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OVIVO® BRACKETT BOSKER® INSTALLATION, MAINTENANCE & OPERATION MANUAL



PROJECT

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6.0 DRAWINGS

DRAWING NUMBER	REV. LEVEL	DESCRIPTION
CSW1584-101	(Rev D)	General Arrangement
CSW1584-151	(Rev C)	General Erection
CSW1584-158	(Rev D)	Bosker Assembly, Right
CSW1584-1366	(Rev A)	Gripper Guide, Right
CSW1584-1370	(Rev A)	Gripper Guide, Left
CSW1584-1581	(Rev C)	Bosker Assembly, Left
CSW1584-121	(Rev F)	Trash Rake Control System
CSW1584-124	(Rev D)	Rake Controls / OCC01 and OCC02
CSW1584-125	(Rev. G)	Rake Control System / 01 and 02
CSW1584-126	(Rev E)	Trolley Junction Box
CSW1584-127	(Rev B)	Panel Cutout Assembly / MCP and PLC Panel
CSW1584-128	(Rev A)	Cable Numbers & Wires
114808	(Rev F)	Torque Values

7.0 ACCESSORIES

Gearbox Oil: ....TAB 1
(Ovivo USA, LLC Part No. 584647)

Bearing Grease: ....TAB 2
(Ovivo USA, LLC Part No. 590157)

Hydraulic Fluid: ....TAB 3
(Ovivo USA, LLC Part No. BB301)

Hoist Motor: ....TAB 4

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(Ovivo USA, LLC Part No. 772328)

Hoist Brake: ..... TAB 5
(Ovivo USA, LLC Part No. 771428)

Radial Encoder: ..... TAB 6
(Ovivo USA, LLC Part No. 771759)

Laser Encoder: ..... TAB 7
(Ovivo USA, LLC Part No. 771624)

Proximity Sensor: ..... TAB 8
(Ovivo USA, LLC Part No. 771678)

Warning Horn: ..... TAB 9
(Ovivo USA, LLC Part No. 771767)

LED Warning Light: ..... TAB 10
(Ovivo USA, LLC Part No. 771768)

Anchor Epoxy: ..... TAB 11
(Ovivo USA, LLC Part No. 594729)

Energy Chain: ..... TAB 12
(Ovivo USA, LLC Part No. CSW1584-1022)

Bridge Crane and Structure: ..... TAB 13
(Ovivo USA, LLC Part No. CSW1584-157)

8.0 CHECKLIST

CSW1584-01 A

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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1.2 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 with an agreed-to 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

1.3 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.

1.3.1 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.

1.3.2 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.

1.3.3 Storage

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

1.3.4 Erection Bolts

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

1.4 EQUIPMENT DESCRIPTION

The HEAVY DUTY BOSKER® Monorail Traveling Gripper Rake consists of an overhead Monorail system, a Trolley, a Gripper and Cable Wagons.

1.4.1 Single Girder Bridge Crane System

a. The single girder bridge crane system (Figure 1.4a) provides a track for bridge to ride on. The bridge includes a drive and support for the hoisting mechanism mounted to it. The bridge travels along the length of the structure to position the trolley over the pick and dump points.

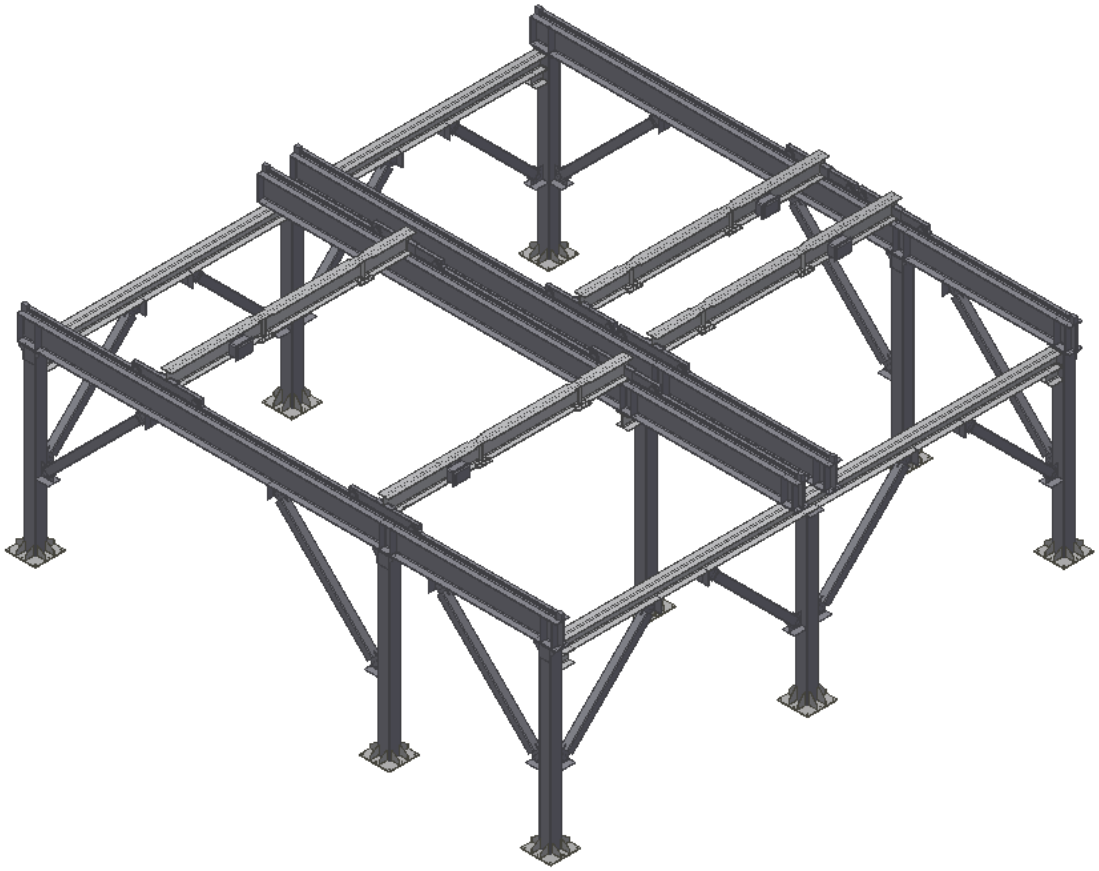


FIGURE 1.4A – SINGLE GIRDER BRIDGE CRANE SYSTEM

b. The major components of this system are the support structure, bridge, energy chain, motors, encoders, and the junction box.

c. Apart from these major components there are other important features included in the bridge system. For example, there are various stops to prevent over-travel damage. There are also laser distance sensors used to detect the position of each bridge on the tracks.

1.4.2 Trolley

The trolley contains a hoisting unit, a hydraulic unit, and swing restrictor plates (Figure 1.4c). Power and controls to the trolley are carried by an energy chain system that is supported by a track it glides in. The trolley does not have a traverse drive. It is hard mounted to the bridge beam. The bridge is used to traverse the trolley to the pick and dump locations.

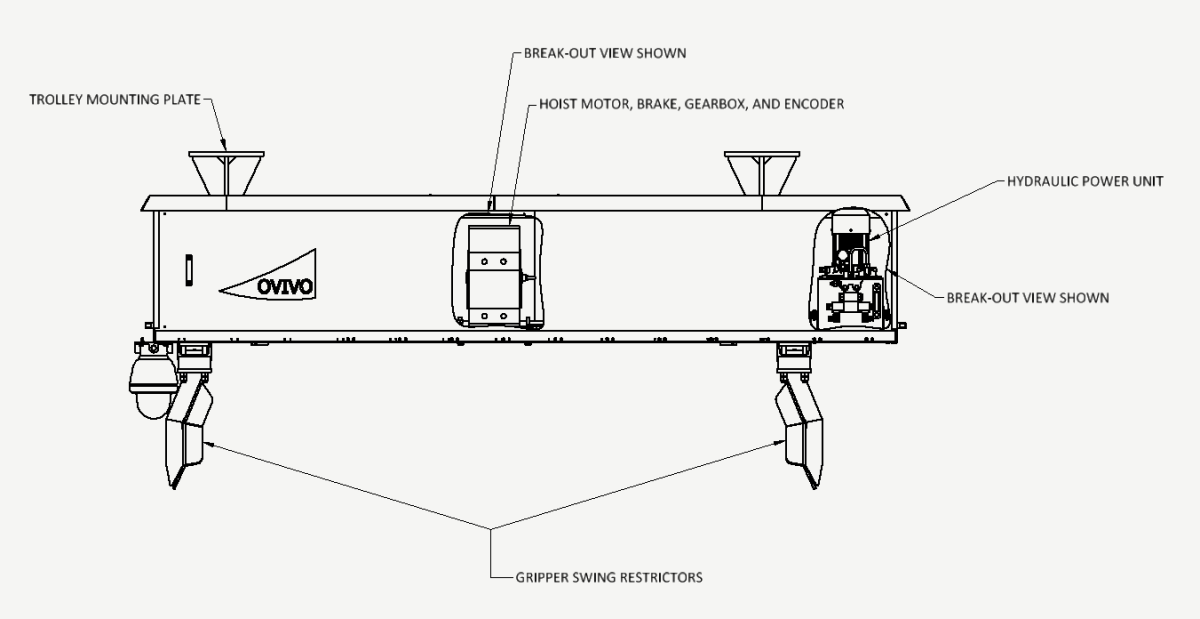


FIGURE 1.4C – TROLLEY

a. Hoisting Unit

The Hoisting Unit raises and lowers the gripper. It consists of a motor, brake, encoder, and reducer connected by a shaft to a pair of gripper cable drums.

b. Traverse Unit

The Traverse Drive Unit mounted to the bridge provides propulsion along the superstructure. It consists of a motor, brake, encoder, and v-groove wheels fitted directly to the output shafts.

c. Hydraulic Unit

The Hydraulic Unit opens and closes the gripper. The main components of the hydraulic system are the pump/motor, return filter, solenoid valve, tank, and the level switch (Figure 1.4d). The power unit is located in the trolley and the cylinders on the gripper. Hudraulic hoses transfer power to the cylinders. These hoses are wound on two (2) chain driven drums (Figure 1.4e), which operate in sequence with the hoisting drums.

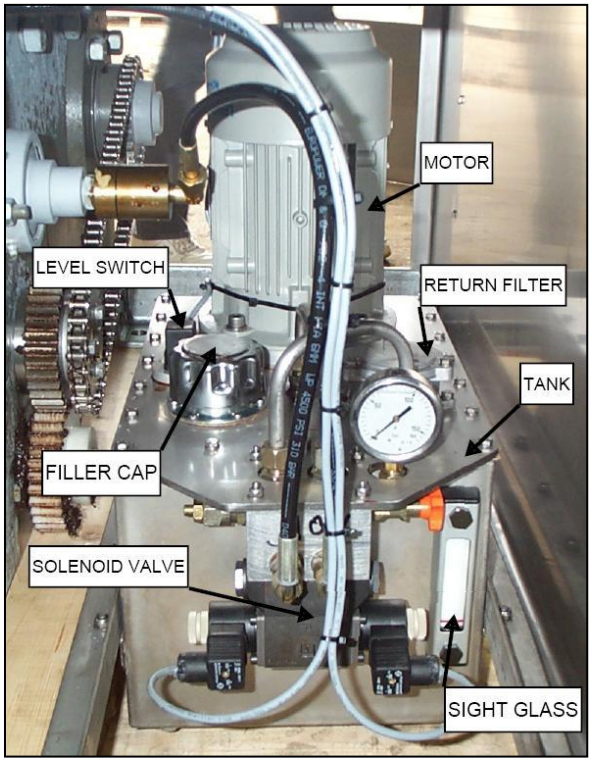


FIGURE 1.4D – HYDRAULIC UNIT

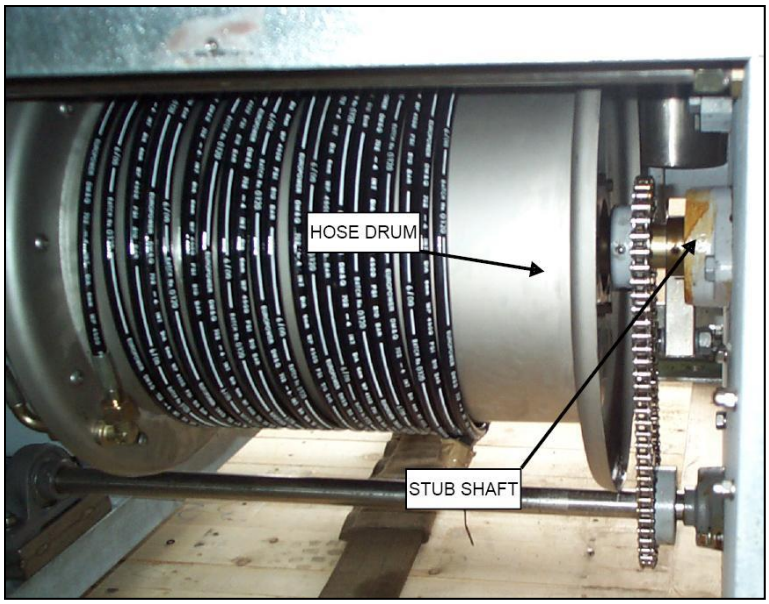


FIGURE 1.4E – HOSE REEL ASSEMBLY

d. Swing Restrictor Plates

A gripper swing restrictor is mounted under the trolley to the lower framework. Gripper movement while in traverse mode causes undue wear to bot cables and drums. The gripper swing restrictors help abate this problem. The gripper swing restrictor is designed to hold the trolley steady as it traverses.

1.4.3 Gripper

The gripper picks up and carries debris from the bar screen to the dump area (see Figure 1.4f). It consists of guide wheels, straight tines, curved pivoting tines, and upper bars. The rear tines engage the bar screen, while the pivoting tines secure the debris. The upper bars across the top of the gripper push the debris to the invert of the well. The guide wheels keep the gripper in the correct position on the bar screen. For tightly spaced bar screens toothed plates are attached to the rear tines enabling full cleaning penetration.



FIGURE 1.4F – GRIPPER



FIGURE 1.4G - GRIPPER GUIDE

1.5 SAFETY IN A SEWAGE ENVIRONMENT

A Safety Aid Kit Should Be Available At All Times

1.5.1 Operational Safety

a. To the best of our knowledge and belief, Ovivo USA, LLC has incorporated such safety devices as are required on our equipment.

b. Handrails, guards and other protective devices must not be removed while the equipment is in operation or capable of starting under an automatic control sequence. Any guards, handrails, or housings removed for maintenance must be replaced before the equipment is returned to service.

c. When lifting wash water spray covers, or whenever in contact with airborne spray, operators should wear disposable gloves, goggles and a protective mask providing filtration down to 2 microns.

REMEMBER, AUTOMATIC EQUIPMENT CAN BE DANGEROUS
EQUIPMENT MAY START WITHOUT WARNING

1.5.2 Maintenance Safety

a. Make sure that electrical supplies are properly isolated before removing guards or covers. The supply should be disconnected by the operation of the main isolating switch, removal of fuses or other acceptable method. A notice should be placed at the point of isolation showing:

DANGER – WORK IN PROGRESS

b. Drive motors are normally installed with anti-condensation heaters, which remain “live” when the motor is stopped. Make sure that all supplies are isolated.

c. Never work alone. When working in or adjacent to sumps, wear suitable harness or lifelines. Do not overlook the danger of drowning.

d. Place a barrier or guardrail around the work area.

e. When working in confined spaces, make sure that no dangerous gases are present.

f. Use a safety helmet, goggles and shoes. Make sure you have a clear path of retreat.

g. Do not ignore health hazards. Personnel working in a sewage environment should be vaccinated against diseases that can occur.

1.5.3 Painting Safety

a. Take normal precautions to avoid skin contact and the inhalation of spray mist. Provide adequate ventilation.

b. If the product comes into contact with the skin, wash thoroughly with a suitable industrial cleanser or lukewarm water and soap (if cleanser is not available). If the eyes are contaminated, wash out with water for at least 10 minutes and seek medical attention at once.

c. Observe any special Health and Safety instructions on containers or data sheets.

1.5.4 Lifting Equipment

a. Make sure that the load is within the rated capacity of the hoist. When lifting equipment from sumps, the hoist should not be oversized or severe damage may be caused if equipment jams.

b. Make sure that the load is directly under the hook and check that the hook and slings are properly connected.

c. Do not use a worn, corroded or damaged hook or sling.

1.5.5 Safety Instructions in Manual

The following headings are used in the text of this manual to amplify instructions:

WARNING: **DANGER OF ACCIDENT OR INJURIES EXISTS**

CAUTION: **RISK OF DAMAGE TO EQUIPMENT EXISTS**

NOTE: **ADDITIONAL INFORMATION PERTINENT TO THE INSTRUCTION.**

1.6 STORAGE

1.6.1 Short Term Storage (Less Than 2 Months)

a. All structural steel/fabricated components stored outside should be blocked off the ground, level and covered with protective tarp.

b. Repair all coating damaged in shipping and handling prior to covering. See Section 1.8 Coating Repair.

c. All electrical and mechanical components should be stored indoors. Connect all electrical heaters, if furnished. Rotate reducers on a weekly basis or fill completely with recommended lubricant.

1.6.2 Long Term Storage

a. Follow steps outlined in Section 1.6.1 “Short Term Storage”.

b. Inspect equipment after six (6) months of storage. Repair all coating damage, observe equipment condition, and check heaters.

1.6.3 Long Term Storage Check List

INSPECTOR:		
DATE:		
1	All heaters (if furnished) connected to prevent motor condensation	
2	All equipment blocked off ground level	
3	All damaged coating repaired	
4	Equipment covered with tarp	
5	Control panel heaters (if furnished) connected.	

1.7 WORKMANSHIP

a. This manual is intended only as an aid for the installation, operation and maintenance. It is based on the assumption that only qualified workers will perform the service work, utilizing good workmanship and practices at all times.

Standard construction for fabricated steel allows for tolerance in lengths and hole locations. Minor misfits are considered a normal part of erection work. The accumulation of the tolerances in foundations, grades, setting of anchor bolts, etc. created the necessity to use drift pins, reamers and gas cutting welding equipment. Dimensional tolerance must be compensated for during installation.

1.8 COATING REPAIR

a. Where damage has occurred, the areas should be prepared to the highest practical standard. The aim should be remove any loose, flaking paint coatings back to firm edges. The remaining coating around the damaged area should be feathered to ensure continuity of the patch coating.

b. If the steel surface is exposed, surface preparation must ensure the removal of any corrosion. The whole area must be free from other contamination.

c. In order to ensure maximum adhesion of the patch coatings, the preparation shall be extended over the surrounding sound coatings to ensure some abrasion of the surface to which the patches are to be applied.

d. Wipe the area to be repaired with a clean rag soaked in xylol, hand and/or power-tool clean to an SSPC-SP 2 or 3 to the affected area. Re-wipe the area with xylol.

e. Apply suitable primer to the area by brush, roller or spray.

f. The materials should be applied in such a way that the primer overlaps onto the prepared previous paint coat by 1”. The succeeding coats should each overlap a little further than the previous patch to ensure that the completed repair presents as smooth and even surface as possible.

g. Small areas coated by brush may have to be covered by multi-coats, as the normal dry film thickness by brush is smaller.

