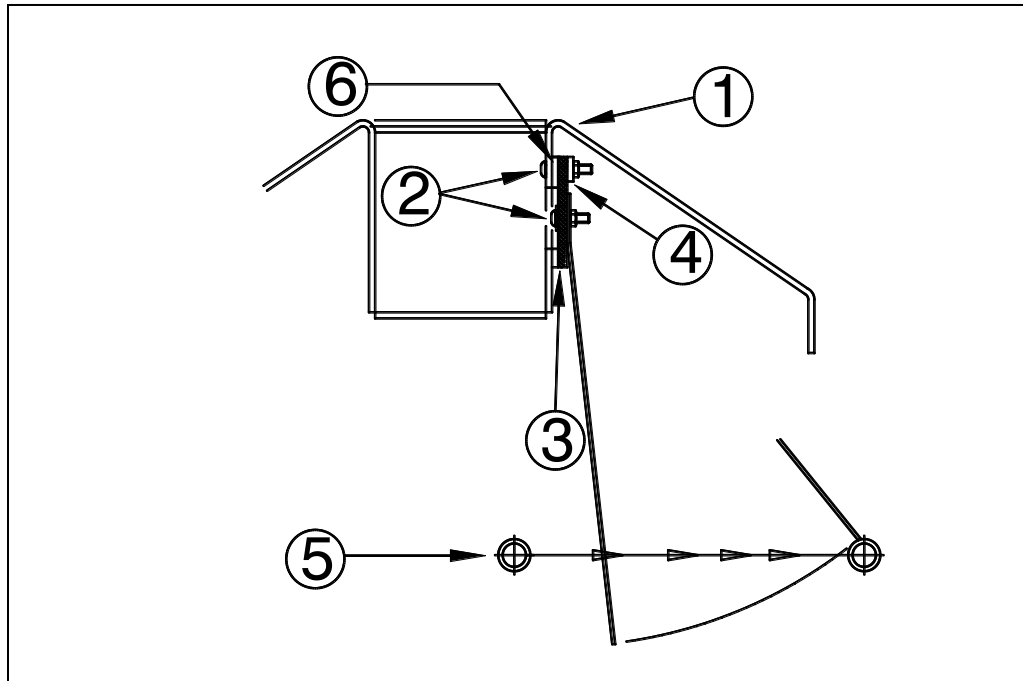


Figure 2.17a

| | | |
|-----------------------------|------------------------|--------------------|
| 1 - Scum Box | 3 - Neoprene Diaphragm | 5 - Actuation Arm |
| 2 - Pan Head Machine Screws | 4 - Retainer Bar | 6 - Mounting Plate |

4. Install the flush lever with the neoprene diaphragm over the pan head screws and onto the seal plate. Place the retainer bar in position as shown, and secure the assembly with the specified washers and nuts.
5. Mount the PVC actuator arm support to the skimmer arm, as shown on the Flush Valve Erection drawing and Figure 2.17b, using the specified U-bolts and channel clamps. Check that the bottom of the notch in the arm housing is at the same elevation as the centerline of the skimmer pipe.

INSTALLATION

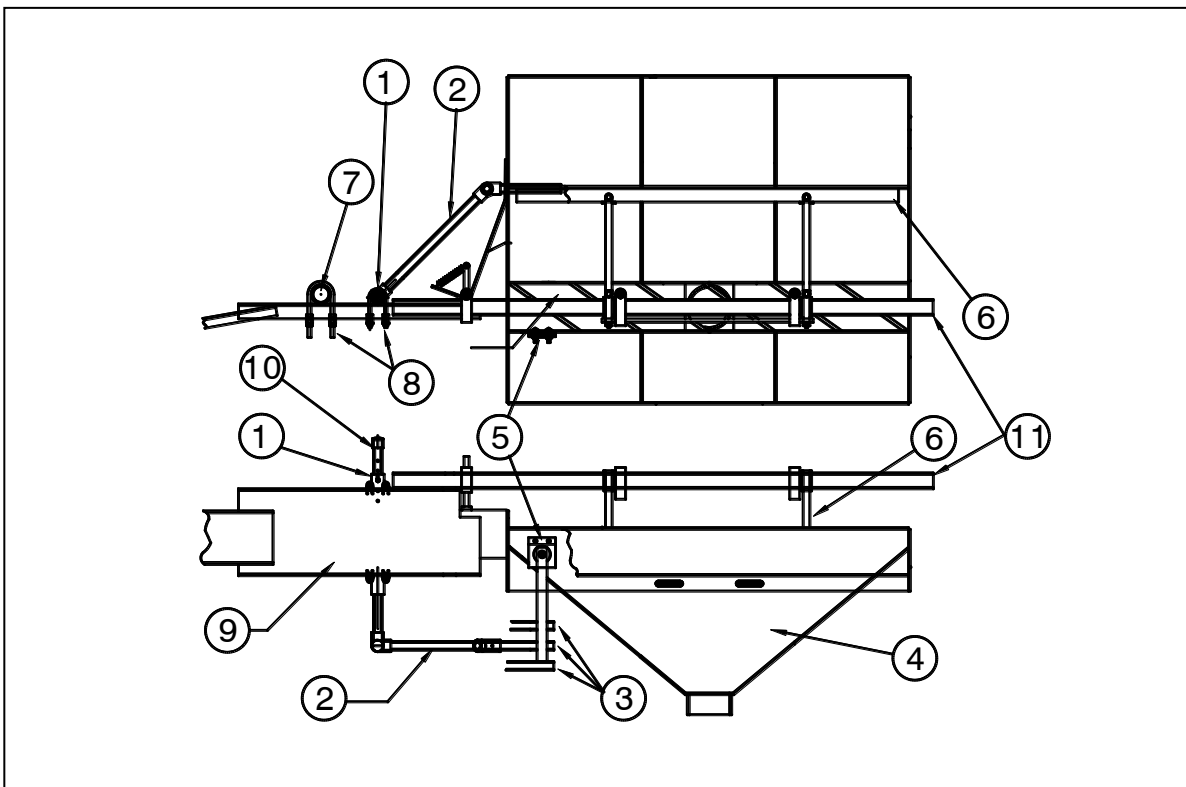


Figure 2.17b

| | | |
|---|----------------------------|--|
| 1 - Actuator Arm Support | 5 - Flush Valve Assembly | 9 - Skimmer Arm |
| 2 - Horizontal Section of Flush Actuation Arm | 6 - Skimming Device | 10 - Vertical Section of Flush Actuation Arm |
| 3 - Adjustment Range | 7 - Skimmer Support (Ref.) | 11 - Skimmer Pipe |
| 4 - Scum Box | 8 - U-Bolts with Nuts | |

6. Assemble the vertical section of the actuation arm and top cap, using the specified PVC cement. Install the positioning capscrew with nut in the top positioning hole in the vertical section of the actuation arm (five holes are provided).
7. Insert the vertical section of the actuation arm down through the actuator arm support, placing the positioning capscrew in the slot, as shown on the Flush Valve Erection drawing.
8. Install the horizontal section of the actuation arm with fittings, as shown on the Flush Valve Erection drawing, using the specified PVC cement. The actuator arm must be parallel to the skimmer arm and level.
9. Using the actuator arm support U-bolts, adjust the position of the actuating arm assembly so that the horizontal section of the arm is $\frac{1}{4}$ " below the flush lever, as specified on the Flush Valve Erection drawing. The actuator arm must be parallel to the skimmer arm and level. After all adjustments are

OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation, Maintenance and Operation Manual

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completed, secure the U-bolt nuts.

10. Raise the actuation arm and install the positioning capscrew with nut in the middle positioning hole (hole #3). Leave the actuation arm in the middle position for initial start-up of the clarifier. During normal operation, the actuation arm can be adjusted up or down, as required, to increase or decrease flush duration.

Note: Raising the actuation arm will increase the flush duration.

INSTALLATION

2.18 FINAL LEVEL THE RAKE ARMS

1. The purpose of this adjustment 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.

2. Check that the 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 piles of sand. Adjust or mark the device for the clearance of the arms from the tank floor.
3. Rotate each arm to the place of the checking device and adjust the arm for the required clearance. Use a jack to lift the arms to assist in this adjustment. Add or remove shims equally at both connections as necessary to achieve equal arm level. Block under the opposite arm before the arm being adjusted is raised or lowered. Shims are not by Ovivo.
4. Secure all arm connections, and recheck alignment.
5. Weld rake arm splices and arm-to-cage connections, as specified.



WELDING WARNING:

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

6. If shims are used, welds must be enlarged so that the load will be transferred from the rake arms to the cage, not from arms to shims.
7. Weld the duct supports to the rake arm struts, as specified on the Rake Arm Erection drawing.
8. Weld the duct supports to the ducts, as specified on the Rake Arm Erection drawing.

INSTALLATION

2.19 PRE-GROUT CHECK

1. At this stage in the erection or installation of the equipment, before the tank is grouted, a pre-grout mechanical check-out of the equipment is required. It could prevent expensive, difficult adjustments later.

2. Do Not Fill the Tank with Water

The pre-grout 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.

3. Arrangements for Service

Arrangements for pre-grout check should be made at least two weeks in advance with your Ovivo representative. Refer to the Offices page to contact him.

4. Final Mechanical Checklist

- a. The installer must complete the "Final Mechanical Checklist", located at the back of this manual, prior to the pre-grout check. Unless the Final Mechanical Checklist is accepted and signed-off by the Service Representative at the completion of installation, the warranty will not be in effect.
- b. Please have the completed copy of the "Final Mechanical Checklist" available before contacting your Ovivo representative to arrange for the pre-grout mechanical check-out.

INSTALLATION

2.20 STATIC TORQUE TEST

Refer to the "Static Torque Test" drawing for test procedures.



WARNING:

For the protection of personnel during the torque test, the following precautions must be taken:

1. Anyone entering the area of this equipment must be wearing adequate safety equipment such as safety glasses, safety shoes, hardhat, etc.
2. Check the torque test kit before use to be sure the cable slings and other components are in good condition.

Note: The dynamometer is by Ovivo. The hoist, cables, chains, etc. by others.

3. Make sure the cinch anchors (not by Ovivo) used to anchor the test equipment are specified size and properly installed.
4. Limit the number of personnel inside the tank to that necessary to perform the test.
5. Stay away from the rake arms while the test is in progress. Do not stand in front of the leading side of the arm(s) while they are under tension during the test.
6. Do not exceed the maximum indicated load (read on the linear scale) specified on the "Torque Test Instructions" drawing.
7. Anyone who will be entering the area of this equipment during the torque test must be informed of these precautions prior to starting the test.

INSTALLATION

2.21 SUGGESTED GROUTING PROCEDURE

2.21.1 Grouting Responsibility

Ovivo is not responsible for grouting the tank, grouting specifications of material, depth or accuracy of placement. Grouting specifications and final approval of the grouted tank are solely the responsibility of the user, or his agent.

This suggested procedure is offered only as a guide to assist those responsible for grouting.

2.21.2 Purpose of Grouting

Grout is added to a tank bottom to provide a bottom surface with controlled contour variation. Such variation, if not specified on contract documents, is usually intended to be $\pm 1/4"$ [6.35 mm], and allows setting sludge duct blades, via adjustable squeegees, 0 to $1/2"$ [12.70 mm]. Clearance of the adjusted squeegee to local low spots may be allowed up to $3/4"$ [19.50 mm]. The clearances provided herein do not supersede contract documents governing equipment installation.

2.21.3 Determine Grout Elevation

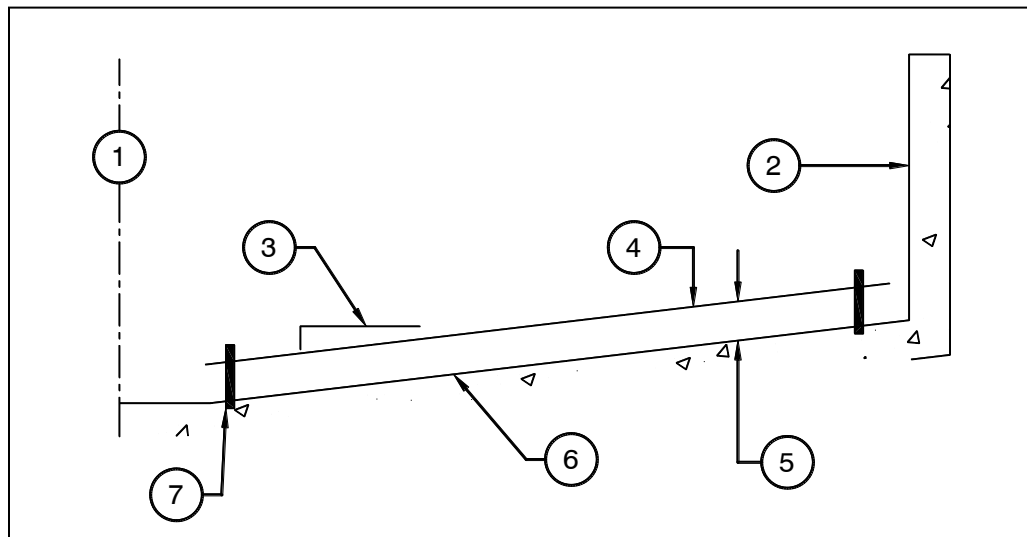


Figure 2.21a

| | |
|------------------------|----------------------------------|
| 1 - Centerline of Tank | 5 - Grout thickness as specified |
| 2 - Tank Wall | 6 - Tank Bottom |
| 3 - Slope as specified | 7 - Temporary bolts or posts |
| 4 - Reference Line | |

INSTALLATION

- a. Refer to the Reference drawing for the specified elevation of grout. Then, using a surveyor's instrument, mark the elevation on bolts or posts secured to the tank bottom radially from center of the tank, referring to Figure 2.21a.
- b. String a reference line or wire between the posts or bolts, set for the surveyed elevation. This line will be used to set the "template" boards for correct grout elevation and slope.

2.21.4 Heat Distortion

Heat distortion, by the sun, can cause the column and arms to distort unevenly during screed board construction or grouting, which will cause an unevenly grouted tank bottom.

Heat distortion of the column can be controlled by mounting sheets of cardboard, Styrofoam, etc. to the sides of the cage, or by grouting in the early morning or on an overcast day.

On mechanisms over 50' dia., heat distortion of the arms can also be a problem. It can be controlled by grouting in the late afternoon or on an overcast day, or by covering the arms. But, if the tank must be grouted during the hot part of the day and the arms are not covered, the amount of distortion should be considered.

- a. During the early morning hours measure the distance from the bottom of the arm to the tank bottom at the outer end of the arm.
- b. Next, during the hottest part of the day, again measure the clearance between the arm and tank bottom at the same point measured in early morning.
- c. The difference between these two measurements (1 and 2) is the amount of heat distortion that must be considered during grouting. Remember that the arms will distort downward at the tips; so, for example, if grouting is started in early morning and it runs into noon, the outer tips of the arms will sag and cut into the outer circle of grout. For that reason it would be better to start in the afternoon.

Note: During operation, heat distortion is not a problem as both the arms and columns are under water and equal temperature.

2.21.5 Template Board Construction

- a. Cut off the lower edges of the template boards at an angle as shown in Figure 2.21b.
- b. Bolt 2 x 4 template boards to the sludge duct blades. The bottom of the boards must just touch and run parallel with the reference line. At no point should the grout thickness be less than 1" to avoid cracking. Refer to Figure 2.21b.

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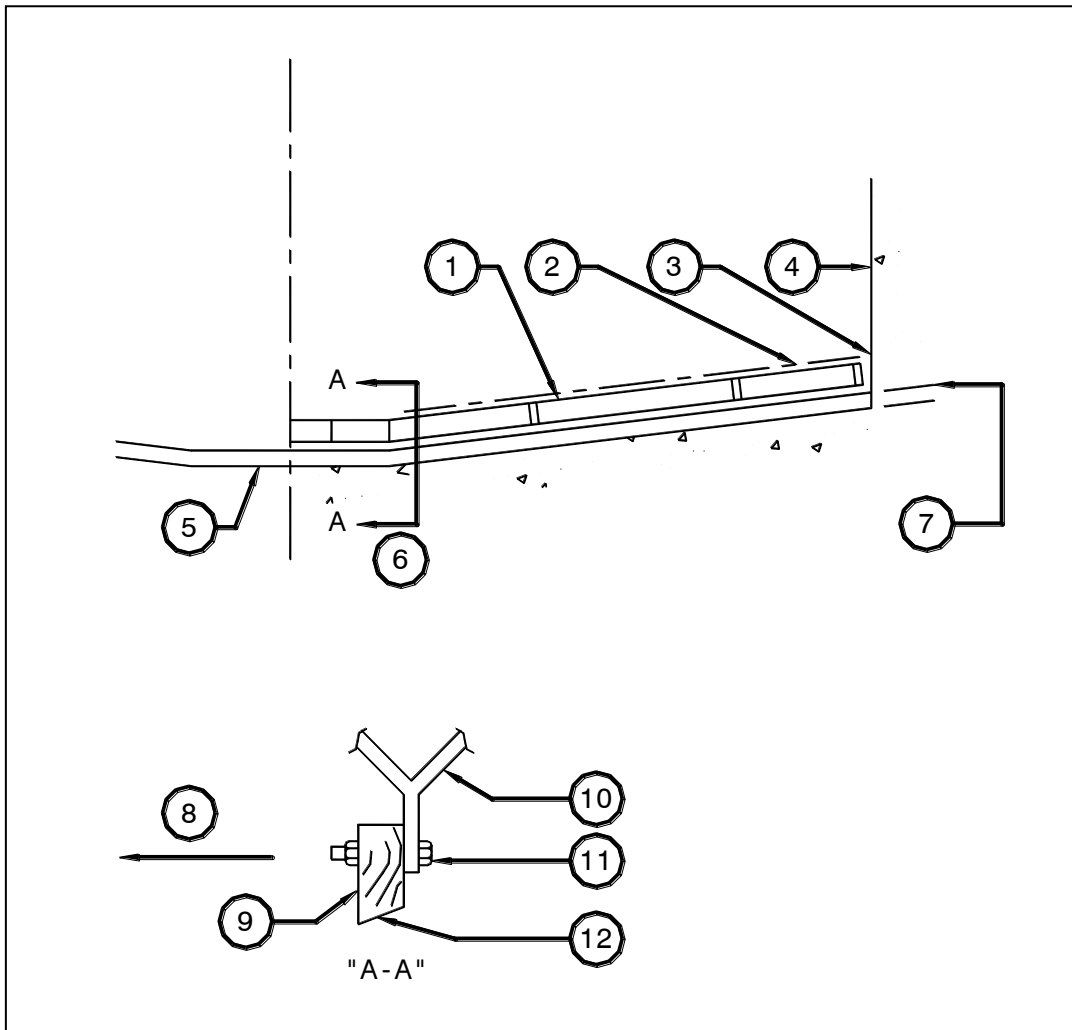


Figure 2.21b – Duct Blades

| | |
|---|-------------------------------|
| 1 – 2x4 Template Board | 8 - Rotation |
| 2 - Bottom Of Arm | 9 – 2x4 |
| 3 - End of board should come as close as possible to tank wall: check thru complete revolution | 10 - Sludge Duct |
| 4 - Tank Wall | 11 - Bolts |
| 5 - Tank Bottom Before Grouting | 12 - Bottom Of Template board |
| 6 - For Slope of Tank Bottom. See General Arrangement drawings | |
| 7 - Reference Line And Bottom Of Template Board | |

INSTALLATION

2.21.6 Suggested Grouting Procedure



WARNING:

The mechanism must not be used to grout the tank bottom. It should be used only as a gauge or "template" to check the grout for proper thickness, slope and overall smoothness.

To ensure the arms will be used only as a template, a hand wheel can be mounted to the worm drive shaft so the arms can be rotated by hand.

- a. Usually, grout of the following proportions will be satisfactory: 3 parts sand by weight, 1 part cement by weight and clear water, enough to permit reasonable slump for ease of equipment distribution (about the consistency of mortar). Do not use gravel.
- b. Start a ring of grout which can be worked by a crew, usually 2' [609 mm] wide, at the outer edge of the tank. This ring can be gradually widened as it approaches the center of the tank. Continue the outer ring in a spiraling pattern, working towards the center of the tank.
- c. Cement finishers should work just ahead of the template arm to be certain the grout is proper thickness to cover the area. Wet down the concrete floor ahead of the grout to ensure a good bond.
- d. When a load of grout is placed in front of the moving arm, it should be wide enough for the cement finishers to work it at the rate of arm travel. Never stand or put weight on an arm during grouting. And avoid walking on the walkway.
- e. Do not use the template board to push or to level the grout. It is only to be used as a template in regulating the thickness and surface of the grout. Make sure the grout does not enter the suction duct openings.
- f. Rotate the mechanism periodically during the grouting to make sure the grout has not sloughed. Watch for rocks or dried pieces of grout that may catch under the template board and gouge the surface.
- g. Careful grouting should produce a finished bottom that is uniform within a $\pm 1/4$ [6.35 mm] inch of the specified depth.
- h. Remove the template boards after the grout has dried.

INSTALLATION

2.22 SQUEEGEE INSTALLATION AND ADJUSTMENT

1. After the tank has been grouted, install all the squeegees, referring to the part numbers on the Rake Arm Erection drawing. The squeegees must be installed on the side of the duct and blade facing the direction of arm rotation, as shown in Figure 2.22a.
2. Adjust each squeegee for minimum clearance with the bottom of the tank. Clearance of the squeegee from the grouted bottom will be from 0" (touching at the highest point in the grout for the full sweep of the arm) to 1/2", with possible 3/4" clearance at a few local low spots. This will be possible if grouting was done properly.
3. CHECK squeegee clearance around the tank by rotating the arms.

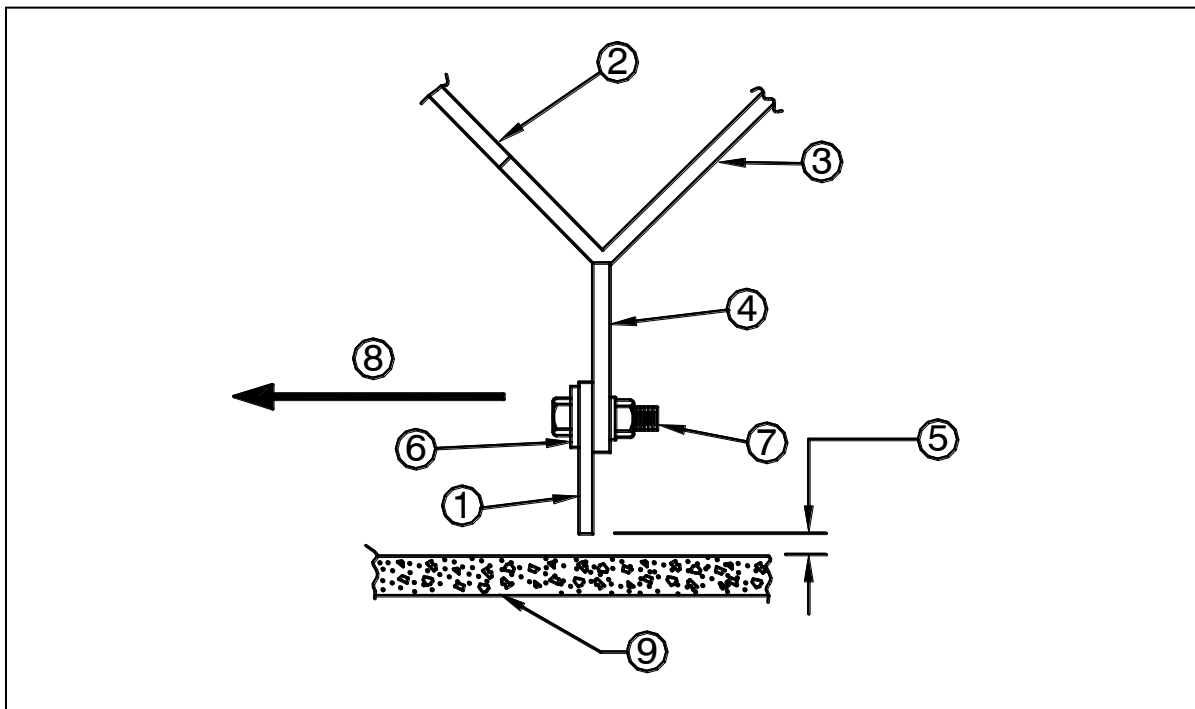


Figure 2.22a

| | | |
|-------------------------|-----------------|------------------------------|
| 1 – Squeegee | 4 – Duct blade | 7 – Capscrew, nut and washer |
| 2 – Duct opening (ref.) | 5 - Clearance | 8 – Direction of rotation |
| 3 – Duct | 6 – Back-up bar | 9 - Grout |

INSTALLATION

2.23 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

3.0 LUBRICATION

3.1 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>CAUTION: 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> |
|---|--|

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 on a following page.

3.1.1 Drive Oil Quantities in Approximate U.S. Gallons

| <u>MODEL</u> | <u>WORM GEAR</u> | <u>MAIN GEAR</u> |
|--------------|------------------|------------------|
| C60LT | 3 gals. | 17 gals. |

A lubrication plate, Figure 3.1a below, is mounted to each drive housing (worm gear and main gear) at the oil fill opening. The "Lubricant No." (No. 1, No. 2 or No. 3) indicated on this plate refers to the "Lubricant Number" shown on the lubricant plate (Figure 3.1b) mounted on the chain guard.

| 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 | 7S |
| | | -0°F TO 50°F | MOBILGEAR 600, XP150 | MOBIL SHC Cibus 460 (NSF-H1 Food Grade) | 7S |
| | | 50° TO 110° F | MOBILGEAR 600, XP460 | - | 4EP |
| ② | OIL BATH | -20°F TO 110°F | - | MOBIL SHC 634 | 7S |
| | | -20°F TO 110°F | - | MOBIL SHC Cibus 460 (NSF-H1 Food Grade) | 7S |
| | | -20°F TO 110°F | - | MOBIL SHC 634 | 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

- 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.

3/2017 REV H 560128

Figure 3.1a

LUBRICATION

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, referring to the Offices page.

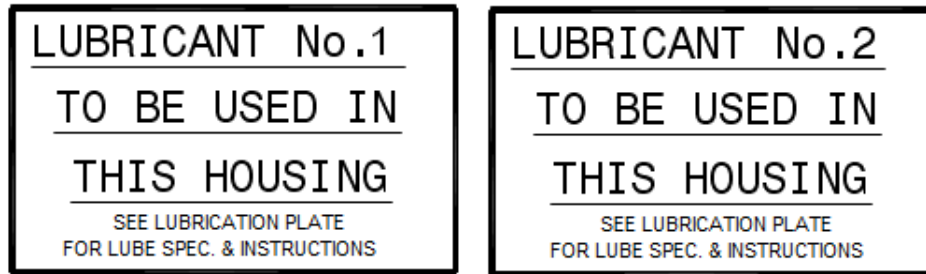



Figure 3.1b

3.1.2 Check Oil Levels Weekly

- a. 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.
- b. Drain condensate once a week.

| | |
|---|---|
|  | <p><u>DRIVE UNIT VENT CAUTION:</u> Vent holes in vented pipe plugs <u>must</u> be kept clear of dirt, paint or other foreign material.</p> |
|---|---|

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.

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.

LUBRICATION

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

- a. Ovivo recommends that oil samples are sent to a commercial laboratory for analysis. This is not required.
- b. 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.

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.

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Instruction No.: 11-AA1

PROJECT: Wichita WWTP

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Date: 11/18/2021

LUBRICATION**3.2 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 |

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LUBRICATION

| MANUFACTURER | PETROLEUM BASED OILS | | |
|---------------------------------------|--|--------------------------------------|--------------------------------------|
| | AGMA EQUIVALENT NUMBER/VISCOSITY cSt AT 40°C | | |
| | 2EP/ISO 68 | 4EP/ISO 150 | 7EP/ISO 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) |
| 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) | | |

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

OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation, Maintenance and Operation Manual

CUSTOMER NAME: Dondlinger & Sons Construction

Instruction No.: 11-AA1

PROJECT: Wichita WWTP

Revision: 1

CSW0001517-01

Date: 11/18/2021

LUBRICATION

| MANUFACTURER | GREASE | MANUFACTURER | GREASE |
|--------------|--------------------------------|---------------------------------------|--------------------------------|
| | NLGI No. 2** EQUIVALENT | | NLGI No. 2** EQUIVALENT |
| AMOCO | Rykon #2 | STANDARD OF CALIFORNIA CHEVRON USA | RPM Multimotive #2 |
| 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

4.0 MAINTENANCE

4.1 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 (chains, sprockets, etc.). 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.



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.

MAINTENANCE



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.

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.

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

4.2 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 assembly. Refer to Drive Lubrication Instructions. Check the motor drive, referring to the Manufacturer's Instructions.
3. Make sure the 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.

Note: To prevent the column-to-manifold seal from catching or tearing, coat the sealing surface of the manifold with light oil before rotating the arms.

6. Watch for clearance of the squeegees with the tank bottom. Check for loose parts, bolts and nuts.
7. Watch the scum skimmer to be sure it is working efficiently and adjusted for smooth operation.
8. Check the scum box flush assembly for proper operation. Refer to the Scum Box Flush Valve Installation instructions.

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CUSTOMER NAME: Dondlinger & Sons Construction

Instruction No.: 14-EX17

PROJECT: Wichita WWTP

Revision: 1

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Date: 11/18/2021

MAINTENANCE

4.3 MAINTENANCE LOGS

4.3.1 Motor Maintenance Record

Refer to manual for instructions. Maintenance records must be logged and available for review to maintain warranty

| DATE | ITEM - BASIN #, UNIT # | VOLUME/TYPE GREASE/RESISTANCE | REMARKS | INITIALS |
|------|---------------------------|----------------------------------|---------|----------|
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OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation, Maintenance and Operation Manual

CUSTOMER NAME: Dondlinger & Sons Construction

Instruction No.: 17-CL16b

PROJECT: Wichita WWTP

Revision: 1

CSW0001517-01

Date: 11/18/2021

MAINTENANCE

4.4 MAINTENANCE SUMMARY

| CHECK and MAINTENANCE | FREQUENCY | LUBRICANT (IF APPLICABLE) | COMMENTS/REFERENCES |
|--|---|--|---|
| <u>Drive:</u> | | | |
| Check oil level in both worm gear and main gear housings | Weekly | Refer to the lubrication plate mounted on the drive unit | Add oil as necessary |
| Drain condensate from the main gear and worm gear housings | Weekly | Refer to the lubrication plate mounted on the drive unit | Refill with oil as necessary |
| Make sure the chain guard is properly installed and functional | Weekly | | Refer to the Maintenance And Operation Warnings page in the Maintenance instructions |
| Check drive chains for tension | Monthly | | |
| Lubricate drive chain | Monthly | SAE 30 weight oil | Coat as necessary |
| Check drive control | Monthly or as recommended | None | Refer to the "General Drive Maintenance" Instructions for frequency and method |
| Replace leaking worm shaft oil seals | Check monthly and replace when oil is replaced | | Refer to the Drive Maintenance Instructions |
| Make sure vent holes in vented pipe plugs and sight glass vent openings are clear | Monthly | | Vent holes in vented pipe plugs 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 | 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 |
| <u>Clarifier Mechanism:</u> | | | |
| Keep drive platform and walkway clean of oil debris and tools. Make sure all guards are in place | Weekly | | Refer to the Maintenance Instructions |
| Drain tank and remove algae, rust or badly corroded steel members. Paint as necessary | Yearly | | Do when flow is at lowest level or when biological growth is lowest (winter). |
| Check for loose bolts and nuts | Monthly | | |
| Check connections between the cage and main gear | Monthly | | Refer to the Cage Installation Instructions |

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MAINTENANCE

| CHECK and MAINTENANCE | FREQUENCY | LUBRICANT (IF APPLICABLE) | COMMENTS/REFERENCES |
|---|-----------|------------------------------|--|
| Check connections between the EDI and cage | Yearly | | Refer to the Cage Installation instructions |
| Check connections between the rake arms and cage | Yearly | | Refer to the Rake Arm Installation Instructions |
| Check sludge manifold for damaged seals and loose gaskets | Yearly | | Refer to the Sludge Manifold Installation Instructions |
| Check the squeegees for wear and damage | Yearly | | Adjust or replace, as necessary. Refer to the Squeegee Installation Instructions |
| <u>Skimmer:</u> | | | |
| Check that the skimmer is properly adjusted and working efficiently. Check wipers for damage or wear | Weekly | None | Refer to the Skimmer Maintenance Instructions |
| Check scraper wear block for condition and replace, if necessary | 3 Months | None | Refer to the Skimmer Maintenance Instructions |
| Check condition of scum box connectors | Yearly | None | |
| Check scum box flush assembly for operation | Weekly | None | Refer to the Scum Box Flushing System Installation instructions |
| <u>Gearmotor:</u> | | | Refer to the Manufacturer's Instructions |

MAINTENANCE

4.5 GENERAL DRIVE MAINTENANCE

4.5.1 Check Drive Rotation

- a. 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.
- b. 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.

4.5.2 Check Drive Sprocket Alignment

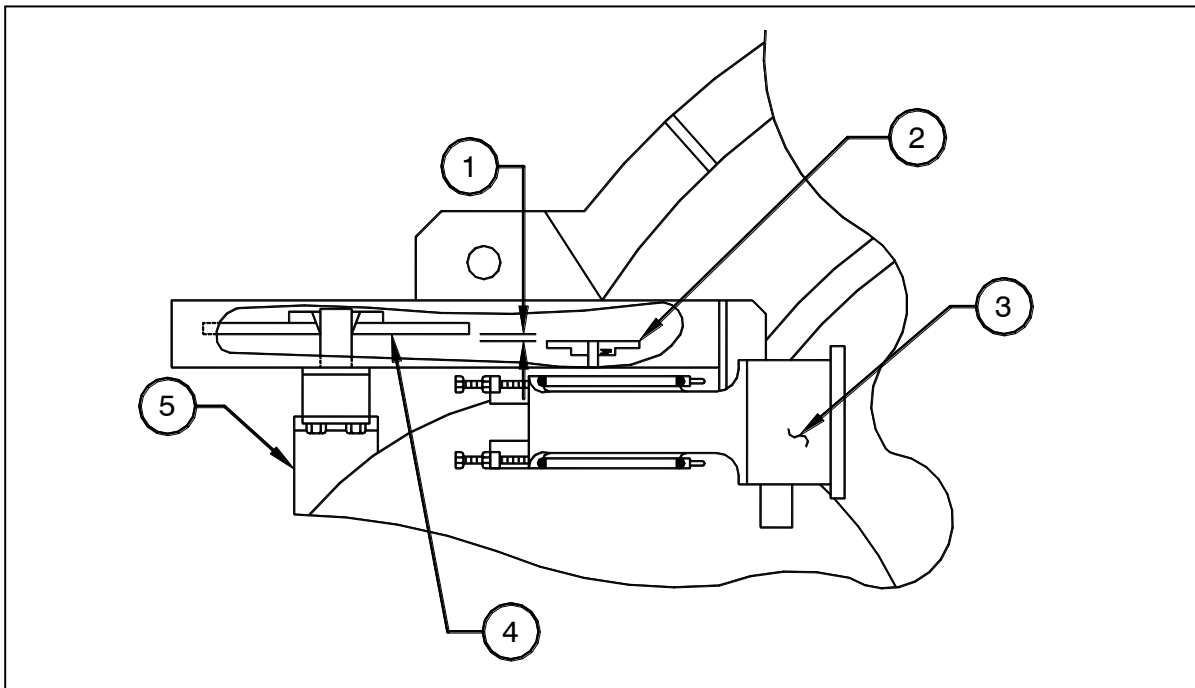


Figure 4.5a

| | |
|------------------------------|---------------------|
| 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 4.5a. 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.

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4.5.3 Check Chain Tension

- a. 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.
- b. 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.
- c. After several weeks of operation, chain tension should be rechecked, and adjusted as necessary.
- d. Refer to the Lubrication instructions for proper lubrication.

4.5.4 Drive Unit General Maintenance

- a. 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.
- b. 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.
- c. 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.

4.5.5 Drive Control General Maintenance

- a. 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.
- b. 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.
- c. 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.
- d. 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.

MAINTENANCE

- e. Start the motor drive.
- f. 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.
- g. If the drive control does not react correctly, check each switch individually.
- h. 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.
- i. 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.
- k. 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.

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.

4.5.6 Electrical Equipment and Enclosures

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

4.6 DRIVE MAINTENANCE WARNING

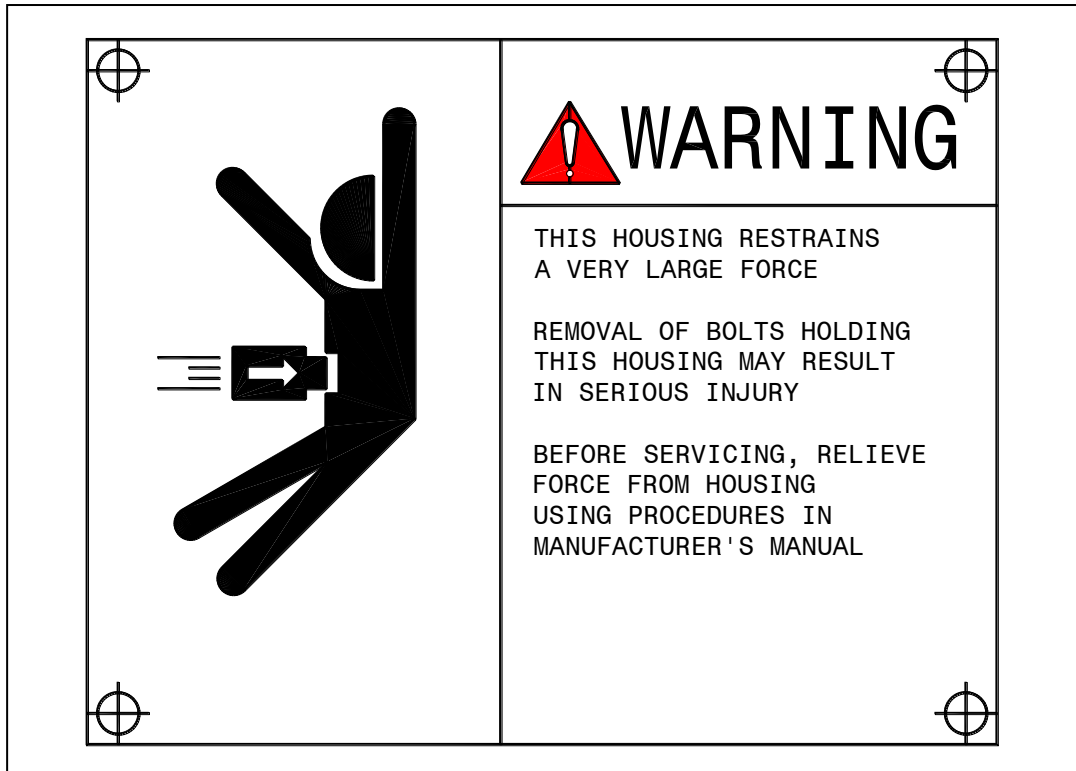


Figure 4.6a

1. This Drive High Torque Shutdown **WARNING** plate on the drive unit is there to warn you of possible danger before you service the drive.
2. 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.
3. 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:

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

MAINTENANCE

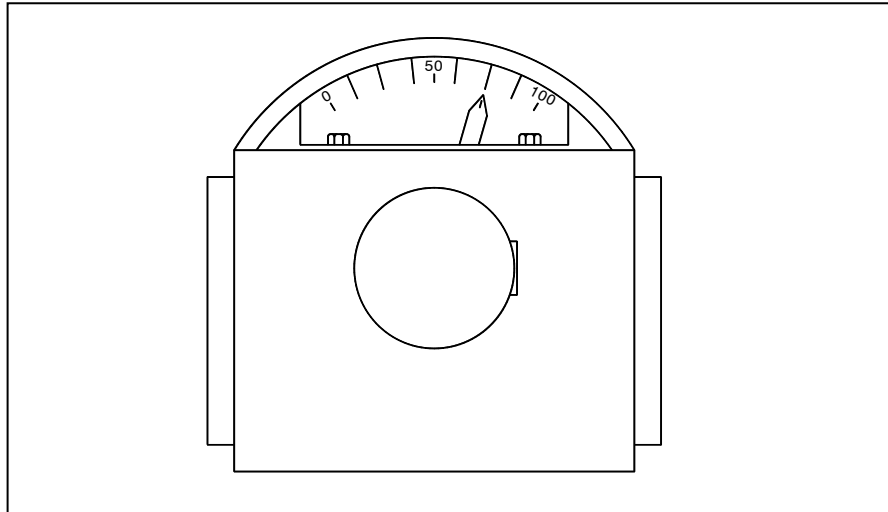


Figure 4.6b

4.6.2 How to Relieve Stored Energy:

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

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- (7) Restore all wiring to its normal operating condition.

4.6.3 Dangerous Methods to Relieve Stored Energy

- a. 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.

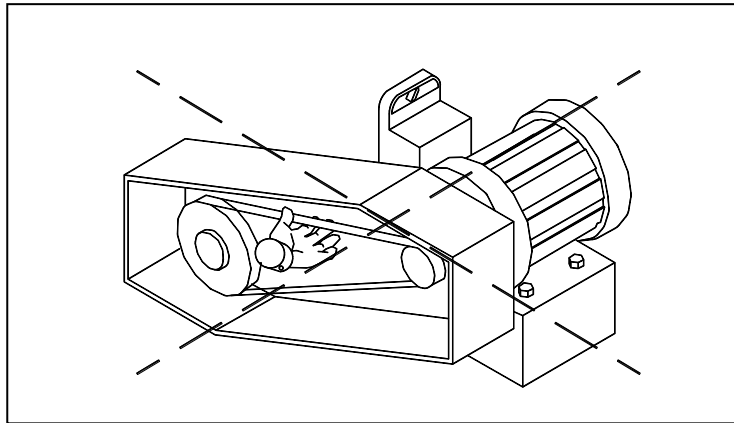


Figure 4.6c

DO NOT ATTEMPT

- b. 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.

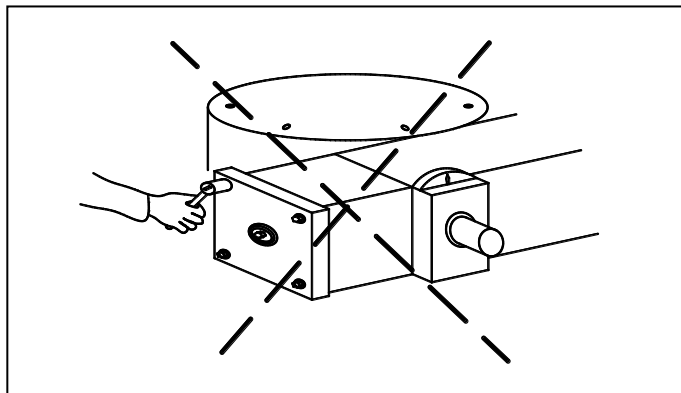


Figure 4.6d

DO NOT ATTEMPT

MAINTENANCE

4.6.4 Safety Signs

- a. 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.

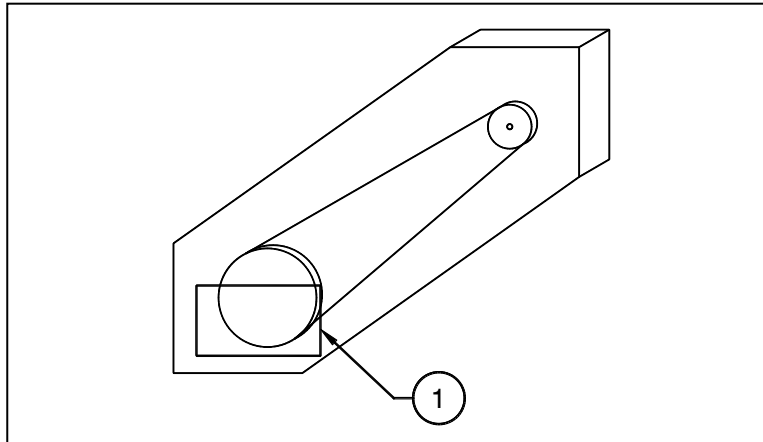


Figure 4.6e

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

- b. And (2) "**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.

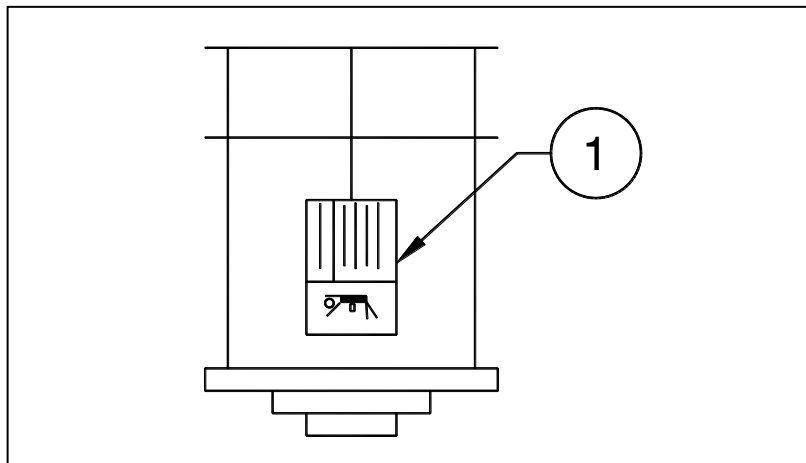


Figure 4.6f

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

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4.7 WORM GEAR MAINTENANCE



WARNING:

Check the drive for torque, referring to the preceding Drive Maintenance **WARNING** before starting disassembly. Also, make sure the power to the drive has been disconnected or blocked out to prevent accidental start-up of the drive.

4.7.1 Removal of the Worm Drive

- a. Remove the chain guard, disconnect the chain and remove the sprockets and gearmotor. See **WARNING** above.
- b. Drain the oil from the worm housing.
- c. Remove the capscrews (23), connecting the worm housing (26) to the main drive (refer to Figure 4.7c).

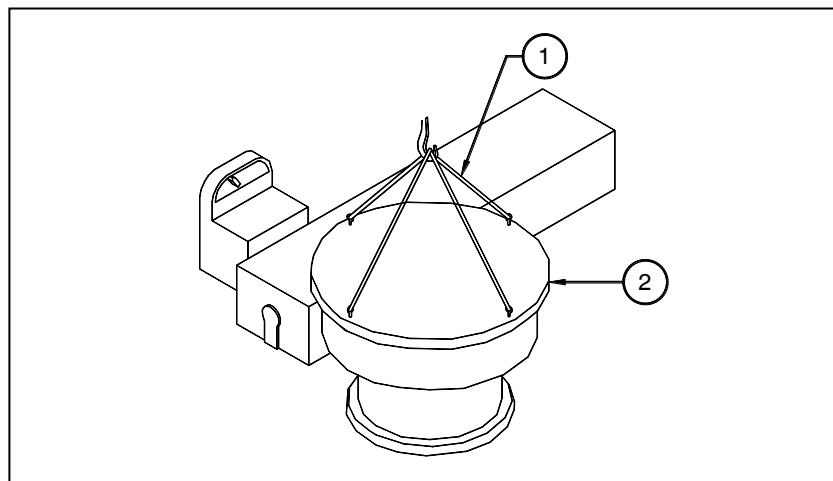


Figure 4.7a

| | |
|--------------------|---------------------------|
| 1 - Lifting Cables | 2 - Worm Gear Drive Assy. |
|--------------------|---------------------------|

- d. Lift the worm gear assembly from the drive, referring to the lifting illustration, Figure 4.7a, as follows:
 - (1) Remove and set aside four symmetrically located capscrews around the drive cover.
 - (2) 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 during reassembly.

MAINTENANCE



CAUTION:

Use care when removing the worm gear assembly from the main gear drive assembly to prevent damage to the drive control, pinion, main gear and/or bearings.

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

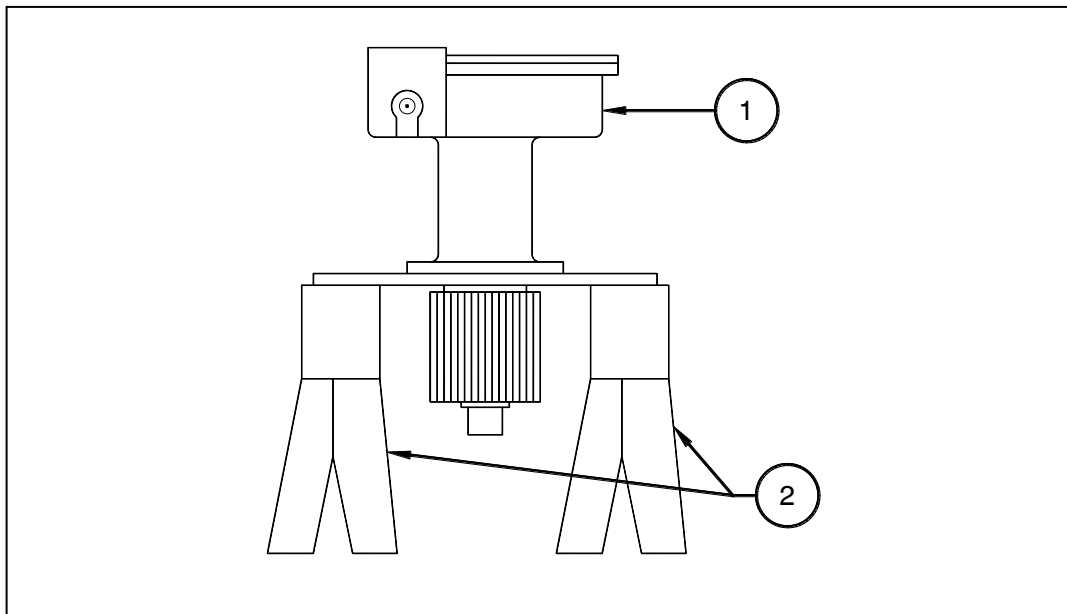


Figure 4.7b

| | |
|---------------------------|-------------------------|
| 1 - Worm Gear Drive Assy. | 2 - Supports (sawhorse) |
|---------------------------|-------------------------|

4.7.2 Disassembly of the Worm Drive

- a. Remove the capscrews and end cap (11) in Figure 4.7d. Remove the spring seat (10) and the spring (9). Referring to the Worm Gear Assembly drawing, remove the "Centering Device" from the stop rod.
- b. Remove the capscrews, bushing housing (3), and oil seal (2) (Figure 4.7d).
- c. Remove the drive control and drive control pin (7).
- d. Remove the worm shaft (5) and bearings (6) by turning the worm shaft by hand so that the worm moves to the drive end. Remove the sliding bearing seat-stop rod assembly (8).

Note: The stop rod is pressed into the sliding bearing seat (8).

MAINTENANCE

- e. Remove the housing capscrews and cover (1).
- f. Place blocking under the pinion (22) to prevent it from falling out of the drive when the retainers are removed. Then remove the gear retaining ring (15) and the key (14). Remove the worm gear (16). Remove the spacer ring (13).
- g. Support the pinion (22) (using an eyebolt in the top of the pinion) and lower it down through the housing as the blocking is removed.
- h. Remove the bearing retaining ring (25). Then remove the pinion bearing (24) and oil seals (18) from the worm housing.
- i. Remove the flat-headed capscrew (20) and the bearing guide (19) from the end of the pinion. Then remove the bearing (21) from the pinion using a bearing puller.
- j. Remove the reverse thrust bearing (4), and bearings (6) from the worm shaft (5). Use a bearing puller.


4.7.3 Inspection

- a. Clean the worm gear and worm with solvent and blow dry. Then inspect the teeth and worm for the following:
 - ABRASIVE WEAR: The wear on the teeth will show at random spacing across the teeth. Dirt or other foreign material in the lube oil normally causes this.
 - 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.
 - PITTING: It is evident in large or numerous pits in the teeth or worm. Note that small pits may occur during run-in of a new gear or worm, but these will smooth out as they wear in. Overload, poor lubrication, or improper lubricant causes this.
 - GALLING: This condition appears on the gear teeth or worm as numerous deep grooves or gouges and it is caused by overload for the lubricant used.
 - NORMAL WEAR: Eventually all worms and 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.
- b. Replace the part, as necessary, depending on the severity and extent of these conditions.
- c. Clean the bearings in solvent or kerosene and coat them with light oil before any rotation. Do not rotate them when dry.

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Inspect the bearings by rotating the outer bearing race by hand. Check for smooth noiseless operation and wobble. Depending on the condition, the bearing may or may not need to be replaced. If the bearing will not rotate freely, if it is rough in rotation or if it wobbles excessively, it should be replaced.

4.7.4 Reassembly of the Worm Drive

| | |
|---|---|
|  | <p>CAUTION: Gaskets in the drive unit are not to be used, except where specified on the Drive Assembly drawing and parts list.</p> |
|---|---|

Note: Coat all bearings and bushings liberally with grease or oil before they are installed.

- a. Press the lower pinion bearing (21) on the pinion shaft (22) and install the bearing guide (19) using the flat-headed capscrew (20).

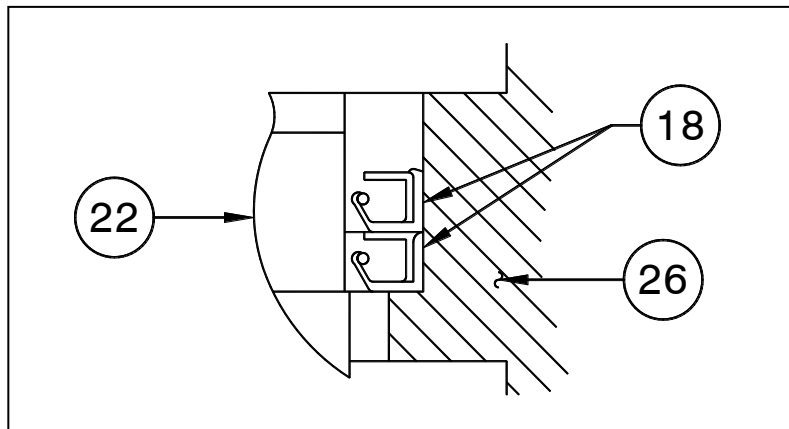



Figure 4.7c

| | | |
|-------------|---------------|-------------------|
| 22 - Pinion | 18 - Oil Seal | 26 - Worm Housing |
|-------------|---------------|-------------------|

| | |
|---|---|
|  | <p>CAUTION: Do not drive directly on the worm gear, use a block of wood.</p> |
|---|---|

- b. Install new oil seals (18) inside the worm housing (26), referring to Figure 4.7c. The oil seals must be installed as shown with the lips facing upwards.

Note: 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.

OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation, Maintenance and Operation Manual

CUSTOMER NAME: Dondlinger & Sons Construction

Instruction No.: 13-CX19

PROJECT: Wichita WWTP

Revision: 1

CSW0001517-01

Date: 11/18/2021

MAINTENANCE

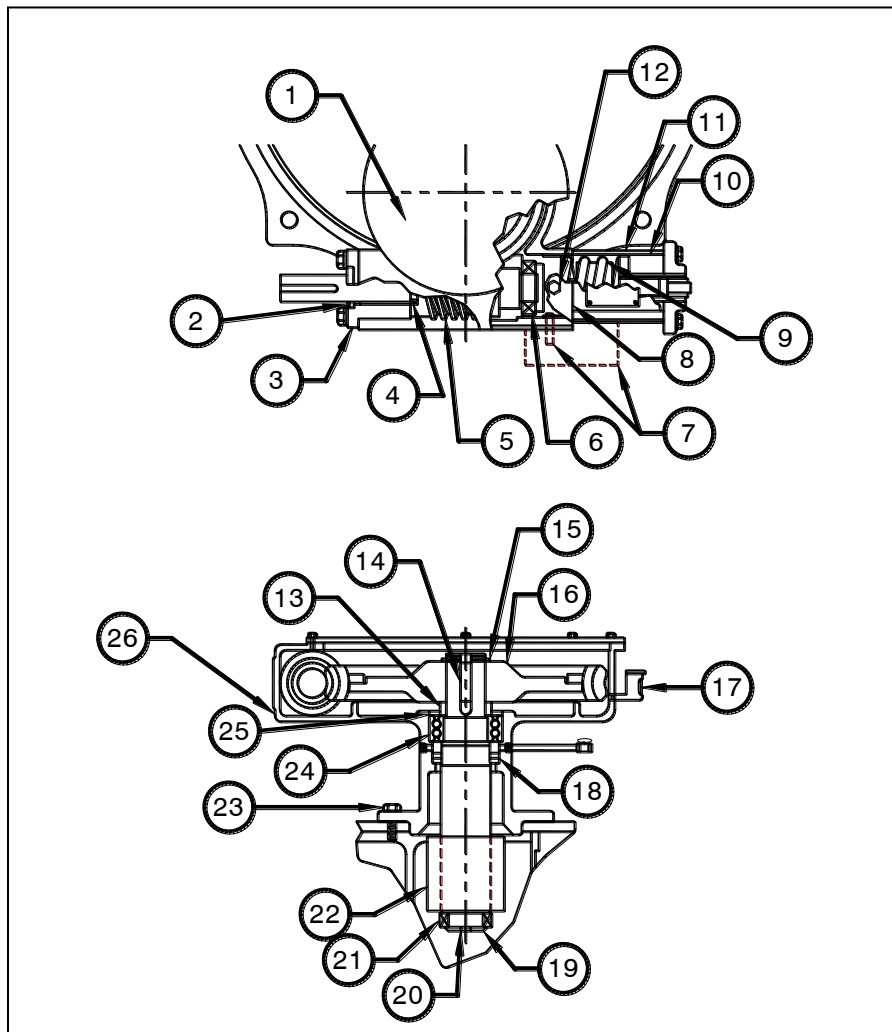


Figure 4.7d

| | | |
|-----------------------------|--------------------------------------|---------------------------------|
| 1 - Drive Cover | 2 - Oil Seal | 3 - Bushing Housing |
| 4 - Reverse Thrust Bearing | 5 - Worm Shaft | 6 - Worm Shaft Bearings |
| 7 - Drive Control & Pin | 8 - Sliding Bearing Seat / Stop Rod | 9 - Spring (w/centering device) |
| 10 - Spring Seat | 11 - End Cap & Capscrew | 12 - Plug |
| 13 - Spacer Ring | 14 - Key | 15 - Gear Retaining Ring |
| 16 - Worm Gear Subassembly | 17 - Oil Gauge | 18 - Oil Seals |
| 19 - Bearing Guide | 20 - Flat Headed Capscrew | 21 - Bearing |
| 22 - Pinion Gear Assembly | 23 - Capscrews and Ring Lock washers | 24 - Pinion Bearing |
| 25 - Bearing Retaining Ring | 26 - Worm Housing | |

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- c. Cover the keyway with tape to prevent it from cutting the seals, then pull the pinion (22) up through the worm housing (26) with an eyebolt and cable, and then support the pinion from below with blocking.
- d. Install the bearing (24) over the shaft. Tap the bearing (24) in as necessary to seat, using a tubular driver. Then install the retaining ring (25).
- e. Place the spacer ring (13) in position over the shaft. Then, mount the worm gear (16) on the pinion shaft and install the key (14). Using a hammer and block of wood, carefully and evenly drive the worm gear down until the pinion retaining ring groove is exposed. Install the retaining ring (15).
- f. Press the bearings (6) on to the worm shaft (5). Make sure they are both facing the same direction as shown in Figure 4.7e. This is essential in order to transfer the thrust toward the spring. Improper assembly will cause bearing failure.

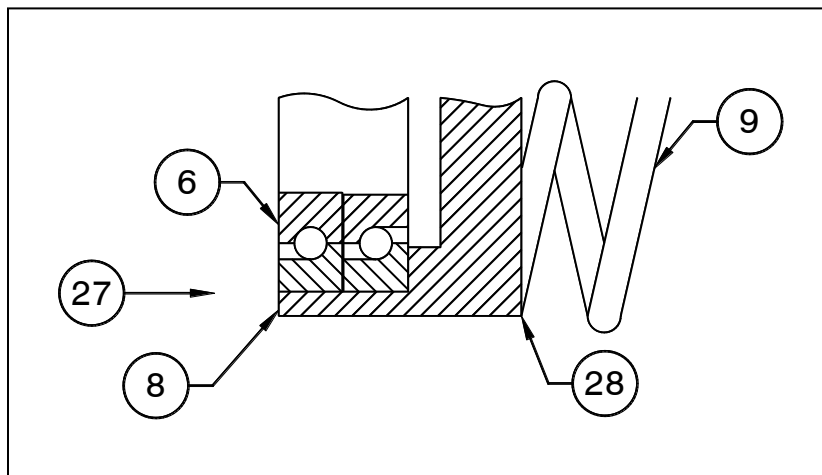


Figure 4.7e

| | |
|-------------------------------------|-------------|
| 8 - Slide Bearing Seat | 27 - Thrust |
| 6 - Bearings | 9 - Spring |
| 28 - Spring Side of Bearing Housing | |

Note: The bearing must seat against the worm shoulder. Use a tubular driver 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.

- g. Set the sliding bearing seat stop rod assembly (8) in place in the worm housing.
- h. Install the reverse thrust bearing (4), referring to Figure 4.7f, and ensure the outer roll must thrust against the bushing housing as shown. Seat it against the worm. Use a driver if the fit is tight.

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- i. Coat the worm with oil. Then insert the worm into the gear housing (from the non-drive end) turning it as necessary to mesh with the worm gear threads.
- j. Coat both ends of the worm housing with Ultra-Blue RTV-Silicone. Then place the "Centering Device" and the spring (9) (Figure 4.7e) over the stop rod and install the spring seat (10) and end cap (11). Secure the capscrews.

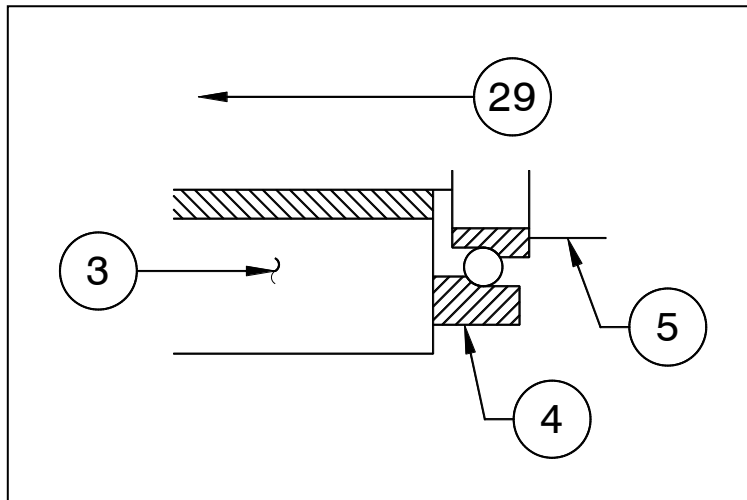


Figure 4.7f

| | |
|---------------------|---------------------------------------|
| 3 - Bushing Housing | 4 - Reverse Thrust Bearing Outer Race |
| 5 - Worm Shaft | 29 - Reverse Thrust |

- k. Place the bushing housing (3) over the shaft and install the capscrews. Turn bolts equally when tightening.
 Note: If the bushing was replaced, make sure it is flush with the inside face of the housing.
- l. Cover the keyway with tape to prevent the seal being cut, then; install the oil seal (2) as shown in Figure 4.7g.
- m. Install the drive control, referring to "Drive Control Installation" below.
- n. Apply Ultra-Blue RTV-Silicone to the worm gear housing, lower mounting face.
- o. Lift the worm gear assembly, referring to the Lifting Instructions earlier in this section, and set it in position on the main drive. Align the gear housing with the main drive referring to the Drive Assembly drawing for orientation.
 Note: If shims were used between the worm housing and the main drive, return them to their original positions.

MAINTENANCE

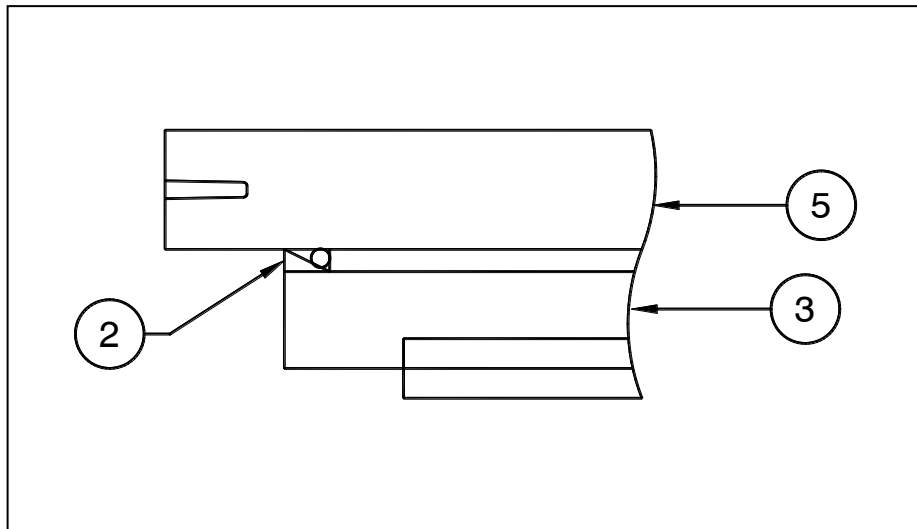


Figure 4.7g

| | | |
|--------------|----------------|---------------------|
| 2 - Oil Seal | 5 - Worm Shaft | 3 - Bushing Housing |
|--------------|----------------|---------------------|

- p. Install the cover (1) (Figure 4.7a) and secure its capscrews.
- q. Lubricate all housings to the drive referring to the Lubrication Instructions.
- r. Install the gearmotor (do not install the drive chain at this time).
- s. Reconnect the electrical wiring and check for proper motor drive rotation.
- t. Install the sprockets, chain, chain guard, etc.



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.

4.7.5 Drive Control Installation

- a. If removed, screw the actuating pin into the drive control assembly (item 7), referring to Figure 4.7d. Torque the pin to 20-25 ft. lbs.
- b. Referring to Figure 4.7h, run a bead of sealant Ultra Blue RTV-Silicone around the pin slot in the drive cover. Install the mounting plate (31), using the capscrews provided, centering the slot in the mounting plate (31) over the slot in the drive cover. Torque the capscrews to 50-60 ft. lbs.

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- c. Set the drive control (30) in place on the mounting plate (31), then install (but Do not secure) the drive control mounting capscrews (32) with washer plate (33).

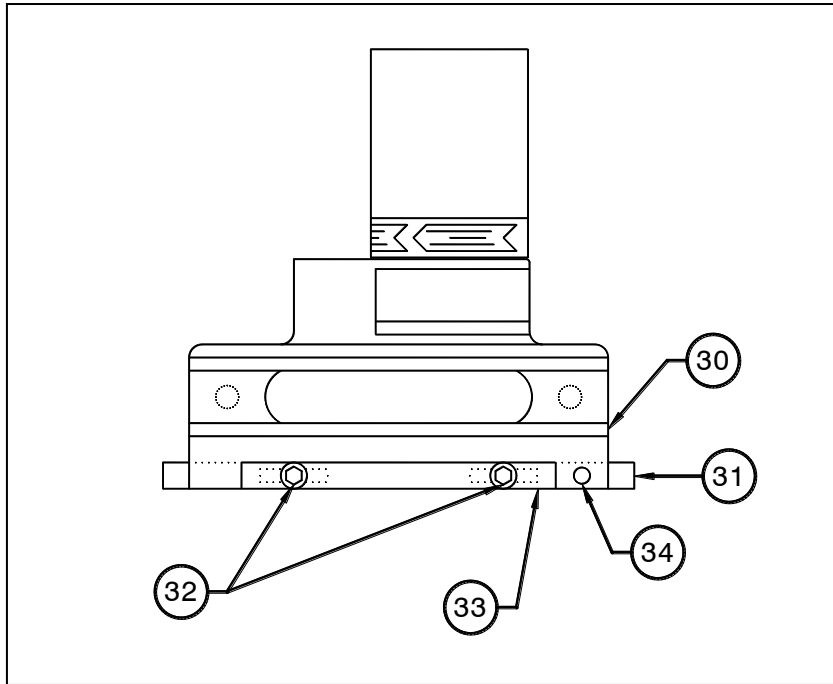


Figure 4.7h

| | |
|--|---------------------|
| 30 - Drive Control Housing | 31 - Mounting Plate |
| 32 - Mounting Capscrews | 33 - Washer Plate |
| 34 - Alignment hole in housing must line up with matching hole in mounting plate. Then install capscrew. | |

- d. 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 (34) in the alignment hole(s). Then, secure the drive control mounting capscrews (32).
- e. Check the drive control for activation, referring to the Drive Maintenance Instructions.

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4.8 C60LT MAIN GEAR MAINTENANCE

No special tools are required for maintenance or repair of this equipment!



WARNING:

Check the drive for torque, referring to the preceding Drive Maintenance **WARNING** before starting disassembly. Also, make sure the power to the drive has been disconnected or blocked out to prevent the drive from being accidentally started.

1. Disconnect or block out all electrical power to the drive.
2. Support the rake arms in position on blocking.
3. Support the skimmer supports and skimmer blade in position. Disconnect any components that will interfere with the lowering of the cage.
4. Disconnect the rake arms from the cage.
5. Disconnect the sludge collection manifold from the cage and remove it from around the CMD/influent column.
6. Disconnect the cage from the drive unit and lower the cage to the tank bottom.
7. Remove the walkway and platform. Retain the slide plates, if used, and match mark for return to their original positions later.

4.8.1 Disassembly of the Main Gear

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.

- a. Remove the worm gear assembly, referring to the worm gear instructions.
- b. Remove the main gear cover.
- c. Remove the main gear from the drive base, using lifting bolts (not by Ovivo) at four (4) of the threaded holes.

Note: If possible, do not remove the drive base from the column. See above.

- d. Place the main gear on blocking, upside down, allowing adequate room for inspection of the main gear teeth and bearing strips.

4.8.2 Inspection

- a. Inspect the teeth of the main gear for the following:

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- (1) **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.
 - (2) **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 or abrasive materials in the lubricant.
 - (3) **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 gear, poor lubrication or improper lubricant.
 - (4) **GALLING:** This condition appears on the gear teeth as numerous deep grooves or gouges and it is caused by overload of the gear for the lubricant used.
 - (5) **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.
- b. Replace the gear, as necessary, depending on the severity and extent of these conditions.
 - c. Clean the bearing balls and strips with solvent or kerosene and coat them with light oil.
 - d. Carefully inspect all bearing balls for pitting or scoring. Check the balls for uneven wear, using a micrometer. Refer to the Parts List for specified ball diameter.
 - e. Inspect the bearing strips on the main gear and drive base for wear and pitting and replace, if necessary. Refer to the bearing strip replacement instructions.

4.8.3 Bearing Strip Replacement

Note: All bearing strips on the main gear and the drive base should be replaced at the same time. The following procedure covers installation of a bearing strip on the main gear, but it is typical for all four (4) bearing strips on the drive unit.

- a. Place the main gear upside down on blocking for access to the bearing strips. See Figure 4.8a.
- b. Using the strip removal slot, carefully pry one end of the bearing strip out of the mounting groove. Then, starting at the free end of the strip, pull the rest of the bearing strip out of the mounting groove.
- c. Clean the mounting groove with solvent and blow dry.



CAUTION:

Care must be taken to avoid damaging the mounting groove.

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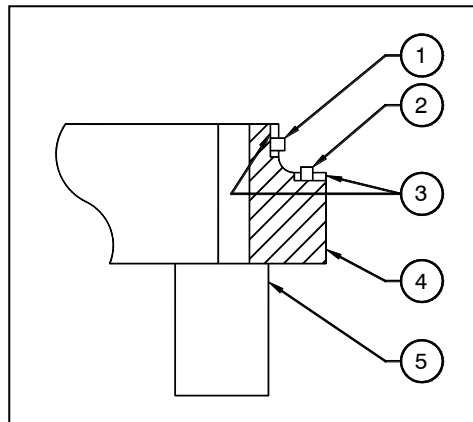



Figure 4.8a

| | |
|-------------------------|---------------|
| 1 - Inner bearing strip | 4 - Main gear |
| 2 - Top bearing strip | 5 - Blocking |
| 3 - Strip removal slots | |

- d. Trim off one straight end section of bearing strip only, as shown in Figure 4.8b. The cut should be made on a radial line from the drive center to provide the proper angle at the joint.



CAUTION: Do not use a cutting torch to trim the bearing strip.

Note: Polished surface of the bearing strip must face out.

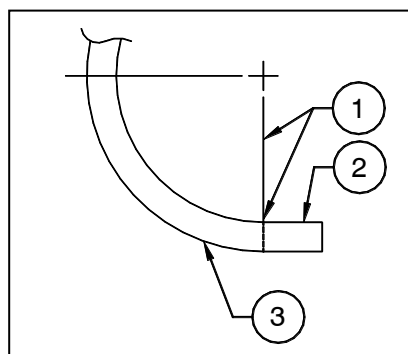



Figure 4.8b

| | |
|---|-------------------|
| 1 - Cut on radial line from drive center (one end only) | 3 - Bearing strip |
| 2 - Straight end section (typical both ends of bearing strip) | |

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- e. Start the trimmed end of the bearing strip (polished surface facing out) into the mounting groove. It will be approximately 2" away from the removal slot on the drive base and 1" away from the removal slot on the main gear. Use a brass bar (not by Ovivo) and hammer (not by Ovivo), as shown in Figure 4.8c.



CAUTION: Do not hammer directly on the bearing strip, as this will damage the surface of the strip.

Note: The ends of the main gear bearing strips must be staggered on opposite sides of the removal slot so they will not line up.

- f. Work the bearing strip gradually down into the groove, while working around the strip. Take care to avoid gouging metal off the drive base or main gear into the mounting groove, as this will prevent the bearing strip from seating in the groove.



CAUTION: Do not use a cutting torch to trim the bearing strip.

Note: The bearing strip must be worked gradually into the grove all around the circumference of the strip. Force seating the bearing strip, as shown in Figure 4.8d, will bend or deform strip, making it impossible to properly seat the bearing strip in the mounting groove.

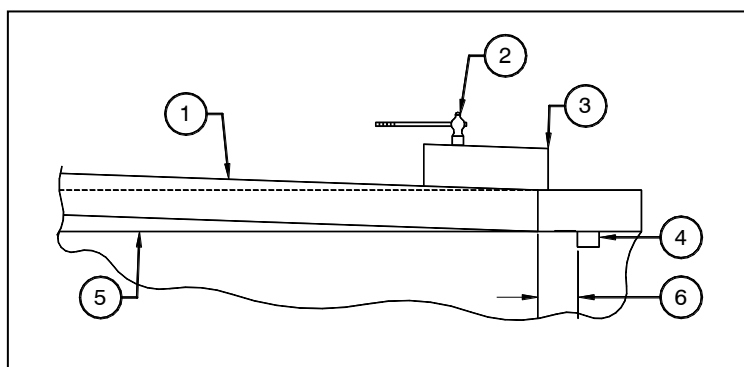


Figure 4.8c

| | |
|------------------------------|---------------------------------------|
| 1 - Bearing strip | 4 - Removal slot |
| 2 - Hammer (not by Ovivo) | 5 - Mounting groove |
| 3 - Brass Bar (not by Ovivo) | 6 - 2" On drive base; 1" On main gear |

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- g. Referring to Figure 4.8e, mark and field trim the trailing end of the bearing strip where it overlaps the leading end.

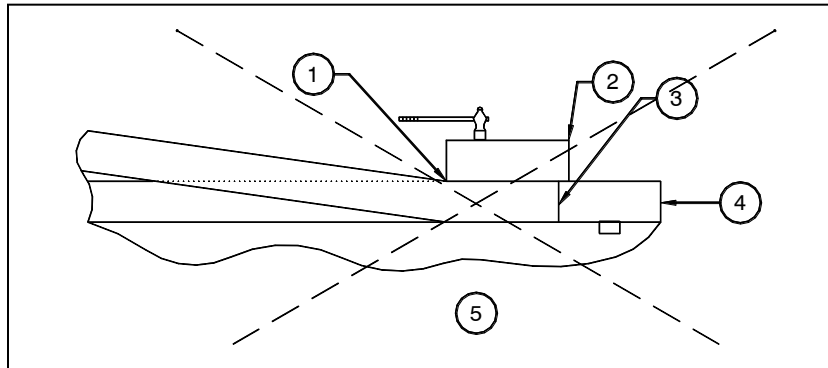


Figure 4.8d

| | |
|---|---|
| 1 - Force seating will bend or deform bearing strip | 4 - Mounting groove |
| 2 - Brass bar (not by Ovivo) | 5 - INCORRECT. Work bearing strip in <u>gradually</u> . Do not force seating of bearing strip |
| 3 - Bearing strip | |

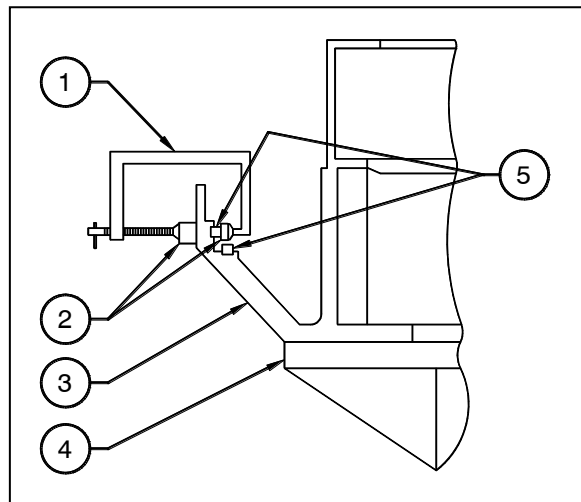


Figure 4.8e

| | |
|--------------------------------|--------------------|
| 1 - C-clamp | 4 - Column (ref.) |
| 2 - Brass bar or block of wood | 5 - Bearing strips |
| 3 - Base housing | |

- h. Check to be sure the mounting groove is free of all metal particles and debris, then finish seating the bearing strip in the mounting groove. Care must be taken to obtain a clean, tight

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joint. The ends of the bearing strip must butt together with a maximum .06" gap between the ends. See Figure 4.8g.

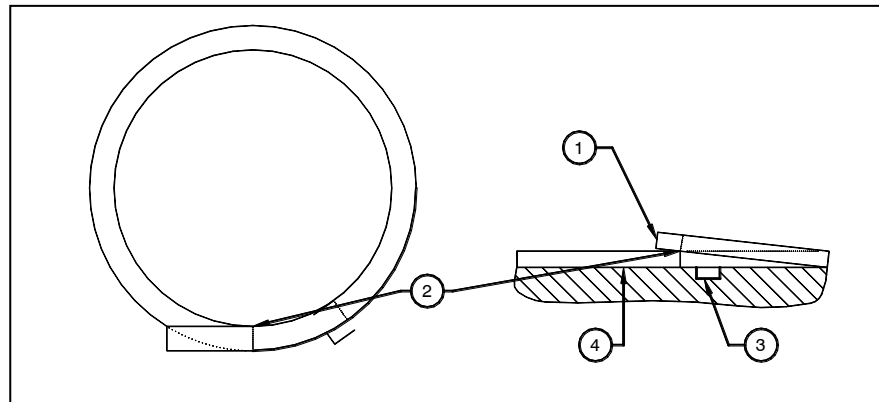


Figure 4.8f

| | |
|--------------------------------|-------------------------------|
| 1 - Bearing strip trailing end | 3 - Removal slot |
| 2 - Mark and field trim | 4 - Bearing strip leading end |

- i. Check to be sure the bearing strip is completely seated all around.
- j. After the strips are installed, polish the bearing surfaces on the strips where the ends join. In some cases where the bearing stub was furnished unpolished on one side, it will be necessary to polish the entire strip.

Polish the surface to a 32 RMS finish using a 120 Emery cloth for polishing.

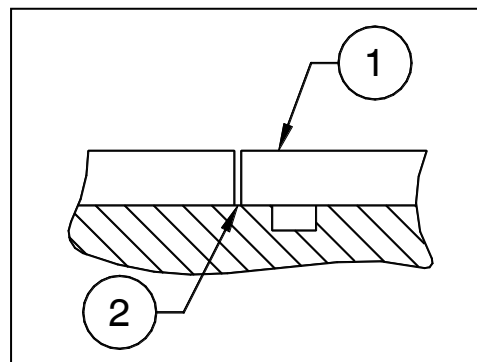


Figure 4.8g

| | |
|-------------------|-------------------------------|
| 1 - Bearing strip | 2 - Maximum .06" gap at joint |
|-------------------|-------------------------------|

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4.8.4 Reassembly of the Main Gear

- a. Thoroughly clean all parts, including housing, before reassembly. Remove all gasket and packing material.
 - (1) Take care to prevent dirt or foreign matter from getting into the drive assembly. All parts must be cleaned with a solvent before reassembly and blown dry.
 - (2) Seals, packing and gaskets should be replaced whenever the unit is disassembled.
 - (c) Inspect all parts for damage or wear and replace as necessary. Refer to the "Inspection".
- b. Coat the bearing balls with grease, then set the balls in place in the drive base. Refer to the parts list for the specified number of bearing balls required.
- c. If the lip seal between the drive base housing and the main gear is being replaced, position it as shown in Figure 4.8h. Secure the seal.

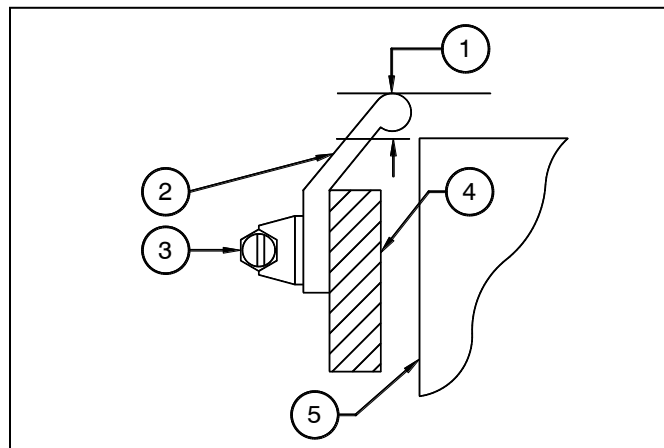



Figure 4.8h

| | |
|----------------------------|----------------|
| 1 - 1/8" | 4 - Drive base |
| 2 - Lip seal | 5 - Main gear |
| 3 - Clamp bands and screws | |

- d. Referring to the main gear disassembly instructions for lifting, set the main gear in place, resting on the bearing balls.
- e. If the lip seal between the main gear and the main gear cover is being replaced, refer to "Replacement of the Lip Seal" on a following page.
- f. Install the main gear cover, using Ultra Blue RTV-Silicone at the joints, as specified on the Drive Assembly drawing.

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- g. Install the worm gear assembly, referring to the worm gear disassembly and reassembly instructions.
- h. Lubricate the drive referring to the lubrication instructions.
- i. Install the motor, guards, chain, etc.

| | |
|---|---|
|  | <p><u>WARNING:</u> 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.</p> |
|---|---|

- j. Reconnect the cage and rake arms and install the platform and walkway referring to the instructions in this manual.
- k. Connect the electrical wiring and check for proper drive rotation.

4.8.5 Replacement of the Lip Seal

- a. Thoroughly clean the seal mounting surfaces. These surfaces must be free of dirt, grease, or any foreign matter.

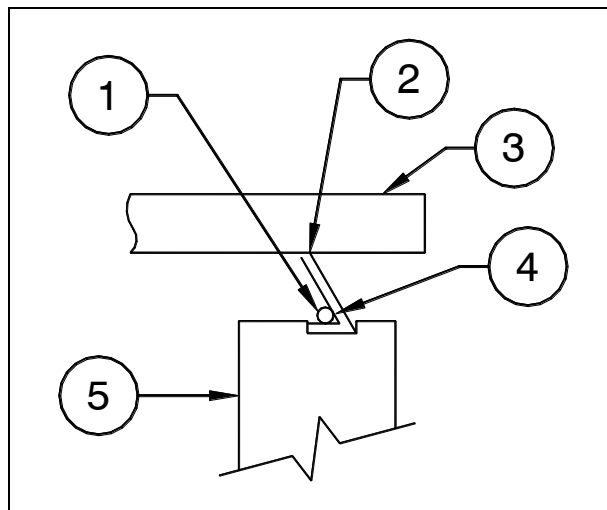


Figure 4.8i

| | | |
|---|--|-----------------|
| 1 - 4" Piece of Wire Rope (Part No. 88951C) at Splice Only | 2 - Oil Lip Seal (orient as shown in Drive Assembly drawing) | 3 - Drive Cover |
| 4 - Use Sealant (Bonding Agent) to Glue Rope in Place at Splice and to Seal (Encapsulate) the Wire Rope in Place after Installation | | 5 - Main gear |

OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation, Maintenance and Operation Manual

CUSTOMER NAME: Dondlinger & Sons Construction

Instruction No.: 13-CX23

PROJECT: Wichita WWTP

Revision: 1

CSW0001517-01

Date: 11/18/2021

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- b. Measure a seal for cutting by laying it in position on the 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 4.8i.
- c. Apply sealant (bonding agent) (Part No. 88899A) over the mounting surfaces where the seals will be installed.
- d. Referring to Figure 4.8i, 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. Then, glue a 4" long piece of wire rope (part no. 88951C) in place, as shown in Figure 4.8i, centered on the splice.
- h. Allow the bonding agent to harden, then use additional bonding agent to seal (encapsulate) the piece of wire rope in position.

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4.9 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:

- a. 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.
- b. 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.
- c. Sealing Element. The normally flexible elastomeric component of a lip seal assembly, which rides against the shaft

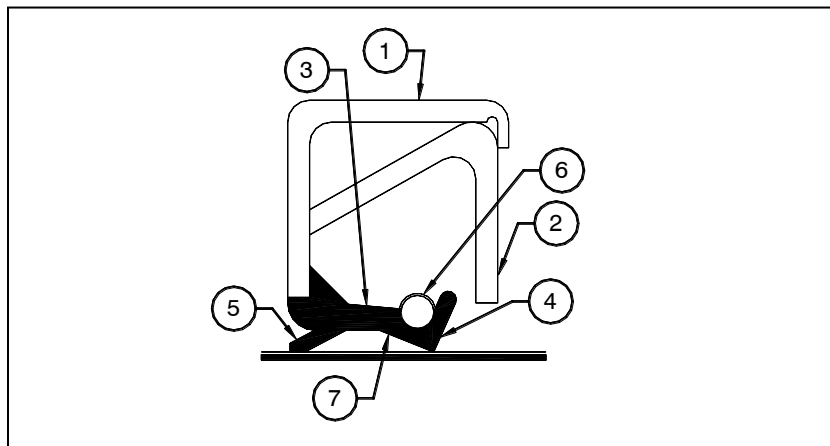


Figure 4.9a

| | |
|------------------------|-----------------------------------|
| 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 | |

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

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- f. 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:

- a. Using a steel hammer,
- b. Using a drift or punch,
- c. Using a chisel or screwdriver,
- d. Using direct hammer blows on the face of the seal, or
- e. Starting seal into bore at an angle (cocked)

4.9.5 Hammering

- a. 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.
- c. 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

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and can cause the lip to be pressed against the shaft. This action produces increased friction between the lip and the shaft surface.

- c. 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.

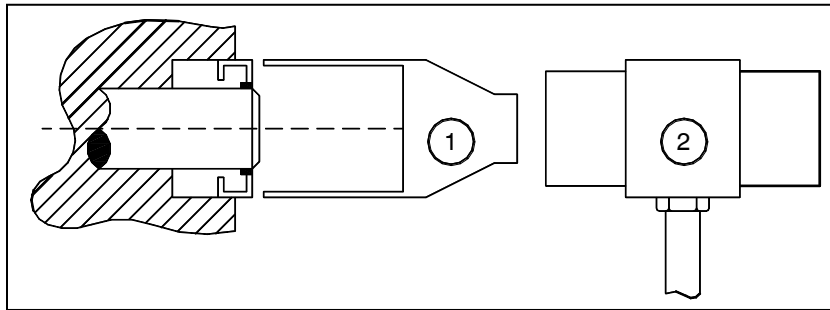


Figure 4.9b

| | |
|----------|-----------------------|
| 1 - Tool | 2 - Soft Faced Mallet |
|----------|-----------------------|

- d. 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.

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4.10 SKIMMING DEVICE MAINTENANCE

The skimming device is designed to skim the surface of the tank and push the floating scum towards the periphery where the scum scraper will collect it and dump it into the scum box. To operate correctly, the skimmer blade and scum scraper must have proper submergence, the skimming device assembly must pivot and rotate correctly and the wipers must be able to wipe most solids from their contact surfaces.

4.10.1 Check Points Before Start-Up

Observe skimming device rotation for several complete revolutions. The scum scraper must be level, proper elevation and aligned parallel to the leading "drop" edge of the scum box, as shown in Figure 4.10a. The scum scraper should be submerged about 3" and all wipers, or scrapers, must contact their wiping surfaces on the baffles and scum box. The baffles must provide a smooth and uninterrupted surface for the scraper. Any deviation should be adjusted as specified below.

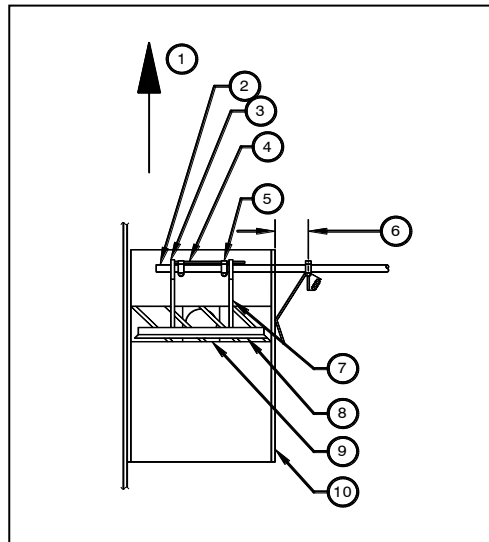


Figure 4.10a

| | |
|---------------------------------|---|
| 1 - Direction of Skimmer Travel | 6 - 6" (Nominal) Allowed Adjustment |
| 2 - Skimmer Arm | 7 - Scraper Arm |
| 3 - Arm Clevis with Set Screw | 8 - Scum scraper aligned parallel to scum box discharge leading drop edge |
| 4 - Stop Rod | 9 - Scum Box Discharge Leading "Drop" Edge |
| 5 - Collar | 10 - Scum Box |

4.10.2 Skimmer Adjustment

- a. Adjust the scum scraper for parallel alignment with the scum box discharge leading "drop" edge, if necessary, referring to Figures 4.10b, 4.10c, and 4.10d. Shift the arm clevis and collar

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for the trailing side of the scum scraper only. Do not shift the leading side arm clevis or collar.

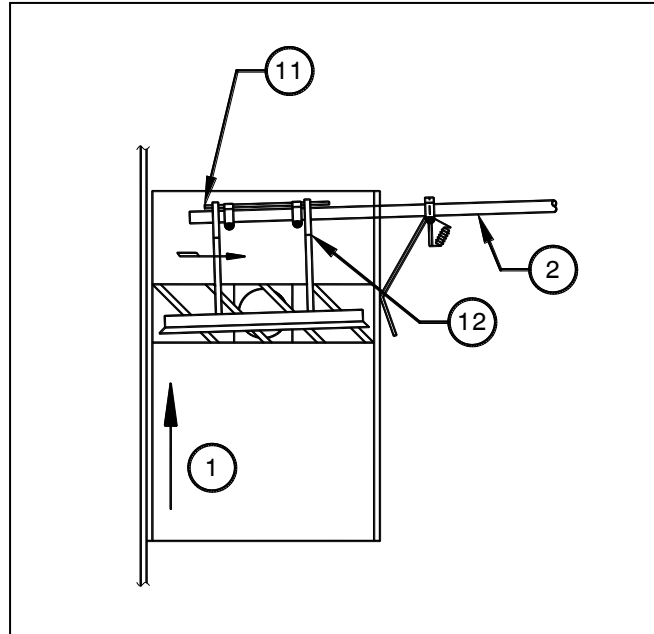


Figure 4.10b

| |
|---|
| 1 - Direction of Skimmer Travel |
| 2 - Skimmer Arm |
| 11 - Loosen arm clevis setscrew and collar capscrew and nut. Then shift collar and arm clevis as shown to pull trailing side of scum scraper into alignment as shown. |
| 12 - Do not shift this (leading side) arm clevis or collar. Shift arm clevis and collar on trailing side only. |

- b. Adjust the scum scraper for specified skimming depth, as specified on the drawings (normally 3" submergence), using the collars (collars, clevis and stop rods). Note that the arm clevis should allow the scum scraper to rise up and over the scum box ramp for discharge, but the collars (and stop rod) should stop the scum scraper from dropping below the adjusted submergence level (about 3" submergence).
- c. Adjust the scum scraper wipers, as required, for contact with their wiping surfaces on the scum box and baffle, using the slotted mounting holes in the wipers.
- d. Adjust the hinged skimmer (vertical hinged deflector) radially and longitudinally on the skimmer arm within the 6" [nominal] allowed to maintain contact with the inner vertical skirt of the scum box. This is to minimize the loss of scum when the scum scraper goes up the scum box ramp.

MAINTENANCE

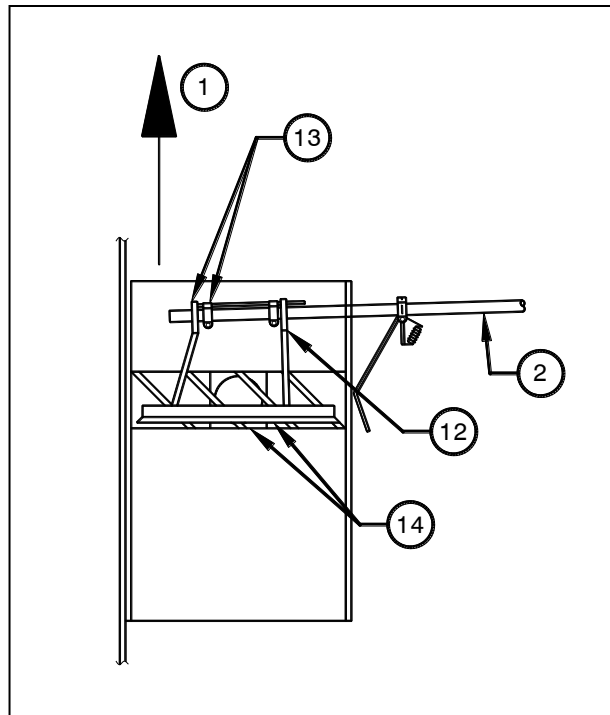


Figure 4.10c

| |
|--|
| 1 - Direction of Travel |
| 2 - Skimmer Arm |
| 12 - Do not shift this side. Shift arm clevis and collar on trailing side only. |
| 13 - Trailing side arm clevis and collar shifted to pull scum scraper into parallel alignment with scum box discharge leading "drop" edge. |
| 14 - Scum scraper in parallel alignment with box leading "drop edge" |

- e. Adjust the spring tension on the hinged skimmer, as specified on the assembly drawing, by shifting the hinged skimmer support and collar on the skimmer arm within the 6" nominal] allowed. This tension should force the scum scraper to pivot horizontally so it will contact the inner surface of the scum baffle (normal spring tension is about 8 lbs. against the wiper).

4.10.3 Upkeep and Maintenance

- a. Once a week, check that the skimming device assembly is collecting the scum from the baffle and carrying it to and into the scum box. This includes the neoprene wipers and hinged skimmer. It is particularly important when the scum scraper passes over the scum box that scum does not run back and down the ramp.

MAINTENANCE

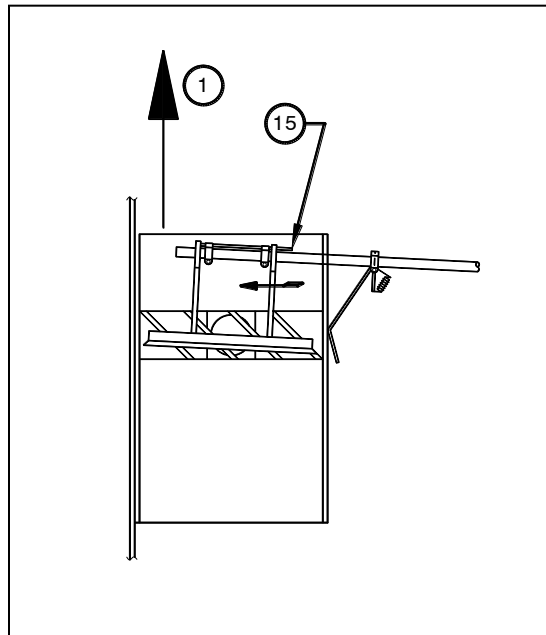


Figure 4.10d

1 - Direction of Travel

15 - Loosen arm clevis setscrew and collar and collar capscrews and nut. Then shift collar and arm clevis as shown to pull trailing side of scum scraper into alignment with scum box discharge leading "drop" edge.

- b. Clean the scum box beach and ramp, as required by operating conditions, to keep them free of heavy scum/float accumulations that could cause skimmer damage.
- c. Icing of the scum box beach and box can also cause skimmer damage. Clean the beach and box, as required by local operating conditions to keep them free from ice
- d. The skimming device assembly is not designed to push ice or other heavy floating items or accumulations. During icing or severe surface float conditions, lock the scum scraper in position above the liquid level on top of the skimmer arm. To raise the scum scraper assembly, lift the scum scraper blade vertically (it will rotate on the arm clevises) above the skimmer arm. Then, move the blade horizontally toward the center of the tank, folding the scum scraper blade and scraper arms down to a position on top of the skimmer arm and vertical hinged skimmer.

Note: When the skimming device is placed back into operation, pull the vertical hinged skimmer out of the way before lowering the scum scraper blade back into operating position. Then, check the skimming device for proper adjustment, referring to the Skimmer Maintenance Instructions above.

MAINTENANCE

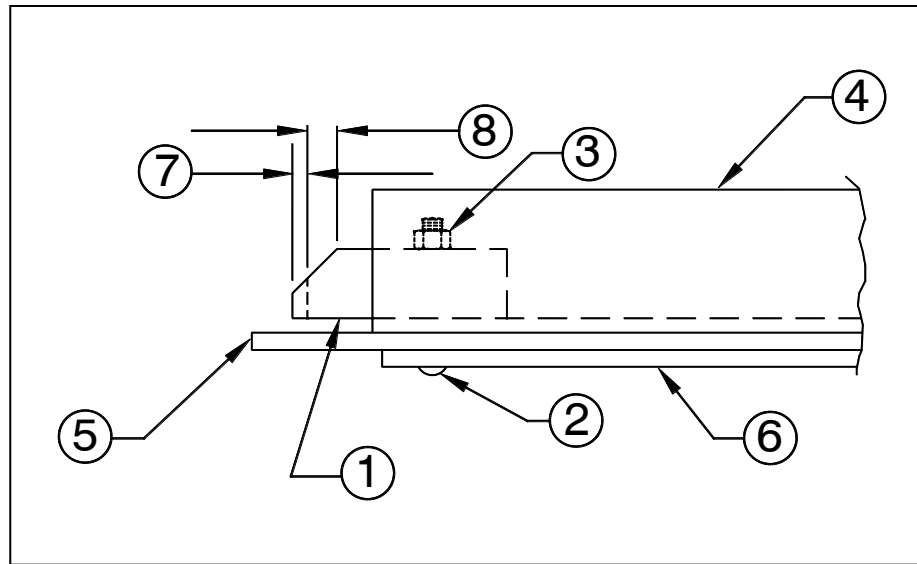




Figure 4.10e

| | | |
|-------------------|-------------------|---|
| 1 – Wear block | 4 – Scraper blade | 7 – 1/8" wear allowed before replacement required |
| 2 – Machine screw | 5 – Side wiper | 8 – 1/4" |
| 3 – Nut | 6 – Wiper clamp | |

- e. Check the scraper blade wear block for wear every three months. The wear block must be replaced when approximately 1/8" of the wear surface has been worn away. Refer to Figure 4.10e.



CAUTION: Make sure the skimming device rests securely in position. It must not be allowed to slip off to either side of the skimmer arm during operation.



CAUTION: Make sure the skimmer assembly does not contact the walkway superstructure or other stationary objects as it is rotated around the tank in this "out of service" condition.

OPERATION

5.0 OPERATION

5.1 STARTUP SERVICES

1. Experienced Ovivo engineers and service personnel are available to assist in the start-up and maintenance of the equipment. They offer the benefits of their technical know-how and firsthand knowledge of the equipment, plus the backing of Ovivo's entire engineering and research facilities.
2. They can instruct on proper operating and maintenance procedures, advise on troubleshooting and, if necessary, supervise the entire start-up, depending on requirements.
3. If such assistance is wanted, arrangements should be made at the earliest possible date, outlining the services required, giving the approximate duration of such services. Charges for the services will be arranged at that time.
4. Contact an Ovivo representative, referring to the Offices page in this manual.

OPERATION

5.2 CLARIFIER OPERATING INSTRUCTIONS

5.2.1 Purpose

- a. The clarifier is installed for the purpose of continuously removing substantial solids from a flow of sewage.
- b. In sewage treatment, the uses for the mechanism vary considerably, depending upon the type of plant and its location in the plant's flowsheet. It may be used for sedimentation of raw sewage after coarse or fine screening, shredding or grit removal, for sedimentation of activated sludge after aeration, or for settling out the humus in the effluent of trickling filters.

5.2.2 Design Features

- a. The feed (influent) enters the center of the tank through the influent column. Refer to the General Arrangement Drawing for further details. As the feed enters the tank below the water surface, it flows outward into an EDI and then into a circular outer feedwell. When the feed discharges from the EDI into the feedwell, its entering velocity is dissipated by means of dispersion gates (fixed openings) around the EDI, causing the feed to take a downward direction into and from the feedwell. From the feedwell the feed flows down towards the bottom of the tank where the solids settle out or float to the surface, and the clear water then flows out radially towards the peripheral overflow weir and effluent launder.
- b. The effluent flows over a weir, which extends around the entire periphery of the clarifier. Flow through the clarifier is of sufficient detention time to allow the solids in the feed to settle during the time of passage from the influent to the effluent weir.
- c. The effluent weir must, therefore, be level in order to discharge a steady and uniform amount of liquid. Any irregularity in weir level will cause a convergence of flow at low points and the velocity at the low points will be enough to carry fine solids over the weir at that point. Most clarifiers, and especially the large diameter clarifiers, use saw-toothed weirs in order to overcome the effect of wind, which would cause flow to the downwind side of the tank if the weir were flat.
- d. The effluent channel may sometimes slope toward the outlet or outlets, but in any case is of sufficient capacity to enable flow to the point of outlet from the channel without flooding or submerging the weirs.

5.2.3 Scum Baffles

- a. Primary clarifiers are provided with scum baffles that are located parallel to and about 8" away from the weirs to prevent scum from overflowing the weirs into the effluent channel.
- b. Integral with the scum baffle is a Scum Box that receives and discharges accumulated scum as it is moved from the center of the tank to the periphery by means of a scum skimmer wiper. This Scum Box must be level and adjusted in height in accordance with the erection instructions.

OPERATION

- c. The skimming wiper requires no maintenance and no lubrication is required. Periodically the condition of the wiper should be checked to make certain they are effectively contacting the Scum Box and baffle surfaces in order to properly contain the scum material for discharge into the Scum Box. The skimming wiper must also be leveled in accordance with the erection instructions.

5.2.4 Raking Mechanism

- a. The raking mechanism at the tank bottom collects the solids as they settle. The rake blades with replaceable squeegees roll and concentrate the solids during their travel to the center of the clarifier. The speed of the raking mechanism has been set for the indicated purpose of the particular machine and should not be changed without consulting Ovivo.
- b. The rake arms are supported and driven by a center drive unit by way of a cage that connects to the drive main gear. Refer to the instructions on General Drive Maintenance Instructions for further details.

5.2.5 Starting Procedure

- a. It is assumed that the mechanism has been lubricated, all parts are in alignment, and proper clearance exists between the rake arm squeegees and the tank bottom throughout a complete revolution of the mechanism. The squeegees are furnished for scraping the tank bottom to prevent septic action of sludge and so a minimum clearance is required during a complete revolution of the arms, as specified in the erection instructions.
- b. The mechanism should be rotated in the empty tank at least 4 or 5 times before any feed is allowed to enter the tank. Any discrepancies or problems should be noted and corrected before start up, referring to the General Maintenance Instructions.
- c. After operating the mechanism in the empty tank, start the feed into the tank while the mechanism continues to operate. Allow the tank to fill.
- d. At first, withdraw the sludge at frequent intervals until a definite schedule for removal can be made. The sludge removal schedule should call for withdrawal at least twice every twenty-four (24) hours. Do not try to discharge the sludge too thick, as this may overload the mechanism, cause septic action, or result in clogged piping or pumps.
- e. A depth of sludge of 24" to 36" over the point of discharge in the sludge pocket should be kept at all times, depending upon the size of the clarifier. This sludge will form a seal over the discharge and sludge outlet pipe and ensure removal of uniform sludge with as high a solids concentration as possible.

5.2.6 Normal Operation

- a. The clarifier mechanism should operate continuously to keep the sludge in constant motion towards the sludge pocket.
- b. The sludge should be removed from the clarifier several times daily, as stated above, to

OPERATION

prevent the accumulation of heavy rake loads and the flotation of sludge (sometimes septic sludge).

- c. A regular schedule of pumping should be determined by experience and strictly followed. The quantity of grit in the incoming flow is very important; if it is present in appreciable quantities, more frequent intervals of pumping will be necessary. If grit is present in large quantities, some provision for its removal should be made prior to its entering the clarifier. Its removal from the clarifier with sludge will cause inevitable deposits in digesters, if used, necessitating their shutdown and cleaning.

5.2.7 Operating Problems and Corrections

Foreign Objects in Tank

To minimize damage resulting from objects such as tools, rocks, rags and other foreign bodies being dropped into the tank, it is imperative that the feed and mechanism be stopped and these objects removed immediately before continuing operation.

Discharge Line Becomes Plugged

If sludge is allowed to become too thick, it may plug the discharge line. Sometimes foreign material may get into the line to cause the plugging. To correct this, turn high-pressure water back through the underflow line until the line is cleared.

Higher Than Normal Torque on the Drive Control

- a. Sludge may gradually accumulate in the tank over a period of time due to the sludge being discharged at a rate less than the rate of solids entering with the feed. This will be noticed by a higher than normal operating torque. It will be necessary to increase the rate or frequency of withdrawal in order to bring the sludge down to appropriate operating level.
- b. If a very gradual increase in the torque load is noted, it is possible that grit or silt is being introduced with the influent. If this material cannot be removed normally through the tank drain it will gradually overload the mechanism. In any case, the drive should not be allowed to operate continuously for days at a high torque (over 20%), even though the alarm does not sound. It will be necessary to remove the silt. This can be done by shutting off the feed and withdrawing the silt by rotating the arms and intermittently withdrawing the sludge. Usually, however, grit and silt are removed from the influent before it can reach the Clarifier and this kind of problem is unlikely to occur.

Overload Alarm Sounds or Gearmotor Stops

- a. If the sludge load becomes so heavy that torque build-up occurs in the machine and the drive control indicates a load sufficient to actuate the alarm, the operator will then be alerted that something is causing an overload on the mechanism. The feed should be stopped immediately and the solids withdrawn to normal level. The operator should not allow the torque to reach this point before taking corrective action.

OPERATION

- b. If the overload is allowed to increase, the drive control will cut electrical power and stop the mechanism. When this occurs, it will be necessary to drain the tank and physically remove the sludge from the tank. Drain the tank and sluice out or dig out the sludge.
- c. If a foreign object has been dropped into the tank accidentally, the mechanism may suddenly overload, sound the alarm and then stop. In this case, the object must be removed. It will be necessary to bypass the feed until the obstruction can be located, and it might be necessary to drain the tank.