1.9 SYMBOLS

1.9.1 Warnings



Floor-level obstacle



General Warning



Warning; Automatic start-up



Warning; Crushing Hand



Warning; Crushing



Warning; Drop (fall)



Warning; Flammable



Warning; Hot surface



Warning; Oxidizing Surface



Warning; Pressurized cylinder



Warning; Sharp



Warning; Slippery surface



Warning; Sudden loud noise



Warning; Toxic material

1.9.2 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



Wear high-visibility clothing



Wear protective gloves



Wear safety footwear

1.9.3 Safety Signs



Do not alter the state of the switch



No heavy load



No reaching in



No stepping on surface

GENERAL



Not drinking water

1.10 LIFTING PROCEDURES



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

1. 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.

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

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



WARNING: Stand clear as the equipment is lifted. **NEVER** stand under a suspended load.

   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. Make sure that the load is within the rated capacity of the hoist. When lifting equipment from sumps, the hoist should not be oversized or severe damage may be caused if equipment jams.

   d. Experienced personnel should do all rigging and lifting.

   e. 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.

   f. Use multiple point lifting whenever possible.

   g. 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.

   h. Make sure that the load is directly under the hook and check that the hook and slings are properly connected.

   i. 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.

   j. Never move the equipment suddenly or in jerks and never allow it to strike the ground, tank or other equipment.

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

l. Do not use a worn, corroded or damaged hook or sling.

1.11 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 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.

1.12 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 CSW0001584-01 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

2.0 INSTALLATION

2.1 GRIPPER GUIDE INSTALLATION

a. The gripper guides can be installed at any point in the installation process. Refer to the General Erection drawing (CSW1584-151) for proper gripper guide installation dimensions and component parts.

b. Within the intake channel, place a line on the side of the concrete wall in-line with the face of the existing bar screens. Create a second line 9 3/4" away from the first line, towards the incoming water flow, and parallel to the first line. Using the dimensions shown on the General Erection drawing (CSW1584-151) mark the location of all the anchor bolts. Use these markings to verify the provided gripper guides will correctly mount to the wall at the marked anchor locations.

   Note: The guides have been match-marked in the shop. The match mark order must be followed during installation, as the joints between the guides have been adjusted to line up at the matched points.

c. Correctly position the gripper guides within the channel. Verify the anchor holes in the gripper guide line up with the marked anchor locations. Match mark any holes that do not correctly line up in the concrete. Match-drill the holes in the concrete.

d. Secure the gripper guides to the concrete using the epoxy anchors provided. Use shims as necessary to keep the guides aligned. The guides should be set so the inner surface the guide wheels roll on prevent side-to-side motion and are roughly 167-1/2" inches apart. If the dimension measures less than 167-1/8" at any point, it may be necessary to chip out concrete. If the dimension measure more than 170-1/4" at any point, shims may be necessary to keep the gripper in the guides. After verifying proper spacing between gripper guides, torque the bolts to the manufacturer's recommended torque.

2.2 SUPER STRUCTURE INSTALLATION

Note: The super structure was disassembled after shop fit up for shipping. Additional information regarding installation of the superstructure and bridge crane may be found in the American Equipment manual found in the appendix.

1. Using a surveyor's level set a benchmark on the intake.

2. Locate and mark the centerlines of all vertical columns using the center wall as the base location. Refer to General Erection drawing (CSW1584-151) General Arrangement drawing (CSW1584-101), and American Equipment Construction Drawings (36481) for proper location of the support structure over the intake. Install the vertical columns on the concrete and verify they are properly located around the intake. Make any adjustments necessary for proper alignment and then torque the baseplate nuts.

3. Install the I-beams and diagonal supports as shown in the American Equipment Construction Drawings (36481). Verify all supports are plumb and level. Verify the I-beam that will be supporting the bridge crane meets the tolerances called out on the American Equipment Construction Drawing (36481-1). After verification of tolerance compliance, torque all fasteners to the values shown on the Bolt Torque Chart (114808).

4. Secure the crane rail to the top of the I-beam using the provided J-bolts. Verify the crane rail meets the tolerances called out on American Equipment Construction Drawing (36481-1).

5. Check the crane rails for level. The installer must level the crane rails to the Earth, so the trolley running surface is not sloped. Verify compliance with American Equipment Construction Drawing (36481-1)

6. Install the bridge cranes on top of the super structure according to the American Equipment Crane System Plan drawing (36481-2). Verify each bridge crane is in the correct location as indicated on the drawing.

7. Verify the brakes, motors, and encoders are installed on the bridge crane. If not preinstalled, install the brakes, motors, and encoders on the bridge crane.

8. Verify the bridge crane junction box is installed on the bridge. Install the junction box on the bridge crane if not already installed.

2.3 TROLLEY

1. Locate the proper trolley to mount to the correct bridge crane. Utilize General Erection drawing (CSW1584-151) to help identify which trollies get attached to each bridge crane.

2. Lift the trolley by crane or other suitable means and secure the trolley to the correct bridge crane. Torque the bolts securing the trolley to the bridge crane per the specified torque values found in the Bolt Torque Chart drawing (114808).

   NOTE: There are two identical trollies for each channel. The trollies are not match marked to go on an individual bridge crane, but it is very important to put the trolly on the correct side to not create alignment issues when the grippers are installed.

3. Install the swing restrictor plates and spring devices to the bottom of the trolley in the existing holes (Figure 2.3a).

4. Install the energy chain to the bridge crane beams. Refer to the General Erection drawing (CSW1584-151) and the energy chain installation manual from the manufacturer.

5. Install the laser sensor to the trolley. With the lasers sensor on, traverse the trolley and keep note of where the laser beam hits on the wall. Install the laser detection plate in a position where the beam hits the plate throughout its total travel distance.

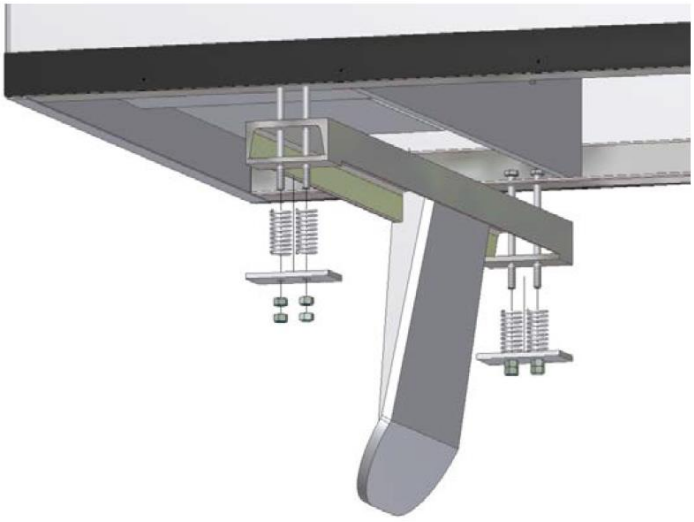


FIGURE 2.3A - INSTALLATION OF SWING RESTRICTOR

2.4 ELECTRICAL CONTROLS

1. Mount the control panel as shown on the Control Panel drawing (CSW1584-121).

2. Mount the junction box to the bridge crane if not already installed, as shown in drawing CSW1584-151. Contractor to run conduit from the control panel to the junction box and make the necessary connections.

3. Connect the electrical service to the control panel.

4. Check for proper trolley and hoist motor rotation.

2.5 GRIPPER INSTALLATION

> Note: This process only to be carried out by approved personnel. Trained Ovivo field service representative will perform this work while on site for start up and commissioning. Procedure below is for information only.

1. Place the gripper underneath the trolley, orienting as required and remove the shipping ties. Remove the shipping plate/bar and any other dunnage from the Gripper's Hydraulic cylinders.

2. Rotate the cable drum hoist shaft to lower the two hoisting cables down to the gripper. Verify the drum is rotating in the correct direction that correlates with the direction shown on the remote control pendent. If the drum rotates in the wrong direction, it will be necessary to reverse two of the motor leads. Route the hoist cable around the slack rope roller as shown in Figure 2.5A.

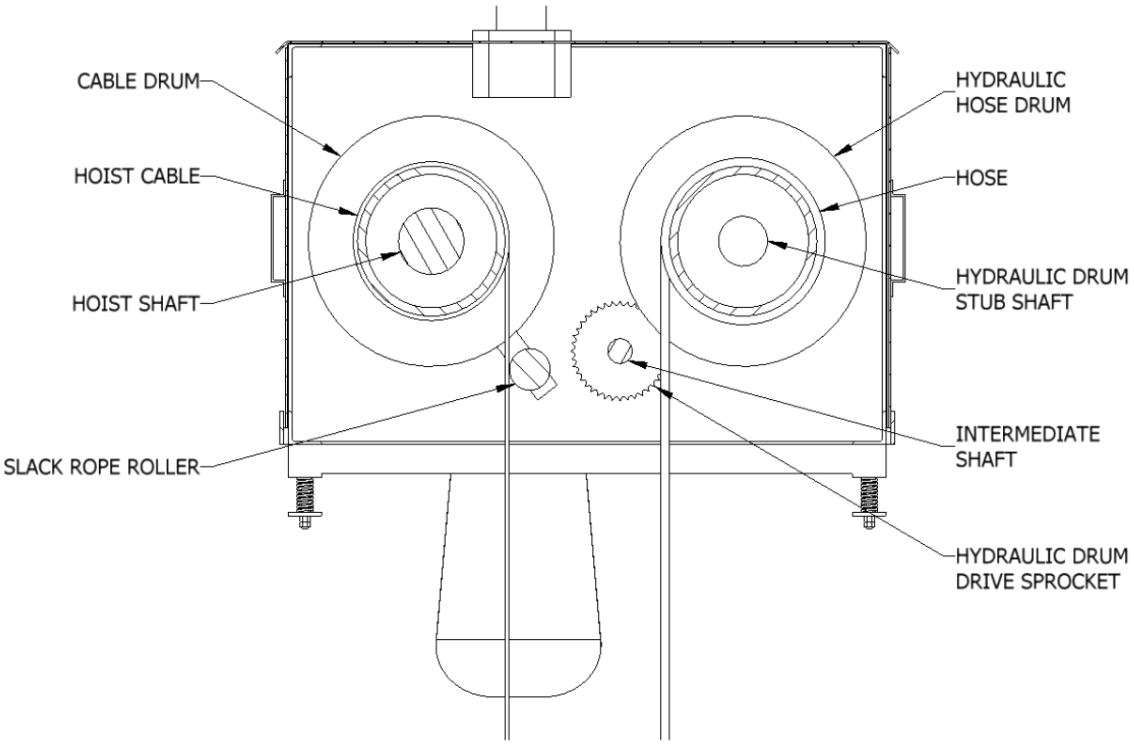


FIGURE 2.5A – HOSE AND CABLE ROUTING DIAGRAM

3. Before attaching the gripper cables to the gripper, verify that the ropes are routed correctly over the slack rope rollers and rope leads. Also, verify that the ropes are in the correct grooves in the drums and not skipping a groove or overwrapped onto itself.

4. Install the lower cable ends into the wedge clamps on the gripper, making sure that the lifting cable is adjacent to the vertical side of the clamp, as shown in Figure 2.5B. DO NOT use cable clamp to attach tail (dead end) to support line (live end). The support line should line up with the pin as shown in Figure 2.5B.5. Install the wedges taking care that the cable does not untwist.

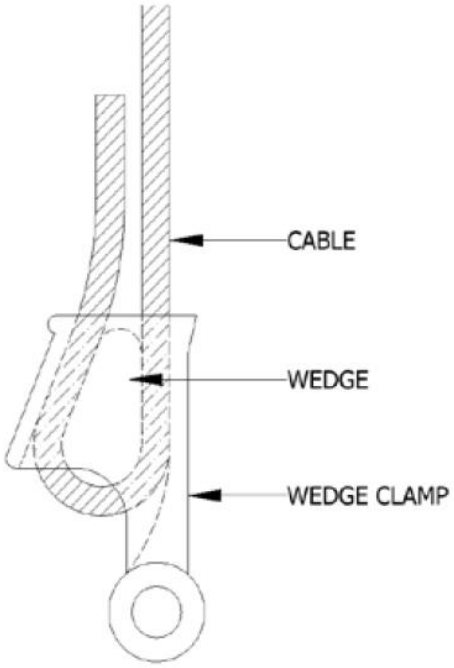


FIGURE 2.5B – CABLE WEDGE

5. Release the slack rope rollers so that they rest against the cables.

6. Pretension one hose reel by four (4) turns and remove the tie wrap securing the hose. Pretension the reel by rotating in the direction of travel during unreeling.

> Note: To provide the correct tension in the hose, there should be a minimum of four (4) complete turns of the drums against the internal spring before the hose is connected to the gripper.

7. Unreel the hose until it reaches the gripper and connect the hose to the corresponding fitting. Make sure that the hose is correctly positioned and is not over the intermediate shaft, see Figure 2.5A, on previous page. If there is a guide bar, the hose should be routed through the guide bar. If there is a hose real guide, route the hose through the hose real guide.

8. Repeat procedure for other hose.

9. Raise the gripper a few inches off the ground. Place a level on the gripper and check that the gripper is level. Make any adjustments necessary to level the gripper if needed.

> CAUTION: CARRY OUT THIS OPERATION WITH CARE.
> REMEMBER THE UPPER LIMIT SWITCHES ARE DISCONNECTED

10. When satisfied that the Gripper is level, raise it so that the dome nuts are resting between the swing restrictor plates, but the wedge clamps are still clear of the slack rope rollers, see Figure 2.4C.

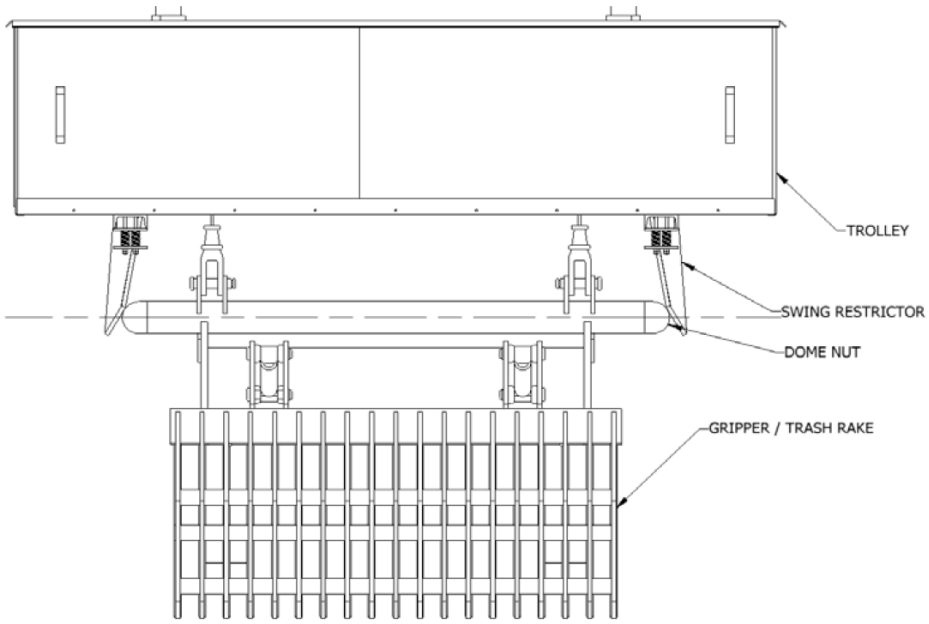


FIGURE 2.4C – GRIPPER BETWEEN SWING RESTRICTOR PLATES

11. With the gripper in the upper position take note of the position shown in the hoist encoder reading and program the position of the upper limit. Then verify the location of the control arm attached to the small positioning gearbox mounted to the top of the inside of the trolley. Adjust the upper limit sensor so that the control arm actuates the limit sensor in the upper position if it rotates any further. A light will change state when the sensor is actuated.

12. Install the drive chain to the small positioning gearbox if not already installed. Verify correct rotation direction of gearbox, correct location of control arm, and correct actuation location of limit switch.

13. Lower the Gripper to ground level and test the slack rope device. If the slack rope device does not work check the position of the slack rope sensor on the Equipment Trolley and adjust as needed. If the sensors are in the correct location, check the wiring in the Equipment Trolley for the slack rope sensors.

14. Raise the Gripper back to the top to check the upper limit sensor. If necessary, relocate the limit sensor until the upper limit is set properly.

15. Check the hydraulic oil level, top off as necessary.

16. Raise the Gripper about three feet off of the deck level. Run the hydraulic pump for a short time to check for correct operation. If the motor is not rotating the proper direction, switch two of the three phase power leads to the hydraulic motor in the control panel to reverse the motor direction and

retest. It may be necessary to open the shut off valve on the pressure gauge, as this may be closed for transport. Do not allow the pump to run for a long time at this pressure or the oil may become overheated.

17. Test the Gripper open and close functions by pushing the GRIPPER OPEN / CLOSE pushbuttons. If the operation is opposite of the labels, i.e. the "OPEN" switch position closes the Gripper, switch the wires to the solenoids located on the front of the hydraulic unit.

18. Operate the cylinders 3 or 4 times to expel any air and again, check the oil level. Top off reservoir if necessary.

19. Traverse the Equipment Trolley to a raking position and lower the Gripper to 3 inches above the screen invert. Take note of the encoder reading and program the lower limit into the control system. Move the lower limit sensor so the Gripper is stopped by the bottom limit sensor at 2 inches above the screen invert, and not by the slack rope devices.

20. Raise the Gripper and again check for level.

21. Trim the ends of the cables to prevent any possible fouling in the Equipment Trolley.

22. Traverse the gripper to its dump location. Take note of the encoder reading and set the dump location in the controls program. Traverse the unit 6 inches past the dump location and take note of the encoder reading. Set the overtravel limit in the controls program.

23. Traverse the gripper to the furthest pick location from the dump area. Lower the gripper so it engages properly with the bar screen at its furthest pick location. Adjust as necessary to find the correct location. Take note of the encoder reading and set the pick location in the controls program. Traverse the unit 6 inches beyond the furthest pick location and set the overtravel limit in the controls program.

24. Traverse the gripper to every pick location. Lower the gripper into the bar screen and check for proper engagement at each location. Note the encoder reading for each location and set each pick location in the controls program.

    Note: Every Bosker unit is unique. There may be instances where special controls may be needed to prevent two units from colliding, or to allow for special control scenarios out of the ordinary. An Ovivo Controls Engineer will need to approve of any special control needs to insure proper and safe operation of the equipment.

25. Run the gripper in manual operations mode and verify the unit is operating correctly. Verify all sensors are working to control the unit as intended.

26. After verifying proper unit operation, check that the Equipment Trolley side covers are secure and properly installed.

2.6 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. In addition, 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 Pit with Water

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

4. Perform the System Test

After the final mechanical check has been completed, perform the system test.

3.0 LUBRICATION

3.1 LUBRICATION REQUIREMENTS

3.1.1 General

a. It is recommended that an operating log be maintained to include the running hours of the machine and any maintenance performed.

b. Many routine maintenance requirements are dependent on running times, operating conditions, etc. These notes should be reviewed from time to time in the light of operating experience.

c. The gearboxes are fitted with oil level plugs. When checking the oil level, the level and filler plugs should be removed and oil added until it just starts to run from the level-plug hole. Do not overfill or seals could be damaged. The hoist unit is accessible by removing the side panel on the trolley. A small-bore tube is required to direct the oil into the filler on the hoist gearbox.

d. Always clean grease nipples before applying grease.

3.2 LUBRICATION SCHEDULE

LUBRICATION SCHEDULE							
MACHINE PART	**OPTIONS**	**TYPE**	**MANUFACTURER**	**AMBIENT TEMPERATURE °C**	**INITIAL CHARGE US Gal/Liters**	**CHECK & RELUBE**	**CHANGE OIL**
Hoist Unit WATT KUA 110C NA213/215	Standard	Alpha SP 220	Castrol	-10 to +60	4.49/17	Monthly	(M) every 10,000hrs. or 2 years. (S) every 20,000 hrs. or 4 years.
	Optional	Mobilgear 600 XP 220	Mobil	-10 to +25			
		Omala S2 G 220	Shell	-10 to +60			
Traverse Unit See American Equipment O&M	Standard	Alpha SP 220	Castrol	0 to +60	See American Equipment O&M	Monthly	(M) every 10,000hrs. or 2 years. (S) every 20,000 hrs. or 4 years.
	Optional	Mobilgear 600 XP 220	Mobil	-15 to +25			
		Omala S2 G 220	Shell	0 to +60			
Ball & Roller Bearings of Gear Units	Mineral	Mobilux EP2	Mobil Oil Corp.	-20 to +40	~ 1 oz.	Annually	----------
		Alvania Grease R3	Shell Oil Co.	-30 to +60			
	Synthetic	Mobiltemp SCH32	Mobil Oil Corp.	-45 to +60			
Gripper Pivot Points		Alvania Grease R3	Shell Oil Co.	-30 to +60		Monthly	
Drive Chains		Shell Malleus Fluid-C	Shell Oil Co.			Monthly	

(M) Mineral Oil (S) Synthetic Oil

3.3 LUBRICANT EQUIVALENTS LIST

3.3.1 Synthetic Oils

MANUFACTURER	**SYNTHETIC OILS 2 SYN - 5 SYN** **AGMA EQUIVALENT NUMBER**/VISCOSITY cSt AT 40°C		
	2 SYN/ISO 68	**4 SYN**/ISO 150	**5 SYN**/ISO 220
MOBIL	*SHC 626	*SHC 629	*SHC 630
TRIBOL		800/150	800/220

* Synthesized hydrocarbon

MANUFACTURER	**SYNTHETIC OILS 6 SYN - 8 SYN** **AGMA EQUIVALENT NUMBER**/VISCOSITY CST AT 40°C		
	6 SYN/ISO 320	**7 SYN**/ISO 460	**8 SYN**/ISO 680
MOBIL	*SHC 632	*SHC 634	*SHC 636
TRIBOL	800/320	800/460	800/680

* Synthesized hydrocarbon

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

	Mobil SHC 626	Mobil SHC 629	Mobil SHC 630	Mobil SHC 632	Mobil SHC 634	Mobil SHC 636
Product Number	60293-8	60294-6	60295-3	60298-7	60291-2	60325-5
ISO Viscosity Grade	68	150	220	320	460	680
Specific Gravity	0.858	0.866	0.866	0.867	0.867	0.867
Gravity, API	33.16	32.4	331.9	31.7	31.4	31.7
Pour Point, °C (°F) max, ASTM D 97	-54 (-65)	-45 (-49)	-45 (-49)	-42 (-44)	-42 (-44)	-42 (-44)
Flash Point, °C (°F) min, ASTM D 92	245 (473)	245 (473)	250 (482)	250 (482)	250 (482)	250 (482)
Viscosity, ASTM D445 cSt at 40° C cSt at 100° C	 69.9 10.9	 142.8 18.3	 217.7 25.9	 325.8 38.6	 436.4 44.9	 663.8 62.8
Viscosity Index, ASTM D 2270	147	144	152	169	159	165
Copper Corrosion 24 Hrs at 121° C, ASTM D130	1B	1B	1B	1B	1B	1B
Rust Protection ASTM D665A and 665B, Distilled and Synthetic sea water	Pass	Pass	Pass	Pass	Pass	Pass
FZG Scuffing, Fail stage, DIN 51534	11	13	13+	13+	13+	13+
Color, ASTM D1500, Max	3.5	3.5	3.5	3.5	3.5	3.5
TOST Life, Hrs., ASTM D943-2	10,000+	10,000+	10,000+	10,000+	10,000+	10,000+

3.3.2 Petroleum Based Oils

MANUFACTURER	**PETROLEUM BASED OILS 2EP – 5EP** **AGMA EQUIVALENT NUMBER**/VISCOSITY cSt AT 40°C		
	2EP/ISO 68	**4EP**/ISO 150	**5EP**/ISO 220
MOBIL	Mobilgear 600, XP 68	Mobilgear 600, XP 150	Mobilgear 600, XP 220
AMOCO	Permagear EP #68	Permagear EP #150	Permagear EP #220
EXXON	Spartan EP-68	Spartan EP 150	Spartan EP 220
GULF OIL	EP Lubricant H.D. 68	EP Lubricant H.D. 150	EP Lubricant H.D. 220
TEXACO	Meropa 68	Meropa 150	Meropa 220
PHILLIPS	All Purpose Philgear (ISO Grade 68)	All Purpose Philgear (ISO Grade 150)	All Purpose Philgear (ISO Grade 220)
SHELL	Omala 68	Omala 150	Omala 220
STANDARD OF CALIFORNIA CHEVRON USA	Chevron Gear Compound NL68	Chevron Gear Compound NL150	Chevron Gear Compound NL220
SUN OIL	Sunep 68	Sunep 150	Sunep 220
KEYSTONE	Zeniplex – 2	Keygear 90	Keygear 110
LUBRICATION ENGINEERS	Monolec 300	Almasol 604	Almasol 607

MANUFACTURER	**PETROLEUM BASED OILS 6EP – 8EP** **AGMA EQUIVALENT NUMBER**/VISCOSITY cSt AT 40°C		
	6EP/ISO 320	**7EP**/ISO 460	**8EP**/ISO 680
MOBIL	Mobilgear 600, XP 320	Mobilgear 600 XP 460	Mobilgear 600 XP 680
AMOCO	Pearmagear EP #320	Permagear EP #460	Permagear EP #680
EXXON		Spartan EP 460	Spartan EP 680
GULF OIL	EP Lubricant H.D. 320	EP Lubricant H.D. 460	EP Lubricant H.D. 680
TEXACO	Meropa 320	Meropa 460	Meropa 680
PHILLIPS	All Purpose Philgear (ISO Grade 320)	All Purpose Philgear (ISO Grade 460)	
SHELL	Omala 320	Omala 460	Omala 680
STANDARD OF CALIFORNIA CHEVRON USA	Chevron Gear Compound NL320	Chevron Gear Compound NL460	Chevron Gear Compound NL680
SUN OIL	Sunep 320	Sunep 460	
KEYSTONE	None	Keygear 140	None
LUBRICATION ENGINEERS	Almasol 605	Almasol 608	Almasol 609

3.3.3 Grease Equivalents

MANUFACTURER	**GREASE**	MANUFACTURER	**GREASE**
	NLGI No. 2 EQUIVALENT**		**NLGI No. 2** EQUIVALENT**
MOBIL	Mobilgrease XHP222 (mineral) Mobilgrease SHC200 (synthetic)	SHELL	Darina EP2
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



CAUTION: Do not mix lubricant types without first verifying product compatibility. Consult a qualified lubrication engineer or 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.

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

4.0 MAINTENANCE

4.1 ROUTINE MAINTENANCE

1. It is recommended that an operating log be maintained to include the running hours of the machine and the maintenance performed. Use the log to better schedule maintenance that is dependent on running time.

2. The gearboxes are fitted with oil level plugs. When checking the oil level, the level and filler plugs should be removed and oil added until it just starts to run from the level-plug hole. Do not overfill or seals could be damaged. The hoist unit is accessible by removing the side panel on the trolley. A small-bore tube is required to direct the oil into the filler hole on the hoist gearbox.

3. Always clean grease nipples before applying grease.

4. Follow appropriate safety procedures and Ovivo recommended maintenance safety. Make sure that electrical supplies are properly isolated before removing guards or covers. Follow all site specific lock out tag out procedures and appropriate OSHA and NEC regulations.

5. When working in, or adjacent to sumps, never work alone. Wear suitable harness or lifelines. Do not overlook the danger of drowning. Place a barrier or guardrail around the work area. When working in confined spaces, make sure that no dangerous gases are present. When working on our around equipment all precautions should be taken and appropriate PPE should be worn.

6. Make sure that the load is within the rated capacity of the hoist. When lifting equipment from sumps, the hoist should not be oversized or severe damage may be caused if equipment jams. Also make sure that the load is directly under the hook and check that the hook and slings are properly connected. Do not use a worn, corroded, or damaged hook or sling.

4.2 GRIPPER CABLE INSPECTION AND REPLACEMENT



WARNING: When working on gripper cables, observe all safety regulations. Never disconnect a gripper cable under load. Do not work on a rope that has power connected or which might move under automatic control.

4.2.1 Inspection

Note: The inspection of gripper cables and other lifting attachments may be covered by statutory regulations. These will take precedence over the following notes, which are given only as a guide.

a. The gripper cables should be cleaned and visually inspected every month and may be lubricated with petroleum jelly or an approved rope lubricant. Never use grease dissolving fluids. A full end to end inspection of each rope and its attachments should be done annually, or as stipulated in any relevant procedures or local code.

b. Generally, a gripper cable should be replaced immediately when:

1) A nest of wire fractures exists or a strand is broke.

2) 10 individual broken wires can be seen over a distance of 4 in.

3) 20 individual broken wires can be seen over a distance of 20 in.

4) The diameter of the rope is diminished by 10% by corrosion or abrasion, even if no fractures are apparent.

5) Individual wires form baskets, loops, knots, constructions or sharp bends, or if any other serious mechanical damage is visible.

6) The wire has been subjected to severe head loss.

7) If any attachment or connection is deformed or if wear exceeds 10% of the original metal, replace it.



WARNING: WEAR GLOVES. FRAYED WIRES ARE VERY SHARP.

4.2.2 Replacement of Gripper Cables

Due to the length, size and specialized nature of these wire ropes, it is recommended to contract with an outside service that has knowledge of and specializes in the replacement of wire ropes. Ovivo can help find a local company that is capable of this type of work and consult with them so that they understand the requirements to successfully change the wire ropes.

After the wire ropes have been changed, reconnect the gripper following the instructions for Gripper Removal and Installation.

1. Turn the system to ON and place in MANUAL mode.

2. Move the Equipment Trolley to the maintenance position and lower the Gripper onto a flat surface.

3. Remove the chain between the hoist shaft and the small position control gear unit in the middle of the hoist shaft. Figure 2-6 shows this drive chain removed, the chain is on the right side of the figure.

4. Secure the two slack-rope devices so that a tight rope is simulated, see Figure 4.2A. A nylon tie holding the slack rope roller toward the intermediate shaft.

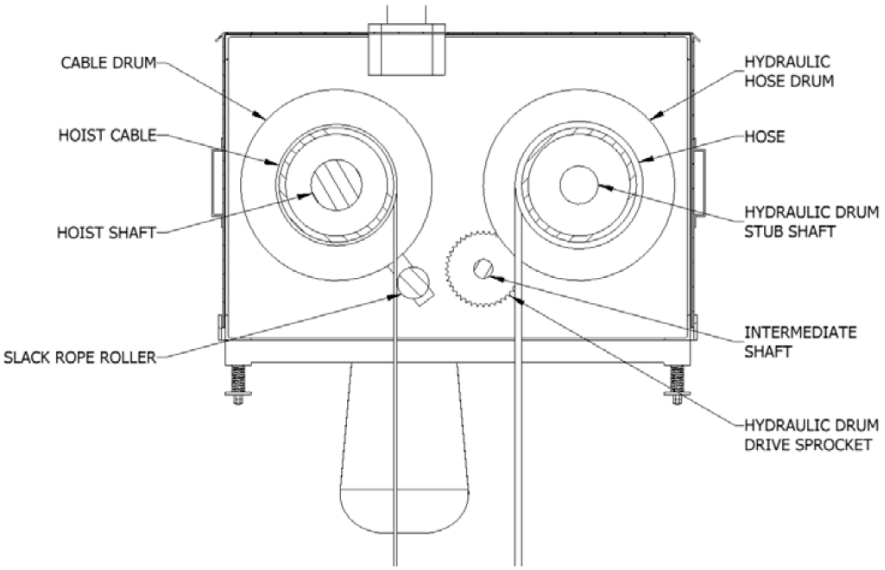


FIGURE 4.2A – DIAGRAM OF HOIST REEL AND CABLE DRUM

5. Let out more cable and disconnect it from the Gripper by driving out the wedges from the wedge clamps, see Figure 4.2B.

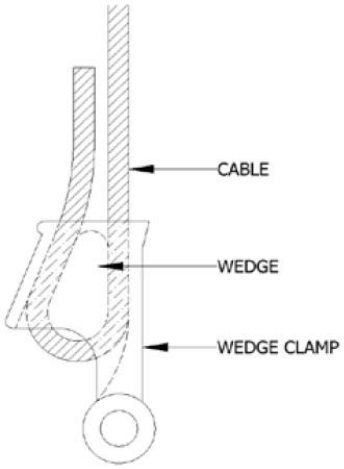


FIGURE 4.2B – CABLE WEDGE

6. Completely unwind the cables from the drums.

7. Release the cable clamps and completely remove the cables.

8. To reinstall the cables, clamp the ends of the new cables (or old cables if not being replaced) to the drums making sure that they pass between the drum and the slack rope roller and that the hydraulic hoses pass between the drum and the intermediate shaft, as shown above in Figure 4.2A.

9. Unroll the cables and carefully raise the Hoist ensuring that the cables lie correctly in the grooves on the drums. Take care that the hydraulic hoses also rewind correctly onto the reels during this operation.

10. Install the lower cable ends into the wedge clamps on the gripper, making sure that the lifting cable is adjacent to the vertical side of the clamp, as shown in Figure 4.2B.

11. Install the wedges taking care that the cable does not try to untwist.

12. Release the slack rope rollers so that they again rest against the cables.

13. Raise the Gripper and check that it is level with a bubble level.

14. When satisfied that the Gripper is level, raise it so that the dome nuts are resting between the swing restrictor plates, but the wedge clamps are still clear of the slack rope rollers, see Figure 4.2C.

15. Rotate the small position control gearbox so that the control arm is just actuating the upper limit sensor. A light will change states when the sensor is actuated. Replace the drive chain, taking care not to move the arm. Verify the control system will stop the hoisting an instant before the limit sensor is activated. It may be necessary to re-calibrate the hoisting encoder after replacing the lifting cables.

16. Lower the Gripper slightly and then raise it carefully to check the cut out point. If necessary, return to Step 14 and 15 to readjust the arm and switch.

17. Traverse the Equipment Trolley to a suitable raking point and lower the gripper to the screen invert. Check that the lowering motion is stopped by the controls system and not by the slack rope devices.

18. Raise the Gripper and again check for level.

19. Trim the ends of the cables to prevent any possible fouling in the trolley.

20. Check that the Equipment Trolley side covers are secure and remove all tools, ladders, staging and loose materials.

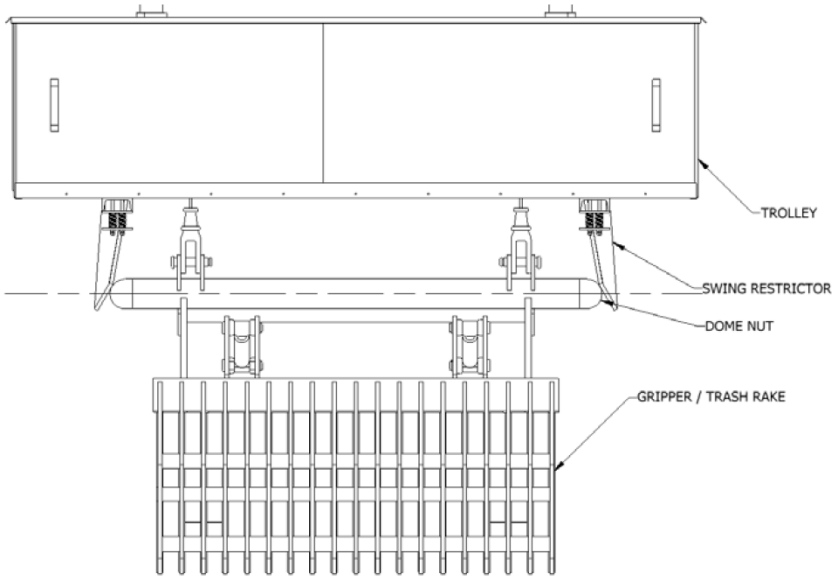


FIGURE 4.2C – GRIPPER BETWEEN SWING RESTRICTOR PLATES

4.2.3 Gripper Hose Removal

1. Turn the system to ON and place in MANUAL mode.

2. Traverse the unit, using the remote control, to the maintenance position and lower the Gripper onto a flat surface.

3. Attach a long rope or line to the hydraulic hose and secure. The hoses are wound on a spring tensioned drum, when the hose is released from the Gripper it will be under tension and want to wind on the drum.

4. Disconnect the hose from the union connection at the Gripper and blank the ends to prevent ingress of dirt.

5. Unsecure the rope and use it to manually allow the spring tension to slowly wind the hose onto its drum. Release all spring tension, 4 to 5 turns.

6. Connect the new hose to the drum and straighten it out. Ensure that the hose is correctly positioned and is NOT over the intermediate shaft.

7. Carefully rotate the hose reel to wind on the hose, taking care to keep it tight, with the turns close together and free from kinks. Gently twisting the hose will assist.

8. Reconnect the drive chain and pull out the hose connecting it to the Gripper.

9. To provide the correct tension in the hose, there should be four (4) complete turns of the drums against the internal spring before the hose is connected to the Gripper. If the distance between reel and Gripper does not achieve this, rotate the drum prior to pulling out the hose.

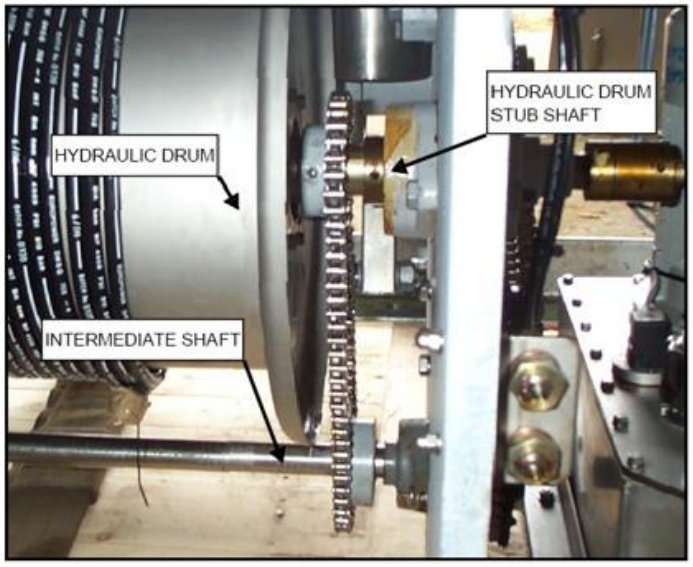
10. Raise the Gripper and check that the hose reels correctly onto the drum.