Solids in the Effluent and Overloading

- a. If the solids rise to the surface and overflow with the effluent, any number of problems may be at fault and each should be investigated individually.
- b. The clarifier may be overloaded either by too great a volume of water or by too many solids in the feed, or by a combination of both.
- c. Too much volume, due to storm water for example, may increase the flow above design capacity of the clarifier causing sludge particles to wash over with the effluent rather than settle out. This also reduces the sludge level in the tank adversely affecting the solids concentration. When there is excessive flow some of the flow should be by-passed if possible. Too many solids in the overflow may be caused simply by an overload of the treatment plant and too many solids for the clarifier to handle. This and too much water, over a period of time, can be corrected only by additional treatment units.
- d. But too many solids in the effluent may be caused simply by inadequate solids withdrawal due to amount or frequency. The sludge pump, timing mechanisms or a plugged sludge pipe could cause this in turn. Temporary shutdown will be necessary.
- e. An overload may also be the result of a single unusually large discharge of solids into the plant, but this must be corrected at the source. Temporary relief may be obtained by storage, if possible, or bypassing to other units or areas.

Poorly Settling Sludge

- a. Solids in the effluent may also be the result of a poorly settling sludge or other sludge problems.
- b. In a low solids condition, inadequate flocculation may occur somewhere in the system and so the solids will be dispersed and fail to settle. This can be controlled by temporarily reducing the sludge withdrawal or additional flocculation upstream. In some cases, flocculants may be added to develop the bulk and weight for the solids to settle.
- c. Growths of certain organisms may also cause the sludge to swell, but they themselves do not flocculate. Since there are various conditions and solutions involving pH, temperature, low oxygen, etc., consult your Ovivo Representative.
- d. When pieces of sludge float to the tank surface accompanied by objectionable odor, this is

OPERATION

caused by septic sludge on the tank bottom due to a lack of oxygen (anaerobic decomposition occurs). This may be due to worn squeegees that are not sufficiently close to the tank bottom to scrape up the sludge, inadequate withdrawal of sludge, or retention time too long. Locate and correct the problem before the condition gets worse.

Surface Ice or Heavy Scum Loading

The skimming device assembly is not designed to push ice or other heavy floating items or accumulations. During icing or severe surface float conditions, lock the skimmer in position above the liquid level on top of the skimmer arm. To raise the skimmer assembly, lift the scum skimmer blade vertically (it will rotate on the arm clevises) above the skimmer arm. Then, move the blade horizontally toward the center of the tank, folding the scum skimmer blade and scraper arms down to a position on top of the skimmer arm and vertical hinged skimmer.



CAUTION:

Make sure the skimming device rests securely in position. It must not be allowed to slip off to either side of the skimmer arm during operation of the clarifier.



CAUTION:


Make sure the skimmer assembly does not contact the walkway superstructure or other stationary objects as it is rotated around the tank in this "out of service" condition.

Note: When the skimming device is placed back into operation, pull the vertical hinged skimmer out of the way before lowering the scum skimmer blade back into operating position. Then, check the skimming device for proper adjustment, referring to the Skimmer Maintenance Instructions.

5.2.8 Shutdown of the Clarifier

- a. Every effort should be made to correct operating problems without draining or dewatering the tank. The sludge pipe should be cleared by applying high-pressure water, and foreign objects should be fished out, if possible, with hooks.
- b. If it is necessary to drain the tank to correct problems or to recondition the mechanism, it should be done preferably in the winter when biological growth would be the least, rather than in the warm weather of summer. It should also be planned so that down time is at a minimum and the flow into the plant is at its lowest point.
- c. Refer to the Maintenance instructions.

OPERATION

| | |
|---|---|
|  | <p><u>OPERATING WARNINGS:</u></p> <ul style="list-style-type: none">• Do not attempt to keep the clarifier running when an overload is indicated! Find the trouble and correct it!• Do not tamper with the overload alarm switch adjustments in an effort to keep the mechanism running.• Do not start up with a load of sludge in the tank! |
|---|---|

5.2.9 Emergency Shutdown


Emergency procedures may be required as a result of a mechanical or electrical failure of a certain piece of equipment, but the emergency situation that occurs most often and requires immediate action is the partial or total loss of electrical power.

a. Power Failure

When the power failure may be of short duration (less than an hour), the following steps should be taken, but preparations should go ahead in the event the outage might be longer than an hour.

1) Less than an hour:

Note: In a wide spread outage, the feed entering the tank will quickly decrease, so the feed should not cause a problem.

| | |
|---|---|
|  | <p><u>WARNING:</u> At the control panel, shut off the drive. If power is restored suddenly and the drive starts without warning, serious injury could result</p> |
|---|---|

(a) Prepare to drain the tank if it appears the failure will continue beyond one hour.

(b) Start-up after power is restored: Start the rake. Jog, if possible, to check operation. Shut off the flush water and resume operation. Sludge pumping should have restarted.

2) More than an hour:

(a) If the loss of power is indefinite, start draining the tank. Shut off the main power switch.

(b) Start-up after power is restored: Refer to the "Start-up Procedure" as it applies.

OPERATION

b. Drive Overload Shutdown

- 1) Immediately shut off the feed to the clarifier and shut off the flocculent feed, if used.
- 2) Shut off the power to the drive.
- 3) Start-up after arms are free and torque is near zero: Start the rake drive. Jog, if possible, to check operation. Refer to the "Start-up Procedure" as it applies.

5.2.10 Scheduled Maintenance Shutdown or Holidays

If the duration of a shutdown is several hours and it will not require the tank to be drained, proceed as follows. If the shutdown will be longer or it will be necessary to drain the tank, refer above to "Emergency Procedures."



CAUTION:

Under no circumstances should the drive be shut down under high torque or heavy sludge conditions.

- a. Shut off the feed to the clarifier 4 to 6 hours before the shutdown, depending on the load in the clarifier and the time required for maintenance.
- b. Continue with the withdrawal of sludge as long as density permits, then recirculate the underflow back to the feed.
- c. Keep the rake drive operating until there is basically no load on the rakes. Then shut off the rake drive for the required maintenance. See the **CAUTION** above.
- d. Start-up after shutdown should proceed as covered under "Drive Overload Shutdown."

5.2.11 Long Term Shutdown

- a. Refer to the "Scheduled Maintenance Shutdown" for the start of the shutdown and then proceed with the "Drive Overload Shutdown."
- b. Refer to the "Storage" Instructions at the front of this manual and the other Accessory Equipment Instructions in this manual for drives, pumps, etc.

OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation, Maintenance and Operation Manual

CUSTOMER NAME: Dondlinger & Sons Construction

Instruction No.: 01-AA5

PROJECT: Wichita WWTP

Revision: 1

CSW0001517-01

Date: 11/18/2021

OPERATION

5.3 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.

OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation, Maintenance and Operation Manual

CUSTOMER NAME: Dondlinger & Sons Construction

Instruction No.: 17-CL13b

PROJECT: Wichita WWTP

Revision: 1

CSW0001517-01

Date: 11/18/2021

OPERATION

5.4 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) Check for grit in sludge. See Operation (3) Check skimmer for hang up (4) Check for foreign object in tank. Stop drive if pointer is jumping |
| 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 drive cutout | (1) Check for overheating refer to manufacturer's instructions (2) Check for broken chain |
| 3. Solids in effluent | a. Overloading of clarifier | (1) Check flow rate and feed solids content. Refer to Operation (2) Reduce sludge blanket level. See Operation |
| | b. Inadequate flocculation | (1) Check for finely dispersed solids. See Operating Instructions |
| | c. Flow through tank short-circuiting | (1) Adjust weirs for even overflow or convergent leakage (2) Adjust baffles for convergent leakage |
| | d. Sludge pump not operating | (1) Check operation of pump (2) Refer to pump manufacturer's instructions |
| | e. Manifold seals failed | (1) See "Low solids content in sludge" below |
| 4. Low solids content in sludge | a. Inadequate sludge blanket in tank | (1) Check flow rate. See Operating Instructions |
| | b. Inadequate flocculation | (1) Check for finely dispersed solids in effluent. See Operating Instructions |
| | c. Manifold seals worn | (1) Drain tank and replace seals, as required |
| 5. Excessive floating scum | a. Skimmer malfunction | (1) Adjust wiper for smooth operation and replace wipers. Refer to the Skimmer Maintenance Instructions, (2) Adjust hinged skimmer (deflector) to trap solids. |
| | b. Scum Box not discharging scum | (1) Check scum box flush valve operation (2) Clean out scum box discharge pipe |
| | c. Septic conditions on bottom of tank (pieces of floating sludge and objectionable odor) | (1) Check for clogged discharge line. See Operating Instructions (2) Squeegees need replacement. See Maintenance Instructions (3) Check sludge removal schedule. May require more frequent intervals of removal. |

OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation, Maintenance and Operation Manual

CUSTOMER NAME: Dondlinger & Sons Construction

Instruction No.: 17-CL13b

PROJECT: Wichita WWTP

Revision: 1

CSW0001517-01

Date: 11/18/2021

OPERATION

| PROBLEM | POSSIBLE CAUSE | CORRECTIVE ACTION |
|------------------------------|--|---|
| 6. Excessive growth on weirs | a. Accumulation of solids causes algae | (1) Increase frequency of cleaning (2) Check adjustment of skimmer wiper |

Parts Lists

GLV Indented Current BOM Report

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GLV Indented Current BOM Report

BOM NUMBER: CSW0001517-01
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: 160' C4D-CMD Clarifiers (4)

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|---------------|------------------------------------|----------|-----------|-----|--------|------|--------------|-----|-----|
| 0 | CSW0001517-01 | 160' C4D-CMD Clarifiers (4) | 1.0 | 1.00 | LOT | 0.00 | | | A | 1 |
| 1 | CSW1517-01M1 | DRIVE,C60LT (MASTER) | 1.0 | 1.00 | EA | 0.00 | 1 | CSW1517-01M1 | A | 2 |
| 1 | CSW1517-01M2 | ELECTRICAL CONTROLS PARTS LIST | 1.0 | 1.00 | EA | 0.00 | 2 | CSW1517-01M2 | A | 283 |
| 1 | CSW1517-01M3 | ANCHORS,EPOXY | 1.0 | 1.00 | EA | 0.00 | 3 | CSW1517-01M3 | A | 287 |
| 1 | CSW1517-01M4 | MECHANISM STEEL-160' C3D-CLARIFIER | 1.0 | 1.00 | EA | 0.00 | 4 | CSW151701M4 | A | 299 |
| 1 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 1.00 | EA | 0.00 | 999 | N/A | A | 501 |

Jobmatl Notes

ECO-S-018311 REV A INITIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-01M1
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: DRIVE,C60LT (MASTER)

DRAWING NUM: CSW1517-01M1

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|-------------|----------------------------------|----------|-----------|-----|--------|------|-------------|-----|-----|
| 2 | CSW1517-132 | DRIVE,C60LT (110K) (COMPLETE) | 4.0 | 4.00 | EA | 0.00 | 2 | CSW1517-132 | A | 3 |
| 2 | CSW1174-137 | PARTS,SPARE C60LT DRIVE | 4.0 | 4.00 | EA | 0.00 | 3 | CSW1174-137 | A | 274 |
| 2 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 1.00 | EA | 0.00 | 999 | N/A | A | 282 |

Jobmatl Notes

ECO-S-018095 (REV A) - INITIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-132
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: DRIVE,C60LT (110K) (COMPLETE)

DRAWING NUM: CSW1517-132

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|--|-------------|--|----------|-----------|-----|--------------|------|-------------|-----|-----|
| 3 | DRAWINGS | ASSEMBLY & REFERENCE | 1.0 | 4.00 | EA | 0.00 LB | 0 | N/A | | 4 |
| Jobmatl Notes | | | | | | | | | | |
| 115713 - DRIVE CONTROL INS & CALB INSTRUCTIONS | | | | | | | | | | |
| 114808 - BOLT TORQUE SPECIFICATIONS | | | | | | | | | | |
| ES0001 - WORKMANSHIP STANDARDS | | | | | | | | | | |
| 588768 - DRIVE SEAL SHOP TEST PROCEDURE | | | | | | | | | | |
| 295126 - SUGGESTED WIRING DIAGRAM | | | | | | | | | | |
| CSW1517-01M1 - C60LT DRIVE (MASTER) | | | | | | | | | | |
| CSW1517-132 - C60LT DRIVE (COMPLETE) | | | | | | | | | | |
| CSW1517-133 - C60LT MDP | | | | | | | | | | |
| 3 | CSW1517-133 | ASSY,C60LT MOTOR DRIVE | 1.0 | 4.00 | EA | 0.00 | 8 | CSW1517-133 | A | 5 |
| 3 | L115709-1 | ASSY,C60LT DRIVE | 1.0 | 4.00 | EA | 6,035.00 LBS | 9 | 115709 | O | 33 |
| 3 | L115759-1 | DRIVE CONTROL,4SPDT,RH,w/o POT | 1.0 | 4.00 | EA | 18.00 LB | 10 | 115759 | Y | 205 |
| 3 | 48806A | PIN,ACTUATING,2.69",STL/SB | 1.0 | 4.00 | EA | 0.15 LB | 11 | 48806 | K | 265 |
| 3 | 204394N | SPRING,HELICAL/COMPRSN (12,958# NOM) | 1.0 | 4.00 | EA | 13.90 LB | 12 | 204394 | L | 266 |
| 3 | 204395D | CENTERING DEVICE,NEOPRENE | 1.0 | 4.00 | EA | 0.46 LB | 13 | 204395 | E | 267 |
| 3 | 560104 | NAMEPLATE,PATENT NUMBER(See IM Notes) | 1.0 | 4.00 | EA | 0.00 | 14 | 560104 | W | 268 |
| 3 | CSW1517-136 | NAMEPLATE,C60LT DRIVE | 1.0 | 4.00 | EA | 0.00 | 15 | CSW1517-136 | A | 269 |
| 3 | 678805 | INSTRUCTIONS,PREP/PAINT DRIVE (SP-6/73) | 1.0 | 4.00 | EA | 0.00 | 16 | 678805 | C | 270 |

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-132
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: DRIVE,C60LT (110K) (COMPLETE)

DRAWING NUM: CSW1517-132

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|--------|--------------------------------------|----------|-----------|-----|---------|------|---------|-----|-----|
| 3 | 582723 | PLATE,LUBRICANT WARNING,RED VINYL | 2.0 | 8.00 | EA | 0.00 | 17 | 582723 | E | 271 |
| 3 | NOTES | SPECIFICATIONS & INSTRUCTIONS | 1.0 | 4.00 | EA | 0.00 LB | 998 | N/A | | 272 |

Jobmatl Notes

- SPECIFICATIONS & INSTRUCTIONS
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 - 56%, #2 - 47%, #3 - 100%, #4 – OVER 100%
 4. ASSEMBLE AND TEST RUN PRIOR TO SHIPMENT. PERFORM OIL SEAL TEST OF WORM ASSEMBLY PER INSTRUCTIONS- DRAWING 588768.
 5. COAT ALL MACHINED SURFACES 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:
 0.032 RPM, 2 HP, 110K TORQUE
 10. ATTACH ITEM 17 - (LUBRICANT WARNING TAG) TO FILL PLUGS-ONE ON EACH WORM AND MAIN GEAR HOUSING.

| | | | | | | | | | | |
|---|-----|-----------------------------|-----|------|----|------|-----|-----|---|-----|
| 3 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 4.00 | EA | 0.00 | 999 | N/A | A | 273 |
|---|-----|-----------------------------|-----|------|----|------|-----|-----|---|-----|

Jobmatl Notes

ECO-S-018095 (REV A) - INITIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-133
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60LT MOTOR DRIVE

DRAWING NUM: CSW1517-133

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|--------------------------------------|--|----------|-----------|-----|----------|------|---------|-----|-----|
| 4 | DRAWINGS | ASSEMBLY & REFERENCE | 1.0 | 4.00 | EA | 0.00 LB | 0 | N/A | | 6 |
| | Jobmatl Notes | | | | | | | | | |
| | CSW1517-133 - C60LT MOTOR DRIVE ASSY | | | | | | | | | |
| 4 | 769678 | GEARMOTOR,2HP,45 RPM,TEFC,IP66 | 1.0 | 4.00 | EA | 70.00 LB | 1 | 769678 | A | 7 |
| 4 | 1108491-01 | GUARD,CHAIN,STL/GALV 18 GA,C/W COVER-922 | 1.0 | 4.00 | EA | 25.00 LB | 3 | 1108491 | N | 8 |
| 4 | 699115A | MOUNT,GEARMOTOR (DRIVE),304SS | 1.0 | 4.00 | EA | 14.00 LB | 4 | 699115 | D | 9 |
| 4 | 699115B | MOUNT,GEARMOTOR (R57 & R67 RDR),304SS | 1.0 | 4.00 | EA | 6.00 LB | 5 | 699115 | D | 10 |
| 4 | 86143AF | SPRCKT,54T,T/L 13.327OD/12.899P w/o BSHG | 1.0 | 4.00 | EA | 17.50 LB | 7 | 86143 | F | 11 |
| 4 | 85853S | BUSHING,TAPER-LOCK, 2-3/16"B,1/2X1/4KST | 1.0 | 4.00 | EA | 2.38 LB | 8 | 85853 | E | 12 |
| 4 | 86143J | SPROCKET,17T,T/L 4.462OD/4.082P w/o BSHG | 1.0 | 4.00 | EA | 1.00 LB | 9 | 86143 | F | 13 |
| 4 | 85844U | BUSHING,TAPER-LOCK,1-3/8B, 5/16x5/32KST | 1.0 | 4.00 | EA | 1.00 LB | 10 | 85844 | C | 14 |
| 4 | F24337 | CAPSCREW,HX HD,304 1/2-13X1 | 9.0 | 36.00 | EA | 0.00 LB | 12 | N/A | _+ | 15 |
| 4 | F50474 | WSHR,PLN TYPE A-N,304 1/2 | 8.0 | 32.00 | EA | 0.00 LB | 13 | N/A | A | 16 |

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-133
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60LT MOTOR DRIVE

DRAWING NUM: CSW1517-133

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|---------|---|----------|-----------|-----|----------|------|---------|-----|-----|
| 4 | F17171 | CAPSCREW,HX HD,304 1/2-13X1 3/4 | 4.0 | 16.00 | EA | 0.00 LB | 14 | N/A | _ + | 17 |
| 4 | F50473 | NUT,HX,304S/S,1/2-13 | 11.0 | 44.00 | EA | 0.00 LB | 15 | N/A | B | 18 |
| 4 | M025311 | WASHER,PLN,TYPE A-W,304S/S,1/2 | 5.0 | 20.00 | EA | 0.00 LB | 16 | N/A | _ + | 19 |
| 4 | F50443 | CAPSCREW,HX HD,304 3/8-16X1 | 4.0 | 16.00 | EA | 0.00 LB | 17 | N/A | _ + | 20 |
| 4 | F17174 | WASHER,PLN,TYPE A-W,304 SS,3/8 | 6.0 | 24.00 | EA | 0.00 | 18 | N/A | | 21 |
| 4 | F12042 | NUT,HX,304S/S,3/8-16 | 4.0 | 16.00 | EA | 0.00 LB | 19 | N/A | | 22 |
| 4 | 86603H | CHAIN,ROLLR,#60,3/4P RIVTD(1600 LNKS/RL) | 87.0 | 348.00 | LNK | 10.50 LB | 20 | 86603 | C | 23 |
| 4 | 86605H | LINK,CONNECTING,STL,#60 3/4P/COTTER(922) | 1.0 | 4.00 | EA | 0.06 LB | 21 | 86605 | C | 24 |
| 4 | 84640A | PLATE INSTRUCTION SS (ARROW)(922) | 1.0 | 4.00 | EA | 1.00 LB | 22 | 84640 | C | 25 |
| 4 | 852263A | NAMEPLATE,INSTRUCTION, (WARNING)(922) | 1.0 | 4.00 | EA | 0.00 LB | 23 | 852263 | B + | 26 |
| 4 | 204181A | SIGN,CAUTION,SS(FOLLOW_I NSTRUCTIONS) | 1.0 | 4.00 | EA | 0.18 LB | 24 | 204181 | B | 27 |
| 4 | 560128 | PLATE,LUBRICATION,SPECS & INSTR.(922)** | 1.0 | 4.00 | EA | 0.00 | 25 | 560128 | H | 28 |

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-133
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60LT MOTOR DRIVE

DRAWING NUM: CSW1517-133

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|--------|---|----------|-----------|-----|---------|------|---------|-----|-----|
| 4 | F50573 | RIVET POP #44 1/8"x.188-.250 AL | 14.0 | 56.00 | EA | 0.50 LB | 26 | N/A | | 29 |
| 4 | F24599 | CAPSCREW,HX HD,304S/S,1/2-13x1-1/4 | 2.0 | 8.00 | EA | 0.00 LB | 27 | N/A | _+ | 30 |
| 4 | 766886 | TAG,OVERFILL LUBRICANT WARN,YELLOW VINYL | 1.0 | 4.00 | EA | 0.00 | 29 | 766886 | B | 31 |
| 4 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 4.00 | EA | 0.00 | 999 | N/A | A | 32 |

Jobmatl Notes

ECO-S-018095 (REV A) - INITIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: L115709-1
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60LT DRIVE

DRAWING NUM: 115709

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|--|--|----------|-----------|-----|-------------|------|----------|-----|-----|
| 4 | 591388 | STRIP LINER (SPEC),COLD DRAWN STEEL,4140 | 73.0 | 292.00 | FT | 0.34 LB | | 591388 | A | 204 |
| 4 | DRAWINGS | ASSEMBLY & REFERENCE | 1.0 | 4.00 | EA | 0.00 LB | 0 | N/A | | 62 |
| | Jobmatl Notes | | | | | | | | | |
| | 115709 - C60LT DRIVE ASSEMBLY DRAWING (REV N) "FOR STOCK DRIVE PRODUCTION, USE WORM GEAR COVER P/N 203507A" | | | | | | | | | |
| 4 | 678850-2 | ASSY,WORM GEAR,C60LT | 1.0 | 4.00 | EA | 0.00 | 1 | 678850 | D | 144 |
| 4 | 115655A1A | BASE,C60HT/C60LT,CI,(cp) | 1.0 | 4.00 | EA | 2,000.00 LB | 2 | 115655-1 | G | 35 |
| | Jobmatl Notes | | | | | | | | | |
| | / (1) P/N 115655A, DWG NO. 115655 BASE,C60LT/HT/OR,CASTING,CI / (1) P/N 20766P, DWG NO. 20766 STRIP,BEARING,C60B,STL /(19) P/N M010137 STRIP,BEARING BAR/FT / (1) P/N 88942A, DWG NO. 88942 LINER,STRIP,BEARING HEAT TREATING LEVEL / (1) P/N 49050A, DWG NO. 49050 LINER,STRIP,BEARING RAW STK PRIOR TO HEAT TREAT / (1) P/N 20766V, DWG NO. 20766 STRIP,BEARING,C60C/CB72,STL /(22) P/N M010137 STRIP,BEARING BAR/FT / (1) P/N 88942A, DWG NO. 88942 LINER,STRIP,BEARING HEAT TREATING LEVEL / (1) P/N 49050A, DWG NO. 49050 LINER,STRIP,BEARING RAW STK PRIOR TO HEAT TREAT | | | | | | | | | |
| 4 | 115656A | COVER,MAIN GEAR,C60LT/HT | 1.0 | 4.00 | EA | 272.00 LB | 3 | 115656 | I | 40 |
| | Jobmatl Notes | | | | | | | | | |
| | / (1) P/N F50362 CPLG,HALF,STD,MS 2FPSC | | | | | | | | | |
| 4 | 115692A1A | GEAR,MAIN,C60LT,DI,ASTM A536,(cp) | 1.0 | 4.00 | EA | 1,823.00 LB | 4 | 115692-1 | H | 41 |

GLV Indented Current BOM Report

BOM NUMBER: L115709-1
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60LT DRIVE

DRAWING NUM: 115709

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|---|------------|---------------------------------------|----------|-----------|-----|----------|------|-----------|-----|-----|
| Jobmatl Notes | | | | | | | | | | |
| / (1) P/N 115692A, DWG NO. 115692 GEAR,MAIN C60LT DUC IR CASTING | | | | | | | | | | |
| / (1) P/N 20766V, DWG NO. 20766 STRIP,BEARING,C60C/CB72,STL | | | | | | | | | | |
| /(22) P/N M010137 STRIP,BEARING BAR/FT | | | | | | | | | | |
| / (1) P/N 88942A, DWG NO. 88942 LINER,STRIP,BEARING HEAT TREATING LEVEL | | | | | | | | | | |
| / (1) P/N 49050A, DWG NO. 49050 LINER,STRIP,BEARING RAW STK PRIOR TO HEAT TREAT | | | | | | | | | | |
| / (1) P/N 20766O, DWG NO. 20766 STRIP,BEARING,C60B,STL | | | | | | | | | | |
| /(21) P/N M010137 STRIP,BEARING BAR/FT | | | | | | | | | | |
| / (1) P/N 88942A, DWG NO. 88942 LINER,STRIP,BEARING HEAT TREATING LEVEL | | | | | | | | | | |
| / (1) P/N 49050A, DWG NO. 49050 LINER,STRIP,BEARING RAW STK PRIOR TO HEAT TREAT | | | | | | | | | | |
| 4 | 203507A | COVER,WORM GEAR,STL,C40** | 1.0 | 4.00 | EA | 60.00 LB | 5 | 203507 | F | 131 |
| Item Notes | | | | | | | | | | |
| (WELD CPLG ON THE FRONT OF COVER) | | | | | | | | | | |
| 4 | 204227A1A | LUG,CORNER,CS,MACH,C60LT (cp) | 4.0 | 16.00 | EA | 19.00 LB | 6 | 204227-1 | B | 46 |
| Jobmatl Notes | | | | | | | | | | |
| / (1) P/N 204227A, DWG NO. 204227 | | | | | | | | | | |
| 4 | 1148480-02 | VALVE,BALL,3/4 NPT, BRONZE | 1.0 | 4.00 | EA | 0.00 | 7 | 1148480 | B | 132 |
| 4 | 24557A365A | VALVE,BALL (CAPRI),1/2" NPT,BRONZE | 1.0 | 4.00 | EA | 0.00 | 8 | 24557A365 | D | 133 |
| Item Notes | | | | | | | | | | |
| PER BRAD @ ATSCO SALES 9/23/2021 - KS | | | | | | | | | | |
| CRANE #9211- NO LONGER AVAILABLE. | | | | | | | | | | |
| PN 220TF005F61F1AGAN - FORTUNE BALL VALVE OUT OF BUSINESS. | | | | | | | | | | |
| NOW OFFERING BONOMI VALVES - COME IN BOXES OF 40 | | | | | | | | | | |

GLV Indented Current BOM Report

BOM NUMBER: L115709-1
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60LT DRIVE

DRAWING NUM: 115709

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|--------|---|----------|-----------|-----|----------|------|---------|-----|-----|
| 4 | 49115J | SHIM PACKAGE,C60LT/C60HT/C60R(988) | 1.0 | 4.00 | EA | 15.90 LB | 9 | 49115 | C | 50 |
| 4 | 591914 | PLUG,PIPE,VENTED,2" NPT,304 SS | 1.0 | 4.00 | EA | 0.00 | 10 | 591914 | B | 53 |
| 4 | 768199 | BUSHING,HX,1/2MPTx3/8 FPT,304 SS | 1.0 | 4.00 | EA | 0.00 | 11 | N/A | | 134 |
| 4 | 767333 | GAUGE,OIL,STRAIGHT,BRASS | 1.0 | 4.00 | EA | 0.00 | 12 | 767333 | C | 135 |
| 4 | 767875 | RING,SNAP (5/8"),ZINC PLATED STEEL | 4.0 | 16.00 | EA | 0.00 | 13 | 767875 | A | 136 |
| 4 | 84640A | PLATE INSTRUCTION SS (ARROW)(922) | 1.0 | 4.00 | EA | 1.00 LB | 14 | 84640 | C | 51 |
| 4 | 85321W | BALL,BEARING,CRM,1-3/4 (988)(cp) | 119.0 | 476.00 | EA | 0.80 LB | 15 | 85321 | F | 52 |
| 4 | 87549D | BOLT,DROP FORGED EYE,6-11/16",CS | 3.0 | 12.00 | EA | 2.42 LB | 16 | 87549 | D | 54 |
| 4 | 88556C | CLAMP,BAND,1/2x.017xFT,SS(9 22)** | 19.0 | 76.00 | FT | 0.03 LB | 17 | 88556 | F | 55 |
| 4 | 88683C | SEAL LIP/FT NEOP/PARAFFIN | 19.0 | 76.00 | FT | 0.12 LB | 18 | 88683 | F | 56 |
| 4 | 88721C | SEAL,LIP,NEOPRENE/PARAFFI N (922) | 19.0 | 76.00 | FT | 0.10 LB | 19 | 88721 | G | 57 |
| 4 | 88917D | SPACER,304 SS,11 GA | 16.0 | 64.00 | EA | 1.00 LB | 20 | 88917 | C | 58 |

GLV Indented Current BOM Report

BOM NUMBER: L115709-1
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60LT DRIVE

DRAWING NUM: 115709

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|---------|---|----------|-----------|-----|---------|------|---------|-----|-----|
| 4 | 88917E | SPACER,304 SS,16 GA | 16.0 | 64.00 | EA | 0.50 LB | 21 | 88917 | C | 59 |
| 4 | 88931J | GAUGE,OIL,EL,BRS 3/8NPT,3-1/2"SIGHT(922) | 1.0 | 4.00 | EA | 0.28 LB | 22 | 88931 | C | 60 |
| 4 | 903155A | PLATE,LUBRICATION,1x2,STL (#1) | 1.0 | 4.00 | EA | 0.20 LB | 23 | 903155 | D | 61 |
| 4 | F10102 | CAPSCREW,HX HD,GR5, 5/8-11x2-1/2 | 4.0 | 16.00 | EA | 0.26 LB | 24 | N/A | | 63 |
| 4 | F10106 | CAPSCREW,HX HD,GR5,5/8-11x1-1/2 | 4.0 | 16.00 | EA | 0.00 LB | 25 | N/A | | 130 |
| 4 | F10227 | CAPSCREW HX HD 3/4-10x1-1/2 GR5 | 16.0 | 64.00 | EA | 0.28 LB | 26 | N/A | | 64 |
| 4 | F10280 | CAPSCREW,HX HD,GR5, 1-8x2 | 2.0 | 8.00 | EA | 1.00 LB | 27 | N/A | - | 65 |
| 4 | F10282 | CAPSCREW,HX HD,GR5, 1-8x1-1/2 | 4.0 | 16.00 | EA | 1.00 LB | 28 | N/A | | 66 |
| 4 | 131990 | NIPPLE,SCH 40,3/4MPTxCLOSE,304 SS | 1.0 | 4.00 | EA | 0.00 | 29 | N/A | | 137 |
| 4 | F10869 | NUT HX 1-8 GR5 | 1.0 | 4.00 | EA | 0.00 LB | 30 | N/A | - | 67 |
| 4 | M019547 | TEE,PIPE,CL150,304,3/4 FPT | 1.0 | 4.00 | EA | 0.00 | 31 | N/A | _+ | 138 |
| 4 | F11195 | WSHR,PLN TYP A-N,5/8x1-5/16x.095,HDN STL | 8.0 | 32.00 | EA | 0.00 LB | 32 | N/A | | 69 |

GLV Indented Current BOM Report

BOM NUMBER: L115709-1
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60LT DRIVE

DRAWING NUM: 115709

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|---------|--|----------|-----------|-----|---------|------|---------|-----|-----|
| 4 | F11194 | WASHER PLN TYPE A-N F844 1" | 3.0 | 12.00 | EA | 0.00 LB | 33 | N/A | | 68 |
| 4 | M030930 | NIPPLE,SCH 40,304SS,3/4MPTx3-1/2 | 1.0 | 4.00 | EA | 1.00 | 34 | N/A | | 139 |
| 4 | F12511 | CAPSCREW,SKT-FLT-HD,ALLO Y,5/8-11x1-1/2 | 12.0 | 48.00 | EA | 0.14 LB | 35 | N/A | | 70 |
| 4 | F13749 | SCREW U-DRIVE 18-8 # 4x1/4 SST (936) | 4.0 | 16.00 | EA | 0.00 LB | 36 | N/A | | 71 |
| 4 | F50245 | CLAMP WORM DRIVE,300/400,3/8** | 8.0 | 32.00 | EA | 0.06 LB | 37 | N/A | | 72 |
| 4 | M028690 | NIPPLE,SCH 40,304 SS,1/2MPTX6 | 1.0 | 4.00 | EA | 0.00 LB | 38 | N/A | | 140 |
| 4 | M030282 | PLUG,PIPE,SQ HD,CORED,304 1/2MPT | 1.0 | 4.00 | EA | 0.00 | 39 | N/A | _ | 141 |
| 4 | M015636 | NIPPLE,SCH40,304,3/4MPTx3 | 1.0 | 4.00 | EA | 1.00 | 40 | N/A | _ + | 142 |
| 4 | 768198 | CPLG,RDCR,STD,3/4x3/8FPT,30 4 SS | 1.0 | 4.00 | EA | 0.00 | 41 | N/A | | 143 |
| 4 | F24337 | CAPSCREW,HX HD,304 1/2-13X1 | 1.0 | 4.00 | EA | 0.00 LB | 42 | N/A | _ + | 202 |
| 4 | F50474 | WSHR,PLN TYPE A-N,304 1/2 | 1.0 | 4.00 | EA | 0.00 LB | 43 | N/A | A | 203 |
| 4 | NOTES | SPECIFICATIONS & INSTRUCTIONS | 1.0 | 4.00 | EA | 0.00 LB | 998 | N/A | | 129 |

GLV Indented Current BOM Report

BOM NUMBER: L115709-1
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,C60LT DRIVE

DRAWING NUM: 115709

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

Jobmatl Notes

BEARING STRIPS ARE TO BE INSERTED INTO ITEMS 2 AND 4 DURING MACHINE SHOP OPERATION.

| | | | | | | | | | | |
|---|-----|-----------------------------|-----|------|----|------|-----|-----|---|----|
| 4 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 4.00 | EA | 0.00 | 999 | N/A | A | 34 |
|---|-----|-----------------------------|-----|------|----|------|-----|-----|---|----|

Jobmatl Notes

D/R 6548,6555,6770,6964,6978,6991,6742
 EN 97-1628 (REV G) - ADDED ITEM 58, QTY ITEM 57 WAS 2
 EN 21967 (REV H) REV'D ITEM 30 FROM 4" NIPPLE F12524 TO 4-1/2" NIPPLE M026818
 EN 22699 (REV J) ADDED ITEM 50, CHANGED QTY OF ITEM 46 FROM 8 TO 4.
 REV K - Rev'd up to match drawing for SL-7, 9/12/05 - LL
 EN 36246 (REV L) - BUBBLE ITEM #22 WAS P/N 85471L (CAST IRON); IS NOW P/N 591914 (304 SS)
 ECO-S-001306 (REV M) - ALL OIL DRAIN PIPING WAS CHANGED TO HDG. THIS INCLUDED BUBBLES 18,23,29,30,32,32,38,AND 40.
 ECO-S-002545 (REV N) - REVISED QTY. ON BUBBLE #20 (WAS 2; IS NOW 8).
 ECO-S-002545 (REV N) - RENUMBERED PARTS ON BOM; UPDATED TITLE BLOCK; ADDED NOTES 8, 9, & 10
 ECO-S-012440 (REV 0) - REVISED MATERIAL ON SPACERS (BUBBLE #'s 20 & 21)

GLV Indented Current BOM Report

BOM NUMBER: 115655A1A
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: BASE,C60HT/C60LT,CI,(cp)

DRAWING NUM: 115655-1

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|---------|-------------------------|----------|-----------|-----|-------------|------|---------|-----|-----|
| 5 | 115655A | BASE,C60LT/HT/CASTING** | 1.0 | 4.00 | EA | 2,215.00 LB | | 115655 | E | 36 |

Item Notes

Cast iron per astm a48 class 40a tensile test requirements waived.
 note drawing notes regarding surface defects and porosity.
 PATTERN HELD AT MACW
 WEIGHT 2146#

PATTERN MOVED TO MACA 5/16/19 - CR

Jobmatl Notes

Cast iron per astm a48 class 40a tensile test requirements waived.
 note drawing notes regarding surface defects and porosity.
 PATTERN HELD AT CUSTOM
 WEIGHT 2146#

GLV Indented Current BOM Report

BOM NUMBER: 115692A1A
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GEAR,MAIN,C60LT,DI,ASTM A536,(cp)

DRAWING NUM: 115692-1

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|--------------|-------------------------------------|----------|-----------|-----|-------------|------|---------|-----|-----|
| 5 | 115692A1A-OS | OS: MACHINE C60LT MAIN GEAR | 1.0 | 4.00 | EA | 0.00 | | | H | 45 |
| 5 | 115692A | GEAR,MAIN,C60LT,DUC IR,CASTING,A536 | 1.0 | 4.00 | EA | 2,075.00 LB | 1 | 115692 | E | 42 |

Item Notes

PATTERN MOVED TO MACA ON 5/14/19 - CR

GLV Indented Current BOM Report

BOM NUMBER: 204227A1A
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: LUG,CORNER,CS,MACH,C60LT(cp)

DRAWING NUM: 204227-1

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|--------------|---------------------------------|----------|-----------|-----|----------|------|----------|-----|-----|
| 5 | 204227A1A-OS | OS MACHINE SERVICE | 1.0 | 16.00 | EA | 0.00 | | 204227-1 | B | 49 |
| 5 | 204227A | LUG,CORNER,CS,CASTING,C60 LT | 1.0 | 16.00 | EA | 20.00 LB | 1 | 204227 | B | 47 |

GLV Indented Current BOM Report

BOM NUMBER: L115209-6
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,WORM GEAR,C60LT/HT RIGHT HAND

DRAWING NUM: 115209 DRWG REV I

| 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 | | 96 |
| | Jobmatl Notes | | | | | | | | | |
| | 115209 - WORM GEAR ASSY (REV O) | | | | | | | | | |
| | 115713 - DRIVE CONTROL INSTALL & ADJUSTMENT | | | | | | | | | |
| 5 | 111663-11 | HOUSING,WORM GEAR FOR 21 1/2 P.D.(MACH)* | 1.0 | 4.00 | EA | 276.00 LB | 1 | 111663-11 | H | 75 |
| | 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 | 4.00 | EA | 53.00 LB | 2 | 204382-1 | D | 80 |
| | 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 | 4.00 | EA | 24.32 LB | 3 | 202316 | F | 110 |
| 5 | 204169A | SEAT,BRG,SLIDING,STL (922) | 1.0 | 4.00 | EA | 9.88 LB | 5 | 204169 | E | 78 |
| 5 | L203243-3 | ASSY,WORM GEAR RH (695) (cp) | 1.0 | 4.00 | EA | 226.00 LB | 8 | 203243 | N | 116 |
| 5 | 204199A | PINION,MAIN,C60LT,4150,AST M A-424 BC | 1.0 | 4.00 | EA | 181.00 LB | 10 | 204199 | G | 79 |
| 5 | 202306A | WORM & SHAFT,STL 21-1/2PD(cp) | 1.0 | 4.00 | EA | 37.00 LB | 11 | 202306 | J | 76 |
| 5 | 48686F | ROD,STOP,C.R. STL,8.60 LG | 1.0 | 4.00 | EA | 2.40 LB | 13 | 48686 | F | 87 |
| 5 | F60073 | BEARING,BALL,UNMTD,ANG CONT SGL(922)** | 1.0 | 4.00 | EA | 0.70 LB | 14 | N/A | | 106 |

GLV Indented Current BOM Report

BOM NUMBER: L115209-6
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,WORM GEAR,C60LT/HT RIGHT HAND

DRAWING NUM: 115209 DRWG REV I

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|---------|---|----------|-----------|-----|---------|------|---------|-----|-----|
| 5 | 88887A | SCREW,SPRING ADJUSTING,C&W,STL | 1.0 | 4.00 | EA | 3.34 LB | 15 | 88887 | D | 91 |
| 5 | 86213A | SCREW,STOP,STL(922) | 1.0 | 4.00 | EA | 0.46 LB | 16 | 86213 | G | 90 |
| 5 | 86196A | SEAT,SPRING,STL (922)(cp) | 1.0 | 4.00 | EA | 4.00 LB | 17 | 86196 | G | 89 |
| 5 | 8997A | PLATE,COVER,304 SS 10 GA,12/21-1/2(922) | 1.0 | 4.00 | EA | 0.25 LB | 20 | 8997 | E | 93 |
| 5 | 88890A | GUIDE,BEARING,STL | 1.0 | 4.00 | EA | 0.68 LB | 21 | 88890 | B | 92 |
| 5 | 903155C | PLATE,LUBRICATION,1x2,STL (#2) | 1.0 | 4.00 | EA | 0.01 LB | 23 | 903155 | D | 95 |
| 5 | 49045A | NAMEPLATE,END CAP,WARNING SIGN(922) | 1.0 | 4.00 | EA | 0.08 LB | 24 | 49045 | C | 88 |
| 5 | 8998A | GASKET,COVER PLATE,NEOPRENE,1/16(922) | 1.0 | 4.00 | EA | 0.02 LB | 27 | 8998 | D | 94 |
| 5 | 203725M | RING, STL 3.36X.32 | 1.0 | 4.00 | EA | 0.84 LB | 28 | 203725 | AA | 77 |
| 5 | 40463E | KEY,SQ,3/8-16 TAP, C1018, 3/4x3-5/8(922) | 1.0 | 4.00 | EA | 0.56 LB | 29 | 40463 | D | 82 |
| 5 | 46758AR | SEAL,OIL,3.001"OD 2-3/16" SHAFT (922) | 2.0 | 8.00 | EA | 0.10 LB | 33 | 46758 | W | 83 |
| 5 | 46763K | SEAL,OIL,1/2 X 5.381 O.D.(922) | 2.0 | 8.00 | EA | 0.55 LB | 34 | 46763 | P | 84 |
| 5 | F60045 | BRNG,BALL,UNMTD ANG CONT SGL RW,45MM(cp) | 2.0 | 8.00 | EA | 3.88 LB | 37 | N/A | | 105 |

GLV Indented Current BOM Report

BOM NUMBER: L115209-6
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,WORM GEAR,C60LT/HT RIGHT HAND

DRAWING NUM: 115209 DRWG REV I

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----------------------------------|---------|--|----------|-----------|-----|----------|------|---------|-----|-----|
| 5 | F60131 | BEARING,BALL,UNMTD ANG CONT ID(922)(cp) | 1.0 | 4.00 | EA | 6.75 LB | 38 | N/A | | 108 |
| 5 | F60129 | BRNG,NDL RLR,UNMTD, INR RACE,3.25ID(cp) | 1.0 | 4.00 | EA | 1.56 LBS | 39 | N/A | | 107 |
| 5 | F60148 | BRNG,NDL RLR,UNMTD, OTR RACE,3.75ID(cp) | 1.0 | 4.00 | EA | 2.85 LBS | 40 | N/A | A | 109 |
| Jobmatl Notes | | | | | | | | | | |
| THIS IS ACTUALLY PART OF ITEM 39. | | | | | | | | | | |
| 5 | 46766BD | RING,RETAINING,STL,6.000"(I NTERNAL)(922) | 1.0 | 4.00 | EA | 0.14 LB | 42 | 46766 | K | 85 |
| 5 | 46767BP | RING,RETAINING,STL,3.250,EX TERNAL(922) | 1.0 | 4.00 | EA | 0.06 LB | 43 | 46767 | S | 86 |
| 5 | F10943 | PLUG,PIPE,SQ HD,MS, 1/2MPT,SOLID(922) | 1.0 | 4.00 | EA | 0.00 LB | 46 | N/A | A | 100 |
| 5 | F10948 | PLUG,PIPE,SQ SKT,MS, 1-1/2MPT,SOLID(922) | 2.0 | 8.00 | EA | 0.46 LB | 48 | N/A | A | 101 |
| 5 | F17031 | CAPSCREW,SKT FLT HD ALLOY 1/2-13X1 | 1.0 | 4.00 | EA | 0.00 | 54 | N/A | _+ | 103 |
| 5 | M038352 | CAPSCREW,HX HD,GR5ZNC,3/4-10X9 1/2 | 4.0 | 16.00 | EA | 0.00 | 56 | N/A | 1 | 97 |
| 5 | F10420 | CAPSCREW,HX HD,GR5,ZNC, 3/4-10x2-1/4 | 4.0 | 16.00 | EA | 0.00 LB | 57 | N/A | _ | 98 |

GLV Indented Current BOM Report

BOM NUMBER: L115209-6
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,WORM GEAR,C60LT/HT RIGHT HAND

DRAWING NUM: 115209 DRWG REV I

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|---------------------------------|---------|---|----------|-----------|-----|---------|------|---------|-----|-----|
| 5 | F10411 | CAPSCREW,HX HD,GR5,ZNC, 1/2-13x3/4 | 2.0 | 8.00 | EA | 0.00 | 59 | N/A | _ + | 99 |
| 5 | F13749 | SCREW U-DRIVE 18-8 # 4x1/4 SST (936) | 6.0 | 24.00 | EA | 0.00 LB | 61 | N/A | | 104 |
| 5 | F11055 | SETSCRW,SKT-HDLS-CP-PT, ALLOY,1/2-13x3/4 | 5.0 | 20.00 | EA | 0.00 | 62 | N/A | | 102 |
| 5 | 653908 | WASHER,PLN TYPE A-N,F436 ZNC,3/4 | 8.0 | 32.00 | EA | 0.00 | 63 | N/A | | 128 |
| 5 | 86953AT | KEY,SQ,C1018/1035 1/2X4 | 1.0 | 4.00 | EA | 0.25 LB | 64 | 86953 | D | 127 |
| Jobmatl Notes | | | | | | | | | | |
| TAPE TO WORM SHAFT FOR SHIPPING | | | | | | | | | | |
| 5 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 4.00 | EA | 0.00 | 999 | N/A | A | 74 |

Jobmatl Notes

D/R 6420,6431,6465,6738,6956,6978,7021
 EN 97-1628 (REV K) - ADD ITEM 23, QTY ITEM 61 WAS 4
 EN18461 (REV L) - ADD ITEM 64
 EN 22501 (REV M) - CHANGED ITEM 63 FROM F11851 TO F11192
 EN 35915 REV N - CHANGED ITEM 54 WAS F11785 NOW F17031
 ECO-S-001469 (REV O) - DELETED BUBBLE #19; REVISED P/N BUBBLES #56, #57, #59, #63; REVISED QTY'S BUBBLE #62.
 ECO-S-002545 (REV P) - DESCRIPTION OF THIS BOM HAS CHANGED TO REFLECT USE ONLY ON C60LT'S. ALSO MAIN PINION DESCRIPTION CHANGED TO REFLECT USE ON C60LT'S ONLY.

GLV Indented Current BOM Report

BOM NUMBER: 204382A1A
 TOP PARENT: CSW0001517-01
 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 | 4.00 | EA | 54.00 LB | 1 | 204382 | E | 81 |

GLV Indented Current BOM Report

BOM NUMBER: L202316
 TOP PARENT: CSW0001517-01
 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 | 4.00 | EA | 0.00 LB | 0 | N/A | | 111 |
| | Jobmatl Notes | | | | | | | | | |
| | 202316 - BUSHING HOUSING ASSEMBLY | | | | | | | | | |
| 6 | 202315A1A | HOUSING,BUSHING,CI (MACHINING)** | 1.0 | 4.00 | EA | 24.00 LB | 1 | 202315-1 | H | 114 |
| 6 | 80115A | BUSHING,WORM SHAFT BRZ,2-3/4(922) | 1.0 | 4.00 | EA | 3.00 LB | 2 | 80115 | F | 113 |
| 6 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 4.00 | EA | 0.00 | 999 | N/A | A | 112 |

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: CSW0001517-01
 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 | 4.00 | EA | 34.00 LB | 1 | 202315 | E | 115 |

GLV Indented Current BOM Report

BOM NUMBER: L203243-3
 TOP PARENT: CSW0001517-01
 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 | 4.00 | EA | 0.00 LB | 0 | N/A | | 117 | |
| | Jobmatl Notes | | | | | | | | | | |
| | 203243 - WORM GEAR ASS'Y | | | | | | | | | | |
| 6 | 204060A1A | RIM,WORM GEAR,W21P, BRZ-SELL w/ASSY ONLY | 1.0 | 4.00 | EA | 91.00 LB | 1 | 204060-1 | D | 119 | |
| 6 | 204230A1A | HUB,WORM,CI 21-1/2(SELLw/ASSY ONLY)(cp) | 1.0 | 4.00 | EA | 100.00 LB | 2 | 204230-1 | F | 124 | |
| 6 | F10102 | CAPSCREW,HX HD,GR5, 5/8-11x2-1/2 | 6.0 | 24.00 | EA | 0.26 LB | 3 | N/A | | 123 | |
| 6 | F50568 | WASHER,FL,THRU HDN, CLIPPED,F436,5/8 | 12.0 | 48.00 | EA | 0.02 LB | 4 | N/A | | 122 | |
| 6 | F10871 | NUT,HX,GR5,5/8-11 | 6.0 | 24.00 | EA | 0.00 LB | 5 | N/A | | 121 | |
| 6 | NOTES | SPECIFICATIONS & INSTRUCTIONS | 0.0 | 0.00 | EA | 0.00 LB | 997 | N/A | | 126 | |
| | Jobmatl Notes | | | | | | | | | | |
| | SHOP ASSEMBLE - DO NOT FURNISH INDIVIDUAL PARTS AS REPLACEMENT OR SPARE PARTS. | | | | | | | | | | |
| 6 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 4.00 | EA | 0.00 | 999 | N/A | A | 118 | |
| | 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: CSW0001517-01
 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 | 4.00 | EA | 152.00 LB | 1 | 204060 | B | 120 |

GLV Indented Current BOM Report

BOM NUMBER: 204230A1A
 TOP PARENT: CSW0001517-01
 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 | 4.00 | EA | 138.00 LB | | 204230 | D | 125 |

Item Notes

ASTM A48 CLASS 40A

GLV Indented Current BOM Report

BOM NUMBER: 678850-2
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,WORM GEAR,C60LT

DRAWING NUM: 678850

| 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 | | 167 | |
| | Jobmatl Notes | | | | | | | | | | |
| | 678850 - WORM GEAR ASSY (REV D) | | | | | | | | | | |
| | 115713 - DRIVE CONTROL INSTALL & ADJUSTING | | | | | | | | | | |
| 5 | 111663-11 | HOUSING,WORM GEAR FOR 21 1/2 P.D.(MACH)* | 1.0 | 4.00 | EA | 276.00 LB | 1 | 111663-11 | H | 146 | |
| 5 | 204382A1A | CAP,END,CI ASTM A48,CLASS 40A,(cp)** | 1.0 | 4.00 | EA | 53.00 LB | 2 | 204382-1 | D | 151 | |
| 5 | L202316 | ASSY,HOUSING,BUSHING,CI(9 22) | 1.0 | 4.00 | EA | 24.32 LB | 3 | 202316 | F | 179 | |
| 5 | 204394N | SPRING,HELICAL/COMPRSN (12,958# NOM) | 1.0 | 4.00 | EA | 13.90 LB | 4 | 204394 | L | 197 | |
| 5 | 204169A | SEAT,BRG,SLIDING,STL (922) | 1.0 | 4.00 | EA | 9.88 LB | 5 | 204169 | E | 150 | |
| 5 | 204395D | CENTERING DEVICE,NEOPRENE | 1.0 | 4.00 | EA | 0.46 LB | 6 | 204395 | E | 198 | |
| 5 | L203243-3 | ASSY,WORM GEAR RH (695) (cp) | 1.0 | 4.00 | EA | 226.00 LB | 7 | 203243 | N | 185 | |
| 5 | 204199A | PINION,MAIN,C60LT,4150,AST M A-424 BC | 1.0 | 4.00 | EA | 181.00 LB | 8 | 204199 | G | 149 | |
| 5 | 202306A | WORM & SHAFT,STL 21-1/2PD(cp) | 1.0 | 4.00 | EA | 37.00 LB | 9 | 202306 | J | 147 | |
| 5 | 48686F | ROD,STOP,C.R. STL,8.60 LG | 1.0 | 4.00 | EA | 2.40 LB | 10 | 48686 | F | 158 | |

GLV Indented Current BOM Report

BOM NUMBER: 678850-2
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,WORM GEAR,C60LT

DRAWING NUM: 678850

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|---------|---|----------|-----------|-----|---------|------|---------|-----|-----|
| 5 | F60073 | BEARING,BALL,UNMTD,ANG CONT SGL(922)** | 1.0 | 4.00 | EA | 0.70 LB | 11 | N/A | | 175 |
| 5 | 88887A | SCREW,SPRING ADJUSTING,C&W,STL | 1.0 | 4.00 | EA | 3.34 LB | 12 | 88887 | D | 163 |
| 5 | 86213A | SCREW,STOP,STL(922) | 1.0 | 4.00 | EA | 0.46 LB | 13 | 86213 | G | 161 |
| 5 | 86196A | SEAT,SPRING,STL (922)(cp) | 1.0 | 4.00 | EA | 4.00 LB | 14 | 86196 | G | 160 |
| 5 | 8997A | PLATE,COVER,304 SS 10 GA,12/21-1/2(922) | 1.0 | 4.00 | EA | 0.25 LB | 15 | 8997 | E | 164 |
| 5 | 88890A | GUIDE,BEARING,STL | 1.0 | 4.00 | EA | 0.68 LB | 16 | 88890 | B | 162 |
| 5 | 903155C | PLATE,LUBRICATION,1x2,STL (#2) | 1.0 | 4.00 | EA | 0.01 LB | 17 | 903155 | D | 166 |
| 5 | 49045A | NAMEPLATE,END CAP,WARNING SIGN(922) | 1.0 | 4.00 | EA | 0.08 LB | 18 | 49045 | C | 159 |
| 5 | 8998A | GASKET,COVER PLATE,NEOPRENE,1/16(922) | 1.0 | 4.00 | EA | 0.02 LB | 19 | 8998 | D | 165 |
| 5 | 203725M | RING, STL 3.36X.32 | 1.0 | 4.00 | EA | 0.84 LB | 20 | 203725 | AA | 148 |
| 5 | 40463E | KEY,SQ,3/8-16 TAP, C1018, 3/4x3-5/8(922) | 1.0 | 4.00 | EA | 0.56 LB | 21 | 40463 | D | 153 |
| 5 | 46758AR | SEAL,OIL,3.001"OD 2-3/16" SHAFT (922) | 2.0 | 8.00 | EA | 0.10 LB | 22 | 46758 | W | 154 |
| 5 | 46763K | SEAL,OIL,1/2 X 5.381 O.D.(922) | 2.0 | 8.00 | EA | 0.55 LB | 23 | 46763 | P | 155 |

GLV Indented Current BOM Report

BOM NUMBER: 678850-2
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,WORM GEAR,C60LT

DRAWING NUM: 678850

| 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 | 8.00 | EA | 3.88 LB | 24 | N/A | | 174 |
| 5 | F60131 | BEARING,BALL,UNMTD ANG CONT ID(922)(cp) | 1.0 | 4.00 | EA | 6.75 LB | 25 | N/A | | 177 |
| 5 | F60129 | BRNG,NDL RLR,UNMTD, INR RACE,3.25ID(cp) | 1.0 | 4.00 | EA | 1.56 LBS | 26 | N/A | | 176 |
| 5 | F60148 | BRNG,NDL RLR,UNMTD, OTR RACE,3.75ID(cp) | 1.0 | 4.00 | EA | 2.85 LBS | 27 | N/A | A | 178 |
| 5 | 46766BD | RING,RETAINING,STL,6.000"(I NTERNAL)(922) | 1.0 | 4.00 | EA | 0.14 LB | 28 | 46766 | K | 156 |
| 5 | 46767BP | RING,RETAINING,STL,3.250,EX TERNAL(922) | 1.0 | 4.00 | EA | 0.06 LB | 29 | 46767 | S | 157 |
| 5 | F10943 | PLUG,PIPE,SQ HD,MS, 1/2MPT,SOLID(922) | 1.0 | 4.00 | EA | 0.00 LB | 30 | N/A | A | 168 |
| 5 | F10948 | PLUG,PIPE,SQ SKT,MS, 1-1/2MPT,SOLID(922) | 2.0 | 8.00 | EA | 0.46 LB | 31 | N/A | A | 169 |
| 5 | F17031 | CAPSCREW,SKT FLT HD ALLOY 1/2-13X1 | 1.0 | 4.00 | EA | 0.00 | 32 | N/A | _+ | 172 |
| 5 | F10084 | CAPSCREW,HX HD,GR5, 3/4-10x9-1/2 | 4.0 | 16.00 | EA | 0.00 LB | 33 | N/A | | 199 |
| 5 | F10224 | CAPSCREW,HX HD,GR5, 3/4-10x2-1/4 | 4.0 | 16.00 | EA | 0.00 LB | 34 | N/A | | 200 |

GLV Indented Current BOM Report

BOM NUMBER: 678850-2
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,WORM GEAR,C60LT

DRAWING NUM: 678850

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-------------------------------------|---------|---|----------|-----------|-----|---------|------|---------|-----|-----|
| 5 | F10257 | CAPSCREW,HX HD,GR5, 1/2-13x3/4 | 2.0 | 8.00 | EA | 0.07 LB | 35 | N/A | | 201 |
| 5 | F13749 | SCREW U-DRIVE 18-8 # 4x1/4 SST (936) | 6.0 | 24.00 | EA | 0.00 LB | 36 | N/A | | 173 |
| 5 | F11055 | SETSCRW,SKT-HDLS-CP-PT, ALLOY,1/2-13x3/4 | 5.0 | 20.00 | EA | 0.00 | 37 | N/A | | 170 |
| 5 | 653908 | WASHER,PLN TYPE A-N,F436 ZNC,3/4 | 8.0 | 32.00 | EA | 0.00 | 38 | N/A | | 171 |
| 5 | 86953AT | KEY,SQ,C1018/1035 1/2X4 | 1.0 | 4.00 | EA | 0.25 LB | 39 | 86953 | D | 196 |
| Jobmatl Notes | | | | | | | | | | |
| TAPE KEY TO WORM SHAFT FOR SHIPPING | | | | | | | | | | |
| 5 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 4.00 | EA | 0.00 | 999 | N/A | A | 145 |

Jobmatl Notes

ECO-S-001469 (REV A) - INITIAL RELEASE (NEW STYLE)
 ECO-S-004169 (REV B) - ADDED NOTE 11 TO ASSEMBLY DRAWING. ALSO INCREASED QUANTITY OF BUBBLE 33 FROM 1 TO 2 (P/N 46758AR).
 ECO-S-009430 (REV C) - ADDED BUBBLE ITEMS 4 & 6 TO BOM & SELECTION TABLE FOR C40LT/HT & C60LT/HT
 ECO-S-011648 (REV D) - ADDED NEW BOM TO SELECTION CHART (678850-11=MOVED D/C TO TOP)

GLV Indented Current BOM Report

BOM NUMBER: L115759-1
 TOP PARENT: CSW0001517-01
 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 | | 234 |
| Jobmatl Notes | | | | | | | | | | |
| 115759 REV. Y = DRIVE CONTROL WEATHER PROOF ENCLOSURE ASSY | | | | | | | | | | |
| 115713 = DRIVE CONTROL INSTALLATION AND CALIBRATION INSTRUCTIONS | | | | | | | | | | |
| 770889 = SURFACE PREPARATION & POWDER COATING SPECIFICATION FOR DRIVE CONTROL | | | | | | | | | | |
| 4 | L48929-2 | COVER,DRIVE CONTROL,WELD/MACH(435) | 1.0 | 4.00 | EA | 0.00 LB | 1 | 48929 | E | 250 |
| 4 | 115595A2A | HOUSING,DRIVE CONTROL,MACH,CAST ALUM | 1.0 | 4.00 | EA | 8.20 LB | 2 | 115595-2 | G | 209 |
| 4 | 204163A | HOUSING,INDICATOR,DC,ACR YLIC (CLEAR) | 1.0 | 4.00 | EA | 0.30 LB | 3 | 204163 | B | 210 |
| 4 | 48993A1A | PLATE,MNTG,ALUM 380 (MACH.)(DR CNTRL) | 1.0 | 4.00 | EA | 4.00 LB | 5 | 48993-1 | E | 212 |
| 4 | 906433A | INDICATOR POINTER DRIVE CONTROL (435) | 1.0 | 4.00 | EA | 0.00 LB | 7 | 906433 | C | 211 |
| 4 | L49080-1 | ASSY,SHAFT | 1.0 | 4.00 | EA | 0.00 LB | 9 | 49080 | C | 244 |
| 4 | 88932A | CAM,DRIVE CONTROL,PHENOLIC (435) | 4.0 | 16.00 | EA | 0.00 | 10 | 88932 | C | 224 |
| 4 | 88966A | PLATE,MOUNTING,SWITCH,P HENOLIC,3/16(435) | 2.0 | 8.00 | EA | 0.00 | 11 | 88966 | C | 227 |
| 4 | 88825A | SEPARATOR,INS,FISH PAPER,CONTROL(435) | 9.0 | 36.00 | EA | 0.00 | 13 | 88825 | B | 219 |

GLV Indented Current BOM Report

BOM NUMBER: L115759-1
 TOP PARENT: CSW0001517-01
 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 | 88753A | PLATE,WASHER,DRIVE CONTROL,AL(435) | 2.0 | 8.00 | EA | 0.00 | 14 | 88753 | A | 216 |
| 4 | M031655 | STUD,THRD,BRS,#10-24x2 (435) | 1.0 | 4.00 | EA | 0.00 | 15 | | | 255 |
| 4 | M010848 | NUT,HX,BRS,#10-24, (435) | 3.0 | 12.00 | EA | 0.00 | 16 | | | 256 |
| 4 | 88845A | COLLAR,SET,303 SS (435) | 1.0 | 4.00 | EA | 0.00 LB | 19 | 88845 | A | 220 |
| 4 | 904311A | WSHR,NYLON,.75"ODx.385"IDx .062"THK(435) | 5.0 | 20.00 | EA | 0.00 | 20 | 904311 | A | 232 |
| 4 | 88965A | BUSHING,FLANGED,BRZ,1/4(435) | 1.0 | 4.00 | EA | 0.00 | 21 | 88965 | 0 | 226 |
| 4 | F60004 | BEARING,NDL RLR,UNMTD,.625ID(cp)(435) | 1.0 | 4.00 | EA | 0.16 LB | 23 | N/A | | 243 |
| 4 | 88964A | WASHER,DC,NYLON,1"OD(435) | 2.0 | 8.00 | EA | 0.10 | 25 | 88964 | 0 | 225 |
| 4 | 88819A | SWITCH MICRO DRIVE CONTROL 15AMP(435) | 4.0 | 16.00 | EA | 0.06 LB | 27 | 88819 | B | 218 |
| 4 | N/R6 | NOT REQUIRED THIS ASSY | 1.0 | 4.00 | EA | 0.00 LB | 31 | NOT REQUIRED | _ + | 257 |
| 4 | N/R7 | NOT REQUIRED THIS ASSY | 1.0 | 4.00 | EA | 0.00 LB | 32 | NOT REQUIRED | _ + | 258 |
| 4 | 88925C | CAP,VINYL,RED,.172" (435) | 2.0 | 8.00 | EA | 0.00 | 34 | 88925 | B | 223 |
| 4 | 88925A | CAP,VINYL,RED,.125" (435) | 4.0 | 16.00 | EA | 0.00 | 35 | 88925 | B | 222 |
| 4 | 88859A | O-RING,BUNA N(435) | 1.0 | 4.00 | EA | 0.01 LB | 37 | 88859 | 0 | 221 |

GLV Indented Current BOM Report

BOM NUMBER: L115759-1
 TOP PARENT: CSW0001517-01
 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 | 8.00 | EA | 0.00 | 38 | 89015 | 0 | 228 |
| 4 | 89015C | ROD,THD,DRIVE CONTROL,316(435) | 2.0 | 8.00 | EA | 0.00 | 39 | 89015 | 0 | 229 |
| 4 | 88584A | INHIBITOR,CORROSION (435) | 1.0 | 4.00 | EA | 0.01 LB | 40 | 88584 | A | 230 |
| 4 | 85692A | SPRING EXT COIL SS 2L HEAVY WIRE (435) | 1.0 | 4.00 | EA | 0.02 LB | 41 | 85692 | 0 | 231 |
| 4 | 88754A | WASHER,RTNR,SPRING,DC,316 (435) | 1.0 | 4.00 | EA | 0.06 LB | 42 | 88754 | B | 217 |
| 4 | N/R8 | NOT REQUIRED THIS ASSY | 1.0 | 4.00 | EA | 0.00 LB | 43 | N/A | _ + | 259 |
| 4 | 86665S | PLUG,PIPE,1-1/4,INDEF PLASTIC(435) | 1.0 | 4.00 | EA | 0.00 | 44 | 86665 | E | 215 |
| 4 | 82045R | CAPLUG,TYPE T,PE-RED,#6 (435) | 4.0 | 16.00 | EA | 0.00 | 45 | 82045 | F | 214 |
| 4 | M023596 | WSHR,PLN TYPE A,316SS,#8X7/16X.049(435) | 1.0 | 4.00 | EA | 0.00 | 47 | N/A | _ + | 263 |
| 4 | 591916 | SCREW,SHLDER,SOC HD,18-8SS,3/16"X1"(435) | 1.0 | 4.00 | EA | 0.00 | 48 | 591916 | A | 207 |
| 4 | F14464 | CAPSCREW,HX HD,316SS,1/4-20x1/2(435) | 1.0 | 4.00 | EA | 0.00 | 49 | N/A | | 238 |
| 4 | M023595 | NUT,HEX,#8-32,316 SS (435) | 1.0 | 4.00 | EA | 0.00 | 51 | N/A | _ + | 208 |

GLV Indented Current BOM Report

BOM NUMBER: L115759-1
 TOP PARENT: CSW0001517-01
 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 | F14596 | SHLD SCR,SKT HD ALLOY, 5/16x1-1/4(435) | 1.0 | 4.00 | EA | 0.00 | 52 | | | 239 |
| 4 | N/R9 | NOT REQUIRED THIS ASSY | 1.0 | 4.00 | EA | 0.00 LB | 53 | NOT REQUIRED | _ + | 260 |
| 4 | F16740 | CAPSCREW,HX HD,316SS, #10-24x1(435) | 2.0 | 8.00 | EA | 0.00 | 55 | | | 241 |
| 4 | F50466 | CAPSCREW,SKT HD,304,3/8-16x1(435) | 4.0 | 16.00 | EA | 0.00 | 56 | | | 236 |
| 4 | F14984 | CAPSCREW,SKT BTN HD,1/2-13x1-1/4 (435) | 2.0 | 8.00 | EA | 0.00 | 59 | N/A | | 240 |
| 4 | F10894 | NUT,HX,316,#10-24, (435) | 6.0 | 24.00 | EA | 0.00 | 63 | | | 235 |
| 4 | F21594 | NUT,HX,316 SS,#6-32 (435) | 8.0 | 32.00 | EA | 0.00 | 64 | N/A | | 242 |
| 4 | F11204 | WSHR,PLN,A-W,316SS,#10 (435) | 2.0 | 8.00 | EA | 0.00 | 65 | N/A | | 237 |
| 4 | M012464 | WASHER,PLN,TYPE A-N,316S/S,#6(435) | 4.0 | 16.00 | EA | 0.00 | 66 | | | 249 |
| 4 | F11204 | WSHR,PLN,A-W,316SS,#10 (435) | 3.0 | 12.00 | EA | 0.00 | 68 | N/A | | 261 |
| 4 | 88937A | NAMEPLATE,DRV-CONTROL,T AG (435)** | 1.0 | 4.00 | EA | 0.00 | 75 | 88937 | E | 264 |
| 4 | 905163A | NAMEPLATE,DRIVE CONTROL,MYLAR(435) | 1.0 | 4.00 | EA | 0.00 | 77 | A586199 | D | 233 |
| 4 | 49067A | NAMEPLATE,,DR,3M MYLAR (435) | 1.0 | 4.00 | EA | 0.00 | 78 | 49067 | A | 213 |

GLV Indented Current BOM Report

BOM NUMBER: L115759-1
TOP PARENT: CSW0001517-01
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 | F50466 | CAPSCREW,SKT HD,304,3/8-16x1(435) | 1.0 | 4.00 | EA | 0.00 | 79 | | | 262 |
|---|--------|--------------------------------------|-----|------|----|------|----|--|--|-----|

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 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 4.00 | EA | 0.00 | 999 | N/A | A | 206 |
|---|-----|-----------------------------|-----|------|----|------|-----|-----|---|-----|

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: CSW0001517-01
 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 | 4.00 | EA | 0.00 LB | 0 | N/A | | 246 | |
| | Jobmatl Notes | | | | | | | | | | |
| | 49080 - SHAFT ASS'Y, CERTIFIED | | | | | | | | | | |
| 5 | 49042C | SHAFT,304S/S,.375x7.31"LG,32-FINSH | 1.0 | 4.00 | EA | 0.00 LB | 1 | 49042 | E | 247 | |
| 5 | F60000 | BEARING,NDL RLR,UNMTD,INNER,.375ID | 1.0 | 4.00 | EA | 1.00 LB | 2 | | | 248 | |
| 5 | REVISION | ENGINEERING CHANGES | 1.0 | 4.00 | EA | 0.00 LB | 99 | N/A | - | 245 | |
| | 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: CSW1174-137
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: PARTS,SPARE C60LT DRIVE

DRAWING NUM: CSW1174-137

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|---|---|----------|-----------|-----|---------|------|---------|-----|-----|
| 3 | DRAWINGS | ASSEMBLY & REFERENCE | 1.0 | 4.00 | EA | 0.00 LB | 0 | N/A | | 275 |
| | Jobmatl Notes | | | | | | | | | |
| | CSW1174-137 - SPARE PARTS, C60LT DRIVE | | | | | | | | | |
| | 579283 - TAGGING INSTRUCTIONS | | | | | | | | | |
| | 115709 - C60LT DRIVE ASSEMBLY | | | | | | | | | |
| 3 | 88439A | TAG,SHIPPING IDENTIFICATION,TYVEK(WHITE) | 3.0 | 12.00 | EA | 0.00 | 1 | 88439 | G | 276 |
| | Jobmatl Notes | | | | | | | | | |
| | IDENTIFICATION TAG TO BE ATTACHED TO THE ITEMS ON THIS LIST | | | | | | | | | |
| 3 | 88931J | GAUGE,OIL,EL,BRS 3/8NPT,3-1/2"SIGHT(922) | 1.0 | 4.00 | EA | 0.28 LB | 2 | 88931 | C | 277 |
| | Jobmatl Notes | | | | | | | | | |
| | THIS ITEM IS BUBBLE #22 ON DRAWING 115709 | | | | | | | | | |
| 3 | 767333 | GAUGE,OIL,STRAIGHT,BRASS | 1.0 | 4.00 | EA | 0.00 | 3 | 767333 | C | 278 |
| | Jobmatl Notes | | | | | | | | | |
| | THIS ITEM IS BUBBLE #12 ON DRAWING 115709 | | | | | | | | | |
| 3 | 767875 | RING,SNAP (5/8"),ZINC PLATED STEEL | 4.0 | 16.00 | EA | 0.00 | 4 | 767875 | A | 280 |
| | Jobmatl Notes | | | | | | | | | |
| | THIS ITEM IS BUBBLE #13 ON DRAWING 115709 | | | | | | | | | |
| 3 | NOTES | SPECIFICATIONS & INSTRUCTIONS | 1.0 | 4.00 | EA | 0.00 LB | 998 | N/A | | 281 |

GLV Indented Current BOM Report

BOM NUMBER: CSW1174-137
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: PARTS,SPARE C60LT DRIVE

DRAWING NUM: CSW1174-137

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

Jobmatl Notes

SPARE PARTS TO BE TAGGED & IDENTIFIED PER TAGGING INSTRUCTION DRAWING 579283. REFER TO NAMEPLATE ASSEMBLY DRAWING FOR SERIAL NUMBER DESIGNATION.

SPARE PARTS TO BE PACKAGED & BOXED FOR LONG TERM STORAGE. BOX TO BE CLEARLY MARKED AS "SPARE PARTS".

| | | | | | | | | | | |
|---|-----|--------------------------|-----|------|----|------|-----|-----|---|-----|
| 3 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 4.00 | EA | 0.00 | 999 | N/A | A | 279 |
|---|-----|--------------------------|-----|------|----|------|-----|-----|---|-----|

Jobmatl Notes

ECO-S-011016 (REV A) - INITIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-01M2
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ELECTRICAL CONTROLS PARTS LIST

DRAWING NUM: CSW1517-01M2

| 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 | | 284 |
| | Jobmatl Notes | | | | | | | | | |
| | REF DWGS | | | | | | | | | |
| | CSW1517-121 CP | | | | | | | | | |
| | 49046 NAMEPLATE - DANGER | | | | | | | | | |
| | 679001 NAMEPLATE- OVIVO | | | | | | | | | |
| 2 | CSW1517-121 | CONTROL PANEL-CLARIFIER (TYPICAL OF 4) | 4.0 | 4.00 | EA | 0.00 | 1 | CSW1517-121 | A | 285 |
| 2 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 1.00 | EA | 0.00 | 999 | N/A | A | 286 |
| | Jobmatl Notes | | | | | | | | | |
| | ECO-S-018311 REV A INITIAL RELEASE | | | | | | | | | |

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-01M3
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ANCHORS,EPOXY

DRAWING NUM: CSW1517-01M3

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|---|------------|------------------------------------|----------|-----------|-----|---------|------|---------|-----|-----|
| 2 | 695555E-03 | BOLT,EPOXY ANCHOR,1-1/4",316 SS | 48.0 | 48.00 | EA | 0.00 | 1 | 695555 | C | 288 |
| 2 | 695555A-03 | BOLT, ANCHOR EPOXY,316 SS | 48.0 | 48.00 | EA | 0.00 | 2 | 695555 | C | 289 |
| 2 | 594729B | ADHESIVE,ANCHOR,HIT-RE 500-V3 | 36.0 | 36.00 | EA | 0.00 | 3 | 594729 | F | 290 |
| 2 | 594729C | GUN,INJECTION-MANUAL | 1.0 | 1.00 | EA | 0.00 | 4 | 594729 | F | 291 |
| 2 | 594729D | NOZZLE,MIXER | 19.0 | 19.00 | EA | 0.00 | 5 | 594729 | F | 292 |
| 2 | 594729F-05 | BLOW OUT NOZZLE, 1" | 1.0 | 1.00 | EA | 0.00 | 6 | 594729 | F | 293 |
| 2 | 594729H-06 | CLEAN OUT BRUSH, 1 1/4" | 1.0 | 1.00 | EA | 0.00 | 7 | 594729 | F | 294 |
| 2 | 594729F-02 | BLOW OUT NOZZLE, 9/16" | 1.0 | 1.00 | EA | 0.00 | 8 | 594729 | F | 295 |
| 2 | 594729H-02 | CLEAN OUT BRUSH, 5/8" | 1.0 | 1.00 | EA | 0.00 | 9 | 594729 | F | 296 |
| 2 | NOTES | SPECIFICATIONS & INSTRUCTIONS | 1.0 | 1.00 | EA | 0.00 LB | 998 | N/A | | 297 |
| Jobmatl Notes | | | | | | | | | | |
| 1. SUPPLIER SHALL CLEARLY MARK PACKAGING TO READ "EPOXY ANCHORS FOR CMD TO TANK FLOOR AND EPOXY ANCHORS FOR ANCHOR RING TO TANK FLOOR". | | | | | | | | | | |
| 2. QUANTITIES ARE FOR THE ENTIRE ORDER. | | | | | | | | | | |
| 2 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 1.00 | EA | 0.00 | 999 | N/A | A | 298 |

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-01M4
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: MECHANISM STEEL-160' C3D-CLARIFIER

DRAWING NUM: CSW151701M4

| 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 | | 300 |

Jobmatl Notes

FAB & ASSY DWGS

ES0001 WORKMANSHIP STDS
 CSW1517-159 SHOP ASSY INST.
 CSW1517-160 SURFACE PREP NOTES
 77012A1 FAB CHECKLIST
 538300 TAGGNG INST.
 895355 HDG SPEC
 114808 BOLT TORQUE CHART

REF DWGS

CSW1517-101 GA
 CSW1517-102 DRIVE CONTROL SWITCHES
 CSW1517-103 TORQUE TEST
 115711 DRIVE GA
 697587 CAGE TO DRIVE CONN.
 697580 CAGE TO CAGE CONN.

| | | | | | | | | | | |
|---|-------------|---|-----|------|----|------|-----|-------------|---|-----|
| 2 | CSW1517-151 | GE,160' C3D CLARIFIER W/ C60LT DRIVE | 1.0 | 1.00 | EA | 0.00 | 1 | CSW1517-151 | A | 301 |
| 2 | CSW1517-158 | SPARE PARTS | 1.0 | 1.00 | EA | 0.00 | 2 | CSW1517-158 | A | 495 |
| 2 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 1.00 | EA | 0.00 | 999 | N/A | A | 500 |

Jobmatl Notes

ECO-S-017940 REV A INITIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-151
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GE,160' C3D CLARIFIER W/ C60LT DRIVE

DRAWING NUM: CSW1517-151

| 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 | | 302 | |
| | Jobmatl Notes | | | | | | | | | | |
| | REF DWGS | | | | | | | | | | |
| | 114808 BOLT TORQUE CHART | | | | | | | | | | |
| | 697584 CAGE TO DRIVE CONN | | | | | | | | | | |
| | 697580 CAGE TO CAGE CONN. | | | | | | | | | | |
| 3 | CSW1517-152 | GE, RAKE ARM, 160' C3D CLARIFIER | 1.0 | 1.00 | EA | 0.00 | 1 | CSW1517-152 | A | 303 | |
| 3 | CSW1517-153 | GE, SKIMMING, 160' C3D CLARIFIER | 1.0 | 1.00 | EA | 0.00 | 2 | CSW1517-153 | A | 347 | |
| 3 | CSW1517-155 | GE, 40' FEEDWELL, W/ FRP PANELS | 1.0 | 1.00 | EA | 0.00 | 3 | CSW1517-155 | A | 429 | |
| 3 | CSW1517-156 | GE, 8' - 8" MANIFOLD,160' C3D CLARIFIER | 1.0 | 1.00 | EA | 0.00 | 4 | CSW1517-156 | A | 447 | |
| 3 | CSW1517-161A | CENTER CAGE 5'-6", STL | 1.0 | 1.00 | EA | 2,004.00 LBS | 5 | CSW1517-161 | A | 468 | |
| 3 | CSW1517-161C | CENTER CAGE 5'-6", STL | 1.0 | 1.00 | EA | 884.00 LBS | 6 | CSW1517-161 | A | 469 | |
| 3 | CSW1517-162 | INFLUENT COLUMN 60", STL | 1.0 | 1.00 | EA | 2,880.00 LBS | 7 | CSW1517-162 | A | 470 | |
| 3 | CSW1517-167 | EDI, 14' (HALF), STL | 2.0 | 2.00 | EA | 2,048.00 LBS | 8 | CSW1517-167 | A | 471 | |
| 3 | CSW1517-185 | SUPPORT,EDI,STL | 4.0 | 4.00 | EA | 83.00 LBS | 9 | CSW1517-185 | A | 472 | |
| 3 | CSW1517-196 | CMD,STEEL | 1.0 | 1.00 | EA | 1,716.00 LBS | 10 | CSW1517-186 | A | 473 | |
| 3 | CSW1432-1162 | COUPLING,FLEXIBLE,PVC-SE RIES1056 | 1.0 | 1.00 | EA | 0.00 | 11 | CSW1432-1162 | A | 474 | |

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-151
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GE,160' C3D CLARIFIER W/ C60LT DRIVE

DRAWING NUM: CSW1517-151

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|---------------------|---|----------|-----------|-----|-----------|------|-------------|-----|-----|
| 3 | CSW1517-171 | DRIVE ADAPTER, STL | 2.0 | 2.00 | EA | 92.00 LBS | 12 | CSW1517-171 | A | 475 |
| 3 | HCS20UNCX064-316SS | HEX HD CAPSCREW, 1 1/4-7 UNC x 4 | 12.0 | 12.00 | EA | 0.00 | 101 | N/A | A | 476 |
| 3 | HCS20UNCX056-316SS | HEX HD CAPSCREW, 1 1/4-7 UNC x 3 1/2 | 15.0 | 15.00 | EA | 0.00 | 102 | N/A | A | 477 |
| 3 | PNW20A-316SS | PLAIN WASHER, 1 1/4 - SMALL OD | 27.0 | 27.00 | EA | 0.00 | 103 | N/A | A | 478 |
| 3 | HXN20UNC-316SS | HEX NUT, 1 1/4-7 UNC | 15.0 | 15.00 | EA | 0.00 | 104 | N/A | A | 479 |
| 3 | C60-16UNCX288-316SS | THREADED ROD, 1-8 UNC x 18 | 4.0 | 4.00 | EA | 0.00 | 105 | N/A | A | 480 |
| 3 | HCS16UNCX040-316SS | HEX HD CAPSCREW, 1-8 UNC x 2 1/2 | 8.0 | 8.00 | EA | 0.00 | 106 | N/A | A | 481 |
| 3 | PNW16A-316SS | PLAIN WASHER, 1 - SMALL OD | 12.0 | 12.00 | EA | 0.00 | 107 | N/A | A | 482 |
| 3 | HXN16UNC-316SS | HEX NUT, 1-8 UNC | 12.0 | 12.00 | EA | 0.00 | 108 | N/A | A | 483 |
| 3 | JHN16UNC-316SS | HEX JAM NUT, 1-8 UNC | 8.0 | 8.00 | EA | 0.00 | 109 | N/A | A | 484 |
| 3 | HCS12UNCX040-316SS | HEX HD CAPSCREW, 3/4-10 UNC x 2 1/2 | 8.0 | 8.00 | EA | 0.00 | 110 | N/A | A | 485 |
| 3 | HCS12UNCX032-316SS | HEX HD CAPSCREW, 3/4-10 UNC x 2 | 16.0 | 16.00 | EA | 0.00 | 111 | N/A | A | 486 |
| 3 | HCS12UNCX024-316SS | HEX HD CAPSCREW, 3/4-10 UNC x 1 1/2 | 16.0 | 16.00 | EA | 0.00 | 112 | N/A | A | 487 |

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-151
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GE,160' C3D CLARIFIER W/ C60LT DRIVE

DRAWING NUM: CSW1517-151

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|--------------------|--|----------|-----------|-----|--------|------|---------|-----|-----|
| 3 | PNW12A-316SS | PLAIN WASHER, 3/4 - SMALL OD, 316SS | 32.0 | 32.00 | EA | 0.00 | 113 | N/A | | 488 |
| 3 | PNW12B-316SS | PLAIN WASHER, 3/4 - LARGE OD,316 SS | 8.0 | 8.00 | EA | 0.00 | 114 | N/A | A | 489 |
| 3 | HXN12UNC-316SS | HEX NUT, 3/4-10 UNC, 316SS | 32.0 | 32.00 | EA | 0.00 | 115 | N/A | A | 490 |
| 3 | HCS10UNCX024-316SS | HEX HD CAPSCREW, 5/8-11 UNC x 1 1/2 | 22.0 | 22.00 | EA | 0.00 | 116 | N/A | A | 491 |
| 3 | PNW10A-316SS | PLAIN WASHER, 5/8 - SMALL OD | 22.0 | 22.00 | EA | 0.00 | 117 | N/A | A | 492 |
| 3 | HXN10UNC-316SS | HEX NUT, 5/8-11 UNC | 22.0 | 22.00 | EA | 0.00 | 118 | N/A | A | 493 |
| 3 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 1.00 | EA | 0.00 | 999 | N/A | A | 494 |

Jobmatl Notes

ECO-S-017940 REV A INITIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-152
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GE, RAKE ARM, 160' C3D CLARIFIER

DRAWING NUM: CSW1517-152

| 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 | | 304 | |
| | Jobmatl Notes | | | | | | | | | | |
| | REF DWGS | | | | | | | | | | |
| | 114808 BOLT TORQUE CHART | | | | | | | | | | |
| 4 | CSW1517-163A | RAKE ARM,160' C3D CLARIFIER, STL | 2.0 | 2.00 | EA | 2,449.00 LBS | 1 | CSW1517-163 | A | 305 | |
| 4 | CSW1517-163B | RAKE ARM,160' C3D CLARIFIER, STL | 2.0 | 2.00 | EA | 1,701.00 LBS | 2 | CSW1517-163 | A | 306 | |
| 4 | CSW1517-163C | RAKE ARM,160' C3D CLARIFIER, STL | 2.0 | 2.00 | EA | 50.00 LBS | 3 | CSW1517-163 | A | 307 | |
| 4 | CSW1517-163D | RAKE ARM,160' C3D CLARIFIER, STL | 2.0 | 2.00 | EA | 20.00 LBS | 4 | CSW1517-163 | A | 308 | |
| 4 | CSW1517-163E | RAKE ARM,160' C3D CLARIFIER, STL | 2.0 | 2.00 | EA | 50.00 LBS | 5 | CSW1517-163 | A | 309 | |
| 4 | CSW1517-163F | RAKE ARM,160' C3D CLARIFIER, STL | 2.0 | 2.00 | EA | 59.00 LBS | 6 | CSW1517-163 | A | 310 | |
| 4 | CSW1517-193A | SUPPORTS,DUCT,STL | 2.0 | 2.00 | EA | 11.00 LBS | 7 | CSW1517-193 | A | 311 | |
| 4 | CSW1517-193B | SUPPORTS,DUCT,STL | 2.0 | 2.00 | EA | 11.00 LBS | 8 | CSW1517-193 | A | 312 | |
| 4 | CSW1517-193C | SUPPORTS,DUCT,STL | 2.0 | 2.00 | EA | 10.00 LBS | 9 | CSW1517-193 | A | 313 | |
| 4 | CSW1517-193D | SUPPORTS,DUCT,STL | 2.0 | 2.00 | EA | 10.00 LBS | 10 | CSW1517-193 | A | 314 | |
| 4 | CSW1517-193E | SUPPORTS,DUCT,STL | 2.0 | 2.00 | EA | 11.00 LBS | 11 | CSW1517-193 | A | 315 | |

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-152
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GE, RAKE ARM, 160' C3D CLARIFIER

DRAWING NUM: CSW1517-152

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|---------------|----------------------------------|----------|-----------|-----|------------|------|--------------|-----|-----|
| 4 | CSW1517-193F | SUPPORTS,DUCT,STL | 2.0 | 2.00 | EA | 13.00 LBS | 12 | CSW1517-193 | A | 316 |
| 4 | CSW1517-1170A | DUCTS SECTIONS, STL | 2.0 | 2.00 | EA | 439.00 LBS | 13 | CSW1517-1170 | A | 317 |
| 4 | CSW1517-1170C | DUCT SECTIONS, STL | 2.0 | 2.00 | EA | 595.00 LBS | 14 | CSW1517-1170 | A | 318 |
| 4 | CSW1517-1170D | DUCT SECTIONS, STL | 2.0 | 2.00 | EA | 698.00 LBS | 15 | CSW1517-1170 | A | 319 |
| 4 | CSW1517-1170F | DUCTS SECTIONS, STL | 2.0 | 2.00 | EA | 760.00 LBS | 16 | CSW1517-1170 | A | 320 |
| 4 | CSW1517-1170G | DUCTS SECTIONS, STL | 2.0 | 2.00 | EA | 767.00 LBS | 17 | CSW1517-1170 | A | 321 |
| 4 | CSW1517-1171A | SQUEEGEE, DUCT (OUTER), NEOP | 2.0 | 2.00 | EA | 0.00 | 18 | CSW1517-1171 | A | 322 |
| 4 | CSW1517-1171C | SQUEEGEE, DUCT (MIDDLE), NEOP | 6.0 | 6.00 | EA | 0.00 | 19 | CSW1517-1171 | A | 323 |
| 4 | CSW1517-1171D | SQUEEGEE, DUCT (MIDDLE), NEOP | 2.0 | 2.00 | EA | 0.00 | 20 | CSW1517-1171 | A | 324 |
| 4 | CSW1517-1172A | DUCT BACKUP BAR, STL | 2.0 | 2.00 | EA | 14.00 LBS | 21 | CSW1517-1172 | A | 325 |
| 4 | CSW1517-1172C | DUCT BACKUP BAR, STL | 6.0 | 6.00 | EA | 12.00 LBS | 22 | CSW1517-1172 | A | 326 |
| 4 | CSW1517-1172D | DUCT BACKUP BAR, STL | 2.0 | 2.00 | EA | 12.00 LBS | 23 | CSW1517-1172 | A | 327 |
| 4 | CSW1517-1173A | DUCT GASKET I, NEOP | 2.0 | 2.00 | EA | 0.00 | 24 | CSW1517-1173 | A | 328 |
| 4 | CSW1517-1173C | DUCT GASKET II, NEOP | 2.0 | 2.00 | EA | 0.00 | 25 | CSW1517-1173 | A | 329 |
| 4 | CSW1517-1173D | DUCT GASKET III, NEOP | 2.0 | 2.00 | EA | 0.00 | 26 | CSW1517-1173 | A | 330 |

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-152
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GE, RAKE ARM, 160' C3D CLARIFIER

DRAWING NUM: CSW1517-152

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|--------------------|---|----------|-----------|-----|--------|------|--------------|-----|-----|
| 4 | CSW1517-1173F | DUCT GASKET IV, NEOP | 2.0 | 2.00 | EA | 0.00 | 27 | CSW1517-1173 | A | 331 |
| 4 | CSW1517-1173G | DUCT GASKET V, NEOP | 2.0 | 2.00 | EA | 0.00 | 28 | CSW1517-1173 | A | 332 |
| 4 | HCS12UNCX048-316SS | HEX HD CAPSCREW, 3/4-10 UNC x 3 | 24.0 | 24.00 | EA | 0.00 | 201 | N/A | A | 333 |
| 4 | HCS12UNCX040-316SS | HEX HD CAPSCREW, 3/4-10 UNC x 2 1/2 | 136.0 | 136.00 | EA | 0.00 | 202 | N/A | A | 334 |
| 4 | HCS12UNCX032-316SS | HEX HD CAPSCREW, 3/4-10 UNC x 2 | 16.0 | 16.00 | EA | 0.00 | 203 | N/A | A | 335 |
| 4 | PNW12A-316SS | PLAIN WASHER, 3/4 - SMALL OD, 316SS | 216.0 | 216.00 | EA | 0.00 | 204 | N/A | | 336 |
| 4 | PNW12B-316SS | PLAIN WASHER, 3/4 - LARGE OD, 316 SS | 16.0 | 16.00 | EA | 0.00 | 205 | N/A | A | 337 |
| 4 | HXN12UNC-316SS | HEX NUT, 3/4-10 UNC, 316SS | 176.0 | 176.00 | EA | 0.00 | 206 | N/A | A | 338 |
| 4 | HCS10UNCX024-316SS | HEX HD CAPSCREW, 5/8-11 UNC x 1 1/2 | 48.0 | 48.00 | EA | 0.00 | 207 | N/A | A | 339 |
| 4 | PNW10A-316SS | PLAIN WASHER, 5/8 - SMALL OD | 24.0 | 24.00 | EA | 0.00 | 208 | N/A | A | 340 |
| 4 | PNW10B-316SS | PLAIN WASHER, 5/8 - LARGE OD | 48.0 | 48.00 | EA | 0.00 | 209 | N/A | A | 341 |
| 4 | HXN10UNC-316SS | HEX NUT, 5/8-11 UNC | 48.0 | 48.00 | EA | 0.00 | 210 | N/A | A | 342 |

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-152
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GE, RAKE ARM, 160' C3D CLARIFIER

DRAWING NUM: CSW1517-152

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|--------------------|---------------------------------------|----------|-----------|-----|--------|------|--------------------|-----|-----|
| 4 | HFT06UNCX016-316SS | HEX FULL THRD BOLT, 3/8-16 UNC x 1 | 162.0 | 162.00 | EA | 0.00 | 211 | HFT06UNCX016-316SS | A | 343 |
| 4 | PNW06A-316SS | PLAIN WASHER, 3/8 - SMALL OD | 162.0 | 162.00 | EA | 0.00 | 212 | N/A | A | 344 |
| 4 | HXN06UNC-316SS | HEX NUT, 3/8-16 UNC | 162.0 | 162.00 | EA | 0.00 | 213 | N/A | A | 345 |
| 4 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 1.00 | EA | 0.00 | 999 | N/A | A | 346 |

Jobmatl Notes

ECO-S-017940 REV A INITIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-153
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GE, SKIMMING, 160' C3D CLARIFIER

DRAWING NUM: CSW1517-153

| 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 | | 348 |
| | Jobmatl Notes | | | | | | | | | |
| | REF DWGS | | | | | | | | | |
| | 1134185 FLUSH VALVE ERECTION | | | | | | | | | |
| | 114808 BOLT TORQUE CHART | | | | | | | | | |
| 4 | CSW1517-1161A | SKIMMER BLADE, STL | 2.0 | 2.00 | EA | 145.00 LBS | 1 | CSW1517-1161 | A | 349 |
| 4 | CSW1517-1161C | SKIMMER BLADE, STL | 2.0 | 2.00 | EA | 138.00 LBS | 2 | CSW1517-1161 | A | 350 |
| 4 | CSW1517-1161D | SKIMMER BLADE, STL | 2.0 | 2.00 | EA | 115.00 LBS | 3 | CSW1517-1161 | A | 351 |
| 4 | CSW1517-1162 | SKIMMER ARM, STL | 2.0 | 2.00 | EA | 91.00 LBS | 4 | CSW1517-1162 | A | 352 |
| 4 | CSW1517-1163A | SUPPORT, SKIMMER BLADE, STL | 2.0 | 2.00 | EA | 78.00 LBS | 5 | CSW1517-1163 | A | 353 |
| 4 | CSW1517-1163C | SUPPORT, SKILLER BLADE, STL | 2.0 | 2.00 | EA | 111.00 LBS | 6 | CSW1517-1163 | A | 354 |
| 4 | CSW1517-1163M | SUPPORT, SKIMMER BLADE, STL | 2.0 | 2.00 | EA | 141.00 LBS | 7 | CSW1517-1163 | A | 355 |
| 4 | CSW1517-1163H | SUPPORT, SKIMMER BLADE, STL | 6.0 | 6.00 | EA | 33.00 LBS | 8 | CSW1517-1163 | A | 356 |
| 4 | CSW1517-1163K | SUPPORT, SKIMMER BLADE, STL | 28.0 | 28.00 | EA | 1.00 LBS | 9 | CSW1517-1163 | A | 357 |
| 4 | CSW1517-1164A | SUPPORT, SKIMMER ARM, STL | 2.0 | 2.00 | EA | 104.00 LBS | 10 | CSW1517-1164 | A | 358 |

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-153
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GE, SKIMMING, 160' C3D CLARIFIER

DRAWING NUM: CSW1517-153

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|--------------------|--|----------|-----------|-----|------------|------|--------------|-----|-----|
| 4 | CSW1517-1164C | SUPPORT, SKIMMER ARM, STL | 2.0 | 2.00 | EA | 21.00 LBS | 11 | CSW1517-1164 | A | 359 |
| 4 | CSW1517-1164F | SUPPORT, SKIMMER ARM, STL | 8.0 | 8.00 | EA | 30.00 LBS | 12 | CSW1517-1164 | A | 360 |
| 4 | CSW1517-1164H | SUPPORT, SKIMMER ARM, STL | 4.0 | 4.00 | EA | 3.00 LBS | 13 | CSW1517-1164 | A | 361 |
| 4 | CSW1517-1166 | SCUM BOX, STL | 1.0 | 1.00 | EA | 610.00 LBS | 14 | CSW1517-1166 | A | 362 |
| 4 | CSW1517-1167 | SUPPORT, SCUM BOX, STL | 2.0 | 2.00 | EA | 61.00 LBS | 15 | CSW1517-1167 | A | 363 |
| 4 | 767657-6A | ASSY,6' SKIMMING DEVICE (ALUM./STL) | 2.0 | 2.00 | EA | 0.00 | 16 | 767657 | C | 364 |
| 4 | 1134185-2LS | ASSY,FLUSH VALVE(2 SKIMMERS 316 SS FAST) | 2.0 | 2.00 | EA | 0.00 | 17 | 1134185 | B | 389 |
| 4 | 88602C | CPLG,FLEX,PIPE,PVC-S/S,6x6 | 1.0 | 1.00 | EA | 4.00 LB | 18 | 88602 | B | 412 |
| 4 | 699073 | WASHER,316 SS (SCUM BOX SUPPORT) | 4.0 | 4.00 | EA | 1.00 LB | 19 | 699073 | A | 413 |
| 4 | 23951A77A | U-BOLT,EXTRA LONG,316 SS | 12.0 | 12.00 | EA | 0.00 LB | 20 | 23951A77 | B | 414 |
| 4 | 23951A77B | U-BOLT,EXTRA LONG,316 SS | 4.0 | 4.00 | EA | 0.00 LB | 21 | 23951A77 | B | 415 |
| 4 | 86751B | CLAMP,CHANNEL,316S/S,5/8",(cp) | 32.0 | 32.00 | EA | 0.12 LB | 22 | 86751 | D | 416 |
| 4 | HCS10UNCX024-316SS | HEX HD CAPSCREW, 5/8-11 UNC x 1 1/2 | 96.0 | 96.00 | EA | 0.00 | 301 | N/A | A | 417 |

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-153
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GE, SKIMMING, 160' C3D CLARIFIER

DRAWING NUM: CSW1517-153

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|--------------------|--|----------|-----------|-----|--------|------|---------|-----|-----|
| 4 | PNW10A-316SS | PLAIN WASHER, 5/8 - SMALL OD | 160.0 | 160.00 | EA | 0.00 | 302 | N/A | A | 418 |
| 4 | PNW10B-316SS | PLAIN WASHER, 5/8 - LARGE OD | 32.0 | 32.00 | EA | 0.00 | 303 | N/A | A | 419 |
| 4 | HXN10UNC-316SS | HEX NUT, 5/8-11 UNC | 96.0 | 96.00 | EA | 0.00 | 304 | N/A | A | 420 |
| 4 | HCS08UNCX032-316SS | HEX HD CAPSCREW, 1/2-13 UNC x 2, 316SS | 8.0 | 8.00 | EA | 0.00 | 305 | N/A | A | 421 |
| 4 | HCS08UNCX024-316SS | HEX HD CAPSCREW, 1/2-13 UNC x 1 1/2 | 16.0 | 16.00 | EA | 0.00 | 306 | N/A | A | 422 |
| 4 | PNW08A-316SS | PLAIN WASHER, 1/2 - SMALL OD, 316SS | 24.0 | 24.00 | EA | 0.00 | 307 | N/A | A | 423 |
| 4 | PNW08B-316SS | PLAIN WASHER, 1/2 - LARGE OD | 48.0 | 48.00 | EA | 0.00 | 308 | N/A | A | 424 |
| 4 | BVW08-316SS | BEVELED WASHER, 1/2 | 8.0 | 8.00 | EA | 0.00 | 309 | N/A | A | 425 |
| 4 | HXN08UNC-316SS | HEX NUT, 1/2-13 UNC, 316SS | 24.0 | 24.00 | EA | 0.00 | 310 | N/A | A | 426 |
| 4 | 495579AM | ANCH, WEDGE, 304 SS, 3/4X8 1/2 | 4.0 | 4.00 | EA | 0.00 | 311 | 495579 | C | 427 |
| 4 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 1.00 | EA | 0.00 | 999 | N/A | A | 428 |

Jobmatl Notes

ECO-S-017940 REV A INITIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: 767657-6A
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,6' SKIMMING DEVICE (ALUM./STL)

DRAWING NUM: 767657

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|------------|---|----------|-----------|-----|----------|------|---------|-----|-----|
| 5 | 1146073-01 | SCRAPER,SCUM,6',6061-T6 ALUMINUM | 1.0 | 2.00 | EA | 12.00 LB | 1 | 1146073 | C | 365 |
| 5 | 1151675-01 | WIPER,BOTTOM,NEOPRENE 3/8" THK | 1.0 | 2.00 | EA | 0.00 | 2 | 1151675 | A | 366 |
| 5 | 81602A | WIPER,SIDE,NEOPRENE,3/8X3 X4 | 2.0 | 4.00 | EA | 0.25 LB | 3 | 81602 | E | 367 |
| 5 | 81598A | CLAMP,SIDE WIPER,ALUMINUM | 2.0 | 4.00 | EA | 0.14 LB | 4 | 81598 | C | 368 |
| 5 | 84031A | CLAMP,BOTTOM WIPER,AL 6061T6 | 1.0 | 2.00 | EA | 1.25 LB | 5 | 84031 | D | 369 |
| 5 | 88188A | HINGED SKIMMER,STEEL,(700) | 1.0 | 2.00 | EA | 16.00 LB | 6 | 88188 | B | 370 |
| 5 | 88187A | SUPPORT,HINGED SKIMMER,STEEL (700) | 1.0 | 2.00 | EA | 3.50 LB | 7 | 88187 | B | 371 |
| 5 | 48080A1 | ARM SCRAPER CAST-ALUM. (922) | 2.0 | 4.00 | EA | 1.50 LB | 8 | 48080A1 | B | 372 |
| 5 | 89081A1A | ARM,CLEVIS,CAST STL (SKIM DEVICE)(cp)** | 2.0 | 4.00 | EA | 2.25 LB | 9 | 89081-1 | B | 373 |
| 5 | 88011A1A | COLLAR,SKIMMING DEVICE,CS(700)(cp) | 3.0 | 6.00 | EA | 2.00 LB | 10 | 88011-1 | C | 374 |
| 5 | 85606A | SPRING,EXTENSION,302 SS,7/8x3-1/2(922)** | 1.0 | 2.00 | EA | 1.00 LB | 11 | 85606 | E | 375 |

GLV Indented Current BOM Report

BOM NUMBER: 767657-6A
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,6' SKIMMING DEVICE (ALUM./STL)

DRAWING NUM: 767657

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|----------------|---|----------|-----------|-----|---------|------|---------|-----|-----|
| 5 | 1183082-02 | BLOCK,WEAR,UHMW-PE (SKIMMER ASSY) | 1.0 | 2.00 | EA | 0.00 | 12 | 1183082 | A | 376 |
| 5 | M012581 | CAPSCREW,HX HD,316SS, 1/2-13x5 | 4.0 | 8.00 | EA | 0.00 | 13 | N/A | | 377 |
| 5 | NHN06UNC-316SS | NUT,HEX,NYLON INSERT,3/8-16 UNC | 15.0 | 30.00 | EA | 0.00 | 14 | N/A | A | 378 |
| 5 | 1007186-06 | ROD,STOP,38",316 SS | 1.0 | 2.00 | EA | 2.00 LB | 15 | 1007186 | A | 379 |
| 5 | F13938 | SETSCRW,SQ HD,CP PT,316,3/8-16x3/4 | 2.0 | 4.00 | EA | 0.03 LB | 16 | N/A | | 380 |
| 5 | F11017 | MACH SCR,PAN REC HD,316 SS,3/8-16X1 1/2 | 9.0 | 18.00 | EA | 1.00 LB | 17 | N/A | | 381 |
| 5 | F10460 | CAPSCREW,HX HD,316SS, 3/4-10x3 | 2.0 | 4.00 | EA | 0.00 | 18 | N/A | | 382 |
| 5 | F10902 | NUT,HX,3/4-10,316 SS | 4.0 | 8.00 | EA | 0.12 LB | 19 | N/A | A | 383 |
| 5 | 85609A | COLLAR,ZINC 13/16IDxNOMx9/16WD(922) | 2.0 | 4.00 | EA | 1.00 LB | 20 | 85609 | D | 384 |
| 5 | M024679 | MACH,SCH PAN REC HD,316 SS,3/8"-16x2 1/2 | 6.0 | 12.00 | EA | 0.00 | 21 | N/A | | 385 |
| 5 | F10899 | NUT,HX,1/2-13,316SS | 8.0 | 16.00 | EA | 0.04 LB | 22 | N/A | | 386 |
| 5 | 1183082-01 | BLOCK,WEAR,UHMW-PE (SKIMMER ASSY) | 1.0 | 2.00 | EA | 0.00 | 23 | 1183082 | A | 388 |

GLV Indented Current BOM Report

BOM NUMBER: 767657-6A
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,6' SKIMMING DEVICE (ALUM./STL)

DRAWING NUM: 767657

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|------|-----------------------------|----------|-----------|-----|--------|------|---------|-----|-----|
| 5 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 2.00 | EA | 0.00 | 999 | N/A | A | 387 |

Jobmatl Notes

- ECO-S-009032 (REV A) - INITIAL RELEASE
- ECO-S-010732 (REV B) - REVISED QTY, OF BUBBLE #21 ON BOM -4A
- ECO-S-013381 (REV C) - REVISED P/N's OF BUBBLE #'s 14, 17 & 21 (MAT'L & SIZE)

GLV Indented Current BOM Report

BOM NUMBER: 1134185-2LS
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,FLUSH VALVE(2 SKIMMERS 316 SS FAST)

DRAWING NUM: 1134185

| 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 | 1 | N/A | | 390 |
| 5 | 1134047LS | ASSY,FLUSH VALVE,316SS | 1.0 | 2.00 | EA | 0.00 | 3 | 1134047 | F | 398 |
| 5 | 1134191-01 | SUPPORT,ACTUATION ARM,PVC | 2.0 | 4.00 | EA | 0.00 | 4 | 1134191 | B | 391 |
| 5 | 1134191-02 | ARM,ACTUATION (SCUM BOX FLUSH),PVC | 2.0 | 4.00 | EA | 0.00 | 5 | 1134191 | B | 392 |
| 5 | 1113320-02 | "U" BOLT,1 1/2" PIPE,316 SS(936) | 4.0 | 8.00 | EA | 0.00 | 11 | 1113320 | B | 393 |
| 5 | 86751B | CLAMP,CHANNEL,316S/S,5/8",(cp) | 8.0 | 16.00 | EA | 0.12 LB | 12 | 86751 | D | 394 |
| 5 | F10468 | CAPSCREW,HX HD,316SS, 3/8-16x2-1/2 | 2.0 | 4.00 | EA | 0.00 LB | 15 | N/A | _+ | 396 |
| 5 | M011705 | WASHER,PLN TYPE B-W,316S/S,3/8(922) | 9.0 | 18.00 | EA | 0.00 LB | 16 | N/A | _+ | 395 |
| 5 | F12750 | NUT,HX,NYLOCK,316SS, 3/8-16 (620) | 2.0 | 4.00 | EA | 1.00 LB | 19 | N/A | | 397 |

GLV Indented Current BOM Report

BOM NUMBER: 1134047LS
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,FLUSH VALVE,316SS

DRAWING NUM: 1134047

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq | |
|-----|------------------------------------|---|----------|-----------|-----|---------|------|---------|-----|-----|--|
| 6 | DRAWINGS | ASSEMBLY & REFERENCE | 0.0 | 0.00 | EA | 0.00 LB | 1 | N/A | | 399 | |
| | Jobmatl Notes | | | | | | | | | | |
| | 1134047 - FLUSH VAVLE ASSY, 316 SS | | | | | | | | | | |
| 6 | 1134063-01 | SEALANT,LOCTITE 587,BLUE, 70ML (2.36 OZ) | 1.0 | 2.00 | EA | 0.00 | 3 | 1134063 | A | 407 | |
| 6 | 1133827-01 | PLATE,SEAL,UHMW-PE | 1.0 | 2.00 | EA | 0.00 | 4 | 1133827 | A | 400 | |
| 6 | 1133829-01 | DIAPHRAGM,FLUSH VALVE, 40 DUROMETER | 1.0 | 2.00 | EA | 0.00 | 5 | 1133829 | A | 401 | |
| 6 | 1133831-01 | RETAINER BAR,FLUSH VALVE,316SS | 1.0 | 2.00 | EA | 0.00 | 7 | 1133831 | A | 402 | |
| 6 | 698290 | BAR,BACK UP (FLUSH VALVE),316 SS | 1.0 | 2.00 | EA | 0.20 LB | 8 | 698290 | A | 410 | |
| 6 | 1134031-01 | TRIP LEVER,316SS | 1.0 | 2.00 | EA | 1.00 LB | 11 | 1134031 | D | 403 | |
| 6 | 1151351-01 | MACH SCR,PAN REC HD,316SS,3/8-16X 1 3/4 | 2.0 | 4.00 | EA | 0.00 | 18 | N/A | 1 + | 405 | |
| 6 | F11008 | MACH SCR,PAN REC HD,316SS,3/8-16x1-1/4 | 1.0 | 2.00 | EA | 0.00 | 19 | N/A | | 406 | |
| 6 | F12750 | NUT,HX,NYLOCK,316SS, 3/8-16 (620) | 3.0 | 6.00 | EA | 1.00 LB | 21 | N/A | | 408 | |
| 6 | F11207 | WASHER PLN TYPE A-N 3/8 316SS | 2.0 | 4.00 | EA | 0.00 LB | 22 | N/A | | 409 | |

GLV Indented Current BOM Report

BOM NUMBER: 1134047LS
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: ASSY,FLUSH VALVE,316SS

DRAWING NUM: 1134047

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|---------|------------------------------------|----------|-----------|-----|--------|------|---------|-----|-----|
| 6 | M023770 | WSHR,FENDER,316SS 3/8x1-1/2x.08 | 2.0 | 4.00 | EA | 0.00 | 23 | N/A | _ + | 404 |
| 6 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 2.00 | EA | 0.00 | 999 | N/A | A | 411 |

Jobmatl Notes

- 9-27-02 (REV A) - INITIAL RELEASE
- EN 34656 (REV B) - UPDATED TITLE BLOCK
- EN 35350 (REV C) - ADDED TENSION PLATE
- EN 35973 (REV D) - ROLL BACK REV C CHANGES
- ECO-S-004460 (REV E) - ADDED BACK UP BAR (BUBBLE #8)

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-155
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GE, 40' FEEDWELL, W/ FRP PANELS

DRAWING NUM: CSW1517-155

| 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 | | 430 | |
| | Jobmatl Notes | | | | | | | | | | |
| | REF DWGS | | | | | | | | | | |
| | 114808 BOLT TORQUE CHART | | | | | | | | | | |
| 4 | CSW1517-180 | FRAME,FEEDWELL,QUARTER, STL | 4.0 | 4.00 | EA | 603.00 LBS | 1 | CSW1517-180 | A | 431 | |
| 4 | CSW1517-186A | PANELS,FIBERGLASS | 28.0 | 28.00 | EA | 0.00 | 2 | CSW1517-186 | A | 432 | |
| 4 | CSW1517-186B | PANELS,FIBERGLASS | 4.0 | 4.00 | EA | 0.00 | 3 | CSW1517-186 | A | 433 | |
| 4 | CSW1517-186C | RESIN FOR FIBERGLASS, (QUART) | 1.0 | 1.00 | EA | 0.00 | 4 | CSW1517-186 | A | 434 | |
| 4 | 767880A | BAFFLE,SCUM PORT (INNER),STEEL | 8.0 | 8.00 | EA | 14.00 LBS | 5 | 767880 | A | 435 | |
| 4 | HFT12UNCX144-316SS | HEX FULL THRD BOLT, 3/4-10 UNC x 9 | 32.0 | 32.00 | EA | 0.00 | 501 | HFT12UNCX144-316SS | A | 436 | |
| 4 | PNW12B-316SS | PLAIN WASHER, 3/4 - LARGE OD,316 SS | 64.0 | 64.00 | EA | 0.00 | 502 | N/A | A | 437 | |
| 4 | HXN12UNC-316SS | HEX NUT, 3/4-10 UNC, 316SS | 32.0 | 32.00 | EA | 0.00 | 503 | N/A | A | 438 | |
| 4 | HCS10UNCX024-316SS | HEX HD CAPSCREW, 5/8-11 UNC x 1 1/2 | 32.0 | 32.00 | EA | 0.00 | 504 | N/A | A | 439 | |
| 4 | PNW10A-316SS | PLAIN WASHER, 5/8 - SMALL OD | 64.0 | 64.00 | EA | 0.00 | 505 | N/A | A | 440 | |
| 4 | HXN10UNC-316SS | HEX NUT, 5/8-11 UNC | 32.0 | 32.00 | EA | 0.00 | 506 | N/A | A | 441 | |

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-155
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GE, 40' FEEDWELL, W/ FRP PANELS

DRAWING NUM: CSW1517-155

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|--------------------|---|----------|-----------|-----|---------|------|---------|-----|-----|
| 4 | HCS08UNCX024-316SS | HEX HD CAPSCREW, 1/2-13 UNC x 1 1/2 | 8.0 | 8.00 | EA | 0.00 | 507 | N/A | A | 442 |
| 4 | PNW08A-316SS | PLAIN WASHER,1/2 - SMALL OD,316SS | 16.0 | 16.00 | EA | 0.00 | 508 | N/A | A | 443 |
| 4 | HXN08UNC-316SS | HEX NUT, 1/2-13 UNC, 316SS | 8.0 | 8.00 | EA | 0.00 | 509 | N/A | A | 444 |
| 4 | M025020 | TEKS5,HXH SEALING WSHR 410 #12-24X1-1/4" | 476.0 | 476.00 | EA | 0.02 LB | 510 | N/A | | 445 |
| 4 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 1.00 | EA | 0.00 | 999 | N/A | A | 446 |

Jobmatl Notes

ECO-S-017940 REV A INITIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-156
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GE, 8' - 8" MANIFOLD,160' C3D CLARIFIER

DRAWING NUM: CSW1517-156

| 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 | | 448 | |
| | Jobmatl Notes | | | | | | | | | | |
| | REF DWGS | | | | | | | | | | |
| | 114808 BOLT TORQUE CHART | | | | | | | | | | |
| 4 | CSW1517-178 | MANIFOLD, 8' - 8" (HALF), STL | 2.0 | 2.00 | EA | 595.00 LBS | 1 | CSW1517-178 | A | 449 | |
| 4 | CSW1517-179A | TOP GASKET, NEOP | 2.0 | 2.00 | EA | 0.00 | 2 | CSW1517-179 | A | 450 | |
| 4 | CSW1517-179C | SIDE GASKET, NEOP | 2.0 | 2.00 | EA | 0.00 | 3 | CSW1517-179 | A | 451 | |
| 4 | CSW1517-177 | ANCHOR RING, STL | 2.0 | 2.00 | EA | 107.00 LBS | 4 | CSW1517-177 | A | 452 | |
| 4 | 699384C | CLAMP,BAND,316 SS BAND/316 SS SCREW | 20.0 | 20.00 | EA | 0.00 | 5 | 699384 | B | 453 | |
| 4 | 699385 | SEAL,3" W MANIFOLD,NEOPRENE | 32.0 | 32.00 | FT | 0.00 | 6 | 699385 | A | 454 | |
| 4 | CSW1517-181 | RING,SEAL (COLUMN) STL | 2.0 | 2.00 | EA | 43.00 LBS | 7 | CSW1517-181 | A | 455 | |
| 4 | CSW1517-198 | SEAL (SLUDGE MANIFOLD) NEOPRENE | 2.0 | 2.00 | EA | 0.00 | 8 | CSW1517-198 | A | 456 | |
| 4 | CSW1517-199 | RING,SEAL BACKUP,STL | 2.0 | 2.00 | EA | 18.00 LBS | 9 | CSW1517-199 | A | 457 | |
| 4 | HCS10UNCX032-316SS | HEX HD CAPSCREW, 5/8-11 UNC x 2 | 4.0 | 4.00 | EA | 0.00 | 601 | N/A | A | 458 | |
| 4 | PNW10B-316SS | PLAIN WASHER, 5/8 - LARGE OD | 8.0 | 8.00 | EA | 0.00 | 602 | N/A | A | 459 | |
| 4 | HXN10UNC-316SS | HEX NUT, 5/8-11 UNC | 4.0 | 4.00 | EA | 0.00 | 603 | N/A | A | 460 | |

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-156
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: GE, 8' - 8" MANIFOLD,160' C3D CLARIFIER

DRAWING NUM: CSW1517-156

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|-----|--------------------|---|----------|-----------|-----|---------|------|---------|-----|-----|
| 4 | HCS08UNCX032-316SS | HEX HD CAPSCREW, 1/2-13 UNC x 2, 316SS | 18.0 | 18.00 | EA | 0.00 | 604 | N/A | A | 461 |
| 4 | HCS08UNCX024-316SS | HEX HD CAPSCREW, 1/2-13 UNC x 1 1/2 | 18.0 | 18.00 | EA | 0.00 | 605 | N/A | A | 462 |
| 4 | PNW08A-316SS | PLAIN WASHER,1/2 - SMALL OD,316SS | 56.0 | 56.00 | EA | 0.00 | 606 | N/A | A | 463 |
| 4 | HXN08UNC-316SS | HEX NUT, 1/2-13 UNC, 316SS | 20.0 | 20.00 | EA | 0.00 | 607 | N/A | A | 464 |
| 4 | M025020 | TEKS5,HXH SEALING WSHR 410 #12-24X1-1/4" | 15.0 | 15.00 | EA | 0.02 LB | 608 | N/A | | 465 |
| 4 | 1124759-01 | WSHR,PLN TYPE B-W,5/16X1 1/8X.0625,304SS | 15.0 | 15.00 | EA | 0.00 | 609 | N/A | _+ | 466 |
| 4 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 1.00 | EA | 0.00 | 999 | N/A | A | 467 |

Jobmatl Notes

ECO-S-0017940 REV A INTIAL RELEASE

GLV Indented Current BOM Report

BOM NUMBER: CSW1517-158
 TOP PARENT: CSW0001517-01
 REQ QTY - 1

DESCRIPTION: SPARE PARTS

DRAWING NUM: CSW1517-158

| Lvl | Item | Description | Base QTY | Total Qty | U/M | Weight | Bub. | Drawing | Rev | Seq |
|---|------------|-----------------------------------|----------|-----------|-----|---------|------|---------|-----|-----|
| 3 | 1151675-01 | WIPER,BOTTOM,NEOPRENE 3/8" THK | 4.0 | 4.00 | EA | 0.00 | 1 | 1151675 | A | 496 |
| 3 | 81602A | WIPER,SIDE,NEOPRENE,3/8X3 X4 | 8.0 | 8.00 | EA | 0.25 LB | 2 | 81602 | E | 497 |
| 3 | NOTES | SPECIFICATIONS & INSTRUCTIONS | 1.0 | 1.00 | EA | 0.00 LB | 998 | N/A | | 498 |
| Jobmatl Notes SPARE PARTS NOTE 1. THIS LIST IS TOTAL FOR THE ENTIRE ORDER 2. SPARE PARTS TO BE PACKED IN A WOODEN BOX, FOR LONG TERM STORAGE, BEARING LABELS CLEARLY DESIGNATING THE CONTENTS AND THE EQUIPMENT FOR WHICH THEY ARE INTENDED. 3. PRIOR TO SHIPMENT OF THE SPARE PARTS, WRITTEN INSTRUCTIONS MUST BE RECEIVED FROM THE CUSTOMER. | | | | | | | | | | |
| 3 | ECO | ENGINEERING CHANGE ORDER | 1.0 | 1.00 | EA | 0.00 | 999 | N/A | A | 499 |

Jobmatl Notes
 ECO-S-017940 REV A INITIAL RELEASE

Ovivo® 160' C3D-CMD Clarifier with C60LT Drive Installation, Operation and Maintenance Manual

CUSTOMER NAME: Dondlinger & Sons Construction

Section: Spare Parts

PROJECT: Wichita WWTP

Revision: 1

CSW0001517-01

Date: 11/17/2021

SPARE PARTS LIST

Page 1

| Item | QTY | Description |
|------------|-----|---|
| 1151675-01 | 4 | Wiper, Bottom, Neoprene, 3/8" THK |
| 81602A | 8 | Wiper, Side, Neoprene, 3/8 x 3 x 4 |
| 88931J | 4 | Gauge, Oil, EL, BRS, 3/8 NPT, 3½" Sight |
| 767333 | 4 | Gauge, Oil, Straight, Brass |
| 767875 | 16 | Ring, Snap, 5/8" Zinc Plated Steel |

This list is total for the mechanism.