11. Operate OPEN / CLOSE several times to expel any air from the hydraulic circuit.

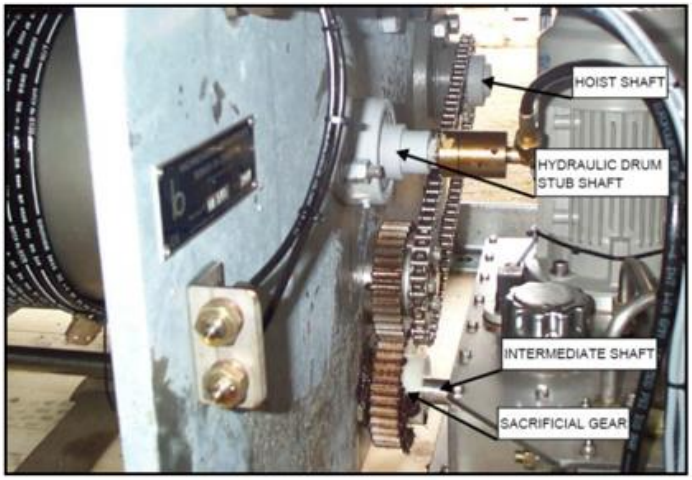
12. Check the oil level in the hydraulic tank and top off if necessary.

13. Move the machine to a raking position and test. Check that the hose turns do not climb over each other or over the end of the drum.

14. Remove all tools, ladders, staging and loose materials.



INNER BULKHEAD



OUTER BULKHEAD

FIGURE 4.3A – HYDRAULIC DRIVE CHAIN

4.2.4 Spring Replacement

1. Remove the hydraulic hose from the gripper. See Section 4.2.3.
2. Remove the swivel connector (5 from Figure 4.4A) and the pipe from the reel center to rim.
3. Remove the adjustable bronze ring (3 from Figure 4.4A).
4. Remove the nuts and bolts securing the stainless end cover plate and remove the cover plate.
5. The outer spring is now visible and can be removed, see note below.

WARNING: REMOVE THE SPRING CAREFULLY OR IT MAY JUMP AND CAUSE INJURY OR DAMAGE. Do not allow the center coils to move separate of the outside coils it could allow the entire spring to unsafely uncoil.

6. Remove the separator plate.
7. The inner spring is now visible and may be removed in a similar manner to the outer spring.
8. Reassemble in the reverse order. Reconnect the gripper hose as described in Section 4.2.3.

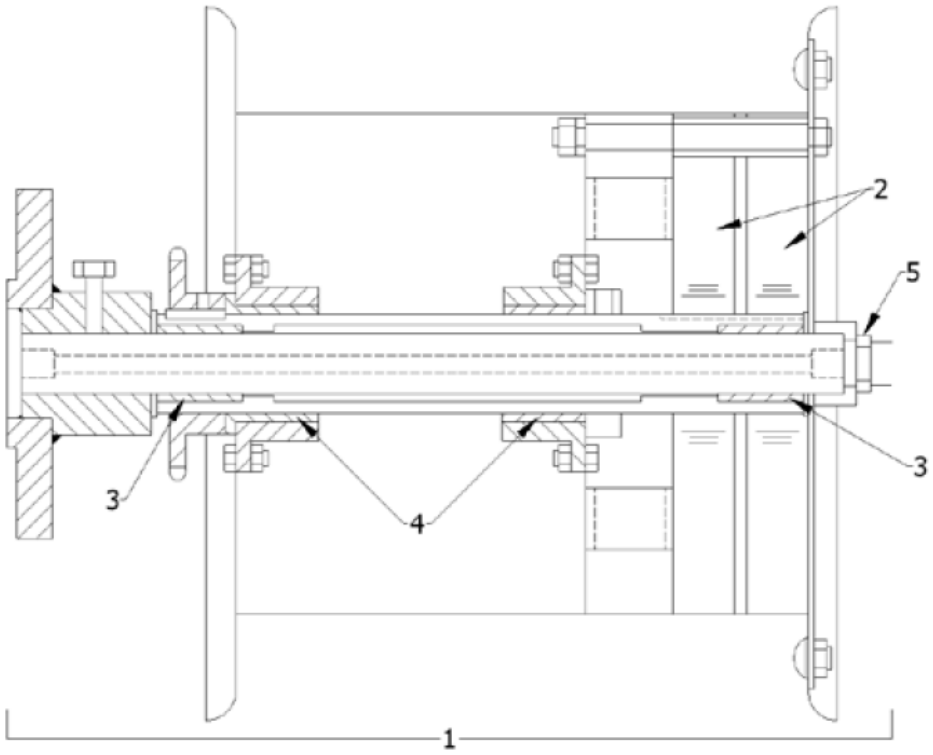


FIGURE 4.4A – HOSE REEL ASSEMBLY

4.2.5 Hydraulic Drum Bushings Replacement

1. Disconnect and remove the hose to the Gripper as described in Section 4.2.3.
2. Disconnect the connecting link and remove the drive chain.
3. Unbolt the complete reel assembly and stub shaft from the trolley and transport to workshop.
4. Remove the springs as described in Section 4.2.4.
5. Slide the reel and hollow hub off the stub shaft.
6. Slacken the grub screw and remove the collar securing the reel on the hollow drive hub.
7. Slide the reel off the hollow drive hub.
8. Remove and renew bushings as required.
9. Reassemble in the reverse order.

4.3 TROLLEY REMOVAL AND MAINTENANCE

4.3.1 Trolley Removal

a. Turn the system to *ON* and place in *MANUAL* mode.

b. Traverse the trolley, using the remote pendant, to the maintenance area and lower the gripper onto a level surface.

c. Disconnect the hoist cables from the gripper. Whether or not the cables should be completely removed at this stage will depend upon the extent of dismantling. If the drums or shaft are to be removed, then the cables should be completely removed as described in this manual.

d. Disconnect the hydraulic hoses following the procedures described in this manual.

e. Traverse the trolley to a location where it can be removed without interfering with anything.

f. Isolate all electrical supplies, including the supplies to the anti-condensation heaters.

g. Disconnect the cables from the trolley junction box, mark and tape ends and disconnect them from the trolley. Ensure no wires from the energy chain remain connected to any components on the trolley.

h. Carefully sling the trolley and monorail section from a suitable overhead or mobile crane or other lifting system, using spreaders below and above the trolley to avoid damage. Once properly rigged the bolts connecting the trolley to the bridge crane may be removed and the trolley can be relocated.

i. Perform maintenance on necessary components.

j. Reassembly is carried out in the reverse order of that detailed for dismantling.

k. The following points should be particularly noted during reassembly.

   1) Make sure that the trolley is the right way around with the cable clamp at the control end.

   2) Refill all gearboxes and the hydraulic tank to the correct levels.

   3) Take care that the energy chain cables are not twisted and are re-landed correctly.

   4) Reconnect and level the gripper support cables.

   5) Reconnect the hydraulic hoses to the gripper.

   6) Remove all ladders, staging, tools and loose materials.

4.3.2 Small Positioning Gearbox Removal

a. The main hoist shaft is carried at the hydraulic pump end and in the middle by self-aligning ball bearings and on the hoist end by the Hoist Unit.

b. Before dismantling check that the limit switches are clear and will not be damaged.

c. Remove the chain from the small positioning gearbox to the hoist shaft.

d. Unbolt the small positioning gearbox from the trolley and carefully remove.

4.3.3 Hoist Shaft Free End Bearing Removal

a. The free end bearing can only be removed after the trolley has been removed from the overhead track and transported to a suitable workshop area.

b. The main hoist shaft is carried at each end by a self-aligning ball bearing and in the middle by the Hoist Unit.

c. Before dismantling check that the limit switches are clear and will not be damaged.

d. Remove the chain sprocket from the end of the shaft. It is secured with an Allen Key.

e. Unbolt the bearing support flange from the trolley bulkhead and remove the bearing.

4.3.4 Trolley Further Dismantling and Hoist Unit Removal

a. If further dismantling is required, it is necessary to slide the shaft itself lengthwise out of the various components mounted on it.

b. Remove the slack rope rollers from their support arms.

c. The shaft is the same diameter throughout and it is essential to ensure that it is perfectly clean and free from burrs or damage before attempting to remove it.

d. Remove keys and set screw from the cable drums and all the sprocket hubs. As each key comes clear, remove it and label for re-use in the same position.

e. Support the cable drums for the Hoist shaft removal.

f. Unbolt the cross member from the end of the trolley so that the shaft can be withdrawn from the trolley and Hoist Unit.

g. Once the shaft is removed, the Hoist Drive Unit can be unbolted and removed.

4.3.5 Hydraulic Power Pack Removal

a. Move the Equipment Trolley to the maintenance position and lower the Gripper onto a level area.

b. Drain the oil from the tank.

c. Isolate the electrical supplies to the pump motor and control valves, including the supply to the anti-condensation heater.

d. Disconnect all electrical leads. Mark and tape ends.

e. Disconnect the hydraulic connections to the hose reels and blank the ends.

f. Release the securing bolts at the bottom of the tank and check that the pack is clear to be lowered carefully through the bottom of the trolley. The unit may need to be lifted over some mounting angles in order to successfully be removed.

4.3.6 Cylinder Seal Removal

a. Disconnect the hydraulic hoses from the cylinder on the Gripper and blank the ends.

b. Remove the cylinder and transport to a clean workshop.

c. Remove the screw on seal cap and remove the nut securing the piston. Remove the piston head.

d. Renew the seal in the cap.

e. Separate the two (2) sections of the piston head and renew the head seals.

f. Reassemble the piston head and tighten the nut using Loctite®.

g. Re-insert the piston and refit the seal cap.

h. Refit the cylinder to the gripper and reconnect the hydraulic hoses.

i. Lift the Gripper clear of the ground and operate the cylinders 3 or 4 times to expel any air. Check the oil level in the tank and top off if necessary.

j. Remove all tools and loose materials.

4.3.7 Hydraulic Power Pack Post Overhaul Procedures

a. Thoroughly clean the system and flush through with oil. Pay particular attention to the cleanliness of the pump suction connection.

b. Spin the motor briefly to check for correct rotation.

c. Check that the oil tank cover is securely fixed and that the breather is clean and clear.

d. Check that all pipe and hose connections are correctly and firmly made.

e. Fill the oil tank to maximum level and check that the pump itself is submerged or full of oil.

f. Unscrew the setting screw on the pressure relief valve so that there is little pressure build up and run the pump for a short time to check for correct operation. Return the valve to its correct setting of 1300psi (90 bar). Do not allow the pump to run for a long time at this pressure or the oil may become overheated.

g. With the Gripper suspended clear of the ground and using the hand control unit, run the pump by opening and closing the gripper.

h. Operate the cylinders 3 or 4 times to expel any air and again, check the oil level. Top off if necessary.

4.3.8 Bridge Crane Maintenance

a. For all bridge crane and bridge crane related component maintenance see the American Equipment O&M Manual in the appendix.

4.4 PREVENTATIVE MAINTENANCE

ACTIVITY DESCRIPTION	HOURS	TYPE OF CRAFT
Routine Maintenance Lists		
Monthly	6.0	Operator / Mechanical / Millwright
Every Three Months	10.0	Operator / Mechanical / Millwright
Annually[1]	16.0	Operator / Mechanical / Millwright
Every Two Years[1]	24.0	Operator / Mechanical / Millwright
Wire Rope Inspection	2.0	Operator / Mechanical / Millwright
Routine Maintenance Items		
Clean / Change the Return Oil Filter Element	2.0	Operator / Mechanical / Millwright
Sight Gripper for Level[3]	0.1	Operator / Mechanical / Millwright
Change Oil in Hoist Gearbox	2.0	Operator / Mechanical / Millwright
Change Oil in Traverse Drive Gearbox	4.0	Operator / Mechanical / Millwright
Lubricate all Pivots on the Gripper	0.5	Operator / Mechanical / Millwright
Traverse the Trolley Over the Full Distance for Smooth Function	0.5	Operator / Mechanical / Millwright
Check that the Cable Wagons Move Freely Across Full Distance	0.5	Operator / Mechanical / Millwright
Operate Grippers in Cleaning Cycle to Check Top and Bottom	0.5	Operator / Mechanical / Millwright
Lubricate Drive Chains	1.0	Operator / Mechanical / Millwright
Check Operation of All Limit Switches[1]	1.5	Operator / Mechanical / Millwright
Check Emergency Stops for Operation[1]	0.2	Operator / Mechanical / Millwright
Check Tension of Swing Restrictor Springs	0.5	Operator / Mechanical / Millwright
Non-Routine Maintenance		
Lubricate All Ball and Roller Bearings	2.0	Operator / Mechanical / Millwright
Removal And Replacement Of Components		
Wire Rope	3.0	Mechanical / Millwright
	1.0	Electrical
Equipment Trolley	4.0	Mechanical / Millwright
Hoist Shaft Free End Bearing[2]	4.0	Mechanical / Millwright

MAINTENANCE

ACTIVITY DESCRIPTION	HOURS	TYPE OF CRAFT
Hoist Unit[2]	8.0	Mechanical / Millwright
	1.0	Electrical
Traverse Drive Unit (See American Equipment Manual for Details)	6.0	Mechanical / Millwright
	1.0	Electrical
Brake Adjustment (Hoist)	4.0	Mechanical / Millwright
Brake Adjustment (Traverse)	4.0	Mechanical / Millwright
Brake Replacement (Hoist)	4.5	Mechanical / Millwright
Brake Replacement (Traverse)	4.5	Mechanical / Millwright
Cylinder Seals Removal (Per Cylinder)	2.0	Mechanical / Millwright
Festoon Wagon Assembly (Per Assembly Plus Staging)	0.1	Mechanical / Millwright
Positioning Proximity Sensor Adjustment	4.0	Electrical
Fuse Replacement	0.1	Electrical
Light Bulb Replacement	0.1	Electrical

[1] The maintenance mentioned above can all be at minimum “checked” by operator, if there is an issue with one of the electrical components this can be fixed / replaced / troubleshot by a trained electrical technician.

[2] The work listed must be performed on the Equipment Trolley after it has been removed from the bridge and transported to an adequate workshop. Include time for Equipment Trolley removal and transportation. See Section 4.3.1

[3] If adjustments needed additional time required.

All times based on personnel experienced in their trade and that all necessary tools are on hand. Times may vary dependent on site conditions and experience / training of personnel performing the work. Times do not include time used for site procedures and lock out / tag out steps.

4.5 MAINTENANCE SCHEDULE

4.5.1 After First 50 Hours of Operation

a. Check hydraulic oil level by sight glass on tank.

b. Clean or change the return oil filter element.

c. Check all hydraulic connections for leaks.

d. Sight gripper for level.

4.5.2 After First 500 Hours Of Operation

a. Change oil in hoist gearbox.

b. Change oil in traverse drive gearbox.

c. Sight gripper for level.

4.5.3 Monthly

a. Lubricate all pivot points on the gripper.

b. Check hydraulic oil level.

c. Check all hydraulic hoses for leaks or cracks.

d. Traverse the trolley over the full distance and check that it moves freely and smoothly.

e. Check that the energy chain also move freely.

f. Operate the gripper over a full cleaning cycle and check that it is horizontal and that the top and bottom limit switches work properly.

g. Check the condition of the gripper cables.

h. Lubricate all drive chains in the trolley.

i. Clean and visually inspect wire ropes.

4.5.4 EVERY SIX (6) MONTHS (In Addition To Monthly Maintenance)

a. Check the condition of the gripper wear pads that ride along the bar screens. Replace if needed.

4.5.5 ANNUALLY (In Addition To Six Month Maintenance)

a. Change the hydraulic oil.

b. Clean or change the element in the return oil filter.

c. Fully inspect both hoisting ropes.

d. Check the operation of all proximity sensors.

e. Check the emergency stop on the control panel.

4.5.6 Every Two (2) Years

a. Change the oil in the hoist gearbox.

b. Change the oil in the traverse gearbox.



WARNING: Unless oil consumption is high, or seal or bearing damage is suspected, the drive units should need no further attention.

4.6 MAINTENANCE LOG

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

DATE	ITEM - BASIN #, UNIT #	VOLUME/TYPE GREASE/RESISTANCE	REMARKS	INITIALS

5.0 OPERATION

5.1 START UP SERVICES

5.1.1 General Start-Up Services

a. 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.

b. They can instruct on proper operating and maintenance procedures, advise on troubleshooting and, if necessary, supervise the entire start-up, depending on requirements.

c. 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.

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

5.1.2 On-Site Start-Up Services

Ovivo shall furnish the services of an Ovivo representative who has complete knowledge and experience in the proper installation, startup and operation of the equipment. The Ovivo representative will be provided for a minimum of 2 eight-hour days per screen unit to inspect the final installation and supervise a test run of the equipment. If there are difficulties in operation of the equipment due to the Manufacturer's fabrication or Construction CONTRACTOR's installation, additional service shall be provided at no additional cost to the OWNER.

After installation is complete and the installation approved by an Ovivo representative and after approval by the ENGINEER, the equipment shall be field tested under the supervision of an Ovivo representative.

a. Test all equipment to demonstrate that the equipment is installed correctly and is in proper operating condition as Specified, free from defects or faults. Furnish all labor and incidentals required to conduct such tests and to correct to the full satisfaction of the ENGINEER all defects or deficiencies noted.

b. Conduct in the presence of the ENGINEER and under the supervision of the Manufacturer's factory representative, test runs to demonstrate the unit's ability to operate as Specified, without noise, vibration or overheating. Any deficiencies noted during the testing shall be corrected at no additional expense to the OWNER.

1) The coarse screen shall have a dry test run to demonstrate the correct alignment, smooth operation, proper and equal spacing of screen bars and freedom from vibration, excessive noise and overheating of the parts and bearings.

2) The equipment shall be operated for a minimum of eight (8) hours to ensure that all clearances, vibrations, tracking and motor operating characteristics are within acceptable limits, as set by the Manufacturer.

3) All defects recorded during the above field tests and all defects and failures occurring within the first year of operation shall be corrected by the Construction CONTRACTOR with no additional cost to the OWNER.

4) The Construction CONTRACTOR shall test the traversing length of each trolley by hand operation to verify that the trolley shall reach the farthest bar screen at the side opposite the trolley parking position. The trolley shall then be traversed to the respective parking position where traversing further in that direction shall be prevented. This test shall be conducted until three (3) successful consecutive tests are achieved.

5) The Construction CONTRACTOR shall park the trolley at the respective dumpsite and lower the trolley to the ground elevation to verify that the lowering operation shall cease upon the trolley resting on the ground and providing a slack rope situation. The gripper shall then be raised to its fullest height to verify the hoist shall stop upward motion upon rising to the proper height. This test shall be conducted until five (5) successful consecutive tests are achieved.

6) The Construction CONTRACTOR shall test the opening and closing capabilities of the gripper and verify it shall fully open and close as required. This test shall be conducted until five (5) successful consecutive tests have been achieved.

7) The Construction CONTRACTOR shall test the manual operation of the trolley by successfully lowering the trolley five (5) times.

8) The Construction CONTRACTOR shall test the automatic modes of each system separately. The system shall be switched to "automatic" and the 24-hour timer prevented from engaging. The Construction CONTRACTOR shall override the bubbler system at PS 6 to show a high head differential and override the upstream level reading at the OSSS. The test shall verify that the trolley properly parks over each coarse screen, the access hatch opens where applicable, the gripper lowers, closes and raises, the trolley returns to the dumpsite, the access hatch at the screen closes, the gripper opens, then returns to the next screen until all or the respective screens have been cycled through. At PS 6 each bubbler shall be tested separately until successful operation is achieved at least three (3) times.