Spare parts are to be packaged in a wooden box, for long term storage, with labels clearly designating the contents and the equipment for which they are intended.

Recommended Spare Parts List

Ovivo USA, LLC does not provide a list of recommended spare parts or predict the life of parts subject to wear. All moving or rotating parts are subject to wear, and the amount of wear depends on the specific operating conditions of the unit. Also, wear increases if the unit is not properly maintained or lubricated, as specified in this Installation, Operation and Maintenance Instruction manual. Therefore, neither recommended spare parts nor predicted life of parts can be provided.

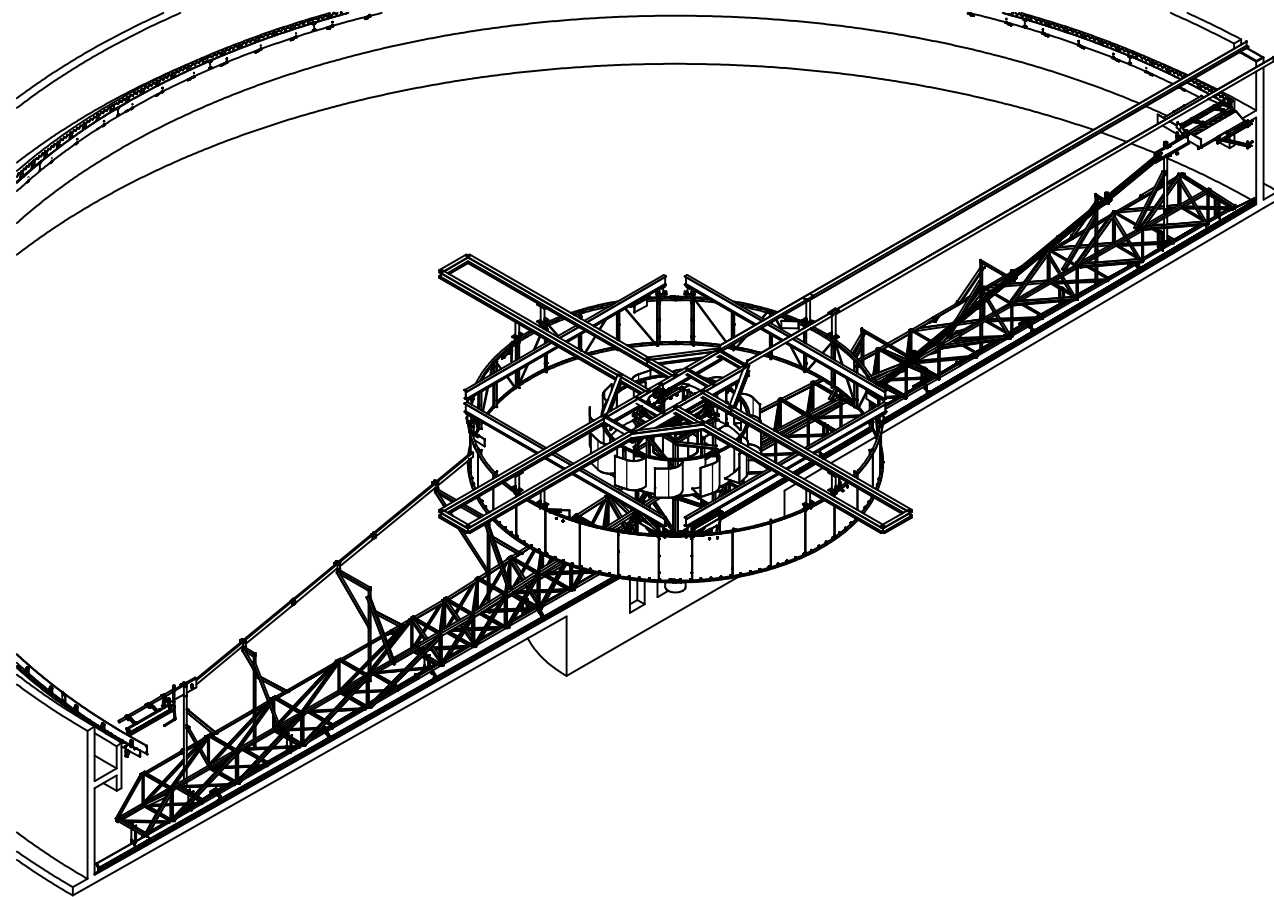
If you require additional information on Ovivo USA, LLC parts, please contact the Ovivo USA, LLC Parts Service Department in Salt Lake City, or your local Ovivo USA, LLC Representative.

Drawings



Worldwide Experts in Water Treatment

WICHITA WWTP WICHITA, KANSAS



GENERAL NOTES:

1. OVIVO TO SUPPLY (4) MECHANISMS AS SHOWN AND NOTED.
2. ASTERISK (*) DENOTES VARIANCE FROM CONTRACT DOCUMENTS AND SHOULD BE PARTICULARLY NOTED.
3. THE FOLLOWING DEFINES THE RESPONSIBILITY OF OVIVO WITH REGARD TO THE INFORMATION AND DIMENSIONS SHOWN ON THIS DRAWING.
 - A. DIMENSIONS, LOADS, AND OTHER INFORMATION ARE PROVIDED TO ACCOMMODATE THE EQUIPMENT TO THE STRUCTURE AS SHOWN.
 - B. THE CUSTOMER IS TO PROVIDE REINFORCING STEEL AND DESIGN FOR CONCRETE STRUCTURES AND IS TO DETERMINE SIZES TO SUIT LOCAL CONDITIONS.
 - C. THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR INSTALLATION PURPOSES UNLESS IT BEARS THE APPROVAL OF THE OWNER, THE ENGINEER OR THEIR AUTHORIZED REPRESENTATIVE.
 - D. THE MECHANISM SHOWN IS DESIGNED FOR DIRECTION OF ROTATION AS INDICATED. OVIVO DOES NOT ASSUME RESPONSIBILITY FOR DAMAGE IF OPERATED IN THE OPPOSITE DIRECTION.
 - E. CHARGES FOR MODIFICATIONS, ADDITIONS OR CORRECTIONS TO THE EQUIPMENT WILL NOT BE ACCEPTED BY OVIVO UNLESS PRIOR APPROVAL IS OBTAINED IN WRITING FROM AN AUTHORIZED OVIVO REPRESENTATIVE.
4. OVIVO DOES NOT FURNISH ELECTRICAL WIRING, CONDUIT OR ELECTRICAL EQUIPMENT; PIPING, VALVES OR FITTINGS; LUBRICATING OIL OR GREASE; FIELD PAINTING; FIELD WELDING OR ERECTION, (EXCEPT AS SPECIFICALLY NOTED). SEE SCOPE OF SUPPLY FOR A COMPLETE LIST OF ITEMS NOT PROVIDED.
5. SHOP PRIMER PAINT IS INTENDED TO SERVE ONLY AS A PROTECTIVE OR SEALING COAT. AS SUCH IT AFFORDS THE METAL ONLY MINIMAL PROTECTION AGAINST THE ELEMENTS, OVIVO CANNOT BE RESPONSIBLE FOR DETERIORATION OF SHOP-PRIMED EQUIPMENT DURING JOB STORAGE OR OTHER EXPOSURE TO THE ELEMENTS PRIOR TO APPLICATION OF FINISH COAT(S).
6. SURFACE PREPARATION TO CONSIST OF:
 DRIVE UNIT:
 SSPC-SP-6 (COMMERCIAL BLAST)

 SUBMERGED STEEL:
 N/A - SHIPPED BARE
 **SUCTION DUCT HEADER - PREPARED FOR HDG

 NON SUBMERGED STEEL:
 N/A - SHIPPED BARE
7. SHOP COATINGS TO CONSIST OF:
 DRIVE UNIT:
 PRIME COAT: ONE (1) COAT TNE MEC HI-BUILD EPOXOLINE II SERIES N69/N69F, COLOR: 00WH 'TNE MEC WHITE' @ 4 - 6 MILS DFT.

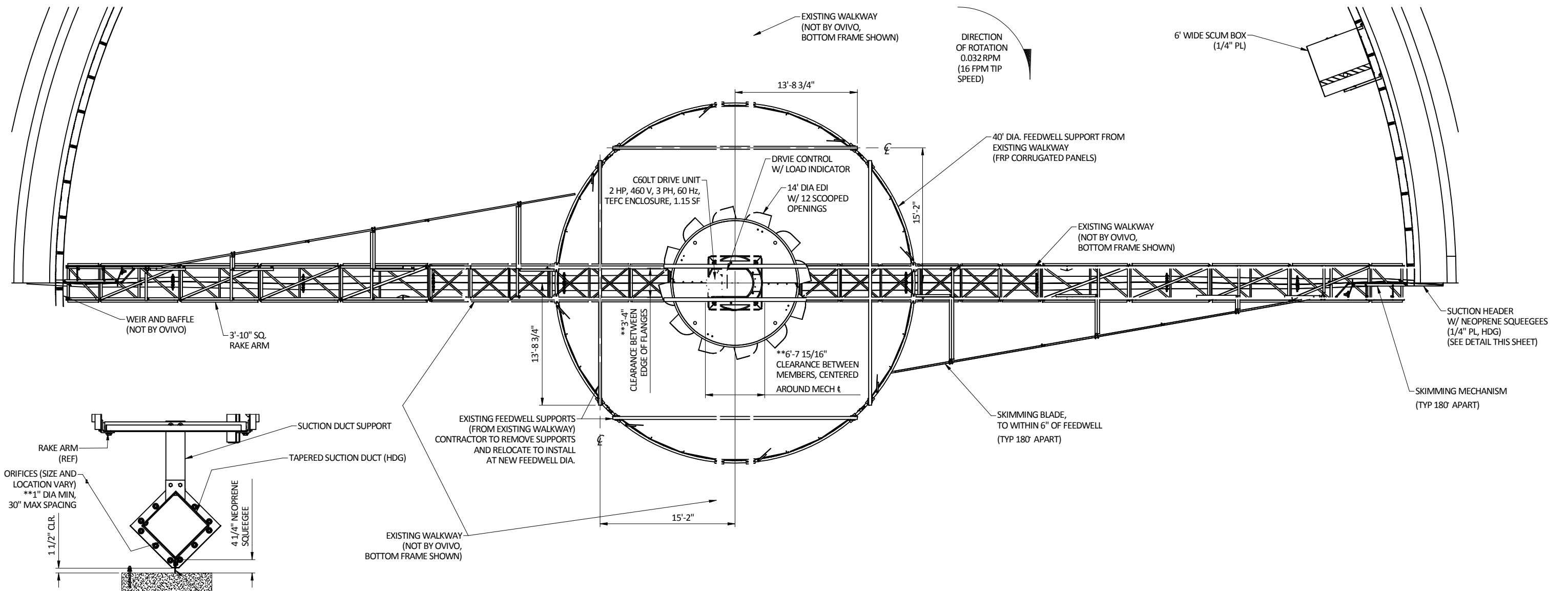
 2ND COAT: ONE (1) COAT TNE MEC HI-BUILD EPOXOLINE II SERIES N69/N69F, COLOR: 33GR 'GRAY' @ 4 - 6 MILS DFT.

 TOP COAT: ONE (1) COAT TNE MEC ENDURA-SHIELD SERIES 73, COLOR: 26BL 'CLEAR SKY' @ 3 - 5 MILS DFT.
8. ALL STRUCTURAL SHAPES AND PLATES TO BE ASTM A36 AND SHALL HAVE A NOMINAL MINIMUM STEEL THICKNESS OF 1/4" (UNLESS OTHERWISE NOTED).
9. ALL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF A.W.S. WELDING PROCEDURES WITH QUALIFICATION RECORDS PER THE FOLLOWING:
 A.W.S. D1.1 - STEEL STRUCTURAL WELDING CODE
 A.W.S. D1.2 - ALUMINUM STRUCTURAL WELDING CODE
 A.W.S. D1.6 - STAINLESS STEEL STRUCTURAL WELDING CODE
10. ISOLATION MUST BE PROVIDED FOR ALL ALUMINUM TO STEEL CONTACT SURFACES (ISOLATION NOT BY OVIVO)
11. FOR MECHANISM ORIENTATION, REFER TO CONTRACT DRAWINGS.
12. FASTENERS SHALL BE AS FOLLOWS, EXCEPT WHERE NOTED
 ANCHOR BOLTS: 316 SS
 ASSEMBLY BOLTS: 316 SS
 (ANTI-SEIZE SHOULD BE USED FOR ALL STAINLESS STEEL FASTENERS. ANTI-SEIZE NOT PROVIDED BY OVIVO)
13. FOR ADDITIONAL DETAILS, REFER TO DRAWINGS:
 CSW1517-102 DRIVE CONTROL SWITCHES
 CSW1517-103 TORQUE TEST
 115711 DRIVE GENERAL ARRANGEMENT
15. SPARE PARTS TO BE BOXED AND SHIPPED WITH EQUIPMENT. QUANTITIES LISTED REFLECT SPARE PARTS REQUIRED FOR (1) MACHINE:
 ONE (1) SET SIGHT GLASSES FOR MAIN DRIVE HOUSING
 ONE (1) SET OF NEOPRENE WIPERS

| THIS DRAWING IS CERTIFIED FOR: | |
|--------------------------------|-------------------------|
| CUSTOMER: | DONDLINGER CONSTRUCTION |
| CUSTOMER ORDER NO.: | 120036-001 |
| OVIVO ORDER NUMBER: | CSW0001517-01 |
| PROJECT: | WICHITA WWTP |
| PROJECT LOCATION: | WICHITA, KS |
| CONSULTING ENGINEER: | N/A |
| BY: EVAN HEYMAN | DATE: 06/23/2021 |

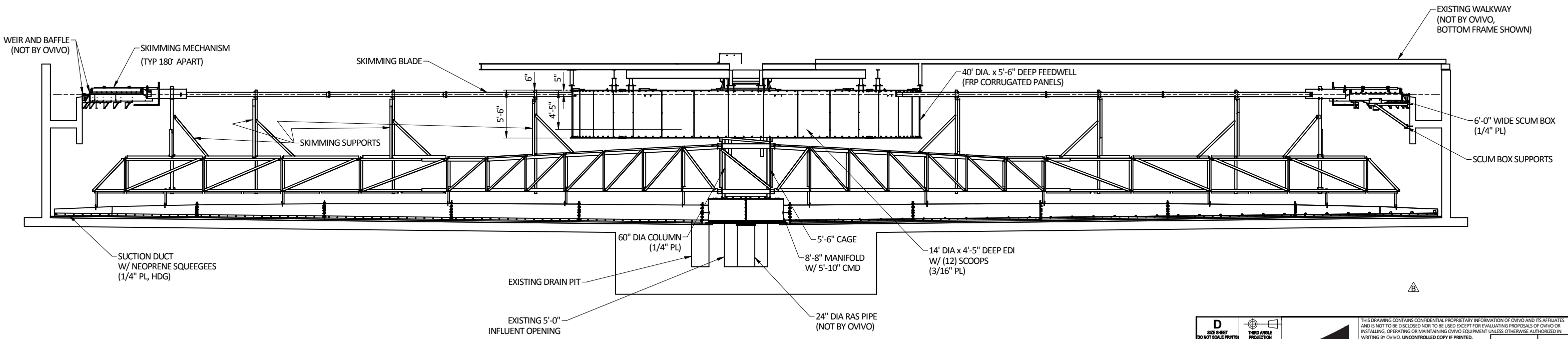
| | | | |
|---|----------|--|--------------|
| D <small>SIZE SHEET (DO NOT SCALE PRINTS)</small> DRAWN BY: EMH CHECKED BY: SDO DATE: 06/23/2021 PROJECT: CSW0001517-01 | | GENERAL ARRANGEMENT TYPE C3D CLARIFIER 160'-0" DIA. W/ C60LT DRIVE | |
| | | | |
| <small>© 2020 OVIVO. ALL RIGHTS RESERVED. WORKMANSHIP STANDARD ES0001 APPLIES</small> | DWG NO.: | CSW1517-101 | SHEET 1 OF 5 |

| BUBBLES REMOVED IN ALL SHEETS | ECO-S-017940 | NPR | EMH | 07/28/2021 | B |
|-------------------------------|--------------|-----|---------|------------|-----|
| INITIAL RELEASE | - | - | - | - | A |
| REVISION DESCRIPTION | EN/ECO | BY | CHECK'D | DATE | REV |

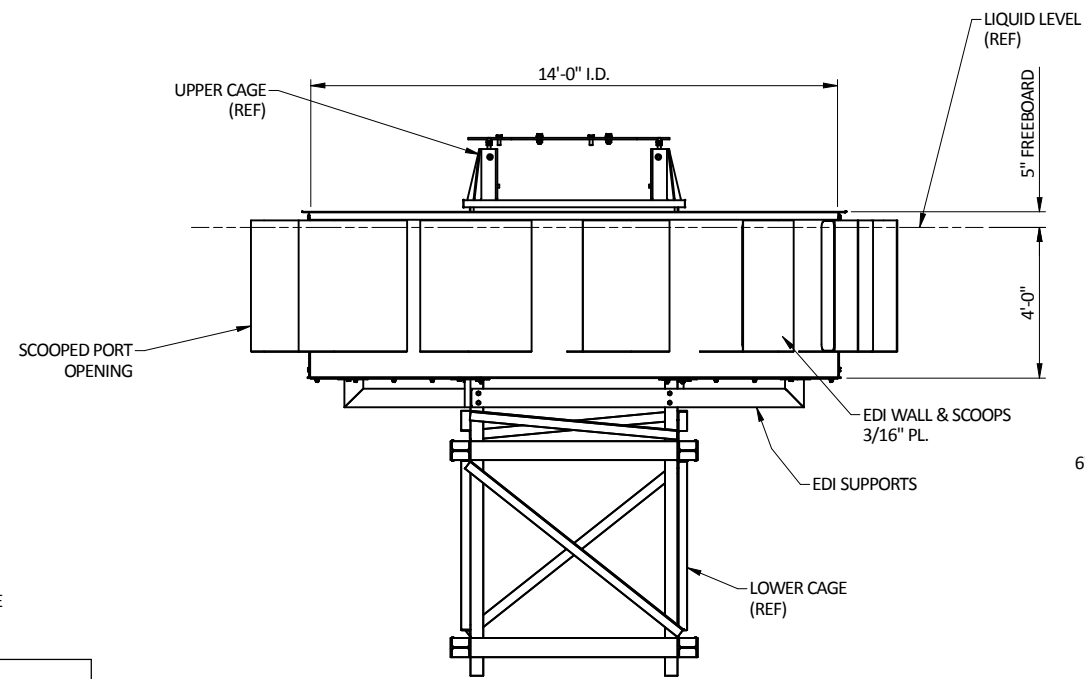


PLAN VIEW

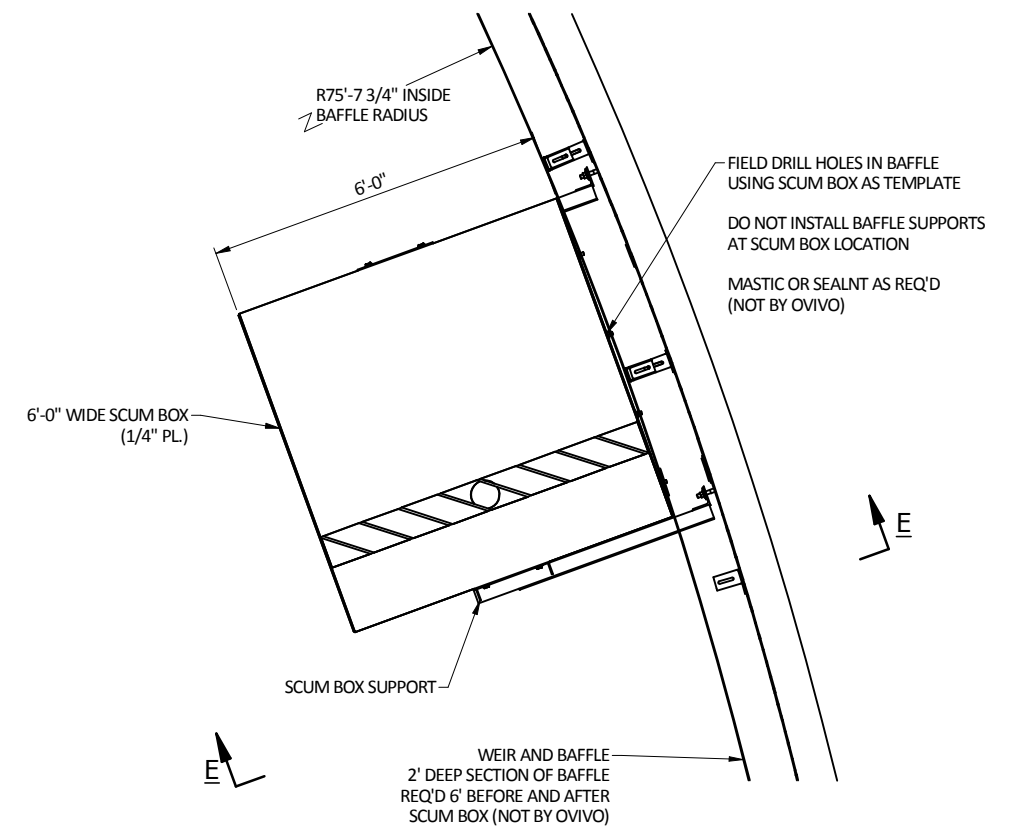
SUCTION DUCT DETAIL



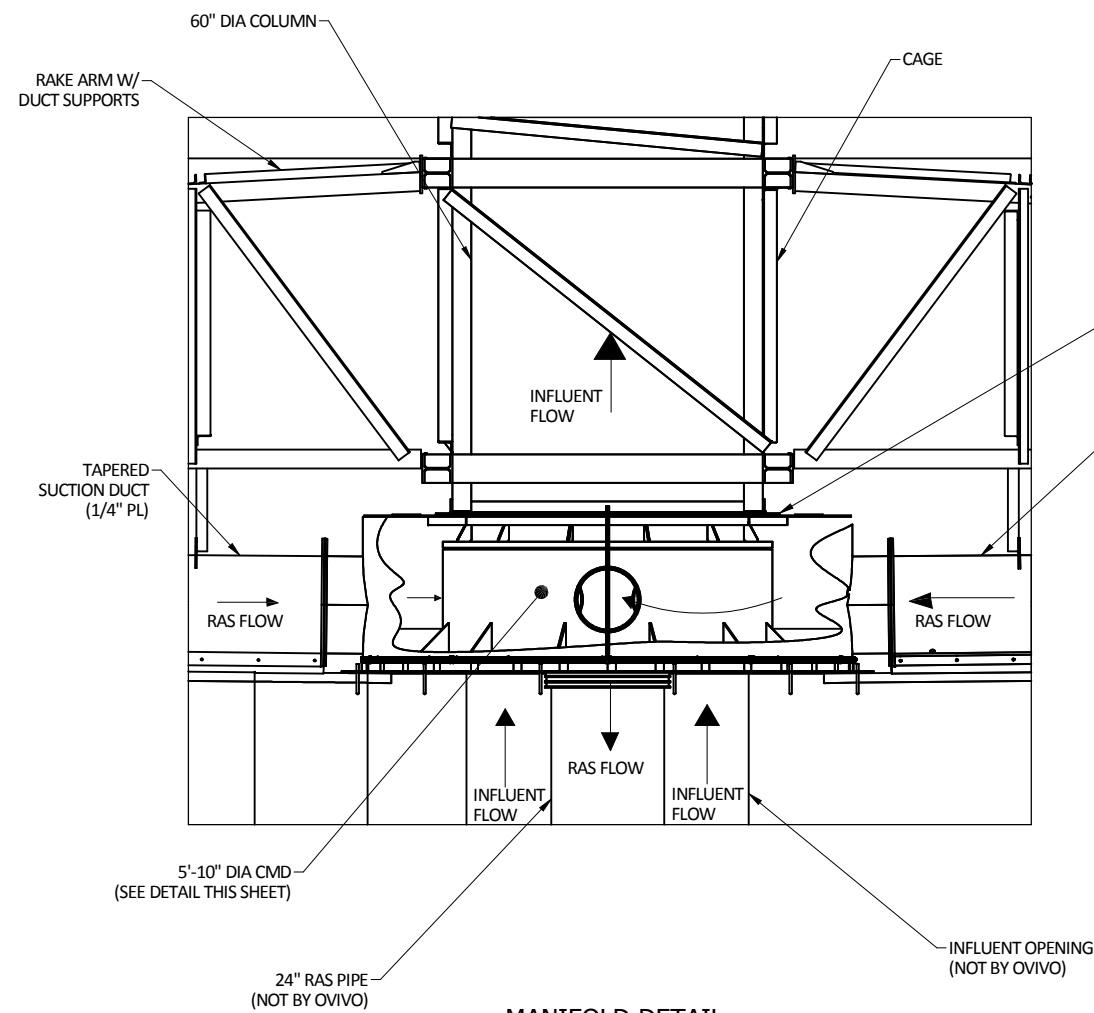
ELEVATION VIEW



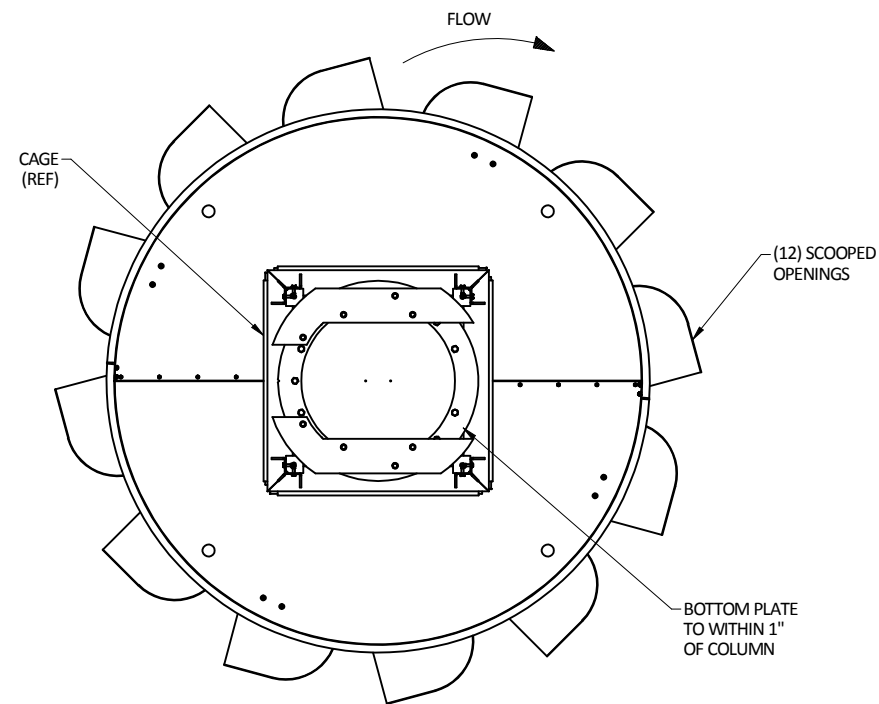
EDI ELEVATION VIEW



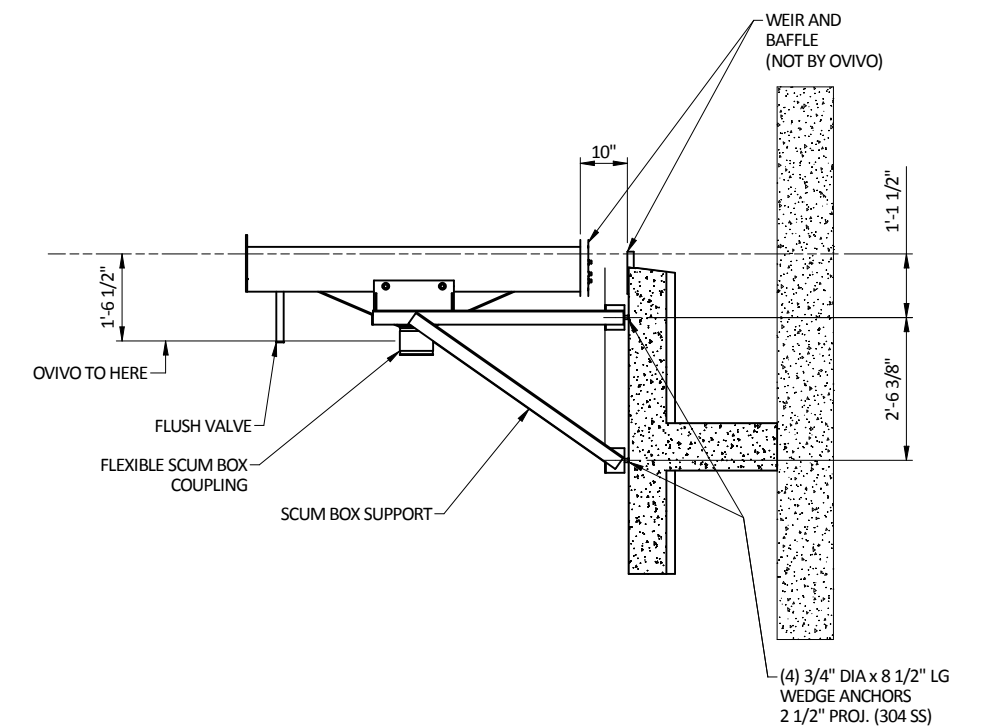
SCUM BOX DETAIL



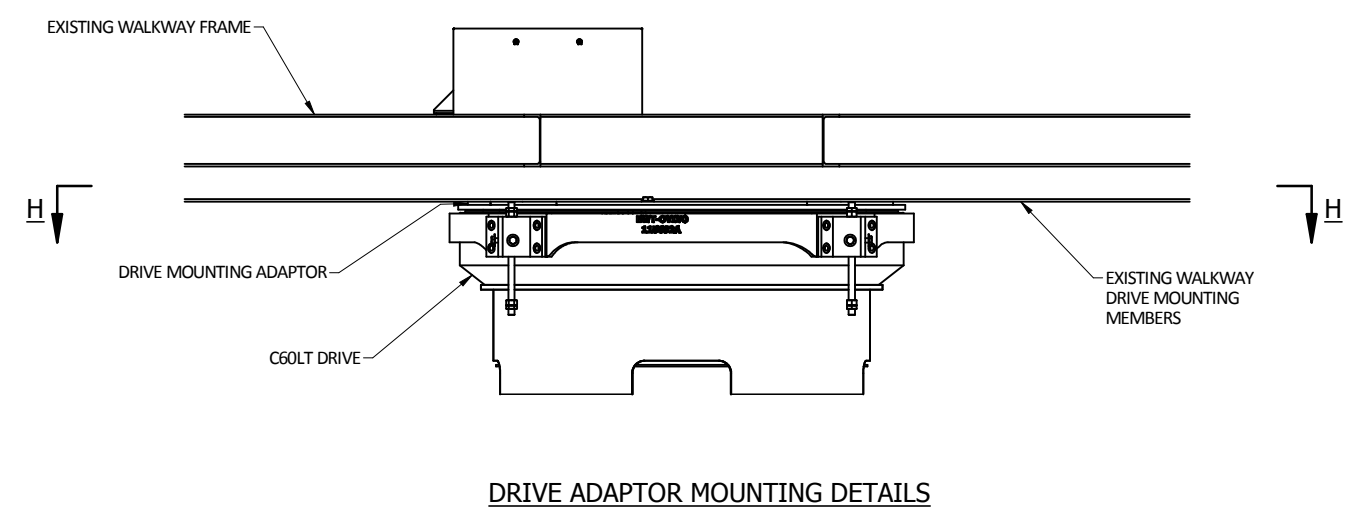
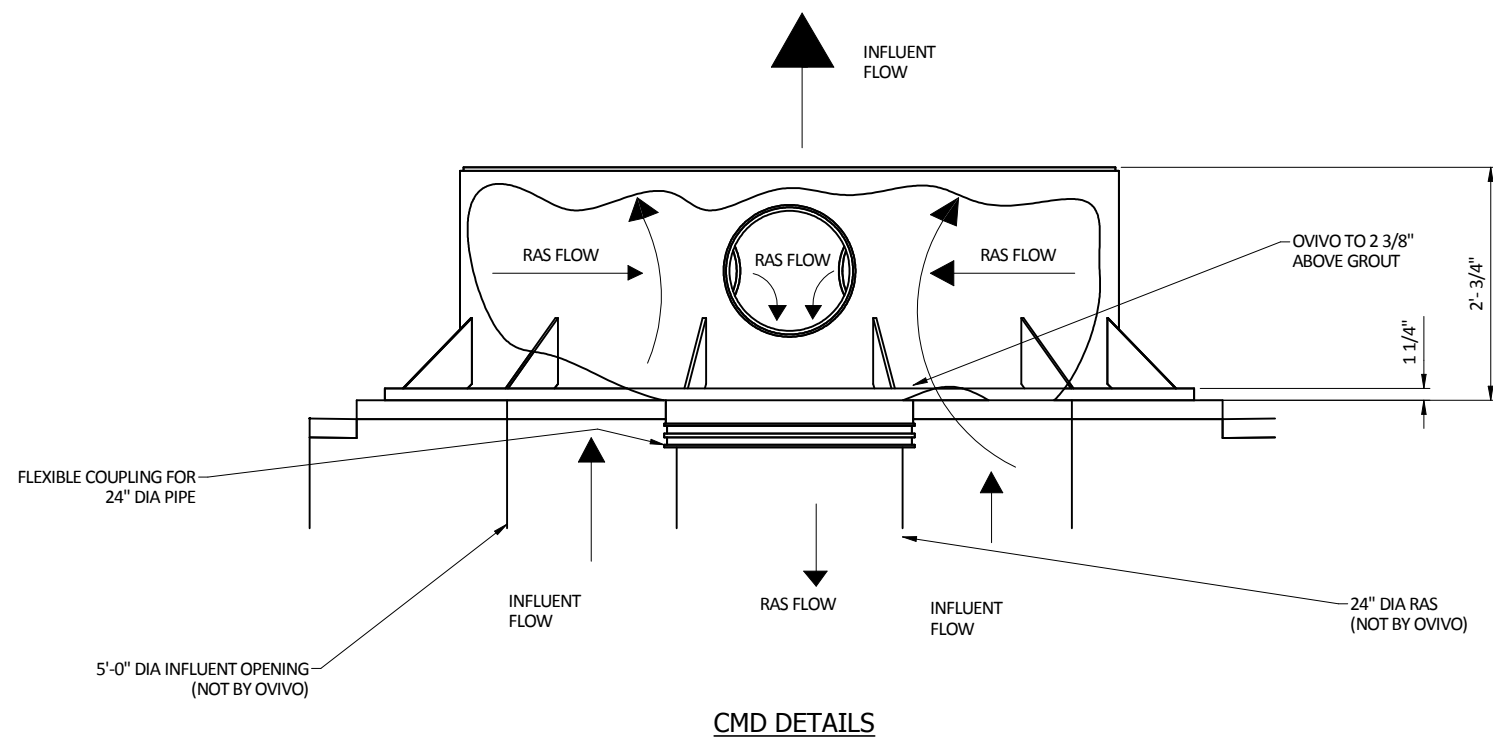
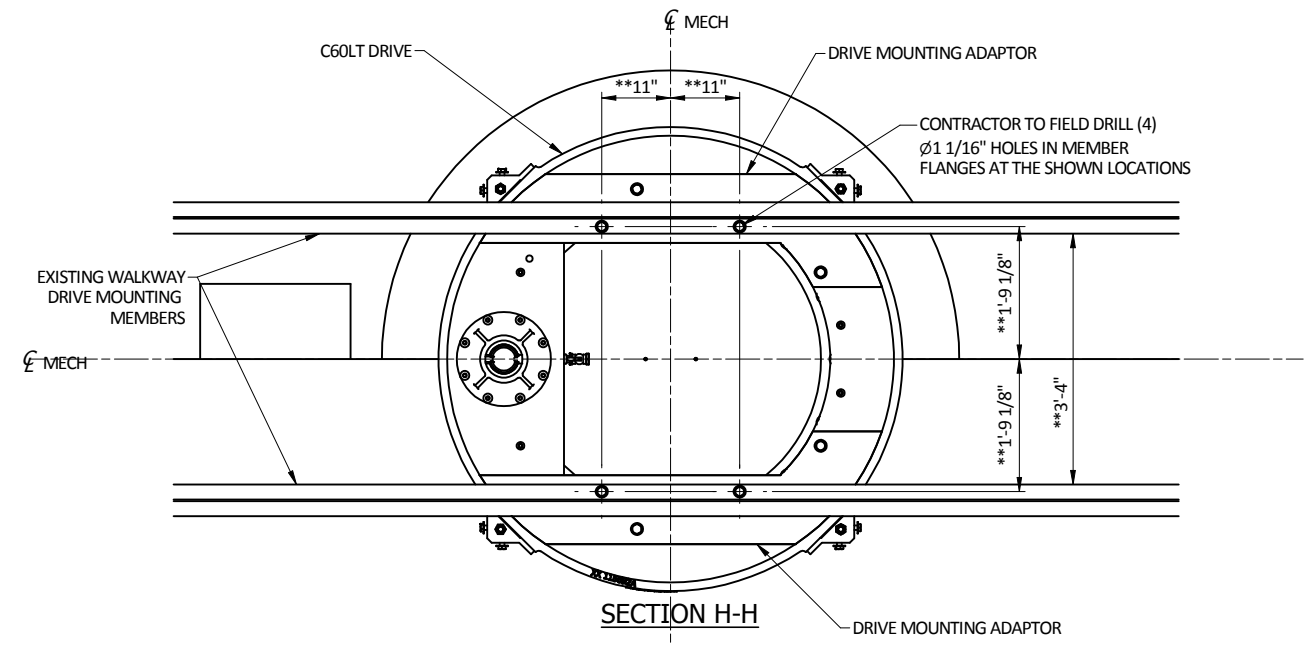
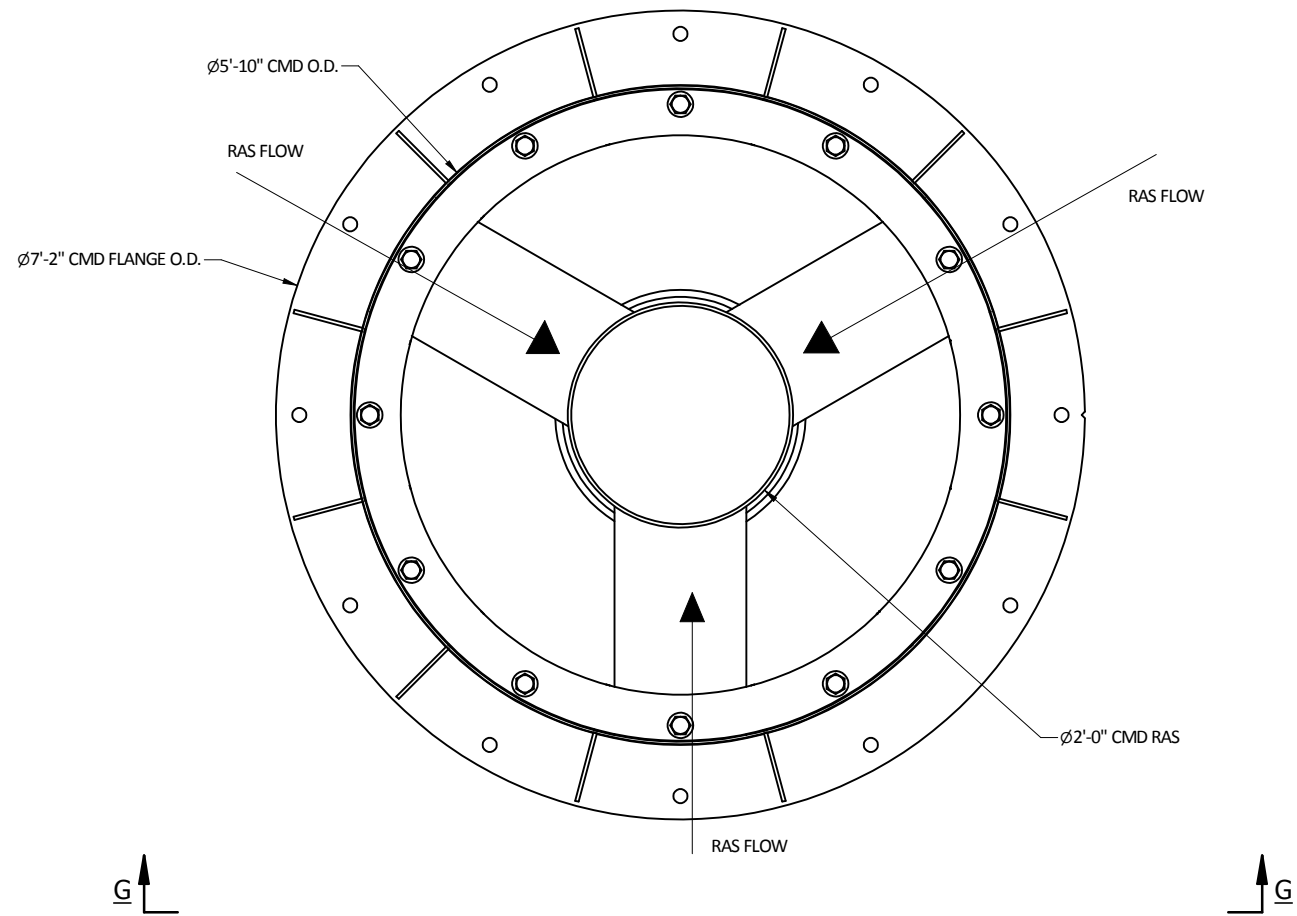
MANIFOLD DETAIL

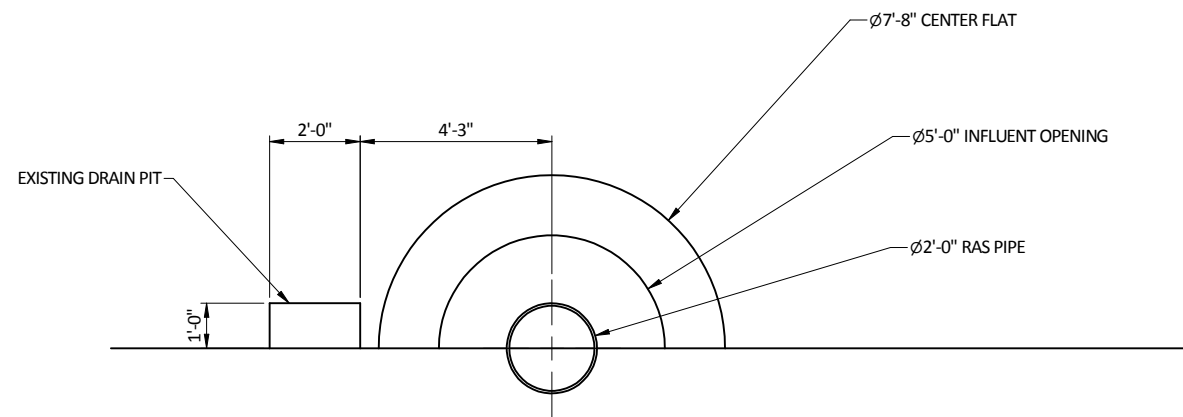


EDI PLAN VIEW

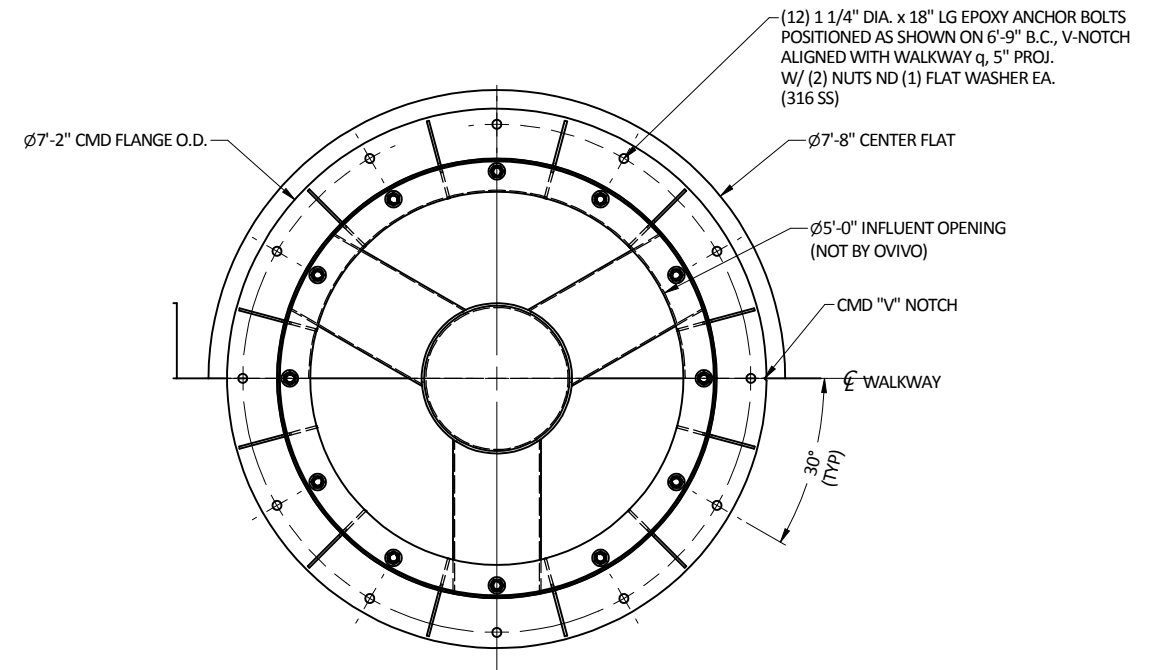


SECTION E-E

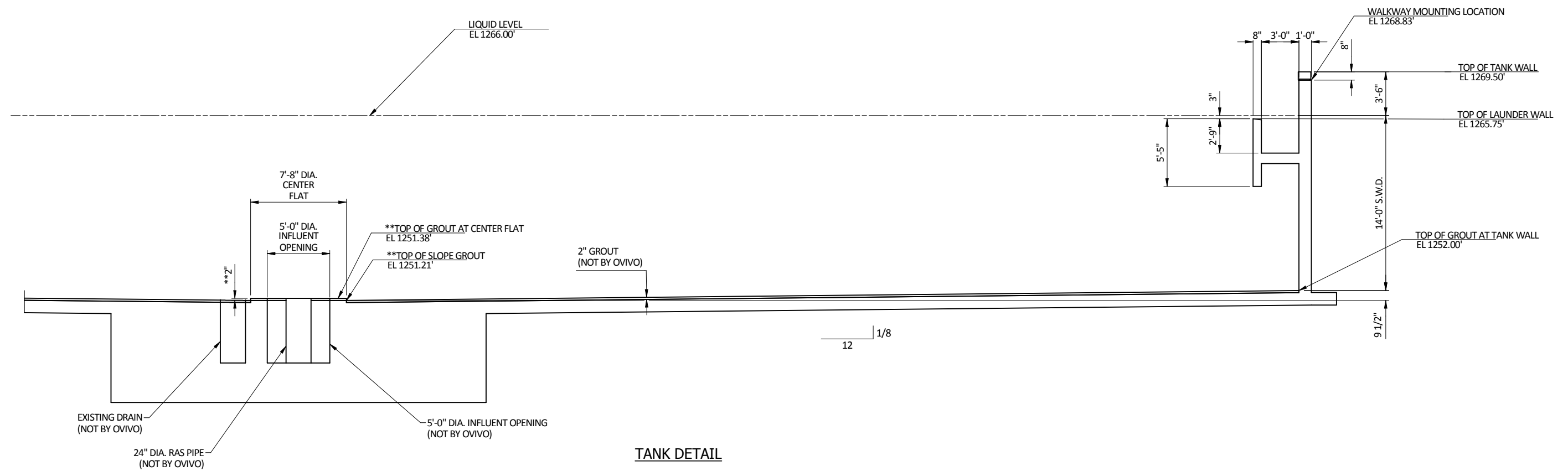




TANK CENTER DETAILS



CMD ANCHOR BOLT DETAIL



TANK DETAIL

FASTENER LIST

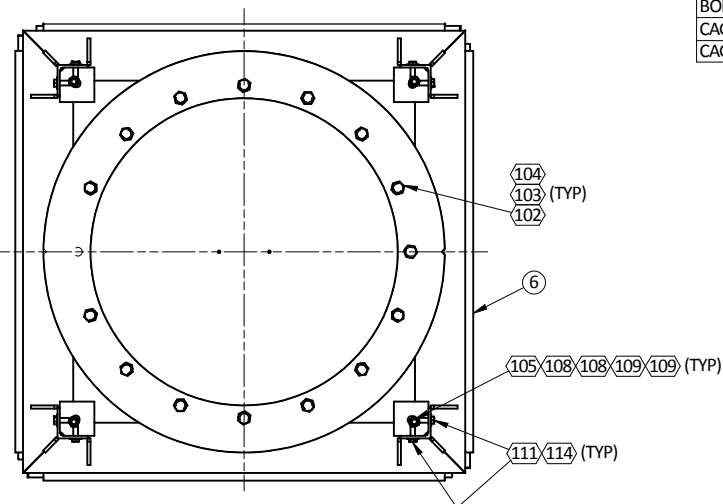
| ITEM | QTY | DESCRIPTION | PART NUMBER | MATERIAL |
|------|-----|--------------------------------------|---------------------|----------|
| 101 | 12 | HEX HD CAPSCREW, 1 1/4-7 UNC x 4 | HCS20UNCX064-316SS | 316 SS |
| 102 | 15 | HEX HD CAPSCREW, 1 1/4-7 UNC x 3 1/2 | HCS20UNCX056-316SS | 316 SS |
| 103 | 27 | PLAIN WASHER, 1 1/4 - SMALL OD | PNW20A-316SS | 316 SS |
| 104 | 15 | HEX NUT, 1 1/4-7 UNC | HXN20UNC-316SS | 316 SS |
| 105 | 4 | THREADED ROD, 1-8 UNC x 18 | C60-16UNCX288-316SS | 316 SS |
| 106 | 8 | HEX HD CAPSCREW, 1-8 UNC x 2 1/2 | HCS16UNCX040-316SS | 316 SS |
| 107 | 12 | PLAIN WASHER, 1 - SMALL OD | PNW16A-316SS | 316 SS |
| 108 | 12 | HEX NUT, 1-8 UNC | HXN16UNC-316SS | 316 SS |
| 109 | 8 | HEX JAM NUT, 1-8 UNC | JHN16UNC-316SS | 316 SS |
| 110 | 8 | HEX HD CAPSCREW, 3/4-10 UNC x 2 1/2 | HCS12UNCX040-316SS | 316 SS |
| 111 | 16 | HEX HD CAPSCREW, 3/4-10 UNC x 2 | HCS12UNCX032-316SS | 316 SS |
| 112 | 16 | HEX HD CAPSCREW, 3/4-10 UNC x 1 1/2 | HCS12UNCX024-316SS | 316 SS |
| 113 | 32 | PLAIN WASHER, 3/4 - SMALL OD | PNW12A-316SS | 316 SS |
| 114 | 8 | PLAIN WASHER, 3/4 - LARGE OD | PNW12B-316SS | 316 SS |
| 115 | 32 | HEX NUT, 3/4-10 UNC | HXN12UNC-316SS | 316 SS |
| 116 | 22 | HEX HD CAPSCREW, 5/8-11 UNC x 1 1/2 | HCS10UNCX024-316SS | 316 SS |
| 117 | 22 | PLAIN WASHER, 5/8 - SMALL OD | PNW10A-316SS | 316 SS |
| 118 | 22 | HEX NUT, 5/8-11 UNC | HXN10UNC-316SS | 316 SS |

REFERENCE DRAWINGS

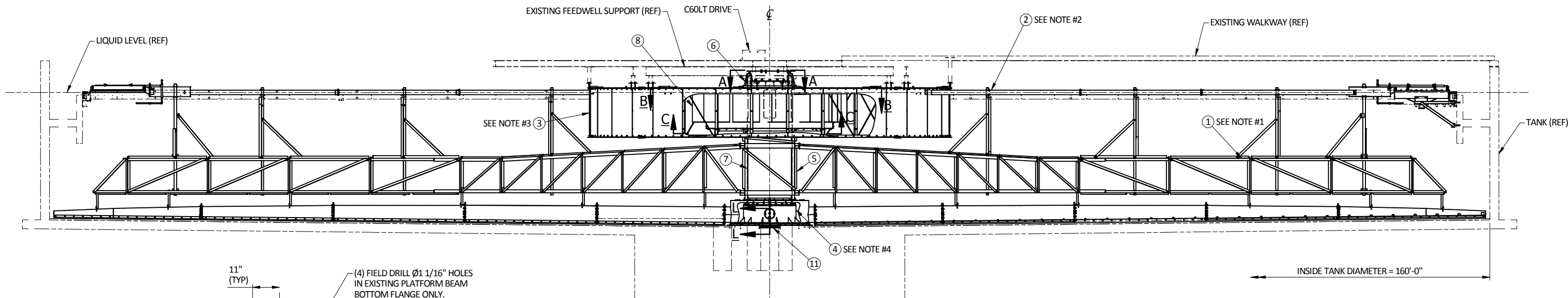
| DESCRIPTION | DRAWING NO. |
|---------------------------------|-------------|
| BOLT TORQUE CHART | 114808 |
| CAGE TO C60 LT DRIVE CONNECTION | 697584 |
| CAGE TO CAGE CONNECTION | 697580 |

BILL OF MATERIAL

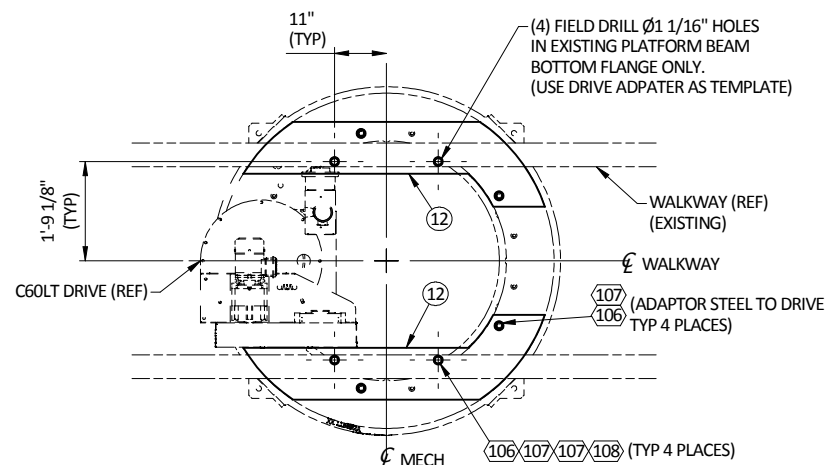
| ITEM | QTY | MATERIAL | DESCRIPTION | PART NUMBER | DRAWING NO. | WEIGHT | |
|------|-----|----------|--------------------------------|--------------|--------------|---------------------|--------------|
| 1 | 1 | AS NOTED | RAKE ARM ERECTION | CSW1517-152 | CSW1517-152 | | |
| 2 | 1 | AS NOTED | SKIMMING ERECTION | CSW1517-153 | CSW1517-153 | | |
| 3 | 1 | AS NOTED | FEEDWELL ERECTION | CSW1517-155 | CSW1517-155 | | |
| 4 | 1 | AS NOTED | MANIFOLD ERECTION | CSW1517-156 | CSW1517-156 | | |
| 5 | 1 | STEEL | LOWER CAGE | CSW1517-161A | CSW1517-161 | 1995 | |
| 6 | 1 | STEEL | UPPER CAGE | CSW1517-161C | CSW1517-161 | 978 | |
| 7 | 1 | STEEL | INFLUENT COLUMN | CSW1517-162 | CSW1517-162 | 2880 | |
| 8 | 2 | STEEL | DISPERSION WELL (HALF SECTION) | CSW1517-167 | CSW1517-167 | 4097 | |
| 9 | 4 | STEEL | EDI SUPPORT | CSW1517-185 | CSW1517-185 | 329 | |
| 10 | 1 | STEEL | CMD | CSW1517-196 | CSW1517-196 | 1714 | |
| 11 | 1 | PVC | FLEXIBLE COUPLING | CSW1432-1162 | CSW1432-1162 | | |
| 12 | 2 | STEEL | DRIVE ADAPTER | CSW1517-171 | CSW1517-171 | 184 | |
| | | | | | | TOTAL WEIGHT | 12177 |



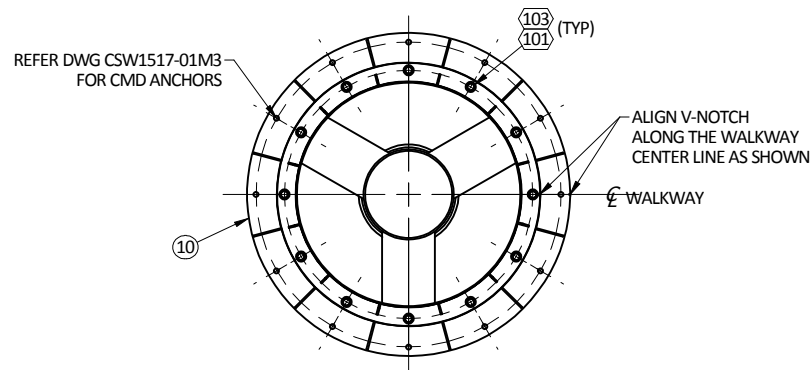
SECTION A-A
(DRIVE MOUNTING DETAILS)



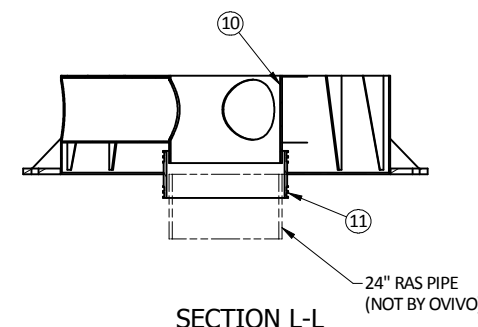
ELEVATION VIEW



ADAPTER TO PLATFORM MOUNTING DETAILS



CMD FLANGE ORIENTATION



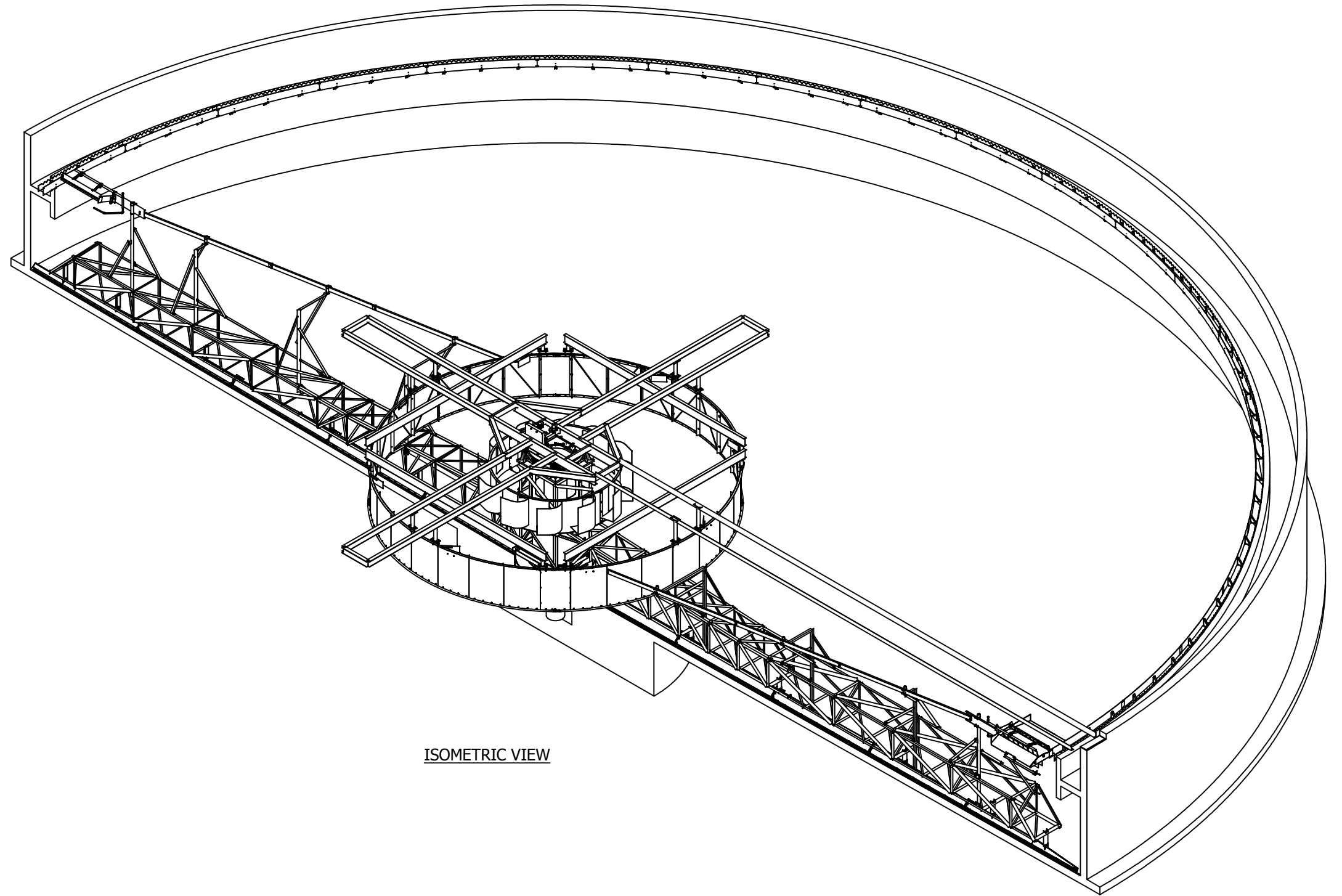
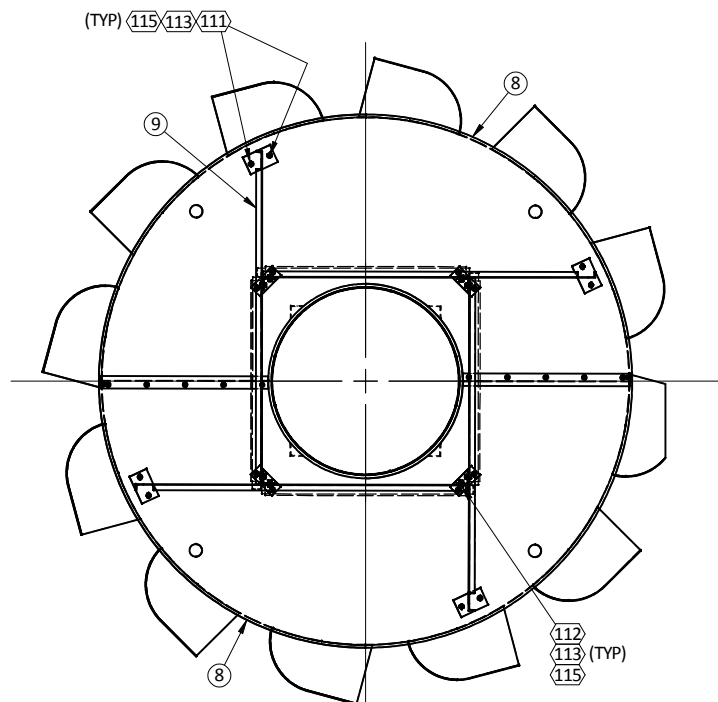
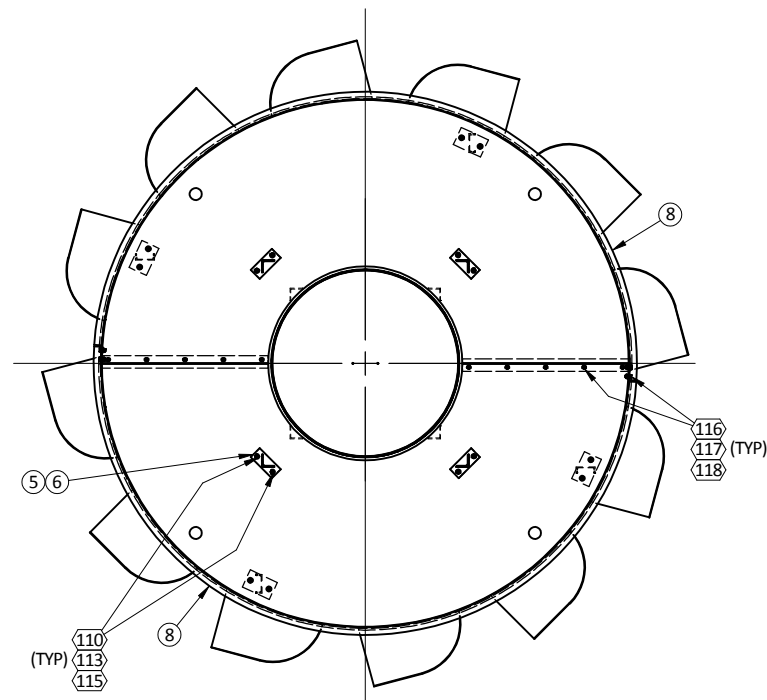
SECTION L-L

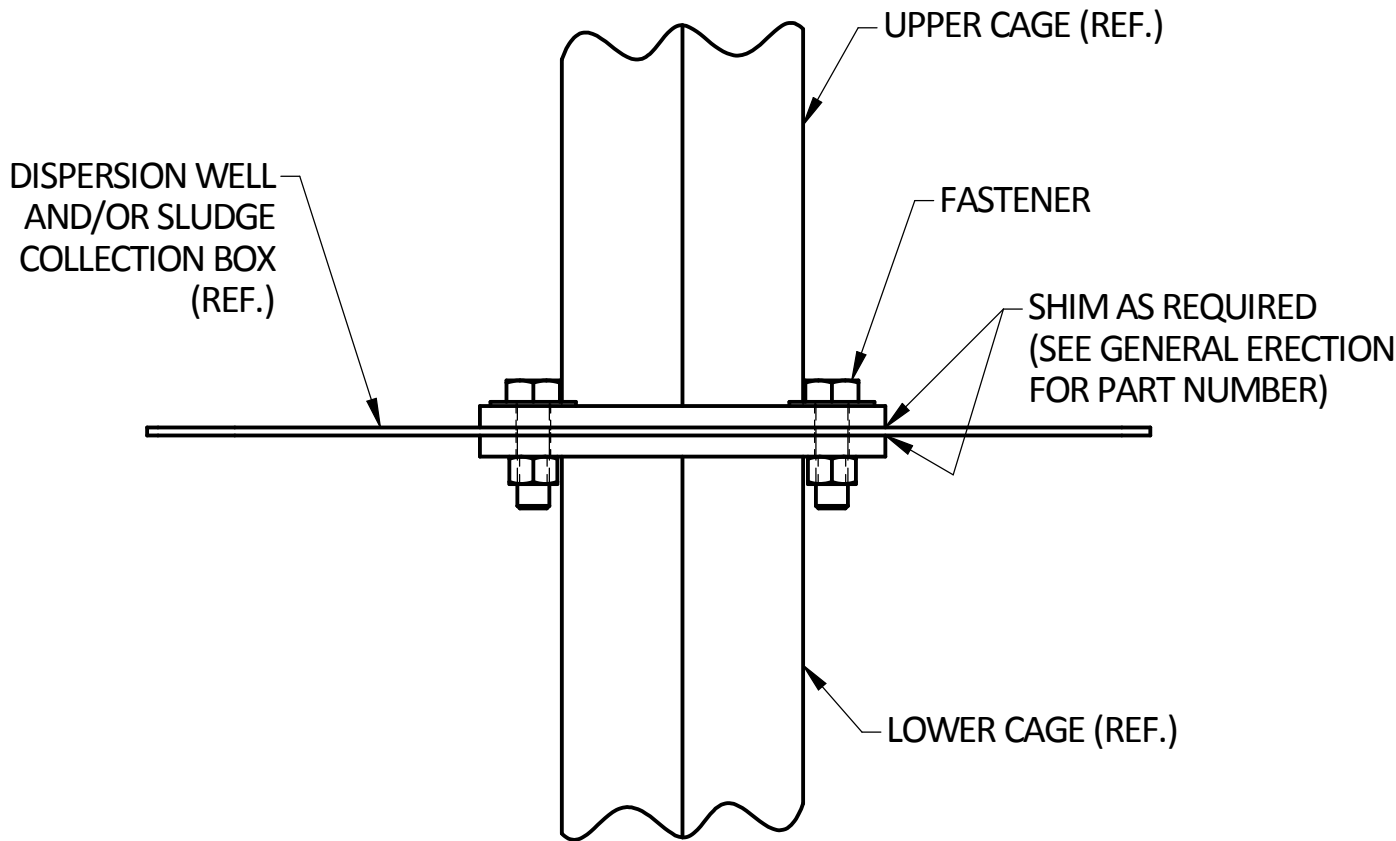
NOTES:

- FOR ERECTION OF RAKE ARMS AND DUCTS AND SQUEEGEES, REFER DWG. NO. CSW1517-152.
- FOR ERECTION OF SKIMMING MECHANISM, REFER DWG. NO. CSW1517-153.
- FOR ERECTION OF FEEDWELL, REFER DWG. NO. CSW1517-155.
- FOR ERECTION OF MANIFOLD, REFER DWG. NO. CSW1517-156.
- THE INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS MANUAL MUST BE STUDIED PRIOR TO STARTING THE ERECTION OF THIS EQUIPMENT.
- AT BOLTED JOINTS, ALL SURFACES MUST BE FREE OF LOOSE MILL SCALE, BURRS AND FOREIGN MATERIAL.
- BOLTS TO BE TIGHTENED PER THE TORQUE METHOD DESCRIBED BOLT TORQUE CHART DRAWING 114808.
- TO PREVENT GALLING, AN ANTISEIZE COMPOUND IS RECOMMENDED FOR USE ON STAINLESS STEEL FASTENERS (NOT BY OVIVO).

| | | | | |
|---|--|--|--|--|
| D SIZE SHEET (DO NOT SCALE PRINTS) DRAWN BY: NPR CHECKED BY: EMH DATE: 01/07/2021 PROJECT: CSW0001517-01 REF: CSW1261-151 | | GENERAL ERECTION Ø160'-0" TANK, C3D-CLARIFIER W/ C60LT DRIVE | | |
| | | 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. | | |
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| | | CSW1517-151 | | |

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



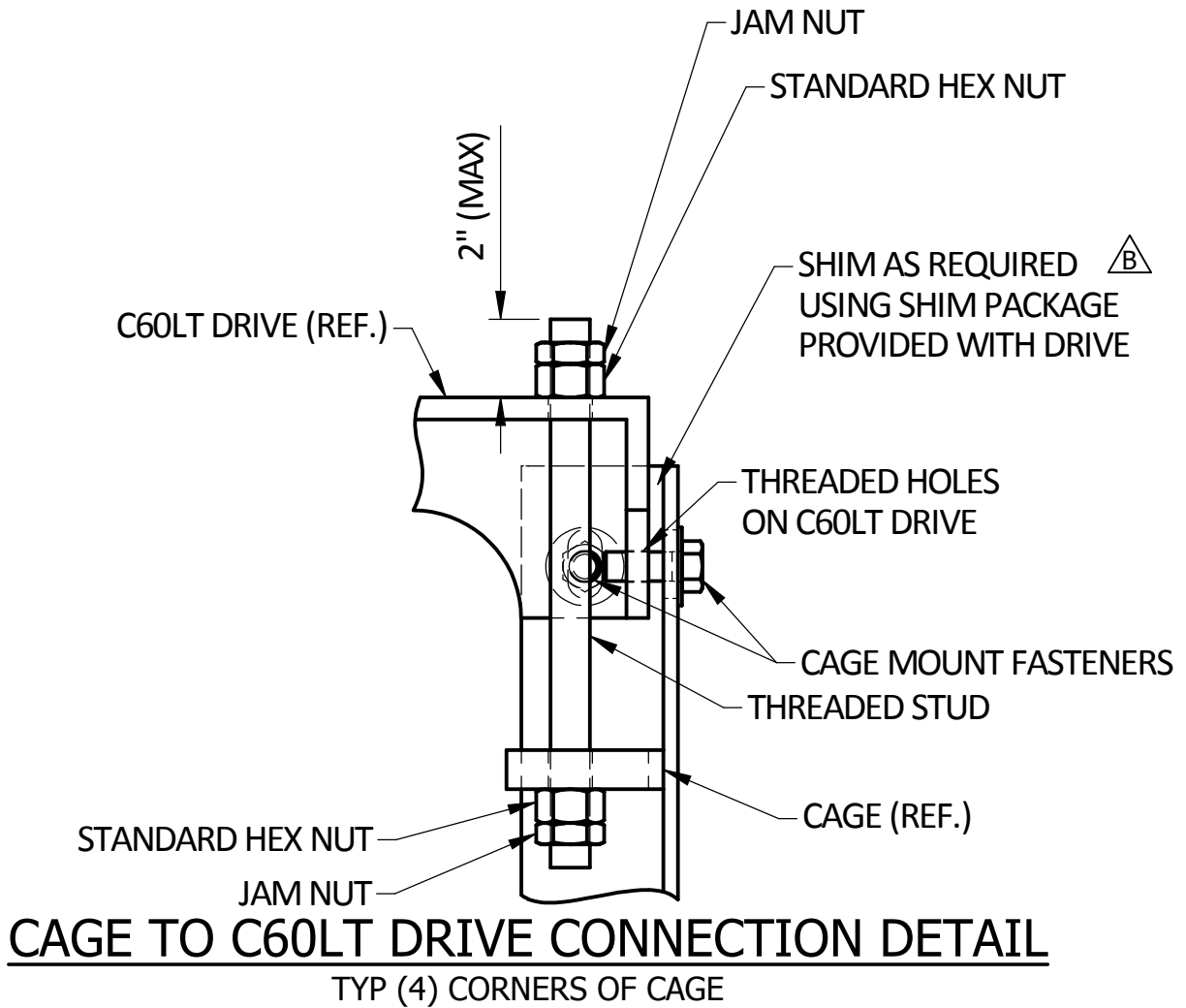


CAGE TO CAGE CONNECTION DETAIL

NOTE:

1. WORK THIS DRAWING WITH GENERAL ERECTION DRAWING.

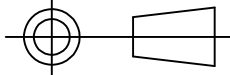

| | | | | | | | | | |
|--|----------------------------|-------------------------------------|--|----------|---------------|----------|---------------|--|--|
| INITIAL RELEASE | | | | | | A | | | |
| REVISION DESCRIPTION | | EN/ECO | BY | CHECK'D | DATE | REV | | | |
| A | THIRD ANGLE PROJECTION | | Bringing water to life | | | | | | |
| ©COPYRIGHT 2010 GLV ALL RIGHTS RESERVED - REV E | | | ERECTION DETAIL FOR CAGE TO CAGE CONNECTION | | | | | | |
| 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 | | | | | | | | | |
| REF. FROM | 537922 | DO NOT SCALE PRINTS | | | | | | | |
| DATE (mm/dd/yyyy) | 7/29/2015 | WORKMANSHIP STANDARD ES0001 APPLIES | | | | | | | |
| DRAWN | BLC | ORIGINAL S.O. | | DWG. NO. | 697580 | | | | |
| CHECK'D | TWB | STANDARD | | SHEET | | | 1 OF 1 | | |
| | | | | | REV | A | | | |



NOTE:

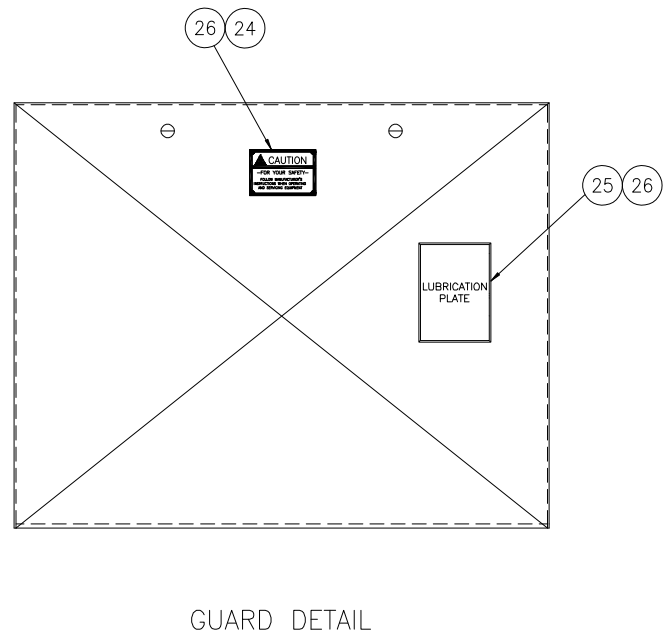
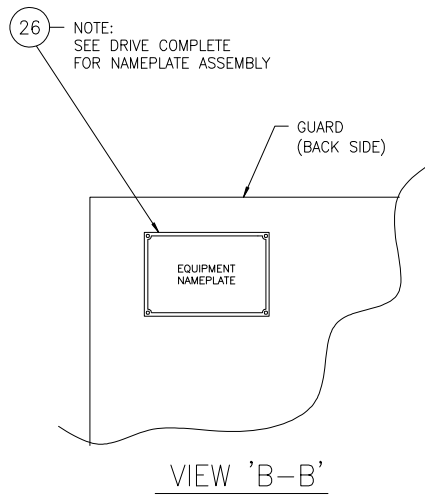
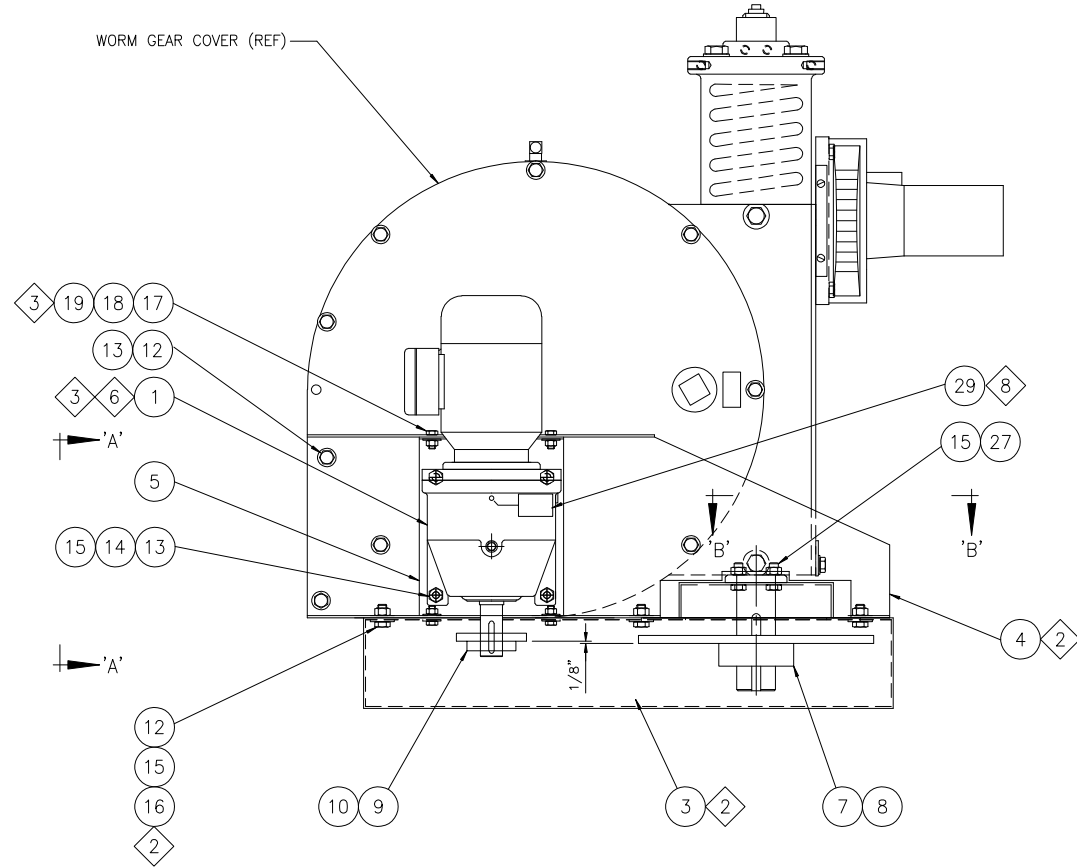
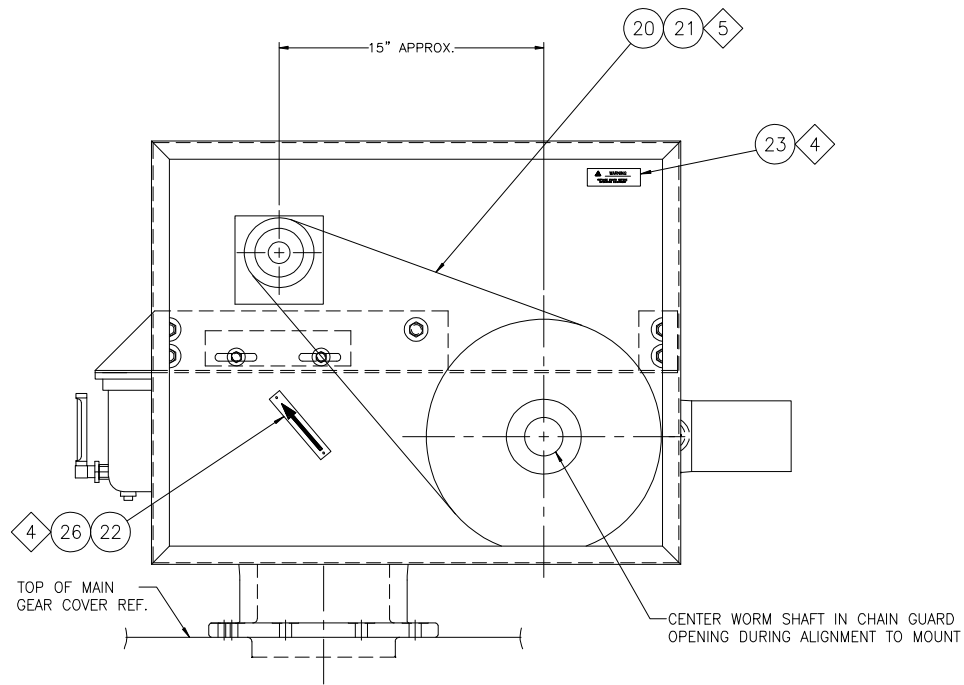
1. WORK THIS DRAWING WITH THE GENERAL ERECTION DRAWING.

| | | | | | |
|--|----------|-----|---------|-----------|-----|
| UPDATE FOR SHIMS TO BE PROVIDED WITH DRIVE | S-008397 | SCF | BLC | 12/4/2015 | B |
| INITIAL RELEASE | | | | | A |
| REVISION DESCRIPTION | EN/ECO | BY | CHECK'D | DATE | REV |

| | | | | | |
|--|---|---|--|----------|---------------|
| A |  THIRD ANGLE PROJECTION |  Bringing water to life | | | |
| ©COPYRIGHT 2010 GLV ALL RIGHTS RESERVED - REV E | | ERECTION DETAIL FOR CAGE TO C60LT DRIVE | | | |
| 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 | | | | | |
| REF. FROM | 537909 | DO NOT SCALE PRINTS | | DWG. NO. | 697584 |
| DATE (mm/dd/yyyy) | 7/30/2015 | WORKMANSHIP STANDARD ES0001 APPLIES | | | |
| DRAWN | BLC | ORIGINAL S.O. | | SHEET | 1 OF 1 |
| CHECK'D | TWB | STANDARD | | | |

| ITEM | QTY. | DESCRIPTION | MATERIAL | PART NO. | DRAWING NO. |
|------|------|---|----------|------------|-------------|
| 1 | 1 | GEARMOTOR, 2.0 HP, 45 RPM | - | 769678 | 769678 |
| 3 | 1 | GUARD, CHAIN, 18 GA. | GALV | 1108491-01 | 1108491 |
| 4 | 1 | GEARMOTOR MOUNT, DRIVE | 304SS | 699115A | 699115 |
| 5 | 1 | GEARMOTOR MOUNT, REDUCER | 304SS | 699115B | 699115 |
| 7 | 1 | SPROCKET, CHAIN, TAPER-LOCK, 54T, #60 | - | 86143AF | 86143 |
| 8 | 1 | BUSHING, TAPER-LOCK, ø2 3/16" BORE, #2517 | - | 85853S | 85853 |
| 9 | 1 | SPROCKET, CHAIN, TAPER-LOCK, 17T, #60 | - | 86143J | 86143 |
| 10 | 1 | BUSHING, TAPER-LOCK, ø1 3/8" BORE, #1610 | - | 85844U | 85844 |
| 12 | 9 | CAPSCREW, HX HD, 1/2-13UNCx1" | 304SS | F24337 | N/A |
| 13 | 8 | WSHR, PLN, TYPE A-N, 1/2" | 304SS | F50474 | N/A |
| 14 | 4 | CAPSCREW, HX HD, 1/2-13UNCx 1 3/4" | 304SS | F17171 | N/A |
| 15 | 11 | NUT, HX, 1/2-13UNC | 304SS | F50473 | N/A |
| 16 | 5 | WSHR, PLN, TYPE A-W, 1/2" | 304SS | M025311 | N/A |
| 17 | 4 | CAPSCREW, HX HD, 3/8-16x1" | 304SS | F50443 | N/A |
| 18 | 6 | WSHR, PLN TYPE A-W, 3/8" | 304SS | F17174 | N/A |
| 19 | 4 | NUT, HX, 3/8-16UNC | 304SS | F12042 | N/A |
| 20 | 87 | CHAIN, ROLLER, #60 | - | 86603H | 86603 |
| 21 | 1 | CHAIN, ROLLER, #60, CONN LINK | - | 86605H | 86605 |
| 22 | 1 | PLATE, INSTRUCTION ARROW | - | 84640A | 84640 |
| 23 | 1 | NAMEPLATE, INSTRUCT., WARNING | - | 852263A | 852263 |
| 24 | 1 | SIGN, CAUTION | - | 204181A | 204181 |
| 25 | 1 | LUBE SPEC/INSTRUC PLATE | SS | 560128 | 560128 |
| 26 | 14 | RIVET, POP #44, 1/8 X .188-.250 | AL | F50573 | N/A |
| 27 | 2 | CAPSCREW, HX HD, 1/2-13UNCx1 1/4" | 304SS | F24599 | N/A |
| 29 | 1 | LUBRICANT WARNING TAG | VINYL | 766886 | 766886 |

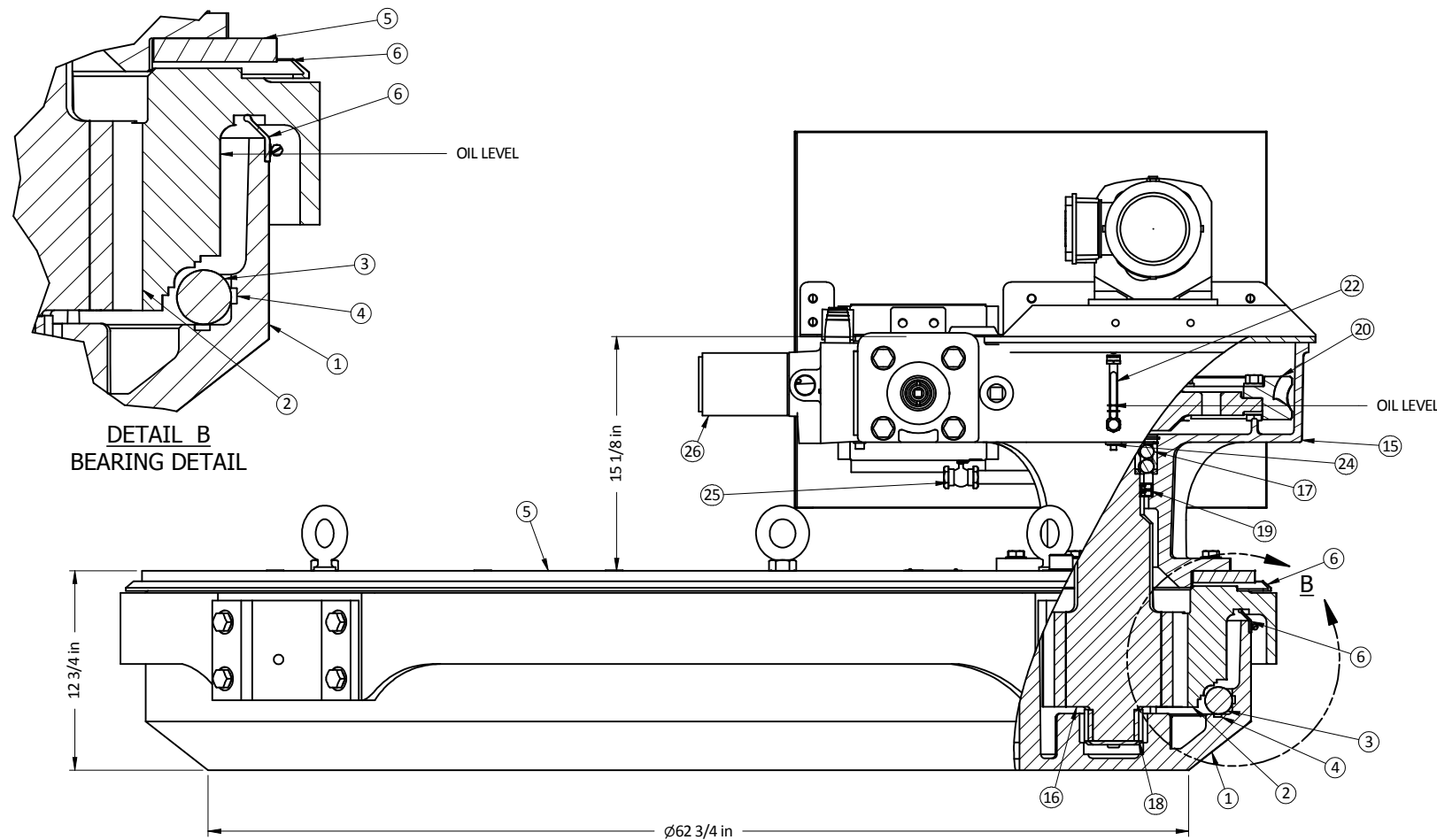
APPROX. TOTAL WEIGHT = 200 LBS.