9) The Construction CONTRACTOR shall coordinate access hatch signals with access hatch and screen suppliers.

10) The Construction CONTRACTOR shall engage the time clock to prove that the system shall cycle through the entire set of coarse screens. Time clock shall be tested until three (3) successful tests are achieved.

11) In the event the coarse screen system fails to meet the above tests, the necessary changes shall be made and the system retested until successful operation is achieved at least three (3) times. If the system remains unable to meet the test requirements to the satisfaction of the ENGINEER, it shall be removed and replaced with a satisfactory system at the Construction CONTRACTOR's expense.

5.2 CONTROLS OPERATING INSTRUCTIONS

5.2.1 Operation Safety

Equipment purchased from Ovivo Inc. has been equipped with all the necessary features for safe operation. However safety features provided by Ovivo DO NOT take precedent over any federal, state, or local code. **Ultimate responsibility for safe operation is left to the operators and site personnel discretion**. Ovivo will not be held responsible for any injury that results from malpractice or misuse of equipment. Nor is Ovivo responsible for any mishap or injury resulting from ignorance with respect to state, local or federal code. The equipment should not be operated in the absence of handrails, guards or any other protective devices. Any guards, handrails, or housings removed for maintenance must be replaced before the equipment is returned to service.

5.2.2 General

The control system is contained in **TWO** control panels for both **MANUAL** and **AUTOMATIC** operation of each TBRS Unit. The **AUTOMATIC** operation is controlled by a PLC and the control input for the **MANUAL** mode is given by a wireless remote. Detail drawings for the control system can be found in the back of this manual.

5.2.3 Automatic Operation

a. The unit will automatically clean the bays on the signal of one of three inputs. These inputs are the 24 hour timer located inside the control panel, the A*UTO START* pushbutton, or the Main inlet channel level sensor measuring high water level in the upstream.

b. To run the system in Auto:

1) The **MANUAL-OFF-AUTO** selector switch must be set to **AUTO**.

2) The unit will move automatically to the park position when the selector switch is placed in *AUTO*. The *AUTOMATIC OPERATION* pilot light will flash on the control panel if the unit is not in position for auto mode

Note: The AUTO Operation Pilot Light on the front of the panel will be illuminated steady when ALL the start conditions are met.

3) When a start command is received, the trolley initiates the cleaning sequence.

4) Once the trolley has reached its first clean position, the gripper is lowered down the bar screen to its set depth. Should the gripper encounter an obstruction the slack rope device will stop the descent.

5) The gripper closes on the gathered debris and ascends into the swing restrictors plates.

6) The trolley then traverses to the dump site and the gripper opens releasing the refuse.

7) At this point the trolley traverses to the next pick position and repeats the sequence. Once all pick locations have been cleaned, the trolley returns to the park position, ending the automatic cleaning cycle.

5.2.4 Manual Operation

Manual control of the Brackett Bosker® is provided by hand held radio remote control transmitter.

a. The remote control transmitter has switches labeled UP/DOWN, FORWARD (FWD)/REVERSE (REV), OPEN/CLOSE, and UNIT A/UNIT B. These switches function exactly as their names indicate.

b. During normal operation, the gripper should travel to the raking position in the open position and be closed when it reaches the invert of the well.

c. From the designated park position, the operator may traverse the trolley by operating the FORWARD (FWD) switch on the remote control transmitter.

d. This action will start the traverse motors and release the traverse motor brake. The trolley will now move toward the bar screen until the operator releases the switch or hits a mechanical stop located on each end of the monorail.

e. Once the trolley has reached the desired raking position, release the FORWARD (FWD)switch. This stops the traverse motors and applies the traverse motor brakes.

f. Now the gripper is ready to be lowered to engage the bar screen. The operator may lower the gripper by operating the DOWN switch on the remote control transmitter.



FIGURE 5.2A – TYPICAL NON-EXPLOSION PROOF REMOTE CONTROL UNITS (ACTUAL CONFIGURATION MAY DIFFER)

g. This action will start the hoist motor and release the hoist motor brake. The hoist shaft will now turn and lower the gripper. A chain drive connected to the hoist shaft turns the small positioning gearbox in the trolley.

h. When the gripper reaches the invert, the encoder will stop the gripper.

i. Release the DOWN switch.

j. With the gripper at the invert of the well, press the CLOSE switch on the hand held remote control transmitter.

k. When the CLOSE switch is pressed, a signal is sent to the HPU to close the gripper.

l. The HPU provides pressure to the hydraulic cylinders. A solenoid is activated, changing the direction of flow of the hydraulic fluid causing the hydraulic cylinders to extend. This action forces the gripper closed.

m. Once the gripper is closed, release the CLOSE switch.

n. The gripper can be raised to the trolley by pushing the UP switch on the handheld remote-control transmitter.

o. The UP switch starts the hoist motor and releases the hoist motor brake.

p. The gripper will, like on the descent, travel until the switch is released or the upper limit is reached.

q. When the gripper reaches the upper limit the hoist motor will be stopped and the motor brake will be activated.

r. The trolley may now be traversed to the dump area. The trolley is traversed to the dump area by pressing the REVERSE switch.

s. This will start the traverse motors and release the traverse motor brakes and move the trolley.

t. When the trolley reaches the dump position release the REVERSE switch and the traverse motors will stop, and the motor brakes will be applied. When the trolley reaches the dump position the encoders will send a signal to the motor to stop.

u. The traverse motors will stop and the motor brakes will be applied.

v. Push the OPEN switch on the handheld remote-control transmitter. The HPU will power up and the solenoid with forces the hydraulic cylinder to retract, releasing the collected debris into the container.

w. Continue this routine until the bar screens is clean then return the trolley to the park position.

Note: The gripper can only be lowered at the dump location or one of the selected cleaning locations.

x. Since there are two units on the rails each remote allows a unit to be selected. To operate Unit A select UNIT A on the handheld remote-control transmitter. To operate Unit B select UNIT B on

the handheld remote-control transmitter. Both units will operate as described in the steps above. Special controls have been added to prevent the units from colliding, but it is still recommended that each unit be placed in its home position prior to operating the other unit. This will allow each unit to reach both the dump and pick locations uninhibited.

5.2.5 System Modes

5.2.5.1 Single trolley mode allows the system to only run one unit at a time. The mode is selected on the main HMI, system settings screen. The operator selects single trolley mode then selects the unit they would like to use. When Trolley two is selected trolley, one automatically moves to the secondary wait position allowing trolley two to clean the bar screen.

5.2.5.2. Dual trolley mode allows the system to run with both units. The mode is selected on the main HMI, system settings screen. The operator selects dual trolley mode and both units become active. When started trolley one moves and cleans the bar screen then moves to the secondary wait position and stops. Trolley two then move to clean the bar screens then moves back to the home/dump position. As trolley two is moving trolley one starts to move to its home position. The two units then dump and wait for another start command.

5.2.5.3. Continuous run mode allows the operator to run the system over and over until the operator turns the mode off from the main HMI system setting screen. This mode works in single trolley mode and dual trolley mode.

5.2.6 HMI Screens

5.2.6.1 MAIN screen



FIGURE 5.2B – HMI MAIN SCREEN

5.2.6.2 Rake Overview

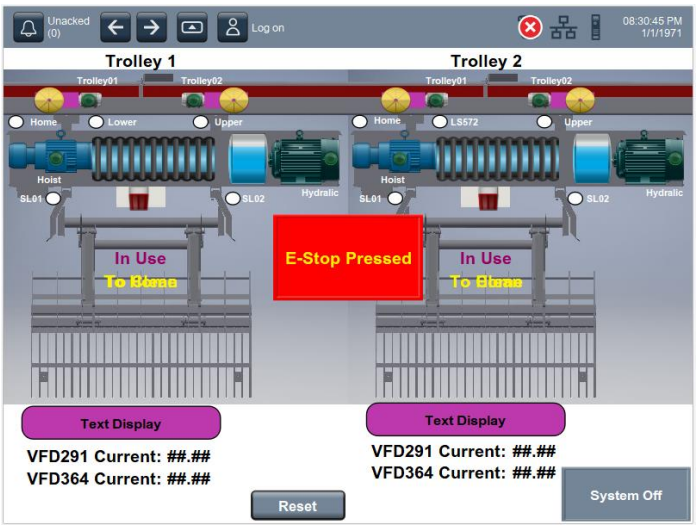


FIGURE 5.2C – RAKE OVERVIEW

5.2.6.3 CONTROL STATUS

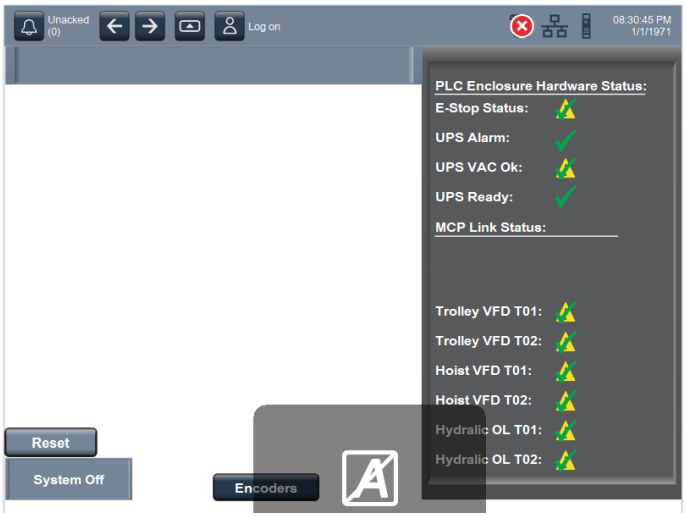


FIGURE 5.2D – CONTROL STATUS

5.2.6.4 STATISTICAL STATUS

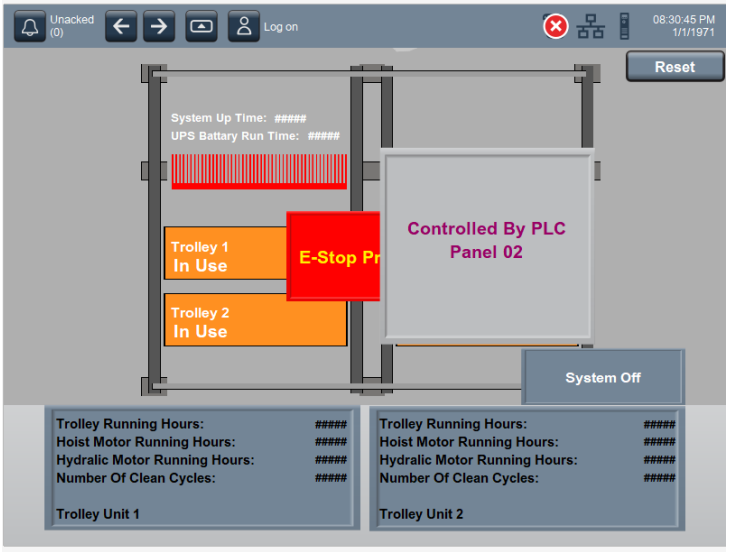


FIGURE 5.2E – STATISTICAL STATUS

5.2.6.5 SYSTEM SETTINGS

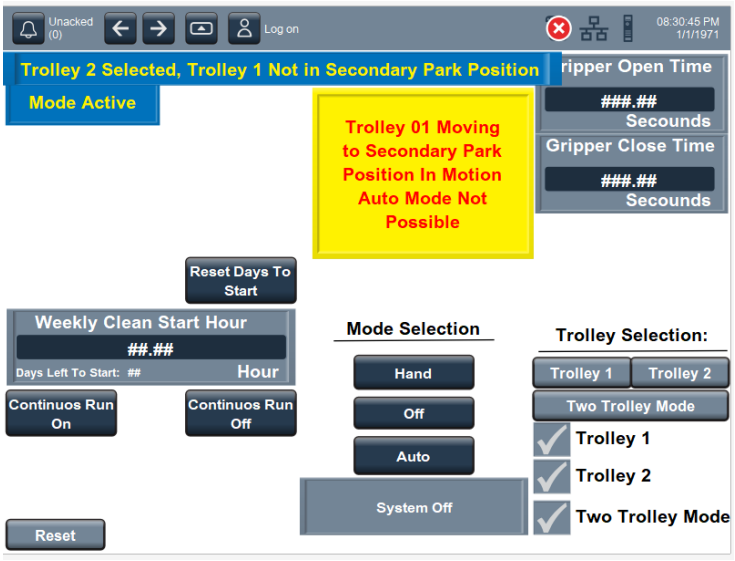


FIGURE 5.2E – SYSTEM SETTINGS

5.3 DETAILED OPERATION

5.3.1 Hoist Drive Unit Operation

a. Raise and lower functions of this unit, is controlled by the PLC sequencer (*AUTO* mode) or by an operator (*MANUAL* mode) using a hand held remote control transmitter. The remote control transmitter controls this function with momentary switches labeled *UP* / *DOWN*.

b. The *DOWN* switch will start the hoist motor and release the hoist motor brake. The hoist shaft will now turn the cable drum and lower the gripper. Either the code, small positioning gearbox, or slack rope roller switches will stop the descent.

c. The gripper can be raised to the trolley by pushing the UP switch. When the gripper reaches the upper limit, the hoist motor will be stopped and the motor brake activated.

5.3.2 Traverse Drive Unit Operation

a. *FORWARD (FWD) / REVERESE (REV)* functions (i.e. lateral traversing) of this unit are controlled by the PLC or an operator.

Note: The trolley can be traversed ONLY with the gripper in the highest “UP” position between the swing restrictors.

b. With the gripper at the upper most position, the operator may traverse the trolley by operating the *FORWARD (FWD) / REVERSE (REV)* switch. This action will start the traverse motors and release the motor brakes. The trolley will now move until the operator releases the switch reactivating the motor brakes stopping the motors. The trolley can be jogged into the desired position if minor adjustments are needed.

5.3.3 Gripper Operation

The remote-control transmitter has switches labeled *OPEN / CLOSED*; these switches open and close the gripper. Power for this system comes from an electrically driven hydraulic pump located in the trolley. When the *CLOSE* switch is present, the motor starts and a signal is sent to the solenoid-operated valve to open. This action allows the fluid to actuate the hydraulic cylinder son the gripper. The cylinders on the Gripper are double acting, which means that fluid is on both sides of the piston. When one side is at a higher pressure than the other, the piston moves toward the low-pressure side. To open the Gripper push the OPEN switch on the hand held remote control transmitter. This time the solenoid-operated valve opens but the fluid paths are switched, which forces the ram to operate in the opposite direction as before mentioned. See Figures 5.3A and 5.3B.

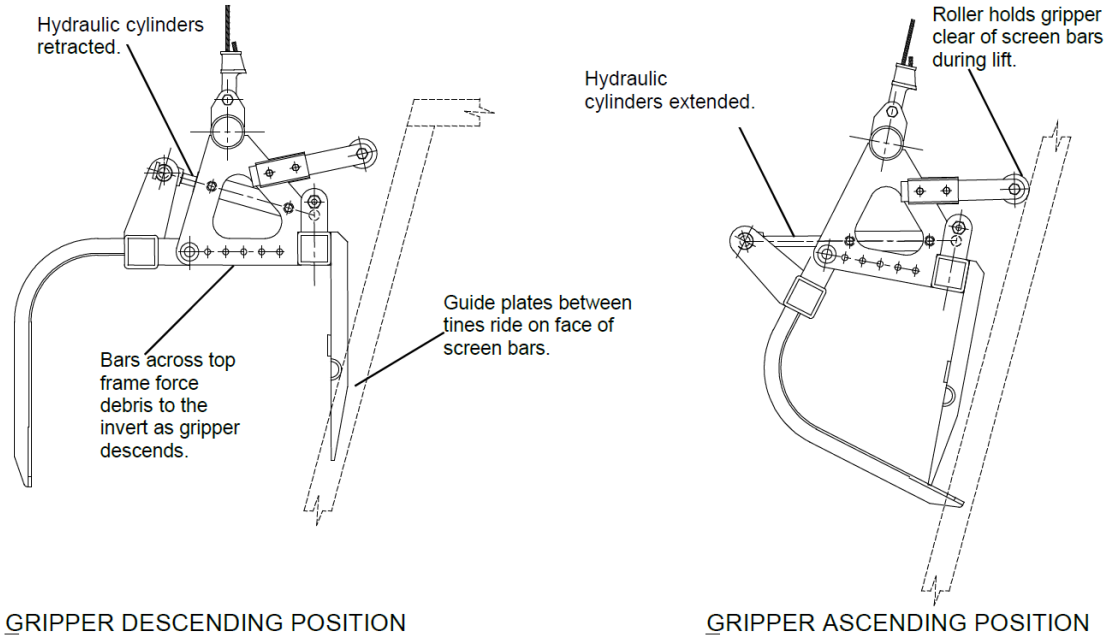
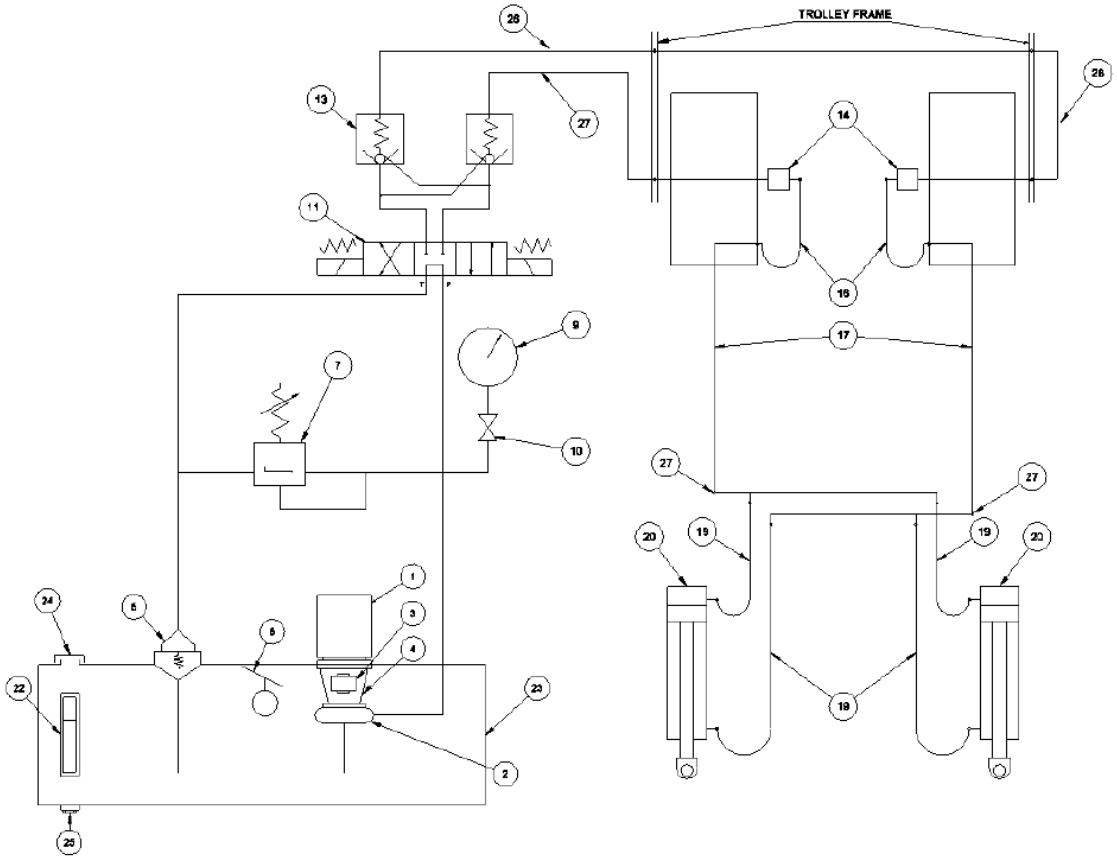


FIGURE 5.3A – TYPICAL POSITION OF THE GRIPPER



5.3B – HYDRAULIC SCHEMATIC

5.3.4 Proximity and Limit Switch Operation

All proximity switches should be positioned 1/8” to 3/16” clear of their respective target plates.

5.3.5 Depth Positioning Gearbox

A small depth positioning gearbox is chain driven from the hoist shaft and has a “T” shaped arm attached to its vertical output shaft, see Figure 5.3D. As the Gripper is raised or lowered this arm rotates and actuates proximity sensor clamped to a circular ring. The upper limit proximity sensor should be set to stop the hoist just after the Gripper enters the spring-loaded swing restrictor plates. The Gripper should be held by the plates but must be able to move higher to actuate the mechanical limit switch. The proximity sensor serves as a backup to the code controlled by the encoder.

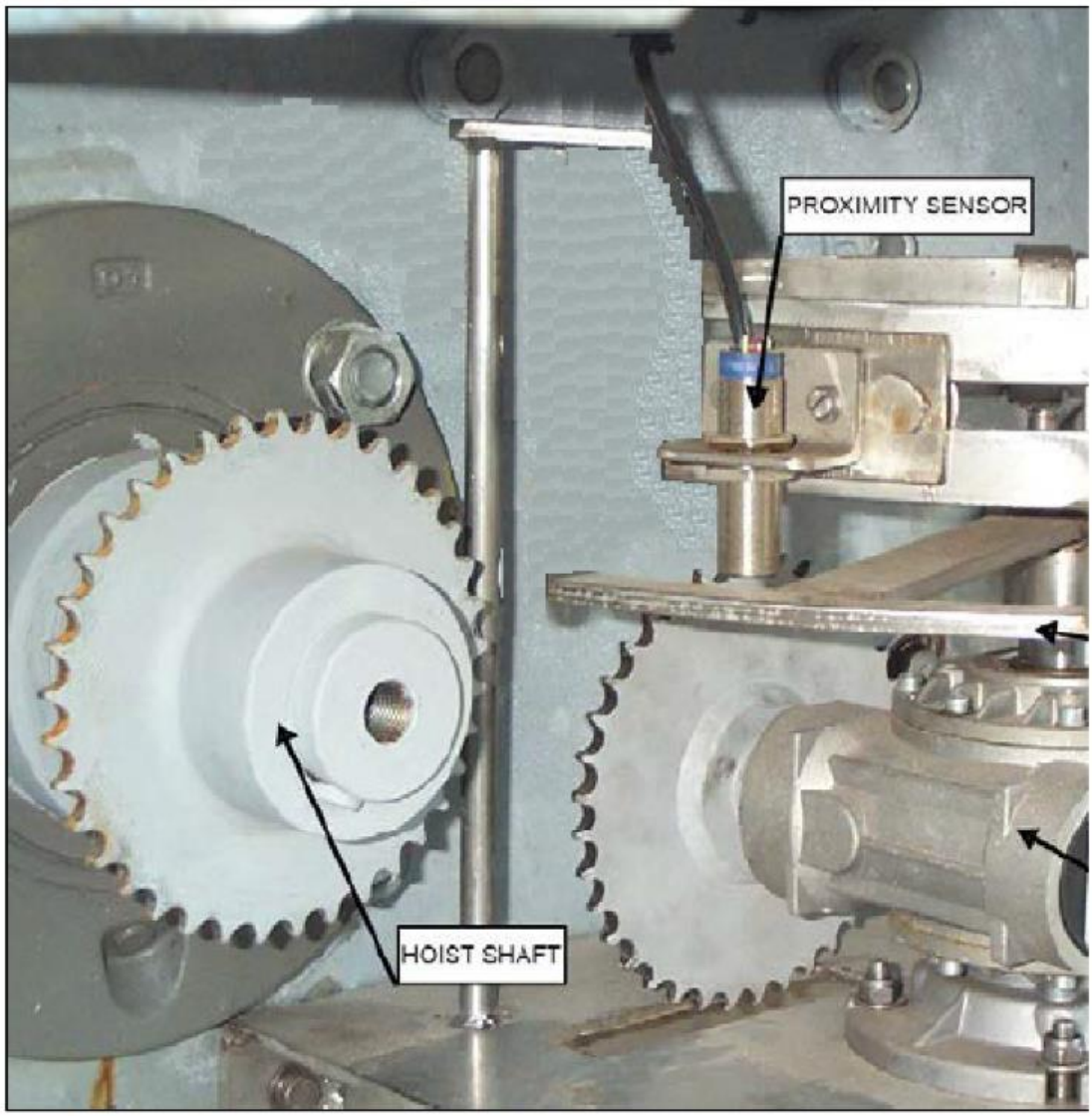


FIGURE 5.3C – DEPTH POSITIONING SENSOR

5.4 TROUBLESHOOTING

If the Heavy Duty Bosker shuts down unexpectedly during automatic operation and the fault light is illuminated, switch the machine to MANUAL mode and return the trolley to the park position. Return the switch to AUTO mode and press the AUTO START BUTTON to begin a cleaning cycle. (Note: Automatic operation can start only if the trolley is directly under the park position proximity switch. The AUTO OPERATING LAMP on the front of the panel will be illuminated when all the start conditions are met). Observe the operation for a fault condition.

PROBLEM	CAUSE	SOLUTION
TROLLEY		
System Fault Light Illuminated and Trolley stuck at CLEAN end of Monorail	Position (PX1) Proximity Switch did not send signal. Trolley tripped over-travel limit switch (LS1)	Check the Position (PX1) proximity sensor for proper function. Replace if necessary.
		Verify Intrinsic Safe Relay ISR30107 is receiving input on Channel 1. Replace ISR if it is not working properly.
		Verify PLC is receiving input from Position Proximity Switch at I:2/10. Indicator I:2/10 should illuminate when Switch is activated.
		Check for proper distance between Position pick-up plate and the Position (PX1) proximity sensor.
System Fault Light Illuminated and Trolley stuck at DUMP end of Monorail	Position (PX1) and/or Dump/Park (PX2) Proximity Switches did not send signal. Trolley tripped over-travel limit switch (LS1)	Check the Dump/Park (PX2) proximity sensor for proper function. Replace if necessary.
		Verify Intrinsic Safe Relay ISR30107 is receiving input on Channel 2. Replace ISR if it is not working properly.
		Verify PLC is receiving input from Dump/Park Proximity Switch at I:2/11. Indicator I:2/11 should illuminate when Switch Is not activated.
		Check for proper distance between respective pick-up plate and the respective proximity sensor.
Trolley Overload Light Illuminated Solid	Trolley Motor Overload Tripped	In Trolley Motor MCC bucket, verify Overload has tripped. Check motor circuit for any faults and correct. Reset overload and test to verify.
Trolley Overload Light Flashing – Thermostat fault.	Trolley Motor(s) Overheated and tripped internal winding thermostats.	Check Trolley Motor System and identify reasons for motors overheating. Reset and test to verify.
Trolley will not traverse.	Gripper not in the upper most position. Trolley will not traverse unless Upper (PX5) Proximity Switch is activated.	Check Upper (PX5) Proximity Switch for Proper Function. Replace if necessary.
		Verify Intrinsic Safe Relay ISR30117 is receiving input on Channel 1. Replace ISR if it is not working properly.
		Verify PLC is receiving input from Proximity Switch at I:2/15. Light on Proximity Switch should illuminate when Switch is activated.
		Manually raise gripper to the upper most position. Verify Upper Proximity Switch is made – Green Light on Proximity Switch is ON. Adjust the location of Proximity Switch as necessary to activate when Gripper is fully raised.

PROBLEM	CAUSE	SOLUTION
Trolley will not traverse. (cont.)	Trolley did not reach next proximity	Check track for obstruction or slipping drive-wheels.
	Motor Circuit Breaker tripped.	Reset Motor Circuit Breaker and verify that motor is operating properly. Check circuit for any faults and correct.
HOIST		
Hoist Overload Light Illuminated Solid	Hoist Motor Overload Tripped	In Hoist Motor MCC bucket, verify Overload has tripped. Check motor circuit for any faults and correct. Reset overload and test to verify.
	Hoist Motor Overcurrent Tripped – Overload has not tripped.	Check Gripper for overweight/jam conditions. Clear debris and/or reasons for overweight/jam. Reset faults and test system.
Hoist Overload Light Flashing – Thermostat fault.	Hoist Motor Overheated and tripped internal winding thermostats.	Check Hoist Motor System and identify reasons for motors overheating. Reset and test to verify.
Hoist/Gripper won't lower	Lower Proximity (PX6) Switch is activated.	Check the Lower (PX6) Proximity Switch for proper function. Replace if necessary.
		Verify Intrinsic Safe Relay ISR30117 is receiving input on Channel 2. Replace ISR if it is not working properly.
		Verify PLC is receiving input from Position Proximity Switch at I:2/14. Indicator I:2/14 should illuminate when Switch is activated.
		Verify Lower Proximity (PX6) is adjusted properly
	Motor Circuit Breaker tripped.	Reset Motor Circuit Breaker and verify that motor is operating properly. Check circuit for any faults and correct.
	Gripper in a Slack Rope condition	Raise gripper to put tension on the gripper cables.
	Gripper at the lowest level and has tripped the Lower Limit Switch (LS6)	Raise gripper and Check the position and actuation of the lower limit switch.
Hoist won't raise	Upper Proximity (PX5) Switch is activated.	Check the Upper (PX5) Proximity Switch for proper function. Replace if necessary.
		Verify Intrinsic Safe Relay ISR30117 is receiving input on Channel 1. Replace ISR if it is not working properly.
		Verify PLC is receiving input from Position Proximity Switch at I:2/14. Indicator I:2/14 should illuminate when Switch is activated.
		Verify Upper Proximity (PX5) is adjusted/positioned properly.
	Motor Circuit Breaker tripped.	Reset Motor Circuit Breaker and verify that motor is operating properly. Check circuit for any faults and correct.

PROBLEM	CAUSE	SOLUTION
Hoist won't raise	Gripper jammed by unusual debris.	Shut down system and remove obstruction.
	Gripper at the highest level	Lower gripper and Check the limit switches.
Gripper Will Not Open or Close	Hydraulic motor overloaded.	Reset motor overload/ Check circuit for fault.
	Low hydraulic fluid.	Add hydraulic fluid/ Check for leaks.
Oil is Overheating	The pump is running against the safety valve.	Check safety valve for proper operation.
	Oil is overflowing from the delivery side of the pump back to the tank without effective operation.	Check for blockage in the hydraulics lines.
Noisy Pump or Valves	There is air in the oil.	Check the oil level in the tank, fill if required.
		Check for fine leakage and repair.
		Operate 3 or 4 times to expel air.
	The pump suction is obstructed.	Clear obstruction.
	There is a mechanical fault.	Check the condition of the motor, pump, and coupling; repair if necessary.
	The safety valve is faulty.	Check that the system is reaching correct pressure.
Oscillating Pressure or Chattering	Air in the oil.	See above.
	The safety valve is faulty.	Check, repair, or replace.
	The control and regulator valves are contaminated.	Check and clean.

PROBLEM	CAUSE	SOLUTION
Insufficient Pressure	Safety valve has a broken spring, is badly adjusted, or is contaminated.	Inspect and correct or renew.
	Damaged seals in cylinder.	Inspect and correct.
	Incorrect pump rotation.	Check and rewire if necessary.

5.5 TRASH RAKE - PARTS LIST

5.5.1 Hoist Unit

a. Hoist Shaft Assembly

ITEM	DESCRIPTION (See Figure 5.5A)	QUANTITY
1	Shaft support bearing	1
2	Cable drums	2
3	Slack rope pivot bearing	4
4	Slack rope roller	2
5	Sack rope roller bearing	6
6	Sprocket for positioned drive	1
7	Positioned drive chain	1
8	Chain connecting link	1
9	Positioned gearbox	1
10	Hoist Gear motor (Not Shown)	1

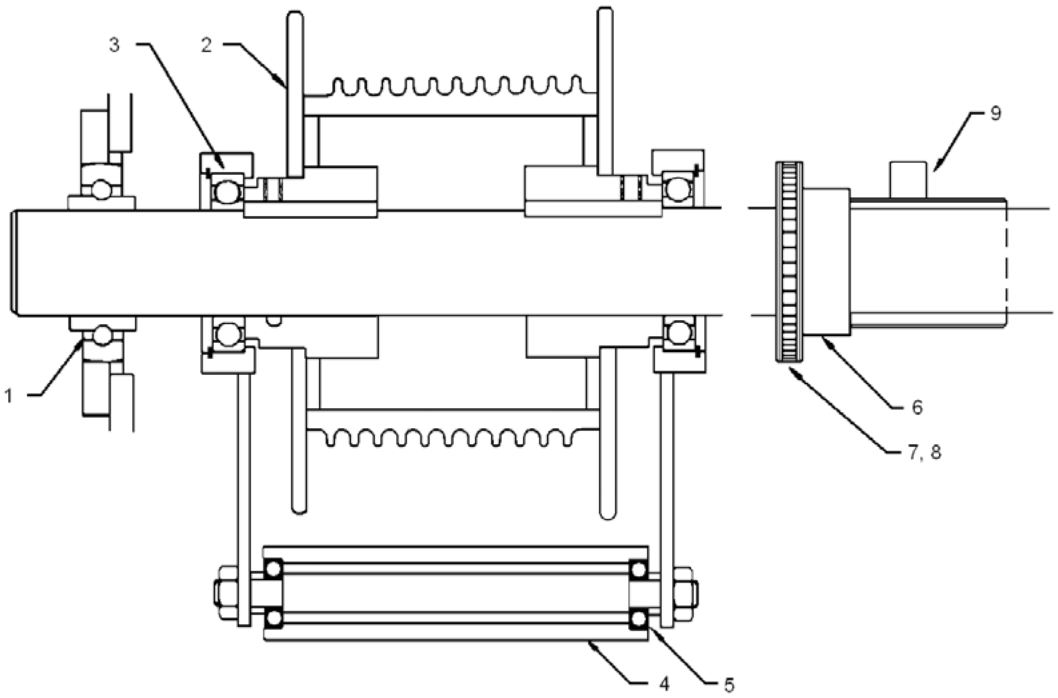


FIGURE 5.5A - HOIST SHAFT ASSEMBLY

5.5.2 Hydraulic Unit

a. Hose Reels and Drums

ITEM	DESCRIPTION (See Figure 5.5B)	QUANTITY
1	Spring loaded hose reel, complete	2
2	Springs	4
3	Bronze bush, inner	2 pairs
4	Bronze bush, outer	2 pairs
5	Swivel coupling	2
6	*Drive chain	2
7	*Half link	2
8	*Connecting Link	2
* Items Not Shown		

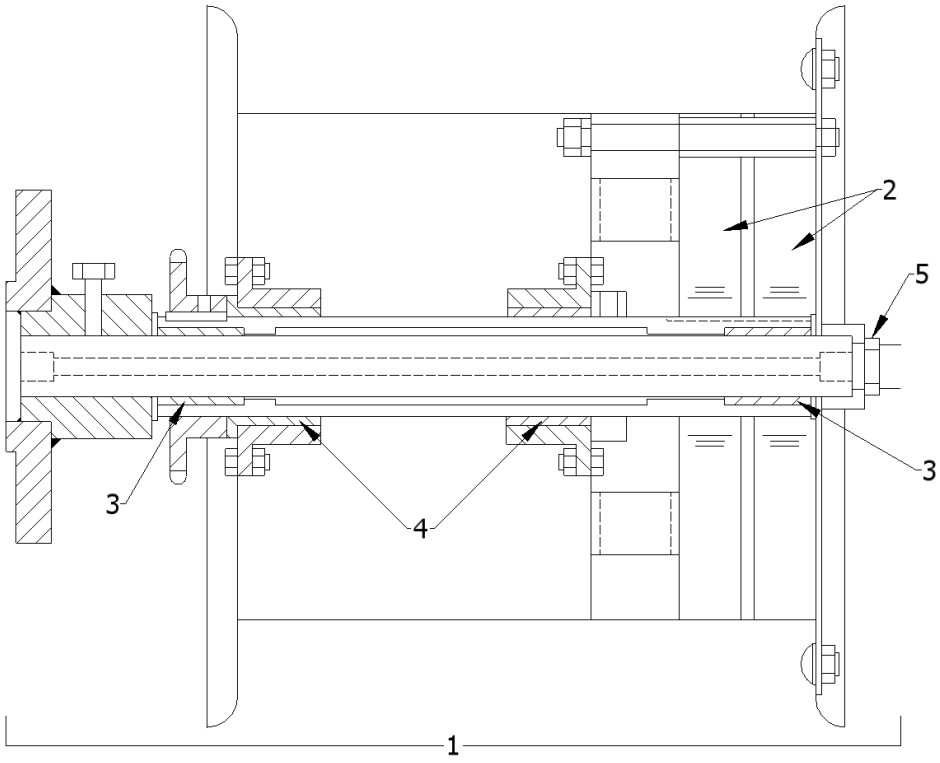


FIGURE 5.5B - HOSE REEL PARTS ASSEMBLY

b. Hydraulic Power Pack

ITEM	DESCRIPTION (See Figure 5.5C, next page)	QUANTITY
1	Pump Motor	1
2	Hydraulic Pump	1
3	Coupling	1
4	Coupling Housing	1
5	Return Filter (Complete)	1
6	Return Filter Element and Spring	(1)
7	Pressure Relief Valve	1
8	Oil Level Switch	1
9	Pressure Gauge	1
10	Gauge Cock	1
11	Solenoid Operated Control Valve (Complete)	1
12	Solenoid Only for Control Valve	(2)
13	Controlled Return Valve	2
14	Swivel Coupling	2
15	Seals for Swivel Coupling	(2 Sets)
16	Hose Reel to Pipe (Stainless)	2
17	Hose to Gripper	2
18	OBSOLETE ITEM	
19	Gripper Hose (Short)	2
20	Hydraulic Cylinder (Complete)	2
21	Seals Only Hydraulic Cylinder	(2 Sets)
22	Hydraulic Reservoir Oil Sight Glass	1
23	Oil Tank	1
24	Filler Cap with Filter	1
25	Oil Drain Plug	1
26	Trolley Hydraulic Manifold	1
27	Swivel Coupling on Gripper	2