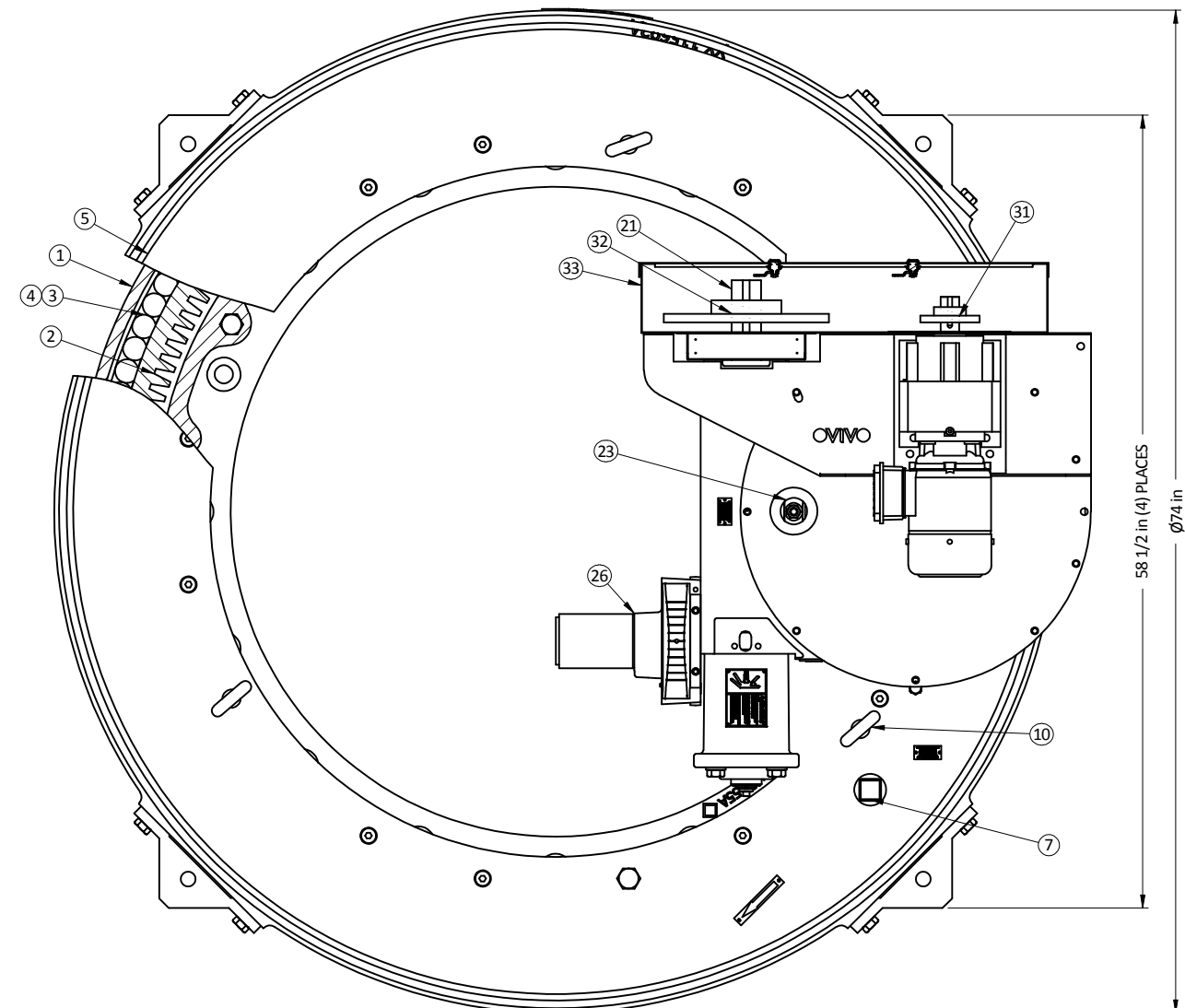
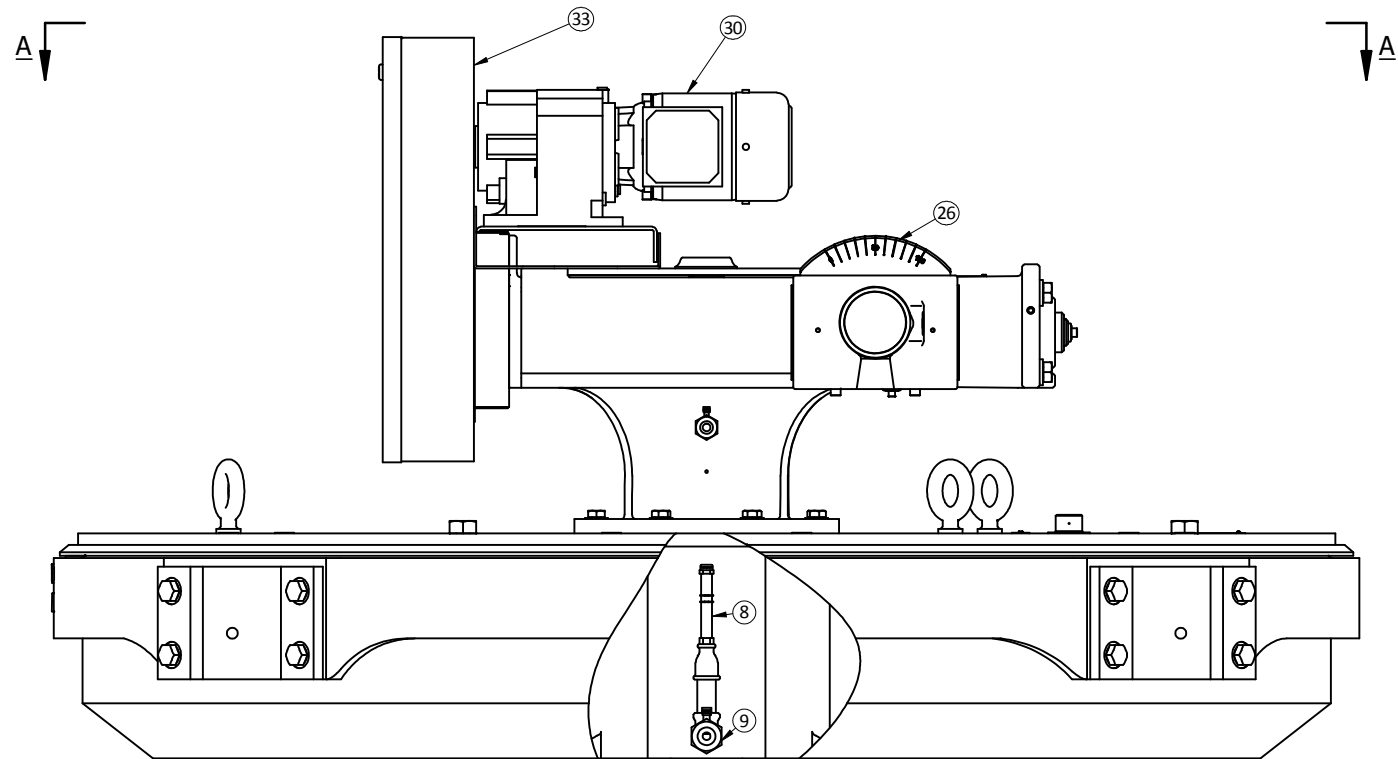
- NOTES:
- DRIVE CONFIGURATION AS SHOWN FOR ILLUSTRATION ONLY. REFER TO THE BASIC DRIVE ASSEMBLY FOR WORM GEAR ORIENTATION.
 - BOLT GEARMOTOR MOUNT ITEM (4) TO WORM COVER. POSITION CHAIN GUARD, ITEM (3) NEXT TO GEARMOTOR MOUNT AS SHOWN, CENTERING WORM SHAFT IN OPENING. BE SURE CHAIN GUARD IS LEVEL AND SQUARE. MATCH MARK MOUNTING HOLES FROM MOTOR MOUNT, DRILL HOLES IN CHAIN GUARD. FASTEN CHAIN GUARD TO MOTOR MOUNT WITH FASTENERS PROVIDED.
 - BOLT REDUCER, ITEM (1) TO DRIVE MOUNT ITEM (5) AND THEN BOLT TO MOTOR MOUNT ITEM (4). MOVE MOTOR TO THE MINIMUM CHAIN LENGTH POSITION BEFORE MEASURING CHAIN LENGTH. INSTALL BOTH SPROCKETS, WRAP CHAIN AROUND SPROCKETS AND CUT TO LENGTH.
 - PLACE INSIDE OF GUARD IN OBVIOUS POSITION. (NOT ON GUARD COVER)
 - CHAIN TENSION: SET SLACK TO 1/4 - 1/2" AT MID-SPAN.
 - REMOVE ALL DRAIN PLUG/S FROM MOTOR.
 - ANTI-SEIZE REQUIRED ON ALL FASTENERS. (NOT BY OVIVO)
 - ATTACH LUBRICANT WARNING TAG, ITEM (29), TO BREATHER ON GEARMOTOR, ITEM (1)

| | | | |
|---|--|------------------------------------|--|
| D <small>SIZE SHEET DO NOT SCALE PRINTS</small> <small>THIRD ANGLE PROJECTION</small> | MOTOR DRIVE ASSY | | OVIVO |
| | C60LT | | |
| <small>DRAWN BY</small> RJB <small>CHECKED BY</small> JLC <small>DATE</small> 8/27/21 <small>PROJECT</small> CSW0001517-01 <small>REF</small> RSW1163-133 | <small>THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION OF OVIVO AND ITS AFFILIATES AND IS NOT TO BE DISCLOSED NOR TO BE USED EXCEPT FOR PROPOSALS OF OVIVO OR INSTALLING, OPERATING OR MAINTAINING OVIVO EQUIPMENT UNLESS OTHERWISE AUTHORIZED IN WRITING BY OVIVO. UNCONTROLLED COPY IF PRINTED.</small> | | <small>SHEET</small> 1 OF 1 <small>REVISION</small> A |
| <small>INITIAL RELEASE</small> | <small>EN/ECO</small> - <small>BY</small> - <small>CHECK'D</small> - <small>DATE</small> --/-- | <small>DWG NO.</small> CSW1517-133 | |

| | | | | |
|-----------------|--------|----|---------|-------|
| INITIAL RELEASE | - | - | - | --/-- |
| REVISION | EN/ECO | BY | CHECK'D | DATE |

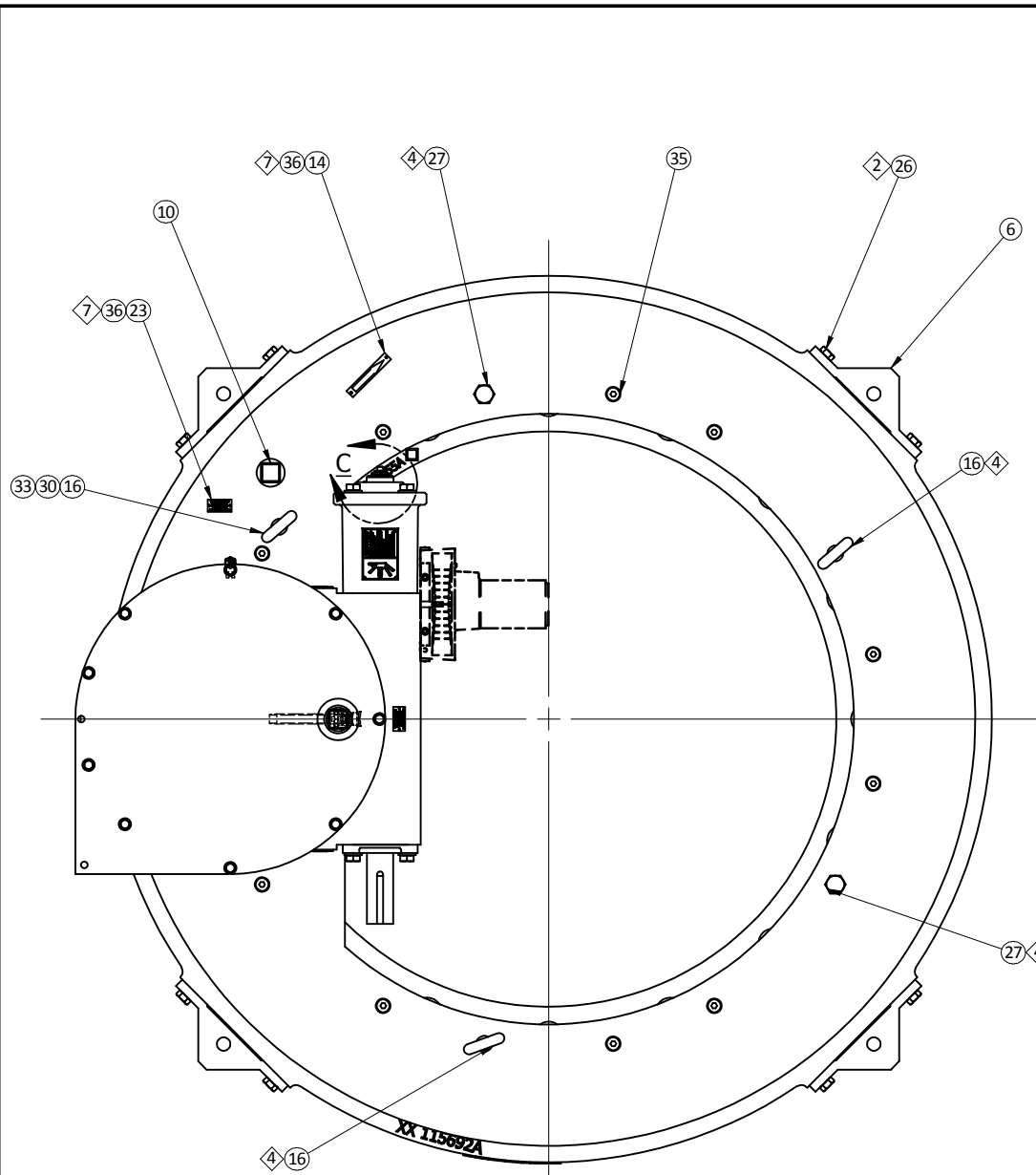


| MAIN GEAR ASSEMBLY | | WORM GEAR ASSEMBLY | | MOTOR DRIVE ASSEMBLY | |
|--------------------|---------------------------|--------------------|--------------------------------|----------------------|-----------------------|
| 1 | DRIVE BASE HOUSING | 15 | WORM GEAR HOUSING | 30 | GEARMOTOR |
| 2 | MAIN GEAR | 16 | MAIN PINION AND INTEGRAL SHAFT | 31 | DRIVE CHAIN SPROCKET |
| 3 | BEARING BALL | 17 | SPHERICAL ROLLER BEARING | 32 | DRIVEN CHAIN SPROCKET |
| 4 | BEARING STRIP LINER | 18 | ROLLER BEARING - LOWER PINION | 33 | OSHA GUARD |
| 5 | MAIN GEAR COVER | 19 | DUAL OIL SEALS | | |
| 6 | LIP SEAL | 20 | WORM GEAR | | |
| 7 | OIL FILL PLUG - MAIN GEAR | 21 | WORM AND SHAFT | | |
| 8 | OIL LEVEL SIGHT GAUGE | 22 | OIL LEVEL SIGHT GAUGE | | |
| 9 | OIL AND CONDENSATE DRAIN | 23 | OIL FILL PLUG - WORM GEAR | | |
| 10 | LIFTING EYE BOLTS | 24 | OIL DRAIN PLUG | | |
| | | 25 | CONDENSATE DRAIN | | |
| | | 26 | DRIVE CONTROL ASSEMBLY | | |



VIEW A-A
PLAN VIEW

| | | | | | | | | | | | | |
|---|----------|-----|---------|---------|-----|-----------------|-----------|-------------------------------------|---|------------------------|----------------------------|--------------|
| REDRAWN IN INVENTOR. UPDATE TITLE BLOCK | S-011093 | RJB | MSS | 6/29/17 | C | REF. FROM | - | DO NOT SCALE PRINTS | OVIVO Worldwide Experts in Water Treatment GENERAL ARRANGEMENT C60LT DRIVE UNIT | DWG. NO. 115711 | SHEET 1 OF 1 | REV C |
| UPDATED TITLE BLOCK / TO ACAD | 34818 | ABS | NBS | 1/7/09 | B | DATE (mm/yy/yy) | 9/10/1987 | WORKMANSHIP STANDARD ES0001 APPLIES | | | | |
| REDRAWN ON CAD | 99-0368 | TRS | JWT | 1/6/99 | A | DRAWN | JKM | ORIGINAL S.O. | NO. 115711 | 1 OF 1 | C | |
| REVISION DESCRIPTION | EN/ECO | BY | CHECK'D | DATE | REV | CHECK'D | GEN | STANDARD | | | | |



PLAN VIEW

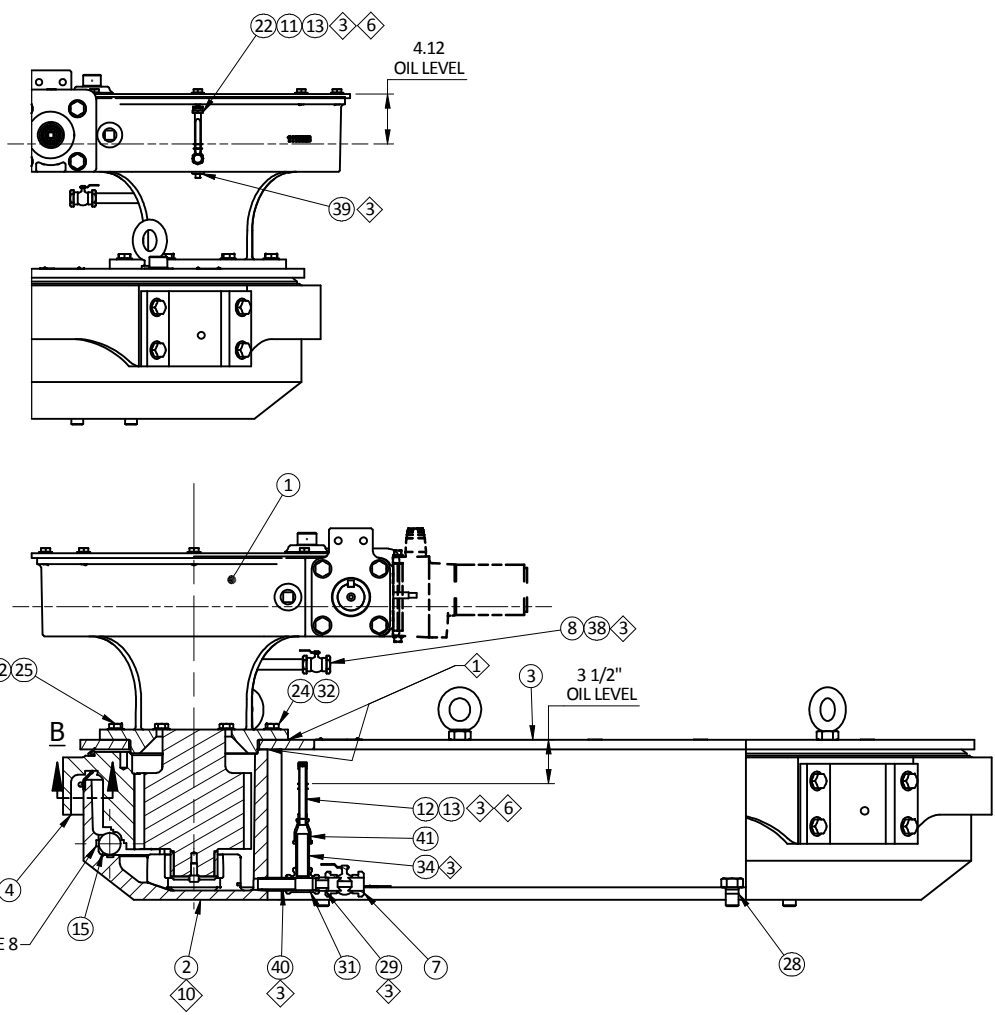
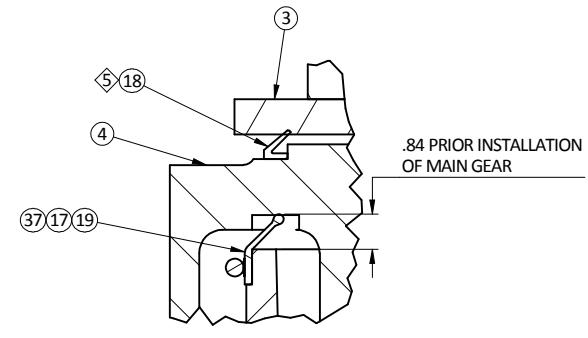
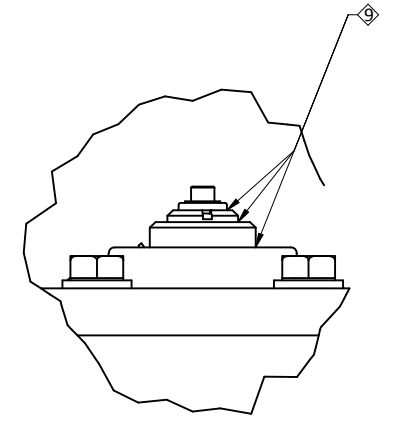


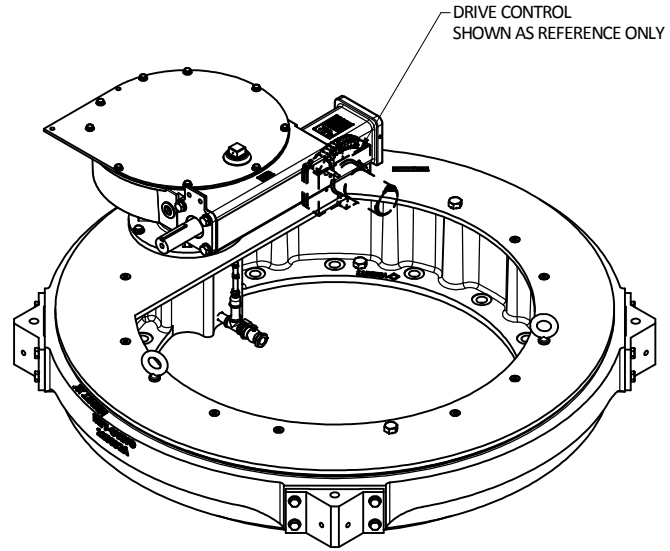
ILLUSTRATION VIEW



DETAIL B



DETAIL C



DRIVE CONTROL SHOWN AS REFERENCE ONLY

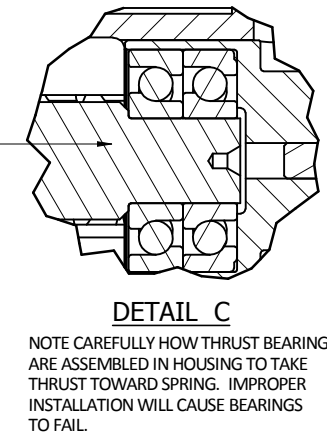
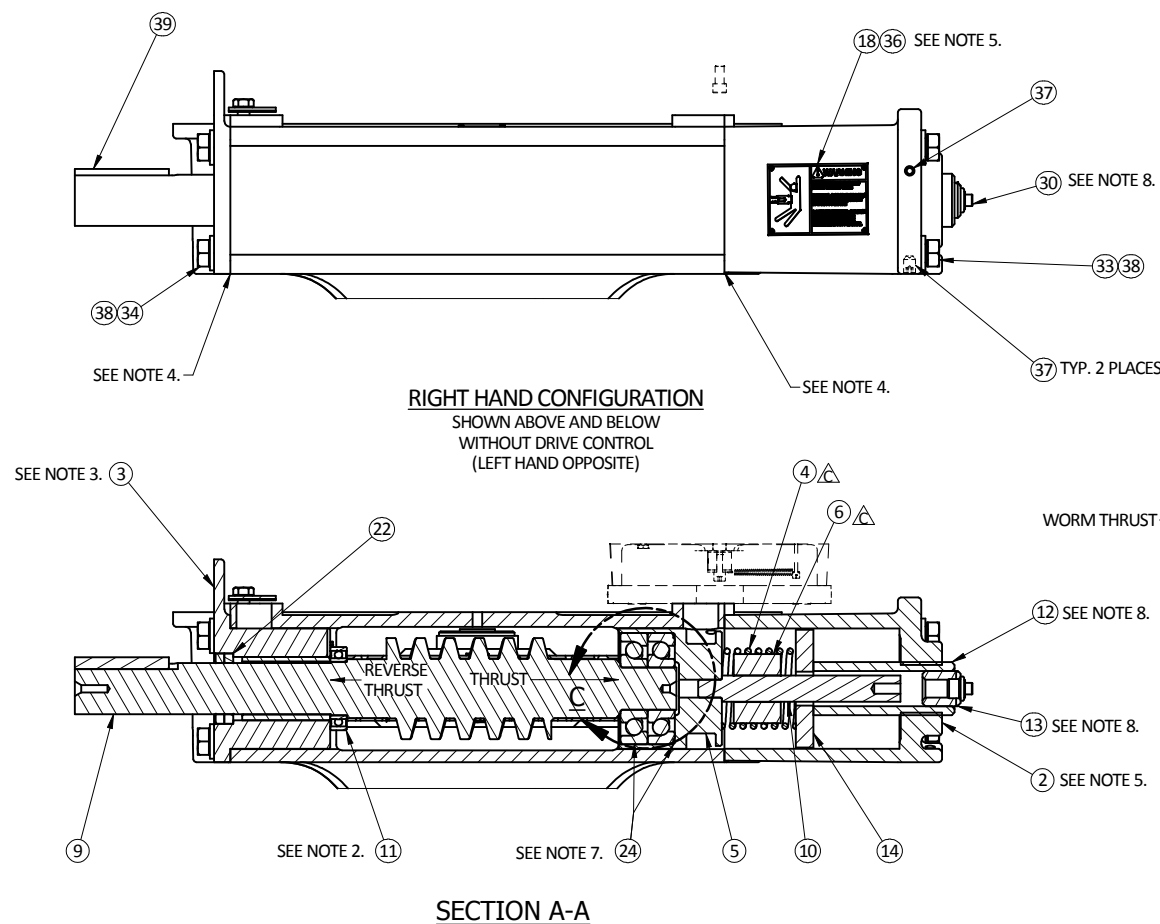
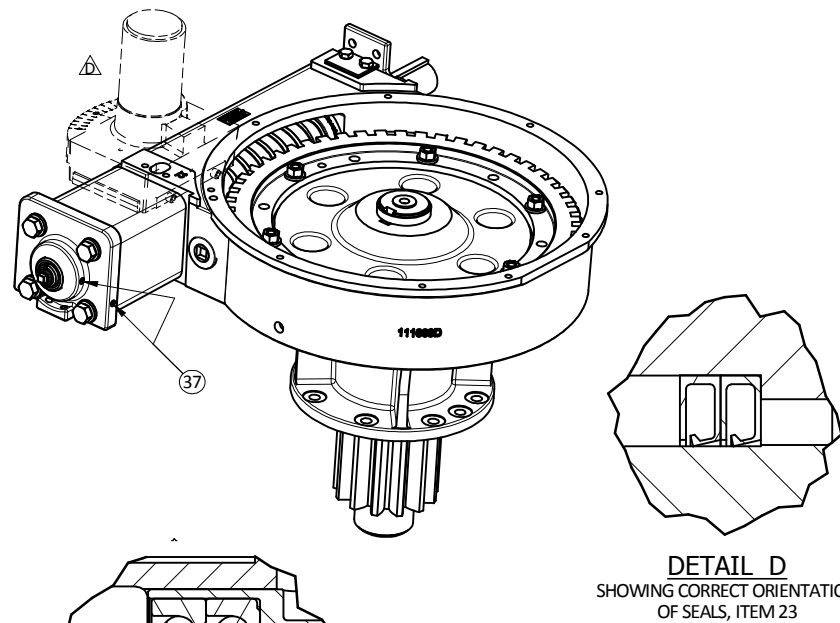
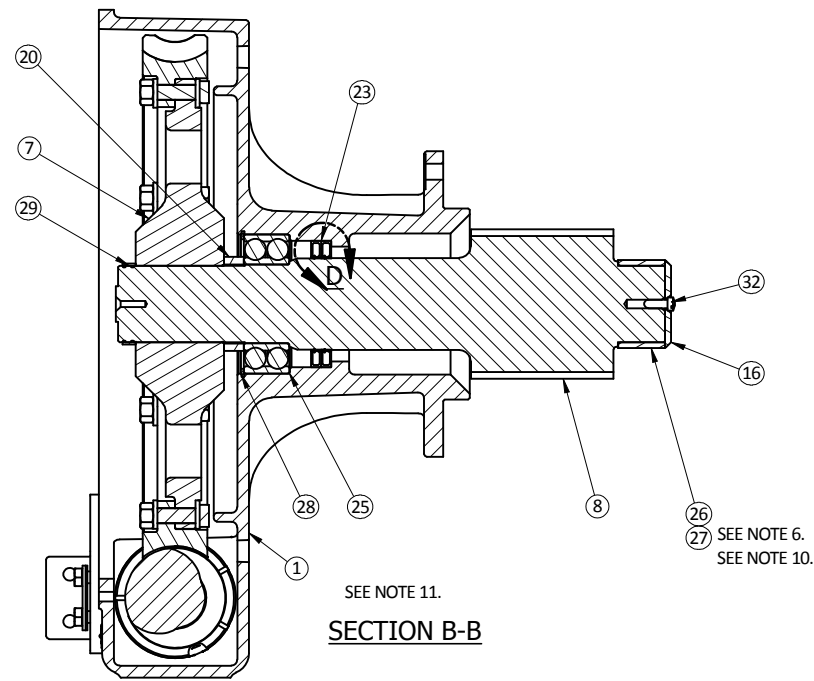
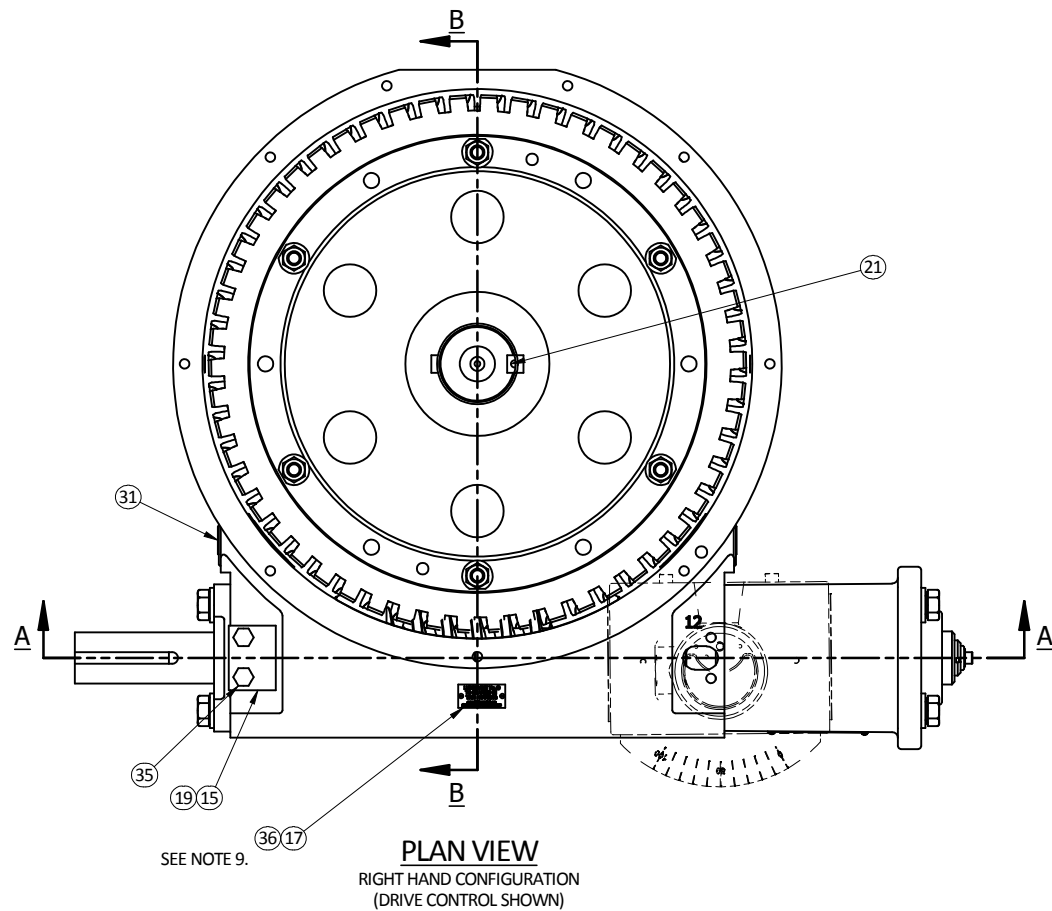
| ITEM | QTY | DESCRIPTION | MATERIAL | PART NUMBER | DRAWING NO. |
|------|-----|--|--------------------------|-------------|-------------|
| 1 | 1 | WORM GEAR ASSY, C60LT/HT, RH | | 678850-2 | 678850 |
| 2 | 1 | BASE, C60LT/HT | Cast Iron | 115655A1A | 115655-1 |
| 3 | 1 | COVER, MAIN GEAR, C60LT/HT | STEEL | 115656A | 115656 |
| 4 | 1 | MAIN GEAR | ASTM A536 GRADE 80-55-06 | 115692A1A | 115692-1 |
| 5 | 1 | COVER, WORM GEAR, C40LT/HT | | 203507A | 203507 |
| 6 | 4 | LUG, CORNER, CS, MACH, C60LT | Cast Steel | 204227A1A | 204227-1 |
| 7 | 1 | BALL VALVE, 3/4" NPT | BRONZE | 1148480-02 | 1148480 |
| 8 | 1 | BALL VALVE, 1/2" NPT | BRONZE | 24557A365A | 24557A365 |
| 9 | 1 | SCHIM PACKAGE, C60LT/HT/R | | 49115J | 49115 |
| 10 | 2 | PLUG, PIPE, VENTED, 2" NPT | 304 SS | 591914 | 591914 |
| 11 | 1 | BUSHING, HX, 1/2MPTx3/8FPT | 304 SS | 768199 | N/A |
| 12 | 1 | GAUGE, OIL, 3 17/32 SIGHT OPENING | BRASS | 767333 | 767333 |
| 13 | 4 | SNAP RING, 5/8" | ZINC | 767875 | 767875 |
| 14 | 1 | INSTRUCTION PLATE | SS | 84640A | 84640 |
| 15 | 119 | BEARING BALL 1 1/4" DIA. | CHROME STEEL | 85321W | 85321 |
| 16 | 3 | BOLT, LIFTING, EYE, 1"x2 1/2" | STEEL | 87549D | 87549 |
| 17 | 19 | CLAMP, BAND, 1/2 X .017 X FT | Stainless Steel | 88556C | 88556 |
| 18 | 19 | LIP SEAL | NEOPRENE (CC) | 88683C | 88683 |
| 19 | 19 | SEAL LIP | NEOPRENE (CC) | 88721C | 88721 |
| 20 | 16 | SPACER, STL, 11GA | STEEL | 88917A | 88917 |
| 21 | 16 | SPACER, STL, 16GA | STEEL | 88917C | 88917 |
| 22 | 1 | GAUGE, OIL, EL, 3/8" MPTx3-1/2" SIGHT | BRASS | 88931J | 88931 |
| 23 | 1 | LUBRICANT PLATE | SS | 903155A | 903155 |
| 24 | 4 | CAPSCREW, HX HD, 5/8-11x2-1/2 | STEEL | F10102 | N/A |
| 25 | 4 | CAPSCREW, HX HD, 5/8-11x1-1/2 | STEEL | F10106 | N/A |
| 26 | 16 | CAPSCREW, HX HD, GR5, 3/4-10x1 1/2" | STEEL | F10227 | N/A |
| 27 | 2 | CAPSCREW, HX HD, GR5, 1-8X 2" | GR5 STEEL | F10280 | N/A |
| 28 | 4 | 1-8 UNC x 3" CAPSCREW HEX BOLT | GR5 STEEL | F10282 | N/A |
| 29 | 1 | NIPPLE, SCH 40, 3/4MPTxCLOSE | 304 SS | 131990 | N/A |
| 30 | 1 | NUT, HEX, 1"-8 UNC | GR5 STEEL | F10869 | N/A |
| 31 | 1 | TEE, PIPE, STD, 3/4FPT | 304 SS | M019547 | N/A |
| 32 | 8 | WASHER, PLN, TYPE A-W, STL, 5/8x1-3/4X.134 | F844 | F11195 | N/A |
| 33 | 1 | WASHER, PLN TYPE, A-N, F844, 1" | STEEL | F11194 | N/A |
| 34 | 1 | NIPPLE, SCH 40, 3/4MPT X 3 1/2" | 304 SS | M030930 | N/A |
| 35 | 12 | CAPSCREW, SKT FLT HD, 5/8-11x1-1/2 | ALLOY STEEL | F12511 | N/A |
| 36 | 4 | SCREW, U DRIVE, 18-8-#4x1/4" | STEEL | F13749 | N/A |
| 37 | 8 | CLAMP WORM DRIVE, 300/400, 3/8 | Stainless Steel | F50245 | N/A |
| 38 | 1 | NIPPLE, SCH 40, 1/2MPTx6 | 304 SS | M028690 | N/A |
| 39 | 1 | PLUG, PIPE, SQ HD, 1/2" MPT, CORED | 304 SS | M030282 | N/A |
| 40 | 1 | NIPPLE, SCH 40, 3/4MPTx3 | 304 SS | M015636 | N/A |
| 41 | 1 | CPLG, RDCR, STD, 3/4x3/8FPT | 304 SS | 768198 | N/A |
| 42 | 9 | CAPSCREW, HX HD, 1/2-13UNCx1 | 304 SS | F24337 | N/A |
| 43 | 9 | WASHER, PLAIN TYPE A-N, 1/2" | 304 SS | F50474 | N/A |

NOTES:

- 1. APPLY ULTRA BLUE RTV-SILICONE TO CONNECTIONS INDICATED TO OBTAIN A LIQUID TIGHT SEAL.
- 2. TORQUE CAPSCREWS, ITEM 26, TO 140 ± 10 FT-LB LUBRICATED.
- 3. APPLY PIPE THREAD SEALANT TO ALL PIPE JOINTS.
- 4. THESE FASTENERS MAY BE REMOVED AT FIELD ERECTION AND REPLACED WITH STRUCTURAL FASTENERS FOR WALKWAY OR PLATFORM.
- 5. FOR INSTALLATION OF ITEM 18, SEE DRAWING 48643.
- 6. USE SNAP RINGS (ITEM 13) ON SIGHT GLASS METAL CASTING OF ITEMS 12 & 22 AT OIL LEVEL.
- 7. DO NOT DRILL THRU ITEM 3 (COVER).
- 8. MAIN BEARING STRIP LINERS (QTY. 4) TO BE PRE-INSTALLED PER DRAWING 582682
- 9. AFTER FINAL ASSEMBLY, APPLY THREAD SEALANT AND TEFLON TAPE AS REQUIRED TO SEAL THREADS. APPLY ULTRA BLUE RTV-SILICON TO CONNECTIONS TO OBTAIN A LIQUID TIGHT SEAL. BEFORE PAINTING, APPLY PAINTABLE CAULK FOR PROPER PAINT ADHESION.
- 10. PRIOR TO ASSEMBLY, BLAST CLEAN INSIDE SURFACES (EXCEPT MACHINED SURFACES) WITH APPROVED MEDIA. COAT INSIDE SURFACES (EXCEPT MACHINED SURFACES) WITH SHERWIN WILLIAMS "OPEX SHOP COAT PRIMER" @ 0.5 - 0.8 MILS DFT (OR EQUAL).
- 11. FOR FINAL LEVELING OF DRIVE UNIT, USE SHIM PACKAGE (ITEM 9). TO BE FIELD INSTALLED PER INSTRUCTIONS TITLED "FINAL LEVEL THE DRIVE" IN THE INSTALLATION, OPERATION AND MAINTENANCE MANUAL.
- 12. BAG AND ATTACH TO THE DRIVE UNIT THE FOLLOWING:
ITEM 20 (SPACER) (16) REQUIRED
ITEM 21 (SPACER) (16) REQUIRED
THESE SPACERS ARE TO BE FIELD INSTALLED (QUANTITY AS REQUIRED) BETWEEN GEAR CAGE CORNERS AND DRIVE CAGE.

| REVISION DESCRIPTION | EN/ECO | BY | CHECK'D | DATE | REV |
|--|----------|-----|---------|-----------|-----|
| UPDATED DRAWING AND TITLE BLOCK, ADDED NOTES 8, 9 & 10 | S-009430 | SCF | RIB | 8/3/2016 | N |
| MOVED ITEMS FOR CCW DRIVES | S-003864 | ZSS | MAN | 8/10/2012 | M |
| ADDED LEFT HAND CONFIGURATION DETAIL | S-003444 | ZSS | MAN | 3/14/2012 | L |
| ADDED NEW TITLE BLOCK | 35033 | BBC | SKS | 2/6/2009 | K |
| ADDED ITEM 22 | 22699 | DSB | JAG | 7/15/2004 | J |
| REDRAWN ON CAD/ REMOVED D/R BLOCK | 99-0530 | TRS | JWT | 1/7/1999 | H |
| ADD ITEMS 36 & 23, FLAG NOTE 7 | 97-1628 | SW | RWK | 5/15/1997 | G |
| REV A-F ON D/R 6559, 6623, 6696, 6703, 6742 AND 6770 | - | - | - | - | - |

| | | | | | |
|--|----------|-------------------------------------|----------|--|--------------|
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| REF. FROM | - | DO NOT SCALE PRINTS | | | |
| DATE (mm/dd/yyyy) | 9/1/1987 | WORKMANSHIP STANDARD ES0001 APPLIES | | | |
| DRAWN | JKM | ORIGINAL S.O. | DWG. NO. | 115709 | SHEET 1 OF 1 |
| CHECK'D | GEN | STANDARD | REV N | | |



| ITEM | QTY | DESCRIPTION | MATERIAL | PART NUMBER | DRAWING NO. | TOTAL WEIGHT |
|------|-----|---|-------------|---------------|-------------|--------------|
| 1 | 1 | HOUSING, WORM GEAR, 21-1/2 | CAST IRON | SEE SELECTION | TABLE BELOW | 277 |
| 2 | 1 | END CAP | CI ASTM A48 | 204382A1A | 204382-1 | 49 |
| 3 | 1 | ASSY, HOUSING, BUSHING | | L202316 | 202316 | 26 |
| 4 | 1 | SPRING, HELICAL, COMPRESSION | | SEE SELECTION | TABLE BELOW | 0 |
| 5 | 1 | SEAT, BEARING, SLIDING | STEEL | 204169A | 204169 | 10 |
| 6 | 1 | CENTERING DEVICE | NEOPRENE | SEE SELECTION | TABLE BELOW | 0 |
| 7 | 1 | ASSY, WORM GEAR, RH | | L203243-3 | 203243 | 205 |
| 8 | 1 | PINION, MAIN | AISI 4150 | SEE SELECTION | TABLE BELOW | 93 |
| 9 | 1 | WORM & SHAFT, 21-1/2PD | STEEL | 202306A | 202306 | 39 |
| 10 | 1 | ROD, STOP | STEEL | 48686F | 48686 | 2 |
| 11 | 1 | BEARING, BALL, ANG CONT SGL | STEEL | F60073 | 87301 | 1 |
| 12 | 1 | SCREW, SPRING ADJUSTING, C&W | STEEL | 88887A | 88887 | 4 |
| 13 | 1 | SCREW, STOP | STEEL | 86213A | 86213 | 1 |
| 14 | 1 | SEAT, SPRING | STEEL | 86196A | 86196 | 4 |
| 15 | 1 | PLATE, COVER, 12 & 21-1/2 | STEEL | 8997A | 8997 | 0 |
| 16 | 1 | GUIDE, BEARING | STEEL | SEE SELECTION | TABLE BELOW | 1 |
| 17 | 1 | LUBRICANT PLATE, 1x2 | SS | 903155C | 903155 | 0 |
| 18 | 1 | NAMEPLATE, END CAP, WARNING SIGN | SS | 49045A | 49045 | 0 |
| 19 | 1 | GASKET, PLATE, COVER, 1/16 | NEOPRENE | 8998A | 8998 | 0 |
| 20 | 1 | RING, 3.36x.32 | STEEL | 203725M | 203725 | 1 |
| 21 | 1 | KEY, 3/4SQx3-5/8, 3/8-16 TAP | STEEL | 40463E | 40463 | 1 |
| 22 | 2 | SEAL, OIL, 3.001" O.D. 2-3/16" SHAFT | NEOPRENE | 46758AR | 46758 | 0 |
| 23 | 2 | SEAL, OIL, 1/2x5.381 O.D. | NEOPRENE | 46763K | 46763 | 0 |
| 24 | 2 | BEARING, BALL, UNMTD, ANG CONT SGL RW, 45MM | STEEL | F60045 | N/A | 7 |
| 25 | 1 | BEARING, BALL, UNMTD, ANG CONT ID | STEEL | SEE SELECTION | TABLE BELOW | 8 |
| 26 | 1 | BEARING, NDL RLR, UNMTD, INR RACE, 3.25 ID | STEEL | F60129 | N/A | 2 |
| 27 | 1 | BEARING, NDL RLR, UNMTD, OTR RACE, 3.75 ID | STEEL | F60148 | N/A | 3 |
| 28 | 1 | RING, RETAINING, 6" (INTERNAL) | STEEL | 46766BD | 46766 | 0 |
| 29 | 1 | RING, RETAINING, 3.25" (EXTERNAL) | STEEL | 46767BP | 46767 | 0 |
| 30 | 1 | PLUG, PIPE, SQ HD, 1/2" MPT, SOLID | STEEL | F10943 | N/A | 0 |
| 31 | 2 | PLUG, PIPE, SQ SKT, SOILD, 1-1/2 MPT | STEEL | F10948 | N/A | 1 |
| 32 | 1 | CAPSCREW, SKT FLT HD | ALLOY STEEL | SEE SELECTION | TABLE BELOW | 0 |
| 33 | 4 | CAPSCREW, HX HD, 3/4-10x9-1/2 | GR5 | F10084 | N/A | 5 |
| 34 | 4 | CAPSCREW, HX HD, 3/4-10x2-1/4 | GR5 | F10224 | N/A | 2 |
| 35 | 2 | CAPSCREW, HX HD, GR5, 1/2-13x3/4 | GR5 | F10257 | N/A | 0 |
| 36 | 6 | SCREW, U DRIVE, 18-8, #4x1/4" | 304 SS | F13749 | N/A | 0 |
| 37 | 5 | SETSCREW, SKT HD, CUP POINT, 1/2-13x3/4 | STEEL | F11055 | N/A | 0 |
| 38 | 8 | WASHER, FLAT, 3/4 | F436 ZINC | 653908 | N/A | 0 |
| 39 | 1 | KEY, SQ, 1/2x4 | STEEL | 86953AT | 86953 | 0 |

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 PER DWG. 768141.
- BEFORE ATTACHING END CAP TO WORM GEAR HOUSING, THE FOLLOWING MUST BE DONE:
 - DRILL (4) .104 DIA. HOLES THRU ONE (1) WALL ONLY OF END CAP AND ATTACH ITEM 18 USING ITEM 36.
 - REMOVE ALL BURRS, CHIPS, ETC FROM INSIDE THE END CAP.
- BEARING, ITEM 26, TO BE A PRESS FIT ONTO SHAFT OF MAIN PINION, ITEM 8.
- BEARINGS, ITEM 24, ARE TO BE A PRESS FIT ONTO SHAFT OF WORM AND SHAFT, ITEM 9, AND A SLIP FIT INTO SLIDING BEARING HOUSING, ITEM 5.
- APPLY THREAD SEALANT TO THREADS OF ITEMS 12, 13, AND 30. 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 27 TO BE PRESSED INTO DRIVE BASE PRIOR TO INSTALLATION OF WORM GEAR HOUSING.
- PRIOR TO ASSEMBLY, BLAST CLEAN INSIDE SURFACES (EXCEPT MACHINED SURFACES) WITH APPROVED MEDIA. COAT INSIDE SURFACES (EXCEPT MACHINED SURFACES) WITH SHERWIN WILLIAMS "OPEX SHOPCOAT PRIMER" @ 0.5 - 0.8 MILS DFT (OR EQUAL).

*PROTECT FROM CORROSION, CONTAMINATION, AND DAMAGE AS REQUIRED BEFORE WORM GEAR HOUSING INSTALLATION.

| SELECTION TABLE | | | | | | | | | | | | | |
|---------------------|-----|-------------------|----------|--------------------------------|------------|----------------|-----------|----------------|-----------|---------------|------------|-----------|-----------|
| DRIVE TYPE LIST NO. | | C40LT/HT 678850-1 | | C40LT/HT VERTICAL DC 678850-11 | | C60LT 678850-2 | | C60HT 678850-3 | | C60R 678850-4 | | | |
| ITEM | QTY | ADD'L INFO | PART NO. | DWG. NO. | ADD'L INFO | PART NO. | DWG. NO. | ADD'L INFO | PART NO. | DWG. NO. | ADD'L INFO | PART NO. | DWG. NO. |
| 1 | 1 | - | 111663-7 | 111663-7 | - | 111663-12 | 111663-12 | - | 111663-11 | 111663-11 | - | 111663-11 | 111663-11 |
| 4 | 1 | - | 204394L | 204394 | - | 204394L | 204394 | - | 204394N | 204394 | - | N/A | N/A |
| 6 | 1 | - | 204395C | 204395 | - | 204395C | 204395 | - | 204395D | 204395 | - | N/A | N/A |
| 8 | 1 | - | 203805A | 203805 | - | 203805A | 203805 | - | 204199A | 204199 | - | 203812A | 203812 |
| 16 | 1 | - | 88762A | 88762 | - | 88762A | 88762 | - | 88890A | 88890 | - | 88762A | 88762 |
| 25 | 1 | - | F60131 | N/A | - | F60131 | N/A | - | F60131 | N/A | - | F60131 | N/A |
| 32 | 1 | 3/8-16x1" | F11785 | N/A | 3/8-16x1" | F11785 | N/A | 1/2-13x1" | F17031 | N/A | 1/2-13x1" | F17031 | N/A |

| | | | | | |
|--|----------|-----|---------|------------|-----|
| ADDED PART No. 678850-11 TO SELECTION TABLE, MOVED D/C TO TOP | S-011648 | MSS | CHH | 12/6/2017 | D |
| ADDED ITEMS 4 & 6 TO BOM AND SELECTION TABLE FOR C40LT/HT & C60LT/HT | S-009430 | SCF | RJB | 8/8/2016 | C |
| ADDED NOTE 11, ADDED 2ND SEAL | S-004169 | ZSS | MAN | 11/20/2012 | B |
| INITIAL RELEASE | S-001469 | - | - | - | A |
| REVISION DESCRIPTION | EN/ECO | BY | CHECK'D | DATE | REV |

D
THIRD ANGLE PROJECTION

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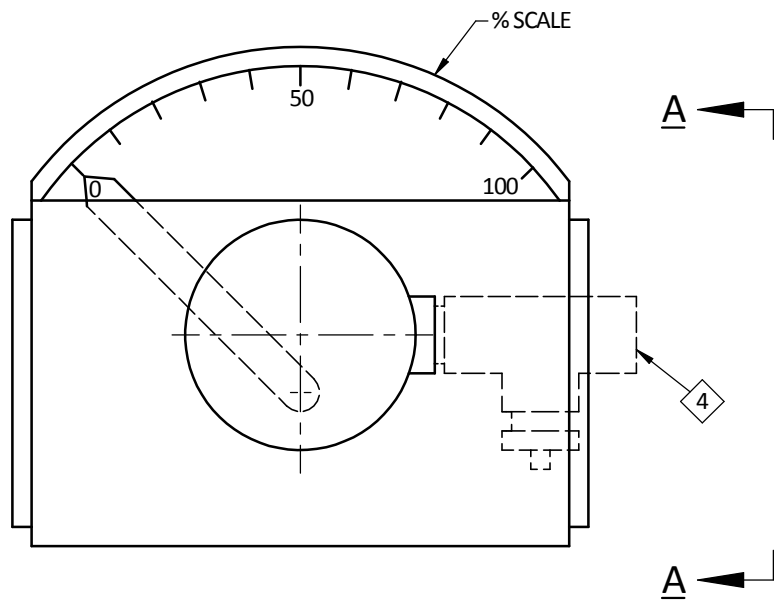
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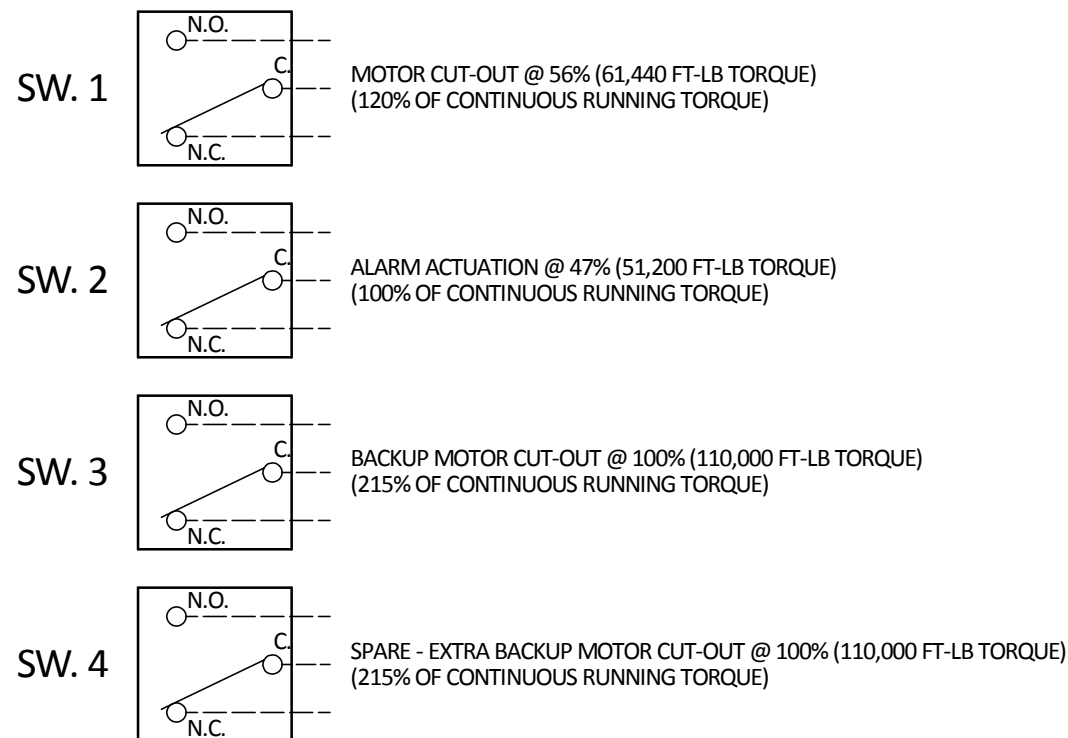
WORM GEAR ASSEMBLY

| | | | |
|------------------|------------------|--|-----------------|
| REF. FROM | 115209 | DO NOT SCALE PRINTS | |
| DATE | 9/22/2011 | WORKMANSHIP STANDARD ES0001 APPLIES | |
| DRAWN | ZSS | ORIGINAL S.O. | DWG. NO. |
| CHECK'D | MAN | STANDARD | 678850 |

SHEET 1 OF 1



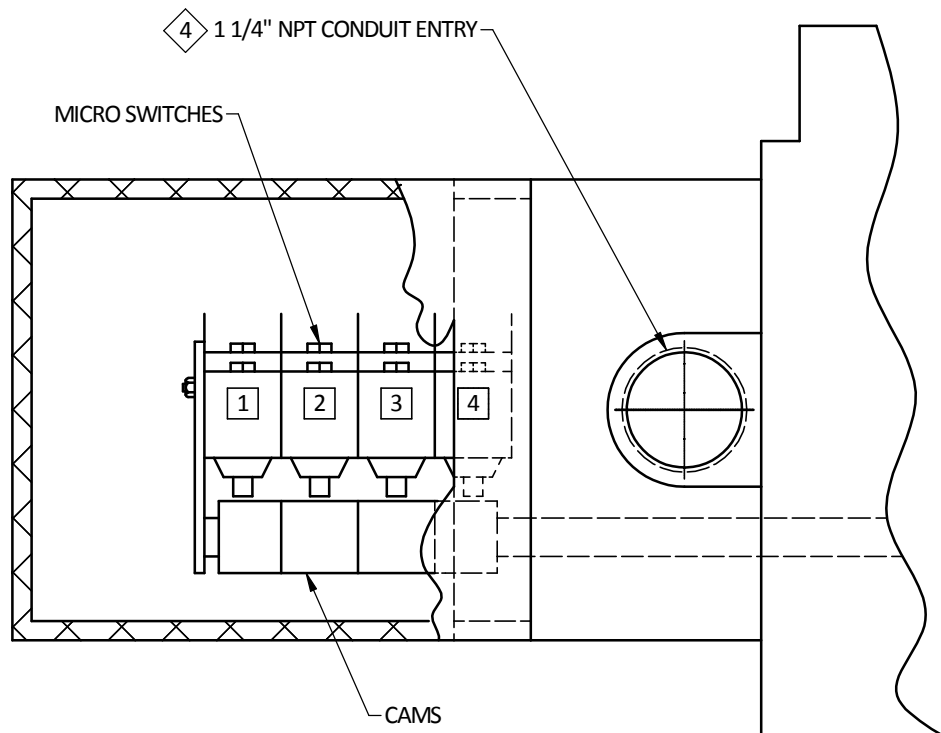
**RIGHT HAND DRIVE CONTROL
CONFIGURATION
(LEFT HAND OPPOSITE)**



NOTES: (UNLESS OTHERWISE SPECIFIED)

- CUT-OUT SWITCH (LIMIT SWITCH #1) ACTUATES ON INCREASING LOAD DE-ENERGIZING RAKE DRIVE UNIT MOTOR STARTER. THIS SWITCH MUST BE UTILIZED TO PROTECT DRIVE MECHANISM. IT IS FACTORY SET AND SHOULD NOT BE CHANGED WITHOUT PRIOR AUTHORIZATION BY OVIVO
- ALARM SWITCH (SWITCH #2) ACTUATES ON INCREASING LOAD, INDICATING IMPENDING OVERLOAD.
- ENCLOSURE IS WEATHERPROOF EPOXY COATED ALUMINUM WITH REMOVABLE GASKETED COVER. DESIGNED TO MEET NEMA 4X REQUIREMENTS.
- APPROPRIATE FITTING AND DRAIN MUST BE USED, PER N.E.C. TO ELIMINATE WATER CONDENSATION. (NOT BY OVIVO)

**NOTE: 100% TORQUE IS
BASED ON 110,000 FT-LB
CONTINUOUS RUNNING TORQUE = 51,200 FT-LBS**



**VIEW A-A
(ENLARGED)**

| | |
|--|--|
| C SIZE SHEET (DO NOT SCALE PRINTS) | THIRD ANGLE PROJECTION |
| DRAWN BY EMH | CHECKED BY SDO |
| DATE 6/25/2021 | PROJECT CSW0001517-01 |
| REF CSW1523-202 | 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. |
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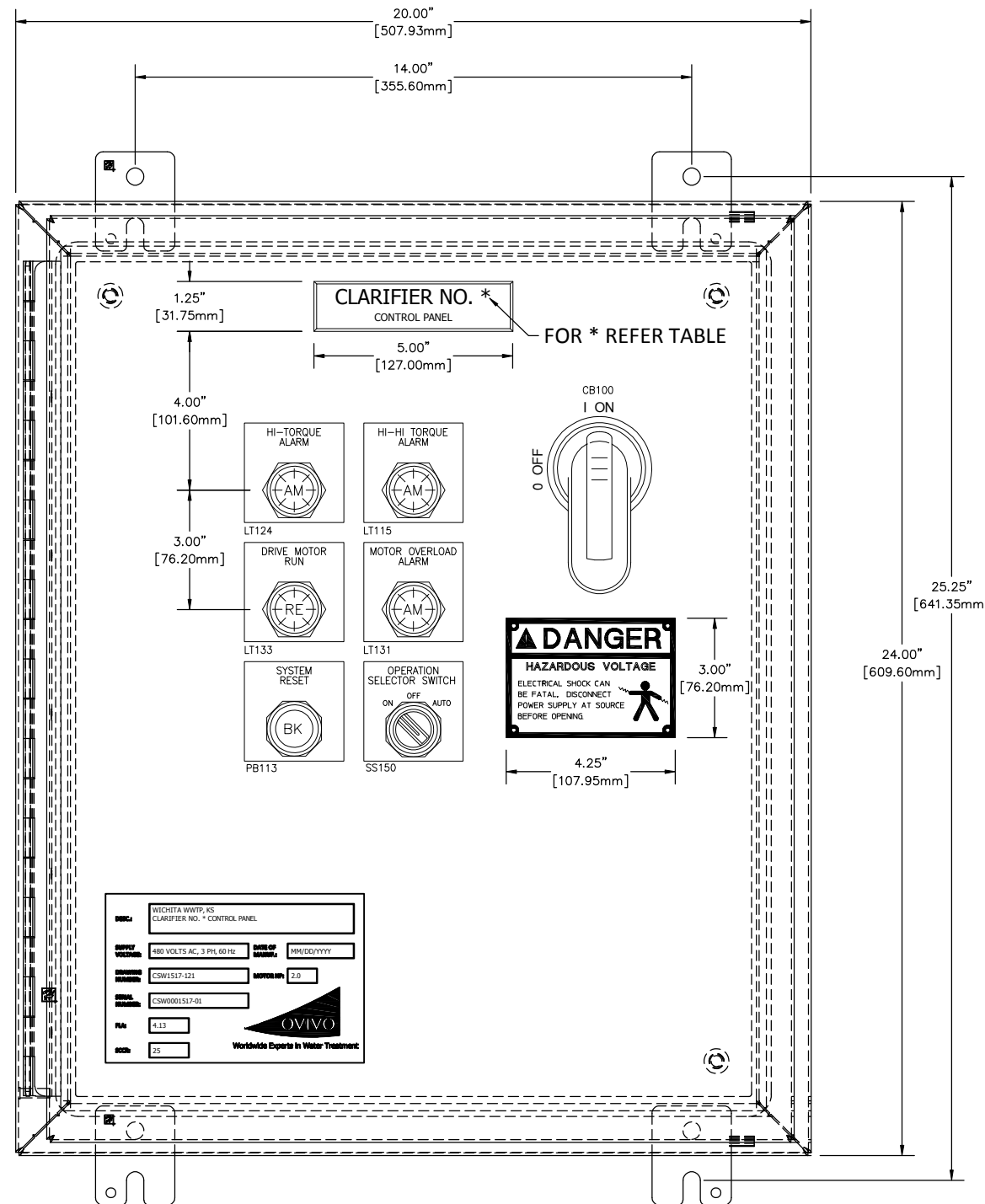
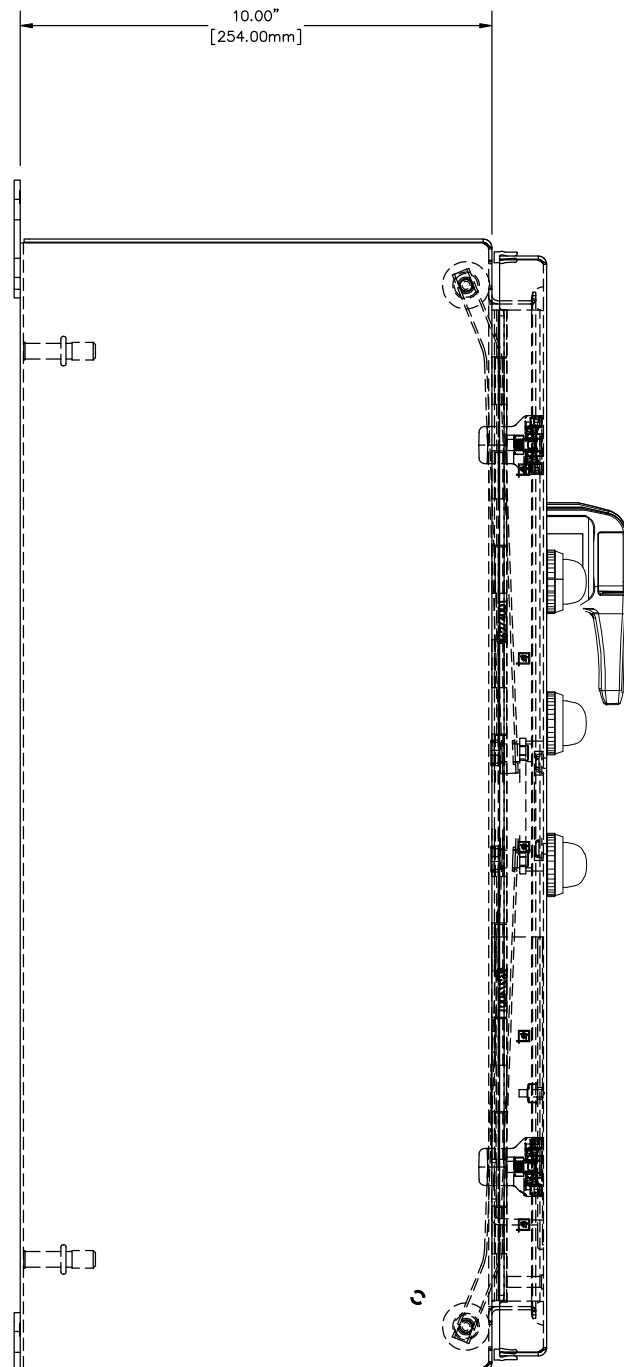
**DRIVE CONTROL SWITCH
SETTINGS**



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

ELECTRICAL DRAWING INDEX

| DWG # | SHEET DESCRIPTION |
|------------------|--|
| CSW1517-121 SHT1 | TITLE SHEET AND CONSTRUCTION NOTES |
| CSW1517-121 SHT2 | SUB-PANEL LAYOUT AND BILL OF MATERIALS |
| CSW1517-121 SHT3 | POWER AND CONTROL SCHEMATICS |



ENCLOSURE LAYOUT
NEMA 4X ENCLOSURE

CONTROL PANEL SPECIFICATIONS

- COMPONENTS SPECIFIC**
 - ENCLOSURE TO BE NEMA 4X CONSTRUCTION.
 - CONTROL PANEL SHALL BE LABELED WITH SERIALIZED UL LABEL.
 - PANEL WILL BE LABELED WITH IDENTIFICATION PLATE AS NOTED ON ENCLOSURE DRAWING.
 - ALL RELAY CONTACTS ARE RATED AT 10 AMPS UNLESS OTHERWISE NOTED.
 - COMPONENT IMAGES MAY NOT ACCURATELY REPRESENT THE ACTUAL DEVICE IN SOME INSTANCES. DIMENSIONS OF DEVICES, HOWEVER, WILL BE ACCURATE FOR PURPOSES OF LAYOUT AND SPACING.
 - SUBSTITUTIONS FOR COMPONENTS MAY BE PERMITTED UPON APPROVAL BY OVIVO ENGINEERS.
- WIRE SIZING & TYPE**

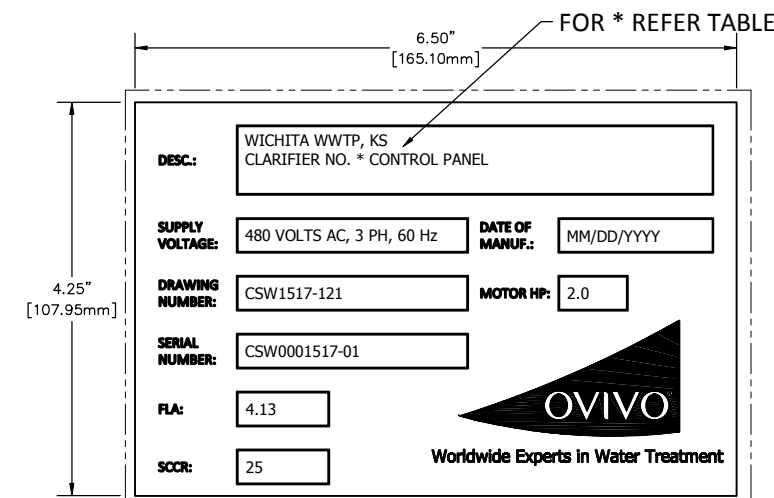
WIRE SIZING SHALL BE NO LESS THAN AS FOLLOWS (UNLESS OTHERWISE NOTED):
 480 3 PHASE - 14 AWG TYPE: MTW
 120 1 PHASE - 16 AWG TYPE: MTW
- WIRE COLOR**

WIRE COLOR SHALL BE AS FOLLOWS:
 POWER (480 VOLTS)
 GREEN - GROUND
 BLACK - ALL PHASES

CONTROL (120 VAC)
 RED - LOAD WIRES FOR ALL LOCAL CONTROL CIRCUITS
 WHITE - NEUTRAL FOR ALL LOCAL CONTROL CIRCUITS
 YELLOW - FOREIGN POWER IN PANEL
- CONNECTIONS**
 - ALL CONNECTIONS SHALL BE POINT TO POINT WITHOUT SPLICES. EXCEPTIONS APPLY TO SOLENOIDS AND MOTORS AND FACTORY WIRED COMPONENTS.
 - ALL CONDUCTORS MUST BE MARKED WITH MACHINE PRINTED TAGS AT EACH TERMINATION. MARKERS SHALL BE OF HEAT SHRINK TYPE.
- DOCUMENTATION**
 - FABRICATOR SHALL PROVIDE ONE COPY OF ALL DOCUMENTS SUPPLIED WITH THE COMPONENTS SUPPLIED BY THE FABRICATOR. THIS INFORMATION INCLUDES BUT IS NOT LIMITED TO MANUFACTURERS SPECIFICATIONS, INSTALLATION MANUALS AND OPERATION MANUALS.
 - ANY OVIVO APPROVED CHANGES OR MARK-UPS TO THE SCHEMATICS, PANEL LAYOUTS AND ANY OTHER PERTAINING DOCUMENTS SHALL BE MAINTAINED AND DELIVERED TO OVIVO AT ACCEPTANCE OF THE PANEL.
- TESTING**
 - OVIVO ENGINEERS OR OVIVO APPROVED FABRICATOR, WILL PERFORM A POINT TO POINT CONTINUITY TEST ON THE PANEL.
 - WHEN APPLICABLE, THE FABRICATOR WILL ALSO PROVIDE POWER TO THE 120VAC CIRCUITS FOR VERIFICATION AND TESTING. FABRICATOR SHALL ALLOW A MINIMUM OF 2 HOUR OF ACCESS TO THE CONTROL PANEL BY AN OVIVO ENGINEER FOR THIS AND PREVIOUSLY STATED TEST. 3 PHASE POWER CIRCUITS WILL NOT BE POWERED ON FOR TESTING.

| | | | |
|-----------------|---|-----------------|------------|
| DESC: | WICHITA WWTP, KS CLARIFIER NO. * CONTROL PANEL | | |
| SUPPLY VOLTAGE: | 480 VOLTS AC, 3 PH, 60 Hz | DATE OF MANUF.: | MM/DD/YYYY |
| DRAWING NUMBER: | CSW1517-121 | MOTOR HP: | 2.0 |
| SERIAL NUMBER: | CSW0001517-01 | | |
| FLA: | 4.13 | | |
| SCCR: | 25 | | |

| TABLE | |
|--------|-----------------|
| NUMBER | EQUIPMENT |
| 1 | CLARIFIER NO. 1 |
| 2 | CLARIFIER NO. 2 |
| 3 | CLARIFIER NO. 3 |
| 4 | CLARIFIER NO. 4 |



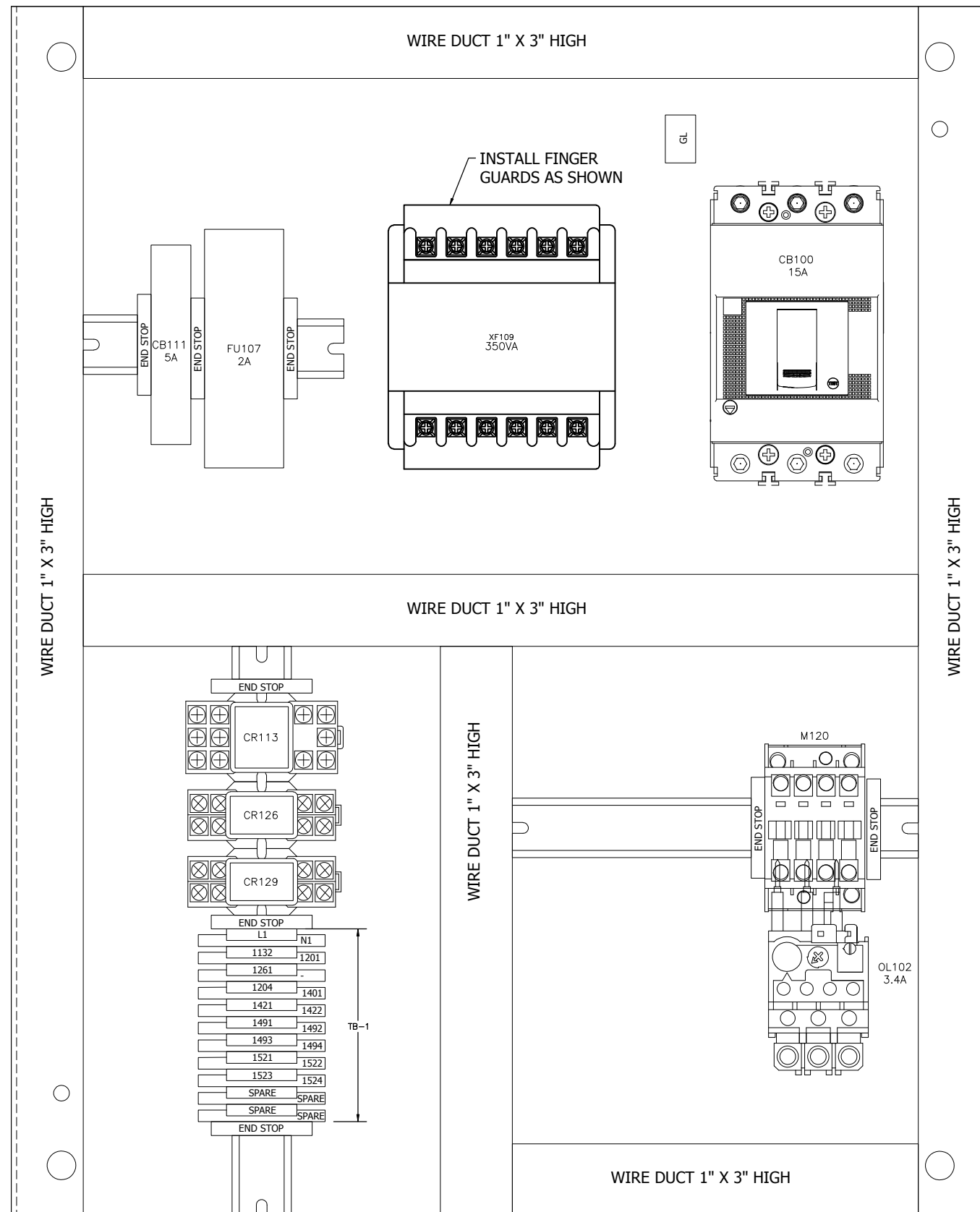
OVIVO NAMEPLATE
ENGRAVE AS SHOWN

| | | | | | | | | | | | |
|--|--|---|----|----|----------|--|--|---------|-------------|-----------------|---------------|
| D SIZE SHEET (DO NOT SCALE PRINTS) THIRDS ANGLE PROJECTION | DRAWN BY: KD | WICHITA WWTP, KS CLARIFIER CONTROL PANEL (TYPICAL OF 4) | | | | | | | | | |
| | CHECKED BY: CL | | | | | | | | | | |
| | DATE: 09/23/21 | | | | | | | | | | |
| | PROJECT: CSW0001517-01 REF: CSW1514-121 | | | | | | | | | | |
| INITIAL RELEASE | | 018201 | KD | CL | 09/23/21 | 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. | © 2021 OVIVO. ALL RIGHTS RESERVED. WORKMANSHIP STANDARD E80901 APPLIES | DWG NO. | CSW1517-121 | SHEET 1 OF 3 | A REVISION |

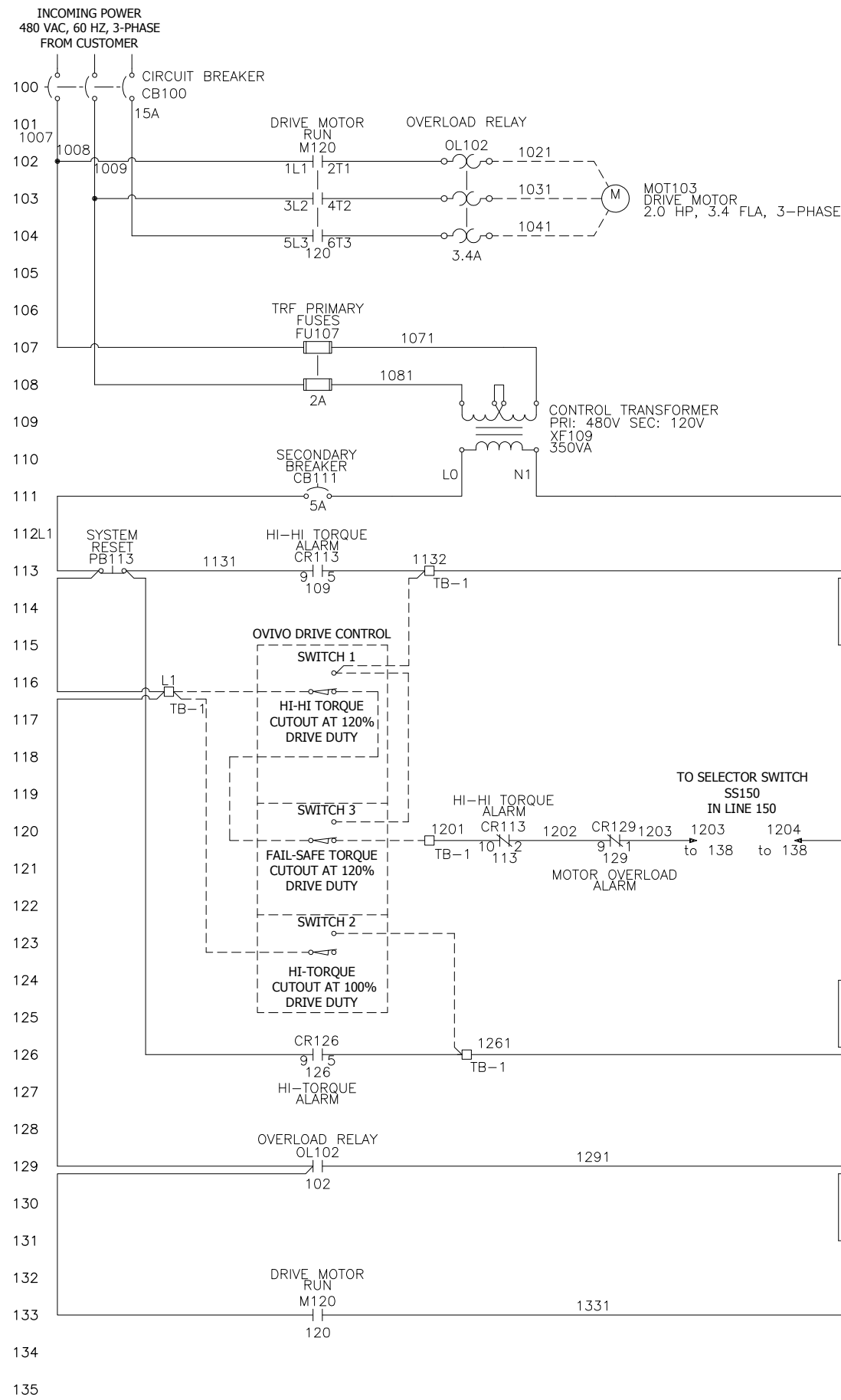
| REVISION | DATE | BY | CHECK'D |
|----------|------|----|---------|
| EN/ECO | | | |

BILL OF MATERIALS

| ITEM | QTY | CATALOG | DESC | MFG | TAGS |
|------|-----|--------------------------------|---|-----------------|--|
| 1 | 1 | A24H2010SSLP | WALL-MOUNT ENCLOSURE, CONTINUOUS HINGE WITH CLAMPS, 24" X 20" X 10", 304 SS, NEMA 4X | HOFFMAN | ENC |
| 2 | 1 | A24P20 | ENCLOSURE, BACK PANEL, 24" X 20" | HOFFMAN | ENC |
| 3 | 1 | 140G-G2C3-C15 | CIRCUIT BREAKER, THREE POLE, THERMAL MAGNETIC FIXED, 15 AMP, 480 VAC RATED, 25kA SCCR | ALLEN BRADLEY | CB100 |
| 4 | 1 | 140G-G-RVM12B | CIRCUIT BREAKER MECHANISM WITH SHAFT 12 INCHES EXTERNAL HANDLE, NEMA 4/4X, BLACK, PADLOCKABLE | ALLEN BRADLEY | CB100 |
| 5 | 1 | 100-C09D10 | 3-POLE CONTACTOR, OPEN, 120V 60HZ, 1 N.O. AUXILIARY CONTACT, RATED UP TO 5HP, 9 AMP MOTORS | ALLEN BRADLEY | M120 |
| 6 | 1 | 100-FA22 | AUXILIARY CONTACT BLOCK, FRONT MOUNT, 2 N.O. + 2 N.C. CONTACTS | ALLEN BRADLEY | M120 |
| 7 | 1 | 193-T1AB40 | BIMETALLIC THERMAL OVERLOAD RELAY, 2.9 TO 4.0 AMPS | ALLEN BRADLEY | OL102 |
| 8 | 2 | LP-CC-2 | TIME DELAY FUSES, 2 AMP, 200kA RMS SCCR | BUSSMAN | FU107 |
| 9 | 1 | CHCC2DIU | FUSE HOLDER, WITH BLOWN FUSE FUSE INDICATION | BUSSMAN | FU107 |
| 10 | 1 | SP350ACP | CONTROL TRANSFORMER 480V TO 120VAC, 350 VA | HAMMOND | XF109 |
| 11 | 1 | 1489-M1C050 | MINIATURE CIRCUIT BREAKER, 5 AMP, 1-POLE | ALLEN BRADLEY | CB111 |
| 12 | 2 | RH2B-ULC-110-120AC | RELAY, DPDT, WITH INDICATOR AND CHECK BUTTON, 120 VAC | IDEC | CR126, CR144 |
| 13 | 2 | SH2B-05 | SOCKET, RELAY | IDEC | CR126, CR144 |
| 14 | 2 | RH3B-ULC-120AC | RELAY, 3PDT, WITH INDICATOR AND CHECK BUTTON, 120 VAC | IDEC | CR113, CR129 |
| 15 | 2 | SH3B-05 | SOCKET, RELAY | IDEC | CR113, CR129 |
| 16 | 3 | APD1126DNUA | AMBER PILOT LIGHT, 120 VAC TRANSFORMER LED, NEMA 4/4X | IDEC | LT115, LT124, LT131 |
| 17 | 1 | APD1126DNUR | RED PILOT LIGHT, 120 VAC TRANSFORMER LED, NEMA 4/4X | IDEC | LT133 |
| 18 | 1 | ABD111NUB | PUSH BUTTON - MOMENTARY, NEMA 4/4X, BLACK, WITH 1 N.O. + 1 N.C. CONTACTS | IDEC | PB113 |
| 19 | 1 | ASD340NU | 3-POSITION SELECTOR SWITCH, MAINTAINED, NEMA 4/4X, BLACK, WITH 4 N.O. CONTACTS | IDEC | SS150 |
| 20 | 6 | GRAVOPLY ULTRA | GENERIC OPERATOR TAG - ENGRAVE AS SHOWN | GRAVOGRAPH | LT115, LT124, LT131, LT133, PB113, SS150 |
| 21 | 11 | 2770011 | FEED-THROUGH TERMINAL BLOCK, 2-LEVEL, SCREW CONNECTION, AWG 24-12, GRAY, 24 AMP, 500 VOLTS | PHOENIX CONTACT | TB-1 |
| 22 | 1 | 2770024 | END COVER, GREY COLOR | PHOENIX CONTACT | TB-1 |
| 23 | 8 | 0800886 | END STOP | PHOENIX CONTACT | AS SHOWN |
| 24 | A/R | TYD1X3WPW6 WITH TYD1CPW6 COVER | WIRE DUCT 1" X 3" HIGH, WHITE WITH COVER, WHITE | THOMAS & BETTS | AS SHOWN |
| 25 | 1 | 49046A | NAME PLATE - "DANGER" | OVIVO | AS SHOWN |
| 26 | 1 | 679002 | NAME PLATE (ETCH AS SHOWN) | OVIVO | AS SHOWN |
| 27 | 2 | 592273 | ENCLOSURE EQUIPMENT TAG ID, AND "ELAPSED TIME METER" | OVIVO | AS SHOWN |
| 28 | A/R | 0807012 | DIN-RAIL | PHOENIX CONTACT | AS SHOWN |
| 29 | 1 | KA26U | GROUND LUG | BURNDY | GL |



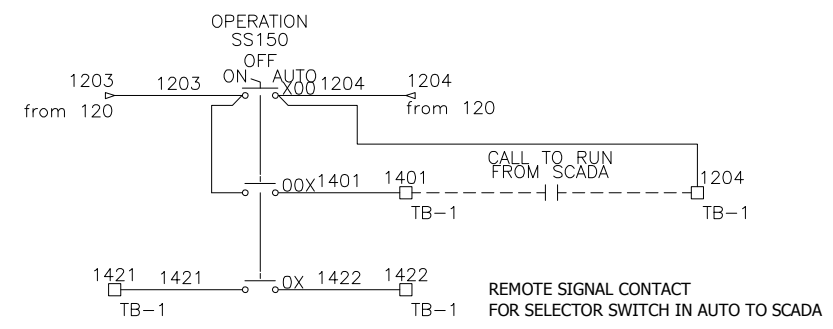
SUB-PANEL LAYOUT



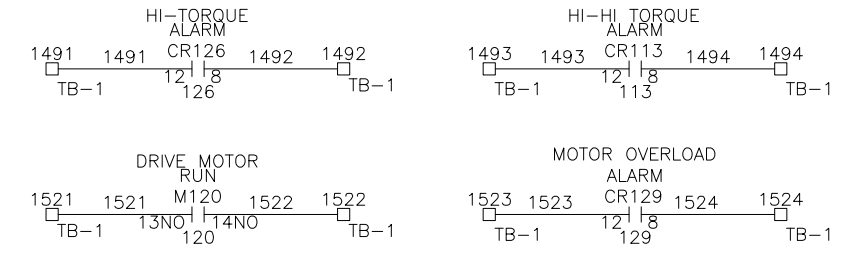
WIRING LEGEND:

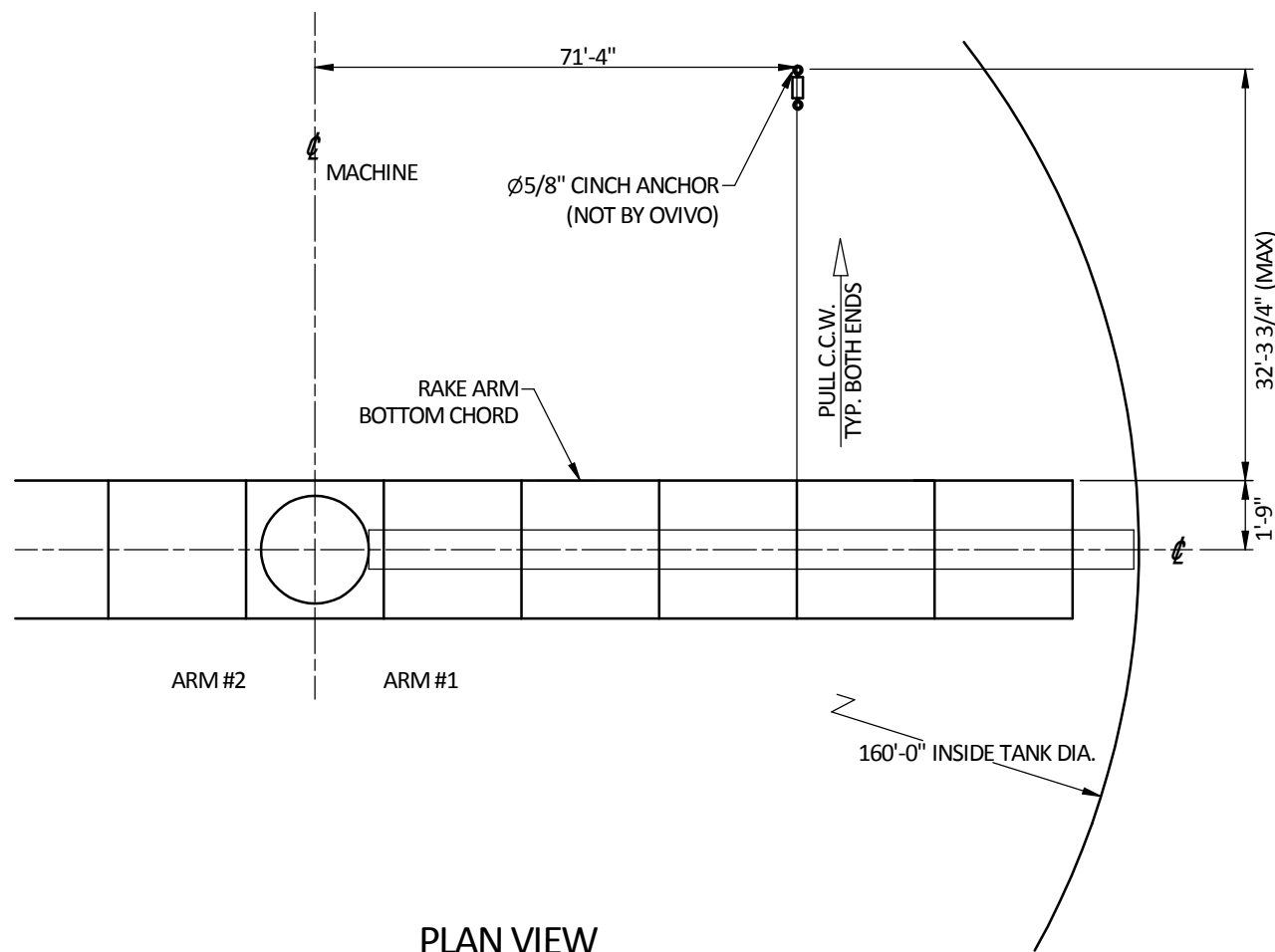
| | |
|-------|-----------------------------|
| ----- | FIELD WIRING (NOT BY OVIVO) |
| ————— | INTERNAL WIRING (BY OVIVO) |

136
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140
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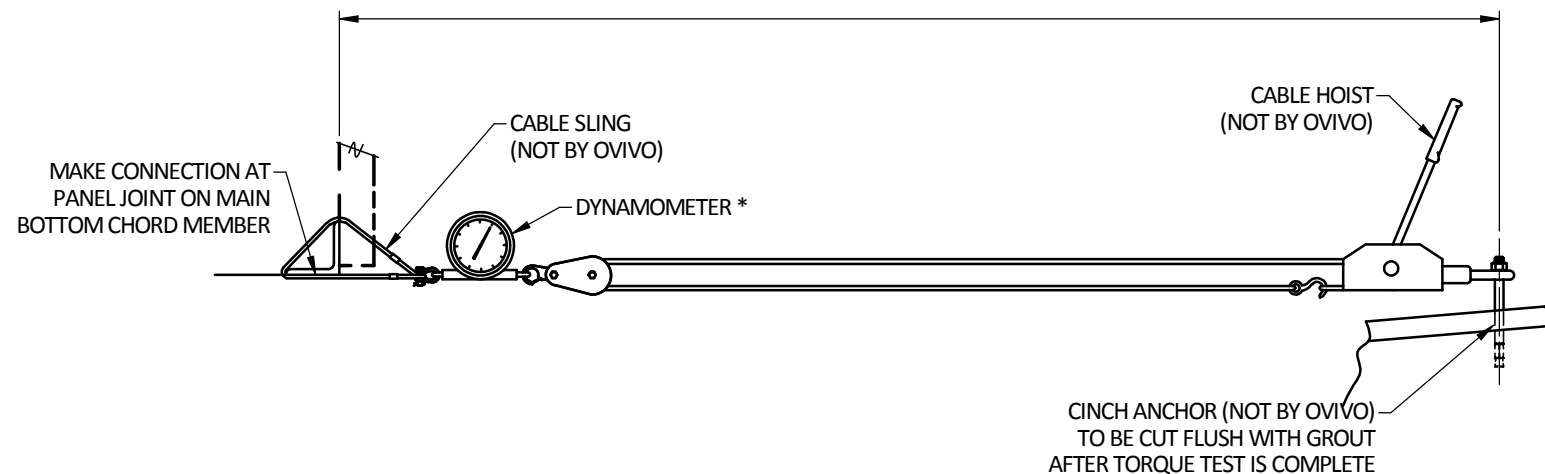
REMOTE SIGNAL CONTACTS





PLAN VIEW

32'-3 3/4" (MAX)
MIN. LENGTH AS REQUIRED FOR HARDWARE AND TENSIONING OF CABLES



TORQUE TEST EQUIPMENT ARRANGEMENT

(DYNAMOMETER PROVIDED BY OVIVO. CABLE HOIST, CHAINS, SLING, ETC. PROVIDED BY OTHERS)

NOTES:

THIS TEST IS DESIGNED FOR STATIC TORQUE TESTS TO CONFIRM THE STRUCTURAL STRENGTH OF THE MECHANISM STEEL. THERE IS NO DIRECT CORRELATION BETWEEN THIS STATIC TEST AND MOVEMENT OF THE DRIVE CONTROL INDICATOR NEEDLE. THE DRIVE CONTROL IS FUNCTIONALLY ACCURATE ONLY WITH THE MECHANISM OPERATING (DYNAMIC CONDITION).

100% TEST TORQUE IS 76,800 (150% OF 51,200 FT-LBF RUNNING TORQUE)

TEST PROCEDURE:

1. CHECK THAT FINAL LEVELING OF MECHANISM IS COMPLETE, THAT ALL BOLTS ARE TIGHT AND FIELD WELDING HAS BEEN ACCOMPLISHED PER ERECTION DRAWINGS.
2. CHECK OIL LEVELS AND RUN MECHANISM (2) TWO COMPLETE REVOLUTIONS TO MINIMIZE SLACK IN GEARING.
3. ADJUST BOTH SCALES TO ZERO SETTING & ASSEMBLE EQUIPMENT AS SHOWN. TIGHTEN ASSEMBLIES TO TAKE UP SLACK (APPROX. 25 LBS. ON BOTH SCALES).
4. TIGHTEN HOISTS ON BOTH RAKE ARMS SIMULTANEOUSLY TO CALCULATED LOAD ON SCALES AS SHOWN BELOW, AND RECORD ACTUAL READINGS.
5. WHEN TESTS ARE COMPLETE TO CUSTOMERS SATISFACTION, RELEASE HOISTS SIMULTANEOUSLY TO ZERO AND REMOVE.
6. CUT ANCHOR BOLTS FLUSH WITH TANK BOTTOM.
7. UPON APPROVAL OF OVIVO REPRESENTATIVE, ROTATE AND OBSERVE MECHANISM FOR AT LEAST (1) ONE COMPLETE REVOLUTION.

| CALCULATED READINGS: | | | ARM #1 | ARM #2 |
|----------------------|-------------------------------------|-----------------|---------|---------|
| TEST #1 | 50% OF TEST TORQUE 38,400 FT-LB | CALCULATED LOAD | 269 LBS | 269 LBS |
| | | ACTUAL READING | | |
| TEST #2 | 75% OF TEST TORQUE 57,600 FT-LB | CALCULATED LOAD | 404 LBS | 404 LBS |
| | | ACTUAL READING | | |
| TEST #3 | 100% OF TEST TORQUE 76,800 FT-LB | CALCULATED LOAD | 538 LBS | 538 LBS |
| | | ACTUAL READING | | |

OVIVO REP.: _____
 WITNESS: _____
 TEST DATE: _____
 TIME: _____

* DYNAMOMETER LIMIT NOTE:
IF TEST LOADING REQUIREMENTS ARE BEYOND THE DYNAMOMETER SCALE CAPACITY, A DOUBLE RUN UTILIZING A PULLEY MAY BE USED TO REDUCE THE LOAD READINGS BY 50%.

| | |
|--|------------------------|
| C | |
| SIZE SHEET (DO NOT SCALE PRINTS) | THIRD ANGLE PROJECTION |
| DRAWN BY | EMH |
| CHECKED BY | SDO |
| DATE (mm/dd/yyyy) | 6/25/2021 |
| PROJECT | CSW0001517-01 |
| REF | CSW1501-103 |
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STATIC TORQUE TEST



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CSW1517-103

SHEET
1 OF 1

A
REVISION

| | | | | | |
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| REVISION DESCRIPTION | EN/ECO | BY | CHECK'D | DATE | REV |

FASTENER LIST

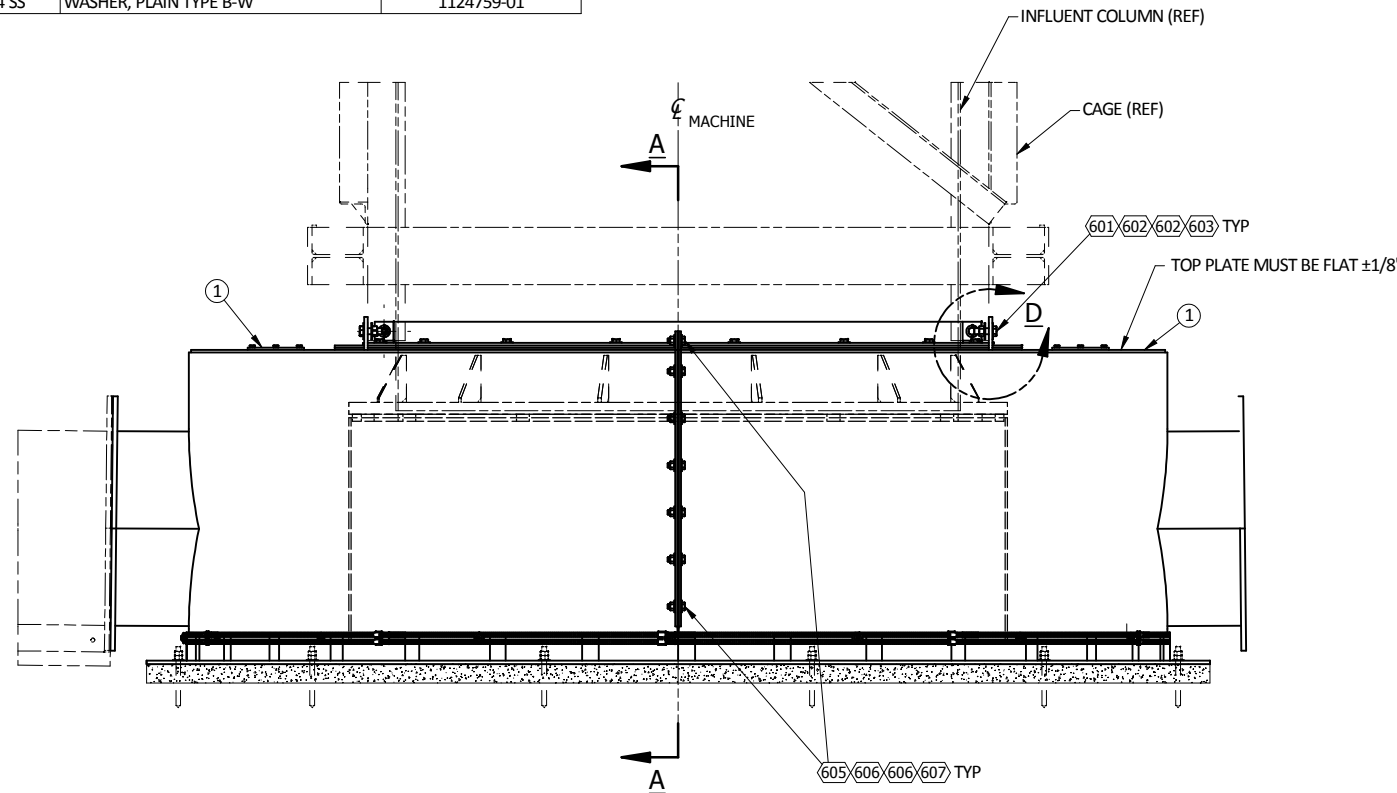
| ITEM | QTY | MATERIAL | DESCRIPTION | PART NUMBER |
|------|-----|----------|---|--------------------|
| 601 | 4 | 316 SS | HEX HD CAPSCREW, 5/8-11 UNC x 2 | HCS10UNCX032-316SS |
| 602 | 8 | 316 SS | PLAIN WASHER, 5/8 - LARGE OD | PNW10B-316SS |
| 603 | 4 | 316 SS | HEX NUT, 5/8-11 UNC | HXN10UNC-316SS |
| 604 | 18 | 316 SS | HEX HD CAPSCREW, 1/2-13 UNC x 2 | HCS08UNCX032-316SS |
| 605 | 18 | 316 SS | HEX HD CAPSCREW, 1/2-13 UNC x 1 1/2 | HCS08UNCX024-316SS |
| 606 | 56 | 316 SS | PLAIN WASHER, 1/2 - SMALL OD | PNW08A-316SS |
| 607 | 20 | 316 SS | HEX NUT, 1/2-13 UNC | HXN08UNC-316SS |
| 608 | 15 | 410 SS | TEKS/5 HEX NEOP WASH HD (12-24 x 1 1/4) | M025020 |
| 609 | 15 | 304 SS | WASHER, PLAIN TYPE B-W | 1124759-01 |

REFERENCE DRAWINGS

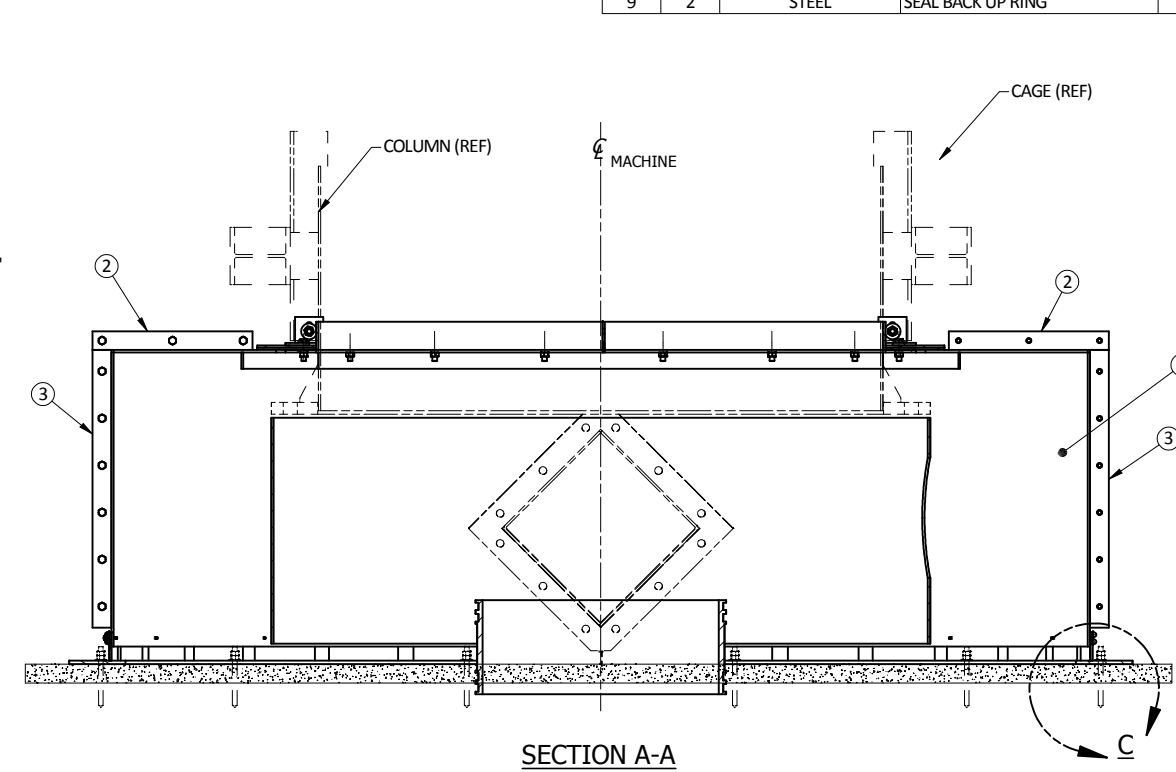
| DESCRIPTION | DRAWING NO. |
|-------------------|-------------|
| BOLT TORQUE CHART | 114808 |

BILL OF MATERIAL

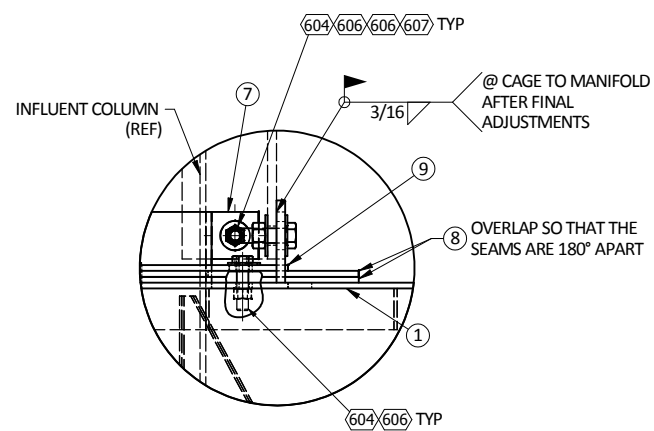
| ITEM | QTY | MATERIAL | DESCRIPTION | PART NUMBER | DRAWING | WEIGHT |
|---------------------|-----|--------------------|-------------------------|--------------|-------------|-------------|
| 1 | 2 | STEEL | MANIFOLD (HALF) | CSW1517-178 | CSW1517-178 | 1200 |
| 2 | 2 | NEOPRENE (60 DUR.) | GASKET-(MANIFOLD TOP) | CSW1517-179A | CSW1517-179 | |
| 3 | 2 | NEOPRENE (60 DUR.) | GASKET-(MANIFOLD SIDE) | CSW1517-179C | CSW1517-179 | |
| 4 | 2 | STEEL | ANCHOR RING (HALF) | CSW1517-177 | CSW1517-177 | 214 |
| 5 | 20 | 316 SS | BAND CLAMP | 699384C | 699384 | 3 |
| 6 | 32 | NEOPRENE (60 DUR.) | LIP SEAL (MANIFOLD) | 699385 | 699385 | |
| 7 | 2 | STEEL | SEAL RING (Ø60" COLUMN) | CSW1517-181 | CSW1517-181 | 88 |
| 8 | 2 | NEOPRENE (60 DUR.) | SEAL (MANIFOLD) | CSW1517-198 | CSW1517-198 | |
| 9 | 2 | STEEL | SEAL BACK UP RING | CSW1517-199 | CSW1517-199 | 36 |
| TOTAL WEIGHT | | | | | | 1542 |



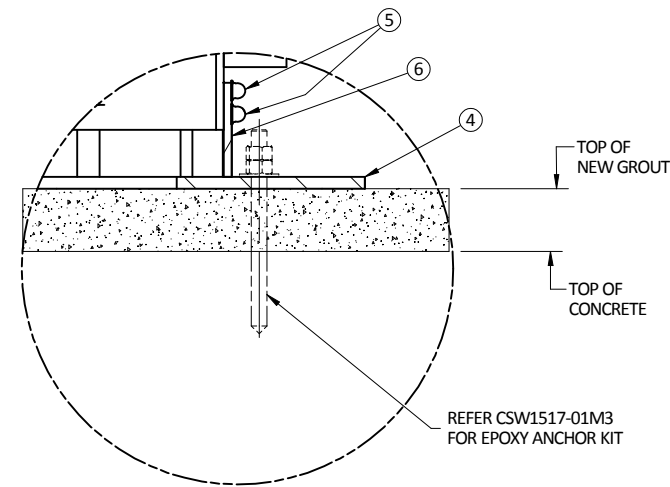
ELEVATION VIEW



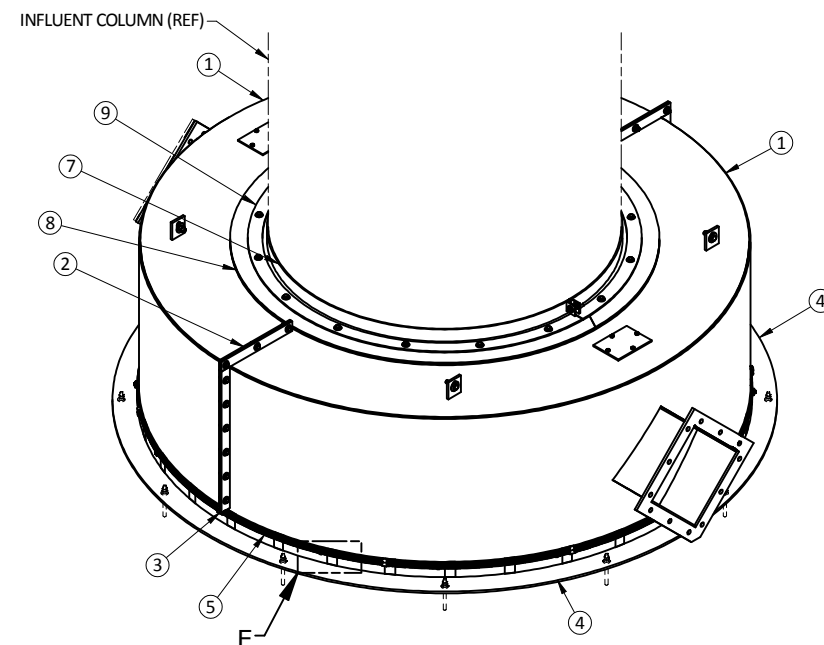
SECTION A-A



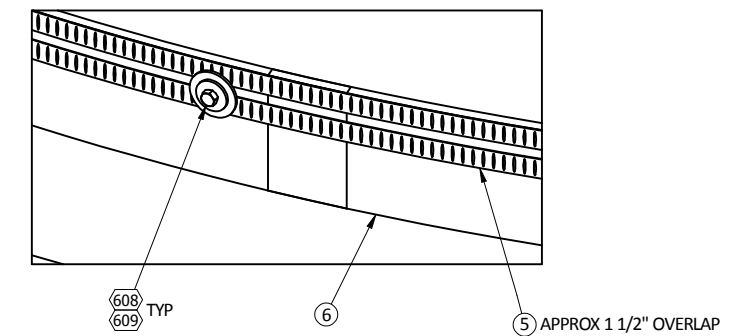
DETAIL D
(INFLUENT COLUMN SEAL)



DETAIL C
(MANIFOLD SEAL)



ISOMETRIC VIEW
(CENTER CAGE IS HIDDEN FOR CLARITY)



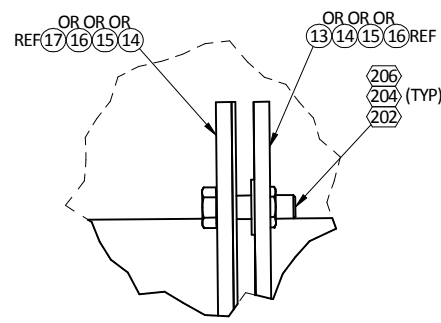
DETAIL E
SEAL CLAMPING DETAIL

NOTES:

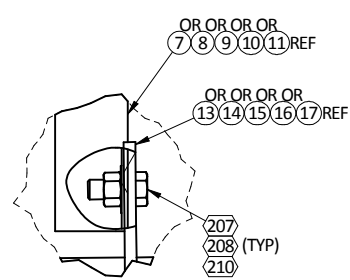
1. THE INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS MANUAL MUST BE STUDIED PRIOR TO STARTING THE ERECTION OF THIS EQUIPMENT.
2. TOP SURFACE OF ANCHOR RING MUST BE FLAT & SMOOTH FOR SEAL TO OPERATE PROPERLY.
3. WORK THIS DRAWING WITH GENERAL ERECTION DRAWING, CSW1517-151 AND RAKE ARM AND DUCT ERECTION DRAWING CSW1517-152.

| | | | |
|---|--|---|---------------------|
| <p>D SIZE SHEET (DO NOT SCALE PRINTS)</p> <p>DRAWN BY: NPR CHECKED BY: EMH DATE: 07/13/2021</p> <p>PROJECT: CSW0001517-01 REF: CSW1261-155</p> | | MANIFOLD ERECTION | |
| | | 8'-8" DIA. MANIFOLD | |
| | | 160'-0" DIA. TYPE C3D CLARIFIER | |
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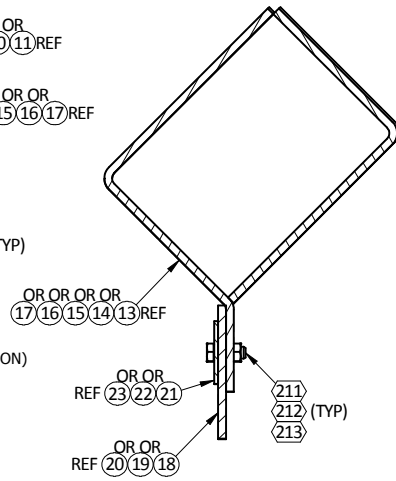
| INITIAL RELEASE | REVISION DESCRIPTION | EN/ECO | BY | CHECK'D | DATE | REV |
|-----------------|----------------------|--------|----|---------|------|-----|
| | | | | | | A |



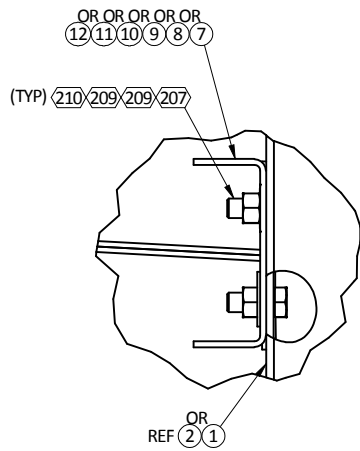
DETAIL A
(TYP DUCT TO DUCT CONNECTION)



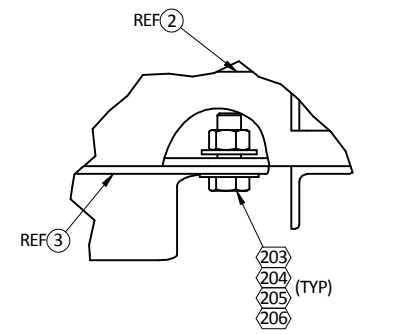
DETAIL B
(TYP DUCT SUPPORT TO DUCT CONNECTION)



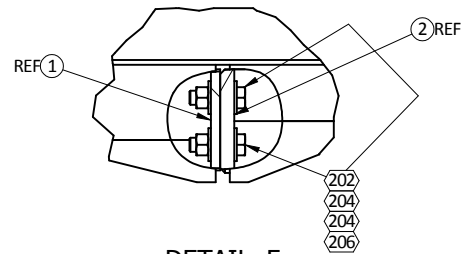
SECTION C-C
(TYP SQUEEGEE TO DUCT CONNECTION)



DETAIL D
(TYP DUCT SUPPORT TO RAKE ARM CONNECTION)



DETAIL E
(TYP RAKE ARM SPLICE TO RAKE ARM CONNECTION)

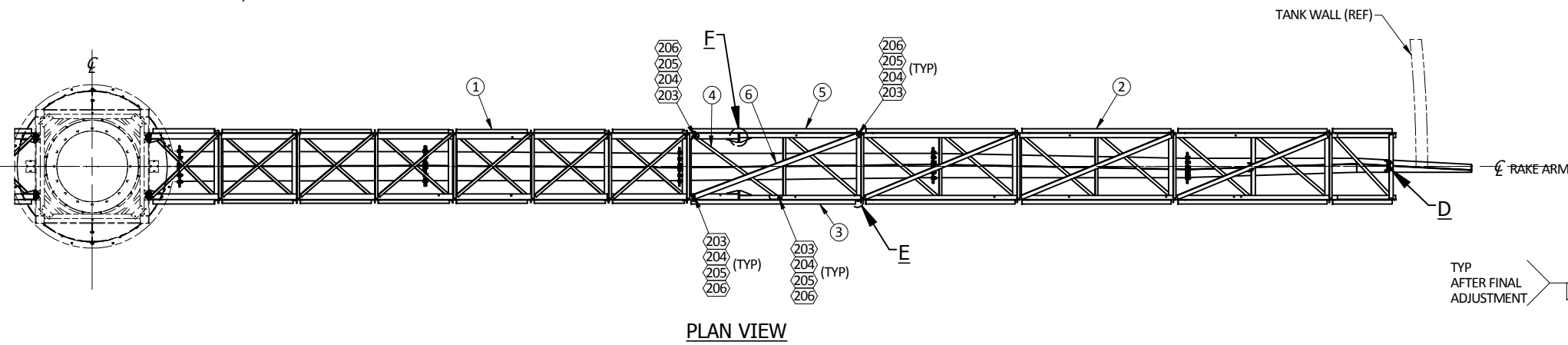


DETAIL F
(TYP INNER RAKE ARM TO OUTER RAKE ARM CONNECTION)

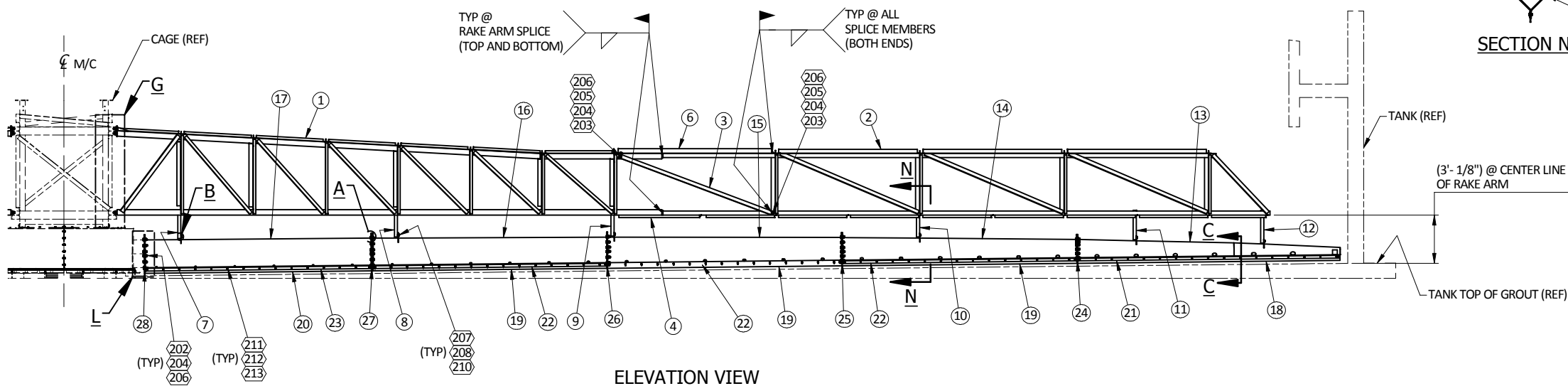
| REFERENCE DRAWINGS | |
|--------------------|-------------|
| DESCRIPTION | DRAWING NO. |
| BOLT TORQUE CHART | 114808 |

| REFERENCE DRAWINGS | | BILL OF MATERIAL | | | | | | |
|--------------------|-------------|--------------------|--------------------------|---------------|--------------|--------------|---------|--------|
| DESCRIPTION | DRAWING NO. | ITEM | QTY | MATERIAL | DESCRIPTION | PART NUMBER | DRAWING | WEIGHT |
| 1 | 2 | STEEL | INNER RAKE ARM | CSW1517-163A | CSW1517-163 | 4896 | | |
| 2 | 2 | STEEL | OUTER RAKE ARM | CSW1517-163B | CSW1517-163 | 3397 | | |
| 3 | 2 | STEEL | RAKE ARM SPLICE (SIDE) | CSW1517-163C | CSW1517-163 | 100 | | |
| 4 | 2 | STEEL | RAKE ARM SPLICE (BOTTOM) | CSW1517-163D | CSW1517-163 | 40 | | |
| 5 | 2 | STEEL | RAKE ARM SPLICE (SIDE) | CSW1517-163E | CSW1517-163 | 100 | | |
| 6 | 2 | STEEL | RAKE ARM SPLICE (TOP) | CSW1517-163F | CSW1517-163 | 118 | | |
| 7 | 2 | STEEL | DUCT SUPPORT (INNER) | CSW1517-193A | CSW1517-193 | 22 | | |
| 8 | 2 | STEEL | DUCT SUPPORT (MIDDLE 1) | CSW1517-193B | CSW1517-193 | 21 | | |
| 9 | 2 | STEEL | DUCT SUPPORT (MIDDLE 2) | CSW1517-193C | CSW1517-193 | 20 | | |
| 10 | 2 | STEEL | DUCT SUPPORT (MIDDLE 3) | CSW1517-193D | CSW1517-163 | 21 | | |
| 11 | 2 | STEEL | DUCT SUPPORT (OUTER 1) | CSW1517-193E | CSW1517-193 | 23 | | |
| 12 | 2 | STEEL | DUCT SUPPORT (OUTER 2) | CSW1517-193F | CSW1517-193 | 26 | | |
| 13 | 2 | STEEL | DUCT - (OUTER) | CSW1517-1170A | CSW1517-1170 | 879 | | |
| 14 | 2 | STEEL | DUCT - (MIDDLE 3) | CSW1517-1170C | CSW1517-1170 | 1190 | | |
| 15 | 2 | STEEL | DUCT - (MIDDLE 2) | CSW1517-1170D | CSW1517-1170 | 1397 | | |
| 16 | 2 | STEEL | DUCT - (MIDDLE 1) | CSW1517-1170F | CSW1517-1170 | 1521 | | |
| 17 | 2 | STEEL | DUCT - (INNER) | CSW1517-1170G | CSW1517-1170 | 1534 | | |
| 18 | 2 | NEOPRENE (60 DUR.) | DUCT SQUEEGEE - (OUTER) | CSW1517-1171A | CSW1517-1171 | | | |
| 19 | 6 | NEOPRENE (60 DUR.) | DUCT SQUEEGEE - (MIDDLE) | CSW1517-1171C | CSW1517-1171 | | | |
| 20 | 2 | NEOPRENE (60 DUR.) | DUCT SQUEEGEE - (INNER) | CSW1517-1171D | CSW1517-1171 | | | |
| 21 | 2 | STEEL | BACKUP BAR (OUTER) | CSW1517-1172A | CSW1517-1172 | 28 | | |
| 22 | 6 | STEEL | BACKUP BAR (MIDDLE) | CSW1517-1172C | CSW1517-1172 | 73 | | |
| 23 | 2 | STEEL | BACKUP BAR (INNER) | CSW1517-1172D | CSW1517-1172 | 24 | | |
| 24 | 2 | NEOPRENE (60 DUR.) | DUCT GASKET I | CSW1517-1173A | CSW1517-1173 | | | |
| 25 | 2 | NEOPRENE (60 DUR.) | DUCT GASKET II | CSW1517-1173C | CSW1517-1173 | | | |
| 26 | 2 | NEOPRENE (60 DUR.) | DUCT GASKET III | CSW1517-1173D | CSW1517-1173 | | | |
| 27 | 2 | NEOPRENE (60 DUR.) | DUCT GASKET IV | CSW1517-1173F | CSW1517-1173 | | | |
| 28 | 2 | NEOPRENE (60 DUR.) | DUCT GASKET V | CSW1517-1173G | CSW1517-1173 | | | |
| | | | | | | TOTAL WEIGHT | 15586 | |

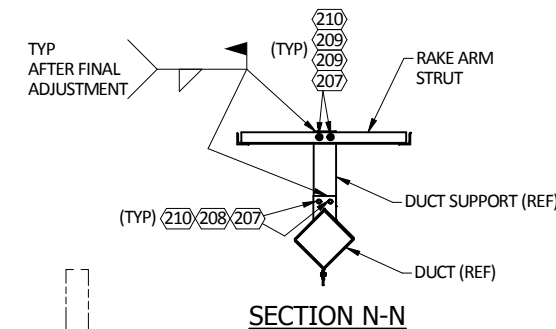
| FASTENER LIST | | | | |
|---------------|-----|----------|---|--------------------|
| ITEM | QTY | MATERIAL | DESCRIPTION | PART NUMBER |
| 201 | 24 | 316 SS | HEX HD CAPSCREW, 3/4-10 UNC x 3 | HCS12UNCX048-316SS |
| 202 | 136 | 316 SS | HEX HD CAPSCREW, 3/4-10 UNC x 2 1/2 | HCS12UNCX040-316SS |
| 203 | 16 | 316 SS | HEX HD CAPSCREW, 3/4-10 UNC x 2 | HCS12UNCX032-316SS |
| 204 | 216 | 316 SS | PLAIN WASHER, 3/4 - SMALL OD | PNW12A-316SS |
| 205 | 16 | 316 SS | PLAIN WASHER, 3/4 - LARGE OD | PNW12B-316SS |
| 206 | 176 | 316 SS | HEX NUT, 3/4-10 UNC | HXN12UNC-316SS |
| 207 | 48 | 316 SS | HEX HD CAPSCREW, 5/8-11 UNC x 1 1/2 | HCS10UNCX024-316SS |
| 208 | 24 | 316 SS | PLAIN WASHER, 5/8 - SMALL OD | PNW10A-316SS |
| 209 | 48 | 316 SS | PLAIN WASHER, 5/8 - LARGE OD | PNW10B-316SS |
| 210 | 48 | 316 SS | HEX NUT, 5/8-11 UNC | HXN10UNC-316SS |
| 211 | 162 | 316 SS | HEX HD FULL THREAD BOLT, 3/8-16 UNC x 1 | HFT06UNCX016-316SS |
| 212 | 162 | 316 SS | PLAIN WASHER, 3/8 - SMALL OD | PNW06A-316SS |
| 213 | 162 | 316 SS | HEX NUT, 3/8-16 UNC | HXN06UNC-316SS |



PLAN VIEW



ELEVATION VIEW



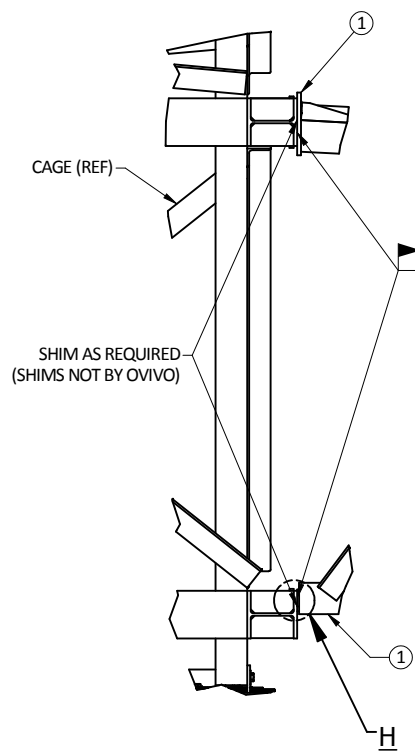
SECTION N-N

NOTES:

1. THE INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS MANUAL MUST BE STUDIED PRIOR TO STARTING THE ERECTION OF THIS EQUIPMENT.
2. AT BOLTED JOINTS, ALL SURFACES MUST BE FREE OF LOOSE MILL SCALE, BURRS AND FOREIGN MATERIAL.
3. BOLTS TO BE TIGHTENED PER THE TORQUE METHOD DESCRIBED ON THE BOLT TORQUE CHART DRAWING, 114808.
4. TO PREVENT GALLING, AN ANTISEIZE COMPOUND IS RECOMMENDED FOR USE ON STAINLESS STEEL FASTENERS (NOT PROVIDED BY OVIVO).
5. WORK THIS DRAWING WITH GENERAL ERECTION DRAWING CSW1517-151.
6. QUANTITIES SHOWN ARE FOR (1) MECHANISM.
7. WHEN MOVING THE RAKE ARMS, PICK UP RAKE ARMS WITH A MINIMUM OF FOUR POINTS. SELECT POINTS TO ACHIEVE A BALANCE WHEN LIFTING.
8. IF SHIMS ARE USED WELD MUST BE ENLARGED SO THAT THE LOAD WILL BE TRANSFERRED FROM RAKE ARMS TO CAGE NOT FROM ARMS TO SHIMS.

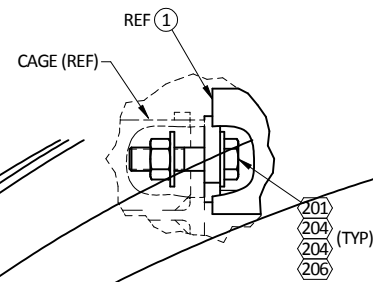
| | | | |
|---|--|--|---|
| D SIZE SHEET (DO NOT SCALE PRINTS) THIRD ANGLE PROJECTION DRAWN BY: NPR/NDN CHECKED BY: EMH DATE: 07/12/2021 PROJECT: CSW0001517-01 REF: CSW1261-152 | | RAKE ARM ERECTION 160'-0" DIA. TANK TYPE: C3D CLARIFIER | |
| | | THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION 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. | © 2021 OVIVO. ALL RIGHTS RESERVED. WORKMANSHIP STANDARD E8001 APPLIES |

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

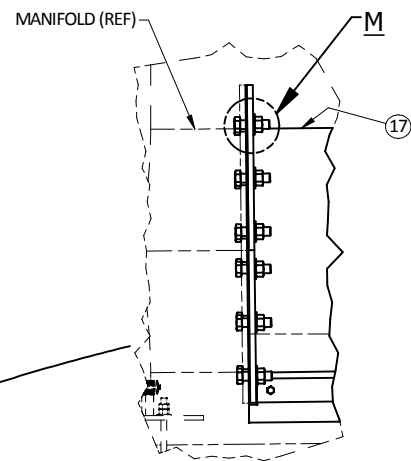


DETAIL G
(TYP RAKE ARM TO CAGE CONNECTION DETAIL)

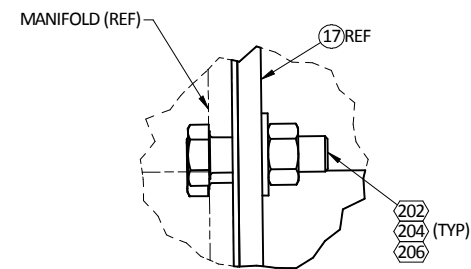
TYP AFTER
FINAL ADJUSTMENTS
(REFER NOTE 8)



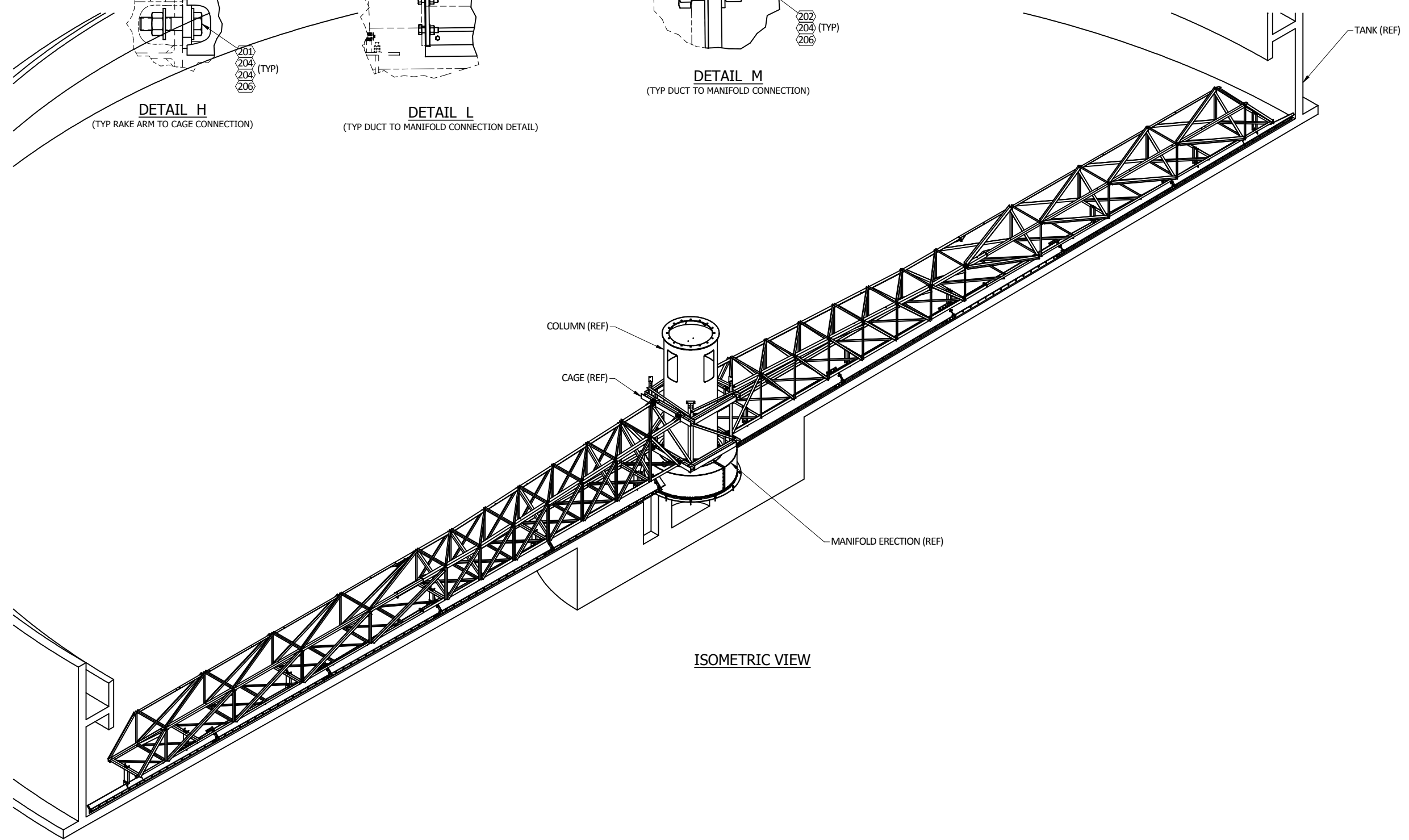
DETAIL H
(TYP RAKE ARM TO CAGE CONNECTION)



DETAIL L
(TYP DUCT TO MANIFOLD CONNECTION DETAIL)



DETAIL M
(TYP DUCT TO MANIFOLD CONNECTION)

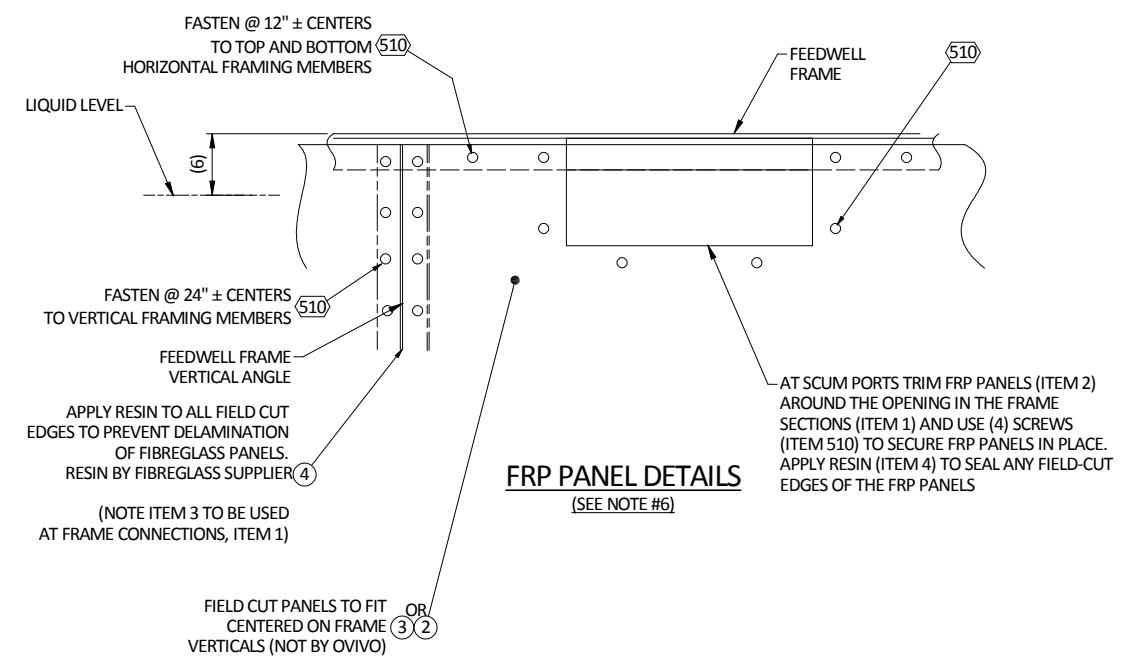
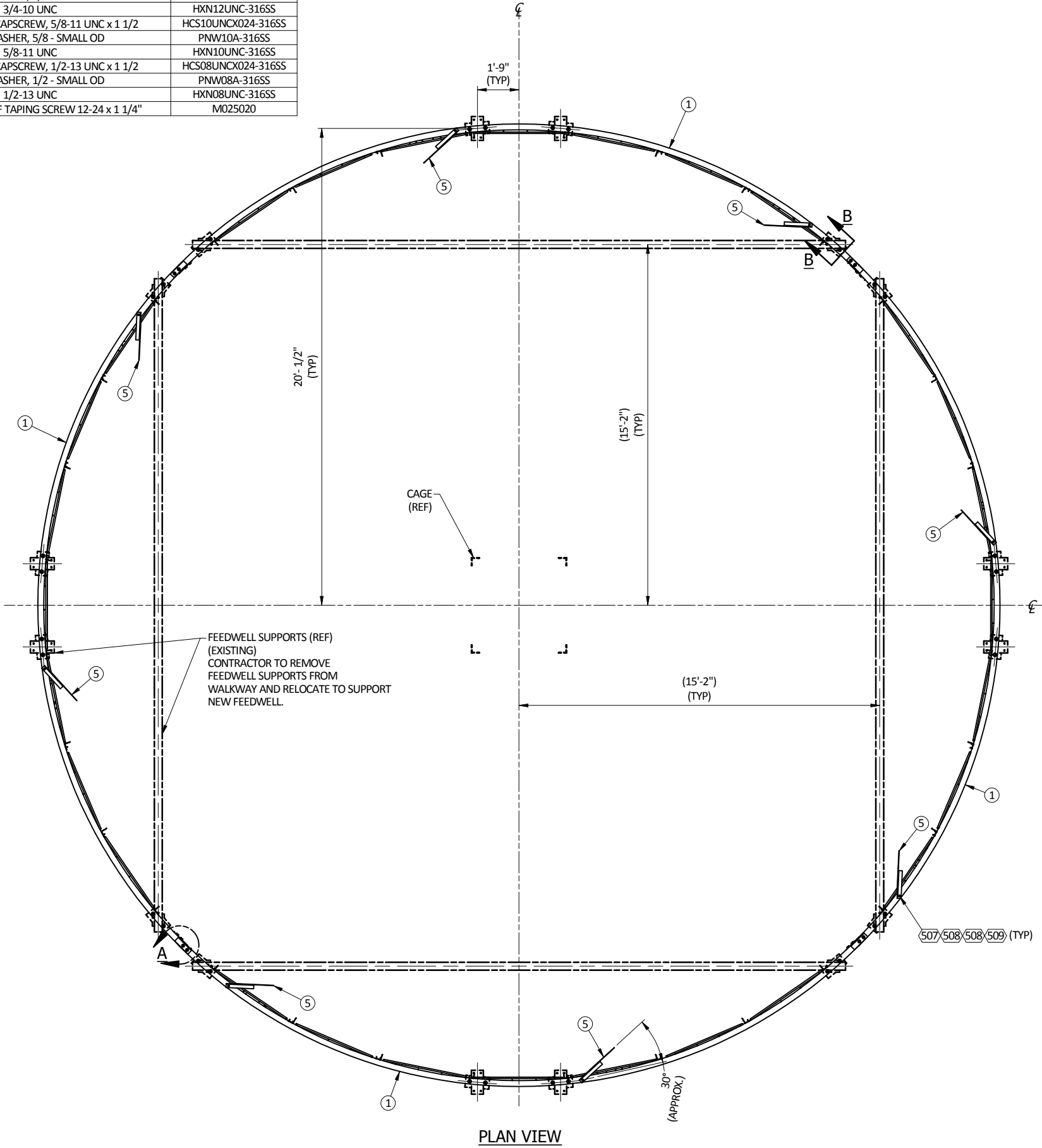


ISOMETRIC VIEW

| FASTENER LIST | | | | |
|---------------|-----|----------|---|--------------------|
| ITEM | QTY | MATERIAL | DESCRIPTION | PART NUMBER |
| 501 | 32 | 316 SS | HEX HD FULL THREAD BOLT, 3/4-10 UNC x 9 | HFT12UNCX144-316SS |
| 502 | 64 | 316 SS | PLAIN WASHER, 3/4 - LARGE OD | PNW12B-316SS |
| 503 | 32 | 316 SS | HEX NUT, 3/4-10 UNC | HXN12UNC-316SS |
| 504 | 32 | 316 SS | HEX HD CAPSCREW, 5/8-11 UNC x 1 1/2 | HCS10UNCX024-316SS |
| 505 | 64 | 316 SS | PLAIN WASHER, 5/8 - SMALL OD | PNW10A-316SS |
| 506 | 32 | 316 SS | HEX NUT, 5/8-11 UNC | HXN10UNC-316SS |
| 507 | 8 | 316 SS | HEX HD CAPSCREW, 1/2-13 UNC x 1 1/2 | HCS08UNCX024-316SS |
| 508 | 16 | 316 SS | PLAIN WASHER, 1/2 - SMALL OD | PNW08A-316SS |
| 509 | 8 | 316 SS | HEX NUT, 1/2-13 UNC | HXN08UNC-316SS |
| 510 | 476 | 410 SS | TEKS SELF TAPING SCREW 12-24 x 1 1/4" | M025020 |

| REFERENCE DRAWING | |
|-------------------|-------------|
| DESCRIPTION | DRAWING NO. |
| BOLT TORQUE CHART | 114808 |

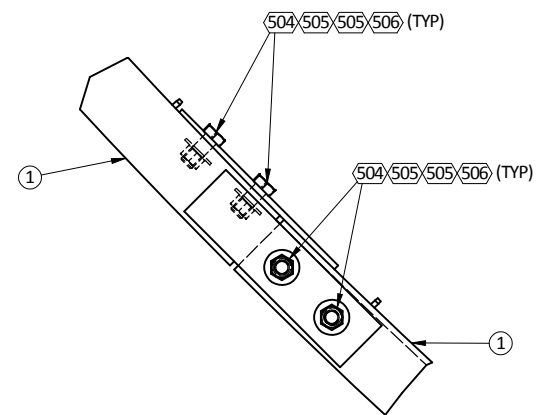
| BILL OF MATERIAL | | | | | | |
|------------------|-----|----------|--------------------------------|--------------|-------------|--------------|
| ITEM | QTY | MATERIAL | DESCRIPTION | PART NUMBER | DRAWING | WEIGHT |
| 1 | 4 | STEEL | FEEDWELL FRAME QUARTER SECTION | CSW1517-180 | CSW1517-180 | 2412 |
| 2 | 28 | FRP | FEEDWELL PANEL | CSW1517-186A | CSW1517-186 | |
| 3 | 4 | FRP | FEEDWELL PANEL | CSW1517-186B | CSW1517-186 | |
| 4 | 1 | - | RESINS | CSW1517-186C | CSW1517-186 | |
| 5 | 8 | STEEL | SCUM PORT BAFFLE | 767880A | 767880 | 115 |
| | | | | | | TOTAL WEIGHT |
| | | | | | | 2527 |



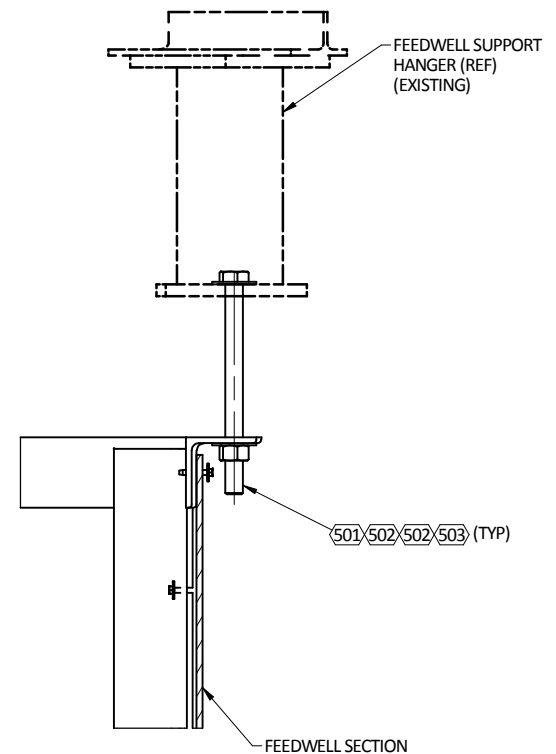
- NOTES:
1. THE INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS MANUAL MUST BE STUDIED PRIOR TO STARTING THE ERECTION OF THIS EQUIPMENT.
 2. THE FINAL INSTALLED TORQUE VALUES FOR BOLTS SHALL BE AS SPECIFIED IN THE TABLE PROVIDED ON THE BOLT TORQUE CHART DRAWING, 114808.
 3. TO PREVENT GALLING, AN ANTISEIZE COMPOUND IS RECOMMENDED FOR USE ON STAINLESS STEEL FASTENERS (COMPOUND AND LABOR NOT BY OVIVO)
 4. WORK THIS DRAWING WITH THE GENERAL ERECTION DRAWING, CSW1517-151
 5. QUANTITIES SHOWN ARE FOR (1) ONE MECHANISM.
 6. FASTENERS USED TO SECURE PANELS MUST UTILIZE NEOP. WASHERS TO PREVENT DAMAGE TO FIBERGLASS. FINAL TIGHTENING OF FASTENERS MUST BE SUCH THAT NEOPRENE WASHER IS COMPRESSED BUT NOT TOTALLY DISTORTED OR LOST FROM SERVICE.

| | | | | |
|---|--|--|--|--|
| D SIZE SHEET (DO NOT SCALE PRINTS) DRAWN BY NPR/NDN CHECKED BY EMH DATE 07/05/2021 PROJECT CSW00001517-01 REF CSW1405-155 | | FEEDWELL ERECTION 40'-0" DIA. W/ FRP PANELS | | |
| | | 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. | | |
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| | | WORKMANSHIP STANDARD E8001 APPLIES | | |
| DWG NO. CSW1517-155 | | SHEET 1 OF 2 | | |

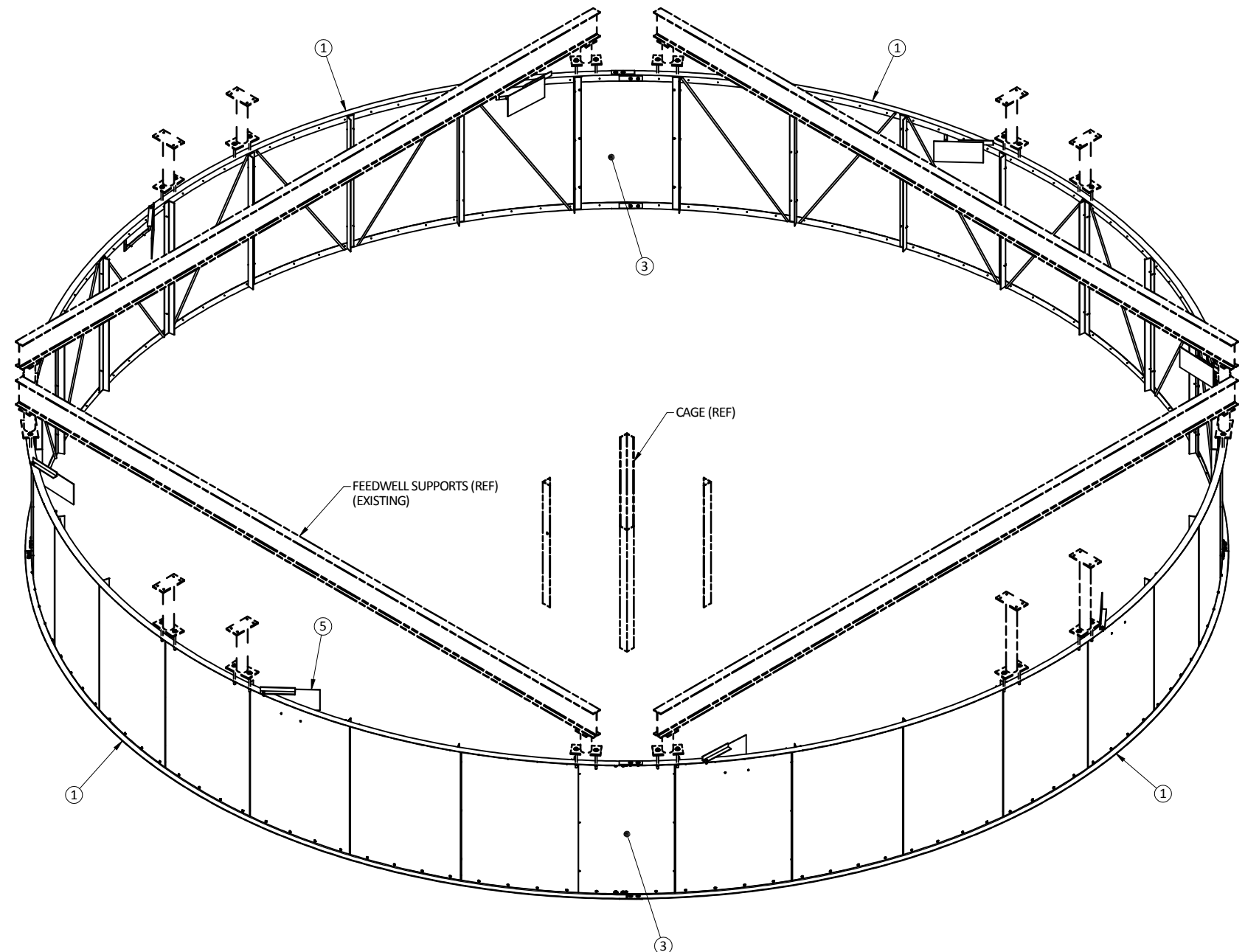
| INITIAL RELEASE | REVISION DESCRIPTION | EN/ECO | BY | CHECK'D | DATE | REV |
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| | | | | | | A |



DETAIL A



SECTION B-B



ISOMETRIC VIEW

FASTENER LIST

| ITEM | QTY | MATERIAL | DESCRIPTION | PART NUMBER |
|------|-----|----------|-------------------------------------|--------------------|
| 301 | 96 | 316 SS | HEX HD CAPSCREW, 5/8-11 UNC x 1 1/2 | HCS10UNCX024-316SS |
| 302 | 160 | 316 SS | PLAIN WASHER, 5/8 - SMALL OD | PNW10A-316SS |
| 303 | 32 | 316 SS | PLAIN WASHER, 5/8 - LARGE OD | PNW10B-316SS |
| 304 | 96 | 316 SS | HEX NUT, 5/8-11 UNC | HXN10UNC-316SS |
| 305 | 8 | 316 SS | HEX HD CAPSCREW, 1/2-13 UNC x 2 | HCS08UNCX032-316SS |
| 306 | 16 | 316 SS | HEX HD CAPSCREW, 1/2-13 UNC x 1 1/2 | HCS08UNCX024-316SS |
| 307 | 24 | 316 SS | PLAIN WASHER, 1/2 - SMALL OD | PNW08A-316SS |
| 308 | 48 | 316 SS | PLAIN WASHER, 1/2 - LARGE OD | PNW08B-316SS |
| 309 | 8 | 316 SS | BEVELED WASHER, 1/2 | BWW08-316SS |
| 310 | 24 | 316 SS | HEX NUT, 1/2-13 UNC | HXN08UNC-316SS |
| 311 | 4 | 304 SS | WEDGE ANCHOR, 3/4" X 8 1/2" | 495579AM |

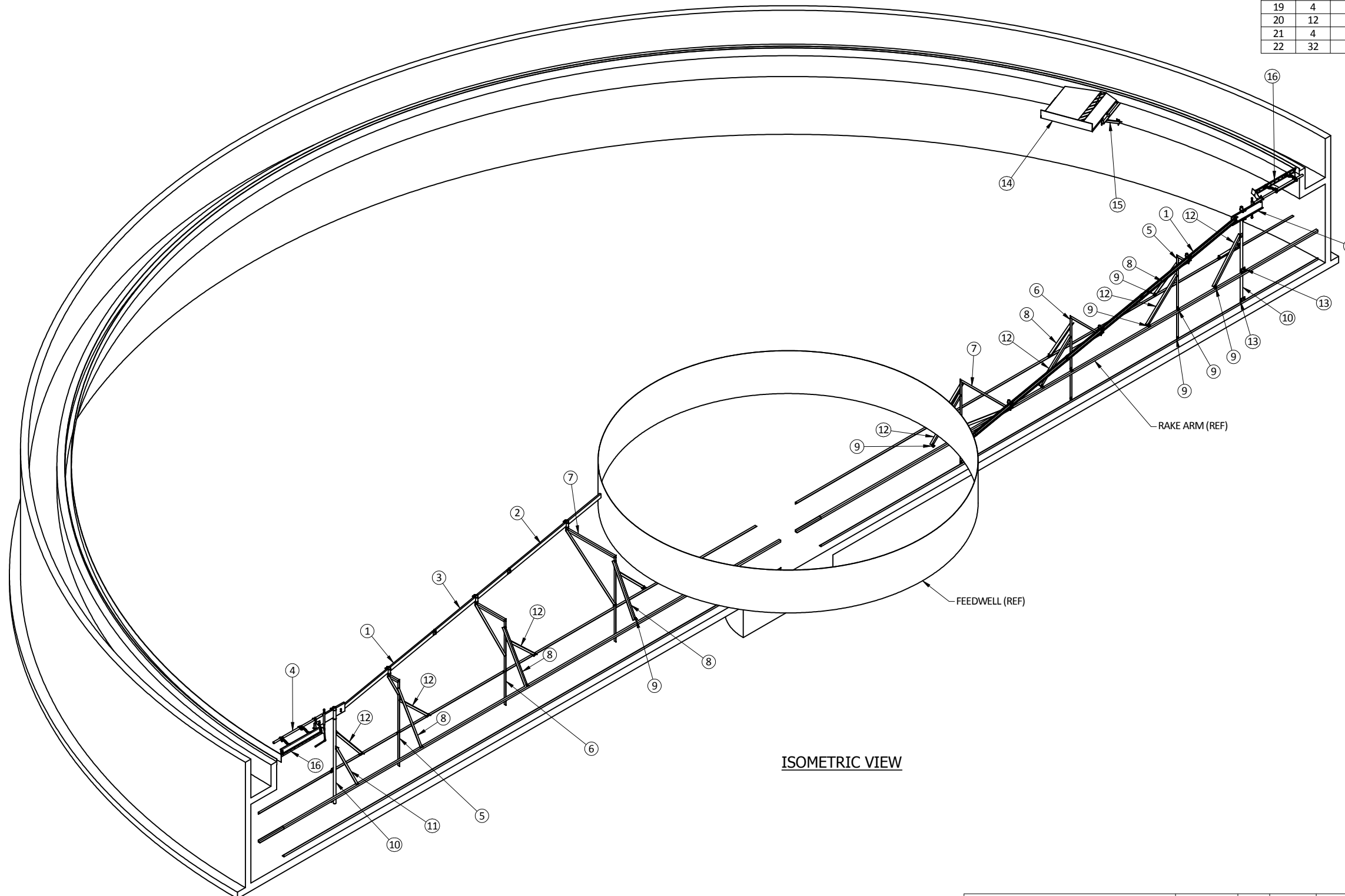
REFERENCE DRAWINGS

| DESCRIPTION | DRAWING NO. |
|----------------------|-------------|
| FLUSH VALVE ERECTION | 1134185 |
| BOLT TORQUE CHART | 114808 |

BILL OF MATERIAL

| ITEM | QTY | MATERIAL | DESCRIPTION | PART NUMBER | DRAWING | WEIGHT |
|------|-----|----------|-------------------------------|---------------|--------------|--------|
| 1 | 2 | STEEL | SKIMMER BLADE | CSW1517-1161A | CSW1517-1161 | 290 |
| 2 | 2 | STEEL | SKIMMER BLADE | CSW1517-1161C | CSW1517-1161 | 277 |
| 3 | 2 | STEEL | SKIMMER BLADE | CSW1517-1161D | CSW1517-1161 | 229 |
| 4 | 2 | STEEL | SKIMMER ARM | CSW1517-1162 | CSW1517-1162 | 181 |
| 5 | 2 | STEEL | SKIMMER BLADE SUPPORT | CSW1517-1163A | CSW1517-1163 | 155 |
| 6 | 2 | STEEL | SKIMMER BLADE SUPPORT | CSW1517-1163C | CSW1517-1163 | 223 |
| 7 | 2 | STEEL | SKIMMER BLADE SUPPORT | CSW1517-1163M | CSW1517-1163 | 283 |
| 8 | 6 | STEEL | MID-SUPPORT BRACE | CSW1517-1163H | CSW1517-1163 | 201 |
| 9 | 28 | STEEL | MID-SUPPORT BRACE BRACKET | CSW1517-1163K | CSW1517-1163 | 27 |
| 10 | 2 | STEEL | SKIMMER ARM SUPPORT | CSW1517-1164A | CSW1517-1164 | 208 |
| 11 | 2 | STEEL | SKIMMER BLADE SUPPORT BRACE | CSW1517-1164C | CSW1517-1164 | 43 |
| 12 | 8 | STEEL | SKIMMER BLADE SUPPORT BRACE | CSW1517-1164F | CSW1517-1164 | 242 |
| 13 | 4 | STEEL | SKIMMER BLADE SUPPORT BRACKET | CSW1517-1164H | CSW1517-1164 | 10 |
| 14 | 1 | STEEL | SCUM BOX | CSW1517-1166 | CSW1517-1166 | 610 |
| 15 | 2 | STEEL | SCUM BOX SUPPORT | CSW1517-1167 | CSW1517-1167 | 122 |
| 16 | 2 | AS NOTED | 6'-0" SKIMMING MECHANISM | 767657-6A | 767657 | |
| 17 | 2 | AS NOTED | FLUSH VALVE ERECTION | 1134185-2LS | 1134185 | |
| 18 | 1 | PVC | 6" FLEXIBLE COUPLING | 88602C | 88602 | |
| 19 | 4 | 316 SS | WASHER - SCUM BOX SUPPORT | 699073 | 699073 | 2 |
| 20 | 12 | 316 SS | U-BOLT, 2 1/2" PIPE | 23951A77A | 23951A77 | 12 |
| 21 | 4 | 316 SS | U-BOLT, 3" PIPE | 23951A77B | 23951A77 | 4 |
| 22 | 32 | 316 SS | CHANNEL CLAMP | 86751B | 86751 | |

TOTAL WEIGHT
3123



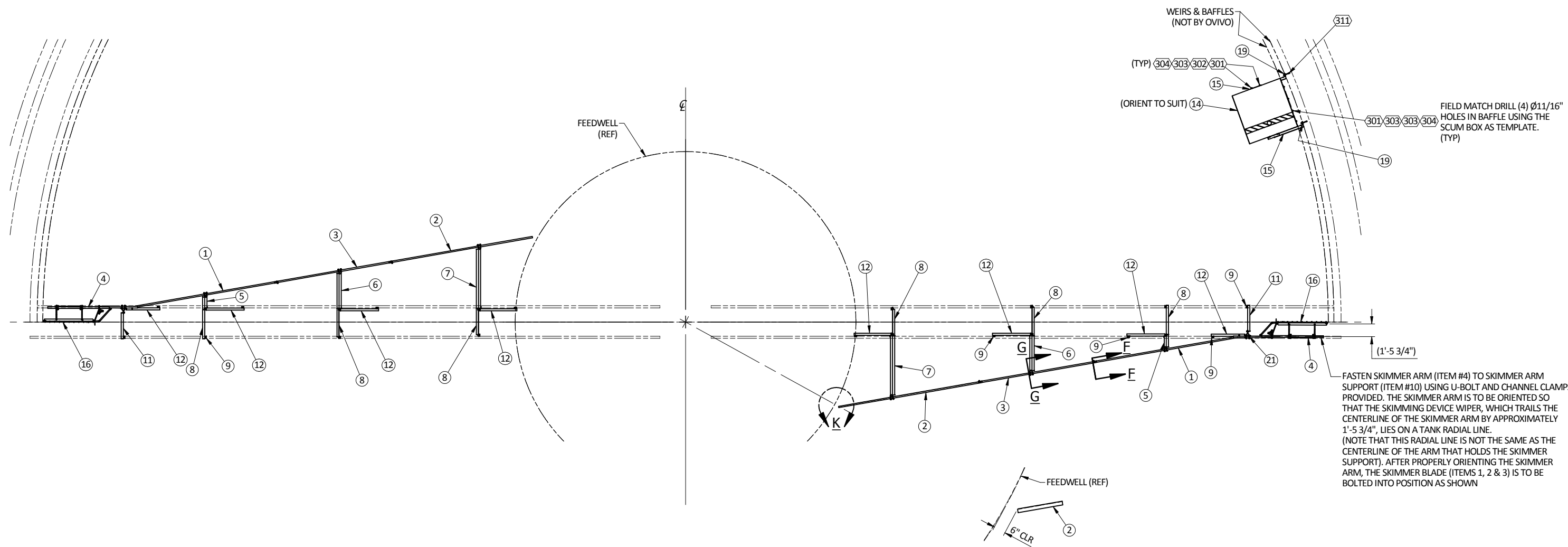
ISOMETRIC VIEW

NOTES:

1. THE INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS MANUAL MUST BE STUDIED PRIOR TO STARTING THE ERECTION OF THIS EQUIPMENT.
2. AT BOLTED JOINTS, ALL SURFACES MUST BE FREE OF LOOSE MILL SCALE, BURRS AND FOREIGN MATERIAL.
3. BOLTS TO BE TIGHTENED PER THE TORQUE METHOD DESCRIBED ON THE BOLT TORQUE CHART DRAWING, 114808.
4. TO PREVENT GALLING, AN ANTISEIZE COMPOUND IS RECOMMENDED FOR USE ON STAINLESS STEEL FASTENERS (NOT BY OVIVO).

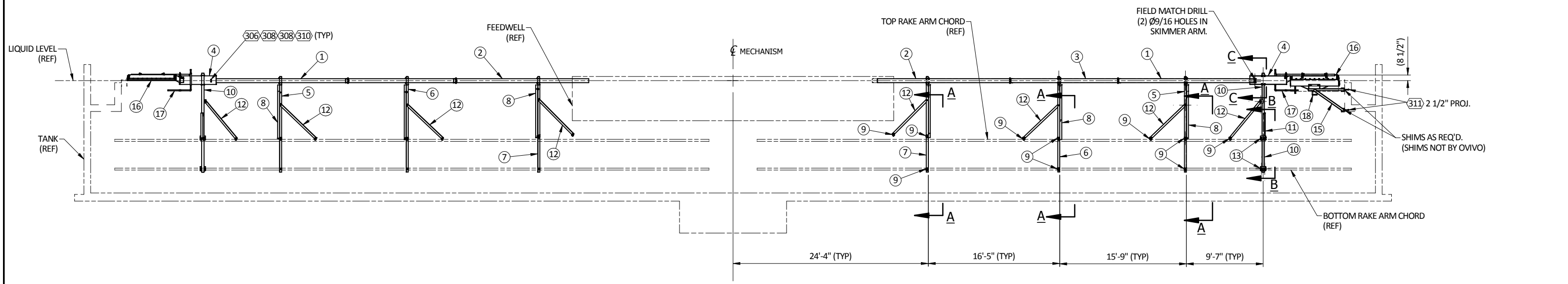
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|---|--|---|---|-----------------------------------|
| <p>D SIZE SHEET (DO NOT SCALE PRINTS)</p> <p>THIRD ANGLE PROJECTION</p> <p>DRAWN BY: NPR/NDN</p> <p>CHECKED BY: EMH</p> <p>DATE: 07/07/2021</p> <p>PROJECT: CSW0001517-01</p> <p>REF: CSW1472-153</p> | <p>SKIMMING ERECTION</p> <p>OVIVO</p> | <p>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.</p> | | |
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| | | | <p>WORKMANSHIP STANDARD E80001 APPLIES</p> | <p>SHEET 1 OF 3</p> |
| | | | <p>INITIAL RELEASE</p> | <p>REVISION</p> |

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

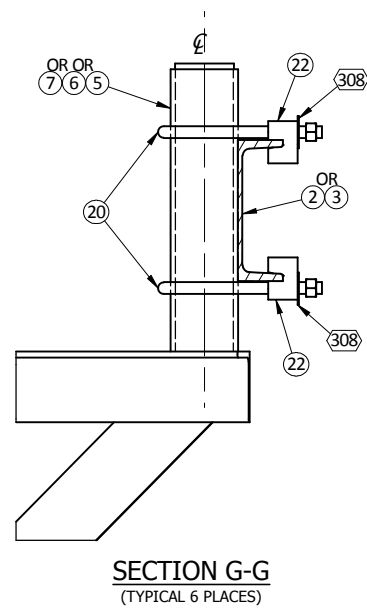
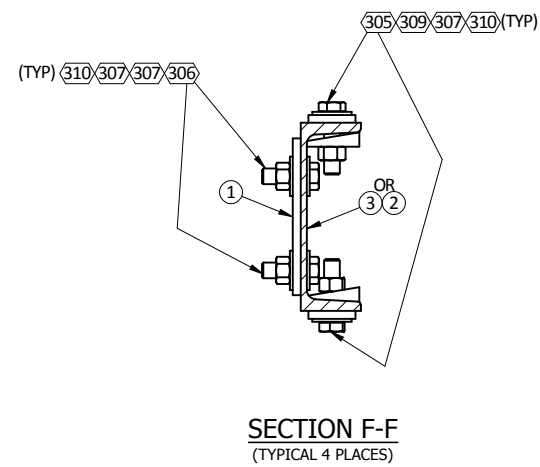
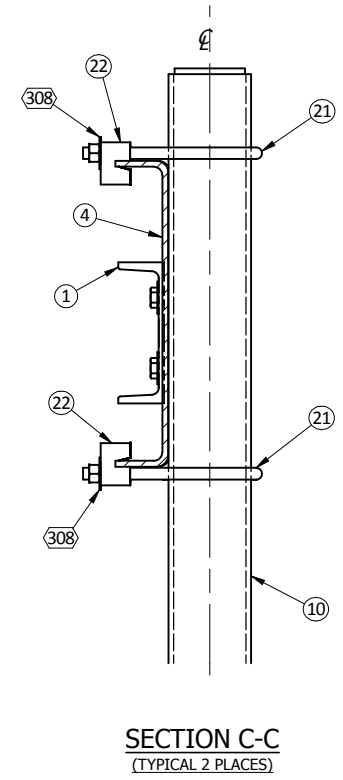
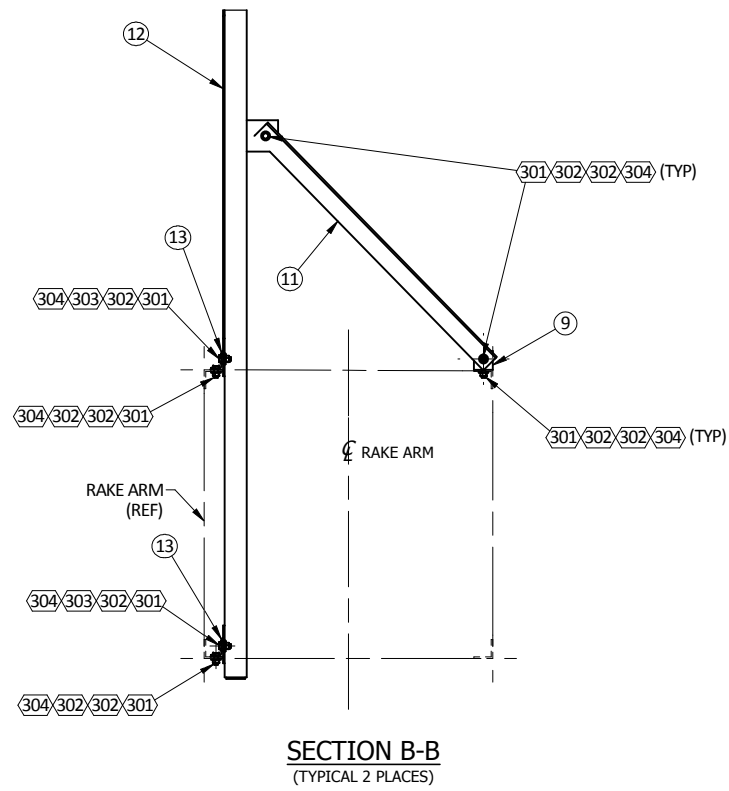
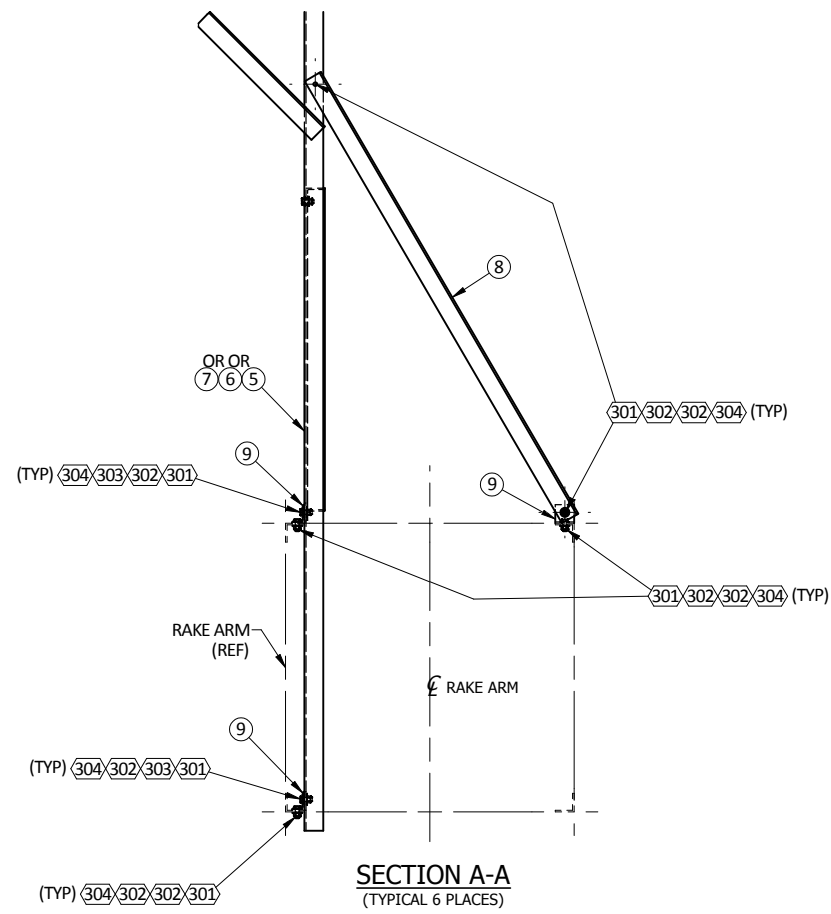


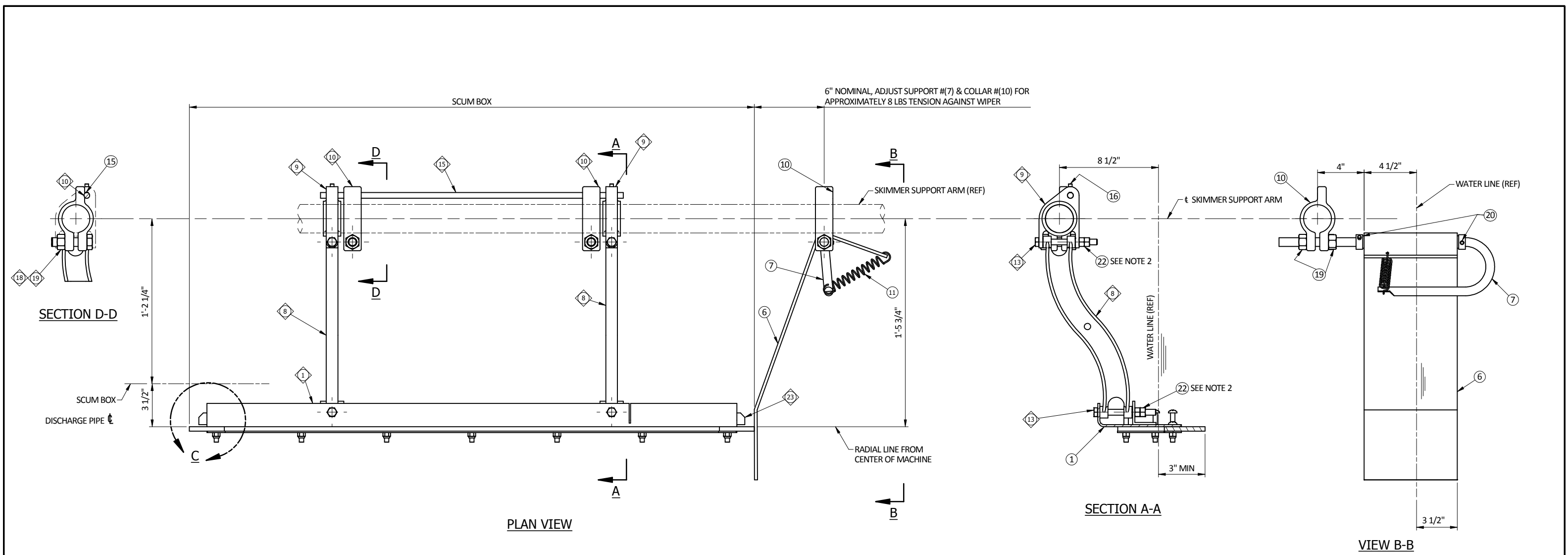
PLAN VIEW

DETAIL K



ELEVATION VIEW





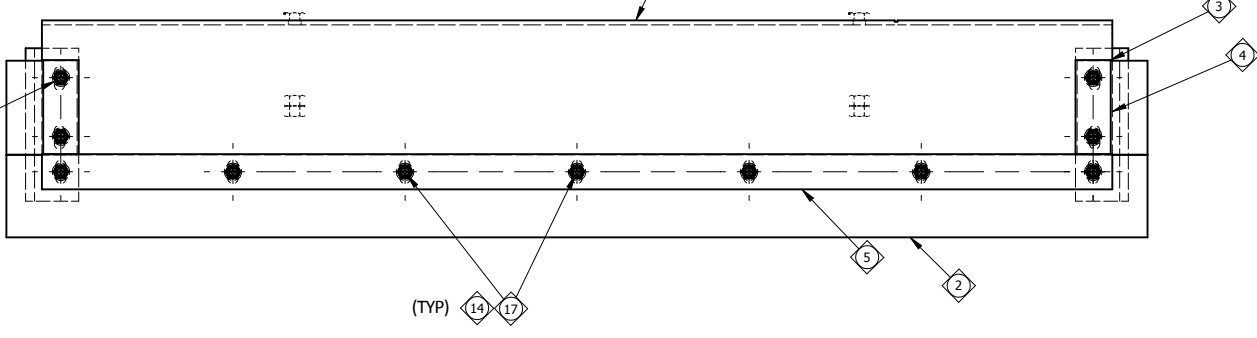
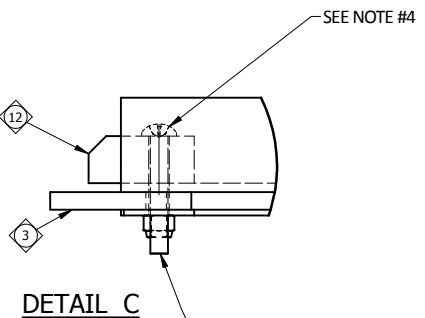
6" NOMINAL, ADJUST SUPPORT # (7) & COLLAR # (10) FOR APPROXIMATELY 8 LBS TENSION AGAINST WIPER

SECTION D-D

PLAN VIEW

SECTION A-A

VIEW B-B



ELEVATION VIEW

- NOTES:
1. DENOTES SHOP ASSEMBLED PARTS.
 2. SCRAPER ARMS MUST PIVOT FREELY AT END CONNECTIONS. TIGHTEN NUT ITEM #22 AGAINST BOLT ITEM #13 AND LOCK IN PLACE BY DOUBLE NUTTING.
 3. USE ANTI-SEIZE ON ALL STAINLESS FASTENERS
 4. HEAD OF PANHEAD SCREWS TO GO INTO WEAR BLOCK & SCUM SCRAPER, NUT TO BE ON WIPER CLAMP SIDE.

| | | | |
|---|--|---|--|
| <p>D</p> <p>©COPYRIGHT 2016 O.V.O. ALL RIGHTS RESERVED - REV. E</p> <p>THIRD ANGLE PROJECTION</p> <p>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.</p> | | <p>OVIVO</p> <p>Bringing water to life</p> | |
| <p>REF. FROM 591133 DO NOT SCALE PRINTS</p> <p>DATE (mm/dd/yyyy) 2/4/2016 WORKMANSHIP STANDARD ES0001 APPLIES</p> | | <p>SKIMMING DEVICE ASSEMBLY</p> | |
| <p>INITIAL RELEASE</p> | | <p>DWG. NO. 767657</p> | |
| <p>REVISION DESCRIPTION</p> | | <p>SHEET 1 OF 5</p> | |

| REVISION DESCRIPTION | EN/ECO | BY | CHECK'D | DATE | REV |
|---------------------------------------|----------|-----|---------|---------|-----|
| UPDATED FASTENERS (ITEM 14, 17, & 21) | S-013381 | RH | TWH | 12/3/18 | C |
| MACHINE SCREW QTY INCREASED | S-010732 | JMW | ZSS | 5/17/17 | B |
| INITIAL RELEASE | | | | | A |

3'-0" SKIMMING DEVICE ASSEMBLY: 767657-3A (ALUMINUM/STEEL)

| ITEM | QTY | DESCRIPTION | MATERIAL | PART NUMBER | DRAWING NO. | TOTAL WEIGHT |
|------|-----|--|--------------------|----------------|-------------|--------------|
| 1 | 1 | SCUM SCRAPER 3'-0" | ALUMINUM | 1146016-01 | 1146016 | 6 |
| 2 | 1 | BOTTOM WIPER, 3'-0" SKIMMER | NEOPRENE (40 DUR.) | 1155541-01 | 1155541 | |
| 3 | 2 | SIDE WIPER | NEOPRENE (60 DUR.) | 81602A | 81602 | |
| 4 | 2 | SIDE WIPER CLAMP | ALUMINUM | 81598A | 81598 | 0 |
| 5 | 1 | BOTTOM WIPER CLAMP, 3'-0" | ALUMINUM | 81596A | 81596 | 1 |
| 6 | 1 | HINGED SKIMMER | STEEL | 88188A | 88188 | 17 |
| 7 | 1 | SUPPORT, HINGED SKIMMER | STEEL | 88187A | 88187 | 4 |
| 8 | 2 | SCRAPER ARM | ALUMINUM | 48080A1 | 48080A1 | 3 |
| 9 | 2 | ARM CLEVIS | STEEL | 89081A1A | 89081-1 | 5 |
| 10 | 3 | COLLAR, SKIMMING DEVICE | STEEL | 88011A1A | 88011-1 | 6 |
| 11 | 1 | SPRING (EXTENSION) | 302 SS | 85606A | 85606 | |
| 12 | 1 | WEAR BLOCK | UHMW-PE | 1183082-02 | 1183082 | |
| 13 | 4 | CAPSCREW, HEX HD, 1/2-13X5 | 316 SS | M012581 | N/A | |
| 14 | 10 | NYLON INSERT HEX NUT, 3/8-16 UNC | 316 SS | NHN06UNC-316SS | N/A | |
| 15 | 1 | STOP ROD, 1/2" DIA. X 1'-8" LG | 316 SS | 1007186-03 | 1007186 | 1 |
| 16 | 2 | SETSCREW, SQ HD, CP PT, 316SS, 3/8-16X3/4 | 316 SS | F13938 | N/A | |
| 17 | 4 | MACH SCR, PAN HD, 3/8-16X1 1/2 | 316 SS | F11017 | N/A | |
| 18 | 2 | CAPSCREW, HEX HD, 3/4-10X3 | 316 SS | F10460 | N/A | |
| 19 | 4 | NUT, HEX, 3/4-10 | 316 SS | F10902 | N/A | |
| 20 | 2 | COLLAR, SOLID, ZINC 13/16ID X NOM X9/16WD(922) | ZINC | 85609A | 85609 | |
| 21 | 6 | MACH SCR, PAN HD, 3/8-16X2 1/2 | 316 SS | M024679 | N/A | |
| 22 | 8 | NUT, HX, 1/2-13, 316SS | 316 SS | F10899 | N/A | |
| 23 | 1 | WEAR BLOCK | UHMW-PE | 1183082-01 | 1183082 | |

3'-0" SKIMMING DEVICE ASSEMBLY: 767657-3B (ALUMINUM/STAINLESS)

| ITEM | QTY | DESCRIPTION | MATERIAL | PART NUMBER | DRAWING NO. | TOTAL WEIGHT |
|------|-----|---|--------------------|----------------|-------------|--------------|
| 1 | 1 | SCUM SCRAPER 3'-0" | ALUMINUM | 1146016-01 | 1146016 | 6 |
| 2 | 1 | BOTTOM WIPER, 3'-0" SKIMMER | NEOPRENE (40 DUR.) | 1155541-01 | 1155541 | |
| 3 | 2 | SIDE WIPER | NEOPRENE (60 DUR.) | 81602A | 81602 | |
| 4 | 2 | SIDE WIPER CLAMP | ALUMINUM | 81598A | 81598 | 0 |
| 5 | 1 | BOTTOM WIPER CLAMP, 3'-0" | ALUMINUM | 81596A | 81596 | 1 |
| 6 | 1 | HINDGED SKIMMER | 316 SS | 76774A85A | 76774A85 | 17 |
| 7 | 1 | SUPPORT, HINGED SKIMMER | 316 SS | 76774A88A | 76774A88 | 4 |
| 8 | 2 | SCRAPER ARM | ALUMINUM | 48080A1 | 48080A1 | 3 |
| 9 | 2 | ARM CLEVIS | CAST SS | 89081C1A | 89081-1 | 5 |
| 10 | 3 | COLLAR, SKIMMING DEVICE | CAST SS | 88011C1A | 88011-1 | 6 |
| 11 | 1 | SPRING (EXTENSION) | 302 SS | 85606A | 85606 | |
| 12 | 1 | WEAR BLOCK | UHMW-PE | 1183082-02 | 1183082 | |
| 13 | 4 | CAPSCREW, HEX HD, 1/2-13X5 | 316 SS | M012581 | N/A | |
| 14 | 10 | NYLON INSERT HEX NUT, 3/8-16 UNC | 316 SS | NHN06UNC-316SS | N/A | |
| 15 | 1 | STOP ROD, 1/2" DIA. X 1'-8" LG | 316 SS | 1007186-03 | 1007186 | 1 |
| 16 | 2 | SETSCREW, SQ HD, CP PT, 316SS, 3/8-16X3/4 | 316 SS | F13938 | N/A | |
| 17 | 4 | MACH SCR, PAN HD, 3/8-16X1 1/2 | 316 SS | F11017 | N/A | |
| 18 | 2 | CAPSCREW, HEX HD, 3/4-10X3 | 316 SS | F10460 | N/A | |
| 19 | 4 | NUT, HEX, 3/4-10 | 316 SS | F10902 | N/A | |
| 20 | 2 | COLLAR, SOLID | 316 SS | 25440A68A | N/A | |
| 21 | 6 | MACH SCR, PAN HD, 3/8-16X2 1/2 | 316 SS | M024679 | N/A | |
| 22 | 8 | NUT, HX, 1/2-13, 316SS | 316 SS | F10899 | N/A | |
| 23 | 1 | WEAR BLOCK | UHMW-PE | 1183082-01 | 1183082 | |

3'-0" SKIMMING DEVICE ASSEMBLY: 767657-3C (ALL STAINLESS)

| ITEM | QTY | DESCRIPTION | MATERIAL | PART NUMBER | DRAWING NO. | TOTAL WEIGHT |
|------|-----|---|--------------------|----------------|-------------|--------------|
| 1 | 1 | SCUM SCRAPER 3'-0" | 316 SS | 1146016-02 | 1146016 | 17 |
| 2 | 1 | BOTTOM WIPER, 3'-0" SKIMMER | NEOPRENE (40 DUR.) | 1155541-01 | 1155541 | |
| 3 | 2 | SIDE WIPER | NEOPRENE (60 DUR.) | 81602A | 81602 | |
| 4 | 2 | SIDE WIPER CLAMP | 316 SS | 76774A86A | 76774A86 | 0 |
| 5 | 1 | BOTTOM WIPER CLAMP, 3'-0" | 316 SS | 525272-03 | 525272 | 2 |
| 6 | 1 | HINDGED SKIMMER | 316 SS | 76774A85A | 76774A85 | 17 |
| 7 | 1 | SUPPORT, HINGED SKIMMER | 316 SS | 76774A88A | 76774A88 | 4 |
| 8 | 2 | SCRAPER ARM | 316 SS | 49097A1A | 49097-1 | 7 |
| 9 | 2 | ARM CLEVIS | CAST SS | 89081C1A | 89081-1 | 5 |
| 10 | 3 | COLLAR, SKIMMING DEVICE | CAST SS | 88011C1A | 88011-1 | 6 |
| 11 | 1 | SPRING (EXTENSION) | 302 SS | 85606A | 85606 | |
| 12 | 1 | WEAR BLOCK | UHMW-PE | 1183082-02 | 1183082 | |
| 13 | 4 | CAPSCREW, HEX HD, 1/2-13X5 | 316 SS | M012581 | N/A | |
| 14 | 10 | NYLON INSERT HEX NUT, 3/8-16 UNC | 316 SS | NHN06UNC-316SS | N/A | |
| 15 | 1 | STOP ROD, 1/2" DIA. X 1'-8" LG | 316 SS | 1007186-03 | 1007186 | 1 |
| 16 | 2 | SETSCREW, SQ HD, CP PT, 316SS, 3/8-16X3/4 | 316 SS | F13938 | N/A | |
| 17 | 4 | MACH SCR, PAN HD, 3/8-16X1 1/2 | 316 SS | F11017 | N/A | |
| 18 | 2 | CAPSCREW, HEX HD, 3/4-10X3 | 316 SS | F10460 | N/A | |
| 19 | 4 | NUT, HEX, 3/4-10 | 316 SS | F10902 | N/A | |
| 20 | 2 | COLLAR, SOLID | 316 SS | 25440A68A | N/A | |
| 21 | 6 | MACH SCR, PAN HD, 3/8-16X2 1/2 | 316 SS | M024679 | N/A | |
| 22 | 8 | NUT, HX, 1/2-13, 316SS | 316 SS | F10899 | N/A | |
| 23 | 1 | WEAR BLOCK | UHMW-PE | 1183082-01 | 1183082 | |

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WORKMANSHIP STANDARD ES0001 APPLIES

| 4'-0" SKIMMING DEVICE ASSEMBLY: 767657-4A (ALUMINUM/STEEL) | | | | | | |
|--|-----|--|--------------------|----------------|-------------|--------------|
| ITEM | QTY | DESCRIPTION | MATERIAL | PART NUMBER | DRAWING NO. | TOTAL WEIGHT |
| 1 | 1 | SCUM SCRAPER, 4'-0" | ALUMINUM | 1155485-01 | 1155485 | 8 |
| 2 | 1 | BOTTOM WIPER, 4'-0" SKIMMER | NEOPRENE (40 DUR.) | 1155495-01 | 1155495 | |
| 3 | 2 | SIDE WIPER | NEOPRENE (60 DUR.) | 81602A | 81602 | |
| 4 | 2 | SIDE WIPER CLAMP | ALUMINUM | 81598A | 81598 | 0 |
| 5 | 1 | BOTTOM WIPER CLAMP, 4'-0" | ALUMINUM | 81597A | 81597 | 1 |
| 6 | 1 | HINGED SKIMMER | STEEL | 88188A | 88188 | 17 |
| 7 | 1 | SUPPORT, HINGED SKIMMER | STEEL | 88187A | 88187 | 4 |
| 8 | 2 | SCRAPER ARM | ALUMINUM | 48080A1 | 48080A1 | 3 |
| 9 | 2 | ARM CLEVIS | STEEL | 89081A1A | 89081-1 | 5 |
| 10 | 3 | COLLAR, SKIMMING DEVICE | STEEL | 88011A1A | 88011-1 | 6 |
| 11 | 1 | SPRING (EXTENSION) | 302 SS | 85606A | 85606 | |
| 12 | 1 | WEAR BLOCK | UHMW-PE | 1183082-02 | 1183082 | |
| 13 | 4 | CAPSCREW, HEX HD, 1/2-13X5 | 316 SS | M012581 | N/A | |
| 14 | 11 | NYLON INSERT HEX NUT, 3/8-16 UNC | 316 SS | NHN06UNC-316SS | N/A | |
| 15 | 1 | STOP ROD, 2'-2" 316 SS | 316 SS | 1007186-04 | 1007186 | 1 |
| 16 | 2 | SETSCREW, SQ HD, CP PT, 316SS, 3/8-16X3/4 | 316 SS | F13938 | N/A | |
| 17 | 5 | MACH SCR, PAN HD, 3/8-16X1 1/2 | 316 SS | F11017 | N/A | |
| 18 | 2 | CAPSCREW, HEX HD, 3/4-10X3 | 316 SS | F10460 | N/A | |
| 19 | 4 | NUT, HEX, 3/4-10 | 316 SS | F10902 | N/A | |
| 20 | 2 | COLLAR, SOLID, ZINC 13/16ID X NOM X9/16WD(922) | ZINC | 85609A | 85609 | |
| 21 | 6 | MACH SCR, PAN HD, 3/8-16X2 1/2 | 316 SS | M024679 | N/A | |
| 22 | 8 | NUT, HX, 1/2-13, 316SS | 316 SS | F10899 | N/A | |
| 23 | 1 | WEAR BLOCK | UHMW-PE | 1183082-01 | 1183082 | |

| 4'-0" SKIMMING DEVICE ASSEMBLY: 767657-4B (ALUMINUM/STAINLESS) | | | | | | |
|--|-----|---|--------------------|----------------|-------------|--------------|
| ITEM | QTY | DESCRIPTION | MATERIAL | PART NUMBER | DRAWING NO. | TOTAL WEIGHT |
| 1 | 1 | SCUM SCRAPER, 4'-0" | ALUMINUM | 1155485-01 | 1155485 | 8 |
| 2 | 1 | BOTTOM WIPER, 4'-0" SKIMMER | NEOPRENE (40 DUR.) | 1155495-01 | 1155495 | |
| 3 | 2 | SIDE WIPER | NEOPRENE (60 DUR.) | 81602A | 81602 | |
| 4 | 2 | SIDE WIPER CLAMP | ALUMINUM | 81598A | 81598 | 0 |
| 5 | 1 | BOTTOM WIPER CLAMP, 4'-0" | ALUMINUM | 81597A | 81597 | 1 |
| 6 | 1 | HINDGED SKIMMER | 316 SS | 76774A85A | 76774A85 | 17 |
| 7 | 1 | SUPPORT, HINGED SKIMMER | 316 SS | 76774A88A | 76774A88 | 4 |
| 8 | 2 | SCRAPER ARM | ALUMINUM | 48080A1 | 48080A1 | 3 |
| 9 | 2 | ARM CLEVIS | CAST SS | 89081C1A | 89081-1 | 5 |
| 10 | 3 | COLLAR, SKIMMING DEVICE | CAST SS | 88011C1A | 88011-1 | 6 |
| 11 | 1 | SPRING (EXTENSION) | 302 SS | 85606A | 85606 | |
| 12 | 1 | WEAR BLOCK | UHMW-PE | 1183082-02 | 1183082 | |
| 13 | 4 | CAPSCREW, HEX HD, 1/2-13X5 | 316 SS | M012581 | N/A | |
| 14 | 11 | NYLON INSERT HEX NUT, 3/8-16 UNC | 316 SS | NHN06UNC-316SS | N/A | |
| 15 | 1 | STOP ROD, 2'-2" 316 SS | 316 SS | 1007186-04 | 1007186 | 1 |
| 16 | 2 | SETSCREW, SQ HD, CP PT, 316SS, 3/8-16X3/4 | 316 SS | F13938 | N/A | |
| 17 | 5 | MACH SCR, PAN HD, 3/8-16X1 1/2 | 316 SS | F11017 | N/A | |
| 18 | 2 | CAPSCREW, HEX HD, 3/4-10X3 | 316 SS | F10460 | N/A | |
| 19 | 4 | NUT, HEX, 3/4-10 | 316 SS | F10902 | N/A | |
| 20 | 2 | COLLAR, SOLID | 316 SS | 25440A68A | N/A | |
| 21 | 6 | MACH SCR, PAN HD, 3/8-16X2 1/2 | 316 SS | M024679 | N/A | |
| 22 | 8 | NUT, HX, 1/2-13, 316SS | 316 SS | F10899 | N/A | |
| 23 | 1 | WEAR BLOCK | UHMW-PE | 1183082-01 | 1183082 | |

| 4'-0" SKIMMING DEVICE ASSEMBLY: 767657-4C (ALL STAINLESS) | | | | | | |
|---|-----|---|--------------------|----------------|-------------|--------------|
| ITEM | QTY | DESCRIPTION | MATERIAL | PART NUMBER | DRAWING NO. | TOTAL WEIGHT |
| 1 | 1 | SCUM SCRAPER 4'-0" SKIMMER | 316 SS | 1155485-02 | 1155485 | 30 |
| 2 | 1 | BOTTOM WIPER, 4'-0" SKIMMER | NEOPRENE (40 DUR.) | 1155495-01 | 1155495 | |
| 3 | 2 | SIDE WIPER | NEOPRENE (60 DUR.) | 81602A | 81602 | |
| 4 | 2 | SIDE WIPER CLAMP | 316 SS | 76774A86A | 76774A86 | 0 |
| 5 | 1 | BOTTOM WIPER CLAMP, 4'-0" | 316 SS | 525272-04 | 525272 | 2 |
| 6 | 1 | HINDGED SKIMMER | 316 SS | 76774A85A | 76774A85 | 17 |
| 7 | 1 | SUPPORT, HINGED SKIMMER | 316 SS | 76774A88A | 76774A88 | 4 |
| 8 | 2 | SCRAPER ARM | 316 SS | 49097A1A | 49097-1 | 7 |
| 9 | 2 | ARM CLEVIS | CAST SS | 89081C1A | 89081-1 | 5 |
| 10 | 3 | COLLAR, SKIMMING DEVICE | CAST SS | 88011C1A | 88011-1 | 6 |
| 11 | 1 | SPRING (EXTENSION) | 302 SS | 85606A | 85606 | |
| 12 | 1 | WEAR BLOCK | UHMW-PE | 1183082-02 | 1183082 | |
| 13 | 4 | CAPSCREW, HEX HD, 1/2-13X5 | 316 SS | M012581 | N/A | |
| 14 | 11 | NYLON INSERT HEX NUT, 3/8-16 UNC | 316 SS | NHN06UNC-316SS | N/A | |
| 15 | 1 | STOP ROD, 2'-2" 316 SS | 316 SS | 1007186-04 | 1007186 | 1 |
| 16 | 2 | SETSCREW, SQ HD, CP PT, 316SS, 3/8-16X3/4 | 316 SS | F13938 | N/A | |
| 17 | 5 | MACH SCR, PAN HD, 3/8-16X1 1/2 | 316 SS | F11017 | N/A | |
| 18 | 2 | CAPSCREW, HEX HD, 3/4-10X3 | 316 SS | F10460 | N/A | |
| 19 | 4 | NUT, HEX, 3/4-10 | 316 SS | F10902 | N/A | |
| 20 | 2 | COLLAR, SOLID | 316 SS | 25440A68A | N/A | |
| 21 | 6 | MACH SCR, PAN HD, 3/8-16X2 1/2 | 316 SS | M024679 | N/A | |
| 22 | 8 | NUT, HX, 1/2-13, 316SS | 316 SS | F10899 | N/A | |
| 23 | 1 | WEAR BLOCK | UHMW-PE | 1183082-01 | 1183082 | |

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| 5'-0" SKIMMING DEVICE ASSEMBLY: 767657-5A (ALUMINUM/STEEL) | | | | | | |
|--|-----|--|--------------------|----------------|-------------|--------------|
| ITEM | QTY | DESCRIPTION | MATERIAL | PART NUMBER | DRAWING NO. | TOTAL WEIGHT |
| 1 | 1 | SCUM SCRAPER, 5'-0" | ALUMINUM | 1146065-01 | 1146065 | 9 |
| 2 | 1 | BOTTOM WIPER, 5'-0" SKIMMER | NEOPRENE (40 DUR.) | 1155526-01 | 1155526 | |
| 3 | 2 | SIDE WIPER | NEOPRENE (60 DUR.) | 81602A | 81602 | |
| 4 | 2 | SIDE WIPER CLAMP | ALUMINUM | 81598A | 81598 | 0 |
| 5 | 1 | BOTTOM WIPER CLAMP 5'-0" | ALUMINUM | 84030A | 84030 | 1 |
| 6 | 1 | HINGED SKIMMER | STEEL | 88188A | 88188 | 17 |
| 7 | 1 | SUPPORT, HINGED SKIMMER | STEEL | 88187A | 88187 | 4 |
| 8 | 2 | SCRAPER ARM | ALUMINUM | 48080A1 | 48080A1 | 3 |
| 9 | 2 | ARM CLEVIS | STEEL | 89081A1A | 89081-1 | 5 |
| 10 | 3 | COLLAR, SKIMMING DEVICE | STEEL | 88011A1A | 88011-1 | 6 |
| 11 | 1 | SPRING (EXTENSION) | 302 SS | 85606A | 85606 | |
| 12 | 1 | WEAR BLOCK | UHMW-PE | 1183082-02 | 1183082 | |
| 13 | 4 | CAPSCREW, HEX HD, 1/2-13X5 | 316 SS | M012581 | N/A | |
| 14 | 13 | NYLON INSERT HEX NUT, 3/8-16 UNC | 316 SS | NHN06UNC-316SS | N/A | |
| 15 | 1 | STOP ROD, 2'-8" 316 SS | 316 SS | 1007186-05 | 1007186 | 2 |
| 16 | 2 | SETSCREW, SQ HD, CP PT, 316SS, 3/8-16X3/4 | 316 SS | F13938 | N/A | |
| 17 | 7 | MACH SCR, PAN HD, 3/8-16X1 1/2 | 316 SS | F11017 | N/A | |
| 18 | 2 | CAPSCREW, HEX HD, 3/4-10X3 | 316 SS | F10460 | N/A | |
| 19 | 4 | NUT, HEX, 3/4-10 | 316 SS | F10902 | N/A | |
| 20 | 2 | COLLAR, SOLID, ZINC 13/16ID X NOM X9/16WD(922) | ZINC | 85609A | 85609 | |
| 21 | 6 | MACH SCR, PAN HD, 3/8-16X2 1/2 | 316 SS | M024679 | N/A | |
| 22 | 8 | NUT, HX, 1/2-13, 316SS | 316 SS | F10899 | N/A | |
| 23 | 1 | WEAR BLOCK | UHMW-PE | 1183082-01 | 1183082 | |

| 5'-0" SKIMMING DEVICE ASSEMBLY: 767657-5B (ALUMINUM/STAINLESS) | | | | | | |
|--|-----|---|--------------------|----------------|-------------|--------------|
| ITEM | QTY | DESCRIPTION | MATERIAL | PART NUMBER | DRAWING NO. | TOTAL WEIGHT |
| 1 | 1 | SCUM SCRAPER, 5'-0" | ALUMINUM | 1146065-01 | 1146065 | 9 |
| 2 | 1 | BOTTOM WIPER, 5'-0" SKIMMER | NEOPRENE (40 DUR.) | 1155526-01 | 1155526 | |
| 3 | 2 | SIDE WIPER | NEOPRENE (60 DUR.) | 81602A | 81602 | |
| 4 | 2 | SIDE WIPER CLAMP | ALUMINUM | 81598A | 81598 | 0 |
| 5 | 1 | BOTTOM WIPER CLAMP 5'-0" | ALUMINUM | 84030A | 84030 | 1 |
| 6 | 1 | HINDGED SKIMMER | 316 SS | 76774A85A | 76774A85 | 17 |
| 7 | 1 | SUPPORT, HINGED SKIMMER | 316 SS | 76774A88A | 76774A88 | 4 |
| 8 | 2 | SCRAPER ARM | ALUMINUM | 48080A1 | 48080A1 | 3 |
| 9 | 2 | ARM CLEVIS | CAST SS | 89081C1A | 89081-1 | 5 |
| 10 | 3 | COLLAR, SKIMMING DEVICE | CAST SS | 88011C1A | 88011-1 | 6 |
| 11 | 1 | SPRING (EXTENSION) | 302 SS | 85606A | 85606 | |
| 12 | 1 | WEAR BLOCK | UHMW-PE | 1183082-02 | 1183082 | |
| 13 | 4 | CAPSCREW, HEX HD, 1/2-13X5 | 316 SS | M012581 | N/A | |
| 14 | 13 | NYLON INSERT HEX NUT, 3/8-16 UNC | 316 SS | NHN06UNC-316SS | N/A | |
| 15 | 1 | STOP ROD, 2'-8" 316 SS | 316 SS | 1007186-05 | 1007186 | 2 |
| 16 | 2 | SETSCREW, SQ HD, CP PT, 316SS, 3/8-16X3/4 | 316 SS | F13938 | N/A | |
| 17 | 7 | MACH SCR, PAN HD, 3/8-16X1 1/2 | 316 SS | F11017 | N/A | |
| 18 | 2 | CAPSCREW, HEX HD, 3/4-10X3 | 316 SS | F10460 | N/A | |
| 19 | 4 | NUT, HEX, 3/4-10 | 316 SS | F10902 | N/A | |
| 20 | 2 | COLLAR, SOLID | 316 SS | 25440A68A | N/A | |
| 21 | 6 | MACH SCR, PAN HD, 3/8-16X2 1/2 | 316 SS | M024679 | N/A | |
| 22 | 8 | NUT, HX, 1/2-13, 316SS | 316 SS | F10899 | N/A | |
| 23 | 1 | WEAR BLOCK | UHMW-PE | 1183082-01 | 1183082 | |

| 5'-0" SKIMMING DEVICE ASSEMBLY: 767657-5C (ALL STAINLESS) | | | | | | |
|---|-----|---|--------------------|----------------|-------------|--------------|
| ITEM | QTY | DESCRIPTION | MATERIAL | PART NUMBER | DRAWING NO. | TOTAL WEIGHT |
| 1 | 1 | SCUM SCRAPER, 5'-0" | 316 SS | 1146065-02 | 1146065 | 28 |
| 2 | 1 | BOTTOM WIPER, 5'-0" SKIMMER | NEOPRENE (40 DUR.) | 1155526-01 | 1155526 | |
| 3 | 2 | SIDE WIPER | NEOPRENE (60 DUR.) | 81602A | 81602 | |
| 4 | 2 | SIDE WIPER CLAMP | 316 SS | 76774A86A | 76774A86 | 0 |
| 5 | 1 | BOTTOM WIPER CLAMP 5'-0" | 316 SS | 525272-05 | 525272 | 3 |
| 6 | 1 | HINDGED SKIMMER | 316 SS | 76774A85A | 76774A85 | 17 |
| 7 | 1 | SUPPORT, HINGED SKIMMER | 316 SS | 76774A88A | 76774A88 | 4 |
| 8 | 2 | SCRAPER ARM | 316 SS | 49097A1A | 49097-1 | 7 |
| 9 | 2 | ARM CLEVIS | CAST SS | 89081C1A | 89081-1 | 5 |
| 10 | 3 | COLLAR, SKIMMING DEVICE | CAST SS | 88011C1A | 88011-1 | 6 |
| 11 | 1 | SPRING (EXTENSION) | 302 SS | 85606A | 85606 | |
| 12 | 1 | WEAR BLOCK | UHMW-PE | 1183082-02 | 1183082 | |
| 13 | 4 | CAPSCREW, HEX HD, 1/2-13X5 | 316 SS | M012581 | N/A | |
| 14 | 13 | NYLON INSERT HEX NUT, 3/8-16 UNC | 316 SS | NHN06UNC-316SS | N/A | |
| 15 | 1 | STOP ROD, 2'-8" 316 SS | 316 SS | 1007186-05 | 1007186 | 2 |
| 16 | 2 | SETSCREW, SQ HD, CP PT, 316SS, 3/8-16X3/4 | 316 SS | F13938 | N/A | |
| 17 | 7 | MACH SCR, PAN HD, 3/8-16X1 1/2 | 316 SS | F11017 | N/A | |
| 18 | 2 | CAPSCREW, HEX HD, 3/4-10X3 | 316 SS | F10460 | N/A | |
| 19 | 4 | NUT, HEX, 3/4-10 | 316 SS | F10902 | N/A | |
| 20 | 2 | COLLAR, SOLID | 316 SS | 25440A68A | N/A | |
| 21 | 6 | MACH SCR, PAN HD, 3/8-16X2 1/2 | 316 SS | M024679 | N/A | |
| 22 | 8 | NUT, HX, 1/2-13, 316SS | 316 SS | F10899 | N/A | |
| 23 | 1 | WEAR BLOCK | UHMW-PE | 1183082-01 | 1183082 | |

| 6'-0" SKIMMING DEVICE ASSEMBLY: 767657-6A (ALUMINUM/STEEL) | | | | | | |
|--|-----|--|--------------------|----------------|-------------|--------------|
| ITEM | QTY | DESCRIPTION | MATERIAL | PART NUMBER | DRAWING NO. | TOTAL WEIGHT |
| 1 | 1 | SCUM SCRAPER, 6'-0" | ALUMINUM | 1146073-01 | 1146073 | 11 |
| 2 | 1 | BOTTOM WIPER, 6'-0" SKIMMER | NEOPRENE (40 DUR.) | 1151675-01 | 1151675 | |
| 3 | 2 | SIDE WIPER | NEOPRENE (60 DUR.) | 81602A | 81602 | |
| 4 | 2 | SIDE WIPER CLAMP | ALUMINUM | 81598A | 81598 | 0 |
| 5 | 1 | BOTTOM WIPER CLAMP, 6'-0" | ALUMINUM | 84031A | 84031 | 1 |
| 6 | 1 | HINGED SKIMMER | STEEL | 88188A | 88188 | 17 |
| 7 | 1 | SUPPORT, HINGED SKIMMER | STEEL | 88187A | 88187 | 4 |
| 8 | 2 | SCRAPER ARM | ALUMINUM | 48080A1 | 48080A1 | 3 |
| 9 | 2 | ARM CLEVIS | STEEL | 89081A1A | 89081-1 | 5 |
| 10 | 3 | COLLAR, SKIMMING DEVICE | STEEL | 88011A1A | 88011-1 | 6 |
| 11 | 1 | SPRING (EXTENSION) | 302 SS | 85606A | 85606 | |
| 12 | 1 | WEAR BLOCK | UHMW-PE | 1183082-02 | 1183082 | |
| 13 | 4 | CAPSCREW, HEX HD, 1/2-13X5 | 316 SS | M012581 | N/A | |
| 14 | 15 | NYLON INSERT HEX NUT, 3/8-16 UNC | 316 SS | NHN06UNC-316SS | N/A | |
| 15 | 1 | STOP ROD, 3/8" 316 SS | 316 SS | 1007186-06 | 1007186 | 2 |
| 16 | 2 | SETSCREW, SQ HD, CP PT, 316SS, 3/8-16X3/4 | 316 SS | F13938 | N/A | |
| 17 | 9 | MACH SCR, PAN HD, 3/8-16X1 1/2 | 316 SS | F11017 | N/A | |
| 18 | 2 | CAPSCREW, HEX HD, 3/4-10X3 | 316 SS | F10460 | N/A | |
| 19 | 4 | NUT, HEX, 3/4-10 | 316 SS | F10902 | N/A | |
| 20 | 2 | COLLAR, SOLID, ZINC 13/16ID X NOM X9/16WD(922) | ZINC | 85609A | 85609 | |
| 21 | 6 | MACH SCR, PAN HD, 3/8-16X2 1/2 | 316 SS | M024679 | N/A | |
| 22 | 8 | NUT, HX, 1/2-13, 316SS | 316 SS | F10899 | N/A | |
| 23 | 1 | WEAR BLOCK | UHMW-PE | 1183082-01 | 1183082 | |

| 6'-0" SKIMMING DEVICE ASSEMBLY: 767657-6B (ALUMINUM/STAINLESS) | | | | | | |
|--|-----|---|--------------------|----------------|-------------|--------------|
| ITEM | QTY | DESCRIPTION | MATERIAL | PART NUMBER | DRAWING NO. | TOTAL WEIGHT |
| 1 | 1 | SCUM SCRAPER, 6'-0" | ALUMINUM | 1146073-01 | 1146073 | 11 |
| 2 | 1 | BOTTOM WIPER, 6'-0" SKIMMER | NEOPRENE (40 DUR.) | 1151675-01 | 1151675 | |
| 3 | 2 | SIDE WIPER | NEOPRENE (60 DUR.) | 81602A | 81602 | |
| 4 | 2 | SIDE WIPER CLAMP | ALUMINUM | 81598A | 81598 | 0 |
| 5 | 1 | BOTTOM WIPER CLAMP, 6'-0" | ALUMINUM | 84031A | 84031 | 1 |
| 6 | 1 | HINDGED SKIMMER | 316 SS | 76774A85A | 76774A85 | 17 |
| 7 | 1 | SUPPORT, HINGED SKIMMER | 316 SS | 76774A88A | 76774A88 | 4 |
| 8 | 2 | SCRAPER ARM | ALUMINUM | 48080A1 | 48080A1 | 3 |
| 9 | 2 | ARM CLEVIS | CAST SS | 89081C1A | 89081-1 | 5 |
| 10 | 3 | COLLAR, SKIMMING DEVICE | CAST SS | 88011C1A | 88011-1 | 6 |
| 11 | 1 | SPRING (EXTENSION) | 302 SS | 85606A | 85606 | |
| 12 | 1 | WEAR BLOCK | UHMW-PE | 1183082-02 | 1183082 | |
| 13 | 4 | CAPSCREW, HEX HD, 1/2-13X5 | 316 SS | M012581 | N/A | |
| 14 | 15 | NYLON INSERT HEX NUT, 3/8-16 UNC | 316 SS | NHN06UNC-316SS | N/A | |
| 15 | 1 | STOP ROD, 3/8" 316 SS | 316 SS | 1007186-06 | 1007186 | 2 |
| 16 | 2 | SETSCREW, SQ HD, CP PT, 316SS, 3/8-16X3/4 | 316 SS | F13938 | N/A | |
| 17 | 9 | MACH SCR, PAN HD, 3/8-16X1 1/2 | 316 SS | F11017 | N/A | |
| 18 | 2 | CAPSCREW, HEX HD, 3/4-10X3 | 316 SS | F10460 | N/A | |
| 19 | 4 | NUT, HEX, 3/4-10 | 316 SS | F10902 | N/A | |
| 20 | 2 | COLLAR, SOLID | 316 SS | 25440A68A | N/A | |
| 21 | 6 | MACH SCR, PAN HD, 3/8-16X2 1/2 | 316 SS | M024679 | N/A | |
| 22 | 8 | NUT, HX, 1/2-13, 316SS | 316 SS | F10899 | N/A | |
| 23 | 1 | WEAR BLOCK | UHMW-PE | 1183082-01 | 1183082 | |

| 6'-0" SKIMMING DEVICE ASSEMBLY: 767657-6C (ALL STAINLESS) | | | | | | |
|---|-----|---|--------------------|----------------|-------------|--------------|
| ITEM | QTY | DESCRIPTION | MATERIAL | PART NUMBER | DRAWING NO. | TOTAL WEIGHT |
| 1 | 1 | SCUM SCRAPER, 6'-0" | 316 SS | 1146073-02 | 1146073 | 34 |
| 2 | 1 | BOTTOM WIPER, 6'-0" SKIMMER | NEOPRENE (40 DUR.) | 1151675-01 | 1151675 | |
| 3 | 2 | SIDE WIPER | NEOPRENE (60 DUR.) | 81602A | 81602 | |
| 4 | 2 | SIDE WIPER CLAMP | 316 SS | 76774A86A | 76774A86 | 0 |
| 5 | 1 | BOTTOM WIPER CLAMP, 6'-0" | 316 SS | 525272-06 | 525272 | 4 |
| 6 | 1 | HINDGED SKIMMER | 316 SS | 76774A85A | 76774A85 | 17 |
| 7 | 1 | SUPPORT, HINGED SKIMMER | 316 SS | 76774A88A | 76774A88 | 4 |
| 8 | 2 | SCRAPER ARM | 316 SS | 49097A1A | 49097-1 | 7 |
| 9 | 2 | ARM CLEVIS | CAST SS | 89081C1A | 89081-1 | 5 |
| 10 | 3 | COLLAR, SKIMMING DEVICE | CAST SS | 88011C1A | 88011-1 | 6 |
| 11 | 1 | SPRING (EXTENSION) | 302 SS | 85606A | 85606 | |
| 12 | 1 | WEAR BLOCK | UHMW-PE | 1183082-02 | 1183082 | |
| 13 | 4 | CAPSCREW, HEX HD, 1/2-13X5 | 316 SS | M012581 | N/A | |
| 14 | 15 | NYLON INSERT HEX NUT, 3/8-16 UNC | 316 SS | NHN06UNC-316SS | N/A | |
| 15 | 1 | STOP ROD, 3/8" 316 SS | 316 SS | 1007186-06 | 1007186 | 2 |
| 16 | 2 | SETSCREW, SQ HD, CP PT, 316SS, 3/8-16X3/4 | 316 SS | F13938 | N/A | |
| 17 | 9 | MACH SCR, PAN HD, 3/8-16X1 1/2 | 316 SS | F11017 | N/A | |
| 18 | 2 | CAPSCREW, HEX HD, 3/4-10X3 | 316 SS | F10460 | N/A | |
| 19 | 4 | NUT, HEX, 3/4-10 | 316 SS | F10902 | N/A | |
| 20 | 2 | COLLAR, SOLID | 316 SS | 25440A68A | N/A | |
| 21 | 6 | MACH SCR, PAN HD, 3/8-16X2 1/2 | 316 SS | M024679 | N/A | |
| 22 | 8 | NUT, HX, 1/2-13, 316SS | 316 SS | F10899 | N/A | |
| 23 | 1 | WEAR BLOCK | UHMW-PE | 1183082-01 | 1183082 | |

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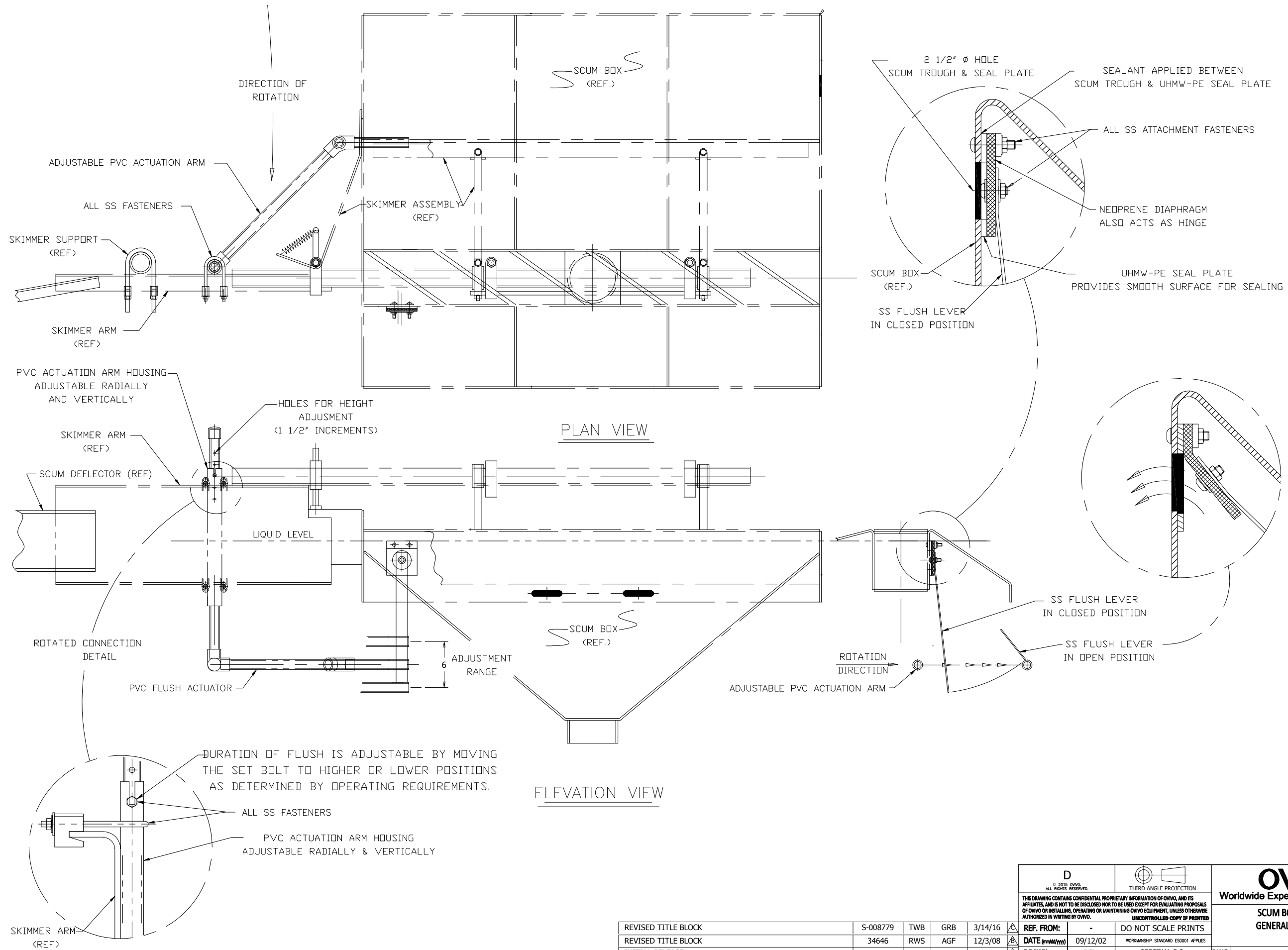
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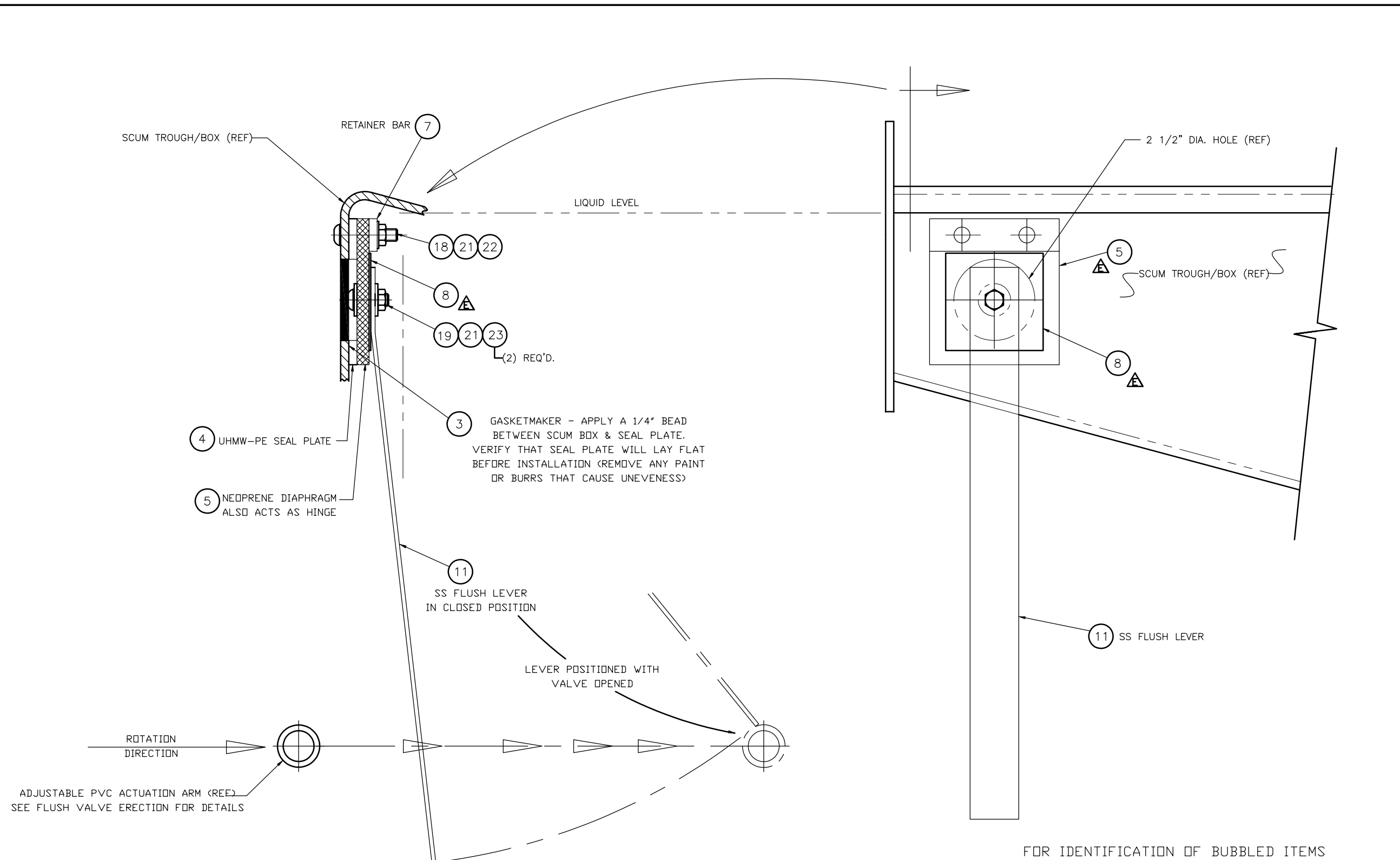
DO NOT SCALE PRINTS
WORKSHOP STANDARD ES001 APPLIES

DWG. NO. **767657** SHEET 5 OF 5 REV **C**

OVIVO
 Bringing water to life



| | | | | | |
|--|-----------------|-------------------------------|----------------|--|-----------------------------------|
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| <p>REVISED TITLE BLOCK</p> | <p>S-008779</p> | <p>TWB</p> | <p>GRB</p> | <p>3/14/16</p> | <p>REF. FROM: -</p> |
| <p>REVISED TITLE BLOCK</p> | <p>34646</p> | <p>RWS</p> | <p>AGF</p> | <p>12/3/08</p> | <p>DATE (mm/dd/yyyy) 09/12/02</p> |
| <p>INITIAL RELEASE</p> | | | | | <p>DRAWN REH ORIGINAL S.O.</p> |
| <p>REVISION</p> | <p>EN/ECO</p> | <p>BY</p> | <p>CHECK'D</p> | <p>DATE</p> | <p>CHECK'D JHD STANDARD</p> |
| | | | | | <p>DWG. NO. 1133808</p> |
| | | | | | <p>SHEET 1 OF 1</p> |
| | | | | | <p>REV C</p> |

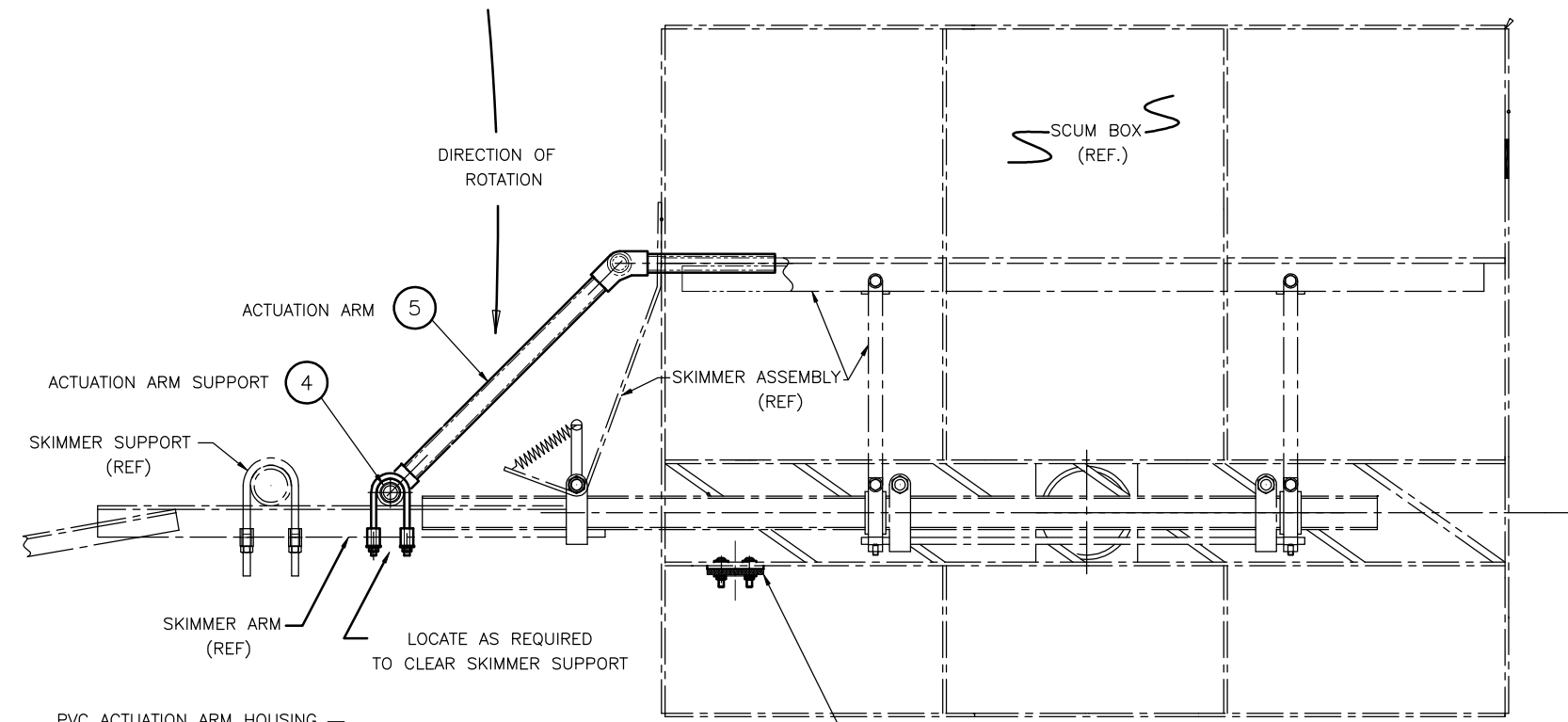


FOR IDENTIFICATION OF BUBBLED ITEMS
REFER TO PARTS LIST FOR ORDER

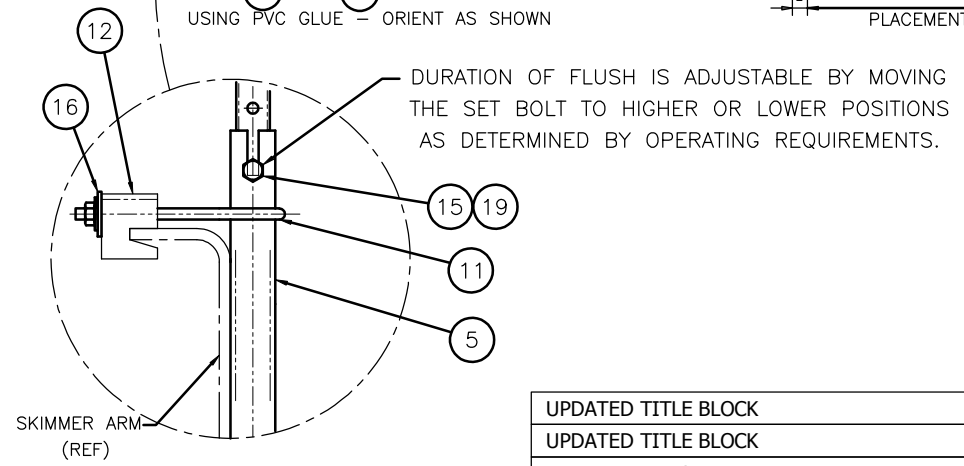
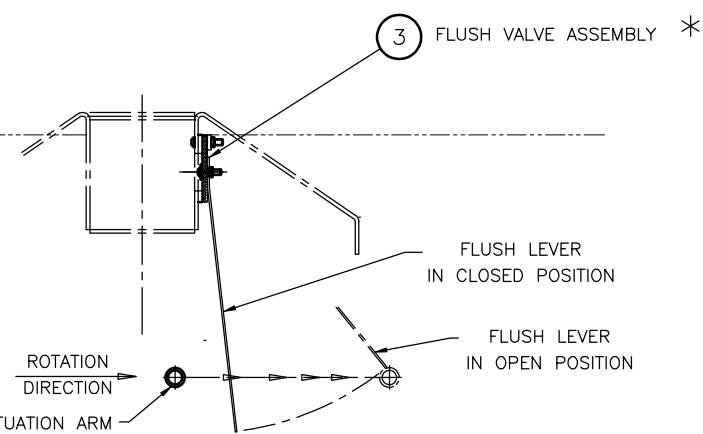
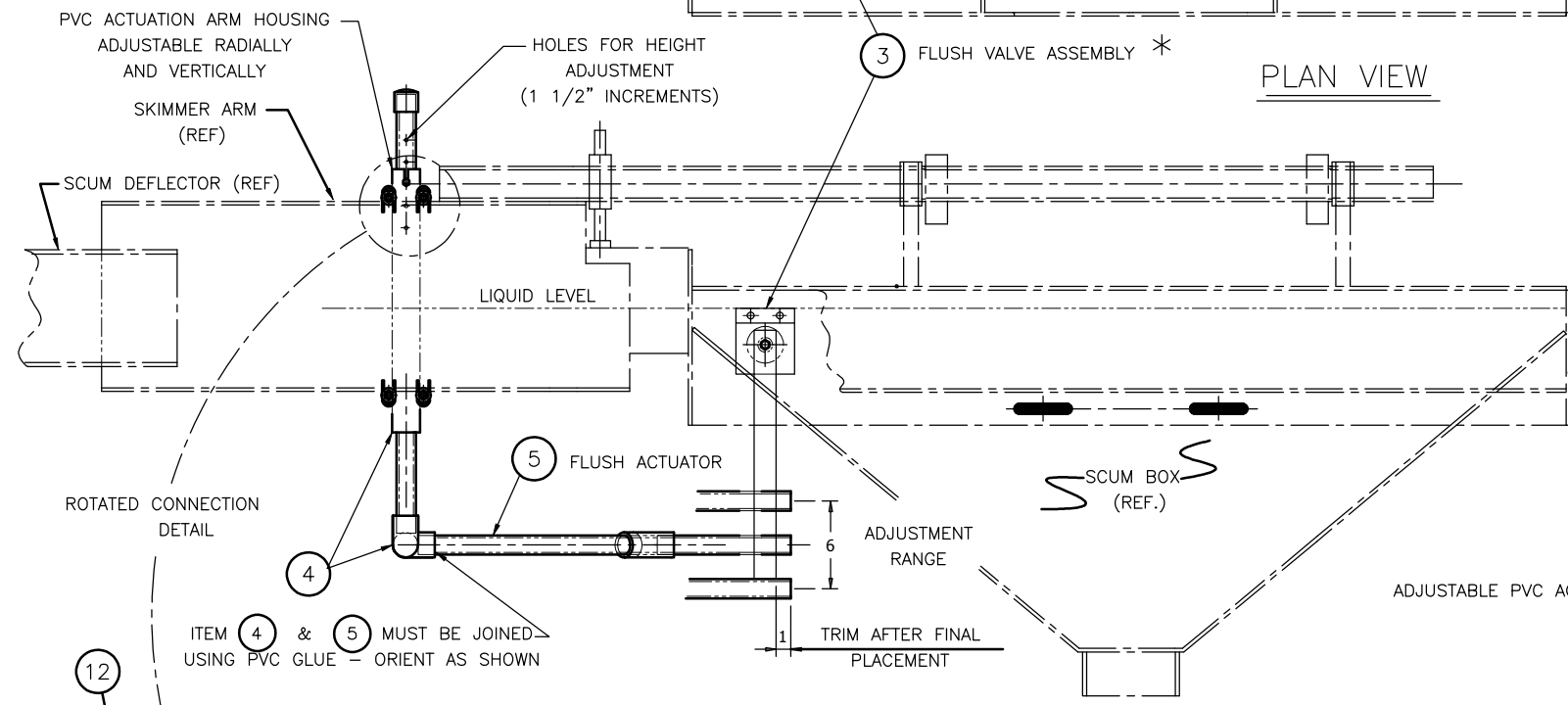
ROTATION
DIRECTION

ADJUSTABLE PVC ACTUATION ARM (REF)
SEE FLUSH VALVE ERECTION FOR DETAILS

| | | | | | | | | | | | | | |
|-------------------------|--|--|--|--|----------|-----|---------|------------|---|---|--|-------------------------------------|-------|
| UPDATED TITLE BLOCK | | | | | S-014860 | TSH | RKC | 09/30/2019 | ⚠ | <p style="text-align: center;">C</p> <p style="text-align: center;">© 2019 OVIVO. ALL RIGHTS RESERVED.</p> <p style="text-align: center;">THIRD ANGLE PROJECTION</p> <p style="text-align: center;">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="text-align: center;">UNCONTROLLED COPY IF PRINTED</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-weight: bold;">FLUSH VALVE ASSEMBLY</p> | | |
| ADD BACK UP BAR | | | | | S-004460 | DJC | BS | 02/11/2013 | ⚠ | | | | |
| ROLL BACK REV C CHANGES | | | | | 35973 | ELP | NBS | 7/13/09 | ⚠ | | | | |
| ADDED TENSION PLATE | | | | | 35350 | BS | REH | 3/23/09 | ⚠ | | | | |
| UPDATED TITLE BLOCK | | | | | 34656 | DJN | ABA | 12/4/08 | ⚠ | | | | |
| INITIAL RELEASE | | | | | - | - | - | - | ⚠ | REF. FROM: | 1134047 | DO NOT SCALE PRINTS | |
| REVISION | | | | | EN/ECO | BY | CHECK'D | DATE | ⚠ | DATE (mm/dd/yyyy) | 9/17/02 | WORKMANSHIP STANDARD ES0001 APPLIES | |
| | | | | | | | | | | DRAWN | REH | ORIGINAL S.O. | |
| | | | | | | | | | | CHECK'D | J-D | | |
| | | | | | | | | | | DWG. NO. | 1134047 | SHEET 1 OF 1 | REV F |



* SET ADJUSTABLE ACTUATION ARM IN POSITION AT FLUSH VALVE. ARM WILL BE SET IN LOWEST POSITION TO CLEAR THE FLUSH LEVER BY 1/4". THE ARM SHOULD BE SET RADIALLY FOR FULL CONTACT WITH THE LEVER. SET ARM IN MIDDLE POSITION FOR START UP.