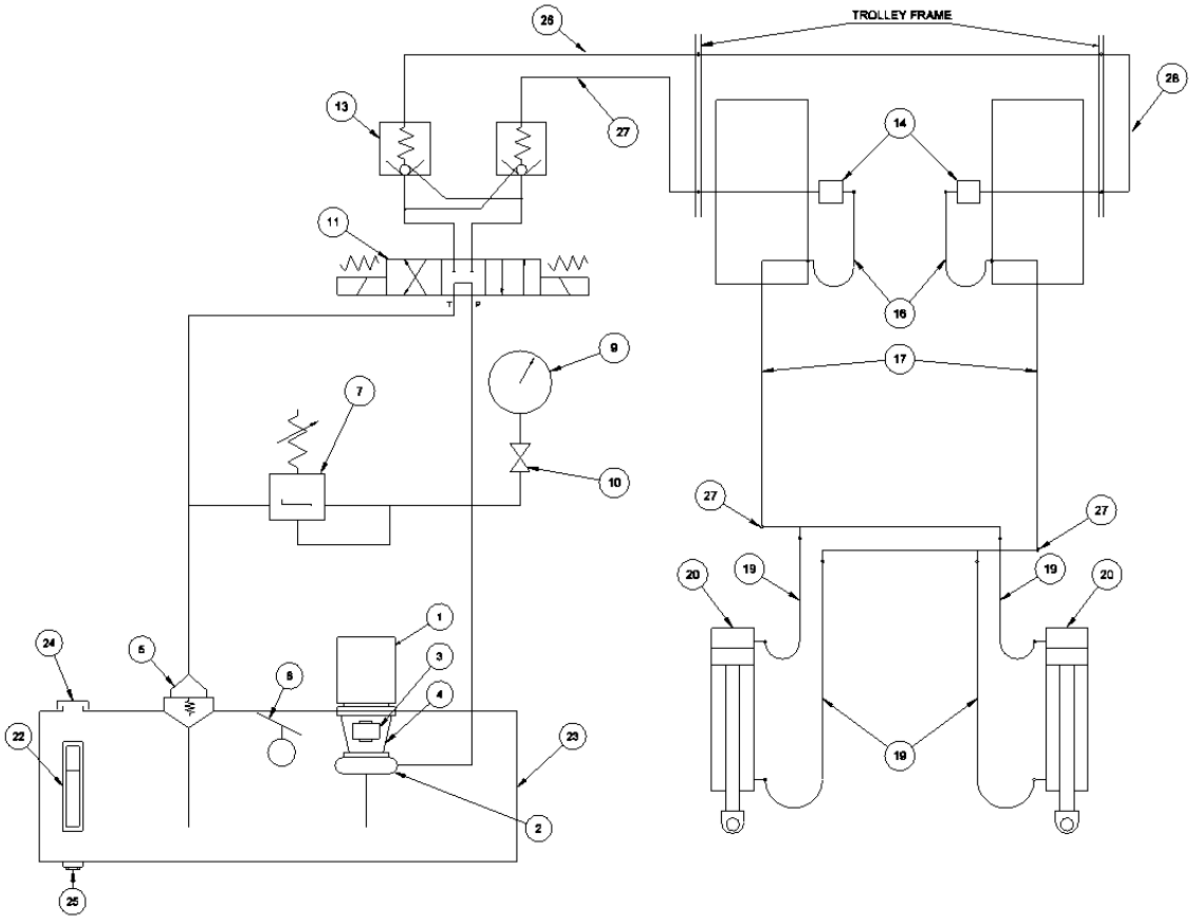


FIGURE 5.5C – HYDRAULIC PARTS LIST

5.5.3 Swing Restrictor Plates

ITEM	DESCRIPTION (See Figure 5.5D)	QUANTITY
1	Swing Restrictor Plate	2
2	Wear Plate (Not on all systems)	2
3	Spring	8
4	Spring Retaining Plate	4
5	Washer	8
6	Spring Adjusting Bolt	8

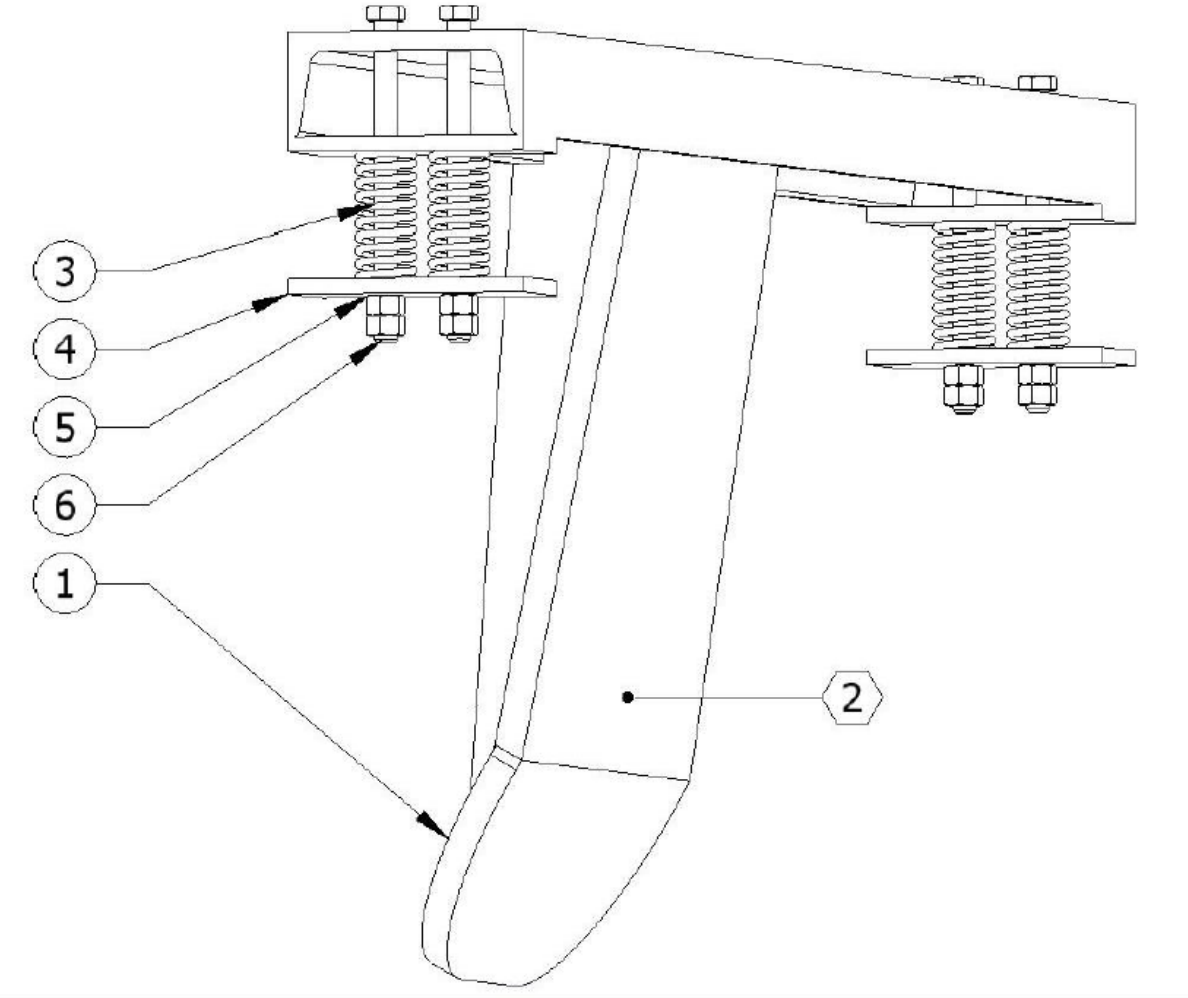


FIGURE 5.5D – SWING RESTRICTOR PARTS LIST

5.6 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.

6.0 DRAWINGS

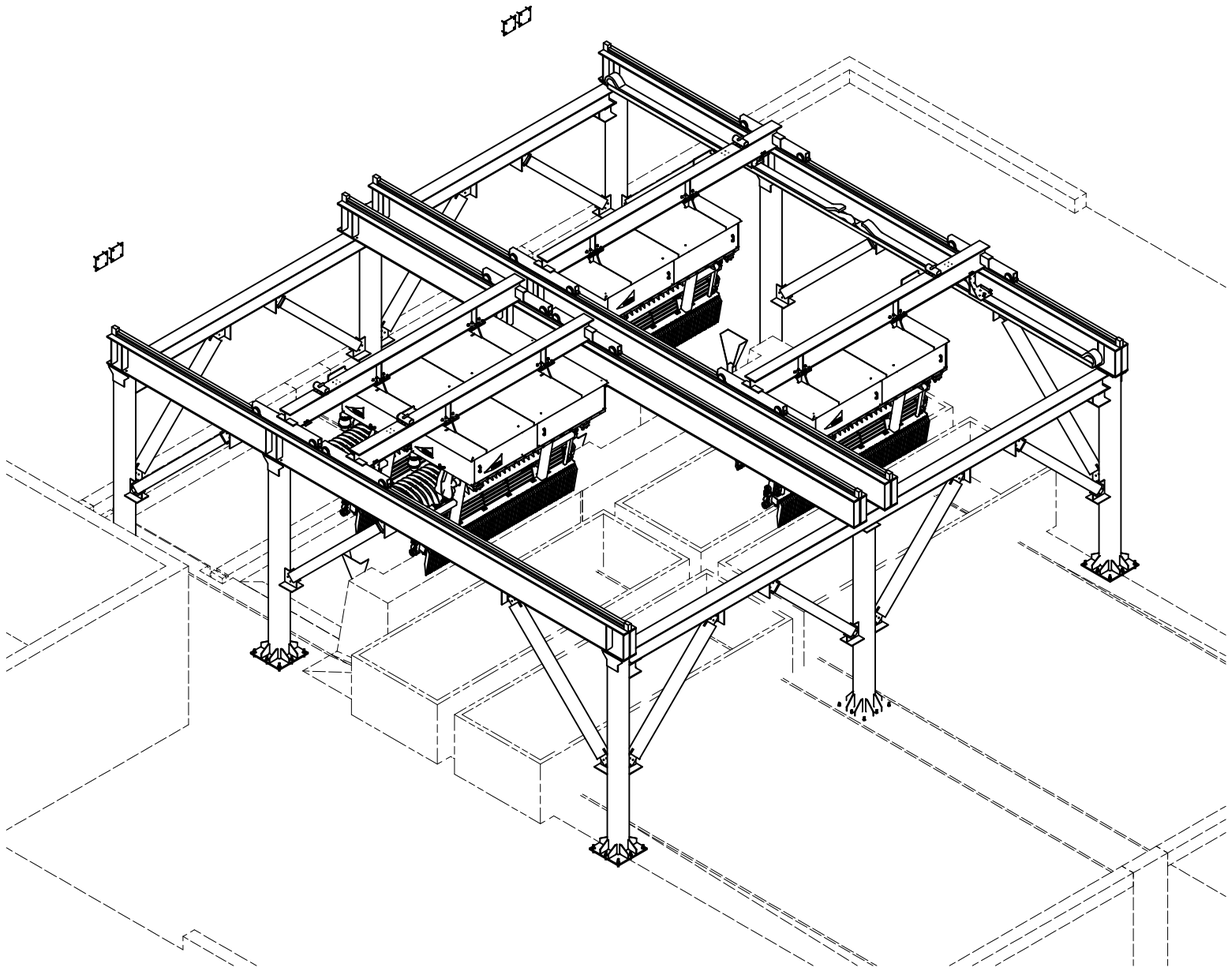
DRAWINGS

General Arrangement
CSW1584-101 (Rev D)

OVIVO

Worldwide Experts in **Water Treatment**

CUSTER AVENUE WWTP
ATLANTA, GEORGIA



NOTES:

1. THE FOLLOWING DEFINES THE RESPONSIBILITY OF OVIVO USA, LLC (OVIVO) WITH REGARD TO THE INFORMATION AND DIMENSIONS SHOWN ON THIS DRAWING:

   (A) DIMENSIONS, LOADS, AND OTHER INFORMATION ARE PROVIDED TO ACCOMODATE THE EQUIPMENT AND STRUCTURE AS SHOWN.
   (B) THE CUSTOMER IS TO PROVIDE REINFORCING STEEL AND DESIGN FOR CONCRETE STRUCTURES AND IS TO DETERMINE CORRESPONDING SIZES ACCORDINGLY TO SUIT LOCAL CONDITIONS.
   (C) THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR INSTALLATION UNTIL IT BEARS THE APPROVAL OF THE OWNER, THE ENGINEER, OR THEIR AUTHORIZED REPRESENTATIVE.
   (D) CHARGES FOR MODIFICATIONS, ADDITIONS, OR CORRECTIONS TO THE STRUCTURE AS SHOWN WILL NOT BE ACCEPTED BY OVIVO USA, LLC UNLESS PRIOR APPROVAL IS OBTAINED IN WRITING FROM AN AUTHORIZED OVIVO REPRESENTATIVE.
   (E) ASTERISK (*) DENOTES VARIANCE FROM CONTRACT DOCUMENTS AND SHOULD BE PARTICULARLY NOTED.

2. **OVIVO SUPPLY:**
   FOUR (4) BOSKER RAKING MACHINES, FOUR(4) TRAVELING BRIDGE CRANES, WITH STEEL SUPPORT STRUCTURE.
   BRIDGE CRANE TRAVERSING MAX SPEED: 120'/MIN. BOSKER HOIST MAX SPEED 30'/MIN. APPROX. CYCLE TIME: 30 MINUTES.
   △1 TWO (2) LOCAL MAIN CONTROL PANELS, EACH PANEL TO CONTROL TWO (2) UNITS. TWO (2) OPERATOR CONTROL CONSOLES (OCC), EACH INCLUDING ONE (1) E-STOP FOR EACH UNIT. FOUR (4) BRIDGE CRANE MOUNTED JUNCTION BOXES, ONE (1) JUNCTION BOX PER UNIT.

   APPROXIMATE WEIGHTS:
   BOSKER LIFTING LOAD: 4,495 LBS
   BOSKER TROLLEY: 4,590 LBS
   BOSKER GRIPPER: 4,875 LBS
   BOSKER TOTAL: **9,465 LBS**
   BRIDGE CRANE ASSEMBLY: 3,600 LBS (EA)

3. OVIVO WILL NOT FURNISH ANY OTHER MATERIALS SUCH AS, HANDRAIL, GRATING, WIRING, COVERS, CONDUIT, ELECTRICAL EQUIPMENT, PIPING, VALVES, FITTINGS, LUBRICATING OIL, GREASE, FIELD PAINTING, FIELD WELDING, OR ERECTIONS UNLESS SPECIFICALLY NOTED IN THIS DRAWING.

4. CUSTOMER TO FIELD VERIFY ALL DIMENSIONS AS SHOWN.
   ALL DIMENSIONS MUST BE VERIFIED BEFORE FABRICATION OF EQUIPMENT MAY COMMENCE.

5. ALL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF A.W.S. WELDING PROCEDURES WITH QUALIFICATION RECORDS PER A.W.S. D1.1, D1.6, AND D14.1.

6. **MATERIALS OF CONSTRUCTION:**
   BOSKER RAKING MACHINE:
   GRIPPER RAKE MECHANISM SHALL BE 304 STAINLESS STEEL WITH ALUMA BRONZE TINES.
   HOIST CABLES TO BE 316 S.S.
   TROLLEY/ HOIST PARTS TO BE GALVANIZED CARBON STEEL.
   TROLLEY ENCLOSURE TO BE 304 STAINLESS STEEL.
   STEEL STRUCTURE SHALL BE HOT DIPPED GALVANIZED STEEL.
   △1 ALL STRUCTURAL BOLTS TO BE A325 GALVANIZED UNLESS NOTED
   ALL ANCHOR BOLTS TO BE 316 SS UNLESS OTHERWISE NOTED

7. **MATERIAL FINISH:**

   ALL FABRICATED STAINLESS STEEL SHALL BE SHIPPED PASSIVATED IN CONCORDANCE TO ASTM A380.
   ALL FABRICATED CARBON STEEL SHALL BE SHIPPED HOT DIP GALVANIZED IN CONCORDANCE TO ASTM A123.
   ALL PURCHASED ITEMS WILL HAVE MANUFACTURER STANDARD SPEC, I.E. BOSKER RAKING MACHINE, MOTERS, GEAR BOXES.

8. **START UP:**
   OVIVO REQUIRES 4 TO 6 WEEKS ADVANCED NOTICE FOR ON SITE START UP PERSONEL SCHEDULING.
   OVIVO WILL COORDINATE UNINTERRUPTED TIME ON SITE TO FINALIZE STARTUP WITH THE CONTRACTOR.
   OVIVO MUST WITNESS THE GRIPPER CYCLE ALL PICK LOCATIONS.

9. **SPARE PARTS:**

   N/A

THIS DRAWING IS CERTIFIED FOR:

CUSTOMER:	LAKESHORE ENGINEERING, LLC
CUSTOMER ORDER NO.:	210088-11500-01
OVIVO ORDER NUMBER:	CSW0001584-01
PROJECT:	CUSTER AVENUE WWTP, GA
PROJECT LOCATION:	ATLANTA, GA
CONSULTING ENGINEER:	N/A
BY: CHRISTOPHER ROBERTSON	DATE: 2/24/2022

REV	DESCRIPTION	EN/ECO	BY	CHECK'D	DATE
D	UPDATED EMBEDMENT DEPTHS & ANCHOR LOCATIONS	S-019504	CLR	MAN	5/26/2022
C	UPDATED SECTION 2 IN NOTES	S-019074	ES	CLR	3/14/2022
B	ADDED ANCHOR AND BASEPLATE DETAILS	S-018989	DJH	CLR	3/8/2022
A	INITIAL RELEASE		-	-	-

D — SIZE SHEET (DO NOT SCALE PRINTS) — THIRD ANGLE PROJECTION

DRAWN BY	DJH
CHECKED BY	CLR
DATE (mm/dd/yyyy)	2/24/2022
PROJECT	CSW0001584-01
REF	-

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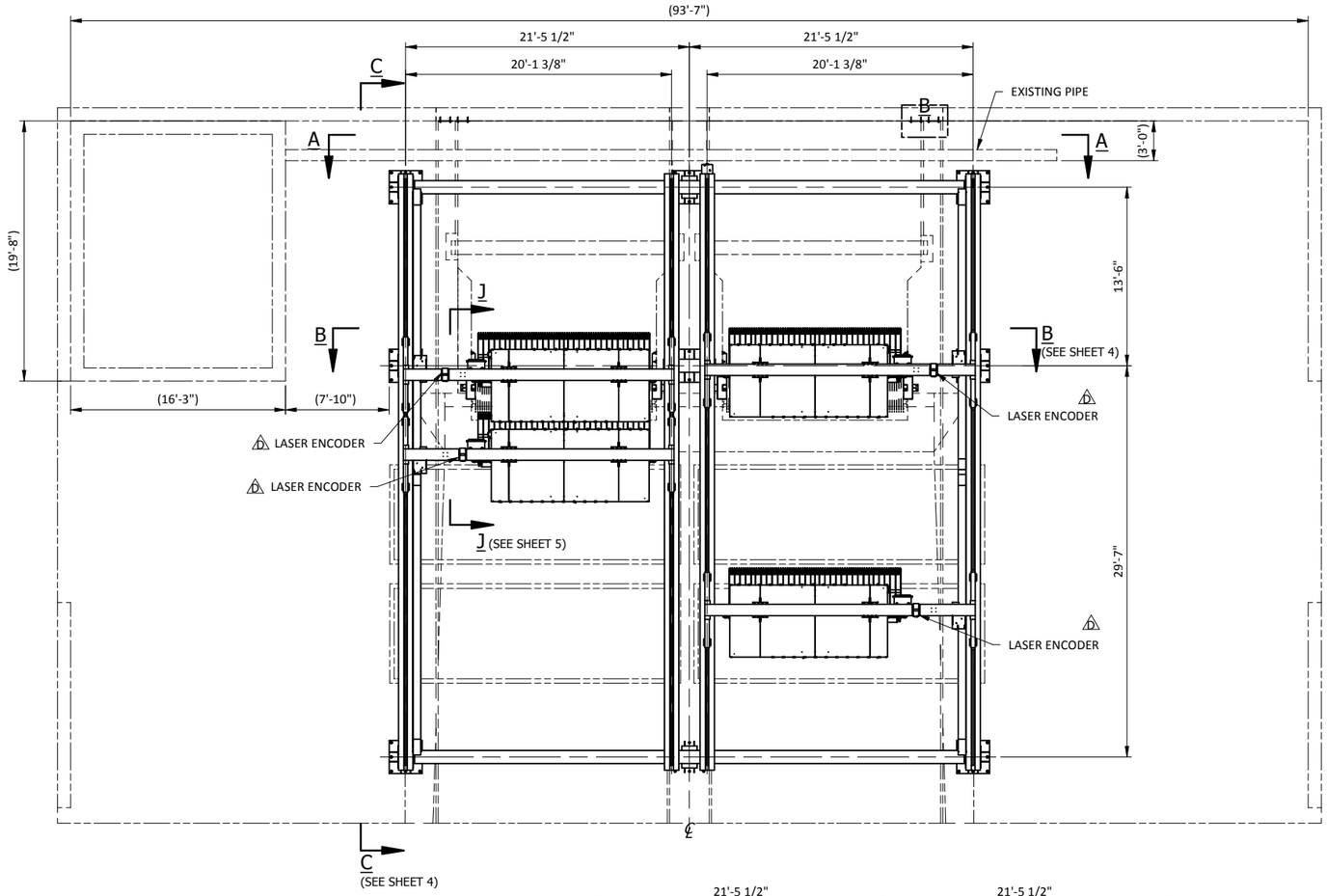
WORKMANSHIP STANDARD ES0001 APPLIES