ELEVATION VIEW

FOR IDENTIFICATION OF BUBBLED ITEMS SEE PARTS LIST FOR ORDER

| | | | | | |
|---------------------|----------|-----|-----|----------|---|
| UPDATED TITLE BLOCK | S-014860 | TSH | RKC | 09/30/19 | △ |
| UPDATED TITLE BLOCK | 34698 | RH | BVV | 12/10/08 | △ |
| INITIAL RELEASE | - | - | - | - | △ |

| | | | |
|---|---------------------|-------------------------------------|----------|
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| REF. FROM: | DO NOT SCALE PRINTS | WORKMANSHIP STANDARD ES0001 APPLIES | |
| DATE (mm/dd/yyyy) | 9/12/02 | DRAWN | REH |
| CHECK'D | JDH | ORIGINAL S.O. | DWG. NO. |

| | |
|--|---------|
| OVIVO Worldwide Experts in Water Treatment | |
| FLUSH VALVE ERECTION | |
| DWG. NO. | 1134185 |
| SHEET | 1 OF 1 |
| 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)

| | | |
|---|----------|---------|
| C | | |
| B | 9820 | 2/7/92 |
| A | 5819 | 1-12-83 |
| | D/R | DATE |
| | REVISION | |

| | | | |
|--|--|--|---|
| | | | 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 |
| ORIGINAL S.O. | | | |
| DATE | | | 1/8/81 |
| DRAWN | | | GBH |
| CHECK'D | | | JKM |
| TORQUE VALUES FOR MACHINERY CONNECTIONS FOR INDUSTRIAL CONNECTIONS | | | DO NOT SCALE PRINTS |
| REF. FROM: - | | | SHEET 1 OF 1 |
| DWG. NO. | | | 114808 |
| REV | | | F |

Accessories

TAB 1

C60LT Drive Information

CSW1517-01



Torque Rating(s) (ft-lbs) **110,000**
Rotation (viewed from above) **Clockwise**

Ratios:
Worm to Worm Gear **54:1**
Main Pinion to Main Gear **8.154:1**
Overall Ratio **440.32:1**

General Arrangement Drawing **115711**

Drive Specification

Main Gear Data:

Main Gear Ratio: 8.154
 Gear Pitch Diameter (in): 60.572
 Gear Face Depth (in): 6
 Number of Teeth: 106
 Tooth Diametral Pitch: 1.75
 Gear Material: Ductile Iron
 ASTM specification: ASTM-A536
 Grade or Class: 100-70-03

Main Bearing Data:

Bearing Type: Replaceable Strip Liner
 Bearing Pitch Diameter (in): 66.5
 Ball Diameter (in): 1.75
 Number of Bearing Balls: 119
 Raceway Hardness: 43-46 Rc
 Raceway Material: AISI E4140
 Vacuum Degassed,
 Carbon Deoxidized

Worm and Worm Gear Data:

Worm Gear Ratio: 54
 Gear Pitch Diameter(in): 21.486
 Worm Pitch Diameter(in): 3.5/0.089
 Number of Starts: 1
 Number of Gear Teeth: 54
 Gear Face Depth: (in) 2.75/0.070
 Circular Pitch (in): 1.25/0.032
 Lead Angle (deg): 6.483
 Pressure Angle (deg): 14.5
 Gear Material: Cast Alloy Bronze
 Worm Material: AISI 4140/42H

Main Pinion Data:

Pinion Pitch Diameter (in): 7.428
 Number of Pinions: 1
 Number of Teeth: 13
 Tooth Diametral Pitch: 1.75
 Pinion Material: Alloy Steel
 AISI Specification: 4150

Housing Data:

Main Gear Drive Housing
 Material: Cast Iron
 Specification: ASTM A48 (Class 40A)

Housing Data:

Worm Gear Housing
 Material: Cast Iron
 Specification: ASTM A48 (Class 40A)

Drive Features:

- Rigid cast base with deep oil reservoir.
- Large main gear face
- Worm gear intermediate reducer.
- Fully supported one-piece pinion.
- Replaceable strip liner main bearing with large diameter chrome alloy balls.
- Full oil bath lubrication for main gear and bearing set.
- Oil drains away from bearing seats.
- No lip seals below oil level.
- Machined shoulder to preserve pinion/main gear alignment.
- Weatherproof enclosed torque control.



MOTOR DRIVE CALCULATIONS FOR C60LT (110K)

Order No.: CSW0001517-01
 Project Name: Wichita
 Project Info: Ø160ft C3D Clarifier
 C60LT (110K) Drive Unit
 Rake Speed: 0.032 RPM Tip Speed: 16.1 ft/min
 Duty Torque: 110000 ft-lbs Cont. Torque: 51200 ft-lbs Momentary Peak Torque: 123000 ft-lbs
 Made By: RJB
 Checked By: CHH
 Date: Friday, June 25, 2021

| COMPONENT | RATIO | EFFIC. | RPM INPUT | RPM OUTPUT | HP INPUT | HP OUTPUT | TORQUE INPUT (FT-LB) | TORQUE OUTPUT (FT-LB) |
|--------------------------|-------|--------|-----------|------------|----------|-----------|----------------------|-----------------------|
| MAIN GEAR | 8.15 | 96% | 0.26 | 0.032 | 0.70 | 0.67 | 14,052 | 110,000 |
| WORM GEAR | 54.00 | 56% | 14.09 | 0.261 | 1.25 | 0.70 | 465 | 14,052 |
| SPROCKETS #60 54 / 17 | 3.18 | 96% | 44.76 | 14.09 | 1.30 | 1.25 | 153 | 465 |
| GEAR MOTOR | | 92% | | 45 | 1.41 | 1.30 | | 153 |

Gear Reducer Design

NORD SK 573.1, $i = 38.02$
 Output Torque, rating 2,770 in-lbs
 Reducer torque s.f. @ Continuous Torque 3.3
 Reducer OHL rating 1,566 lbs
 Chain pull, cont 417 lbs
 Reducer, OHL s.f. 3.8

Chain/Sprocket Design #60 54/17T

Sprocket Dia 4.082 in
 Chain pull, mom peak 1,003 lb
 Chain Pull Rating 8,500 lb
 Chain s.f. Pull @ mom. peak: 8.5
 Chain power, @ continuous torque 0.61 hp
 Chain Power, rating 1.1 hp
 Chain s.f. Power 1.9 @ 45 rpm

Drive Control Switch Settings

| | | | |
|-----------|---------------|------|---------------|
| Switch #1 | 61,440 ft-lb | 56% | Cutout |
| Switch #2 | 51,200 ft-lb | 47% | Alarm |
| Switch #3 | 110,000 ft-lb | 100% | Backup Cutout |
| Switch #4 | 110,000 ft-lb | 100% | Spare |

MAIN GEAR RATING PER ANSI/AGMA 2001-D04

1. OVIVO Drive Size: C60LT
2. Main Gear Life: 20 Years
3. Output Speed (RPM): 0.032
4. Load Cycles for Gear (Xg) and Pinion (Xp):
 Xg = 336,384 Cycles (Gear)
 Xp = 2,742,875 Cycles (Pinion)

CSW1517-01

5. AGMA Life Factors:
 a. Pitting Resistance (ZN): From Figure 17 of AGMA 2001-D04
 Gear ZN = 1.209
 Pinion ZN = 1.075
 b. Bending Strength (YN): From Figure 18 of AGMA 2001-D04
 Gear YN = 1.302 245 BHN
 Pinion YN = 1.051 301 BHN

6. AGMA Torque Rating Equations:

$$T_p = \frac{(N R F I) (d S_{ac} Z_N Ch)^2}{24 K_o K_m (C_p)^2} \text{ ft-lbs (Pitting)}$$

Ref: Derived from Section 5.1.3 Eq. (5) of AGMA 2001-D04

$$T_s = \frac{N R F J d S_{at} Y_N}{24 P_d K_o K_m K_b} \text{ ft-lbs (Strength)}$$

Ref: Derived from Section 5.2.3 Eq. (14) of AGMA 2001-D04

$$T_y = \frac{S_{ay} K_y N R F J d K_f}{24 P_d K_{my}} \text{ ft-lbs (Yield Strength)}$$

Ref: Derived from Section 16.4 Eq. (46) of AGMA 2001-D04

7. Torque Rating Calculations:

| Description | Symbol | Gear | Pinion |
|------------------------------------|--------|----------------------------|---------|
| Gear type | - | involute, full-depth tooth | |
| Number of Pinions | N | | 1 |
| Gear Ratio | R | | 8.154 |
| Gear Face (in) | F | 6.000 | 6.060 |
| Pinion Pitch Diameter (in) | d | | 7.429 |
| Tooth Diametral Pitch | Pd | 1.75 | 1.75 |
| Hardness Ratio Factor | Ch | 1.020 | 1.000 |
| Tooth Geometry Factor (Pitting) | I | 0.182 | 0.182 |
| Tooth Geometry Factor (Strength) | J | 0.360 | 0.308 |
| Elastic Coefficient | Cp | | 2160 |
| Load Distribution Factor | Km | | 1.348 |
| Allowable Contact Stress Number | Sac | 112,000 | 126,022 |
| Life Factor (Pitting) | ZN | 1.209 | 1.075 |
| Allowable Bending Stress Number | Sat | 29,941 | 36,067 |
| Life Factor (Strength) | YN | 1.302 | 1.051 |
| Allowable Yield Strength (psi) | Say | 70,000 | 112,282 |
| Yield Strength Factor | Ky | | 0.75 |
| Yield Load Distribution Factor | Kmy | | 1.156 |
| Overload Factor (200%) | Ko | | 1.00 |
| Stress Correction Factor | Kf | 1.689 | 1.53 |
| Rim Thickness Factor | Kb | 1.00 | N/A |
| Pitting Resistance Rating (ft-lbs) | Tp | 62,080 | 59,767 |
| Bending Strength Rating (ft-lbs) | Ts | 90,082 | 74,957 |
| Yield Strength Rating (ft-lbs) | Ty | 238,884 | 296,967 |

8. Continuous Rating: 59,767 ft-lbs (Pinion Pitting)
9. Yield (Peak) Rating: 238,884 ft-lbs (Gear)

Prepared by: RJB
 Sheet: 1 of 3
CONFIDENTIAL

WORM GEAR RATING PER ANSI/AGMA 6034-B92

1. OVIVO Drive Size: C60LT

2. Output Speed (RPM): 0.032

3. Worm Gear Data:

| | | |
|----------------------------------|----|--------|
| Gear Ratio | Mg | 54.00 |
| Pitch Diameter of Worm Gear (in) | Dm | 21.486 |
| Actual Gear Face (in) | Fa | 2.750 |
| Mean worm Diameter (in): | d | 3.500 |
| Effective Gear Face (in): | Fe | 2.345 |
| Lead Angle (deg): | La | 6.483 |
| Pressure Angle (deg): | Pa | 14.5 |
| Number of Leads | - | Single |

4. Sliding Velocity (Vs) and Efficiency: Section 3.3.3 of AGMA 6034-B92

| | | |
|----------------------------|------|--------|
| Worm Speed (RPM): | n = | 14.090 |
| Worm Gear Speed (RPM): | N = | 0.2609 |
| Sliding Velocity (ft/min): | Vs = | 12.994 |
| Worm Gear Efficiency: | | 55.9 % |

5. AGMA Rating Factors:

a. Ratio Correction Factor: Table 2 of AGMA 6034-B92

$$C_m = 0.771$$

b. Materials Factor: Figure 1 of AGMA 6034-B92

$$C_s = 1000$$

c. Velocity Factor: Table 3 of AGMA 6034-B92

$$C_v = 0.6420$$

6. Tangential Load on Tooth: Section 3.3.1 of AGMA 6034-B92

$$W_t = C_s D_m^{0.08} F_e C_m C_v = 13,504 \text{ (lbs)}$$

7. Allowable Output Horsepower: Section 3.3, 3.5 & 3.6 of AGMA 6034-B92

The allowable output power and torque for 10 hrs/day, uniform load is:

$$P_{o10} = \frac{W_t D_m n}{126,000 Mg} = 0.6009 \text{ HP} \quad T_{o10} = 12,090 \text{ ft-lbs}$$

Required Service Factor: 1.250 24 hrs/day, uniform load
Table A-1 AGMA 6034-B92

$$P_o = \frac{P_{o10}}{\text{Service Factor}} = 0.4807 \text{ HP}$$

8. Allowable Output Torque of Worm Gear Assembly:

$$T_o = \frac{5250 P_o}{N} = 9,672 \text{ ft-lbs}$$

9. Allowable Output Torque at Main Gear:

| | |
|--|---------------|
| Main Gear Ratio: | 8.154 |
| Main Gear Efficiency: | 96 % |
| Number of Pinions: | 1 |
| $T_g = (T_o)(\text{Ratio})(\text{Efficiency})(\text{Pinions}) =$ | 75,709 ft-lbs |

10. Momentary Peak Load at Main Gear: Section 6.4 of AGMA 6034-B92

allows peak loads up to 300% of the 10 hr/day rating.

$$T_p = 3.0 (T_{o10})(\text{Ratio})(\text{Efficiency})(\text{Pinions}) = 283,907 \text{ ft-lbs}$$

Prepared by: RJB

Sheet: 2 of 3

CONFIDENTIAL

MAIN BEARING RATING CALCULATIONS

Drive Designation: C60LT

Rake Speed (RPM): 0.032
 Bearing Type: Replaceable Strip Liner

Bearing Basic Dynamic Rating:

| | |
|---|--------|
| Bearing Pitch Diameter (in) | 66.500 |
| Ball Diameter (In) | 1.75 |
| Number of Balls | 119 |
| Ca Basic Dynamic Rating (one million revolutions) | 32,009 |

Revolutions based on 24 Hrs/Day, 365 Days/Year

16,819 Revolutions/Year
 1.920 Revolutions/Hour

Bearing L10 Life:

Axial Load (Pa lbs) = 20,000 Pounds

$L_{10} = (Ca/Pa)^3 \times 10^6$ revolutions
 L10 = 4,099,543 Revolutions

Bearing Life = 243.7 Years
 2,135,179 Hours

Note: Proper lubrication and maintenance as outlined in the OVIVO O&M Manual for this equipment is essential to maximize bearing life.

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 Sheet: 3 of 3

TAB 2

NORDBLOC®.1 HELICAL IN-LINE SPEED REDUCERS/GEAR MOTORS



PERFORMANCE SPECIFICATIONS

Configuration : concentric
 Integral motor HP (min/ max) : 0.16 / 50
 Integral motor kW (min/ max) : 0.12 / 37
 Typical efficiency : 97%
 Number of gear reductions : 2 to 3

MOUNTING STYLES

Footed housing style : standard
 B5 flange outside diameter range [in] : 4.72 to 15.75
 B5 flange outside diameter range [mm] : 120 to 450
 B14 flange outside diameter range [in] : 3.15 to 9.29
 B14 flange outside diameter range [mm] : 0.80 to 236

OPTIONS

NEMA C-face or IEC input
 Custom adapter flange
 Flange pilot removed

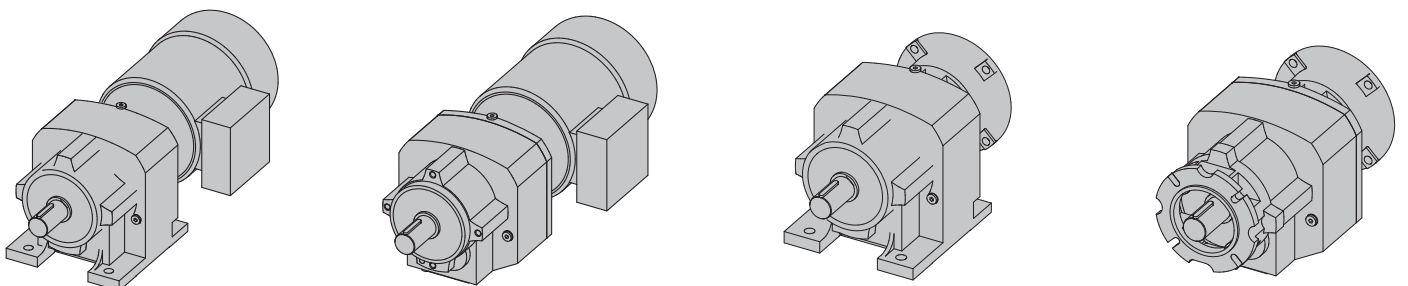


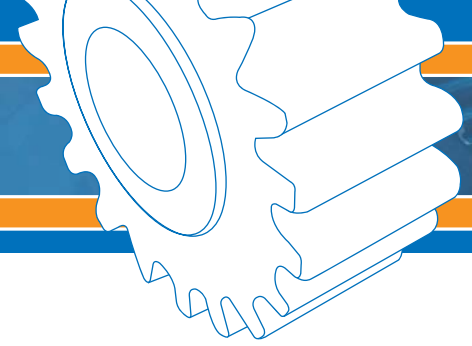
RATIO AND SPEED

Minimum standard ratio : 2.10:1
 Maximum standard ratio : 456.77:1
 Minimum output speed from 1750 rpm motor : 4.3 rpm
 Maximum output speed from 1750 rpm motor : 819 rpm

| Unit Size | Torque Max* | | Ratio Range Min - Max | Shaft Diameter | |
|-----------|-------------|------|--------------------------|----------------|-------|
| | [lb-in] | [Nm] | | [in] | [mm] |
| SK 072.1 | 487 | 55 | 2.10 - 63.56 | 0.750 | 20 |
| SK 172.1 | 814 | 92 | 2.32 - 81.45 | 0.750 | 20 |
| SK 372.1 | 1770 | 200 | 2.62 - 72.38 | 1.000 | 25 |
| SK 373.1 | 1947 | 220 | 18.63 - 343.92 | 1.000 | 25 |
| SK 572.1 | 3806 | 430 | 2.92 - 54.41 | 1.250/1.375 | 30/35 |
| SK 573.1 | 3983 | 450 | 17.42 - 402.80 | 1.250/1.375 | 30/35 |
| SK 672.1 | 5399 | 610 | 2.66 - 56.65 | 1.375 | 35 |
| SK 673.1 | 5664 | 640 | 22.82 - 362.43 | 1.375 | 35 |
| SK 772.1 | 7257 | 820 | 3.12 - 26.86 | 1.625 | 40 |
| SK 773.1 | 7700 | 870 | 21.49 - 395.46 | 1.625 | 40 |
| SK 872.1 | 14160 | 1600 | 3.18 - 42.67 | 2.125 | 50 |
| SK 873.1 | 15045 | 1700 | 19.34 - 439.77 | 2.125 | 50 |
| SK 972.1 | 25665 | 2900 | 3.33 - 42.76 | 2.375 | 60 |
| SK 973.1 | 29205 | 3300 | 22.42 - 456.77 | 2.375 | 60 |

* Torque may vary by ratio





SHAFT DATA

- AISI 1045 or 4140 input & output shaft material
- Inch shaft key dimensions according to AISI B17
- Metric shaft key dimensions according to DIN 6885
- Standard output shaft drill & tap

SHAFT DATA OPTIONS

Custom shaft diameters, Custom spline, Cross drilled holes, 304 stainless steel



MOTOR MOUNTING

- Integral motor : 1/6 to 50 HP
- C-face adapter frame size range : 56C to 280TC
- IEC adapter (B5) frame size range : IEC 63 to IEC 200

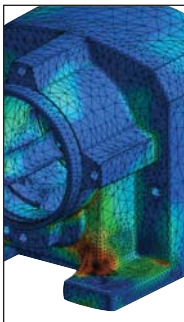
MOTOR MOUNTING OPTIONS

Custom motor adapter : custom order, Custom coupling diameter



GEARING

- Up to AGMA Class 13 gear quality
- 58 Rockwell C minimum gear hardness
- Ground or skive hobbed hard gear teeth finishing
- Standard drop forged gear blanks
- 275% momentary overload capacity
- Standard hunting tooth ratios



HOUSING

- Corrosion resistant aluminum alloy housing material (072.1-673.1)
- Class 35 gray iron housing material (772.1-973.1)
- Single setup machining method
- UNICASE™ one piece main housing design
- Seals directly contact main housing
- Exceptional housing torsional stiffness
- Thick Housing wall section
- Casting are dip sealed



BEARINGS

- ABEC-1 quality bearings
- Standard output ball bearings
- Heavy-duty output ball bearings



INTERNAL PARTS ASSEMBLY

- Heavy press fit assembly method
- Standard reversing duty
- Typical backlash range [arc minutes] : 11 to 20



LUBRICANT & SEALING COMPONENTS

- Factory filled ISO 220 mineral oil
- Standard AUTOVENT™ breather style
- Double lip output seal design
- Nitrile rubber oil seals

LUBRICANT & SEALING OPTIONS

Custom synthetic lubricating oil, Custom temperature lubricating oil, Fluid grease lubricant, Food grade lubricating oil, Long term storage preparation, Magnetic drain plug, Bullseye sight glass, Custom drain plug, Fluorinated rubber oil seal material, Custom oil seals



ENVIRONMENTAL PROTECTION

- Exterior primer coverage on all metal exterior surfaces
- Water Based Resin paint type
- 316 stainless steel flake paint additive
- H1 USDA incidental contact exposure



ENVIRONMENTAL OPTIONS

Severe duty or washdown duty paint options, Custom paint, Shaft seal covers : custom order, High pressure washdown IP66 oil seals : custom order

2.0 hp Gearmotors

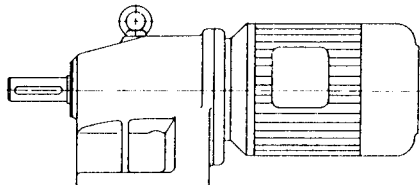


Gearmotors

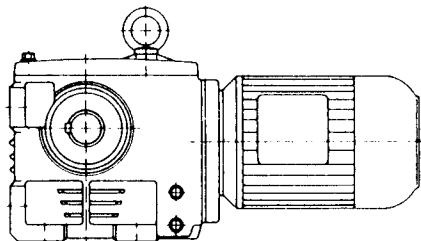
| Motor Power P_n [hp] | Output Speed n_2 [rpm] | Output Torque T_2 [lb-in] | Service Factor f_B | AGMA Class | Gear Ratio i_{tot} | Standard Bearings | | Heavy Duty Bearings (VL) | | Model Type  | Weight  [lb] | Dim. Page |
|------------------------------|--------------------------------|-----------------------------------|-------------------------|------------|-------------------------|-------------------------|----------------------------|--------------------------|-----------------------------|---|---|-----------|
| | | | | | | F_{RN} OHL [lb] | F_{AN} Thrust [lb] | F_{RVL} OHL [lb] | F_{AVL} Thrust [lb] | | | |
| 2.0 | 26 | 4928 | 0.8 | * | 67.64 | 1308 | 3260 | 2473 | 3260 | SK 573.1 - 90 LP/4 | 70 | 158 |
| | 28 | 4442 | 0.9 | * | 60.97 | 1507 | 3260 | 2473 | 3260 | | | |
| | 35 | 3614 | 1.1 | I | 49.60 | 1802 | 3260 | 2473 | 3260 | | | |
| | 36 | 3493 | 1.1 | I | 47.95 | 1826 | 3260 | 2473 | 3260 | | | |
| | 40 | 3162 | 1.3 | I | 43.40 | 1886 | 3260 | 2473 | 3260 | | | |
| | 41 | 3073 | 1.3 | I | 42.18 | 1900 | 3260 | 2473 | 3260 | | | |
| | 45 | 2770 | 1.4 | II | 38.02 | 1945 | 3260 | 2473 | 3260 | | | |
| | 50 | 2536 | 1.5 | II | 34.80 | 2003 | 3260 | 2473 | 3260 | | | |
| | 56 | 2254 | 1.7 | II | 30.93 | 1999 | 3260 | 2473 | 3260 | | | |
| | 65 | 1950 | 2.0 | III | 26.77 | 2036 | 3260 | 2473 | 3260 | | | |
| | 73 | 1734 | 2.2 | III | 23.79 | 2014 | 3260 | 2473 | 3260 | | | |
| | 81 | 1553 | 2.5 | III | 21.32 | 1988 | 3260 | 2473 | 3260 | | | |
| 90 | 1400 | 2.7 | III | 19.22 | 1960 | 3260 | 2473 | 3260 | | | | |
| 99 | 1269 | 3.0 | III | 17.42 | 1929 | 3260 | 2473 | 3260 | | | | |
| 2.0 | 39 | 3246 | 1.2 | I | 44.55 | 2306 | 4496 | 3324 | 4496 | SK 672.1 - 90 LP/4 | 81 | 164 |
| | 48 | 2605 | 1.9 | II | 35.75 | 2372 | 4496 | 3370 | 4496 | | | |
| | 59 | 2119 | 2.3 | III | 29.08 | 2413 | 4496 | 3372 | 4496 | | | |
| | 84 | 1503 | 3.6 | III | 20.62 | 2451 | 4496 | 3372 | 4496 | | | |
| 2.0 | 18 | 6912 | 0.8 | * | 94.86 | 1127 | 4496 | 2817 | 4496 | SK 673.1 - 90 LP/4 | 83 | 164 |
| | 21 | 6099 | 0.9 | * | 83.70 | 1751 | 4496 | 2970 | 4496 | | | |
| | 23 | 5365 | 1.1 | I | 73.64 | 1947 | 4496 | 3086 | 4496 | | | |
| | 26 | 4805 | 1.2 | I | 65.95 | 2066 | 4496 | 3162 | 4496 | | | |
| | 29 | 4404 | 1.3 | I | 60.45 | 2139 | 4496 | 3210 | 4496 | | | |
| | 31 | 4016 | 1.4 | II | 55.12 | 2202 | 4496 | 3253 | 4496 | | | |
| | 35 | 3607 | 1.6 | II | 49.50 | 2260 | 4496 | 3292 | 4496 | | | |
| | 39 | 3268 | 1.7 | II | 44.85 | 2303 | 4496 | 3322 | 4496 | | | |
| | 42 | 3027 | 1.9 | II | 41.54 | 2330 | 4496 | 3341 | 4496 | | | |
| | 46 | 2713 | 2.1 | III | 37.23 | 2362 | 4496 | 3363 | 4496 | | | |
| | 51 | 2486 | 2.1 | III | 34.12 | 2383 | 4496 | 3372 | 4496 | | | |
| | 56 | 2253 | 2.1 | III | 30.92 | 2402 | 4496 | 3372 | 4496 | | | |
| | 63 | 2011 | 2.3 | III | 27.61 | 2420 | 4496 | 3372 | 4496 | | | |
| | 69 | 1835 | 2.4 | III | 25.19 | 2432 | 4496 | 3372 | 4496 | | | |
| 76 | 1663 | 2.4 | III | 22.82 | 2442 | 4496 | 3372 | 4496 | | | | |
| 2.0 | 168 | 750 | 1.1 | I | 10.30 | 1180 | 2023 | 2384 | 4587 | SK 771.1 - 90 LP/4 | 63 | 167 |
| | 204 | 619 | 1.8 | II | 8.50 | 1115 | 2023 | 2385 | 4354 | | | |
| | 225 | 560 | 2.3 | III | 7.69 | 1082 | 2023 | 2385 | 4234 | | | |
| | 320 | 394 | 3.7 | III | 5.41 | 972 | 1825 | 2386 | 3837 | | | |
| | 349 | 361 | 5.1 | III | 4.96 | 947 | 1779 | 2386 | 3746 | | | |
| | 418 | 301 | 7.0 | III | 4.14 | 894 | 1681 | 2387 | 3556 | | | |
| | 461 | 273 | 8.6 | III | 3.75 | 867 | 1599 | 2387 | 3458 | | | |
| | 511 | 247 | 9.3 | III | 3.38 | 840 | 1520 | 2387 | 3358 | | | |

(AGMA Class I = f_B 1.0 - 1.39 II = f_B 1.4 - 1.99 III = f_B \geq 2.0 * = f_B < 1.0)

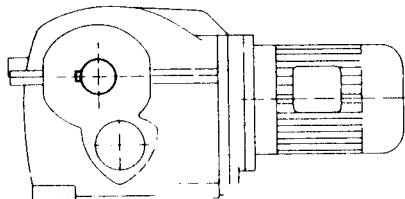
OPERATING & MAINTENANCE INSTRUCTIONS



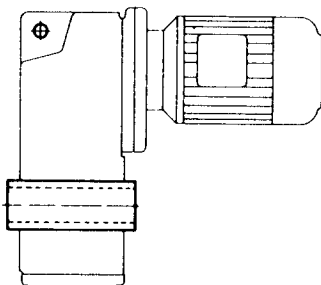
HELICAL



HELICAL-WORM

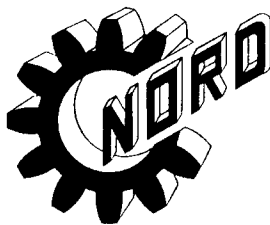


BEVEL-HELICAL



SHAFT MOUNT

318-618/93



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.

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.

| | | |
|---|----------------|---|
|  | WARNING |  |
| <p>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.</p> | | |



SAFETY NOTES



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 |

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

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) |

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.

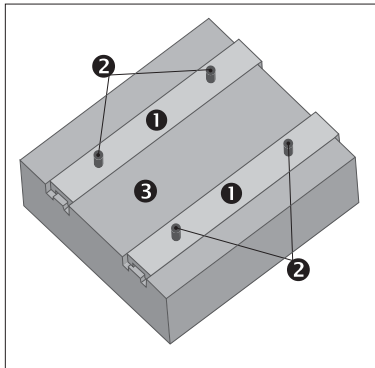
STOP
HARMFUL SITUATION
STOP

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.

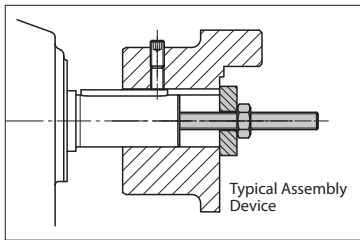


Table 2: Solid Shaft End - Threaded Holes

| 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 |

NORD Gear Limited

Toll Free in Canada: 800.668.4378

NORD Gear Corporation

Toll Free in the United States: 888.314.6673

STOP HARMFUL SITUATION STOP

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.

STOP HARMFUL SITUATION STOP

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.

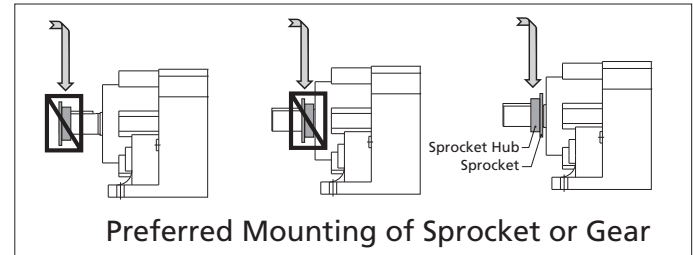
Check alignment

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.

| STOP | <i>HARMFUL SITUATION</i> | STOP |
|--|--------------------------|------|
| <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.

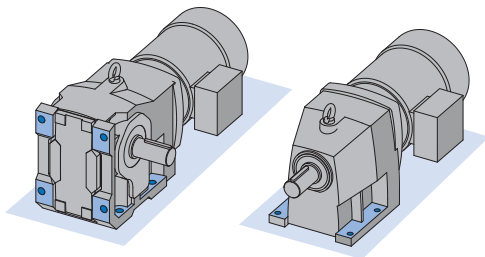


Table : Flange Pilot Tolerance

| 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

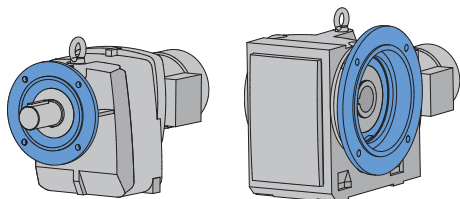
Gear units may be subjected to radial loads or side pull, caused by external chain drives or belt drives. In these instances it is recommended that the mounting base be designed with a slide-plate adjustment to accommodate extra slack in the chain or the belt after the feet are loosened. When using an 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
i

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.

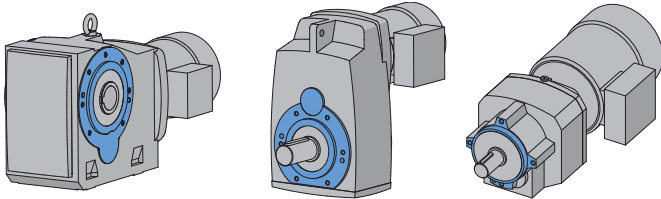


REDUCER MOUNTING FOOTED & FLANGE MOUNT GEAR UNITS



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.

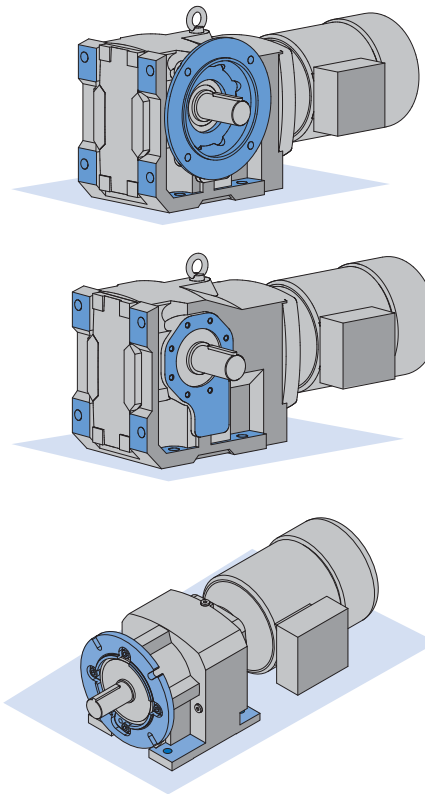


4. Foot & flange reducer housings

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.

| | | |
|--|-----------------------|--|
| | 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> | | |

| | | |
|---|--------------------------|--|
| | 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.**

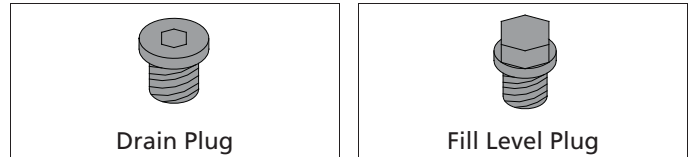
| | | |
|--|--------------------------|------|
| STOP | HARMFUL SITUATION | STOP |
| <p>Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional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

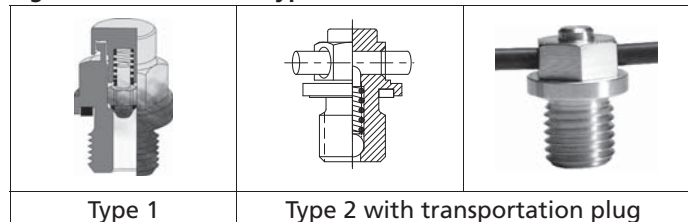


10. Vent plug locations

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.

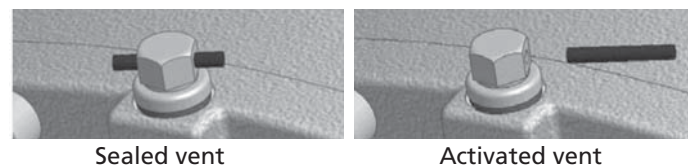
AUTOVENT™ - The AUTOVENT™ helps prevent bearing and gear damage by behaving like a check valve to block the entry of foreign material (water, dust, corrosives, etc.). The breather opens at approximately 2-3 psi during operation and closes tightly as the gearbox cools. This option is perfect for humid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

U11000 - 1 of 2

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



- The “Ambient Temperature” is intended to be an operation guideline based upon the typical properties of all the lubricant. The viscosity and other properties of the lubricant change based upon load, speed, ambient conditions, and reducer operating temperatures. The user should consult with their lubrication supplier & NORD gear before considering changes in oil type or viscosity.
- To prevent reducer overheating, observe the maximum operating oil temperature limits:
Mineral Oil: 80-85 °C (176 – 180 °F).
Synthetic Oil: 105 °C (225 °F).
- In the following instances, please consult NORD for specific recommendations:
 - √ Gear units will operate in high ambient temperature conditions exceeding 40 °C (104 °F).
 - √ Gear units will operate in cold ambient temperature conditions approaching 0 °C (32 °F) or lower.
 - √ Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.
 - √ Fluid grease is required for lubricating the gear unit.
- Observe the general lubrication guidelines outlined in user manual U10750.

Oil Formulation Codes

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

Lubrication Notes

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

NORD Gear Limited

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HELICAL & BEVEL REDUCER LUBRICATION TYPES



DRIVESYSTEMS

RETAIN FOR FUTURE USE

U11000 - 2 of 2

Oil Cross-reference Chart

| ISO Viscosity | Oil Type | Ambient Temperature Range | Mobil | Shell | Castrol | FUCHS | KLÜBER LUBRICATION |
|---------------|----------|------------------------------|---------------------|--------------|----------------|----------------------|------------------------|
| VG150 | MIN-EP | 0 to 25°C (32 to 77°F) | Mobilgear 600XP150 | Omala 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.

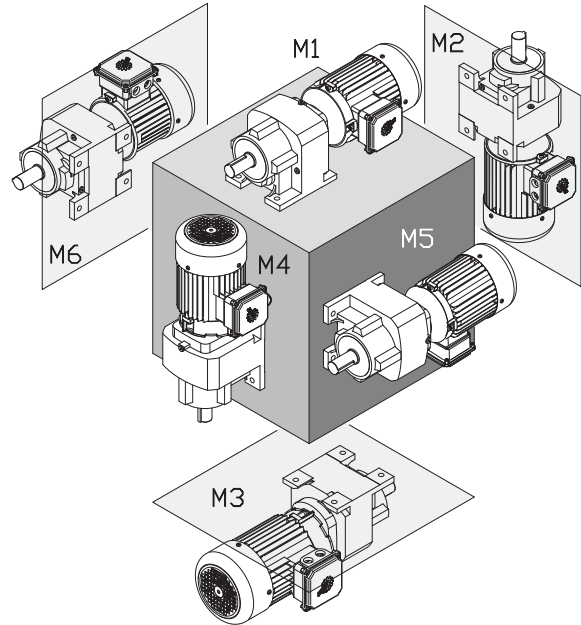


NORDBLOC®.1 FOOTED OIL FILL QUANTITIES



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



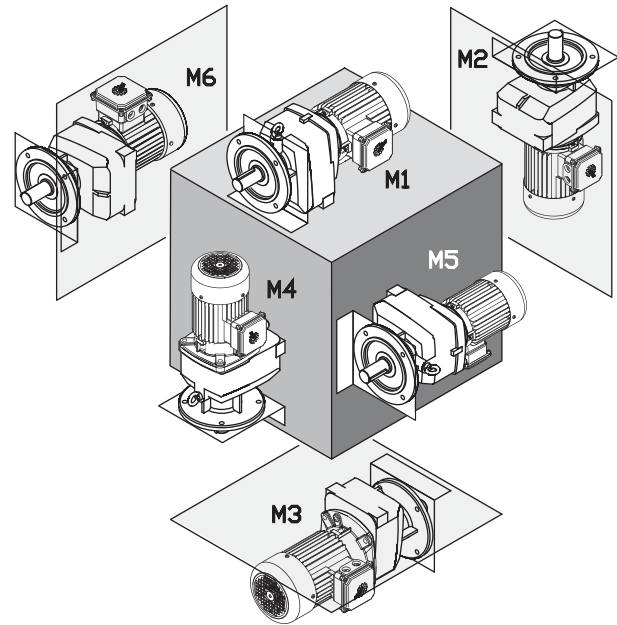
DRIVESYSTEMS

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.



HARMFUL SITUATION



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



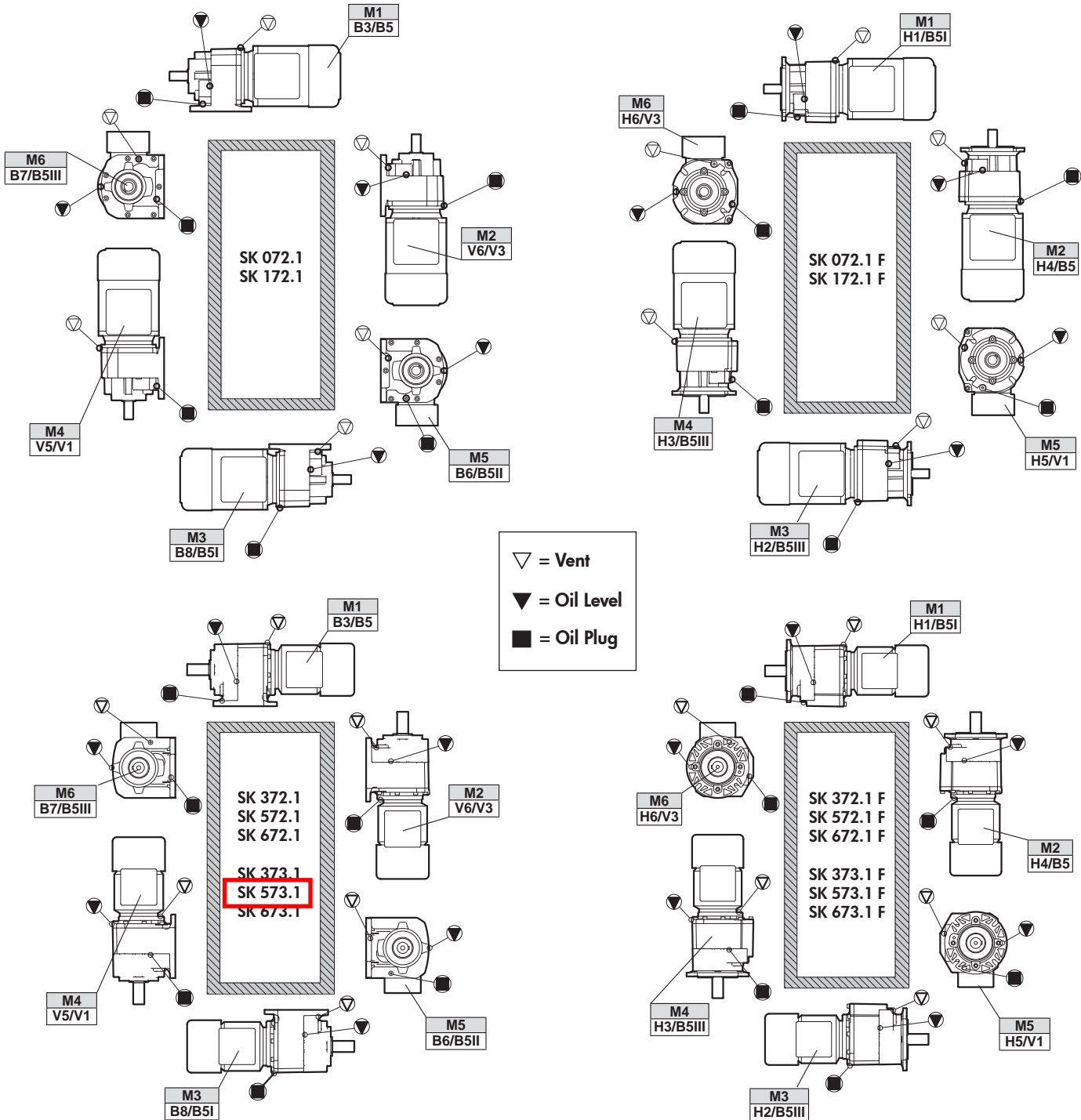
DRIVESYSTEMS

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



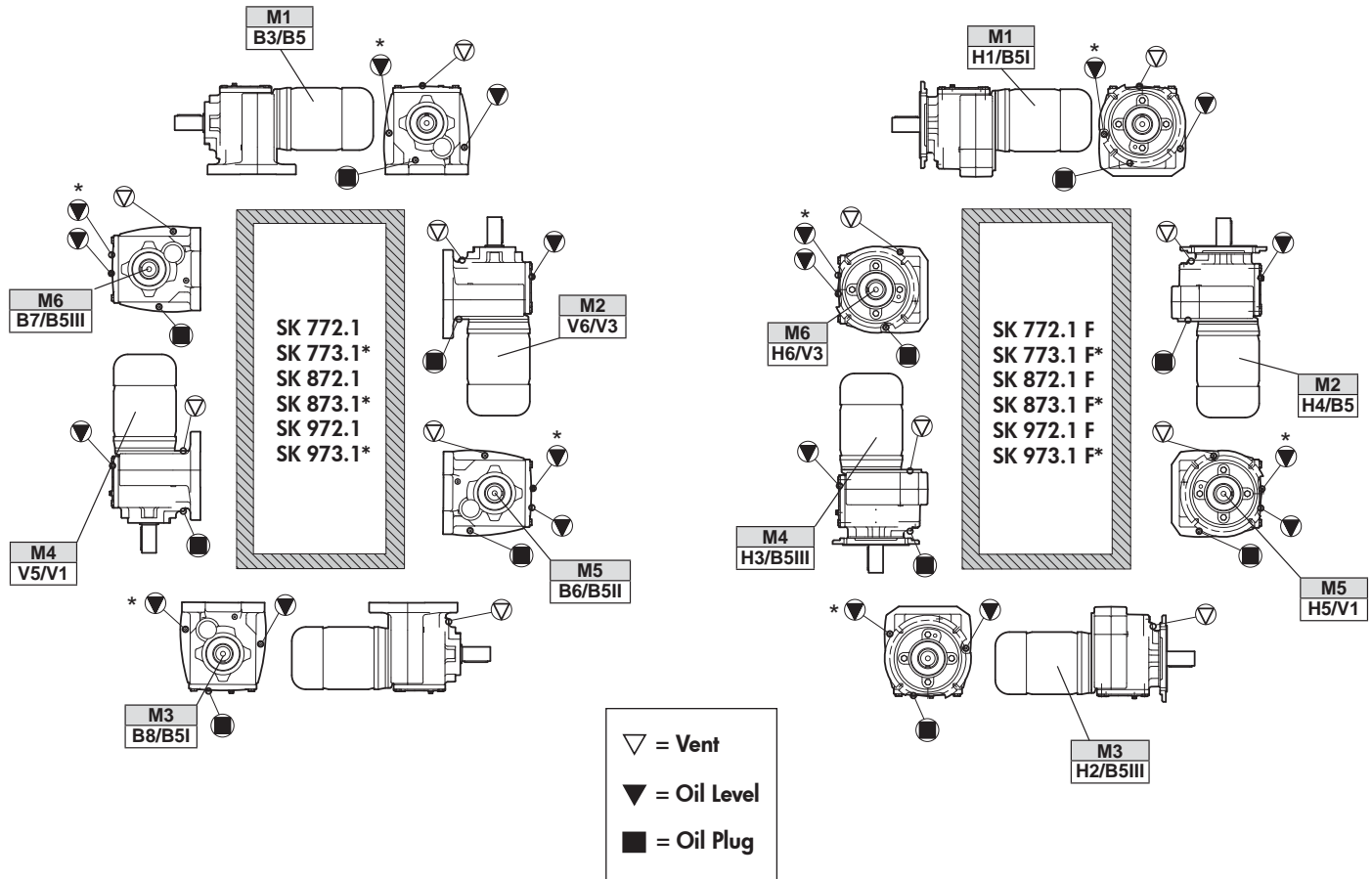
DRIVESYSTEMS

RETAIN FOR FUTURE USE

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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.*



* Oil fill level for three stage gear units.

Continuous Duty 230/460V - 60Hz



Inverter duty • Induction motor • TEFC
Synchronous speed 1800rpm @ 60Hz • 4-pole • Three-phase
Voltages: 230/460V – 60Hz • 1.15 Service Factor
Continuous Duty • 40°C Ambient • up to 3300ft Elevation
Class B temperature rise • Class F insulation

| Motor Type | P _n Full Load Power | | Eff. Class | n _n Full-Load Speed | I _n Full-Load Current | | I ₂ /I _n Locked Rotor Current Ratio | NEMA Code Letter | T _n Full-Load Torque | T ₂ /T _n Locked Rotor Torque Ratio | T _v /T _n Break Down Torque Ratio | pf Power Factor | η Full Load Efficiency | J _m Rotor Inertia | Wt. Weight |
|----------------|--------------------------------|------------|------------|--------------------------------|----------------------------------|-------------|---|------------------|---------------------------------|--|--|-----------------|------------------------|------------------------------|------------|
| | [hp] | [kW] | | | [A] | [A] | | | | | | | | | |
| 63 S/4 | 0.16 | 0.12 | - | 1700 | 0.88 | 0.44 | 250% | F | 5.93 | 2.7 | 3.5 | 0.66 | 52.0% | 0.0050 | 7.9 |
| 63 L/4 | 0.25 | 0.18 | - | 1680 | 1.12 | 0.56 | 270% | E | 9.38 | 2.3 | 2.5 | 0.71 | 57.0% | 0.0066 | 9.3 |
| 71 S/4 | 0.33 | 0.25 | - | 1710 | 1.56 | 0.78 | 310% | G | 12.2 | 2.4 | 2.7 | 0.64 | 63.0% | 0.017 | 12 |
| 71 L/4 | 0.5 | 0.37 | - | 1720 | 1.90 | 0.95 | 350% | F | 18.3 | 2.3 | 2.7 | 0.69 | 71.0% | 0.020 | 14 |
| 80 S/4 | 0.75 | 0.55 | - | 1710 | 2.70 | 1.35 | 350% | F | 27.6 | 2.2 | 2.3 | 0.71 | 72.0% | 0.026 | 18 |
| 80 LP/4 | 1 | 0.75 | | 1730 | 3.14 | 1.57 | 650 | K | 36.4 | 3.5 | 3.8 | 0.70 | 86.1 | 0.045 | 22 |
| 90 SP/4 | 1.5 | 1.1 | | 1740 | 4.20 | 2.10 | 840 | L | 54.3 | 4.2 | 4.9 | 0.76 | 86.9 | 0.081 | 33 |
| 90 LP/4 | 2 | 1.5 | | 1730 | 5.60 | 2.80 | 760 | K | 72.9 | 3.9 | 4.3 | 0.78 | 87.0 | 0.093 | 37 |
| 100 LP/4 | 3 | 2.2 | | 1770 | 7.68 | 3.84 | 920 | L | 107 | 3.0 | 4.5 | 0.79 | 90.0 | 0.192 | 62 |
| 112 MP/4 | 5 | 3.7 | | 1755 | 13.0 | 6.50 | 950 | L | 180 | 4.1 | 4.6 | 0.80 | 90.3 | 0.332 | 78 |
| 132 SP/4 | 7.5 | 5.5 | | 1770 | 19.5 | 9.75 | 1020 | M | 267 | 4.7 | 5.0 | 0.77 | 91.7 | 0.759 | 121 |
| 132 MP/4 | 10 | 7.5 | | 1765 | 26.7 | 13.4 | 960 | M | 357 | 4.7 | 5.0 | 0.77 | 91.7 | 0.831 | 137 |
| 160 MP/4 | 15 | 11 | | 1770 | 35.6 | 17.8 | 880 | K | 534 | 3.2 | 3.8 | 0.84 | 92.5 | 1.59 | 205 |
| 160 LP/4 | 20 | 15 | | 1775 | 47.6 | 23.8 | 1080 | M | 710 | 4.3 | 4.7 | 0.85 | 93.0 | 2.18 | 269 |
| 180 MP/4 | 25 | 18.5 | | 1780 | 60.6 | 30.3 | 1010 | L | 885 | 3.9 | 4.0 | 0.82 | 93.6 | 3.80 | 342 |
| 180 LP/4 | 30 | 22 | | 1780 | 69.6 | 34.8 | 880 | K | 1062 | 3.3 | 3.4 | 0.85 | 93.6 | 3.80 | 342 |
| 225 RP/4 | 40 | 30 | | 1785 | - | 49.5 | 890 | K | 1420 | 3.4 | 3.8 | 0.81 | 94.5 | 11.63 | 694 |
| 225 SP/4 | 50 | 37 | | 1785 | - | 59.7 | 880 | K | 1752 | 3.0 | 3.7 | 0.82 | 94.6 | 12.81 | 728 |

Motor Ratings





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



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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 E 191510 Energy Efficient CC 502 A 18000 0851280

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
 16 rpm 17 PF 18 rpm
 EFF 19 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 E 191510 LR 112560 CE

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 E 191510 18000 0851210

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
 16 rpm 17 PF 18 rpm
 EFF 19 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 E 191510 LR 112560 CE

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 0851210

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
 24 25 26

CE EN 60034 (H) 0851210 0

Type SK 1
 2 ~ Mot Nr 3
 Th Cl 5 F IP 6 S 7
 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



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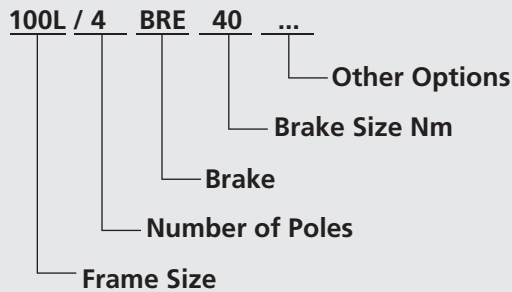
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6. Motor Options And Nomenclature

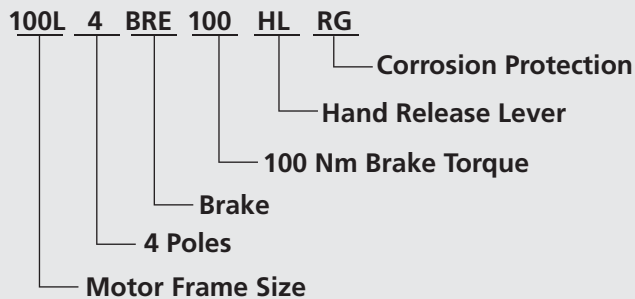
NORD offers many options for its motors. The option code will be shown in the motor nomenclature. Below are commonly used options.

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

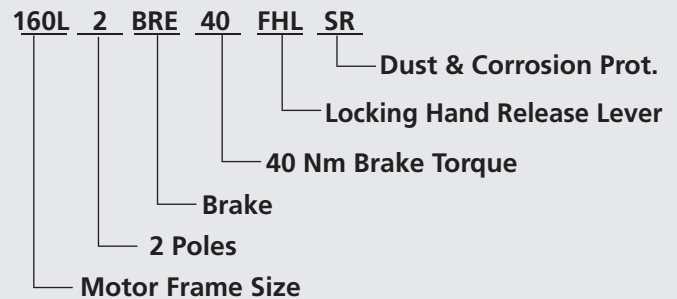
Motor Nomenclature



Ordering Examples



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



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



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. | | |



MOTORS - AC INDUCTION, SINGLE & POLYPHASE



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 |



MOTORS - AC INDUCTION, SINGLE & POLYPHASE



DRIVESYSTEMS

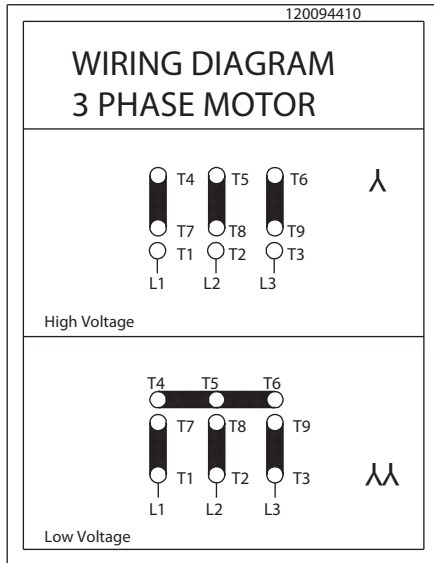
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15. Wiring Diagrams

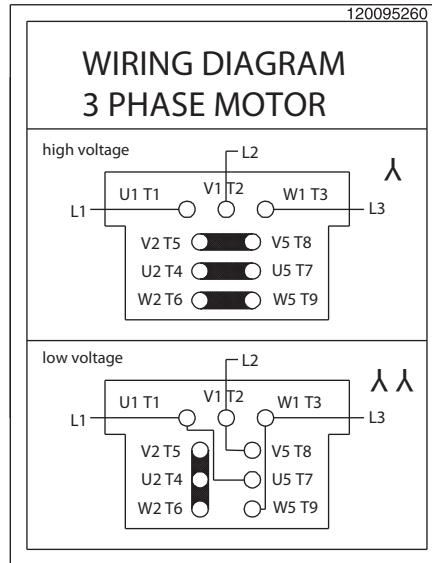
Frames 63-132

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



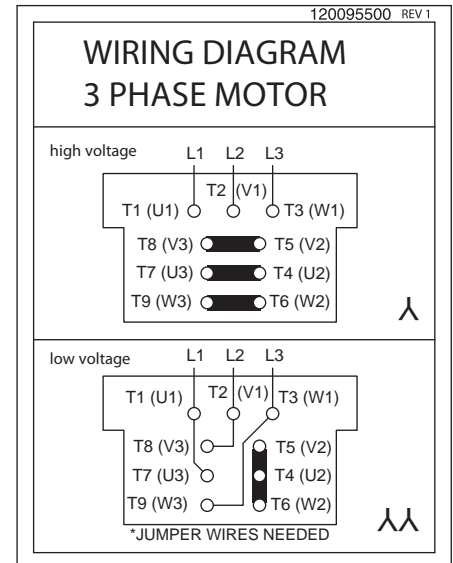
Frames 160 +

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

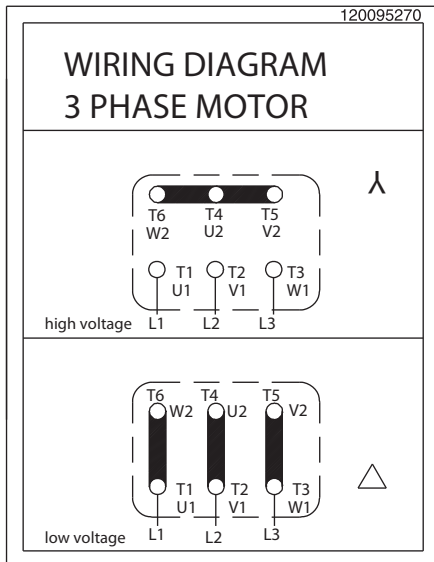


Frames 160 +

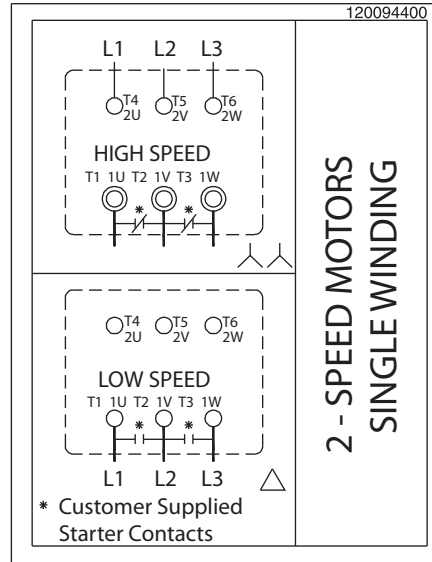
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø
190 / 380V, 60Hz, 3Ø



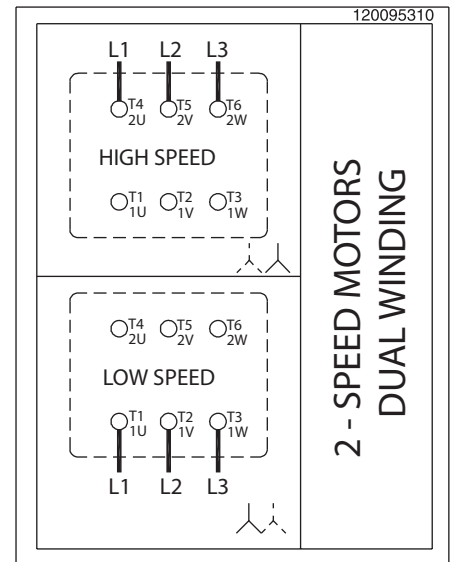
460 / 800V, 60Hz, 3Ø | 230 / 400V, 50Hz, 3Ø
208 / 360V, 60Hz, 3Ø | 400 / 690V, 50Hz, 3Ø
332 / 575V, 60Hz, 3Ø



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



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





MOTORS - AC INDUCTION, SINGLE & POLYPHASE



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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DRIVESYSTEMS

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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



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 | |
| <p>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.</p> | | |

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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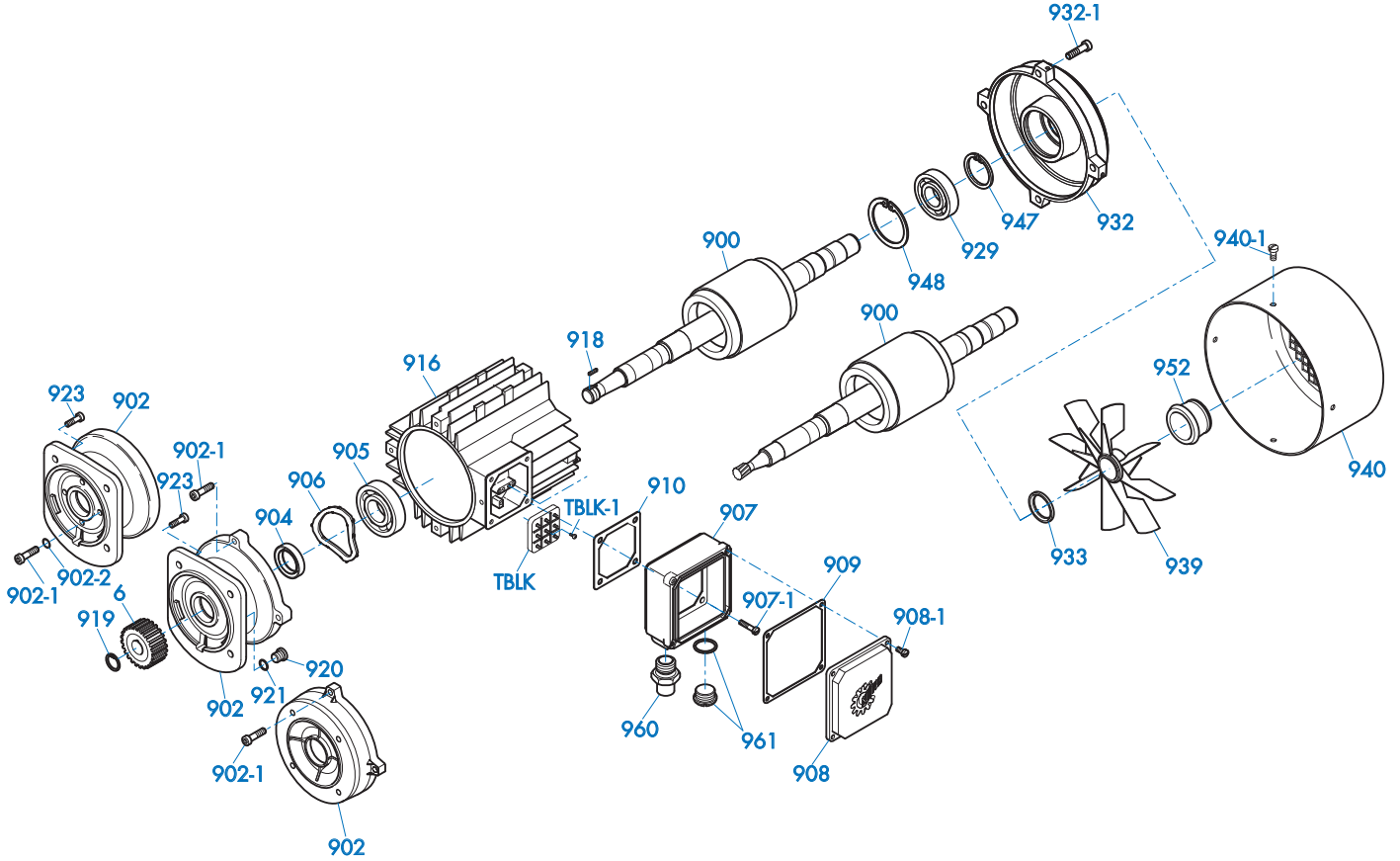
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18. Parts List

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



MOTORS - AC INDUCTION, SINGLE & POLYPHASE



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.



MOTORS - AC INDUCTION, SINGLE & POLYPHASE



DRIVESYSTEMS

RETAIN FOR FUTURE USE

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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 3



ENGINEERING/TECHNICAL

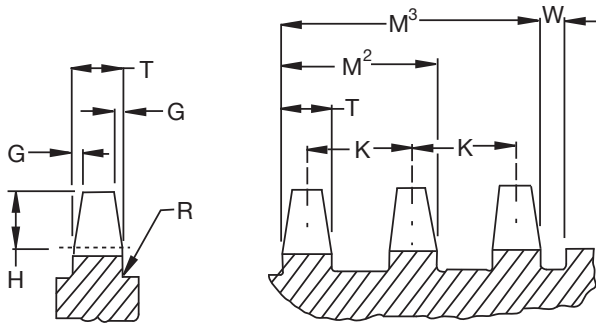
Sprocket Dimensions, Chain Data

| Ref. For Single & Multiple Chain | | | | G | H | K | M ² | M ³ | R Max. | Nominal Tooth Thickness (T) | | Tolerance on "T" | | |
|----------------------------------|-------|-------------|--------------|------|------|-------|----------------|----------------|--------|-----------------------------|----------------------------|-------------------------|--------------------------------------|------------------|
| Chain No. | Pitch | Roller Dia. | Roller Width | | | | | | | Using Single Strand Chain | Using 2 and 3 Strand Chain | For Machined Sprocket * | For Sprocket Which Is Not Machined † | W Side Clearance |
| 35 | 3/8 | .200 | 3/16 | 3/64 | 3/16 | .399 | .561 | .960 | .015 | .168 | .162 | +0.00-0.08 | +0.00-.027 | 3/16 |
| 41 | 1/2 | .306 | 1/4 | 1/16 | 1/4 | | | | .020 | .227 | | +0.00-0.09 | +0.00-.032 | 7/32 |
| 40 | 1/2 | .312 | 5/16 | 1/16 | 1/4 | .566 | .841 | 1.407 | .020 | .284 | .275 | +0.00-0.09 | +0.00-.035 | 1/4 |
| 55 | 5/8 | .408 | 3/8 | 5/64 | 5/16 | .713 | 1.016 | 1.753 | .025 | .318 | .302 | +0.00-.09 | +0.00-.038 | 3/32 |
| 60 | 3/4 | .469 | 1/2 | 3/32 | 3/8 | .897 | 1.341 | 2.238 | .030 | .459 | .444 | +0.00-.011 | +0.00-.036 | 11/32 |
| 88 | 1 | .625 | 5/8 | 1/8 | 1/2 | 1.153 | 1.713 | 2.888 | .038 | .575 | .557 | +0.00-.012 | +0.00-.038 | 7/16 |
| 100 | 1-1/4 | .750 | 3/4 | 5/32 | 5/8 | 1.408 | 2.077 | 3.485 | .050 | .692 | .669 | +0.00-.014 | +0.00-.046 | 17/32 |
| 120 | 1-1/2 | .875 | 1 | 3/16 | 3/4 | 1.789 | 2.683 | 4.472 | .060 | .924 | .894 | +0.00-.016 | +0.00-.057 | 21/32 |
| 140 | 1-3/4 | 1.000 | 1 | 7/32 | 7/8 | 1.924 | 2.818 | 4.742 | .070 | .924 | .894 | +0.00-.016 | +0.00-.057 | 3/4 |
| 160 | 2 | 1.125 | 1-1/4 | 1/4 | 1 | 2.305 | 3.424 | 5.729 | .080 | 1.156 | 1.119 | +0.00-.019 | +0.00-.062 | 7/8 |

* Represents Type B or C hub type sprocket.

† Represents an "A" plate sprocket or a welded sprocket using an "A" plate.

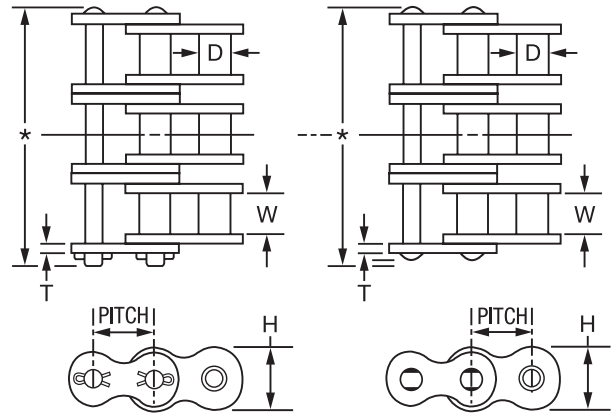
Sprockets



Single Stand

2 and 3 Strand

Roller Chain



COTTERED TYPE

RIVETED TYPE

ANSI Standard Roller Chain Dimensions

| ANSI No. | Roller W | Roller D | Inside Link Plate Height | Cottered Chain Width* | Riveted Chain Width* | Average Tensile Strength |
|----------|----------|----------|--------------------------|-----------------------|----------------------|--------------------------|
| 25-2 | 1/8 | .130 | .237 | .37 | .34 | 875 |
| 25-2 | 1/8 | .130 | .237 | .63 | .59 | 1750 |
| 25-3 | 1/8 | .130 | .237 | .88 | .84 | 2626 |
| 35 | 3/16 | .200 | .356 | .56 | .50 | 2100 |
| 35-2 | 3/16 | .200 | .356 | .96 | .90 | 4200 |
| 35-3 | 3/16 | .200 | .356 | 1.36 | 1.31 | 6300 |
| 41 | 1/4 | .306 | .383 | .65 | .57 | 2000 |
| 40 | 5/16 | .312 | .475 | .72 | .67 | 3700 |
| 40-2 | 5/16 | .312 | .475 | 1.29 | 1.24 | 7400 |
| 40-3 | 5/16 | .312 | .475 | 1.85 | 1.80 | 11100 |
| 50 | 3/8 | .400 | .594 | .89 | .83 | 6600 |
| 50-2 | 3/8 | .400 | .594 | 1.60 | 1.55 | 13200 |
| 50-3 | 3/8 | .400 | .594 | 2.31 | 2.24 | 19800 |
| 60 | 1/2 | .469 | .712 | 1.11 | 1.04 | 8500 |
| 60-2 | 1/2 | .469 | .712 | 2.01 | 1.91 | 17000 |
| 60-3 | 1/2 | .469 | .712 | 2.91 | 2.84 | 25500 |
| 80 | 5/8 | .625 | .950 | 1.44 | 1.32 | 14500 |
| 80-2 | 5/8 | .625 | .950 | 2.59 | 2.47 | 29000 |
| 80-3 | 5/8 | .625 | .950 | 3.74 | 3.62 | 43500 |

* Dimensions are across pins.

| ANSI No. | Roller W | Roller D | Inside Link Plate Height | Cottered Chain Width* | Riveted Chain Width* | Average Tensile Strength |
|----------|----------|----------|--------------------------|-----------------------|----------------------|--------------------------|
| 100 | 3/4 | .750 | 1.187 | 1.73 | 1.61 | 24000 |
| 100-2 | 3/4 | .750 | 1.187 | 3.14 | 3.02 | 48000 |
| 100-3 | 3/4 | .750 | 1.187 | 4.56 | 4.43 | 72000 |
| 120 | 1 | .875 | 1.425 | 2.14 | 2.00 | 34000 |
| 120-2 | 1 | .875 | 1.425 | 3.85 | 3.79 | 68000 |
| 120-3 | 1 | .875 | 1.425 | 5.72 | 5.58 | 102000 |
| 140 | 1 | 1.000 | 1.662 | 2.31 | 2.14 | 46000 |
| 140-2 | 1 | 1.000 | 1.662 | 4.24 | 4.07 | 92000 |
| 140-3 | 1 | 1.000 | 1.662 | 6.16 | 6.00 | 138000 |
| 160 | 1-1/4 | 1.125 | 1.900 | 2.73 | 2.54 | 58000 |
| 160-2 | 1-1/4 | 1.125 | 1.900 | 5.04 | 4.85 | 116000 |
| 160-3 | 1-1/4 | 1.125 | 1.900 | 7.35 | 7.16 | 174000 |
| 180 | 1-13/32 | 1.406 | 2.137 | 3.13 | 2.88 | 76000 |
| 180-2 | 1-13/32 | 1.406 | 2.137 | 5.75 | 5.48 | 152000 |
| 180-3 | 1-13/32 | 1.406 | 2.137 | 8.34 | 8.07 | 228000 |
| 200 | 1-1/2 | 1.562 | 2.375 | 3.44 | 3.18 | 95000 |
| 200-2 | 1-1/2 | 1.562 | 2.375 | 6.26 | 5.94 | 190000 |
| 200-3 | 1-1/2 | 1.562 | 2.375 | 9.08 | 8.76 | 285000 |
| 240 | 1-7/8 | 1.875 | 2.812 | 4.06 | 3.72 | 135000 |
| 240-2 | 1-7/8 | 1.875 | 2.812 | 7.52 | 7.18 | 260000 |

| | | | |
|----------------------------------|-------------------------------|---------------------------|----------------------------------|
| FEATURES/BENEFITS PAGE PT14-2 | SPECIFICATIONS PAGE PT14-3 | SELECTION PAGE PT14-16 | RELATED PRODUCTS PAGE PT14-28 |
|----------------------------------|-------------------------------|---------------------------|----------------------------------|

TAB 4

Ovivo Drive Control Information

Description:

The drive control, equipped with factory installed micro switches, provides torque detection which can be used for monitoring, triggering alarms, and equipment shutdown for Ovivo drive units.



Features:

- Accurately detects percentage of torque on drive
- 0 to 100% torque range
- Local alarm and shutdown capability
- Factory calibrated and tested

Specifications

Housing Data:

- Encloses (4) Micro Switches
- Designed to meet NEMA 4x Standards
- Epoxy coated aluminum or stainless steel
- Encloses large Pointer, totally enclosed, mounted on a sealed, lubricated for life, anti-friction bearing

Micro Switch Data (4x):

- 125Vac 15A
- SPDT
- For use in compression
- Independently adjustable, cam actuated
- Temperature range: -67° to 185°F (-55° to 85°C)
- Plunger Actuator



Unless otherwise specified, the cams are pre-set at the factory to perform the following functions:

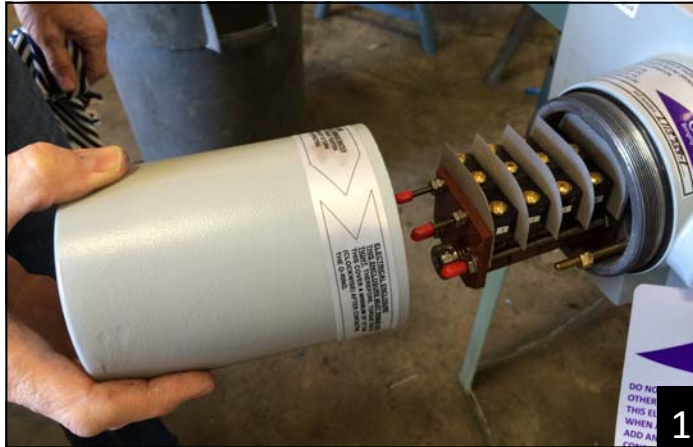
| <u>Switch</u> | <u>Normal Torque Setting</u> | <u>Function</u> |
|---------------|------------------------------|--|
| 1 | 85 to 100% | Motor Cutout |
| 2 | 40% | Alarm |
| 3 | 100/50% | Spare/Raise Arms (Units with motorized lift) |
| 4 | 100/30% | Spare/Lower Arms (Units with motorized lift) |

Where the function of a switch is not required, the switch is provided but not connected.

OVIVO DRIVE CONTROL REMOVAL AND REPLACEMENT INSTRUCTIONS

REMOVAL OF DRIVE CONTROL

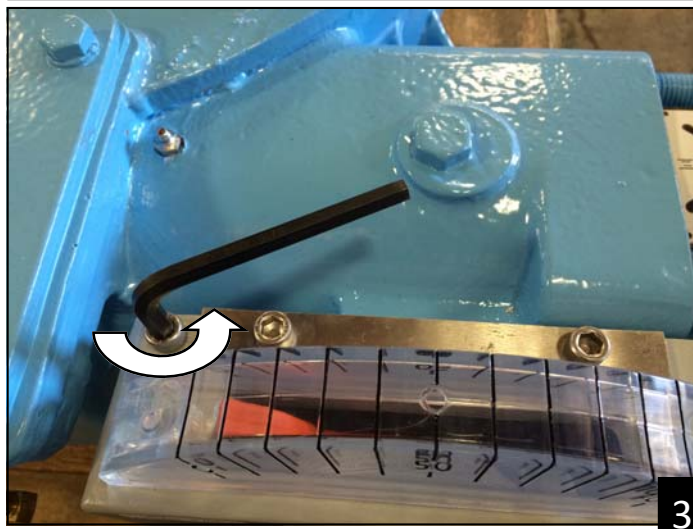
DISABLE ALL POWER TO DRIVE CONTROL AND DRIVE GEAR MOTOR.
REMOVE ROUND SWITCH COVER FROM DRIVE CONTROL.



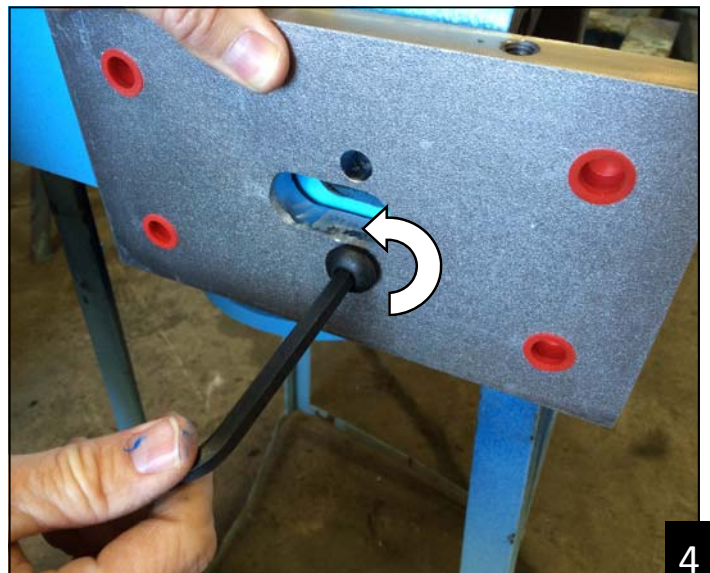
LABEL AND DISCONNECT SWITCH WIRES. DISCONNECT CONDUIT FROM DRIVE CONTROL HOUSING.



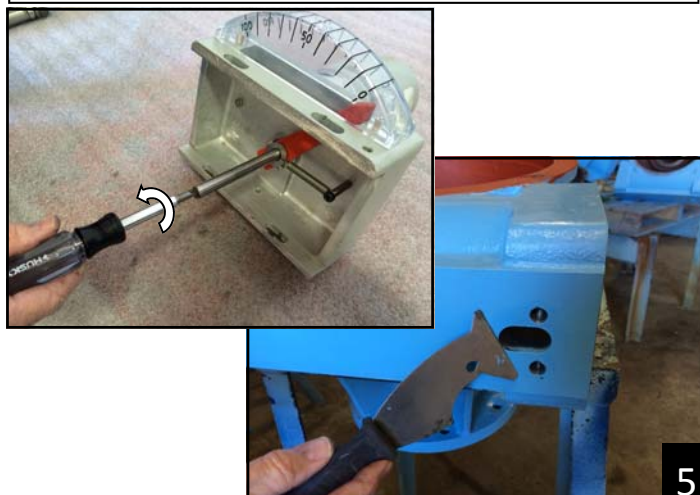
REMOVE (5) SOCKET CAP SCREWS, INCLUDING THE DOWEL SCREW, FROM DRIVE CONTROL, THEN REMOVE DRIVE CONTROL.



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

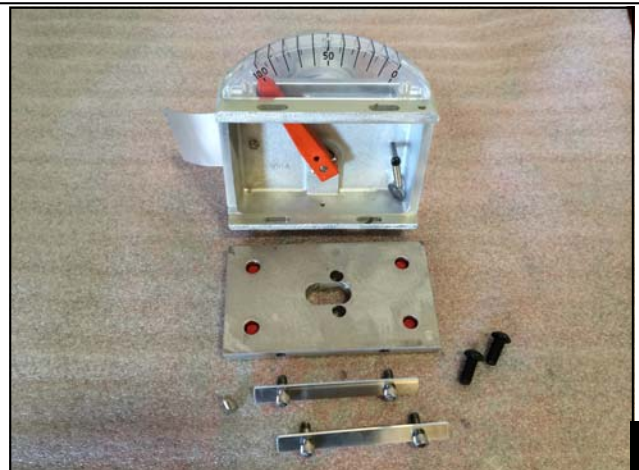


REMOVE ACTUATING PIN FROM OLD DRIVE CONTROL POINTER, THEN CLEAN SURFACE OF WORM GEAR HOUSING AND REMOVE ANY RESIDUAL SEALANT.



INSTALLATION OF DRIVE CONTROL

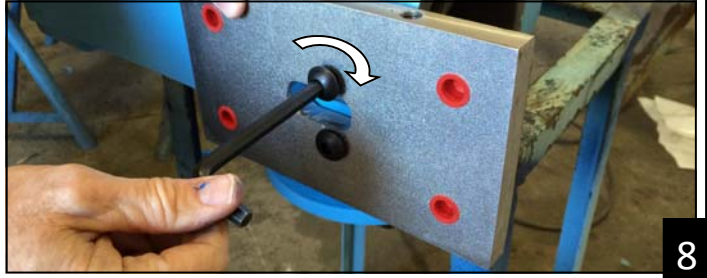
SEPARATE NEW DRIVE CONTROL FROM MOUNTING PLATE BY REMOVING (4) SOCKET CAP SCREWS AND DISASSEMBLE AS SHOWN.



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



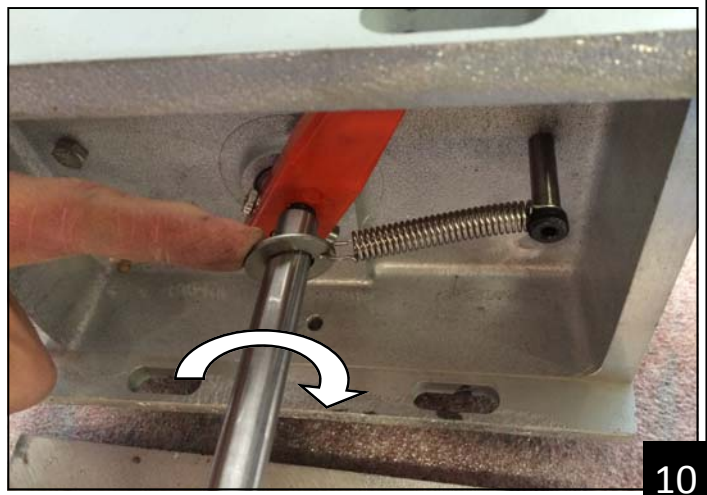
APPLY RTV SEALANT TO (2) 1/2-13NCx1-1/4" BUTTON HEAD CAP-SCREW THREADS. INSTALL MOUNTING PLATE AND TORQUE FROM 50-60 FT-LBS. SLOT IN PLATE MUST LINE UP WITH HOUSING.



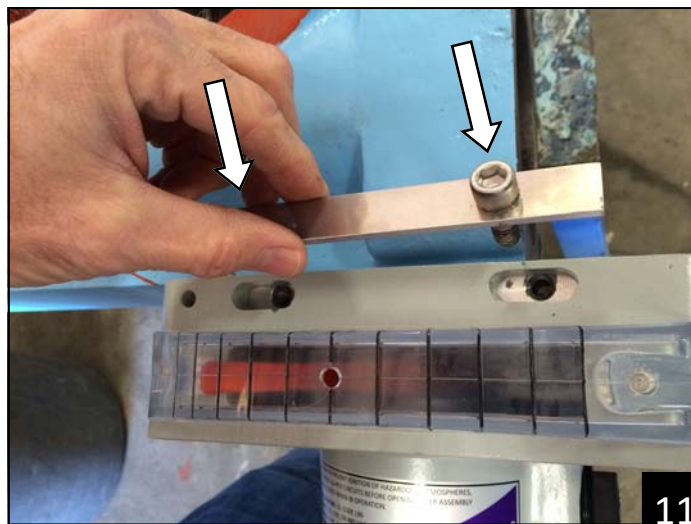
PLACE OLD ACTUATING PIN THROUGH WASHER ON NEW DRIVE CONTROL.



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.



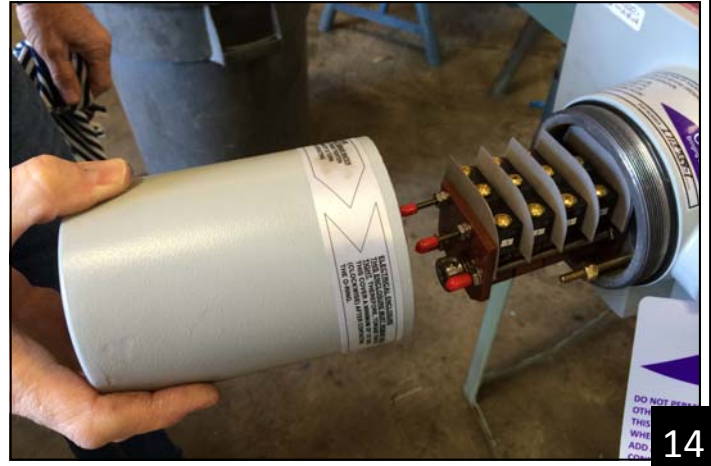
LOCK IN PLACE BY TIGHTENING THE (4) CAP-SCREWS AS NOTED IN STEP 11. SNUG TIGHT, DO NOT OVER TORQUE.



13

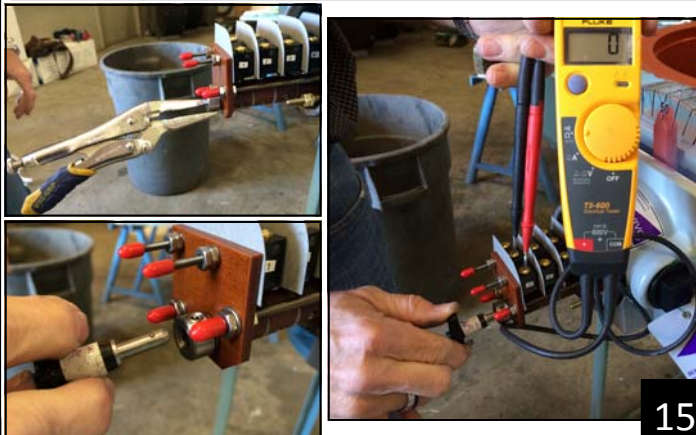
DRIVE CONTROL SWITCH INSTRUCTIONS

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



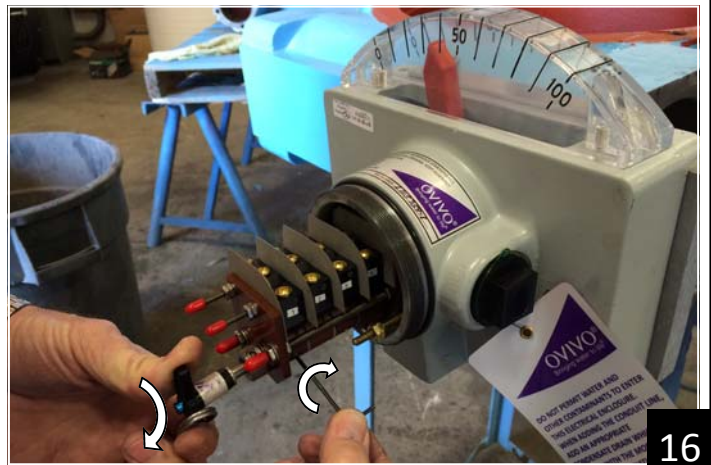
14

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).



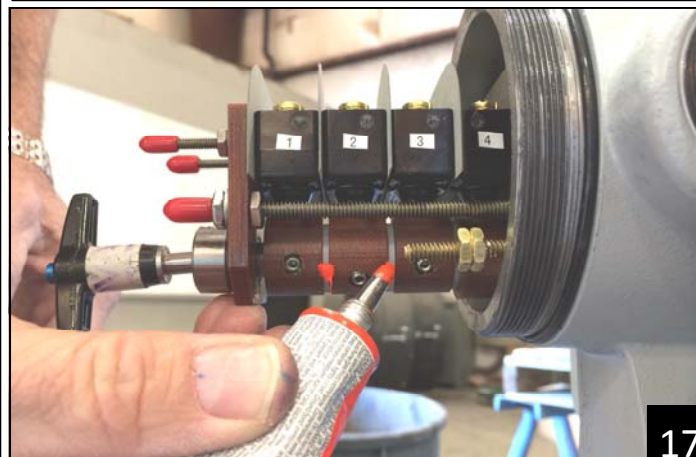
15

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.



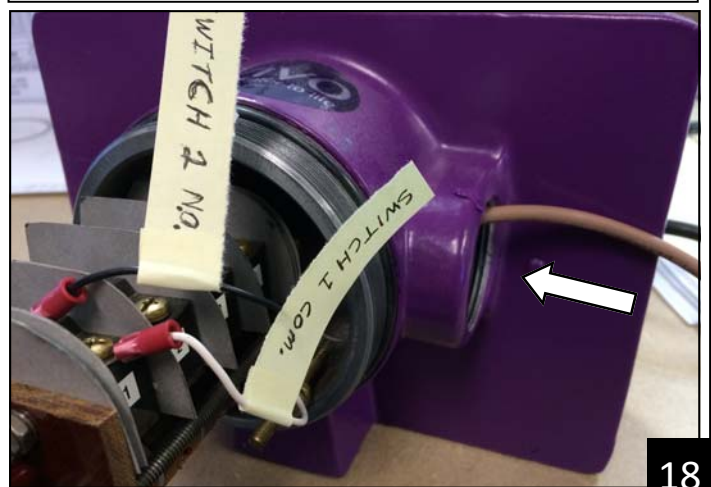
16

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

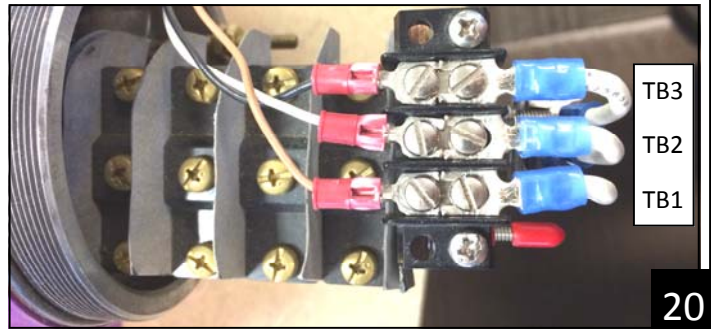
IF POTENTIOMETER IS NOT USED, SKIP TO STEP 24.

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

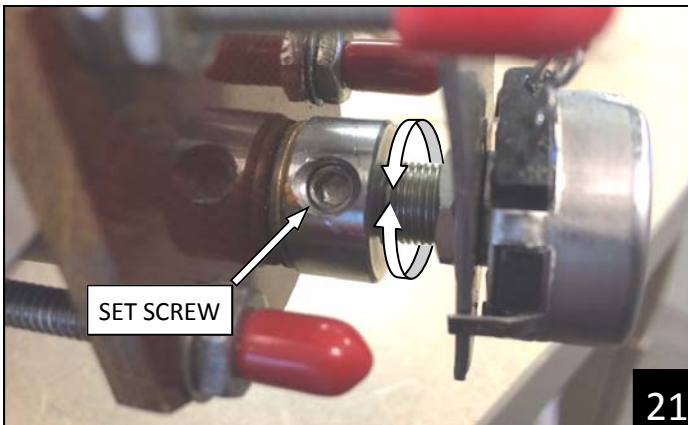
PROCEDURE: ATTACH OHMMETER TO APPLICABLE POTENTIOMETER TERMINALS MARKED TB1 AS SHOWN IN TABLE BELOW.

| 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.

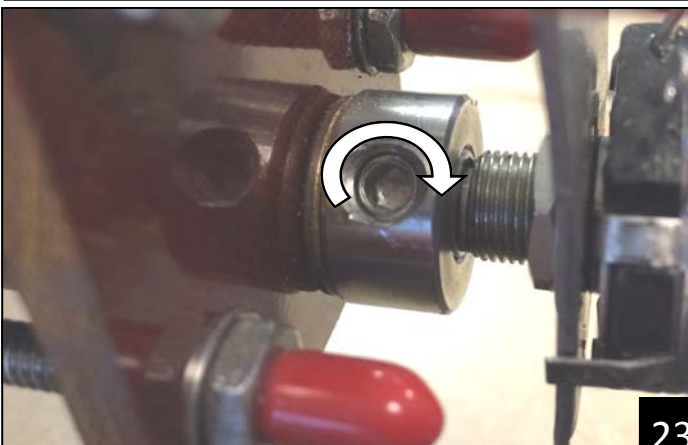


21

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

TAB 5

CONTINUOUS HINGE WITH CLAMPS, TYPE 4X

INDUSTRY STANDARDS

UL 508A Listed; Type 3R, 4, 4X, 12; File No. E61997
 cUL Listed per CSA C22.2 No 94; Type 3R, 4, 4X, 12; File No. E61997

NEMA/EEMAC Type 3, 3R, 4, 4X, 12, 13
 CSA File No. 42186: Type 4, 4X, 12
 IEC 60529, IP66
 Meets NEMA Type 3RX requirements

APPLICATION

For use in indoor and outdoor corrosive environments that require a water-tight seal, this enclosure's seamless foam-in-place gasket and screw-down clamps provide a secure seal against contaminants.

SPECIFICATIONS

- 14 gauge Type 304 or Type 316L stainless steel bodies and doors
- Seams continuously welded and ground smooth
- Seamless foam-in-place gasket
- Rolled lip around three sides of door
- Stainless steel door clamp assembly
- Hasp and staple for padlocking
- Door removed by pulling stainless steel continuous hinge pin
- Data pocket is high-impact thermoplastic
- Collar studs provided for mounting optional panels
- Exterior hardware on Type 316L stainless steel enclosures matches enclosure material
- Bonding provision on door; grounding stud on body

FINISH

Door, sides, top and bottom have smooth #4 brushed finish.

ACCESSORIES

Fast-Operating Clamp Assembly
 Panels for Type 3R, 4, 4X, 12 and 13 Enclosures
 Junction Box and Wall-Mount Enclosure Swing-Out Panel Kit
 Steel, Stainless Steel and Non-Metallic Window Kits
 H2OMIT Vent Drains, Type 4X
 H2OMIT Thermoelectric Dehumidifier
 Steel, Stainless Steel and Non-Metallic Window Kits
 PANELITE Enclosure Lights
 Hol-Sealers Hole Seals
 Thermoelectric Temperature Controller

MODIFICATION AND CUSTOMIZATION

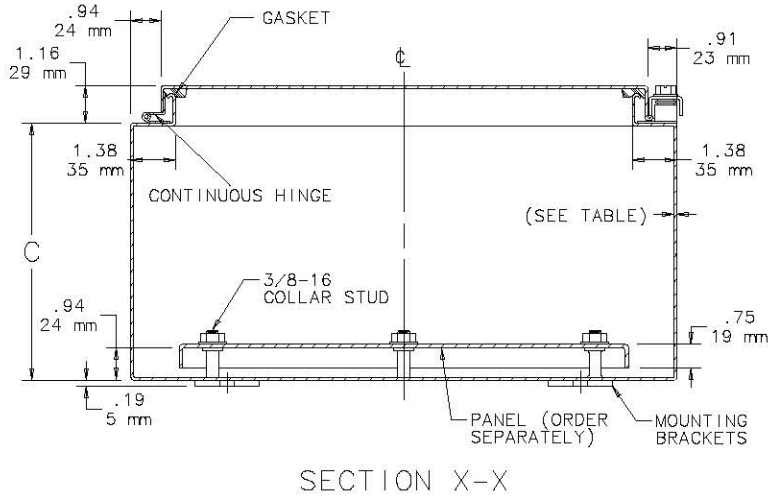
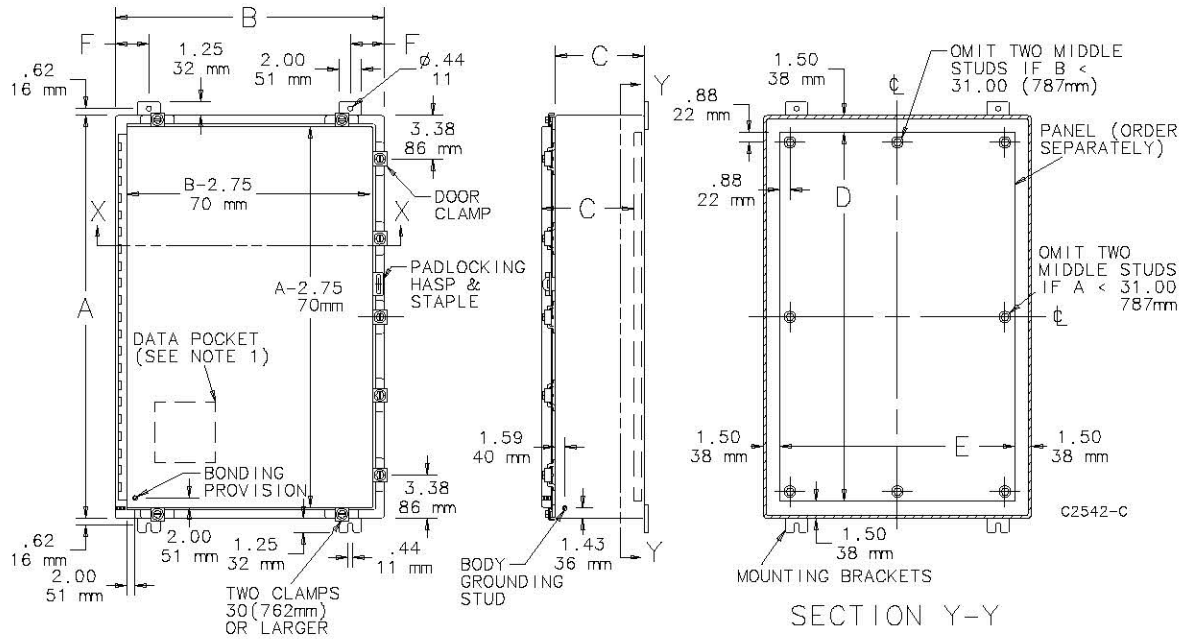
Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

BULLETIN: A4S

Standard Product

| Catalog Number | AxBxC in./mm | Stainless Steel Type | Steel Panel | Conductive Steel Panel | Stainless Steel Panel | Panel Size D x E in./mm | F in./mm | Clamps Qty. | Data Pocket |
|----------------|---|----------------------|-------------|------------------------|-----------------------|----------------------------|------------|-------------|-------------|
| A16H1206SSLP | 16.00 x 12.00 x 6.00 406 x 305 x 152 | 304 | A16P12 | A16P12G | A16P12SS6 | 13.00 x 9.00 330 x 229 | 1.25 32 | 4 | Small |
| A16H1206SS6LP | 16.00 x 12.00 x 6.00 406 x 305 x 152 | 316L | A16P12 | A16P12G | A16P12SS6 | 13.00 x 9.00 330 x 229 | 1.25 32 | 4 | Small |
| A16H1606SSLP | 16.00 x 16.00 x 6.00 406 x 406 x 152 | 304 | A16P16 | A16P16G | A16P16SS6 | 13.00 x 13.00 330 x 330 | 3.00 76 | 4 | Small |
| A16H1606SS6LP | 16.00 x 16.00 x 6.00 406 x 406 x 152 | 316L | A16P16 | A16P16G | A16P16SS6 | 13.00 x 13.00 330 x 330 | 3.00 76 | 4 | Small |
| A16H2006SSLP | 16.00 x 20.00 x 6.00 406 x 508 x 152 | 304 | A20P16 | A20P16G | A20P16SS6 | 17.00 x 13.00 432 x 330 | 3.00 76 | 4 | Small |
| A16H2006SS6LP | 16.00 x 20.00 x 6.00 406 x 508 x 152 | 316L | A20P16 | A20P16G | A20P16SS6 | 17.00 x 13.00 432 x 330 | 3.00 76 | 4 | Small |
| A20H1606SSLP | 20.00 x 16.00 x 6.00 508 x 406 x 152 | 304 | A20P16 | A20P16G | A20P16SS6 | 17.00 x 13.00 432 x 330 | 3.00 76 | 4 | Small |
| A20H1606SS6LP | 20.00 x 16.00 x 6.00 508 x 406 x 152 | 316L | A20P16 | A20P16G | A20P16SS6 | 17.00 x 13.00 432 x 330 | 3.00 76 | 4 | Small |
| A20H2006SSLP | 20.00 x 20.00 x 6.00 508 x 508 x 152 | 304 | A20P20 | A20P20G | A20P20SS6 | 17.00 x 17.00 432 x 432 | 3.00 76 | 4 | Small |
| A20H2006SS6LP | 20.00 x 20.00 x 6.00 508 x 508 x 152 | 316L | A20P20 | A20P20G | A20P20SS6 | 17.00 x 17.00 432 x 432 | 3.00 76 | 4 | Small |
| A24H2006SSLP | 24.00 x 20.00 x 6.00 610 x 508 x 152 | 304 | A24P20 | A24P20G | A24P20SS6 | 21.00 x 17.00 533 x 432 | 3.00 76 | 5 | Small |
| A24H2006SS6LP | 24.00 x 20.00 x 6.00 610 x 508 x 152 | 316L | A24P20 | A24P20G | A24P20SS6 | 21.00 x 17.00 533 x 432 | 3.00 76 | 5 | Small |
| A24H2406SSLP | 24.00 x 24.00 x 6.00 610 x 610 x 152 | 304 | A24P24 | A24P24G | A24P24SS6 | 21.00 x 21.00 533 x 533 | 3.00 76 | 5 | Small |
| A24H2406SS6LP | 24.00 x 24.00 x 6.00 610 x 610 x 152 | 316L | A24P24 | A24P24G | A24P24SS6 | 21.00 x 21.00 533 x 533 | 3.00 76 | 5 | Small |

| Catalog Number | AxBxC in./mm | Stainless Steel Type | Steel Panel | Conductive Steel Panel | Stainless Steel Panel | Panel Size D x E in./mm | F in./mm | Clamps Qty. | Data Pocket |
|----------------|--|----------------------|-------------|------------------------|-----------------------|-----------------------------|------------|-------------|-------------|
| A16H1208SSSLP | 16.00 x 12.00 x 8.00 406 x 305 x 203 | 304 | A16P12 | A16P12G | A16P12SS6 | 13.00 x 9.00 330 x 229 | 1.25 32 | 4 | Small |
| A16H1208SS6LP | 16.00 x 12.00 x 8.00 406 x 305 x 203 | 316L | A16P12 | A16P12G | A16P12SS6 | 13.00 x 9.00 330 x 229 | 1.25 32 | 4 | Small |
| A20H1608SSSLP | 20.00 x 16.00 x 8.00 508 x 406 x 203 | 304 | A20P16 | A20P16G | A20P16SS6 | 17.00 x 13.00 432 x 330 | 3.00 76 | 4 | Small |
| A20H1608SS6LP | 20.00 x 16.00 x 8.00 508 x 406 x 203 | 316L | A20P16 | A20P16G | A20P16SS6 | 17.00 x 13.00 432 x 330 | 3.00 76 | 4 | Small |
| A20H2008SSSLP | 20.00 x 20.00 x 8.00 508 x 508 x 203 | 304 | A20P20 | A20P20G | A20P20SS6 | 17.00 x 17.00 432 x 432 | 3.00 76 | 4 | Small |
| A20H2008SS6LP | 20.00 x 20.00 x 8.00 508 x 508 x 203 | 316L | A20P20 | A20P20G | A20P20SS6 | 17.00 x 17.00 432 x 432 | 3.00 76 | 4 | Small |
| A20H2408SSSLP | 20.00 x 24.00 x 8.00 508 x 610 x 203 | 304 | A24P20 | A24P20G | A24P20SS6 | 21.00 x 17.00 533 x 432 | 3.00 76 | 4 | Small |
| A20H2408SS6LP | 20.00 x 24.00 x 8.00 508 x 610 x 203 | 316L | A24P20 | A24P20G | A24P20SS6 | 21.00 x 17.00 533 x 432 | 3.00 76 | 4 | Small |
| A24H1608SSSLP | 24.00 x 16.00 x 8.00 610 x 406 x 203 | 304 | A24P16 | A24P16G | A24P16SS6 | 21.00 x 13.00 533 x 330 | 3.00 76 | 5 | Small |
| A24H1608SS6LP | 24.00 x 16.00 x 8.00 610 x 406 x 203 | 316L | A24P16 | A24P16G | A24P16SS6 | 21.00 x 13.00 533 x 330 | 3.00 76 | 5 | Small |
| A24H2008SSSLP | 24.00 x 20.00 x 8.00 610 x 508 x 203 | 304 | A24P20 | A24P20G | A24P20SS6 | 21.00 x 17.00 533 x 432 | 3.00 76 | 5 | Small |
| A24H2008SS6LP | 24.00 x 20.00 x 8.00 610 x 508 x 203 | 316L | A24P20 | A24P20G | A24P20SS6 | 21.00 x 17.00 533 x 432 | 3.00 76 | 5 | Small |
| A24H2408SSSLP | 24.00 x 24.00 x 8.00 610 x 610 x 203 | 304 | A24P24 | A24P24G | A24P24SS6 | 21.00 x 21.00 533 x 533 | 3.00 76 | 5 | Small |
| A24H2408SS6LP | 24.00 x 24.00 x 8.00 610 x 610 x 203 | 316L | A24P24 | A24P24G | A24P24SS6 | 21.00 x 21.00 533 x 533 | 3.00 76 | 5 | Small |
| A24H3008SSSLP | 24.00 x 30.00 x 8.00 610 x 762 x 203 | 304 | A30P24 | A30P24G | A30P24SS6 | 27.00 x 21.00 686 x 533 | 3.00 76 | 7 | Small |
| A24H3008SS6LP | 24.00 x 30.00 x 8.00 610 x 762 x 203 | 316L | A30P24 | A30P24G | A30P24SS6 | 27.00 x 21.00 686 x 533 | 3.00 76 | 7 | Small |
| A30H2008SSSLP | 30.00 x 20.00 x 8.00 762 x 508 x 203 | 304 | A30P20 | A30P20G | A30P20SS6 | 27.00 x 17.00 686 x 432 | 3.00 76 | 5 | Small |
| A30H2008SS6LP | 30.00 x 20.00 x 8.00 762 x 508 x 203 | 316L | A30P20 | A30P20G | A30P20SS6 | 27.00 x 17.00 686 x 432 | 3.00 76 | 5 | Small |
| A30H2408SSSLP | 30.00 x 24.00 x 8.00 762 x 610 x 203 | 304 | A30P24 | A30P24G | A30P24SS6 | 27.00 x 21.00 686 x 533 | 3.00 76 | 5 | Large |
| A30H2408SS6LP | 30.00 x 24.00 x 8.00 762 x 610 x 203 | 316L | A30P24 | A30P24G | A30P24SS6 | 27.00 x 21.00 686 x 533 | 3.00 76 | 5 | Large |
| A30H3008SSSLP | 30.00 x 30.00 x 8.00 762 x 762 x 203 | 304 | A30P30 | A30P30G | A30P30SS6 | 27.00 x 27.00 686 x 686 | 3.00 76 | 7 | Large |
| A30H3008SS6LP | 30.00 x 30.00 x 8.00 762 x 762 x 203 | 316L | A30P30 | A30P30G | A30P30SS6 | 27.00 x 27.00 686 x 686 | 3.00 76 | 7 | Large |
| A36H2408SSSLP | 36.00 x 24.00 x 8.00 914 x 610 x 203 | 304 | A36P24 | A36P24G | A36P24SS6 | 33.00 x 21.00 838 x 533 | 3.00 76 | 5 | Large |
| A36H2408SS6LP | 36.00 x 24.00 x 8.00 914 x 610 x 203 | 316L | A36P24 | A36P24G | A36P24SS6 | 33.00 x 21.00 838 x 533 | 3.00 76 | 5 | Large |
| A36H3008SSSLP | 36.00 x 30.00 x 8.00 914 x 762 x 203 | 304 | A36P30 | A36P30G | A36P30SS6 | 33.00 x 27.00 838 x 686 | 3.00 76 | 7 | Large |
| A36H3008SS6LP | 36.00 x 30.00 x 8.00 914 x 762 x 203 | 316L | A36P30 | A36P30G | A36P30SS6 | 33.00 x 27.00 838 x 686 | 3.00 76 | 7 | Large |
| A42H3608SSSLP | 42.00 x 36.00 x 8.00 1067 x 914 x 203 | 304 | A42P36 | A42P36G | A42P36SS6 | 39.00 x 33.00 991 x 838 | 3.00 76 | 8 | Large |
| A42H3608SS6LP | 42.00 x 36.00 x 8.00 1067 x 914 x 203 | 316L | A42P36 | A42P36G | A42P36SS6 | 39.00 x 33.00 991 x 838 | 3.00 76 | 8 | Large |
| A48H3608SSSLP | 48.00 x 36.00 x 8.00 1219 x 914 x 203 | 304 | A48P36 | A48P36G | A48P36SS6 | 45.00 x 33.00 1143 x 838 | 3.00 76 | 8 | Large |
| A48H3608SS6LP | 48.00 x 36.00 x 8.00 1219 x 914 x 203 | 316L | A48P36 | A48P36G | A48P36SS6 | 45.00 x 33.00 1143 x 838 | 3.00 76 | 8 | Large |
| A20H1610SSSLP | 20.00 x 16.00 x 10.00 508 x 406 x 254 | 304 | A20P16 | A20P16G | A20P16SS6 | 17.00 x 13.00 432 x 330 | 3.00 76 | 4 | Small |
| A20H1610SS6LP | 20.00 x 16.00 x 10.00 508 x 406 x 254 | 316L | A20P16 | A20P16G | A20P16SS6 | 17.00 x 13.00 432 x 330 | 3.00 76 | 4 | Small |
| A24H2010SSSLP | 24.00 x 20.00 x 10.00 610 x 508 x 254 | 304 | A24P20 | A24P20G | A24P20SS6 | 21.00 x 17.00 533 x 432 | 3.00 76 | 5 | Small |
| A24H2010SS6LP | 24.00 x 20.00 x 10.00 610 x 508 x 254 | 316L | A24P20 | A24P20G | A24P20SS6 | 21.00 x 17.00 533 x 432 | 3.00 76 | 5 | Small |
| A30H2410SSSLP | 30.00 x 24.00 x 10.00 762 x 610 x 254 | 304 | A30P24 | A30P24G | A30P24SS6 | 27.00 x 21.00 686 x 533 | 3.00 76 | 5 | Large |
| A30H2410SS6LP | 30.00 x 24.00 x 10.00 762 x 610 x 254 | 316L | A30P24 | A30P24G | A30P24SS6 | 27.00 x 21.00 686 x 533 | 3.00 76 | 5 | Large |
| A36H2410SSSLP | 36.00 x 24.00 x 10.00 914 x 610 x 254 | 304 | A36P24 | A36P24G | A36P24SS6 | 33.00 x 21.00 838 x 533 | 3.00 76 | 5 | Large |
| A36H2410SS6LP | 36.00 x 24.00 x 10.00 914 x 610 x 254 | 316L | A36P24 | A36P24G | A36P24SS6 | 33.00 x 21.00 838 x 533 | 3.00 76 | 5 | Large |
| A36H3010SSSLP | 36.00 x 30.00 x 10.00 914 x 762 x 254 | 304 | A36P30 | A36P30G | A36P30SS6 | 33.00 x 27.00 838 x 686 | 3.00 76 | 7 | Large |



- NOTE:**
1. Removable data pocket included (see table for size). Large data pocket 12.00 x 12.00 (305mm x 305mm); small data pocket 6.00 x 6.00 (152mm x 152mm).
 2. Maximum spacing between door clamps is 15.00 (382mm)

Assembled Molded Case Circuit Breakers — 125 A, G-Frame



Interrupting Rating/Breaking Capacity — Thermal-Magnetic Circuit Breakers

| Interrupting Rating (50/60 Hz), UL 489/CSA C22.2-5, No. 5-02 [kA] | | | Breaking Capacity (50/60 Hz), IEC 60947-2 I_{cu} [kA]/ I_{cs} % | | | | | | | | Breaking Capacity (DC), IEC 60947-2 | | | | Interrupting Code† |
|---|------|---------------|--|------------------------|---------------|------------------------|---------------|------------------------|---------------|------------------------|--|------------------------|--------------------------------|------------------------|-----------------------|
| 240V | 480V | 600V/ 347V | 220V★ | | 415V | | 440V★ | | 690V | | 250V DC (2- pole in series) | | 500V DC (3- pole in series) | | |
| | | | I_{cu} [kA] | I_{cs} [% I_{cu}] | I_{cu} [kA] | I_{cs} [% I_{cu}] | I_{cu} [kA] | I_{cs} [% I_{cu}] | I_{cu} [kA] | I_{cs} [% I_{cu}] | I_{cu} [kA] | I_{cs} [% I_{cu}] | I_{cu} [kA] | I_{cs} [% I_{cu}] | |
| 50 | 25 | 10 | 65 | 75 | 36 | 100 | 36 | 50 | 6 | 75 | 36 | 100 | 36 | 100 | G2 |
| 65 | 35 | 14 | 85 | 75 | 50 | 75 | 50 | 50 | 8 | 50 | 50 | 100 | 50 | 100 | G3 |
| 100 | 65 | 25 | 100 | 75 | 70 | 50 | 65 | 50 | 10 | 50 | 70 | 75 | 70 | 75 | G6 |

★ These ratings have not been tested for the CCC listing.

† See table below for Cat. No. selection

Thermal-Magnetic, Fixed Thermal-Fixed Magnetic

| Rated Current I_n [A] | Thermal Trip [A] $I_r = I_n$ (Fixed) | Magnetic Trip [A] I_m | Interrupting Code G2 | | Interrupting Code G3 | | Interrupting Code G6 | |
|-------------------------------|--|-------------------------------|----------------------|---------------|----------------------|---------------|----------------------|---------------|
| | | | Cat. No. | | Cat. No. | | Cat. No. | |
| | | | 3 Poles | 4 Poles | 3 Poles | 4 Poles | 3 Poles | 4 Poles |
| 15 | 15 | 500 | 140G-G2C3-C15 | 140G-G2C4-C15 | 140G-G3C3-C15 | 140G-G3C4-C15 | 140G-G6C3-C15 | 140G-G6C4-C15 |
| 16 | 16 | 500 | 140G-G2C3-C16 | 140G-G2C4-C16 | 140G-G3C3-C16 | 140G-G3C4-C16 | 140G-G6C3-C16 | 140G-G6C4-C16 |
| 20 | 20 | 500 | 140G-G2C3-C20 | 140G-G2C4-C20 | 140G-G3C3-C20 | 140G-G3C4-C20 | 140G-G6C3-C20 | 140G-G6C4-C20 |
| 25 | 25 | 500 | 140G-G2C3-C25 | 140G-G2C4-C25 | 140G-G3C3-C25 | 140G-G3C4-C25 | 140G-G6C3-C25 | 140G-G6C4-C25 |
| 30 | 30 | 500 | 140G-G2C3-C30 | 140G-G2C4-C30 | 140G-G3C3-C30 | 140G-G3C4-C30 | 140G-G6C3-C30 | 140G-G6C4-C30 |
| 32 | 32 | 500 | 140G-G2C3-C32 | 140G-G2C4-C32 | 140G-G3C3-C32 | 140G-G3C4-C32 | 140G-G6C3-C32 | 140G-G6C4-C32 |
| 35 | 35 | 500 | 140G-G2C3-C35 | 140G-G2C4-C35 | 140G-G3C3-C35 | 140G-G3C4-C35 | 140G-G6C3-C35 | 140G-G6C4-C35 |
| 40 | 40 | 500 | 140G-G2C3-C40 | 140G-G2C4-C40 | 140G-G3C3-C40 | 140G-G3C4-C40 | 140G-G6C3-C40 | 140G-G6C4-C40 |
| 45 | 45 | 500 | 140G-G2C3-C45 | 140G-G2C4-C45 | 140G-G3C3-C45 | 140G-G3C4-C45 | 140G-G6C3-C45 | 140G-G6C4-C45 |
| 50 | 50 | 500 | 140G-G2C3-C50 | 140G-G2C4-C50 | 140G-G3C3-C50 | 140G-G3C4-C50 | 140G-G6C3-C50 | 140G-G6C4-C50 |
| 60 | 60 | 600 | 140G-G2C3-C60 | 140G-G2C4-C60 | 140G-G3C3-C60 | 140G-G3C4-C60 | 140G-G6C3-C60 | 140G-G6C4-C60 |
| 63 | 63 | 630 | 140G-G2C3-C63 | 140G-G2C4-C63 | 140G-G3C3-C63 | 140G-G3C4-C63 | 140G-G6C3-C63 | 140G-G6C4-C63 |
| 70 | 70 | 700 | 140G-G2C3-C70 | 140G-G2C4-C70 | 140G-G3C3-C70 | 140G-G3C4-C70 | 140G-G6C3-C70 | 140G-G6C4-C70 |
| 80 | 80 | 800 | 140G-G2C3-C80 | 140G-G2C4-C80 | 140G-G3C3-C80 | 140G-G3C4-C80 | 140G-G6C3-C80 | 140G-G6C4-C80 |
| 90 | 90 | 900 | 140G-G2C3-C90 | 140G-G2C4-C90 | 140G-G3C3-C90 | 140G-G3C4-C90 | 140G-G6C3-C90 | 140G-G6C4-C90 |
| 100 | 100 | 1000 | 140G-G2C3-D10 | 140G-G2C4-D10 | 140G-G3C3-D10 | 140G-G3C4-D10 | 140G-G6C3-D10 | 140G-G6C4-D10 |
| 110 | 110 | 1100 | 140G-G2C3-D11 | 140G-G2C4-D11 | 140G-G3C3-D11 | 140G-G3C4-D11 | 140G-G6C3-D11 | 140G-G6C4-D11 |
| 125 | 125 | 1250 | 140G-G2C3-D12 | 140G-G2C4-D12 | 140G-G3C3-D12 | 140G-G3C4-D12 | 140G-G6C3-D12 | 140G-G6C4-D12 |
| 160★ | ‡ | 1600 | 140G-G2E3-D16 | 140G-G2E4-D16 | 140G-G3E3-D16 | 140G-G3E4-D16 | 140G-G6E3-D16 | 140G-G6E4-D16 |

★ IEC only.

‡ Adjustable thermal trip. 112 A min., 136 A med., 160 A max.

Molded Case Switch — UL489§

| Rated Current I_n [A] | Magnetic Trip [A] I_m | Cat. No. | |
|-------------------------------|-------------------------------|---------------|---------------|
| | | 3 Poles | 4 Poles |
| 125 | 1250 | 140G-G6S3-D12 | 140G-G6S4-D12 |

§ Does not provide overcurrent protection; may open above 1250 A.



Cat. No. 140G-G6C3-D12

significantly less expensive. With the introduction of this internal handle, customers can now comply with the NFPA 79 requirement and use the less-expensive, non-flanged enclosure with circuit breakers.

Applications Where NFPA 79 Compliance is Required as an Upgrade

From an installation perspective, the internal handle replaces the existing operating shaft. Externally, the same 140G handle is used. In the case of an existing 140G installation, installing the kit can be as simple as removing the existing operating shaft, measuring it, and then cutting the new internal operating handle shaft to the same length. It is then installed in place of the existing operating shaft.


Easy to Use, No-Tools-Required Internal Handle Operation

When the door is open, the kit provides an internal handle with a positive grip, allowing users to operate the breaker. If the enclosure were opened using the defeater on the external handle with the circuit breaker on, the user could then turn the breaker off using the internal handle, rather than using a tool to rotate the operating shaft.

Compliance with “Deliberate Action Required”

Finally, the handle complies with the NFPA 79 requirement to: “Prevent closing of the disconnecting means while the enclosure door is open, unless an interlock is operated by deliberate action.” The internal handle must be pulled out before it can be turned, otherwise the handle itself will just ratchet on the shaft.

Rotary Variable Depth Operators

| | Description | Frame Size | Handle Color | Shaft Length | Cat. No. |
|---|---|-----------------|---------------|-----------------|---------------|
|  | <ul style="list-style-type: none"> Supplied with external handle, operating shaft, and MCCB mounted operating mechanism. See page 90 to select as components. Frames G, H, I, and J use a Bul. 140U P-style handle. Frames K, M, and N use a Bul. 140U medium style handle. | G, I | Black | 12 in. (305 mm) | 140G-G-RVM12B |
| | | | Red/Yellow | | 140G-G-RVM12R |
| | | | Black | 21 in. (533 mm) | 140G-G-RVM21B |
| | | | Red/yellow | | 140G-G-RVM21R |
| | | H, J | Black | 12 in. (305 mm) | 140G-H-RVM12B |
| | | | Red/yellow | | 140G-H-RVM12R |
| | | | Black | 21 in. (533 mm) | 140G-H-RVM21B |
| | | | Red/yellow | | 140G-H-RVM21R |
| K | Black | 12 in. (305 mm) | 140G-K-RVM12B | | |
| | Red/yellow | | 140G-K-RVM12R | | |
| | Black | 22 in. (559 mm) | 140G-K-RVM21B | | |
| | Red/yellow | | 140G-K-RVM21R | | |
| M | Black | 12 in. (305 mm) | 140G-M-RVM12B | | |
| | Red/yellow | | 140G-M-RVM12R | | |
| | Black | 22 in. (559 mm) | 140G-M-RVM21B | | |
| | Red/yellow | | 140G-M-RVM21R | | |
| N | Black | 12 in. (305 mm) | 140G-N-RVM12B | | |
| | Red/yellow | | 140G-N-RVM12R | | |
| | Black | 22 in. (559 mm) | 140G-N-RVM21B | | |
| | Red/yellow | | 140G-N-RVM21R | | |






IEC Contactor Specifications

Bulletin Numbers 100/104-K, 100/104-C, 100/104S-C, 100/104-E, 100S-E, 100Q-C

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IEC Contactors

| |  |  |  |
|--------------------------|---|--|---|
| Bulletin No. | 100-K/104-K | 100-C/104-C | 100-E/104-E |
| Screw Terminals | ✓ | ✓ | ✓ (9...96 A), Thru-hole (116...2650 A) |
| Spring Terminals | ✓ (5...9 A) | ✓ (9...16 A) | — |
| Max. Current I_e | 12 A | 97 A | 2650 A |
| Current Rating | 5...12 A | 9...97 A | 9...2650 A |
| Features | <ul style="list-style-type: none"> • Mini-contactors • Uniform panel mounting dimensions • Panel mounting or mounting on 35 mm DIN Rail • AC or DC coil control • Made of environmentally friendly materials | <ul style="list-style-type: none"> • Panel mounting or mounting on 35 mm DIN Rail • AC or DC coil control • Reversible coil terminals (line or load side) • Common accessories • Made of environmentally friendly materials | <ul style="list-style-type: none"> • Panel mounting or mounting on 35 mm DIN Rail • E09...E370 AC/DC electronic coil; with optional PLC interface on E116...E370 • E400...E2650 AC/DC with PLC interface • Made of environmentally friendly materials |
| Contacts | <ul style="list-style-type: none"> • 3 power poles with internal N.O. or N.C. auxiliary contact, or 4 power poles. • Optional front-mounted 2- or 4-pole external auxiliary contact block. | <ul style="list-style-type: none"> • 3 power poles with internal N.O. or N.C. auxiliary contact or 4 power poles (9...23 A). • Optional front- or side-mounted 1-, 2- or 4-pole external auxiliary contact block. | <ul style="list-style-type: none"> • 3 main poles with 2 auxiliary contacts (1 N.O. and 1 N.C.) on E116...E2650 • Optional side- or front-mounted external auxiliary contact block. |
| Coil Voltages | AC = 24...600V, 50/60Hz DC = 12...250V | AC = 12...600V, 50/60Hz DC = 9...250V | 20...500V 50/60 Hz/DC |
| Optional Overload Relays | Electronic or bimetallic | Electronic or bimetallic | Electronic |
| Optional Accessories | <ul style="list-style-type: none"> • Front-mount auxiliary contacts • Surge suppressors • Electronic timers • Mechanical interlocks | <ul style="list-style-type: none"> • Front or side-mount auxiliary contacts • Surge suppressors • Electronic or pneumatic timers • Mechanical interlocks • Mechanical latches | <ul style="list-style-type: none"> • Side- or front-mount auxiliary contacts • Mechanical interlocks • Terminal lugs • Terminal shields • Connecting bars |
| Standards/Certifications | <ul style="list-style-type: none"> • UL • CSA • IEC • CE Marked • CCC | <ul style="list-style-type: none"> • UL • CSA • IEC • CE Marked • CCC | <ul style="list-style-type: none"> • EN/IEC • CE Marked • cULus • CCC • EAC • C-tick • KC |

Product Selection—100-C/104-C Contactors

- Compact sizes from 4...55 kW/5...75 Hp (9...97 A)
- Common accessories for all contactor sizes
- Front and side mounting of auxiliary contacts
- Electronic and pneumatic timing modules
- Space-saving coil-mounted control modules
- Reversible coil terminations (line or load side)
- All devices can be attached to 35 mm DIN mounting Rail
- Environmentally friendly materials



100-C Contactor



104-C Reversing Contactor

The Bulletin 100-C/104-C IEC contactor family, along with a wide range of common accessories and Bulletin 193 solid-state overload relays, provides the most compact and flexible starter component system available.

3-Pole AC- and DC-operated Contactors

| Rated Operational Current I_e [A] | | Ratings for switching AC motors - AC-2, AC-3, AC-4 | | | | | | | | | | Auxiliary Contacts | | Cat. No. (1) |
|-------------------------------------|------|--|---------|------|----------|------------|-------|---------|-------|---------|-------|--------------------|------|--------------|
| | | 3-phase kW (50 Hz) | | | | Hp (60 Hz) | | | | | | N.O. | N.C. | |
| | | 40 °C (104 °F) | | 230V | 400/415V | 500V | 690V | 1-Phase | | 3-Phase | | | | |
| AC-3 | AC-1 | 115V | 230V | | | | | 200V | 230V | 460V | 575V | | | |
| 9 | 32 | 3 | 4 | 4 | 4 | 1/2 | 1-1/2 | 2 | 2 | 5 | 7-1/2 | 1 | 0 | 100-C09⊗10 |
| 12 | 32 | 4 | 5.5 | 5.5 | 5.5 | 1/2 | 2 | 3 | 3 | 7-1/2 | 10 | 0 | 1 | 100-C09⊗01 |
| 16 | 32 | 5.5 | 7.5 | 7.5 | 7.5 | 1 | 3 | 5 | 5 | 10 | 15 | 1 | 0 | 100-C12⊗10 |
| 23 | 32 | 7.5 | 11 | 13 | 10 | 2 | 3 | 5 | 7-1/2 | 15 | 15 | 0 | 1 | 100-C12⊗01 |
| 30 | 65 | 10 | 15 | 15 | 15 | 2 | 5 | 7-1/2 | 10 | 20 | 25 | 1 | 0 | 100-C16⊗10 |
| 37 | 65 | 11 | 18.5/20 | 20 | 18.5 | 3 | 5 | 10 | 10 | 25 | 30 | 0 | 1 | 100-C16⊗01 |
| 43 | 85 | 13 | 22 | 25 | 22 | 3 | 7-1/2 | 10 | 15 | 30 | 30 | 1 | 0 | 100-C23⊗10 |
| 55 | 85 | 15 | 30 | 30 | 30 | 5 | 10 | 15 | 20 | 40 | 40 | 0 | 1 | 100-C23⊗01 |
| 60 | 100 | 18.5 | 32 | 37 | 32 | 5 | 10 | 15 | 20 | 40 | 50 | 0 | 0 | 100-C30⊗00 |
| 72 | 100 | 22 | 40 | 45 | 40 | 5 | 15 | 20 | 25 | 50 | 60 | 1 | 0 | 100-C30⊗10 |
| 85 | 100 | 25 | 45 | 55 | 45 | 7-1/2 | 15 | 25 | 30 | 60 | 60 | 0 | 1 | 100-C30⊗01 |
| 97 | 130 | 30 | 55 | 55 | 55 | 10 | 20 | 30 | 30 | 75 | 75 | 0 | 0 | 100-C37⊗00 |
| | | | | | | | | | | | | 1 | 0 | 100-C37⊗10 |
| | | | | | | | | | | | | 0 | 1 | 100-C37⊗01 |
| | | | | | | | | | | | | 0 | 0 | 100-C43⊗00 |
| | | | | | | | | | | | | 1 | 0 | 100-C43⊗10 |
| | | | | | | | | | | | | 0 | 1 | 100-C43⊗01 |
| | | | | | | | | | | | | 0 | 0 | 100-C55⊗00 |
| | | | | | | | | | | | | 1 | 0 | 100-C55⊗10 |
| | | | | | | | | | | | | 0 | 1 | 100-C55⊗01 |
| | | | | | | | | | | | | 0 | 0 | 100-C60⊗00 |
| | | | | | | | | | | | | 1 | 0 | 100-C60⊗10 |
| | | | | | | | | | | | | 0 | 1 | 100-C60⊗01 |
| | | | | | | | | | | | | 0 | 0 | 100-C72⊗00 |
| | | | | | | | | | | | | 1 | 0 | 100-C72⊗10 |
| | | | | | | | | | | | | 0 | 1 | 100-C72⊗01 |
| | | | | | | | | | | | | 0 | 0 | 100-C85⊗00 |
| | | | | | | | | | | | | 1 | 0 | 100-C85⊗10 |
| | | | | | | | | | | | | 0 | 1 | 100-C85⊗01 |
| | | | | | | | | | | | | 0 | 0 | 100-C97⊗00 |
| | | | | | | | | | | | | 1 | 0 | 100-C97⊗10 |
| | | | | | | | | | | | | 0 | 1 | 100-C97⊗01 |

(1) For screwless terminals on 100-C09...C16, add an "R" after the letter "C" in the catalog number. Example: Cat. No. 100-C09⊗10 becomes 100-CR09⊗10. The AC-1 rating for the 100-CR is limited to 25 A.

⊗ Coil voltage code and terminal position—see [page 19](#)

Coil Voltage Codes

The Cat. No. as listed is incomplete. Select a coil voltage code from the table below to complete the Cat. No. Example: 120V, 60 Hz: Cat. No. 100-C09⊗10 becomes Cat. No.100-C09D10.

| AC Voltages [V] | 12 | 24 | 32 | 36 | 42 | 48 | 100 | 100... 110 | 110 | 120 | 127 | 200 | 200... 220 | 208 | 208... 240 |
|-----------------|----|----|----|----|----|----|-----|---------------|-----|-----|-----|-----|-------------------|-----|---------------|
| 50 Hz | R | K | V | W | X | Y | KP | — | D | P | S | KG | L | — | — |
| 60 Hz | Q | J | — | V | — | X | — | KP | — | D | — | — | KG | H | L |
| 50/60 Hz | — | KJ | — | — | — | KY | KP | — | KD | — | — | KG | KL ⁽¹⁾ | — | — |

(1) Not available on 100/104-C90 or -C97 contactors.

| AC Voltages [V] | 220... 230 | 230 | 230... 240 | 240 | 277 | 347 | 380 | 380... 400 | 400 | 400... 415 | 440 | 480 | 500 | 550 | 600 |
|-----------------|-------------------|-----|---------------|-----|-----|-----|-----|---------------|-----|---------------|-----|-----|-----|-----|-----|
| 50 Hz | F | — | VA | T | — | — | — | N | — | G | B | — | M | C | — |
| 60 Hz | — | — | — | A | T | I | E | — | — | — | N | B | — | — | C |
| 50/60 Hz | KL ⁽¹⁾ | KF | — | KA | — | — | — | — | KN | — | KB | — | — | — | — |

(1) Not available on 100/104-C90 or -C97 contactors.

| DC Voltages [V] | | 9 | 12 | 24 | 24 | 36 | 36...48 | 48 | 48...72 | 60 | 64 |
|-----------------|-------------------------------------|----|----|----|-------------------|----|---------|----|---------|----|----|
| 100-C09...C55 | Electronic with Integrated Diode | — | EQ | EJ | QJ ⁽¹⁾ | — | EW | — | EY | — | — |
| 100-C60...C97 | with Integrated Diode | DR | DQ | DJ | — | DW | — | DY | — | DZ | DB |

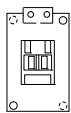
(1) "QJ" coil has faster dropout time (16...21 ms).

| DC Voltages [V] | | 72 | 80 | 110 | 110...125 | 115 | 125 | 220 | 220...250 | 230 | 250 |
|-----------------|-------------------------------------|----|----|-----|-----------|-----|-----|-----|-----------|-----|-----|
| 100-C09...C55 | Electronic with Integrated Diode | — | — | — | ED | — | — | — | EA | — | — |
| 100-C60...C97 | with Integrated Diode | DG | DE | DD | — | DP | DS | DA | — | DF | DT |

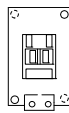
Coil Terminal Position

All contactors are delivered with the coil terminals located on the line side.

For load side coil terminations, insert a "U" prior to the coil voltage code. Ordering example: Cat. No. 100-C09UD10.



Cat. No.100-C09⊗10 Line Side



Cat. No.100-C09U⊗10 Load Side

Device Combinations in Accordance with IEC 60947-1 / -4-1

| Auxiliary Contact Blocks | | 100-C Contactors (AC and DC Control) | | | | | | | |
|--------------------------------|---------|--|--|--|--|--|--|----------------|--|
| Circuit Diagram | Control | 100-C09_⊗10 100-C12_⊗10 100-C16_⊗10 100-C23_⊗10 | 100-C09_⊗01 100-C12_⊗01 100-C16_⊗01 100-C23_⊗01 | 100-C30_⊗00 100-C37_⊗00 100-C43_⊗00 100-C55_⊗00 100-C60_⊗00 100-C72_⊗00 100-C85_⊗00 100-C97_⊗00 | 100-C09_⊗400 100-C12_⊗400 100-C16_⊗400 100-C23_⊗400 100-C40_⊗400 100-C90_⊗400 | 100-C09_⊗300 100-C12_⊗300 100-C16_⊗300 100-C23_⊗300 | 100-C09_⊗200 100-C12_⊗200 100-C16_⊗200 100-C23_⊗200 100-C40_⊗200 100-C90_⊗200 | | |
| | | | | | | | | | |
| Front Mounting (1) | | | | | | | | | |
| 100-FA02, 100-FAB02 | | AC/DC | 10 + 02 = 12 | 01 + 02 = 03 | 00 + 02 = 02 | 00 + 02 = 02 | 00 + 02 = 02 | 00 + 02 = 02 | |
| 100-FA11, 100-FAB11 | | AC/DC | 10 + 11 = 21 | 01 + 11 = 12 | 00 + 11 = 11 | 00 + 11 = 11 | 00 + 11 = 11 | 00 + 11 = 11 | |
| 100-FB11, 100-FBB11 | | AC/DC | — | — | 00 + 11 = 11 | 00 + 11 = 11 | 00 + 11 = 11 | 00 + 11 = 11 | |
| 100-FC11, 100-FCB11 | | AC/DC | 10 + 11 = 21 | — | — | — | — | — | |
| 100-FA20, 100-FAB20 | | AC/DC | 10 + 20 = 30 | 01 + 20 = 21 | 00 + 20 = 20 | 00 + 20 = 20 | 00 + 20 = 20 | 00 + 20 = 20 | |
| 100-FBL11 (2) | | AC/DC | — | — | 00 + L11 = L11 | 00 + L11 = L11 | 00 + L11 = L11 | 00 + L11 = L11 | |
| 100-FA22, 100-FAB22 | | AC/DC | 10 + 22 = 32 | 01 + 22 = 23 | 00 + 22 = 22 | 00 + 22 = 22 | 00 + 22 = 22 | 00 + 22 = 22 | |
| 100-FB22, 100-FBB22 | | AC/DC | — | — | 00 + 22 = 22 | 00 + 22 = 22 | 00 + 22 = 22 | 00 + 22 = 22 | |
| 100-FC22, 100-FCB22 | | AC/DC | 10 + 22 = 32 | — | — | — | — | — | |
| 100-FA31, 100-FAB31 | | AC/DC | 10 + 31 = 41 | 01 + 31 = 32 | 00 + 31 = 31 | 00 + 31 = 31 | 00 + 31 = 31 | 00 + 31 = 31 | |
| 100-FA40, 100-FAB40 | | AC/DC | 10 + 40 = 50 | 01 + 40 = 41 | 00 + 40 = 40 | 00 + 40 = 40 | 00 + 40 = 40 | 00 + 40 = 40 | |
| 100-FAL22 (2) | | AC/DC | 10 + L22 = L32 | 01 + L22 = L23 | 00 + L22 = L22 | 00 + L22 = L22 | 00 + L22 = L22 | 00 + L22 = L22 | |
| 100-FA04, 100-FAB04 | | AC/DC | 10 + 04 = 14 | 01 + 04 = 05 | 00 + 04 = 04 | 00 + 04 = 04 | 00 + 04 = 04 | 00 + 04 = 04 | |
| 100-FA13, 100-FAB13 | | AC/DC | 10 + 13 = 23 | 01 + 13 = 14 | 00 + 13 = 13 | 00 + 13 = 13 | 00 + 13 = 13 | 00 + 13 = 13 | |
| 100-FB02, 100-FBB02 | | AC/DC | 10 + 02 = 12 | 01 + 02 = 03 | 00 + 02 = 02 | 00 + 02 = 02 | 00 + 02 = 02 | 00 + 02 = 02 | |
| 100-FB20, 100-FBB20 | | AC/DC | 10 + 20 = 30 | 01 + 20 = 21 | 00 + 20 = 20 | 00 + 20 = 20 | 00 + 20 = 20 | 00 + 20 = 20 | |
| 100-FC31, 100-FCB31 | | AC/DC | 10 + 31 = 41 | 01 + 31 = 32 | 00 + 31 = 31 | 00 + 31 = 31 | 00 + 31 = 31 | 00 + 31 = 31 | |

(1) Up to 8 auxiliary contacts possible: contactor + front mounted (AC max. 4 N.C. / DC max. 4 N.C.), side mounted (AC max. 2 N.O. / DC max. 2 N.O. and max. 2 N.C.).
 (2) Early make and/or late break.

Bimetallic Overload Relay Specifications

Bulletin Number 193-K, 193-T1

| Topic | Page |
|---|------|
| Product Overview | 2 |
| Standards compliance and Certifications | 2 |
| General Specifications—193-K | 3 |
| Approximate Dimensions—193-K | 5 |
| General Specifications—193-T1 | 6 |
| Approximate Dimensions—193-T1 | 11 |

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

| Resource | Description |
|---|---|
| Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1 | Provides general guidelines for installing a Rockwell Automation industrial system. |
| Product Certifications website, http://www.ab.com | Provides declarations of conformity, certificates, and other certification details. |

You can view or download publications at <http://www.rockwellautomation.com/literature/>. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.



| Bulletin | 193-K | 193-T1 |
|---|---------------------------|----------------------|
| Type | Bimetallic Overload Relay | |
| Rated Current (Range) | 0.1...12.5 A | 0.1...90 A |
| Operating Voltage, Nominal | 600V | |
| Overload Type | Bimetallic | |
| Trip Class (Fixed) | 10 | 10 |
| Ambient Temperature Compensated | ✓ | ✓ |
| Reset Type | Automatic and Manual | Automatic and Manual |
| Adjustment Range | 1.5:1 | 1.5:1 |
| Phase Loss | Normal Sensing | Normal Sensing |
| N.C. Trip Contact | ✓ | ✓ |
| N.O. Alarm Contact | ✓ | ✓ |
| Variable Frequency Drive (VFD) Compatible | ✓ | ✓ |

Standards Compliance—193-K

IEC/EN 60947-1,-4-1,-5-1
 UL 508
 CSA 22.2. No. 14

Certifications—193-K

CE Marked
 cULus Listed (File No. E33916, Guide NKCR, NKCR7)

Standards Compliance—193-T1

IEC/EN 60947-1, -4-1, -5-1
 UL508
 CSA C22.2 No.14

Certifications—193-T1

cULus (File No. E33916, Guide NKCR, NKCR7),
 CE marked

Thermal Overload Relays









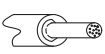
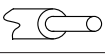

Main Circuits

| Cat. No. | | | 193-T1... |
|--|------------------|-------------|--------------------|
| Rated isolation voltage U_i | | | 690V AC |
| Rated impulse withstand voltage U_{imp} (between main poles and between main poles and auxiliary circuits) | | | 6kV AC |
| Rated impulse withstand voltage U_{imp} (between auxiliary circuits) | | | 4kV AC |
| Rated operating voltage U_e | IEC | | 690V AC 440V DC |
| | UL, CSA | | 600V AC |
| Rated frequencies | | | 50/60 |
| Operational frequencies | | | DC...400 Hz |
| Power dissipation | 193-T1A, 193-T1B | up to 0.4 A | 7 W |
| | | 0.5...36 A | 6 W |
| | | 38 A | 12 W |
| | 193-T1C | 25...47 A | 12 W |
| | 193-T1D | 47...90 A | 18 W |

Control Circuits

| Cat. No. | | | | 193-T1... |
|--|------|------------|-----|-----------|
| Rated operating current I_e | | | | |
| AC-15 | 24V | [A] | | 4 |
| | 240V | [A] | | 2 |
| | 400V | [A] | | 1.6 |
| | 690V | [A] | | 0.15 |
| DC-13 | 24V | [A] | | 2 |
| | 110V | [A] | | 0.4 |
| | 220V | [A] | | 0.25 |
| | 440V | [A] | | 0.08 |
| Thermal Current I_{th} | | | | 5 |
| Short-circuit withstand, Fuse | | IEC, gL/gG | [A] | 6 |
| Short-circuit withstand, circuit breaker ≤ 1 kA prospective short-circuit-current | | | [A] | 4 |
| Min. contact load for reliable operation | | | | 15V, 2 mA |
| UL Rating | | | | A600/Q300 |

Terminations

| Cat. Nos. | Main Circuits | | | | | | Control Circuits | Remote Reset | |
|--|---|----------------------------|---|-----------------|-----------------|----------------|---|---|-----------|
| | 193-T1A... | 193-T1BC20... T1BC25 | 193-T1BC30... T1BC38 | 193-T1C... | 193-T1D... | 193-T1APM | 193-T1... all | 193-T1R... | |
| Wiring cross section |  | |  | | | |  |  | |
| Terminal type |  | |  | | | |  |  | |
| Terminal screws | M4 | M4 | M4 | M5 | M6 | M4 | M3.5 | M3.5 | |
|  Fine stranded with ferrule | 1 conductor [mm ²] 2 conductors [mm ²] | 1.5...4 1.5...4 | 1.5...4 1.5...4 | 2.5...10 - | 2.5...16 - | 10...35 - | 1.5...10 - | 1...2.5 - | |
|  Solid or coarse stranded | 1 conductor [mm ²] 2 conductors [mm ²] | 1.5...6 1.5...6 | 1.5...6 1.5...6 | 2.5...16 - | 2.5...25 - | 10...35 - | 1.5...16 - | 1...2.5 - | |
|  Fine stranded | 1 conductor [AWG] 2 conductors [AWG] | No. 16...10 No. 16...10 | No. 14...10 No. 14...10 | No. 10...6 - | No. 10...6 - | No. 8...1 - | No. 16...6 - | No. 18...12 No. 18...12 | |
| Recommended torque | [N•m] | 1.5 ... 2.2 | 1.5 ... 2.2 | 2.5 ... 3.5 | 2.5 ... 3.5 | 4.5 ... 6 | 1.8...2.8 | 1.2 | 1.2 |
| | [lb•in] | 13 ... 20 | 13 ... 20 | 22 ... 31 | 22 ... 31 | 40 ... 53 | 16...25 | 10.6 | 10.6 |
| Pozidrive screwdriver No. | Size | 2 | 2 | 2 | 2 | - | 2 | 2 | 2 |
| Slotted screwdriver | [mm] | 0.8 x 5.5 | 0.8 x 5.5 | 0.8 x 5.5 | 0.8 x 5.5 | - | 0.8 x 5.5 | 0.8 x 5.5 | 0.8 x 5.5 |
| Hexagon socket screw | Size | - | - | - | - | 4 | - | - | - |

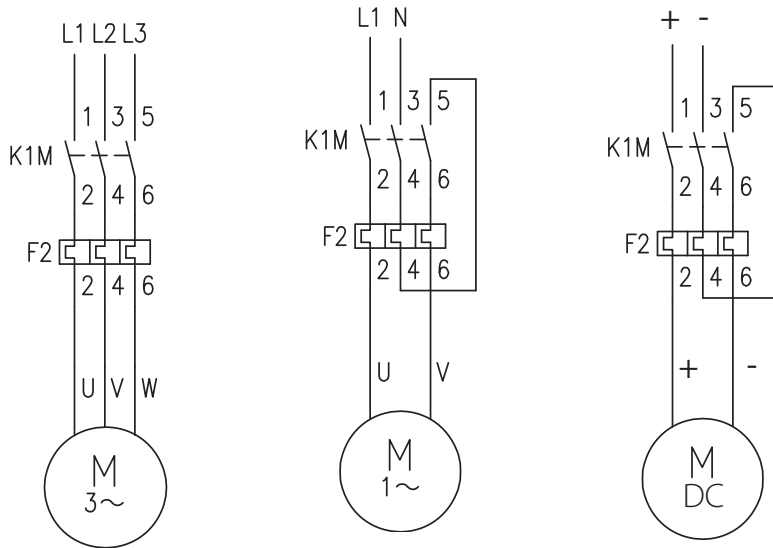
193-T1R Remote Reset

| Operating Limits | | |
|-------------------------|----------------------|--------------------------------|
| Maximum Command Impulse | | 5s |
| AC 50/60 Hz | Pick-up [$x U_s$] | 0.8...1.1 |
| | Drop-out [$x U_s$] | |
| DC | Pick-up [$x U_s$] | 0.7...1.25 |
| | Drop-out [$x U_s$] | |
| Coil Consumption | | |
| AC 50/60 Hz | Pick-up [VA/W] | |
| | Hold-in [VA/W] | |
| DC | Pick-up [W] | 17 (24, 110, 125V) 25 (48V) |
| | Hold-in [W] | 17 (24, 110, 125V) 25 (48V) |

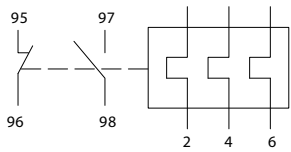
General

| Cat. No. | | 193-T1... | |
|---|--|--------------------------------------|----------|
| Type of Overload Relay | Bimetallic, Ambient Compensated, Phase Loss Sensitive | | |
| Trip Rating (ultimate tripping current) | 120% FLA | | |
| Phase loss sensitivity: Trip rating at phase loss | 115% FLA | | |
| Trip Class | 193-T1A/-T1B | 193-T1C/-T1D | |
| | IEC/EN 60947-4-1 | | |
| | UL | 10A | 10 |
| Reset Mode | Automatic or Manual | | |
| Test release | Manual release of auxiliary contacts | | |
| Trip indication | By means of a flag visible through an opening in the relay front | | |
| Compensation temperature range | -20...+60 °C (-4...+140 °F) | | |
| Climatic Conditions | Release Tolerance at -20 °C | 1.05...1.4 $x I_n$ | |
| | Storage Temperature Range | -55...+80 °C (-67...+176 °F) | |
| | Operating Temperature Range | -20...+60 °C (-4...+140 °F) | |
| | Air moisture (Storage/Operating) | 5...95% rel.humidity, non-condensing | |
| Vibration | (per IEC/EN 60068-2-6), service | 3g | |
| | IEC/EN 61373 (vibration railways) | category 1, class B | |
| Shock | IEC/EN 60092-504 (vibration ships), service | 0.7 g, all axes, 2...200 Hz | |
| | (per IEC/EN 68000-2-27), transport | 30 g | |
| | IEC/EN 60068-2-27 (Shock half-sinus), service | 11 ms > 5 g all axes | |
| | IEC/EN 61373 (shock railways) | category 1, class B, 5g 30 ms | |
| Max. Altitude | 2000 m | | |
| Pollution Degree | 3 | | |
| Degree of Protection, with wires connected | IP2X | | |
| Approximate Weight (unpacked) | 193-T1A, 193-T1B | 0.16...25 A | 0.115 kg |
| | 193-T1B | 30...38 A | 0.155 kg |
| | 193-T1C | 25...47 A | 0.330 kg |
| | 193-T1D | 47...90 A | 0.360 kg |
| | 193-T1...P | 47...90 A | 0.415 kg |
| Standards | IEC/EN 60497-1, -4-1, -5-1, UL508, CSA C22.2 No.14 | | |
| Certifications | CE, cULus | | |

Circuit Diagrams



Wiring Schematic



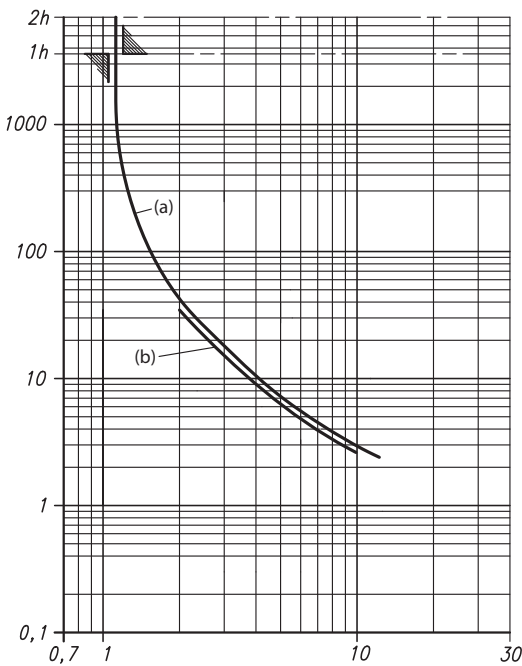
Typical IEC Wiring Schematic

Trip Characteristics

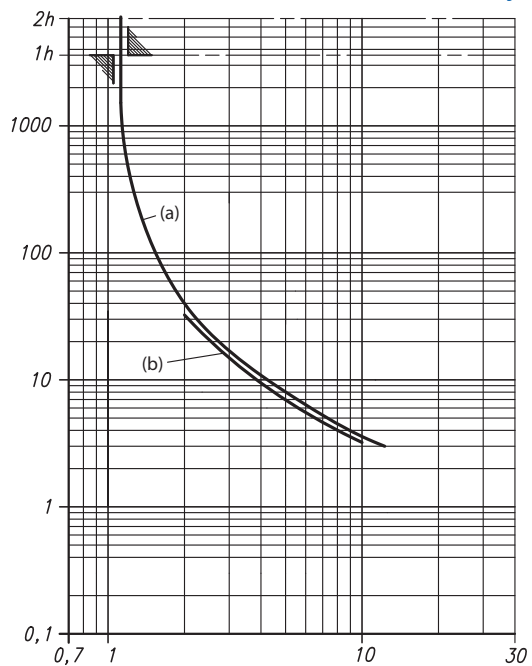
These trip characteristics refer to IEC/EN 60947-4-1 and are average values from cold start at an ambient temperature of 20 °C. Trip time is pictured as a function of operating current. With the device at max. operating temperature, the trip time decreases to approximately 25% of the shown value.

- (a) Tripping characteristics 3-poles from the cold state
- (b) Tripping characteristics 2-poles from the cold state

Cat. Nos. 193-T1AA16...AA40 Overload Relays

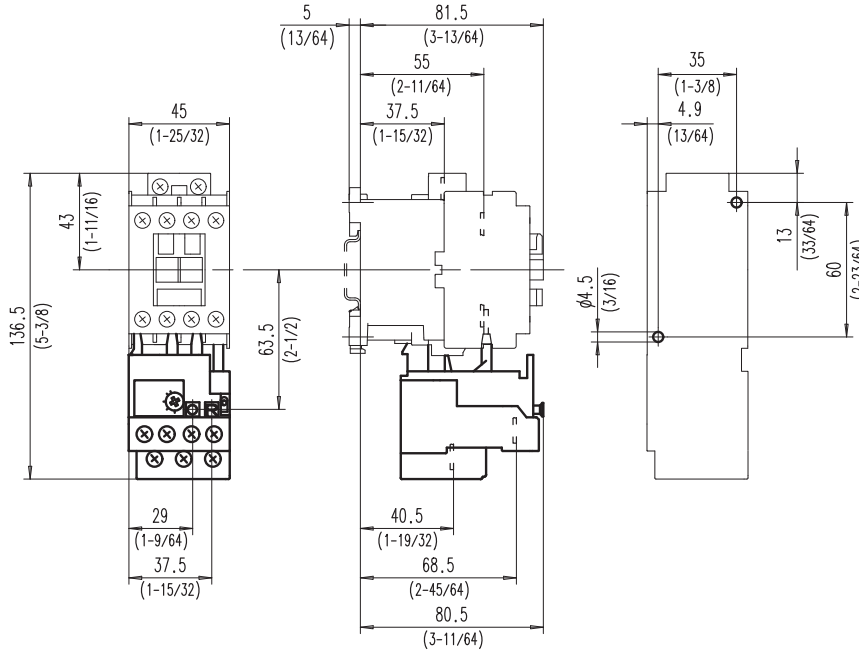


Cat. Nos. 193-T1AA50...AB40 Overload Relays

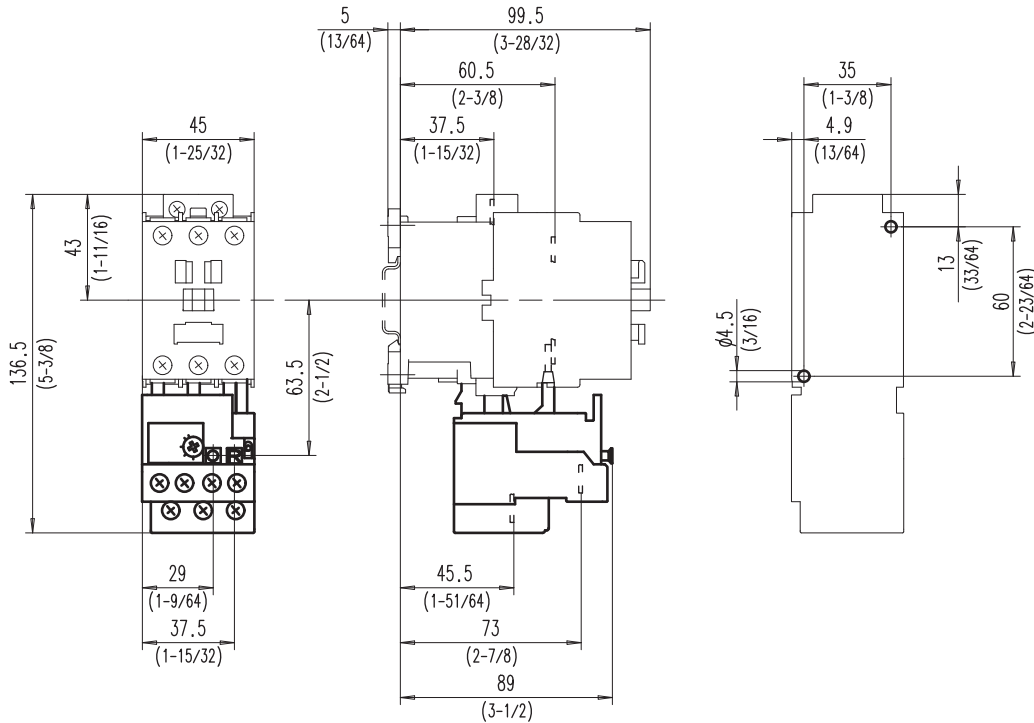


Dimensions are shown in millimeters (inches). Dimensions are not intended for manufacturing purposes.

Cat. Nos. 193-T1AA16...AC25 Overload Relays



Cat. Nos. 193-T1BC20...25 Overload Relays



Low-Peak™ LP-CC Class CC 600 Vac/300 Vdc, 1/2-30 A time-delay fuses



Catalog numbers (amps)

| | | | | |
|--------------|----------------|--------------|-------------|----------|
| LP-CC-1/2 | LP-CC-1-1/2 | LP-CC-3 | LP-CC-6 | LP-CC-12 |
| LP-CC-6/10 | LP-CC-1-6/10 | LP-CC-3-2/10 | LP-CC-6-1/4 | LP-CC-15 |
| LP-CC-8/10 | LP-CC-1-8/10 | LP-CC-3-1/2 | LP-CC-7 | LP-CC-20 |
| LP-CC-1 | LP-CC-2 | LP-CC-4 | LP-CC-7-1/2 | LP-CC-25 |
| LP-CC-1-1/8 | LP-CC-2-1/4 | LP-CC-4-1/2 | LP-CC-8 | LP-CC-30 |
| LP-CC-1-1/4 | LP-CC-2-1/2 | LP-CC-5 | LP-CC-9 | |
| LP-CC-1-4/10 | LP-CC-2-8/10 | LP-CC-5-6/10 | LP-CC-10 | |

Carton quantity:

| Amp rating | Carton qty. |
|------------|-------------|
| 1/2-30 | 10 |

Catalog symbol:

- LP-CC-(amp)

Description:

Bussmann™ series Ultimate protection Low-Peak Class CC current-limiting, time-delay fuses. Time-delay – 12 seconds (minimum) at 200% of rated current.

Specifications:

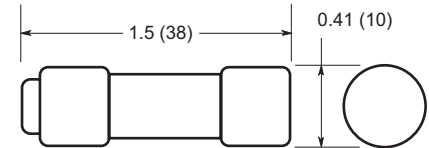
Ratings

- Volts
 - 600 Vac
 - 300 Vdc (1/2 to 2-8/10 A, 20-30 A)
 - 150 Vdc (3-15 A)
- Amps 1/2-30 A
- IR
 - 200 kA Vac RMS Sym.
 - 20 kA Vdc

Agency information

- UL® Listed Class CC, Std. 248-4, Guide JDDZ, File E4273
- CSA® Certified; Class 1422-02, File 53787
- CE
- RoHS compliant

Dimensions - in (mm)



Features:

- 200 kA interrupting rating complies with NEC® Section 110.9 for today's large capacity systems.
- Fast short-circuit protection and dual-element, time-delay performance provide ultimate protection.
- Reduces existing fuse inventory by up to 33% when upgrading to Low-Peak fuses.
- Consistent 2:1 amp rating ratios for all Low-Peak fuses make selective coordination easy.
- Time-delay characteristic avoids unwanted fuse openings from surge currents while fast response speed under fault conditions provides a high degree of current limitation.
- Current-limitation protects downstream components against damaging thermal and magnetic effects of fault currents.
- A superior, all-purpose, space-saving branch circuit fuse that meets most protection requirements up to 30 A.
- Very compact physical size that's only 13/32" x 1-1/2" (10 x 38 mm) with rejection tip.
- Proper sizing can provide "No Damage" Type 2 coordinated protection for NEMA and IEC motor controllers.
- Can be used where either a time-delay or a fast-acting fuse is needed, making selection easier and reducing spare fuse inventories for substantial cost reduction.
- Superior protection for small horsepower motor circuits.

Recommended fuse blocks and holders:

| Fuse amps | 1-pole | 2-pole | 3-pole |
|----------------------------|-----------|-----------|-------------|
| Modular open blocks | | | |
| up to 30 | BCM603-1_ | BCM603-2_ | BCM603-3_ |
| DIN-Rail holders | | | |
| Up to 30 | CHCC1D_ | CHCC2D_ | CHCC3D_ |
| | — | — | OPM-NG_ |
| | — | — | OPM-1038_ |
| | — | — | OPM-1038_SW |
| Panel mount holders | | | |
| Up to 30 | HPS-RR | — | — |
| | HPF-RR | — | — |
| In-line holders | | | |
| Up to 30 | — | HEY | — |
| | HEZ | — | — |

For additional information on Class CC fuse blocks and holders, see data sheets:

- Modular open blocks No. 10241 (BCM)
- DIN-Rail holders No. 10430 (CHCC), No. 1109 (OPM-NG), No. 1102 (OPM-1038), No. 1103 (OPM-1038_SW)
- Panel mount holders No. 2113 (HPS), No. 2114 (HPF)
- In-line holders No. 2126 (HEY), No. 2130 (HEZ)

CH Modular, IP20 finger-safe DIN-Rail holders for Class CC, supplemental and PV fuses



Catalog symbol:

- CHCC_ (Class CC)
- CHM_ (UL® supplemental/IEC 10x38)
- CHPV_ (13/32 x 1-1/2 and 10x38 photovoltaic)

Description:

Eaton's Bussmann™ series CH DIN-Rail fuse holders are for UL Class CC and supplemental fuses, and IEC 10x38 fuses. They are available with and without indication in 1-, 2- and 3-pole IP20 finger-safe versions. A variety of accessories extends their application flexibility and they may be ganged together to meet specific application requirements.

For other Bussmann series CH fuse holders, please see the following data sheets.

| Fuse class | Fuse size | Data sheet No. |
|------------|-------------|----------------|
| Class J | 30 and 60 A | 2144 |
| | 8 x 32 mm | 720147 |
| IEC | 14 x 51 mm | 10080 |
| | 22 x 58 mm | 10015 |

Specifications:

Ratings

- Volts
 - 600 V (or less) UL
 - 690 V (or less) IEC
 - 1000 Vdc (or less) photovoltaic (PV)
- Amps
 - 30 A UL
 - 32 A IEC
- Short-Circuit Current Rating (SCCR)
 - 33 kA photovoltaic
 - 200 kA RMS Sym. (CHCC, CHM*)

* CHM SCCR is fuse interrupting rating dependent.

Agency information

- Class CC version: UL Listed File E14853, Guide IZLT, Recognized IZLT2
- PV version: UL Listed to E348242 and Guide IZMR (CHPV)
- CSA® File 47235, CHPV and CHM - Class 6225-30, CHCC - Class 6225-01
- IEC 60269-2 (CHM, CHPV)
- CCC
- RoHS compliant

Mounting

- 35 mm DIN-Rail

Wire range (see conductor table on page 3 for details)

- 75°C and 90°C Cu
- #18 to #4 (0.8 mm² to 21.1 mm²)
 - Solid
 - Stranded
 - Fine stranded

Terminals

- Single or dual conductors
- Comb busbar
- Terminal screws
 - Standard phil-slot
 - Optional hex head (order by adding "-H" suffix to the catalog number, e.g., CHM1DU-H)

Flammability

- UL 94V0, self-extinguishing

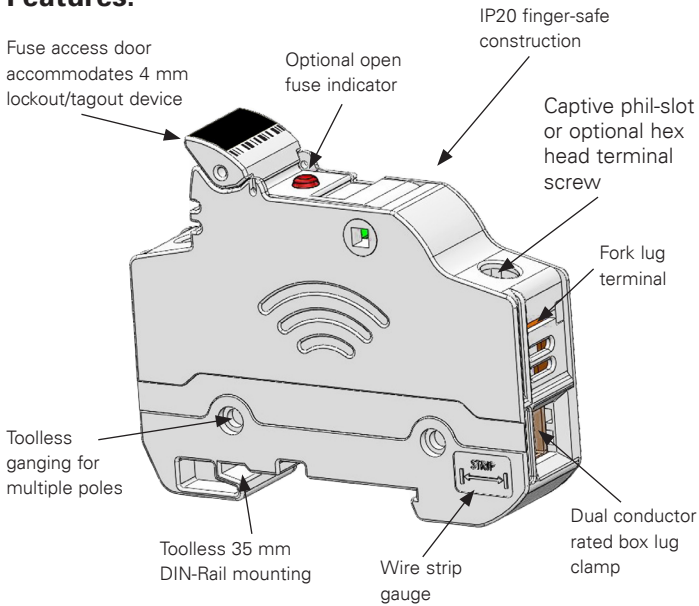
Storage and operating temperature

- -4°F (-20°C) to 194°F (90°C) indicating
- -4°F (-20°C) to 248°F (120°C) non-indicating

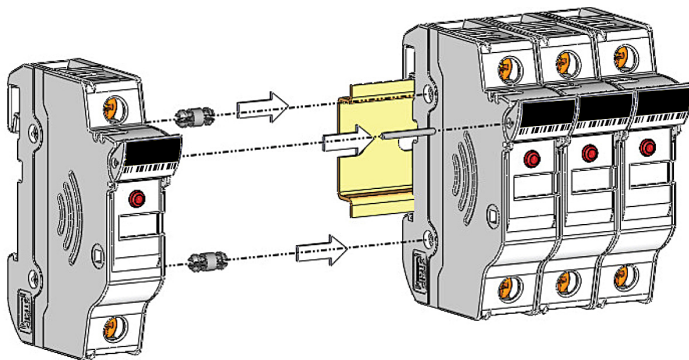
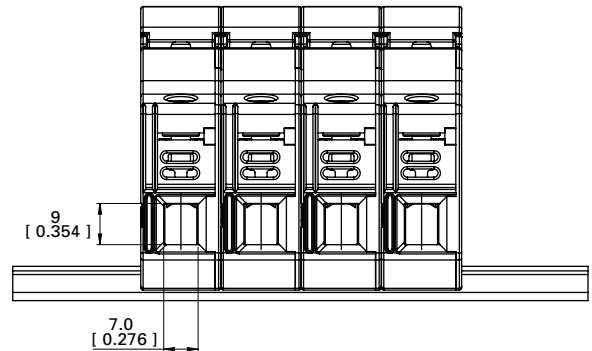
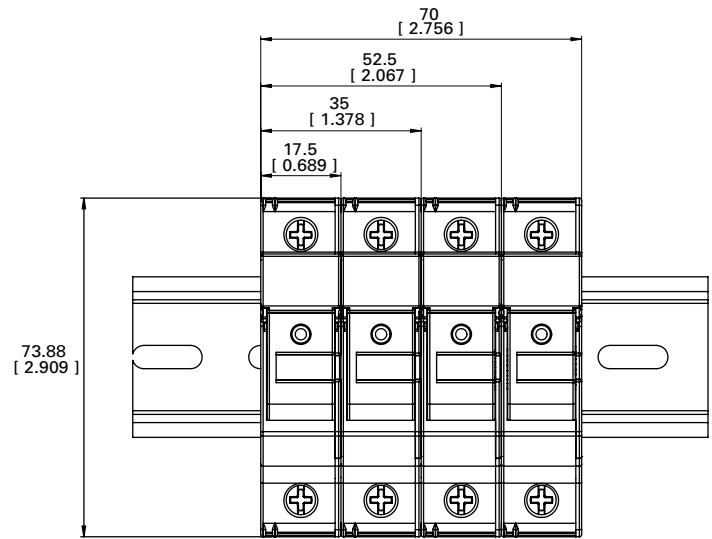
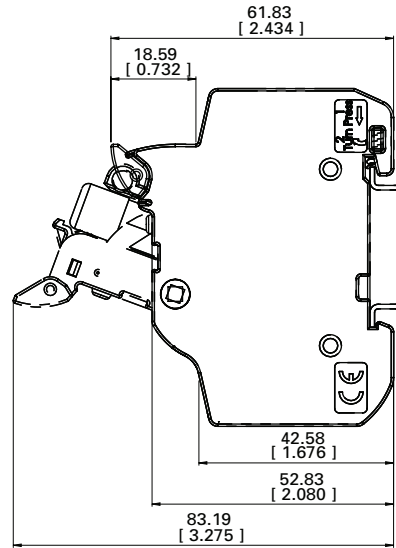
Features and benefits:

- High SCCR rated, UL Listed Class CC holder with optional open fuse indication for 600 Vac/dc and 48 V dc (see catalog number table for details)
- Enhanced safety with IP20 finger-safe construction
- UL Recognized midjet and IEC 10x38 holders with factory assembled neutral pole option
- Agency ratings up to 1000 Vdc for use with PV fuses
- Available remote PLC fuse indication module
- Wiring flexibility with terminals rated for use with 75°C or 90°C solid, stranded and fine stranded wire, and spade terminals and comb busbars. (Use any higher temperature insulations at the 90°C ampacity.)
- Complete range of UL Listed and high SCCR rated one- and three-phase finger-safe comb busbars and power feed lugs
- Optional hex head terminal screw makes it easier to achieve necessary torque values

Features:



Dimensions - mm (in):



Gang multiple poles to meet application requirements using kit catalog number JV-L (gangs up to four poles).

UL midget and IEC 10x38 CHM holder catalog numbers



| Catalog number† | | Volts and amps | | | Agency marks | Poles | SCCR | Recommended Bussmann series fuses |
|------------------|--------------------|-------------------------|-------------|---------------------------|--------------|-------------------------------|---|-----------------------------------|
| With indication* | Without indication | UL | IEC | Agency marks | | | | |
| CHM1DIU | CHM1DU | 600 V/30 A | 690 V/32 A | UR, CSA, IEC 60269-2, CCC | 1 | 200 kA** RMS Sym.†† | BAF, BAN, FNM, FNQ, FWA, FWC, KLM, KTK, AGU, C10G_, C10M_ | |
| CHM2DIU | CHM2DU | | | | 2 | | | |
| CHM3DIU | CHM3DU | | | | 3 | | | |
| CHM4DIU | CHM4DU | | | | 4 | | | |
| CHM1DNIU | CHM1DNU | | | | 1 + neutral | | | |
| CHM3DNIU | CHM3DNU | 3 + neutral | | | | | | |
| CHM1DI-48U | — | 48 Vdc/30 A | 48 Vdc/32 A | UR, CSA, IEC 60269-2, CCC | 1 | | | |
| — | CHM1DNXU | — | 690V/32 A | IEC 60269-2 | | N/A | N/A | |
| CHM1DCIU | CHM1DCU | 600 Vac, 1000 Vdc, 30 A | 690 V, 32 A | UR, CSA, IEC 60269-2 | 1 | 200 kA** RMS Sym., 33 kA DC†† | 600/690V BAF, BAN, FNM, FNQ, FWA, FWC, KLM, KTK, AGU, C10G_, C10M_, 1000Vdc PV-(amp)A10F, PV10M-(amp) | |
| CHM2DCIU | CHM2DCU | | | | 2 | | | |
| CHM3DCIU | CHM3DCU | | | | 3 | | | |
| CHM4DCIU | CHM4DCU | | | | 4 | | | |

† Available with optional hex head terminal screws. To order, add "-H" suffix to the desired catalog number.

†† SCCR is limited to the interrupting rating of the installed fuse or 200 kA, which ever is less.

* All models require 90 V minimum for illumination, except CHM1DI-48U that requires 15 V minimum.

** SCCR is limited to the interrupting rating of the installed fuse or 200 kA, which ever is less.

UL Class CC CHCC holder catalog numbers



| Catalog number† | | Volts / amps | Agency marks | Poles | SCCR | Recommended Bussmann series fuses |
|------------------|--------------------|--------------|--------------|-------|-----------------|-----------------------------------|
| With indication* | Without indication | | | | | |
| CHCC1DIU | CHCC1DU | 600 V/30 A | UL, CSA, CCC | 1 | 200 kA RMS Sym. | LP-CC, FNQ-R, KTK-R |
| CHCC2DIU | CHCC2DU | | | 2 | | |
| CHCC3DIU | CHCC3DU | | | 3 | | |
| CHCC1DI-48U | — | 48 Vdc/30 A | | 1 | 33 kA DC | |

† Available with optional hex head terminal screws. To order, add "-H" suffix to the desired catalog number.

* All models require 90 V minimum for illumination, except CHCC1DI-48U that requires 15 V minimum.

UL and IEC photovoltaic CHPV holder catalog numbers



| Catalog number† | | Volts / amps | Agency marks | Poles | SCCR | Recommended Bussmann series fuses |
|-----------------|--------------------|---------------|---|-------|----------|-----------------------------------|
| With indication | Without indication | | | | | |
| CHPV1IU | CHPV1U | 1000 Vdc/30 A | UL, CSA, , UL 4248-18, IEC 60269-1, CCC | 1 | 33 kA DC | PV-(amp)A10F, PV10M-(amp) |
| CHPV2IU | CHPV2U | | | 2 | | |

† Available with optional hex head terminal screws. To order, add "-H" suffix to the desired catalog number.

* All models require 90 V minimum for illumination.

Conductor information

| AWG wire range | Wire type | Wire rating | Terminal torque N·m (lb·in)* |
|----------------|--------------------------------|-----------------|------------------------------|
| 4-12 | Solid/Stranded/compact/Class K | 75°C or 90°C Cu | 3.4 (30) |
| 14-18 | Solid/Stranded/Class K | | 2.3 (20) |
| (2) 10-12 | Stranded | | 3.4 (30) |
| (2) 14 | Solid/Stranded | | 3.4 (30) |
| (2) 16-18 | | | 2.8 (25) |
| Fork terminals | N/A | | 3.4 (30) |
| Comb busbar | | 3.4 (30) | |

* Use a phil-slot bit designed for high torque, or specify hex head terminal screw option.

HPS Spartan® Industrial Open-Style Control Transformer

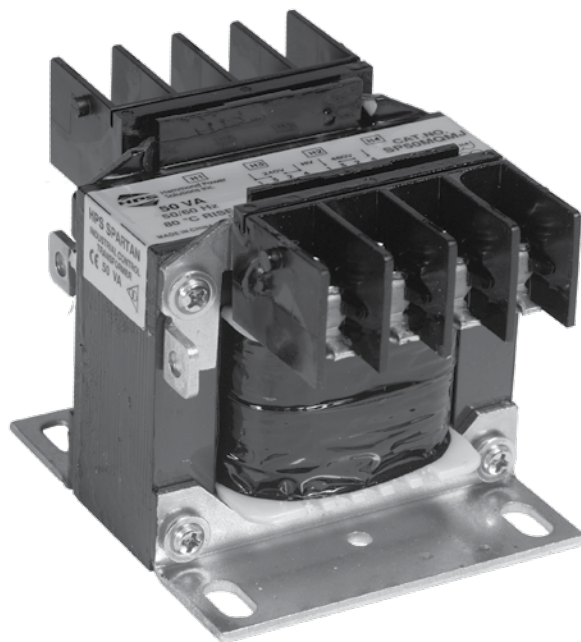
The Economical Solution

The HPS Spartan® line of industrial control transformers are ideally suited for general purpose, industrial and light duty loads. Designed for applications where high inrush or machine tool duty are not necessary, the HPS Spartan industrial open-style control transformer offers an efficient and economical solution. These units are well suited for HVAC applications, signal and alarm systems, motor control circuits, lighting and circuit isolation.

The HPS Spartan control transformer is an open style unit with molded terminal blocks up to 3000 VA or 30 amps. Optional finger guards and a fuse block adapter kit are available upon request.

For an economical approach to control transformers, the HPS Spartan is the transformer of choice.

SECTION 1



STANDARDS

The HPS Spartan Control Transformers meet or exceed the standards established by UL, CSA, IEC and NEMA.

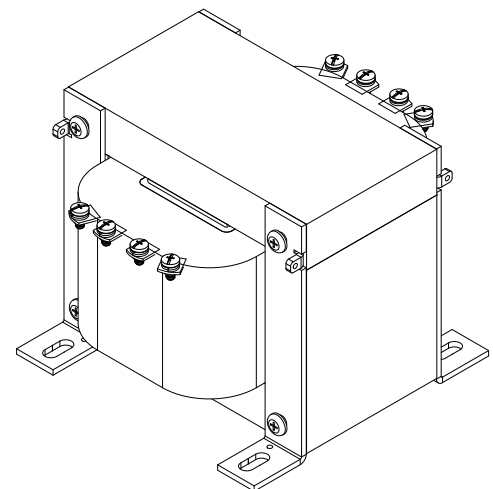
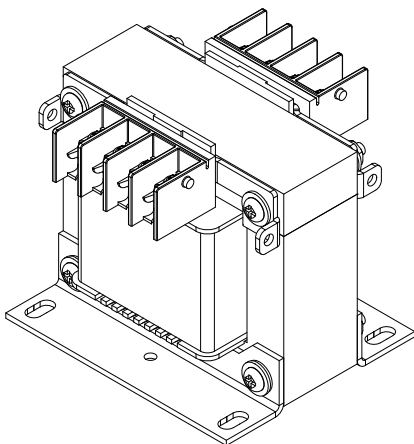
| Standard | File # | VA Size |
|-----------------|--------|---------|
| UL (ANSI/UL506) | E50394 | All |
| CSA | LR3902 | All |
| IEC 61558 | | All |
| NEMA (ST-1) | | All |



Features and Benefits

- Molded terminal blocks for primary and secondary connections¹
- Coil face termination over 3000VA or 30 amps
- Vacuum Impregnated with Polyester Resin and oven cured
- Bolted core construction
- Bolt-on mounting brackets
- All terminal blocks utilize a combination slot/Phillips #6 screw with a SEMS washer (suitable for 18 AWG to 14 AWG for solid wire and 18 AWG to 12 AWG for stranded wire). Coil face terminations utilize a ¼ - 20 UNC X 0.50" combination slot/Phillips screw and a spring lock washer
- All units supplied with primary and secondary voltage links/jumpers
- 50/60 Hz (60 Hz on SP***ACP and SP***AR)
- Copper wound coils with high dielectric strength insulation
- Seismically certified in accordance with IBC 2009; Section 1613 Earthquake Loads, for $S_{DS} \leq 2.00g$, $z/h = 1.0$, and $I_p = 1.5$
- CSA Certified, UL Listed, CE Marked and RoHS compliant
- Meets NEMA standards
- Superior insulating materials. The HPS Spartan series transformers offer the following insulation systems:
Up to 1500 VA: 80°C rise, 130°C temperature class (B)
2000 VA to 5000 VA: 115°C rise, 180°C temperature class (F)
- "Premium Packaging"¹ which feature:
 - Premium fluted cartons
 - Custom molded foam inserts
 - Easy removal and repacking
 - Industry's best box label
- Supplied with trilingual installation and wiring instruction sheets
- 15 year warranty
- Optional finger guards available¹
- Optional fuse block adapter kit available¹

¹ up to and including 3000VA or 30 amps



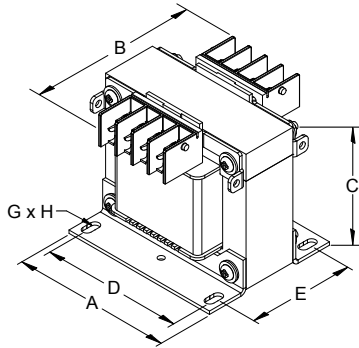


FIGURE A

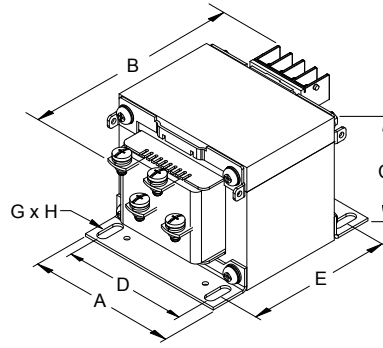


FIGURE B

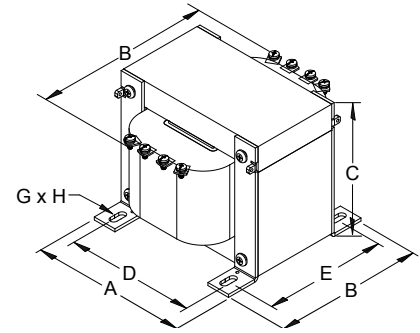


FIGURE C

Group A

Primary Voltage: **600/480** || 575/460 || 550/440
 Secondary Voltage: **120 X 240** || 115 X 230 || 110 X 220



| VA Rating | CE VA Rating | Catalog Number | Mtg. Fig. | Output Amps | Overall Dimensions | | | Mounting Centers | | Mounting Slot G X H | Height with Finger Guard | Height with Fuse Block Adapter | Approx. Ship Weight Lbs. |
|------------|--------------|-----------------|-----------|------------------|--------------------|-------------------|-------------|------------------|-------------|------------------------|--------------------------|--------------------------------|--------------------------|
| | | | | | A | B | C | D | E | | | | |
| 50 | 50 | SP50ACP | A | 0.42/0.21 | 2.60 | 3.82 | 2.60 | 2.13 | 2.64 | 0.22 x 0.44 | 2.98 | 2.79 | 2.2 |
| 100 | 100 | SP100ACP | A | 0.83/0.42 | 2.99 | 3.74 | 2.85 | 2.52 | 2.60 | 0.22 x 0.44 | 3.23 | 3.04 | 3.3 |
| 150 | 150 | SP150ACP | A | 1.25/0.63 | 2.99 | 4.29 | 2.85 | 2.52 | 3.15 | 0.22 x 0.44 | 3.23 | 3.04 | 4.4 |
| 250 | 160 | SP250ACP | A | 2.08/1.04 | 3.78 | 4.09 | 3.40 | 3.31 | 2.99 | 0.22 x 0.44 | 3.78 | 3.59 | 6.4 |
| 350 | 250 | SP350ACP | A | 2.92/1.46 | 3.78 | 4.49 | 3.40 | 3.31 | 3.39 | 0.22 x 0.44 | 3.78 | 3.59 | 7.5 |
| 500 | 300 | SP500ACP | A | 4.17/2.08 | 4.49 | 4.69 | 3.78 | 3.78 | 3.66 | 0.31 x 0.81 | 4.16 | 3.97 | 11 |
| 750 | 500 | SP750ACP | A | 6.25/3.13 | 5.25 | 5.08 ¹ | 4.37 | 4.50 | 4.06 | 0.31 x 0.81 | 4.75 | 4.56 | 18 |
| 1000 | 650 | SP1000ACP | A | 8.33/4.17 | 5.25 | 5.47 ¹ | 4.37 | 4.50 | 4.45 | 0.31 x 0.81 | 4.75 | 4.56 | 21 |
| 1500 | 1000 | SP1500ACP | A | 12.5/6.25 | 5.25 | 6.85 ¹ | 4.37 | 4.50 | 5.83 | 0.31 x 0.81 | 4.56 | 4.37 | 28 |
| 2000 | 1300 | SP2000ACP | A | 16.7/8.33 | 6.38 | 5.87 ¹ | 5.31 | 5.75 | 4.84 | 0.31 x 0.81 | 5.69 | 5.50 | 34 |
| 3000 | 2000 | SP3000ACP | A | 25.0/12.5 | 7.50 | 7.50 | 6.50 | 6.30 | 6.85 | 0.44 x 1.00 | 6.50 | 6.50 | 60 |
| 5000 | 3000 | SP5000ACP | C | 41.7/20.8 | 8.98 | 9.88 | 7.76 | 7.40 | 7.13 | 0.44 x 1.00 | N/A | N/A | 93 |

Primary and Secondary voltage links/jumpers supplied standard with all transformers.
 Refer to page 73 for wiring schematic drawing. Custom voltages and VA sizes available upon request.
¹ Note: For 750 through 2000 VA units actual overall depth is 0.24" plus the value in column B.

All dimensions in inches

Group B

Primary Voltage: **600** || 575 || 550
 Secondary Voltage: **12 X 24** || 11.5 X 23 || 11 X 22



| VA Rating | CE VA Rating | Catalog Number | Mtg. Fig. | Output Amps | Overall Dimensions | | | Mounting Centers | | Mounting Slot G X H | Height with Finger Guard | Height with Fuse Block Adapter | Approx. Ship Weight Lbs. |
|-----------|--------------|----------------|-----------|-------------|--------------------|------|------|------------------|------|------------------------|--------------------------|--------------------------------|--------------------------|
| | | | | | A | B | C | D | E | | | | |
| 50 | 50 | SP50AR | A | 4.17/2.08 | 2.60 | 3.23 | 2.60 | 2.13 | 2.05 | 0.22 x 0.44 | 2.98 | 2.79 | 1.5 |
| 100 | 100 | SP100AR | A | 8.33/4.17 | 2.99 | 3.74 | 2.85 | 2.52 | 2.60 | 0.22 x 0.44 | 3.23 | 3.04 | 3.3 |
| 150 | 150 | SP150AR | A | 12.5/6.25 | 2.99 | 4.09 | 2.85 | 2.52 | 2.95 | 0.22 x 0.44 | 3.23 | 3.04 | 3.9 |
| 250 | 160 | SP250AR | A | 20.8/10.4 | 3.78 | 3.70 | 3.40 | 3.31 | 2.60 | 0.22 x 0.44 | 3.78 | 3.59 | 5.2 |
| 350 | 250 | SP350AR | A | 29.2/14.6 | 3.78 | 4.29 | 3.40 | 3.31 | 3.19 | 0.22 x 0.44 | 3.78 | 3.59 | 7.1 |
| 500 | 300 | SP500AR | B | 41.7/20.8 | 4.49 | 5.08 | 3.78 | 3.78 | 3.27 | 0.31 x 0.81 | 4.16 | 3.97 | 9.9 |

Primary and Secondary voltage links/jumpers supplied standard with all transformers.
 Refer to page 73 for wiring schematic drawing. Custom voltages and VA sizes available upon request.

All dimensions in inches

1489-M Circuit Breakers



Bulletin 1489-M thermal-magnetic Circuit Breakers are approved for branch circuit protection in the United States and Canada, and are certified as Miniature Circuit Breakers for IEC applications.

These branch protectors are compatible with many accessories to meet diverse application needs, including UL 508 Listed bus bars for convenience in panel assembly, auxiliary contacts, signal contacts and shunt trips for versatility, and lockout attachments for safety during maintenance.

Features



- Current limiting
- Fast breaking time
- High rated voltage
- Dual terminals provide a more secure connection of up to four wires, or two wires and a bus bar
- Superior shock and vibration resistance to help prevent nuisance tripping
- Terminal design helps prevent wiring misses by directing wires into the terminal openings, even while tightening
- Reversible line and load connections
- Single and multi-pole toggle mount lock out attachments available for Lockout/Tagout (LOTO)
- RoHS compliant and fully recyclable device
- Suitable for extreme ambient conditions

1489-M Circuit Breakers

| | |
|------------------------------|--|
| Rated Voltage | UL/CSA: Max. 480Y/277V AC IEC: U_g 230/400V AC |
| Interrupting Capacity | UL/CSA: 10 kA IEC: 15 kA |
| Current Ratings | 0.5...63 A |
| Poles | 1, 2, 3 |
| Trip Curves | C, D |
| Standards Compliance | UL 489 CSA C22.2 No. 5.1 EN 60947-2 GB 14048.2 |
| Certifications | UL Listed, File No. E197878 CSA Certified, File No. 259391 CE Marked VDE Certified CCC Certified RoHS Compliant |

Product Selection

1-Pole Circuit Breakers

| Photo/Wiring Diagram | UL/CSA Max. Voltage | IEC/EN Max. Voltage | Continuous Current Rating (I_n) [A] | Trip Curve C Inductive 5...10 I_n Cat. No. | Trip Curve D Highly Inductive 10...20 I_n Cat. No. | |
|--|---------------------|--|---|--|--|-------------|
|   | 277V AC, 48V DC | 230V AC | 0.5 | 1489-M1C005 | 1489-M1D005 | |
| | | | 1 | 1489-M1C010 | 1489-M1D010 | |
| | | | 1.6 | 1489-M1C016 | 1489-M1D016 | |
| | | | 2 | 1489-M1C020 | 1489-M1D020 | |
| | | | 3 | 1489-M1C030 | 1489-M1D030 | |
| | | | 4 | 1489-M1C040 | 1489-M1D040 | |
| | | | 5 | 1489-M1C050 | 1489-M1D050 | |
| | | | 6 | 1489-M1C060 | 1489-M1D060 | |
| | | | 7 | 1489-M1C070 | 1489-M1D070 | |
| | | | 8 | 1489-M1C080 | 1489-M1D080 | |
| | | | 10 | 1489-M1C100 | 1489-M1D100 | |
| | | | 13 | 1489-M1C130 | 1489-M1D130 | |
| | | | 15 | 1489-M1C150 | 1489-M1D150 | |
| | | | 16 | 1489-M1C160 | 1489-M1D160 | |
| | | | 20 | 1489-M1C200 | 1489-M1D200 | |
| | | | 25 | 1489-M1C250 | 1489-M1D250 | |
| | | | 30 | 1489-M1C300 | 1489-M1D300 | |
| | | | 32 | 1489-M1C320 | 1489-M1D320 | |
| | | | 35 | 1489-M1C350 | 1489-M1D350 | |
| | | C Curve: 277V AC, 48V DC D Curve: 240V AC, 48V DC | | 40 | 1489-M1C400 | 1489-M1D400 |
| | | 240V AC, 48V DC | | 50 | 1489-M1C500 | 1489-M1D500 |
| | | | 60 | 1489-M1C600 | 1489-M1D600 | |
| | | | 63 | 1489-M1C630 | 1489-M1D630 | |

Specifications

| Electrical Ratings | | | | | |
|---|---|---|-------------|---------------------------|--------------|
| Poles | 1, 2, 3 | | | | |
| Tripping characteristics | C, D | | | | |
| Rated current (I_n) | 0.5...63 A | | | | |
| Rated frequency [f] | 50/60 Hz | | | | |
| Rated insulation voltage U_i per IEC/EN 60664-1 | 250V AC (phase to ground) 440V AC (phase to phase) | | | | |
| Overvoltage category | III | | | | |
| Pollution degree | 3 | | | | |
| Data per UL/CSA | | | | | |
| Rated voltage | AC | 1-pole | C Curve | 0.5...40 A | 277V AC |
| | | | | 50...63 A | 240V AC |
| | | D Curve | | 0.5...35 A | 277V AC |
| | | | | 40...63 A | 240V AC |
| | 2-, 3-pole | C Curve | | 0.5...40 A | 480Y/277V AC |
| | | | | 50...63 A | 240V AC |
| | | D Curve | | 0.5...35 A | 480Y/277V AC |
| | | | | 40...63 A | 240V AC |
| DC | 1-pole | | | 48V DC | |
| | 2-pole | | | 96V DC (2-pole in series) | |
| Rated interrupting capacity per UL 489 | | 10 kA | | | |
| Reference temperature for tripping characteristics | | 40 °C | | | |
| Electrical endurance | | 6,000 operations (AC and DC); 1 cycle (1s - ON, 9s - OFF) | | | |
| Data per IEC/EN 60947-2 | | | | | |
| Rated operational voltage (U_e) | 1-pole | | 230V AC | | |
| | 2-, 3-pole | | 400 V AC | | |
| Highest supply or utilization voltage (U_{max}) | AC | 1-pole | 253/440V AC | | |
| | | 2-, 3-pole | 440V AC | | |
| | DC ★ | 1-pole | 48V DC | | |
| | | 2-pole | 96V DC | | |
| Min. operating voltage | | 12V AC, 12V DC | | | |
| Rated ultimate short-circuit breaking capacity (I_{CU}) | | 15 kA | | | |
| Rated service short-circuit breaking capacity (I_{CS}) | | ≤40 A: 11.25 kA >40 A: 7.5 kA | | | |
| Rated impulse withstand voltage U_{imp} . (1.2/50μs) | | 4 kV (test voltage 6.2kV at sea level, 5kV at 2,000m) | | | |
| Dielectric test voltage | | 2 kV (50/60Hz, 1 min.) | | | |
| Reference temperature for tripping characteristics | | 30 °C | | | |
| Electrical endurance | | $I_n < 30A$:20,000 ops.(AC) $I_n \geq 30A$:10,000 ops. (AC) 1 cycle (2s - ON, 13s - OFF, $I_n \leq 32A$), 1 cycle (2s - ON, 28s - OFF, $I_n > 32A$) 1,000 ops. (DC) | | | |

★ Self-declared IEC DC ratings.

| Mechanical Data | | |
|--|---|---|
| Housing | Insulation group II, RAL 7035 | |
| Indicator window | red ON/green OFF | |
| Protection degree per EN 60529 | IP20, IP40 in enclosure with cover | |
| Mechanical endurance | 20,000 operations | |
| Shock resistance per IEC/EN 60068-2-27 | 25 g - 2 shocks - 13 ms | |
| Vibration resistance per IEC/EN 60068-2-6 | 5g - 20 cycles at 5...150...5 Hz with load 0.8 In | |
| Environmental | | |
| Environmental conditions (damp heat) per IEC/EN 60068-2-30 | 28 cycles with 55°C/90-96% and 25°C/95-100% | |
| Ambient temperature Δ | -25...+55 °C | |
| Storage temperature | -40...+70 °C | |
| Installation | | |
| Terminal | Dual terminal | |
| Cross-section of wire ◆ – solid, stranded (front/back terminal slot) | 35/35 mm ² | |
| | 18...4/18...10 AWG | |
| Cross-section of wire – flexible (front/back terminal slot) | 25/10 mm ² | |
| Multi-wire rating per UL, CSA | 1 wire, 18...4 AWG | |
| | 2-4 wires‡, 18...10 AWG | |
| Cross-section of bus bars (back terminal slot) | 10 mm ² | |
| Tightening torque | IEC | 2.8 N•m |
| | UL/CSA | AWG 18...16: 13.3 in•lb, AWG 14...10: 17.7 in•lb, AWG 8...4: 39.8 in•lb |
| Screwdriver | No. 2 Pozidrive | |
| Mounting | DIN Rail (EN 60715, 35 mm) with fast clip | |
| Mounting position | Any | |
| Supply | Optional | |
| Approximate Dimensions and Weight | | |
| Pole dimensions (H x D x W) | 111 x 69 x 17.5 mm (4.37 x 2.72 x .69") | |
| Pole weight | 125 g (4.4 oz.) | |
| Combination with Auxiliary Elements | | |
| Auxiliary contact | Yes | |
| Signal contact | Yes | |
| Shunt trip | Yes | |

◆ 35 mm self-declared, not included in IEC/EN approval.

Δ Refer to the ambient temperature derating tables.

‡ Wires must be of like size and stranding. Up to two wires per terminal slot.

RH Series Compact Power Relays

Key features

- SPDT through 4PDT, 10A contacts
- Compact power type relays
- Miniature power relays with a large capacity
- 10A contact capacity
- Compact size saves space



Part Number Selection

| Contact | Model | Part Number | | Coil Voltage Code (Standard Stock in bold) |
|---|---|-------------------|--------------|---|
| | | Blade Terminal | PCB Terminal | |
|  SPDT | Standard | RH1B-U □ | RH1V2-U □ | |
| | With Indicator | RH1B-UL □ | — | |
| | With Check Button | RH1B-UC □ | — | AC6V, AC12V, AC24V , AC110V, AC120V , AC220V, AC240V DC6V, DC12V , DC24V , DC48V, DC110V |
| | With Indicator and Check Button | RH1B-ULC □ | — | |
| | Top Bracket Mounting | RH1B-UT □ | — | |
| | With Diode (DC coil only) | RH1B-UD □ | RH1V2-UD □ | DC6V, DC12V , DC24V , DC48V, DC110V |
| | With Indicator and Diode (DC coil only) | RH1B-ULD □ | — | DC12V , DC24V , DC48V, DC110V |
|  DPDT | Standard | RH2B-U □ | RH2V2-U □ | |
| | With Indicator | RH2B-UL □ | RH2V2-UL □ | |
| | With Check Button | RH2B-UC □ | — | AC6V, AC12V, AC24V , AC110-120V , AC220-240V |
| | With Indicator and Check Button | RH2B-ULC □ | — | DC6V, DC12V , DC24V , DC48V, DC100-110V |
| | Top Bracket Mounting | RH2B-UT □ | — | |
| | With Diode (DC coil only) | RH2B-UD □ | RH2V2-UD □ | DC6V, DC12V , DC24V , DC48V, DC100-110V |
| | With Indicator and Diode (DC coil only) | RH2B-ULD □ | RH2V2-ULD □ | |
|  3PDT | Standard | RH3B-U □ | RH3V2-U □ | |
| | With Indicator | RH3B-UL □ | RH3V2-UL □ | |
| | With Check Button | RH3B-UC □ | — | AC6V, AC12V, AC24V , AC110V, AC120V , AC220V, AC240V DC6V, DC12V , DC24V , DC48V, DC110V |
| | With Indicator and Check Button | RH3B-ULC □ | — | |
| | Top Bracket Mounting | RH3B-UT □ | — | |
| | With Diode (DC coil only) | RH3B-UD □ | — | DC6V, DC12V, DC24V, DC48V, DC110V |
| | With Indicator and Diode (DC coil only) | RH3B-ULD □ | — | |
|  4PDT | Standard | RH4B-U □ | RH4V2-U □ | |
| | With Indicator | RH4B-UL □ | RH4V2-UL □ | |
| | With Check Button | RH4B-UC □ | — | AC6V, AC12V, AC24V , AC110V, AC120V , AC220V, AC240V DC6V, DC12V , DC24V , DC48V, DC110V |
| | With Indicator and Check Button | RH4B-ULC □ | — | |
| | Top Bracket Mounting | RH4B-UT □ | — | |
| | With Diode (DC coil only) | RH4B-UD □ | RH4V2-UD □ | DC6V, DC12V, DC24V, DC48V, DC110V |
| | With Indicator and Diode (DC coil only) | RH4B-ULD □ | — | |



PCB terminal relays are designed to mount directly to a circuit board without any socket.

Ordering Information

When ordering, specify the Part No. and coil voltage code:

(example) **RH3B-U** **AC120V**
 Part No. Coil Voltage Code

Switches & Pilot Lights

Signaling Lights

Relays & Sockets

Timers

Contactors

Terminal Blocks

Circuit Breakers

Sockets (for Blade Terminal Models)

| Relays | Standard DIN Rail Mount ¹ | Finger-safe DIN Rail Mount ¹ | Through Panel Mount | PCB Mount |
|-------------|--------------------------------------|---|---------------------|-----------|
| RH1B | SH1B-05 | SH1B-05C | SH1B-51 | SH1B-62 |
| RH2B | SH2B-05 | SH2B-05C | SH2B-51 | SH2B-62 |
| RH3B | SH3B-05 | SH3B-05C | SH3B-51 | SH3B-62 |
| RH4B | SH4B-05 | SH4B-05C | SH4B-51 | SH4B-62 |











- DIN Rail mount socket comes with two horseshoe clips. Do not use unless you plan to insert pullover wire spring. Replacement horseshoe clip part number is Y778-011.

Hold Down Springs & Clips

| Appearance | Item | Relay | For DIN Mount Socket | For Through Panel & PCB Mount Socket |
|---|--------------------------|------------------------|------------------------|--------------------------------------|
|  | Pullover Wire Spring | RH1B | SY2S-02F1 ² | SY4S-51F1 |
| | | RH2B | SY4S-02F1 ² | |
| | | RH3B | SH3B-05F1 ² | |
| | | RH4B | SH4B-02F1 ² | |
|  | Leaf Spring (side latch) | RH1B, RH2B, RH3B, RH4B | SFA-202 ³ | SFA-302 ³ |
|  | Leaf Spring (top latch) | RH1B, RH2B, RH3B, RH4B | SFA-101 ³ | SFA-301 ³ |



- Must use horseshoe clip when mounting in DIN mount socket. Replacement horseshoe clip part number is Y778-011.
- Two required per relay.

AC Coil Ratings

| Voltage (V) | Rated Current (mA) ±15% at 20°C | | | | | | | | Coil Resistance (Ω) ±10% at 20°C | | | | Operation Characteristics (against rated values at 20°C) | | |
|----------------|---------------------------------|----------|------|------|---------|---------|------|------|----------------------------------|--------|--------|-------|--|----------------|-----------------|
| | AC 50Hz | | | | AC 60Hz | | | | SPDT | DPDT | 3PDT | 4PDT | Max. Continuous Applied Voltage | Pickup Voltage | Dropout Voltage |
| | SPDT | DPDT | 3PDT | 4PDT | SPDT | DPDT | 3PDT | 4PDT | | | | | | | |
| 6 | 170 | 240 | 330 | 387 | 150 | 200 | 280 | 330 | 330 | 9.4 | 6.4 | 5.4 | | | |
| 12 | 86 | 121 | 165 | 196 | 75 | 100 | 140 | 165 | 165 | 39.3 | 25.3 | 21.2 | | | |
| 24 | 42 | 60.5 | 81 | 98 | 37 | 50 | 70 | 83 | 83 | 153 | 103 | 84.5 | | | |
| 110 | 9.6 | — | 18.1 | 21.6 | 8.4 | — | 15.5 | 18.2 | 18.2 | — | 2,200 | 1,800 | | | |
| 110-120 | — | 9.4-10.8 | — | — | — | 8.0-9.2 | — | — | — | — | — | — | | | |
| 120 | 8.6 | — | 16.4 | 19.5 | 7.5 | — | 14.2 | 16.5 | 16.5 | — | 10,800 | 7,360 | | | |
| 220 | 4.7 | — | 8.8 | 10.7 | 4.1 | — | 7.7 | 9.1 | 9.1 | — | 10,800 | 7,360 | | | |
| 220-240 | — | 4.7-5.4 | — | — | — | 4.0-4.6 | — | — | — | 18,820 | — | — | | | |
| 240 | 4.9 | — | 8.2 | 9.8 | 4.3 | — | 7.1 | 8.3 | 8.3 | — | 12,100 | 9,120 | | | |

DC Coil Ratings

| Voltage (V) | Rated Current (mA) ±15% at 20°C | | | | Coil Resistance (Ω) ±10% at 20°C | | | | Operation Characteristics (against rated values at 20°C) | | |
|-------------|---------------------------------|---------|------|------|----------------------------------|--------|-------|-------|--|----------------|-----------------|
| | SPDT | DPDT | 3PDT | 4PDT | SPDT | DPDT | 3PDT | 4PDT | Max. Continuous Applied Voltage | Pickup Voltage | Dropout Voltage |
| 6 | 128 | 150 | 240 | 250 | 47 | 40 | 25 | 24 | 110% | 80% maximum | 10% minimum |
| 12 | 64 | 75 | 120 | 125 | 188 | 160 | 100 | 96 | | | |
| 24 | 32 | 36.9 | 60 | 62 | 750 | 650 | 400 | 388 | | | |
| 48 | 18 | 18.5 | 30 | 31 | 2,660 | 2,600 | 1,600 | 1,550 | | | |
| 100-110 | — | 8.2-9.0 | — | — | — | 12,250 | — | — | | | |
| 110 | 8 | — | 12.8 | 15 | 13,800 | — | 8,600 | 7,340 | | | |



Standard coil voltages are in **BOLD**.

Specifications

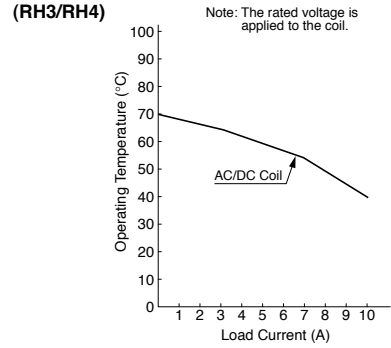
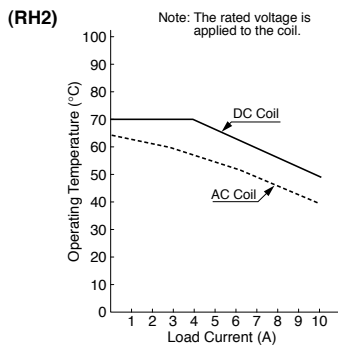
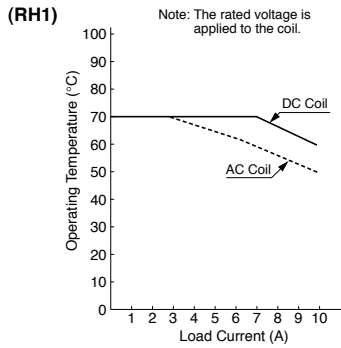
| | | |
|------------------------------------|--|---|
| Contact Material | Silver cadmium oxide | |
| Contact Resistance ¹ | 50mΩ maximum | |
| Minimum Applicable Load | 24V DC, 30 mA; 5V DC, 100 mA (reference value) | |
| Operating Time ² | SPDT DPDT | 20ms maximum |
| | 3PDT 4PDT | 25ms maximum |
| Release Time ² | SPDT DPDT | 20ms maximum |
| | 3PDT 4PDT | 25ms maximum |
| Power Consumption (approx.) | SPDT | AC: 1.1VA (50Hz), 1VA (60Hz) DC: 0.8W |
| | DPDT | AC: 1.4VA (50Hz), 1.2VA (60Hz) DC: 0.9W |
| | 3PDT | AC: 2VA (50Hz), 1.7VA (60Hz) DC: 1.5W |
| | 4PDT | AC: 2.5VA (50Hz), 2VA (60Hz) DC: 1.5W |
| Insulation Resistance | 100MΩ minimum (500V DC megger) | |
| Dielectric Strength ³ | SPDT | Between live and dead parts: 2,000V AC, 1 minute Between contact and coil: 2,000V AC, 1 minute Between contacts of the same pole: 1,000V AC, 1 minute |
| | DPDT 3PDT 4PDT | Between live and dead parts: 2,000V AC, 1 minute Between contact and coil: 2,000V AC, 1 minute Between contacts of different poles: 2,000V AC, 1 minute Between contacts of the same pole: 1,000V AC, 1 minute |
| Operating Frequency | Electrical: | 1,800 operations/hour maximum |
| | Mechanical: | 18,000 operations/hour maximum |
| Vibration Resistance | Damage limits: | 10 to 55Hz, amplitude 0.5 mm |
| | Operating extremes: | 10 to 55Hz, amplitude 0.5 mm |
| Shock Resistance | Damage limits: | 1,000m/s ² (100G) |
| | Operating extremes: | 200m/s ² (20G - SPDT, DPDT) 100m/s ² (10G - 3PDT, 4PDT) |
| Mechanical Life | 50,000,000 operations minimum | |
| Electrical Life | DPDT | 500,000 operations minimum (120V AC, 10A) |
| | SPDT 3PDT 4PDT | 200,000 operations minimum (120V AC, 10A) |
| Operating Temperature ⁴ | SPDT DPDT 3PDT 4PDT | -25 to +70°C (no freezing) |
| Operating Humidity | 45 to 85% RH (no condensation) | |
| Weight (approx.) | SPDT: 24g, DPDT: 37g, 3PDT: 50g, 4PDT: 74g | |



Note: Above values are initial values.

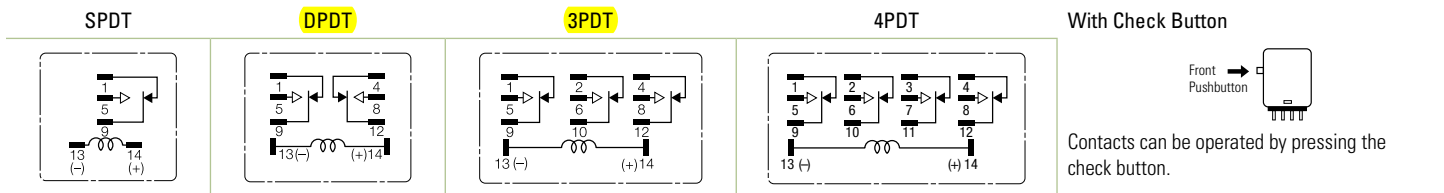
1. Measured using 5V DC, 1A voltage drop method
2. Measured at the rated voltage (at 20°C), excluding contact bouncing
Release time of relays with diode: 40 ms maximum
3. Relays with indicator or diode: 1000V AC, 1 minute
4. For use under different temperature conditions, refer to Continuous Load Current vs. Operating Temperature Curve. The operating temperature range of relays with indicator or diode is -25 to +40°C.

Continuous Load Current vs. Operating Temperature Curve (Basic Type, With Check Button, and Top Bracket Mounting Type)

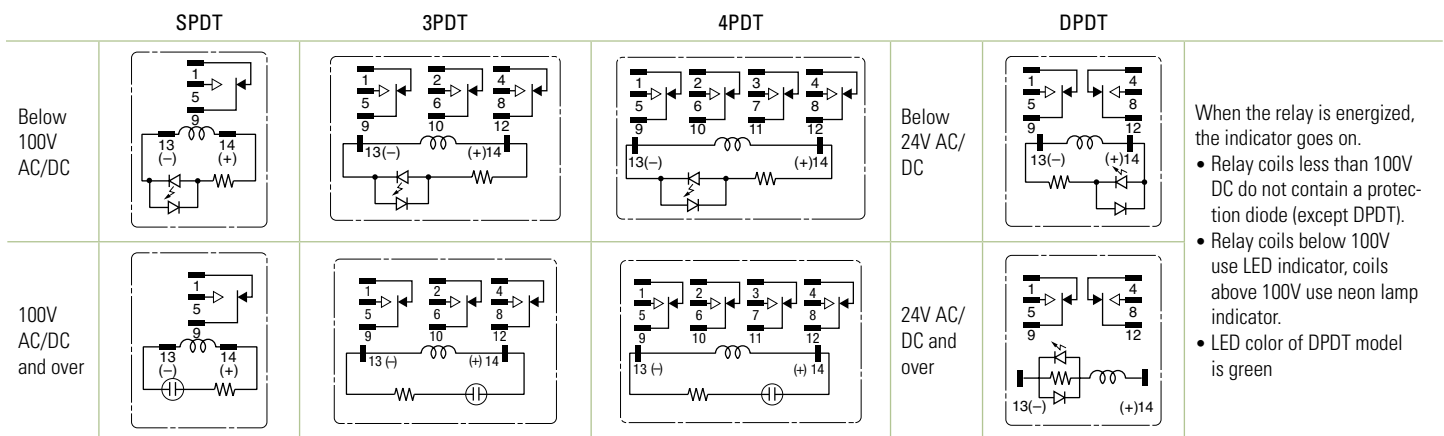


Internal Connection (View from Bottom)

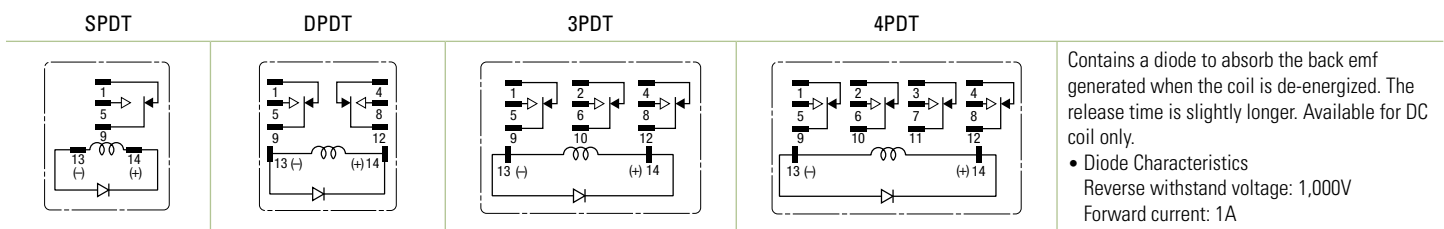
Basic Type



With Indicator (-L type)



With Diode (-D type)



New TWND Series – Full Size NEMA Pushbuttons



New! TWND Series: Heavy duty switches built to last

Key features:

- Variety of button sizes up to 2 9/16" (65mm)
- Rugged construction includes chrome plated zinc locking ring die cast zinc mounting thread
- LED illumination
- Transformer or full voltage
- Slow make, double break wiping contacts
- Modular construction for maximum flexibility
- Available assembled or as sub-components
- UL Type 4X, 13 and IP65 watertight/oiltight panel

The rugged series of TWND switches offers both variety and durability in an attractive design.

With button sizes up to 2 9/16" (65mm), chrome plated zinc locking rings, die cast zinc mounting threads, steel anti-rotation rings, and self cleaning contacts, the TWNDs are here to stay.

The TWND series also offers LED illumination in full voltage and transformer models.

Regardless of your switching needs, the NEW TWND series provides the kind of long lasting, industrial strength quality you've come to expect from IDEC.



Switches & Pilot Devices

Signaling Lights

Relays & Sockets

Timers

Contactors


Terminal Blocks

Circuit Breakers

Specifications

| | |
|---|--|
| Conforming to Standards | EN60947-5-1, UL508, CSA C22-2 No.14 |
| Approvals | CSA: pushbuttons and selector switches: A600 pilot lights and illuminated pushbuttons, direct supply pilot lights and illuminated pushbuttons with integral transformer (100/110, 115, 120, 200/220, 230, 240, 380, 400/440, 480V) UL: pushbuttons and selector switches: A600 pilot lights and illuminated pushbuttons, direct supply pilot lights and illuminated pushbuttons with integral transformer (100/110, 115, 120, 200/220, 230, 240, 380, 400/440, 480V) TUV: pushbuttons and selector switches: A600 pilot lights and illuminated pushbuttons, direct supply pilot lights and illuminated pushbuttons with integral transformer (100/110, 115, 120, 200/220, 230, 240, 380, 400/440, 480V) |
| Operating Temperature | Operation: -25 to +50°C (illuminated versions) -25 ~ +70C non-illuminated Storage: -40 to +80°C (without freezing) C-> °C |
| Vibration Resistance | 5 to 55Hz, 98m/sec ² (10g) conforming to IEC60068-2-6 |
| Shock Resistance | 980m/sec ² (100g) conforming to IEC60068-2-27 |
| Electric Shock Protection | Class 2 conforming to IEC60664-1 |
| Degree of Protection | IP65 (from front of the panel) (conforming to IEC60529) UL Type 1, 2, 3, 3R, 3S, 4, 4X, 5, 12, 13 (conforming to NEMA ICS6-110) |
| Mechanical Life | Momentary pushbuttons: 5,000,000 (1800 operations per hour) All other switches: 500,000 |
| Pollution Degree (conforming to IEC60947-1) | 3 |

Mechanical-Electrical Specifications

| | | | | | | |
|--|---|-------------------|--|------------------------------------|----------------|------------|
| Rated Operational Characteristics | AC-15: A600 | | | | | |
| Rated Insulation Voltage | 600V | | | | | |
| Rated Impulse Withstanding Voltage øDielectric Strength | Between live and dead metal parts 2.5kV AC, 1 minute | | | | | |
| Rated Thermal Current | 10 Amp | | | | | |
| Minimum Switching Capacity | 5 mA at 3V AC/DC (applicable range may vary with operating conditions and load types) | | | | | |
| Contact Operation | Slow break NC or NO | | | | | |
| Operating Force | Flush and extended pushbuttons—with 1NO or 1NC contact: 6.2±2N (momentary), 9.0±1.5N Additional contacts—1NO or 1NC: +3.0N | | | | | |
| Recommended Terminal Torque | Unit | Wire | Number of Wires | Recommended Tightening Torque (Nm) | Terminal Screw | |
| | HW-U Contact Block | Crimping Terminal | 2 | 1.0 to 1.3 | M3.5 | |
| | | | Solid Wire | ø0.5 to 1.6 mm (AWG14 to 22) | | 2 |
| | | Stranded Wire | ø1.7 to 2.0 mm (AWG12) | 1 | | 1.2 to 1.3 |
| | | | 0.3 to 2.0 mm ² (AWG14 to 22) | 2 | | 1.0 to 1.3 |
| | Illuminated Unit (*1) | Crimping Terminal | 2 | 1.0 to 1.3 | M3.5 | |
| | | | Solid Wire | ø0.5 to 1.6 mm (AWG14 to 22) | | 2 |
| | | Stranded Wire | 0.3 to 2.0 mm (AWG14 to 22) | 2 | | 1.0 to 1.3 |
| 2.1 to 3.5 mm ² (AWG12) | | | 1 | 1.2 to 1.3 | | |
| Applicable Wire Size | Pilot Light | Crimping Terminal | 2 | 0.6 to 1.0 (M3.0) | | |
| | | Solid Wire | ø0.5 to 1.6 mm (AWG14 to 22) | 1.0 to 1.3 (M3.5) | | |
| | | Stranded Wire | ø0.3 to 2.0 mm (AWG14 to 22) | 1.0 to 1.3 (M3.5) | | |
|  1. * refers to the lamp terminals of the illuminated push buttons and selector switches. | | | | | | |
| Contact Resistance | Initial contact resistance of 50mΩ or less | | | | | |
| Contact Gap | 4mm (NO and NC) 2mm (NO-EM and NC-LB) | | | | | |
| LED Ratings | LEDs: 6V: 8mA, 12V: 11mA, 24V: 11mA, 120V: 8.8mA, 240V: 8.6mA | | | | | |
| Contact Material | Silver | | | | | |

Contact Ratings

| | | | | | | | | |
|---|--------------|--|-----|-----|------|------|------|----|
| Contact Ratings by Utilization Category IEC 60947-5-1 | AC-15 (A600) | | | | | | | |
| | DC-13 (P600) | | | | | | | |
| Contact Ratings by Utilization Category | | | | | | | | |
| Operational Voltage | | 24V | 48V | 50V | 110V | 220V | 440V | |
| Operation Current | AC 50/60 Hz | AC-12 Control of resistive loads & solid state loads | 10A | — | 10A | 10A | 6A | 2A |
| | | AC-15 Control of electromagnetic loads (> 72VA) | 10A | — | 7A | 5A | 3A | 1A |
| | DC | DC-12 Control of resistive loads & solid state loads | 10A | 5A | — | 2.2A | 1.1A | — |
| | | DC-13 Control of electromagnets | 5A | 2A | — | 1.1A | 0.6A | — |

Switches & Pilot Devices

Signaling Lights

Relays & Sockets

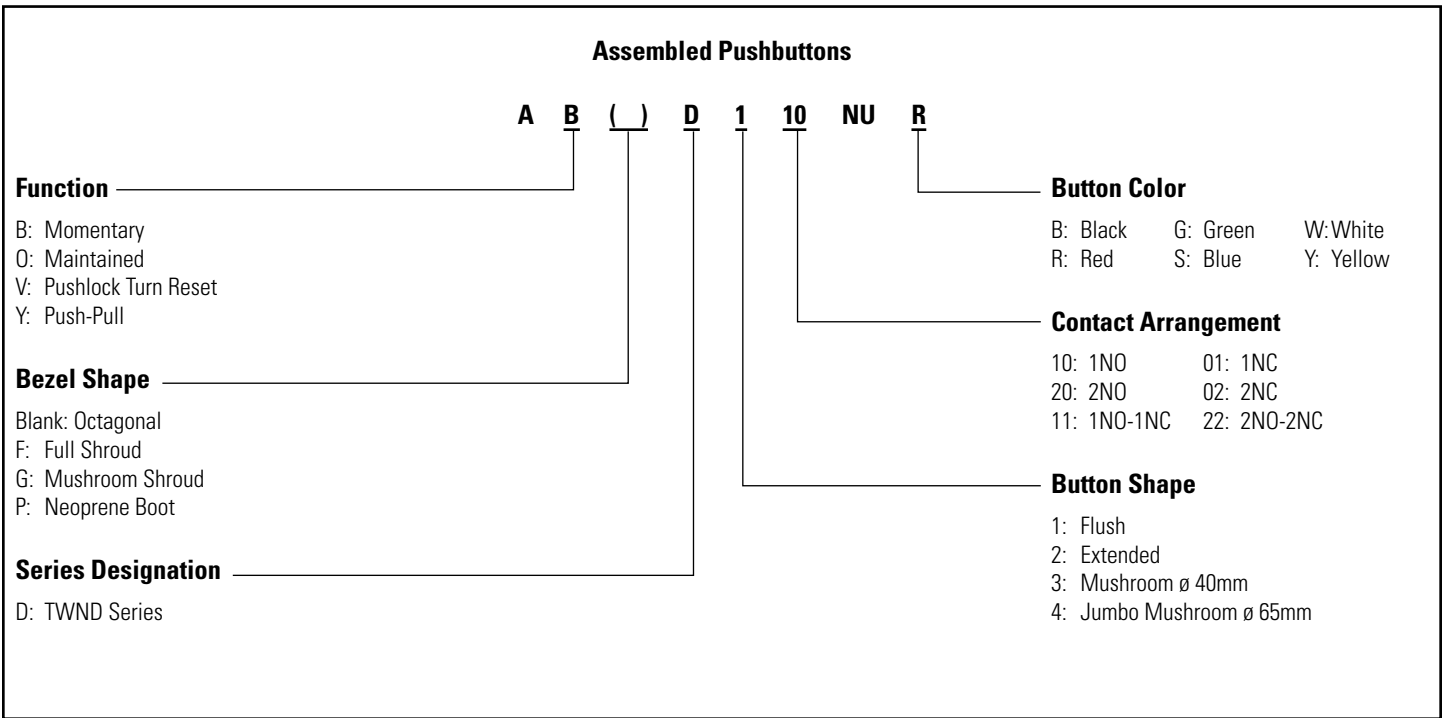
Timers

Contactors

Terminal Blocks

Circuit Breakers

Non-Illuminated Pushbuttons (Assembled)



1. Use only when interpreting part numbers. Do not use for developing part numbers.
2. Custom contact configurations available, contact IDEC for details.

Non-Illuminated Pushbuttons (Assembled)

Non-Illuminated Pushbuttons

| Style | Contacts | Momentary | Maintained |
|--|----------|------------|------------|
| Flush | 1NO | ABD110NUⓄ | AOD110NUⓄ |
| | 1NC | ABD101NUⓄ | AOD101NUⓄ |
| | 1NO-1NC | ABD111NUⓄ | AOD111NUⓄ |
| | 2NO | ABD120NUⓄ | AOD120NUⓄ |
| Extended | 2NC | ABD102NUⓄ | AOD102NUⓄ |
| | 1NO | ABD210NUⓄ | AOD210NUⓄ |
| | 1NC | ABD201NUⓄ | AOD201NUⓄ |
| | 1NO-1NC | ABD211NUⓄ | AOD211NUⓄ |
| Extended with Neoprene Boot* | 2NO | ABD220NUⓄ | AOD220NUⓄ |
| | 2NC | ABD202NUⓄ | AOD202NUⓄ |
| | 1NO | ABPD210NUⓄ | AOPD210NUⓄ |
| | 1NC | ABPD201NUⓄ | AOPD201NUⓄ |
| Recessed | 1NO-1NC | ABPD211NUⓄ | AOPD211NUⓄ |
| | 2NO | ABPD220NUⓄ | AOPD220NUⓄ |
| | 2NC | ABPD202NUⓄ | AOPD202NUⓄ |
| | 1NO | ABFD110NUⓄ | AOFD110NUⓄ |
| Extended with Full Shroud | 1NC | ABFD101NUⓄ | AOFD101NUⓄ |
| | 1NO-1NC | ABFD111NUⓄ | AOFD111NUⓄ |
| | 2NO | ABFD120NUⓄ | AOFD120NUⓄ |
| | 2NC | ABFD102NUⓄ | AOFD102NUⓄ |
| ø 40mm Mushroom Head | 1NO | ABFD210NUⓄ | AOFD210NUⓄ |
| | 1NC | ABFD201NUⓄ | AOFD201NUⓄ |
| | 1NO-1NC | ABFD211NUⓄ | AOFD211NUⓄ |
| | 2NO | ABFD220NUⓄ | AOFD220NUⓄ |
| ø 40mm Mushroom Head with Full Shroud | 2NC | ABFD202NUⓄ | AOFD202NUⓄ |
| | 1NO | ABD310NUⓄ | AOD310NUⓄ |
| | 1NC | ABD301NUⓄ | AOD301NUⓄ |
| | 1NO-1NC | ABD311NUⓄ | AOD311NUⓄ |
| ø 65mm Jumbo Mushroom Head | 2NO | ABD320NUⓄ | AOD320NUⓄ |
| | 2NC | ABD302NUⓄ | AOD302NUⓄ |
| | 1NO | ABGD310NUⓄ | AOGD310NUⓄ |
| | 1NC | ABGD301NUⓄ | AOGD301NUⓄ |
| ø 65mm Mushroom Head with Full Shroud | 1NO-1NC | ABGD311NUⓄ | AOGD311NUⓄ |
| | 2NO | ABGD320NUⓄ | AOGD320NUⓄ |
| | 2NC | ABGD302NUⓄ | AOGD302NUⓄ |
| | 1NO | ABD410NUⓄ | AOD410NUⓄ |
| ø 65mm Jumbo Mushroom Head with Shallow Shroud | 1NC | ABD401NUⓄ | AOD401NUⓄ |
| | 1NO-1NC | ABD411NUⓄ | AOD411NUⓄ |
| | 2NO | ABD420NUⓄ | AOD420NUⓄ |
| | 2NC | ABD402NUⓄ | AOD402NUⓄ |
| ø 65mm Jumbo Mushroom Head With Deep Shroud | 1NO | ABGD410NUⓄ | AOGD410NUⓄ |
| | 1NC | ABGD401NUⓄ | AOGD401NUⓄ |
| | 1NO-1NC | ABGD411NUⓄ | AOGD411NUⓄ |
| | 2NO | ABGD420NUⓄ | AOGD420NUⓄ |
| | 2NC | ABGD402NUⓄ | AOGD402NUⓄ |
| | 1NO | ABFD410NUⓄ | AOFD410NUⓄ |
| | 1NC | ABFD401NUⓄ | AOFD401NUⓄ |
| | 1NO-1NC | ABFD411NUⓄ | AOFD411NUⓄ |
| | 2NO | ABFD420NUⓄ | AOFD420NUⓄ |
| | 2NC | ABFD402NUⓄ | AOFD402NUⓄ |

① Button Color Codes

| Color | Code |
|--------|------|
| Black | B |
| Green | G |
| Red | R |
| Blue | S |
| Yellow | Y |
| White | W |

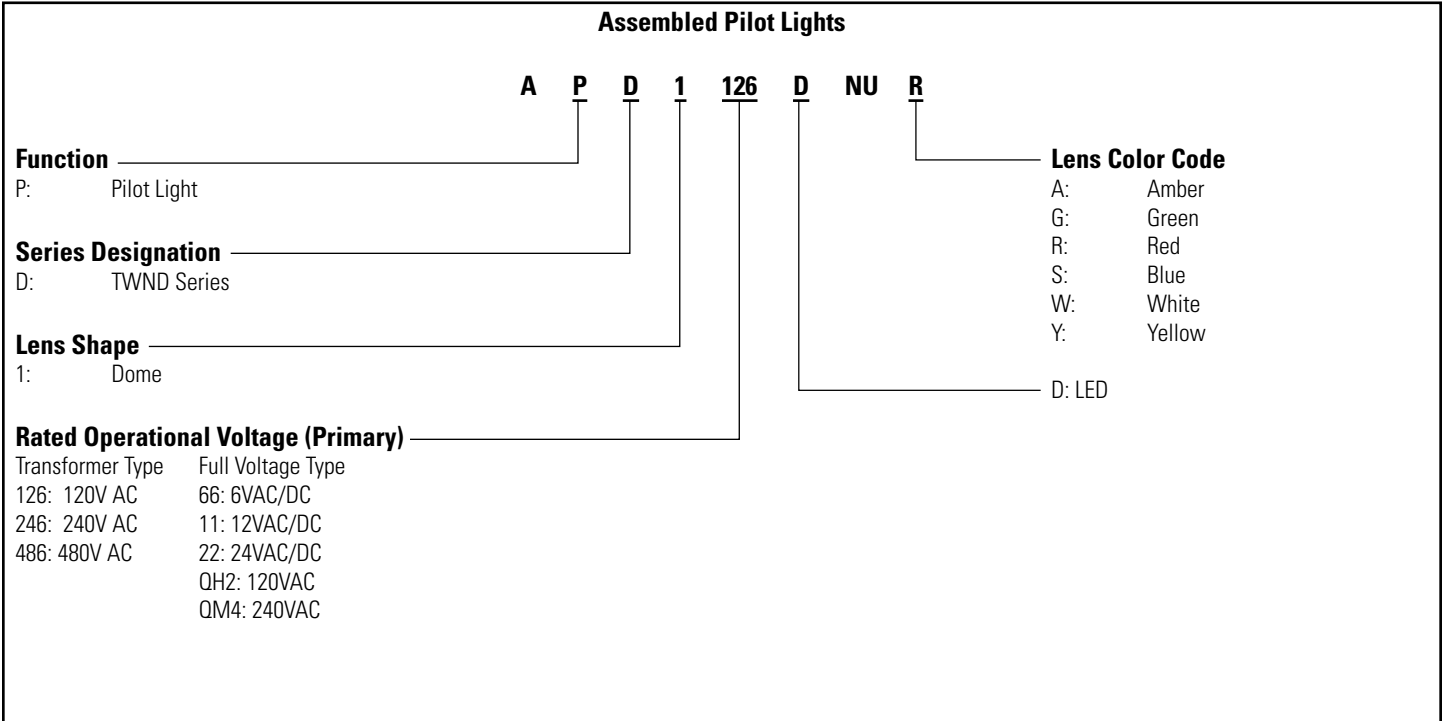


- 65mm Jumbo mushroom not available in white.
- Neoprene boot is not available in blue or white.



- In place of Ⓞ, specify the Button Color Code.
- For sub-assembly part numbers, see next page.
- *Neoprene boot available only in Black (B), Green (G), Red (R) and Yellow (Y).

Pilot Lights (Assembled)



Use only when interpreting part numbers. Do not use for developing part numbers.

LED Pilot Lights

| Style | Operating Voltage | Part Number |
|---------------------------------|--|---|
| | | LED |
| <p>Transformer Dome</p> | <p>120V AC</p> <p>240V AC</p> <p>480V AC</p> | <p>APD1126DNU^②</p> <p>APD1246DNU^②</p> <p>APD1486DNU^②</p> |
| <p>Full Voltage Dome</p> | <p>—</p> | <p>APD1^③DN^②</p> |

② Lens Color Codes

| Color | Code |
|--------|------|
| Amber | A |
| Green | G |
| Red | R |
| Blue | S |
| White | W |
| Yellow | Y |

③ Full Voltage Codes

| Voltage | Code |
|-----------|------|
| 6V AC/DC | 66 |
| 12V AC/DC | 11 |
| 24V AC/DC | 22 |
| 120V AC | QH2 |
| 240V AC | QM4 |

- 1. In place of ^②, specify the Lens/LED Color Code.
- 2. In place of ^③, specify the Full Voltage Code (LED voltage).
- 3. Yellow pilot light comes with white LED.

Non-Illuminated Selector Switches (Assembled)



Assembled Selector Switches

A S D 2 () () 11 NU - ()

Function

S: Selector Switch

Series Designation

D: TWND Series

Number of Positions

2: 2-Position
3: 3-Position

Spring Return Action

Blank: Maintained
1: Spring return from Right
2: Spring return from Left
3: 2-Way spring return from Left and Right

Circuit Number

(See Circuit # column of Selector Switch Contact Arrangement Chart on beginning on page 739.)

Contact Arrangement Code

10: 1NO 01: 1NC
20: 2NO 02: 2NC
40: 4NO 04: 4NC
11: 1NO-1NC 22: 2NO-2NC

Operator Style Code

Blank: Knob Operator
L: Lever Operator
K: Key Operator

- 1. Use only when interpreting part numbers. Do not use for developing part numbers.
- 2. Custom key removal codes available. Please contact IDEC for details.

Non-Illuminated Selector Switches (Assembled)

Non-Illuminated 2-Position Selector Switches

| Style | | | | | Part Number | | |
|------------|------------------|-------------------|------------------|----------------------|--|---|---|
| Contact | Mounting | Operator Position | | | Maintained | Spring Return from Right | Spring Return from Left |
| | | L | R | | | | |
| 1NO | 1 2 | 0 0 | X 0 | Knob Lever Key | ASD210NU ASD2L10NU ASD2K10NU | ASD2110NU ASD21L10NU ASD21K10NU | ASD2210NU ASD22L10NU ASD22K10NU |
| 1NC | 1 2 | X 0 | 0 0 | Knob Lever Key | ASD201NU ASD2L01NU ASD2K01NU | ASD2101NU ASD21L01NU ASD21K01NU | ASD2201NU ASD22L01NU ASD22K01NU |
| 1NO 1NC | 1 2 | 0 X | X 0 | Knob Lever Key | ASD211NU ASD2L11NU ASD2K11NU | ASD2111NU ASD21L11NU ASD21K11NU | ASD2211NU ASD22L11NU ASD22K11NU |
| 2NO | 1 2 | 0 0 | X X | Knob Lever Key | ASD220NU ASD2L20NU ASD2K20NU | ASD2120NU ASD21L20NU ASD21K20NU | ASD2220NU ASD22L20NU ASD22K20NU |
| 2NC | 1 2 | X X | 0 0 | Knob Lever Key | ASD202NU ASD2L02NU ASD2K02NU | ASD2102NU ASD21L02NU ASD21K02NU | ASD2202NU ASD22L02NU ASD22K02NU |
| 2NO 2NC | 1 2 3 4 | 0 X 0 X | X 0 X 0 | Knob Lever Key | ASD222NU ASD2L22NU ASD2K22NU | ASD2122NU ASD21L22NU ASD21K22NU | ASD2222NU ASD22L22NU ASD22K22NU |
| 2NO 2NC | 1 2 3 4 | 0 0 X X | X X 0 0 | Knob Lever Key | ASD222NU-111 ASD2L22NU-111 ASD2K22NU-111 | ASD2122NU-111 ASD21L22NU-111 ASD21K22NU-111 | ASD2222NU-111 ASD22L22NU-111 ASD22K22NU-111 |



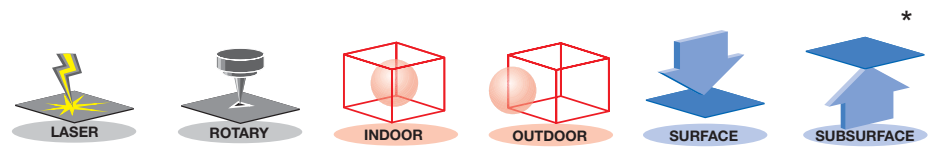
- The truth table indicates the operating position of contact block when the operator is switched to that position.
X = On (closed contacts) 0 = Off (open contacts)
X-X = Overlapping Contacts: Remain on (closed contacts) when switch is moved between these two positions.
- All knob and lever selector switches come in black. Other colors are available by ordering the knob or lever separately.
- Custom contact arrangements available, see page 739.

Non-Illuminated 3-Position Selector Switches

| Style | | | | | | Part Number | | | |
|------------|------------------|-------------------|------------------|------------------|----------------------|--|---|---|---|
| Contact | Mounting | Operator Position | | | | Maintained | Spring Return from Right | Spring Return from Left | Spring Return Two-Way |
| | | L | C | R | | | | | |
| 2NO | 1 2 | X 0 | 0 0 | 0 X | Knob Lever Key | ASD320NU ASD3L20NU ASD3K20NU | ASD3120NU ASD31L20NU ASD31K20NU | ASD3220NU ASD32L20NU ASD32K20NU | ASD3320NU ASD33L20NU ASD33K20NU |
| 2NC | 1 2 | 0 X | X X | X 0 | Knob Lever Key | ASD302NU ASD3L02NU ASD3K02NU | ASD3102NU ASD31L02NU ASD31K02NU | ASD3202NU ASD32L02NU ASD32K02NU | ASD3302NU ASD33L02NU ASD33K02NU |
| 2NO 2NC | 1 2 3 4 | X 0 0 X | 0 0 X X | 0 X X 0 | Knob Lever Key | ASD322NU ASD3L22NU ASD3K22NU | ASD3122NU ASD31L22NU ASD31K22NU | ASD3222NU ASD32L22NU ASD32K22NU | ASD3322NU ASD33L22NU ASD33K22NU |
| 2NO 2NC | 1 2 3 4 | X X 0 0 | 0 X X 0 | X 0 0 X | Knob Lever Key | ASD322NU-309 ASD3L22NU-309 ASD3K22NU-309 | ASD3122NU-309 ASD31L22NU-309 ASD31K22NU-309 | ASD3222NU-309 ASD32L22NU-309 ASD32K22NU-309 | ASD3322NU-309 ASD33L22NU-309 ASD33K22NU-309 |
| 2NO 2NC | 1 2 3 4 | 0 0 0 0 | X 0 X 0 | 0 X 0 X | Knob Lever Key | ASD322NU-310 ASD3L22NU-310 ASD3K22NU-310 | ASD3122NU-310 ASD31L22NU-310 ASD31K22NU-310 | ASD3222NU-310 ASD32L22NU-310 ASD32K22NU-310 | ASD3322NU-310 ASD33L22NU-310 ASD33K22NU-310 |
| 4NO | 1 2 3 4 | X 0 X 0 | 0 0 0 0 | 0 X 0 X | Knob Lever Key | ASD340NU ASD3L40NU ASD3K40NU | ASD3140NU ASD31L40NU ASD31K40NU | ASD3240NU ASD32L40NU ASD32K40NU | ASD3340NU ASD33L40NU ASD33K40NU |
| 4NC | 1 2 3 4 | 0 X 0 X | X X X X | X 0 X 0 | Knob Lever Key | ASD304NU ASD3L04NU ASD3K04NU | ASD3104NU ASD31L04NU ASD31K04NU | ASD3204NU ASD32L04NU ASD32K04NU | ASD3304NU ASD33L04NU ASD33K04NU |

GRAVOPLY™ ULTRA

- Badges
- Awards plaques
- Indoor and outdoor signage



- Satin or matt finish
- Unique 0.5 mm (.002") cap layer for detailed engraving
- UV stable
- Excellent for photo lasering
- Reduce inventory with one material for rotary, laser, indoor and outdoor needs

Specifications

| | |
|------------------------|------------------------------|
| Surface | Satin or Matt |
| Composition | DR Acrylic |
| Rotary engraving depth | 0.1 mm (.004") |
| Full sheet | 1220 mm x 610 mm (24" x 48") |
| Half sheet | 610 mm x 610 mm (24" x 24") |
| Quarter sheet | 610 mm x 305 mm (12" x 24") |

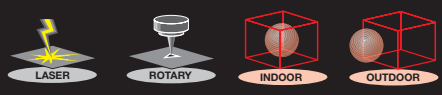
Capabilities

| | | | |
|-------------------|---|------|--------------|
| Interior | ■ | ■ | Exterior |
| Shear | ■ | ■ | Saw |
| Silk screen | ■ | ■ | Hot stamp |
| Scratch resistant | ■ | ■ | Flexible |
| Break resistant | | ■ | UV resistant |
| | | 80°C | Max. temp. |

| | Surface colour | Core colour | Matt 2-ply | | Satin 2-ply | |
|---|----------------|-------------|------------|--------|-------------|--------|
| | | | 0.5 mm | 1.6 mm | 1.6 mm | 2.4 mm |
| | | | .020" | 1/16" | 1/16" | 3/32" |
| ○ | clear* | white | 18965 | 19009 | | |
| ● | clear* | black | 18962 | 19006 | | |
| ● | white | red | | 18997 | | |
| ● | white | blue | | 18996 | | |
| ● | white | black | 18946 | 18984 | 29507 | |
| ● | yellow | black | 18955 | 18993 | 29511 | |
| ● | orange | white | | 19000 | | |
| ● | orange | black | | 29499 | | |
| ● | red | white | 18949 | 18987 | 29512 | |
| ● | red | black | | 29498 | | |
| ● | red | gold | | 29503 | | |
| ● | burgundy | white | | 18980 | | |
| ● | burgundy | gold | 18958 | 18999 | | |
| ● | green apple | white | 18970 | 19012 | 29513 | |
| ● | forest green | white | | 19001 | | |
| ● | forest green | gold | | 18998 | | |
| ● | pine green | white | | 29491 | | |
| ● | blue | white | 18952 | 18990 | 29510 | |
| ● | navy blue | white | | 29494 | | |
| ● | royal blue | white | | 19015 | | |
| ● | royal blue | gold | 18942 | 18979 | | |
| ● | brown | white | | 29495 | | |
| ● | black | white | 18943 | 18981 | 29508 | 29687 |
| ● | black | silver grey | | 19005 | | |
| ● | glossy black | gold | 18973 | | | |
| ● | matt black | gold | 18976 | 19004 | | |

* Suitable for subsurface engraving.

Gravoply™ Ultraglow



NEW

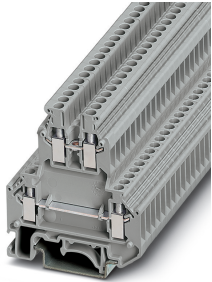
Photoluminescent

| | Surface colour | Core colour | Matt 2-ply |
|---|----------------|-------------|----------------|
| | | | 0.8 mm (1/32") |
| ○ | glow | white | 49884 |

Please note: This product allows for white engraving on the photoluminescent surface. 0.8 mm (1/32") thickness may be used to cut profile letters for DDA tactile signage applications. The glow times for this product meet the following norms: ISO:10012-1 & MIL-STD-45662A

Double-level terminal block - UKK 3 - 2770011

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Double-level terminal block, connection method: Screw connection, cross section: 0.2 mm² - 4 mm², AWG: 24 - 12, width: 5.2 mm, color: gray, mounting type: NS 35/7,5, NS 35/15, NS 32

Your advantages

- Large-surface labeling option



Key Commercial Data

| | |
|--------------------------------------|---|
| Packing unit | 1 pc |
| Minimum order quantity | 50 pc |
| GTIN |  4 017918 067755 |
| GTIN | 4017918067755 |
| Weight per Piece (excluding packing) | 12.800 g |
| Custom tariff number | 85369010 |
| Country of origin | China |

Technical data

General

| | |
|--|---------------------|
| Number of levels | 2 |
| Number of connections | 4 |
| Nominal cross section | 2.5 mm ² |
| Color | gray |
| Insulating material | PA |
| Flammability rating according to UL 94 | V0 |
| Rated surge voltage | 6 kV |

Double-level terminal block - UKK 3 - 2770011

Technical data

General

| | |
|---|---|
| Degree of pollution | 3 |
| Overvoltage category | III |
| Insulating material group | I |
| Connection in acc. with standard | IEC 60947-7-1 |
| Nominal current I_N | 24 A |
| Maximum load current | 32 A (with 4 mm ² conductor cross section) |
| Nominal voltage U_N | 500 V |
| Open side panel | Yes |
| Shock protection test specification | DIN EN 50274 (VDE 0660-514):2002-11 |
| Back of the hand protection | guaranteed |
| Finger protection | guaranteed |
| Result of surge voltage test | Test passed |
| Surge voltage test setpoint | 7.3 kV |
| Result of power-frequency withstand voltage test | Test passed |
| Power frequency withstand voltage setpoint | 1.89 kV |
| Checking the mechanical stability of terminal points (5 x conductor connection) | Test passed |
| Result of flexion and pull-out test | Test passed |
| Bending test rotation speed | 10 rpm |
| Bending test turns | 135 |
| Bending test conductor cross section/weight | 0.2 mm ² / 0.2 kg |
| | 2.5 mm ² / 0.7 kg |
| | 4 mm ² / 0.9 kg |
| Tensile test result | Test passed |
| Result of tight fit on support | Test passed |
| Tight fit on carrier | NS 32/NS 35 |
| Setpoint | 1 N |
| Result of voltage-drop test | Test passed |
| Result of temperature-rise test | Test passed |
| Short circuit stability result | Test passed |
| Conductor cross section short circuit testing | 2.5 mm ² |
| Short-time current | 0.3 kA |
| Conductor cross section short circuit testing | 4 mm ² |
| Short-time current | 0.48 kA |
| Result of thermal test | Test passed |
| Proof of thermal characteristics (needle flame) effective duration | 30 s |
| Relative insulation material temperature index (Elec.; UL 746 B) | 130 °C |

Double-level terminal block - UKK 3 - 2770011

Technical data

General

| | |
|---|-------------|
| Temperature index of insulation material (DIN EN 60216-1 (VDE 0304-21)) | 130 °C |
| Static insulating material application in cold | -60 °C |
| Surface flammability NFPA 130 (ASTM E 162) | passed |
| Specific optical density of smoke NFPA 130 (ASTM E 662) | passed |
| Smoke gas toxicity NFPA 130 (SMP 800C) | passed |
| Calorimetric heat release NFPA 130 (ASTM E 1354) | 28 MJ/kg |
| Fire protection for rail vehicles (DIN EN 45545-2) R22 | HL 1 - HL 3 |
| Fire protection for rail vehicles (DIN EN 45545-2) R23 | HL 1 - HL 3 |
| Fire protection for rail vehicles (DIN EN 45545-2) R24 | HL 1 - HL 3 |
| Fire protection for rail vehicles (DIN EN 45545-2) R26 | HL 1 - HL 3 |

Dimensions

| | |
|------------------|---------|
| Width | 5.2 mm |
| End cover width | 2.5 mm |
| Length | 56 mm |
| Height NS 35/7,5 | 62 mm |
| Height NS 35/15 | 69.5 mm |
| Height NS 32 | 67 mm |

Connection data

| | |
|---|----------------------|
| Connection method | Screw connection |
| Conductor cross section solid min. | 0.2 mm ² |
| Conductor cross section solid max. | 4 mm ² |
| Conductor cross section flexible min. | 0.2 mm ² |
| Conductor cross section flexible max. | 2.5 mm ² |
| Conductor cross section AWG min. | 24 |
| Conductor cross section AWG max. | 12 |
| Conductor cross section flexible, with ferrule without plastic sleeve min. | 0.25 mm ² |
| Conductor cross section flexible, with ferrule without plastic sleeve max. | 2.5 mm ² |
| Conductor cross section flexible, with ferrule with plastic sleeve min. | 0.25 mm ² |
| Conductor cross section flexible, with ferrule with plastic sleeve max. | 1.5 mm ² |
| Cross section with insertion bridge, solid max. | 2.5 mm ² |
| Cross section with insertion bridge, stranded max. | 2.5 mm ² |
| 2 conductors with same cross section, solid min. | 0.2 mm ² |
| 2 conductors with same cross section, solid max. | 1 mm ² |
| 2 conductors with same cross section, stranded min. | 0.2 mm ² |
| 2 conductors with same cross section, stranded max. | 1.5 mm ² |
| Two conductors with the same cross section stranded, with ferrule and without plastic sleeve, minimum | 0.25 mm ² |

Double-level terminal block - UKK 3 - 2770011

Technical data

Connection data

| | |
|--|---------------------|
| Two conductors with the same cross section stranded, with ferrule and without plastic sleeve, maximum | 1.5 mm ² |
| Two conductors with the same cross section, flexible, with TWIN ferrules, with plastic sleeve, minimum | 0.5 mm ² |
| Two conductors with the same cross section, flexible, with TWIN ferrules, with plastic sleeve, maximum | 1 mm ² |
| Cross section with insertion bridge, solid max. | 2.5 mm ² |
| Cross section with insertion bridge, stranded max. | 2.5 mm ² |
| Stripping length | 8 mm |
| Screw thread | M3 |
| Tightening torque, min | 0.5 Nm |
| Tightening torque max | 0.6 Nm |

Ambient conditions

| | |
|--|---|
| Operating temperature | -60 °C ... 105 °C (max. short-term operating temperature 130°C) |
| Ambient temperature (storage/transport) | -25 °C ... 60 °C (for a short time, not exceeding 24 h, -60 °C to +70 °C) |
| Permissible humidity (storage/transport) | 30 % ... 70 % |
| Ambient temperature (assembly) | -5 °C ... 70 °C |
| Ambient temperature (actuation) | -5 °C ... 70 °C |

Standards and Regulations

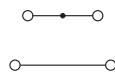
| | |
|--|---------------|
| Connection in acc. with standard | CSA |
| | IEC 60947-7-1 |
| Flammability rating according to UL 94 | V0 |

Environmental Product Compliance

| | |
|------------|---|
| REACH SVHC | Lead 7439-92-1 |
| China RoHS | Environmentally Friendly Use Period = 50 years |
| | For details about hazardous substances go to tab "Downloads", Category "Manufacturer's declaration" |

Drawings

Circuit diagram



Classifications

eCl@ss

| | |
|---------------|----------|
| eCl@ss 10.0.1 | 27141120 |
|---------------|----------|

Double-level terminal block - UKK 3 - 2770011

Classifications

eCl@ss

| | |
|-------------|----------|
| eCl@ss 11.0 | 27141120 |
| eCl@ss 4.0 | 27141100 |
| eCl@ss 4.1 | 27141100 |
| eCl@ss 5.0 | 27141100 |
| eCl@ss 5.1 | 27141100 |
| eCl@ss 6.0 | 27141100 |
| eCl@ss 7.0 | 27141120 |
| eCl@ss 9.0 | 27141120 |

ETIM

| | |
|----------|----------|
| ETIM 2.0 | EC000897 |
| ETIM 3.0 | EC000897 |
| ETIM 4.0 | EC000897 |
| ETIM 6.0 | EC000897 |
| ETIM 7.0 | EC000897 |

UNSPSC

| | |
|---------------|----------|
| UNSPSC 6.01 | 30211811 |
| UNSPSC 7.0901 | 39121410 |
| UNSPSC 11 | 39121410 |
| UNSPSC 12.01 | 39121410 |
| UNSPSC 13.2 | 39121410 |
| UNSPSC 18.0 | 39121410 |
| UNSPSC 19.0 | 39121410 |
| UNSPSC 20.0 | 39121410 |
| UNSPSC 21.0 | 39121410 |

Approvals

Approvals

Approvals

DNV GL / CSA / UL Recognized / KEMA-KEUR / cUL Recognized / IECCEB Scheme / EAC / RS / LR / cULus Recognized

Ex Approvals

Approval details

Double-level terminal block - UKK 3 - 2770011

Accessories

End clamp - CLIPFIX 35 - 3022218



Quick mounting end clamp for NS 35/7,5 DIN rail or NS 35/15 DIN rail, with marking option, width: 9.5 mm, color: gray

End clamp - CLIPFIX 35-5 - 3022276



Quick mounting end clamp for NS 35/7,5 DIN rail or NS 35/15 DIN rail, with marking option, with parking option for FBS...5, FBS...6, KSS 5, KSS 6, width: 5.15 mm, color: gray

End clamp - E/NS 35 N - 0800886



End clamp, width: 9.5 mm, color: gray

End clamp - E/UK - 1201442



End clamp, width: 9.5 mm, height: 35.3 mm, material: PA, length: 50.5 mm, Mounting on a DIN rail NS 32 or NS 35, color: gray

End clamp - E/UK 1 - 1201413



End clamps, for supporting the ends of double-level and three-level terminal blocks, width: 10 mm, color: gray

End cover

Double-level terminal block - UKK 3 - 2770011

Accessories

Spacer plate - DG-UKK 3/5 - 2770817



Spacer plate, to compensate for level offsets, length: 56 mm, width: 2.5 mm, height: 52 mm, color: gray

End cover - D-UKK 3/5 - 2770024



End cover, length: 56 mm, width: 2.5 mm, height: 52 mm, color: gray

Insertion bridge

Insertion bridge - EBL 3- 5 - 2303158



Insertion bridge, pitch: 5.2 mm, number of positions: 3, color: gray

Insertion bridge - EBL 2- 5 - 2303145



Insertion bridge, pitch: 5.2 mm, number of positions: 2, color: gray

Insertion bridge - EBL 10- 5 - 2303132



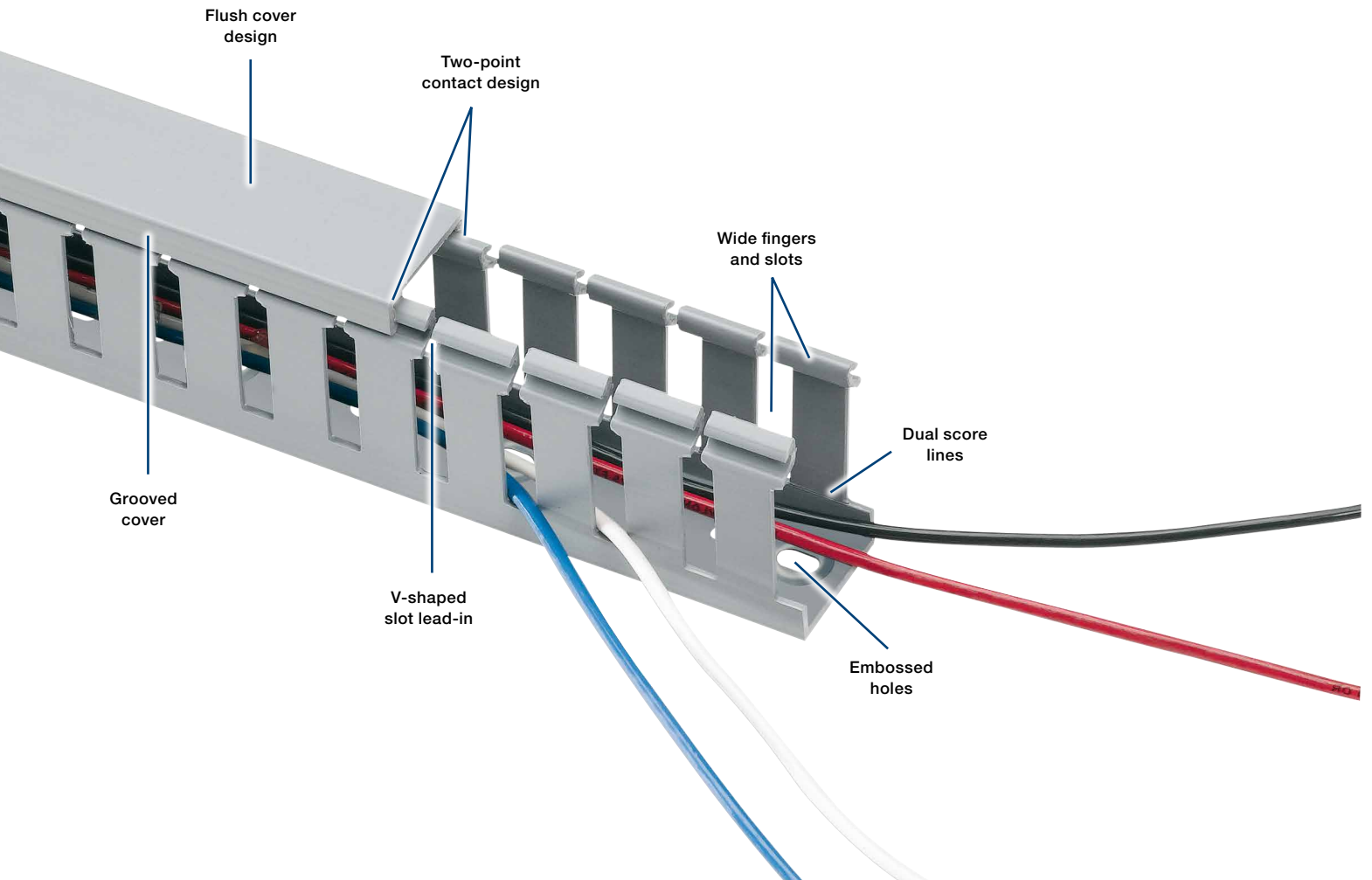
Insertion bridge, pitch: 5.2 mm, number of positions: 10, color: gray

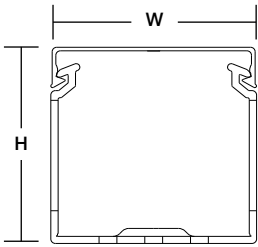
Wide slot wiring duct

A Greater sidewall rigidity with increased versatility.

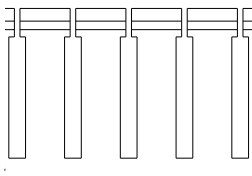
Wide slot wiring duct — PVC

- Wide fingers and slots increase rigidity and enable easier insertion of wiring bundles
- Non-slip cover does not slide easily and resists vibration
- Rounded edges keep hands and wires free of abrasion
- V-shaped slot lead-in enables easier and faster wire installation
- Dual score lines are designed to yield clean breakoffs at the base of the slot and the duct
- Restricted slot design ensures that wires are held with or without the cover inserted
- Cover attaches flush with sidewall for finished look
- Improved flush sidewall and cover style for greater wire capacity
- Versatile North American and DIN standard mounting holes enable use of the same duct for multiple applications
- Constructed of flame-retardant PVC
- Integrated mounting holes — larger sizes include staggered holes for mounting flexibility (see page B-5 for illustration)
- Lead-free construction

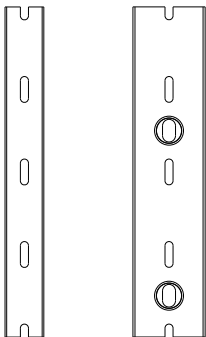




Front view with cover

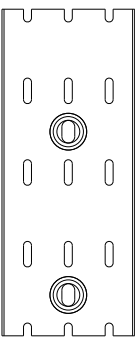


Side view



Pattern for 3/4" & 1"

Pattern for 1-1/2"



Pattern for 2", 2-1/2", 3", 4" & 6"

For a complete listing of wide slot dimensional details, see page B-5.



A

| Cat. no. | Description | Size (W x H) | | Cover cat. no. | Duct std. ctn. qty. | Cover std. ctn. qty. | Length (ft.) | |
|------------------|---------------------------|--------------|---------------|----------------|---------------------|----------------------|--------------|---|
| | | In. | mm | | | | | |
| TYD75X1WP[_]6 | 0.75 x 1 Wide slot duct | 0.94 x 1.14 | 23.9 x 27.7 | TYD75CP[_]6 | 120 | 120 | 6 | |
| TYD75X15WP[_]6 | 0.75 x 1.5 Wide slot duct | 0.94 x 1.60 | 23.9 x 39.6 | | | | | |
| TYD75X2WP[_]6 | 0.75 x 2 Wide slot duct | 0.94 x 2.10 | 23.9 x 52.6 | | | | | |
| TYD1X1WP[_]6 | 1 x 1 Wide slot duct | 1.25 x 1.14 | 31.8 x 27.7 | TYD1CP[_]6 | 120 | 120 | 6 | |
| TYD1X15WP[_]6 | 1 x 1.5 Wide slot duct | 1.25 x 1.60 | 31.8 x 39.9 | | | | | |
| TYD1X2WP[_]6 | 1 x 2 Wide slot duct | 1.25 x 2.10 | 31.8 x 52.8 | | | | | |
| TYD1X3WP[_]6 | 1 x 3 Wide slot duct | 1.25 x 3.05 | 31.8 x 77.7 | | | | | |
| TYD1X4WP[_]6 | 1 x 4 Wide slot duct | 1.25 x 4.37 | 31.8 x 111.3 | TYD15CP[_]6 | 60 | 120 | 6 | |
| TYD15X1WP[_]6 | 1.5 x 1 Wide slot duct | 1.75 x 1.14 | 44.5 x 27.7 | | | | | |
| TYD15X15WP[_]6 | 1.5 x 1.5 Wide slot duct | 1.75 x 1.60 | 44.5 x 39.9 | | | | | |
| TYD15X2WP[_]6 | 1.5 x 2 Wide slot duct | 1.75 x 2.10 | 44.5 x 52.8 | | | | | |
| TYD15X3WP[_]6 | 1.5 x 3 Wide slot duct | 1.75 x 3.05 | 44.5 x 77.7 | | | | | |
| TYD15X4WP[_]6 | 1.5 x 4 Wide slot duct | 1.75 x 4.37 | 44.5 x 111.3 | 60 | TYD25CP[_]6 | 120 | 120 | 6 |
| TYD2X1WP[_]6 | 2 x 1 Wide slot duct | 2.25 x 1.24 | 57.2 x 28.4 | | | | | |
| TYD2X15WP[_]6 | 2 x 1.5 Wide slot duct | 2.25 x 1.70 | 57.2 x 40.4 | | | | | |
| TYD2X2WP[_]6 | 2 x 2 Wide slot duct | 2.25 x 2.19 | 57.2 x 53.3 | | | | | |
| TYD2X3WP[_]6 | 2 x 3 Wide slot duct | 2.25 x 3.14 | 57.2 x 78.2 | | | | | |
| TYD2X4WP[_]6 | 2 x 4 Wide slot duct | 2.25 x 4.46 | 57.2 x 111.8 | | | | | |
| TYD2X5WP[_]6 | 2 x 5 Wide slot duct | 2.25 x 5.15 | 57.2 x 129.3 | 60 | TYD25CP[_]6 | 120 | 120 | 6 |
| TYD25X2WP[_]6 | 2.5 x 2 Wide slot duct | 2.75 x 2.19 | 69.9 x 53.6 | | | | | |
| TYD25X3WP[_]6 | 2.5 x 3 Wide slot duct | 2.75 x 3.14 | 69.9 x 78.2 | | | | | |
| TYD25X4WP[_]6 | 2.5 x 4 Wide slot duct | 2.75 x 4.46 | 69.9 x 111.8 | 60 | TYD3CP[_]6 | 120 | 120 | 6 |
| TYD3X1WP[_]6 | 3 x 1 Wide slot duct | 3.25 x 1.24 | 82.6 x 29.0 | | | | | |
| TYD3X2WP[_]6 | 3 x 2 Wide slot duct | 3.25 x 2.19 | 82.6 x 54.9 | | | | | |
| TYD3X3WP[_]6 | 3 x 3 Wide slot duct | 3.25 x 3.14 | 82.6 x 79.8 | | | | | |
| TYD3X4WP[_]6 | 3 x 4 Wide slot duct | 3.25 x 4.46 | 82.6 x 113.5 | | | | | |
| TYD3X5WP[_]6 | 3 x 5 Wide slot duct | 3.25 x 5.15 | 82.6 x 130.6 | 60 | TYD4CP[_]6 | 120 | 120 | 6 |
| TYD4X15WP[_]6 | 4 x 1.5 Wide slot duct | 4.25 x 1.70 | 108.0 x 42.4 | | | | | |
| TYD4X2WP[_]6 | 4 x 2 Wide slot duct | 4.25 x 2.19 | 108.0 x 55.1 | | | | | |
| TYD4X3WP[_]6 | 4 x 3 Wide slot duct | 4.25 x 3.14 | 108.0 x 80.0 | | | | | |
| TYD4X4WP[_]6 | 4 x 4 Wide slot duct | 4.25 x 4.46 | 108.0 x 113.8 | | | | | |
| TYD4X5WP[_]6 | 4 x 5 Wide slot duct | 4.25 x 5.15 | 108.0 x 130.8 | 30 | TYD6CP[_]6 | 30 | 60 | 6 |
| TYD6X4WP[_]6 | 6 x 4 Wide slot duct | 6.25 x 4.46 | 158.8 x 114.0 | | | | | |

[] = space for color identifier:

- G = Gray
- W = White
- B = Black
- I = Intrinsic blue

- Standard lengths are 6 feet.
- + Catalog number must be completed by adding suffix G for gray, W for white, I for intrinsic blue, B for black.
- Example: TYD75X1WPG6 is a 0.75" x 1" wide slot gray duct.
- To order duct without mounting holes, add suffix NM to catalog number.
- Example: TYD75X1WPGNM6 is a 0.75" x 1" wide slot gray duct with no mounting holes.
- To order adhesive-backed duct, add suffix A to Catalog Number.
- Example: TYD75X1WPGA6 is a 0.75" x 1" wide slot gray duct with adhesive backing. Shelf life for adhesive is 1 year.
- PVC vinyl duct is UL® Recognized , CSA certified and CE compliant.

DIN rail perforated - NS 35/ 7.5 PERF 1000MM - 0807012

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DIN rail perforated, Standard profile, width: 35 mm, height: 7.5 mm, acc. to EN 60715, material: Steel, galvanized, passivated with a thick layer, length: 1000 mm, color: silver

Key Commercial Data

| | |
|--------------------------------------|---------------|
| Packing unit | 10 STK |
| GTIN | |
| GTIN | 4017918254889 |
| Weight per Piece (excluding packing) | 320.000 g |
| Custom tariff number | 72166190 |
| Country of origin | Germany |

Technical data

Dimensions

| | |
|--------------------|----------|
| Height | 7.5 mm |
| Length | 1000 mm |
| Width | 35 mm |
| Hole width | 15.00 mm |
| Hole height | 6.20 mm |
| Drill hole spacing | 25.00 mm |

General

| | |
|----------|---|
| Material | Steel |
| Coating | galvanized, passivated with a thick layer |
| Color | silver |

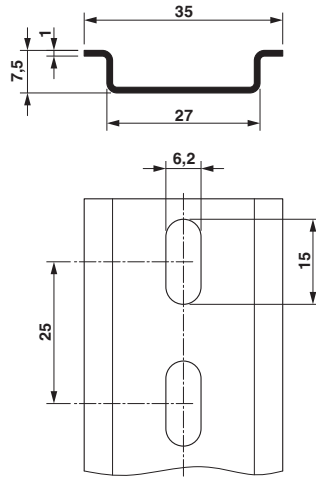
Standards and Regulations

| | |
|---------------|------------------|
| Test standard | acc. to EN 60715 |
|---------------|------------------|

Drawings

DIN rail perforated - NS 35/ 7.5 PERF 1000MM - 0807012

Dimensional drawing





KA26U

by Burndy
Catalog ID: KA26U

Prop 65 Notice

Aluminum Universal Terminal, 1 Hole, 6-2/0 AWG (Str), 1/4" Stud, 1 Screw, Al/Cu Rated, Tin Plated.

Features: These Dual-Rated One-Conductor Lugs Are Constructed From High Strength Aluminum Alloy And Electro Tin-Plated To Provide Low Contact Resistance, Stud/bolt Hole Size: 1/4 IN, Set Screw Type: Allen Key, Length: 1.47 IN, Installation Torque: 120 IN-LB, Width: 0.63 IN, Height: 0.8 IN, Dimension D: 0.81 IN, Dimension N: 0.47 IN, Dimension T: 0.19 IN

Product Details

General

| | |
|---------------------------------------|------------------------------------|
| Application | For Aluminum And Copper Conductors |
| Connector Type | Terminal |
| Installation Torque Recommended in-lb | 120 LBS/in |
| Material | Aluminum |
| Material - Hardware | Aluminum |
| Physical Attribute - Number of Holes | 1 |
| Physical Attribute - Number of Screws | 1 |
| Physical Attribute - Screw Type | Allen |
| Plated | Y |
| Plating Type | Tin |
| Sub Brand | UNIVERSAL TERM |
| Temperature Rating | 194 |
| Type | Bolted Lugs & Terminals |
| UPC | 781810370100 |

Dimensions

| | |
|---------------------------------|-----------|
| Dimension - Bolt Hole Size inch | 0.25 in |
| Dimension - D inch | 0.81 in |
| Dimension - Height fraction | 4/5 in |
| Dimension - Height inch | 0.80 in |
| Dimension - Hole Size inch | 0.27 in |
| Dimension - Hole Size mm | 7 mm |
| Dimension - L Length Overall mm | 37 mm |
| Dimension - Length Overall inch | 1.47 in |
| Dimension - N inch | 0.45 in |
| Dimension - Pad Width inch | 0.64 in |
| Dimension - Stud Size inch | 1/4 |
| Dimension - Width fraction | 63/100 in |
| Dimension - Width inch | 0.63 in |

| | |
|----------------------|-------|
| Dimension - Width mm | 16 mm |
|----------------------|-------|

Conductor Related

| | |
|-----------------------------------|---|
| Conductor - AL Str Size | 14;4;3;2;1;1/0;2/0 |
| Conductor - AL Str Size Range | 14-2/0 |
| Conductor - Copper Str Size | 14;5;4;3;2;1;1/0;2/0 |
| Conductor - Copper Str Size Range | 14-2/0 |
| Conductor - Nominal Diameter | 0.184, 0.184, 0.206, 0.232, 0.232, 0.260, 0.260, 0.292, 0.320, 0.328, 0.360, 0.368, 0.390, 0.414, 0.438 |
| Conductor Type | <ul style="list-style-type: none"> • CU C Str-Size • AL C Str-Size |
| Number Of Conductors | 1 |

Certifications and Compliance

| | |
|---|--------------|
| Certification - CSA Approved | Yes |
| Certification - UL Listed Direct Burial | No |
| Industry Standard(s) | UL 486A-486B |
| Standards - Industry Standards Met | UL 486A-486B |
| Standards - RoHS Compliance Status | EX |
| UL Listed | Yes |

Logistics

| | |
|-----------------------|--------|
| Carton Quantity | 900 EA |
| Minimum Pack Quantity | 50 |

For further technical assistance, please contact us

BURNDY Headquarters

47 East Industrial Park Drive
Manchester, New Hampshire 03109

Customer Service Hours:

8 AM - 8 PM Eastern Monday-Friday
Emergency Service 24-hours/365 Days
Phone: 1-800-346-4175
1-603-647-5299 (International)

TAB 6



Worldwide Experts
in **Water Treatment**

YOUR OVIVO SUPPORT NUMBER

1.855.GO.OVIVO

FOR MORE INFORMATION ON PARTS,
SERVICES, SUPPORT & MANUALS, VISIT

OVIVOWATER.COM

PRODUCT NAME:

Ovivo® Clarifier Drives

ORDER NUMBER:

CSW0001517-01

SERIAL NUMBER:

CSW0001517-01A

NOTES:

**Ø160 FT C3D CLARIFIER
C60LT DRIVE UNIT (110K)
FINAL RAKE SPEED: 0.032 RPM**

MFG YEAR: 2021



**Worldwide Experts
in Water Treatment**

YOUR OVIVO SUPPORT NUMBER

1.855.GO.OVIVO

FOR MORE INFORMATION ON PARTS,
SERVICES, SUPPORT & MANUALS, VISIT

OVIVOWATER.COM

PRODUCT NAME:

Ovivo® Clarifier Drives

ORDER NUMBER:

CSW0001517-01

SERIAL NUMBER:

CSW0001517-01B

NOTES:

**Ø160 FT C3D CLARIFIER
C60LT DRIVE UNIT (110K)
FINAL RAKE SPEED: 0.032 RPM**

MFG YEAR: 2021



YOUR OVIVO SUPPORT NUMBER

1.855.GO.OVIVO

FOR MORE INFORMATION ON PARTS,
SERVICES, SUPPORT & MANUALS, VISIT

OVIVOWATER.COM

PRODUCT NAME:

Ovivo[®] Clarifier Drives

ORDER NUMBER:

CSW0001517-01

SERIAL NUMBER:

CSW0001517-01C

NOTES:

**Ø160 FT C3D CLARIFIER
C60LT DRIVE UNIT (110K)
FINAL RAKE SPEED: 0.032 RPM**

MFG YEAR: 2021



**Worldwide Experts
in Water Treatment**

YOUR OVIVO SUPPORT NUMBER

1.855.GO.OVIVO

FOR MORE INFORMATION ON PARTS,
SERVICES, SUPPORT & MANUALS, VISIT

OVIVOWATER.COM

PRODUCT NAME:

Ovivo® Clarifier Drives

ORDER NUMBER:

CSW0001517-01

SERIAL NUMBER:

CSW0001517-01D

NOTES:

**Ø160 FT C3D CLARIFIER
C60LT DRIVE UNIT (110K)
FINAL RAKE SPEED: 0.032 RPM**

MFG YEAR: 2021

Checklist

OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation and Maintenance Manual

CUSTOMER NAME: Dondlinger & Sons Construction

Section: 02-BC7

PROJECT: Wichita WWTP

Revision: 1

CSW0001517-01

Date: 11/18/2021

FINAL MECHANICAL CHECKLIST

Page 1 of 40

DRIVE SERIAL NUMBER: CSW0001517-01 A

Sign off by initialing and dating each check made. When the 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 clarifier mechanism with drive unit furnished to the Ovivo Project Management Department to ensure warranty coverage.

| CHECK | REFERENCE | INSTALLER SIGN OFF | DATE |
|--|--|--------------------|------|
| Check to be sure all shipping braces have been removed | Receiving and Inspection and Lifting Precautions instructions in the General section of the Ovivo instruction manual | | |
| Check elevation of the walkway mounting surfaces | General Arrangement drawing and Check The Tank instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check for specified top of grout elevation at the tank wall and center of the tank | General Arrangement drawings and Suggested Tank Grouting Procedure instruction in the Installation instruction section of the Ovivo instruction manual | | |
| Check tank bottom for specified slope at approximate 90° locations around tank curve | General Arrangement drawing, Check The Tank instructions and Suggested Tank Grouting Procedures instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check existing walkway and platform for proper reinstallation | Original installation manual | | |
| Check the drive adapter for proper installation to the drive | General Erection drawing, Drive Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the drive adapter has been field drilled as specified for connection to the platform | General Erection drawing, Drive Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check platform-to-drive connections for specified fasteners | General Erection drawing, Platform and Walkway Re-Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check platform-to-drive connection fasteners are secure | General Erection drawing, Platform and Walkway Re-Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI supports for proper installation to the EDI and cage | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI support connection fasteners are secure | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |
| Check for proper orientation of the EDI flow gates. | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |

OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation and Maintenance Manual

CUSTOMER NAME: Dondlinger & Sons Construction

Section: 02-BC7

PROJECT: Wichita WWTP

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FINAL MECHANICAL CHECKLIST

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| CHECK | REFERENCE | INSTALLER SIGN OFF | DATE |
|---|--|--------------------|------|
| Check the EDI and cage for alignment and use of shimming, if required | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI-to-cage connections for specified fasteners | General Erection drawing, parts list and Install the Cage and EDI instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI-to-cage connection fasteners are secure | General Erection drawing and Install the Cage and EDI instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge manifold for centering around and for clearance with the influent column | Sludge Manifold and Anchor Ring Installation Instruction in the Installation section of the Ovivo instruction manual | | |
| Check existing feedwell supports have been relocated as required for installation of the new feedwell | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check existing feedwell support connection fasteners are secure | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the feedwell frame for alignment of the upper rim | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the feedwell frame for specified elevation and all around level | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the FRP panels have been coated with resin on all cuts | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the FRP panels for proper installation to the feedwell frames | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the FRP panel connection fasteners are secure | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the rake arms for specified clearance with tank bottom | General Arrangement drawing, Rake Arm Erection drawing and the Rake Arm Installation and Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check arms for square alignment | General Arrangement drawing and Rake Arm Installation instructions in the Installation section of the Ovivo instruction manual | | |

OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation and Maintenance Manual

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| CHECK | REFERENCE | INSTALLER SIGN OFF | DATE |
|---|---|--------------------|------|
| Check arm splices and arm-to-cage connections for specified welds | Rake Arm Erection drawing and Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check arm-to-cage welds to be sure load is transferred from the arm to the cage (not arm to shim) | Rake Arm Erection drawing and Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check manifold connections for specified fasteners | General Erection drawing, parts list and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check manifold connection fasteners are secure | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check manifold-to-column and manifold to tank bottom seals for proper installation and alignment | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the manifold-to-cage connections for specified welding | General Erection drawing, parts list and Final Plumb the Cage instructions in the Installation section of the Ovivo instruction manual | | |
| Check the manifold anchor ring for proper installation | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the manifold anchor ring fasteners are secure | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the anchor ring, sludge recycle pipe (not by Ovivo) and influent column for proper grouting | General Arrangement Drawing and the Grouting under the Sludge Manifold and Anchor Ring instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure grout has not fallen into the sludge return pipe (not by Ovivo) or influent pipe (not by Ovivo) | Grouting under the Sludge Manifold and Anchor Ring instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge duct sections for specified fasteners and gaskets. | Rake Arm Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge duct fasteners and gaskets are secure | Rake Arm Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge ducts for alignment with sludge manifold and that the ducts are in line with the centerline of the rake arms | Duct Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge duct-to-sludge duct support for specified welds | Rake Arm Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |

OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation and Maintenance Manual

CUSTOMER NAME: Dondlinger & Sons Construction

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PROJECT: Wichita WWTP

Revision: 1

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Date: 11/18/2021

FINAL MECHANICAL CHECKLIST

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| CHECK | REFERENCE | INSTALLER SIGN OFF | DATE |
|---|---|--------------------|------|
| Check the duct supports-to-rake arm connection for specified welds. | Rake Arm Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check tank grout for proper installation | General Arrangement drawing and Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |
| Check for minimum one inch tank grout thickness | General Arrangement drawing and Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |
| Check squeegees for minimum clearance with bottom of tank all around tank | General Arrangement drawing and Squeegee Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check squeegee-to-duct connection for specified fasteners and back-up bars | Rake Arm and Duct Erection drawing, parts list and Squeegee Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check squeegee-to-duct connection fasteners are secure | Rake Arm and Duct Erection drawing and Squeegee Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check static torque tests have been successfully completed | Static Torque Test drawing and Torque Test Warnings in the Installation section of the Ovivo instruction manual | | |
| Check CMD anchor bolts for proper size, projection, elevation and orientation | General Arrangement drawing, General Erection drawing, parts list and Check The Tank instructions in the Installation section of the Ovivo instruction manual | | |
| Check CMD anchor nuts are secure | General Erection drawing and Influent Column Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check influent column anchor bolts for proper size, projection, elevation and orientation | General Arrangement drawing, General Erection drawing, parts list and Check The Tank instructions in the Installation section of the Ovivo instruction manual | | |
| Check influent column anchor nuts are secure | General Erection drawing and Influent Column Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure grout has not fallen into the sludge drain pocket | Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure the template boards have been removed from the rake arms | Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |

OVIVO® 160' C3D-CMD Clarifier with C60LT Drive Installation and Maintenance Manual

CUSTOMER NAME: Dondlinger & Sons Construction

Section: 02-BC7

PROJECT: Wichita WWTP

Revision: 1

CSW0001517-01

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FINAL MECHANICAL CHECKLIST

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| CHECK | REFERENCE | INSTALLER SIGN OFF | DATE |
|--|---|--------------------|------|
| Check the weirs for elevation and level | General Arrangement drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure mastic sealer (if required) has been installed between the weirs and their mounting surface | General Arrangement drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the baffle for specified radius all around | General Arrangement drawing and Skimming Erection drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the baffle for specified elevation | General Arrangement drawing and Skimming Erection drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box for level and proper elevation | General Arrangement drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box flexible connector and hose clamp have been properly installed | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box-to-baffle connections for specified fasteners | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box-to-baffle connection fasteners are secure | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box support-to-scum box connections for specified fasteners | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box support-to-scum box connection fasteners are secure | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |

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|--|--|-----------------------|------|
| Check scum box support-to-tank wall connection for specified anchor bolts | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box support-to-tank wall anchor nuts are secure | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the skimmer arms for specified elevation and level | Skimming Erection drawing, General Arrangement drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimming device assembly fasteners are secure | Skimming Device Assembly drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the skimmer arm-to-skimmer support connections for specified fasteners | Skimming Erection drawing, parts list and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer arm-to-skimmer support connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the skimmer blade-to-skimmer arm connection fasteners are secure | Skimming Erection drawing, parts list and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer blade-to-skimmer brace connections for specified fasteners | Skimming Erection drawing, parts list and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer blade-to-skimmer brace connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer vertical supports for specified position on rake arm | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer vertical support-to-rake arm connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer vertical support brace-to-rake connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| Check skimmer vertical support brace-to-vertical support connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check for the 6" clearance between the skimmer blade and feedwell | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the scum scrapers for contact with the wiping surfaces on the baffles and scum box | Skimming Erection drawing, Skimming Device Maintenance and Adjustment instructions, and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum scraper for parallel alignment with the scum box discharge leading drop edge | Skimming Erection drawing, Skimming Device Maintenance and Adjustment instructions, and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check for specified spring tension on vertical hinged skimmer | Skimming Erection drawing, Skimmer Assembly drawing, Skimming Device Maintenance and Adjustment instructions, and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the flush valve assembly for specified fasteners | Flush Valve Erection drawing, Flush Valve Assembly drawing, parts list and Scum Box Flushing System Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check flush valve assembly fasteners are secure | Flush Valve Erection drawing, Flush Valve Assembly drawing and Scum Box Flushing System Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the flush valve assembly for smooth operation | Flush Valve Erection drawing, Flush Valve Assembly drawing and Scum Box Flushing System Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure all blocking and shoring used in the erection of the equipment has been removed from the tank | Pre-Start-Up Check instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check structural components for specified final painting. Inspect painted surfaces for deterioration of paint | General Arrangement drawing and Storage precautions in the General section of the Ovivo instruction manual | | |
| Check drive-to-column connection for specified fasteners | General Erection drawing, parts list, and the Drive Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| 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 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 main gear has been filled with specified oil type/viscosity | Drive Lubrication instructions in the Ovivo instruction manual | | |
| Check worm gear has 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 bearing grease lubrication | Manufacturer's instructions in the Accessory Equipment section of the Ovivo instruction manual | | |
| Check chain lubrication | Drive Lubrication instructions in 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 gearmotor wiring | Manufacturer's instructions in the Accessory Equipment section of the Ovivo instruction manual, and Ovivo Control Panel Schematics in the Ovivo instruction manual. All interconnecting wiring must meet local electrical codes. | | |
| Check drive motor is wired so an automatic restarting of the motor cannot occur after a drive control shutdown, following a torque load | Ovivo Control Panel Schematics in the Ovivo instruction manual | | |
| Check drive control wiring | Ovivo Control Panel Schematics 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 | Ovivo Control Panel Schematics in 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 | | |

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| 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 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-to-drive connections have been shimmed to fill in any gaps between the drive and cage | 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 | | |
| 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 guard is 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 | | |

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DRIVE SERIAL NUMBER: CSW0001517-01 B

Sign off by initialing and dating each check made. When the 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 clarifier mechanism with drive unit furnished to the Ovivo Project Management Department to ensure warranty coverage.

| CHECK | REFERENCE | INSTALLER SIGN OFF | DATE |
|--|--|--------------------|------|
| Check to be sure all shipping braces have been removed | Receiving and Inspection and Lifting Precautions instructions in the General section of the Ovivo instruction manual | | |
| Check elevation of the walkway mounting surfaces | General Arrangement drawing and Check The Tank instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check for specified top of grout elevation at the tank wall and center of the tank | General Arrangement drawings and Suggested Tank Grouting Procedure instruction in the Installation instruction section of the Ovivo instruction manual | | |
| Check tank bottom for specified slope at approximate 90° locations around tank curve | General Arrangement drawing, Check The Tank instructions and Suggested Tank Grouting Procedures instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check existing walkway and platform for proper reinstallation | Original installation manual | | |
| Check the drive adapter for proper installation to the drive | General Erection drawing, Drive Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the drive adapter has been field drilled as specified for connection to the platform | General Erection drawing, Drive Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check platform-to-drive connections for specified fasteners | General Erection drawing, Platform and Walkway Re-Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check platform-to-drive connection fasteners are secure | General Erection drawing, Platform and Walkway Re-Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI supports for proper installation to the EDI and cage | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI support connection fasteners are secure | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |
| Check for proper orientation of the EDI flow gates. | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |

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| Check the EDI and cage for alignment and use of shimming, if required | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI-to-cage connections for specified fasteners | General Erection drawing, parts list and Install the Cage and EDI instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI-to-cage connection fasteners are secure | General Erection drawing and Install the Cage and EDI instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge manifold for centering around and for clearance with the influent column | Sludge Manifold and Anchor Ring Installation Instruction in the Installation section of the Ovivo instruction manual | | |
| Check existing feedwell supports have been relocated as required for installation of the new feedwell | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check existing feedwell support connection fasteners are secure | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the feedwell frame for alignment of the upper rim | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the feedwell frame for specified elevation and all around level | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the FRP panels have been coated with resin on all cuts | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the FRP panels for proper installation to the feedwell frames | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the FRP panel connection fasteners are secure | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the rake arms for specified clearance with tank bottom | General Arrangement drawing, Rake Arm Erection drawing and the Rake Arm Installation and Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check arms for square alignment | General Arrangement drawing and Rake Arm Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| Check arm splices and arm-to-cage connections for specified welds | Rake Arm Erection drawing and Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check arm-to-cage welds to be sure load is transferred from the arm to the cage (not arm to shim) | Rake Arm Erection drawing and Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check manifold connections for specified fasteners | General Erection drawing, parts list and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check manifold connection fasteners are secure | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check manifold-to-column and manifold to tank bottom seals for proper installation and alignment | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the manifold-to-cage connections for specified welding | General Erection drawing, parts list and Final Plumb the Cage instructions in the Installation section of the Ovivo instruction manual | | |
| Check the manifold anchor ring for proper installation | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the manifold anchor ring fasteners are secure | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the anchor ring, sludge recycle pipe (not by Ovivo) and influent column for proper grouting | General Arrangement Drawing and the Grouting under the Sludge Manifold and Anchor Ring instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure grout has not fallen into the sludge return pipe (not by Ovivo) or influent pipe (not by Ovivo) | Grouting under the Sludge Manifold and Anchor Ring instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge duct sections for specified fasteners and gaskets. | Rake Arm Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge duct fasteners and gaskets are secure | Rake Arm Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge ducts for alignment with sludge manifold and that the ducts are in line with the centerline of the rake arms | Duct Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge duct-to-sludge duct support for specified welds | Rake Arm Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| Check the duct supports-to-rake arm connection for specified welds. | Rake Arm Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check tank grout for proper installation | General Arrangement drawing and Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |
| Check for minimum one inch tank grout thickness | General Arrangement drawing and Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |
| Check squeegees for minimum clearance with bottom of tank all around tank | General Arrangement drawing and Squeegee Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check squeegee-to-duct connection for specified fasteners and back-up bars | Rake Arm and Duct Erection drawing, parts list and Squeegee Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check squeegee-to-duct connection fasteners are secure | Rake Arm and Duct Erection drawing and Squeegee Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check static torque tests have been successfully completed | Static Torque Test drawing and Torque Test Warnings in the Installation section of the Ovivo instruction manual | | |
| Check CMD anchor bolts for proper size, projection, elevation and orientation | General Arrangement drawing, General Erection drawing, parts list and Check The Tank instructions in the Installation section of the Ovivo instruction manual | | |
| Check CMD anchor nuts are secure | General Erection drawing and Influent Column Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check influent column anchor bolts for proper size, projection, elevation and orientation | General Arrangement drawing, General Erection drawing, parts list and Check The Tank instructions in the Installation section of the Ovivo instruction manual | | |
| Check influent column anchor nuts are secure | General Erection drawing and Influent Column Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure grout has not fallen into the sludge drain pocket | Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure the template boards have been removed from the rake arms | Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |

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| Check the weirs for elevation and level | General Arrangement drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure mastic sealer (if required) has been installed between the weirs and their mounting surface | General Arrangement drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the baffle for specified radius all around | General Arrangement drawing and Skimming Erection drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the baffle for specified elevation | General Arrangement drawing and Skimming Erection drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box for level and proper elevation | General Arrangement drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box flexible connector and hose clamp have been properly installed | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box-to-baffle connections for specified fasteners | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box-to-baffle connection fasteners are secure | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box support-to-scum box connections for specified fasteners | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box support-to-scum box connection fasteners are secure | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| Check scum box support-to-tank wall connection for specified anchor bolts | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box support-to-tank wall anchor nuts are secure | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the skimmer arms for specified elevation and level | Skimming Erection drawing, General Arrangement drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimming device assembly fasteners are secure | Skimming Device Assembly drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the skimmer arm-to-skimmer support connections for specified fasteners | Skimming Erection drawing, parts list and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer arm-to-skimmer support connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the skimmer blade-to-skimmer arm connection fasteners are secure | Skimming Erection drawing, parts list and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer blade-to-skimmer brace connections for specified fasteners | Skimming Erection drawing, parts list and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer blade-to-skimmer brace connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer vertical supports for specified position on rake arm | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer vertical support-to-rake arm connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer vertical support brace-to-rake connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| Check skimmer vertical support brace-to-vertical support connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check for the 6" clearance between the skimmer blade and feedwell | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the scum scrapers for contact with the wiping surfaces on the baffles and scum box | Skimming Erection drawing, Skimming Device Maintenance and Adjustment instructions, and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum scraper for parallel alignment with the scum box discharge leading drop edge | Skimming Erection drawing, Skimming Device Maintenance and Adjustment instructions, and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check for specified spring tension on vertical hinged skimmer | Skimming Erection drawing, Skimmer Assembly drawing, Skimming Device Maintenance and Adjustment instructions, and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the flush valve assembly for specified fasteners | Flush Valve Erection drawing, Flush Valve Assembly drawing, parts list and Scum Box Flushing System Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check flush valve assembly fasteners are secure | Flush Valve Erection drawing, Flush Valve Assembly drawing and Scum Box Flushing System Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the flush valve assembly for smooth operation | Flush Valve Erection drawing, Flush Valve Assembly drawing and Scum Box Flushing System Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure all blocking and shoring used in the erection of the equipment has been removed from the tank | Pre-Start-Up Check instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check structural components for specified final painting. Inspect painted surfaces for deterioration of paint | General Arrangement drawing and Storage precautions in the General section of the Ovivo instruction manual | | |
| Check drive-to-column connection for specified fasteners | General Erection drawing, parts list, and the Drive Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| CHECK | REFERENCE | INSTALLER SIGN OFF | DATE |
|--|--|--------------------|------|
| 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 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 main gear has been filled with specified oil type/viscosity | Drive Lubrication instructions in the Ovivo instruction manual | | |
| Check worm gear has 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 bearing grease lubrication | Manufacturer's instructions in the Accessory Equipment section of the Ovivo instruction manual | | |
| Check chain lubrication | Drive Lubrication instructions in 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 gearmotor wiring | Manufacturer's instructions in the Accessory Equipment section of the Ovivo instruction manual, and Ovivo Control Panel Schematics in the Ovivo instruction manual. All interconnecting wiring must meet local electrical codes. | | |
| Check drive motor is wired so an automatic restarting of the motor cannot occur after a drive control shutdown, following a torque load | Ovivo Control Panel Schematics in the Ovivo instruction manual | | |
| Check drive control wiring | Ovivo Control Panel Schematics 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 | Ovivo Control Panel Schematics in 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 | | |

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|---|--|--------------------|------|
| 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 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-to-drive connections have been shimmed to fill in any gaps between the drive and cage | 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 | | |
| 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 guard is 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 | | |

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|--|---|--------------------|------|
| 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 gearmotor | | | |
| 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 | | |
| <u>NOTES AND COMMENTS:</u> | | | |
| | | | |

(Installer/Erector)

(Date)

Receipt of Completed Checklist Acknowledged by Ovivo:

(Ovivo Service Representative)

(Date)

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DRIVE SERIAL NUMBER: CSW0001517-01 C

Sign off by initialing and dating each check made. When the 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 clarifier mechanism with drive unit furnished to the Ovivo Project Management Department to ensure warranty coverage.

| CHECK | REFERENCE | INSTALLER SIGN OFF | DATE |
|--|--|--------------------|------|
| Check to be sure all shipping braces have been removed | Receiving and Inspection and Lifting Precautions instructions in the General section of the Ovivo instruction manual | | |
| Check elevation of the walkway mounting surfaces | General Arrangement drawing and Check The Tank instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check for specified top of grout elevation at the tank wall and center of the tank | General Arrangement drawings and Suggested Tank Grouting Procedure instruction in the Installation instruction section of the Ovivo instruction manual | | |
| Check tank bottom for specified slope at approximate 90° locations around tank curve | General Arrangement drawing, Check The Tank instructions and Suggested Tank Grouting Procedures instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check existing walkway and platform for proper reinstallation | Original installation manual | | |
| Check the drive adapter for proper installation to the drive | General Erection drawing, Drive Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the drive adapter has been field drilled as specified for connection to the platform | General Erection drawing, Drive Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check platform-to-drive connections for specified fasteners | General Erection drawing, Platform and Walkway Re-Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check platform-to-drive connection fasteners are secure | General Erection drawing, Platform and Walkway Re-Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI supports for proper installation to the EDI and cage | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI support connection fasteners are secure | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |
| Check for proper orientation of the EDI flow gates. | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |

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| CHECK | REFERENCE | INSTALLER SIGN OFF | DATE |
|---|--|--------------------|------|
| Check the EDI and cage for alignment and use of shimming, if required | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI-to-cage connections for specified fasteners | General Erection drawing, parts list and Install the Cage and EDI instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI-to-cage connection fasteners are secure | General Erection drawing and Install the Cage and EDI instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge manifold for centering around and for clearance with the influent column | Sludge Manifold and Anchor Ring Installation Instruction in the Installation section of the Ovivo instruction manual | | |
| Check existing feedwell supports have been relocated as required for installation of the new feedwell | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check existing feedwell support connection fasteners are secure | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the feedwell frame for alignment of the upper rim | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the feedwell frame for specified elevation and all around level | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the FRP panels have been coated with resin on all cuts | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the FRP panels for proper installation to the feedwell frames | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the FRP panel connection fasteners are secure | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the rake arms for specified clearance with tank bottom | General Arrangement drawing, Rake Arm Erection drawing and the Rake Arm Installation and Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check arms for square alignment | General Arrangement drawing and Rake Arm Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| Check arm splices and arm-to-cage connections for specified welds | Rake Arm Erection drawing and Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check arm-to-cage welds to be sure load is transferred from the arm to the cage (not arm to shim) | Rake Arm Erection drawing and Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check manifold connections for specified fasteners | General Erection drawing, parts list and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check manifold connection fasteners are secure | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check manifold-to-column and manifold to tank bottom seals for proper installation and alignment | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the manifold-to-cage connections for specified welding | General Erection drawing, parts list and Final Plumb the Cage instructions in the Installation section of the Ovivo instruction manual | | |
| Check the manifold anchor ring for proper installation | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the manifold anchor ring fasteners are secure | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the anchor ring, sludge recycle pipe (not by Ovivo) and influent column for proper grouting | General Arrangement Drawing and the Grouting under the Sludge Manifold and Anchor Ring instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure grout has not fallen into the sludge return pipe (not by Ovivo) or influent pipe (not by Ovivo) | Grouting under the Sludge Manifold and Anchor Ring instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge duct sections for specified fasteners and gaskets. | Rake Arm Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge duct fasteners and gaskets are secure | Rake Arm Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge ducts for alignment with sludge manifold and that the ducts are in line with the centerline of the rake arms | Duct Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge duct-to-sludge duct support for specified welds | Rake Arm Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| Check the duct supports-to-rake arm connection for specified welds. | Rake Arm Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check tank grout for proper installation | General Arrangement drawing and Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |
| Check for minimum one inch tank grout thickness | General Arrangement drawing and Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |
| Check squeegees for minimum clearance with bottom of tank all around tank | General Arrangement drawing and Squeegee Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check squeegee-to-duct connection for specified fasteners and back-up bars | Rake Arm and Duct Erection drawing, parts list and Squeegee Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check squeegee-to-duct connection fasteners are secure | Rake Arm and Duct Erection drawing and Squeegee Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check static torque tests have been successfully completed | Static Torque Test drawing and Torque Test Warnings in the Installation section of the Ovivo instruction manual | | |
| Check CMD anchor bolts for proper size, projection, elevation and orientation | General Arrangement drawing, General Erection drawing, parts list and Check The Tank instructions in the Installation section of the Ovivo instruction manual | | |
| Check CMD anchor nuts are secure | General Erection drawing and Influent Column Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check influent column anchor bolts for proper size, projection, elevation and orientation | General Arrangement drawing, General Erection drawing, parts list and Check The Tank instructions in the Installation section of the Ovivo instruction manual | | |
| Check influent column anchor nuts are secure | General Erection drawing and Influent Column Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure grout has not fallen into the sludge drain pocket | Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure the template boards have been removed from the rake arms | Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |

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| Check the weirs for elevation and level | General Arrangement drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure mastic sealer (if required) has been installed between the weirs and their mounting surface | General Arrangement drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the baffle for specified radius all around | General Arrangement drawing and Skimming Erection drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the baffle for specified elevation | General Arrangement drawing and Skimming Erection drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box for level and proper elevation | General Arrangement drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box flexible connector and hose clamp have been properly installed | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box-to-baffle connections for specified fasteners | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box-to-baffle connection fasteners are secure | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box support-to-scum box connections for specified fasteners | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box support-to-scum box connection fasteners are secure | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| Check scum box support-to-tank wall connection for specified anchor bolts | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box support-to-tank wall anchor nuts are secure | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the skimmer arms for specified elevation and level | Skimming Erection drawing, General Arrangement drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimming device assembly fasteners are secure | Skimming Device Assembly drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the skimmer arm-to-skimmer support connections for specified fasteners | Skimming Erection drawing, parts list and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer arm-to-skimmer support connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the skimmer blade-to-skimmer arm connection fasteners are secure | Skimming Erection drawing, parts list and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer blade-to-skimmer brace connections for specified fasteners | Skimming Erection drawing, parts list and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer blade-to-skimmer brace connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer vertical supports for specified position on rake arm | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer vertical support-to-rake arm connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer vertical support brace-to-rake connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| Check skimmer vertical support brace-to-vertical support connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check for the 6" clearance between the skimmer blade and feedwell | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the scum scrapers for contact with the wiping surfaces on the baffles and scum box | Skimming Erection drawing, Skimming Device Maintenance and Adjustment instructions, and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum scraper for parallel alignment with the scum box discharge leading drop edge | Skimming Erection drawing, Skimming Device Maintenance and Adjustment instructions, and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check for specified spring tension on vertical hinged skimmer | Skimming Erection drawing, Skimmer Assembly drawing, Skimming Device Maintenance and Adjustment instructions, and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the flush valve assembly for specified fasteners | Flush Valve Erection drawing, Flush Valve Assembly drawing, parts list and Scum Box Flushing System Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check flush valve assembly fasteners are secure | Flush Valve Erection drawing, Flush Valve Assembly drawing and Scum Box Flushing System Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the flush valve assembly for smooth operation | Flush Valve Erection drawing, Flush Valve Assembly drawing and Scum Box Flushing System Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure all blocking and shoring used in the erection of the equipment has been removed from the tank | Pre-Start-Up Check instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check structural components for specified final painting. Inspect painted surfaces for deterioration of paint | General Arrangement drawing and Storage precautions in the General section of the Ovivo instruction manual | | |
| Check drive-to-column connection for specified fasteners | General Erection drawing, parts list, and the Drive Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| 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 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 main gear has been filled with specified oil type/viscosity | Drive Lubrication instructions in the Ovivo instruction manual | | |
| Check worm gear has 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 bearing grease lubrication | Manufacturer's instructions in the Accessory Equipment section of the Ovivo instruction manual | | |
| Check chain lubrication | Drive Lubrication instructions in 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 gearmotor wiring | Manufacturer's instructions in the Accessory Equipment section of the Ovivo instruction manual, and Ovivo Control Panel Schematics in the Ovivo instruction manual. All interconnecting wiring must meet local electrical codes. | | |
| Check drive motor is wired so an automatic restarting of the motor cannot occur after a drive control shutdown, following a torque load | Ovivo Control Panel Schematics in the Ovivo instruction manual | | |
| Check drive control wiring | Ovivo Control Panel Schematics 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 | Ovivo Control Panel Schematics in 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 | | |

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| 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 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-to-drive connections have been shimmed to fill in any gaps between the drive and cage | 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 | | |
| 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 guard is 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 | | |

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|--|---|--------------------|------|
| 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 gearmotor | | | |
| 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 | | |
| <u>NOTES AND COMMENTS:</u> | | | |
| | | | |

(Installer/Erector)

(Date)

Receipt of Completed Checklist Acknowledged by Ovivo:

(Ovivo Service Representative)

(Date)

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Sign off by initialing and dating each check made. When the 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 clarifier mechanism with drive unit furnished to the Ovivo Project Management Department to ensure warranty coverage.

| CHECK | REFERENCE | INSTALLER SIGN OFF | DATE |
|--|--|--------------------|------|
| Check to be sure all shipping braces have been removed | Receiving and Inspection and Lifting Precautions instructions in the General section of the Ovivo instruction manual | | |
| Check elevation of the walkway mounting surfaces | General Arrangement drawing and Check The Tank instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check for specified top of grout elevation at the tank wall and center of the tank | General Arrangement drawings and Suggested Tank Grouting Procedure instruction in the Installation instruction section of the Ovivo instruction manual | | |
| Check tank bottom for specified slope at approximate 90° locations around tank curve | General Arrangement drawing, Check The Tank instructions and Suggested Tank Grouting Procedures instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check existing walkway and platform for proper reinstallation | Original installation manual | | |
| Check the drive adapter for proper installation to the drive | General Erection drawing, Drive Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the drive adapter has been field drilled as specified for connection to the platform | General Erection drawing, Drive Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check platform-to-drive connections for specified fasteners | General Erection drawing, Platform and Walkway Re-Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check platform-to-drive connection fasteners are secure | General Erection drawing, Platform and Walkway Re-Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI supports for proper installation to the EDI and cage | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI support connection fasteners are secure | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |
| Check for proper orientation of the EDI flow gates. | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |

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| Check the EDI and cage for alignment and use of shimming, if required | Cage and EDI Assembly Instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI-to-cage connections for specified fasteners | General Erection drawing, parts list and Install the Cage and EDI instructions in the Installation section of the Ovivo instruction manual | | |
| Check the EDI-to-cage connection fasteners are secure | General Erection drawing and Install the Cage and EDI instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge manifold for centering around and for clearance with the influent column | Sludge Manifold and Anchor Ring Installation Instruction in the Installation section of the Ovivo instruction manual | | |
| Check existing feedwell supports have been relocated as required for installation of the new feedwell | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check existing feedwell support connection fasteners are secure | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the feedwell frame for alignment of the upper rim | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the feedwell frame for specified elevation and all around level | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the FRP panels have been coated with resin on all cuts | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the FRP panels for proper installation to the feedwell frames | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the FRP panel connection fasteners are secure | General Erection drawing, Feedwell Erection drawing, parts list and Feedwell Installation instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check the rake arms for specified clearance with tank bottom | General Arrangement drawing, Rake Arm Erection drawing and the Rake Arm Installation and Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check arms for square alignment | General Arrangement drawing and Rake Arm Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| Check arm splices and arm-to-cage connections for specified welds | Rake Arm Erection drawing and Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check arm-to-cage welds to be sure load is transferred from the arm to the cage (not arm to shim) | Rake Arm Erection drawing and Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check manifold connections for specified fasteners | General Erection drawing, parts list and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check manifold connection fasteners are secure | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check manifold-to-column and manifold to tank bottom seals for proper installation and alignment | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the manifold-to-cage connections for specified welding | General Erection drawing, parts list and Final Plumb the Cage instructions in the Installation section of the Ovivo instruction manual | | |
| Check the manifold anchor ring for proper installation | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the manifold anchor ring fasteners are secure | Manifold Erection Drawing and Manifold Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the anchor ring, sludge recycle pipe (not by Ovivo) and influent column for proper grouting | General Arrangement Drawing and the Grouting under the Sludge Manifold and Anchor Ring instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure grout has not fallen into the sludge return pipe (not by Ovivo) or influent pipe (not by Ovivo) | Grouting under the Sludge Manifold and Anchor Ring instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge duct sections for specified fasteners and gaskets. | Rake Arm Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge duct fasteners and gaskets are secure | Rake Arm Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge ducts for alignment with sludge manifold and that the ducts are in line with the centerline of the rake arms | Duct Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the sludge duct-to-sludge duct support for specified welds | Rake Arm Erection Drawing and Sludge Duct Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| Check the duct supports-to-rake arm connection for specified welds. | Rake Arm Final Arm Adjustment instructions in the Installation section of the Ovivo instruction manual | | |
| Check tank grout for proper installation | General Arrangement drawing and Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |
| Check for minimum one inch tank grout thickness | General Arrangement drawing and Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |
| Check squeegees for minimum clearance with bottom of tank all around tank | General Arrangement drawing and Squeegee Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check squeegee-to-duct connection for specified fasteners and back-up bars | Rake Arm and Duct Erection drawing, parts list and Squeegee Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check squeegee-to-duct connection fasteners are secure | Rake Arm and Duct Erection drawing and Squeegee Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check static torque tests have been successfully completed | Static Torque Test drawing and Torque Test Warnings in the Installation section of the Ovivo instruction manual | | |
| Check CMD anchor bolts for proper size, projection, elevation and orientation | General Arrangement drawing, General Erection drawing, parts list and Check The Tank instructions in the Installation section of the Ovivo instruction manual | | |
| Check CMD anchor nuts are secure | General Erection drawing and Influent Column Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check influent column anchor bolts for proper size, projection, elevation and orientation | General Arrangement drawing, General Erection drawing, parts list and Check The Tank instructions in the Installation section of the Ovivo instruction manual | | |
| Check influent column anchor nuts are secure | General Erection drawing and Influent Column Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure grout has not fallen into the sludge drain pocket | Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure the template boards have been removed from the rake arms | Suggested Tank Grouting Procedure instructions in the Installation section of the Ovivo instruction manual | | |

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| Check the weirs for elevation and level | General Arrangement drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure mastic sealer (if required) has been installed between the weirs and their mounting surface | General Arrangement drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the baffle for specified radius all around | General Arrangement drawing and Skimming Erection drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the baffle for specified elevation | General Arrangement drawing and Skimming Erection drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box for level and proper elevation | General Arrangement drawing and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box flexible connector and hose clamp have been properly installed | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box-to-baffle connections for specified fasteners | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box-to-baffle connection fasteners are secure | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box support-to-scum box connections for specified fasteners | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box support-to-scum box connection fasteners are secure | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| Check scum box support-to-tank wall connection for specified anchor bolts | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum box support-to-tank wall anchor nuts are secure | General Arrangement and Skimming Erection drawings and Weir, Baffle and Scum Box Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the skimmer arms for specified elevation and level | Skimming Erection drawing, General Arrangement drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimming device assembly fasteners are secure | Skimming Device Assembly drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the skimmer arm-to-skimmer support connections for specified fasteners | Skimming Erection drawing, parts list and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer arm-to-skimmer support connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the skimmer blade-to-skimmer arm connection fasteners are secure | Skimming Erection drawing, parts list and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer blade-to-skimmer brace connections for specified fasteners | Skimming Erection drawing, parts list and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer blade-to-skimmer brace connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer vertical supports for specified position on rake arm | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer vertical support-to-rake arm connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check skimmer vertical support brace-to-rake connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| Check skimmer vertical support brace-to-vertical support connection fasteners are secure | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check for the 6" clearance between the skimmer blade and feedwell | Skimming Erection drawing and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the scum scrapers for contact with the wiping surfaces on the baffles and scum box | Skimming Erection drawing, Skimming Device Maintenance and Adjustment instructions, and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check scum scraper for parallel alignment with the scum box discharge leading drop edge | Skimming Erection drawing, Skimming Device Maintenance and Adjustment instructions, and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check for specified spring tension on vertical hinged skimmer | Skimming Erection drawing, Skimmer Assembly drawing, Skimming Device Maintenance and Adjustment instructions, and Skimming Device Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the flush valve assembly for specified fasteners | Flush Valve Erection drawing, Flush Valve Assembly drawing, parts list and Scum Box Flushing System Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check flush valve assembly fasteners are secure | Flush Valve Erection drawing, Flush Valve Assembly drawing and Scum Box Flushing System Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check the flush valve assembly for smooth operation | Flush Valve Erection drawing, Flush Valve Assembly drawing and Scum Box Flushing System Installation instructions in the Installation section of the Ovivo instruction manual | | |
| Check to be sure all blocking and shoring used in the erection of the equipment has been removed from the tank | Pre-Start-Up Check instructions in the Installation instruction section of the Ovivo instruction manual | | |
| Check structural components for specified final painting. Inspect painted surfaces for deterioration of paint | General Arrangement drawing and Storage precautions in the General section of the Ovivo instruction manual | | |
| Check drive-to-column connection for specified fasteners | General Erection drawing, parts list, and the Drive Installation instructions in the Installation section of the Ovivo instruction manual | | |

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| 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 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 main gear has been filled with specified oil type/viscosity | Drive Lubrication instructions in the Ovivo instruction manual | | |
| Check worm gear has 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 bearing grease lubrication | Manufacturer's instructions in the Accessory Equipment section of the Ovivo instruction manual | | |
| Check chain lubrication | Drive Lubrication instructions in 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 gearmotor wiring | Manufacturer's instructions in the Accessory Equipment section of the Ovivo instruction manual, and Ovivo Control Panel Schematics in the Ovivo instruction manual. All interconnecting wiring must meet local electrical codes. | | |
| Check drive motor is wired so an automatic restarting of the motor cannot occur after a drive control shutdown, following a torque load | Ovivo Control Panel Schematics in the Ovivo instruction manual | | |
| Check drive control wiring | Ovivo Control Panel Schematics 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 | Ovivo Control Panel Schematics in 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 | | |

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| 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 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-to-drive connections have been shimmed to fill in any gaps between the drive and cage | 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 | | |
| 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 guard is 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 | | |

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| 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 gearmotor | | | |
| 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 | | |
| <u>NOTES AND COMMENTS:</u> | | | |

(Installer/Erector)

(Date)

Receipt of Completed Checklist Acknowledged by Ovivo:

(Ovivo Service Representative)

(Date)