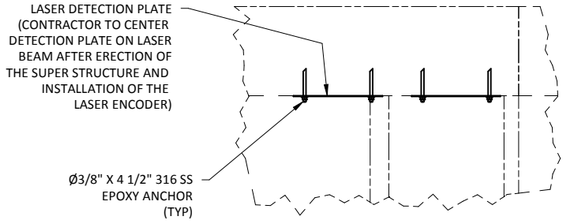
GENERAL ARRANGEMENT
CUSTER AVENUE WWTP
ATLANTA, GA

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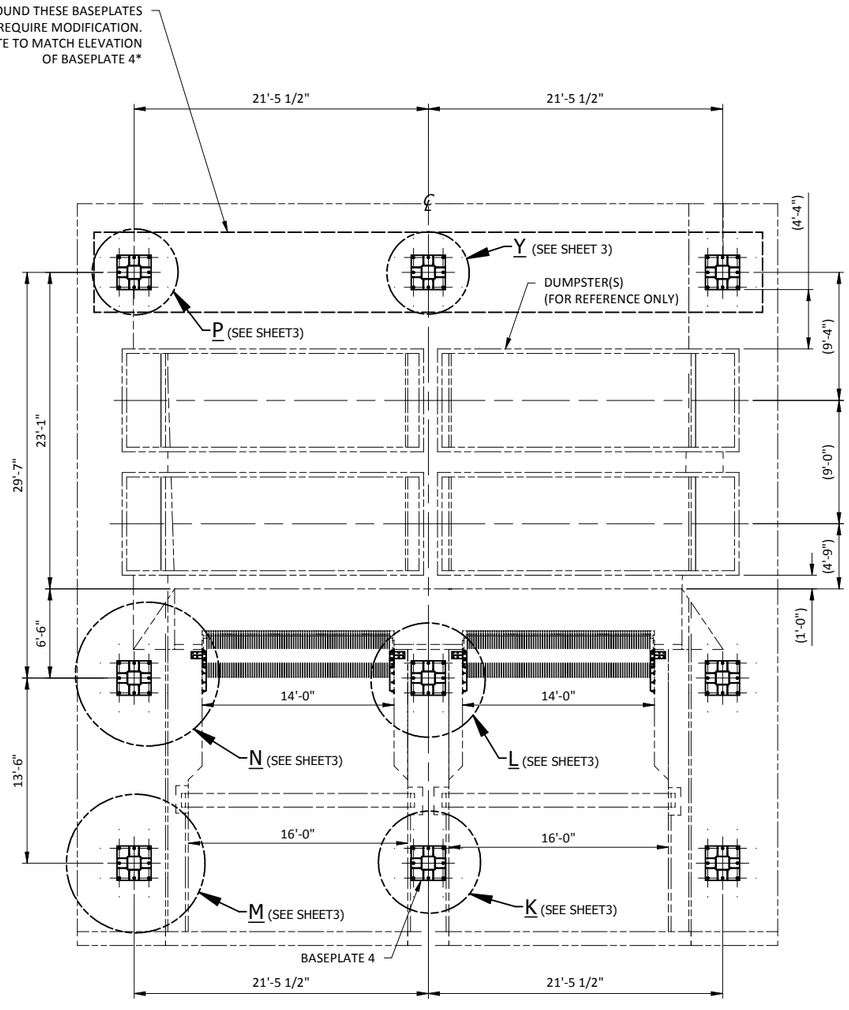
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D REVISION

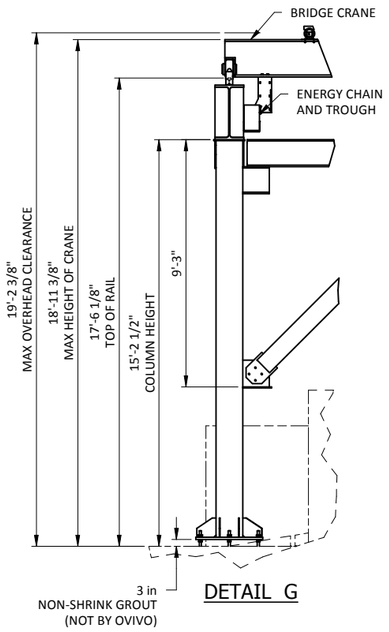




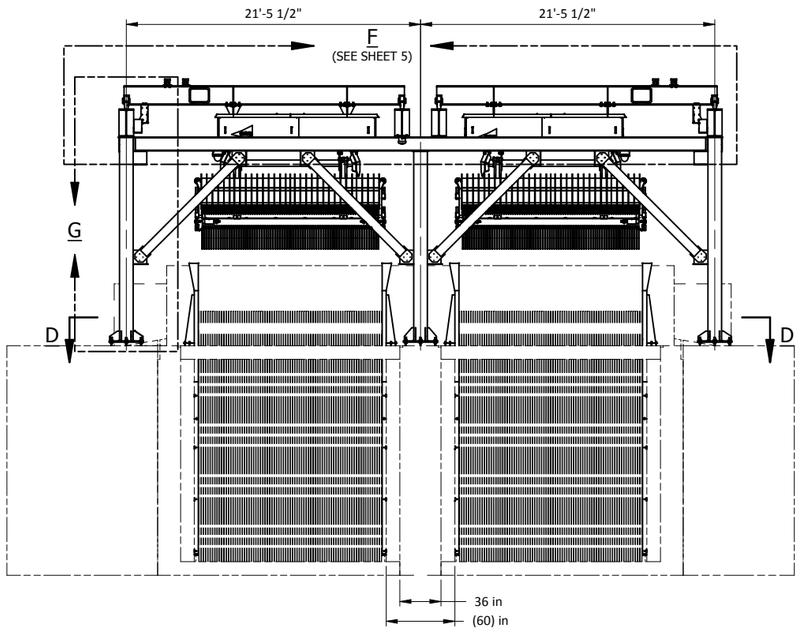
DETAIL B



SECTION D-D
(BASEPLATE LOCATION DETAIL)

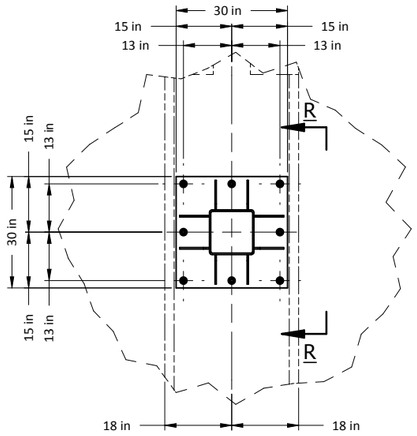


DETAIL G

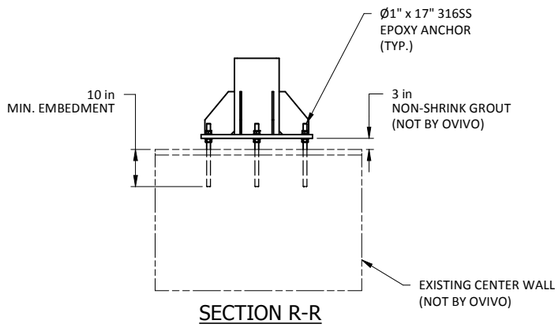


SECTION A-A

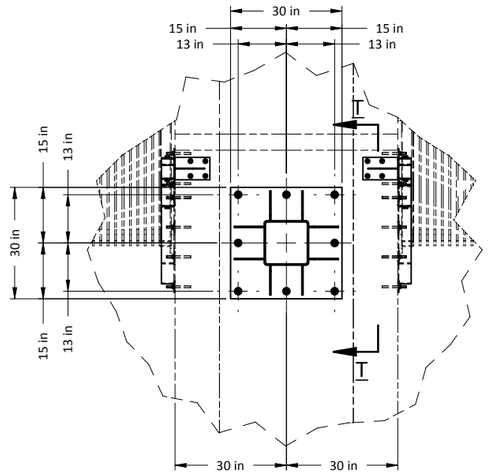
D
SIZE SHEET
DO NOT SCALE PRINTS
THIRD ANGLE PROJECTION
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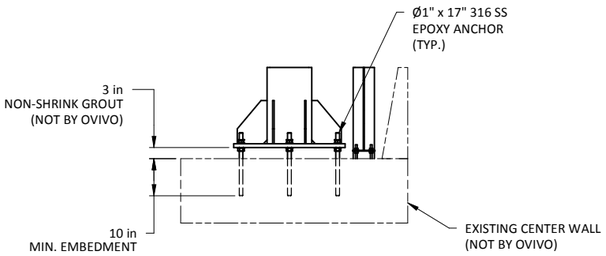
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(FROM SHEET 2)



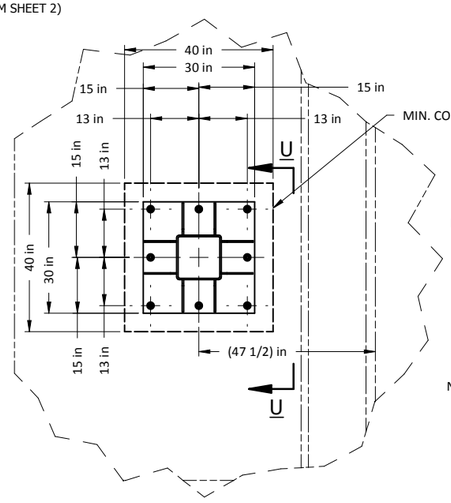
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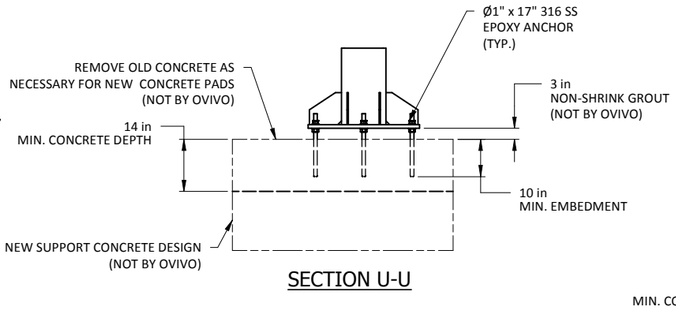
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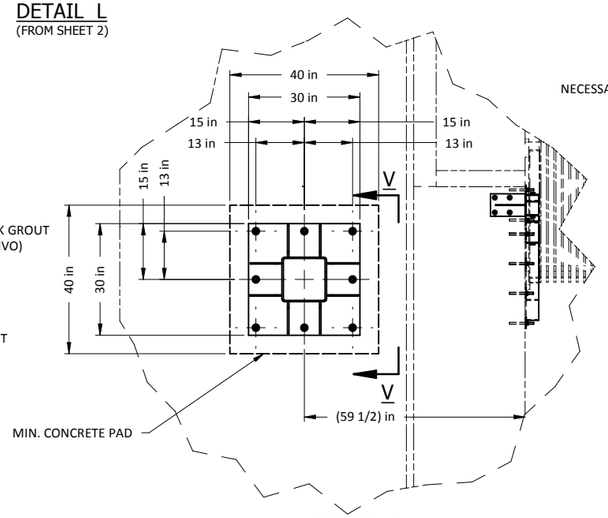
SECTION T-T



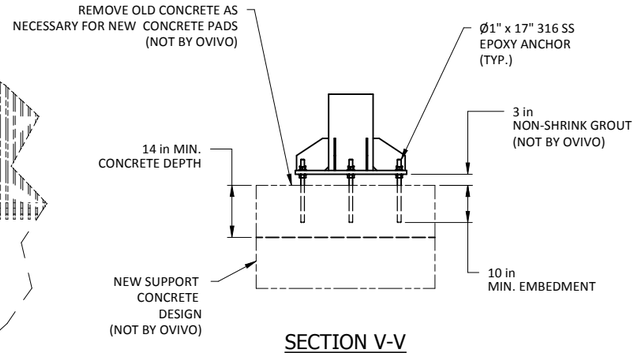
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(1 AS SHOWN, 1 OPPOSITE)
(FROM SHEET 2)



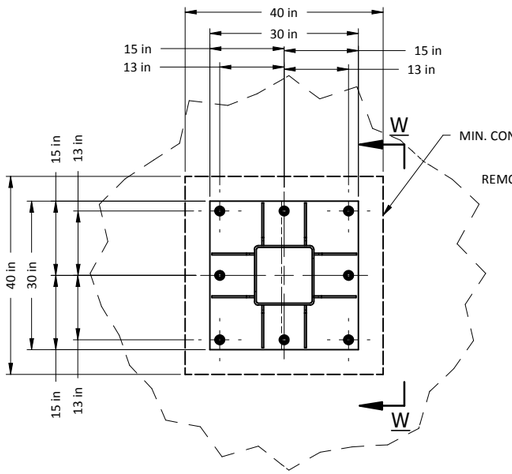
SECTION U-U



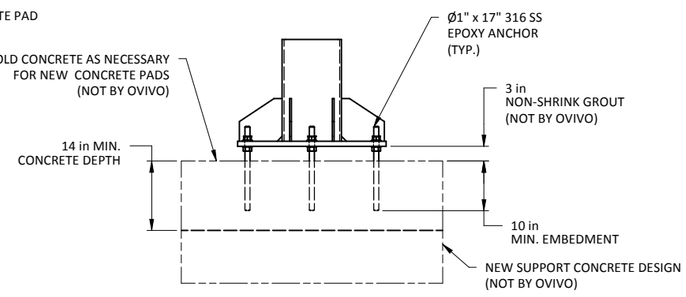
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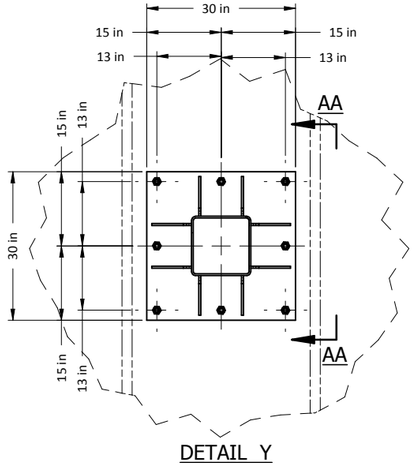
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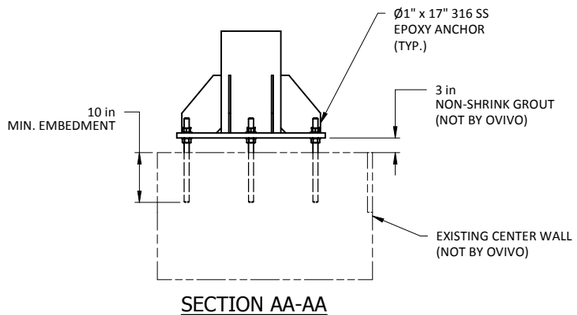
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SECTION W-W

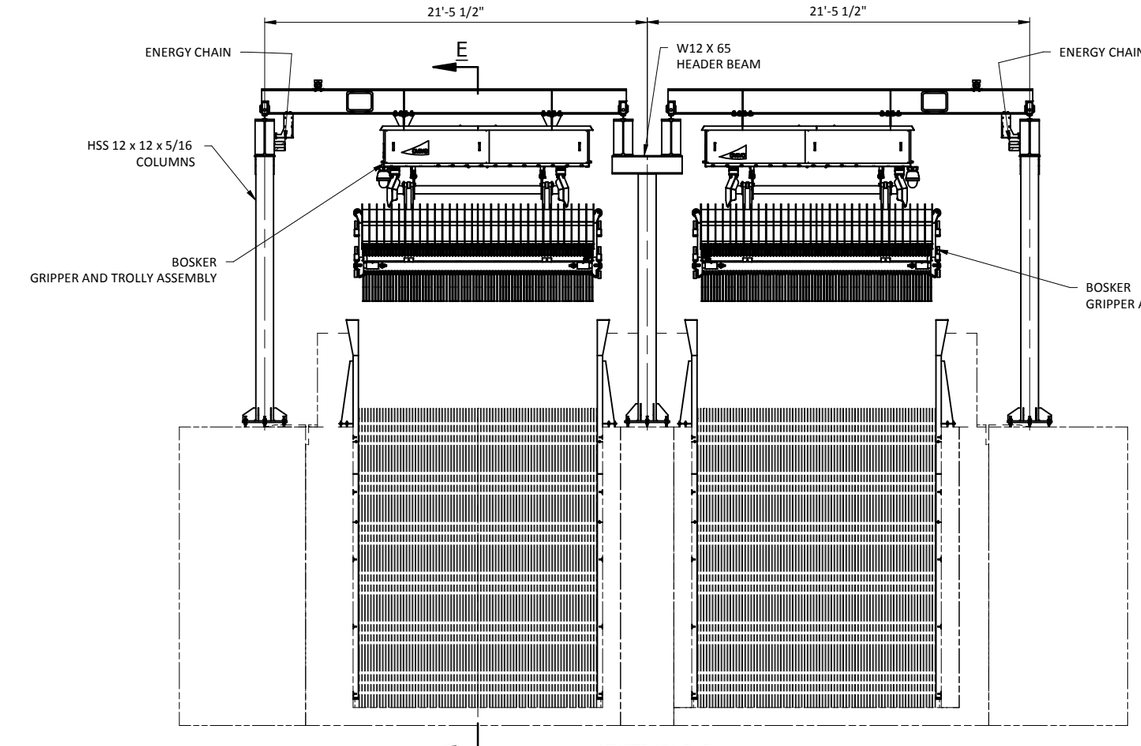


DETAIL Y
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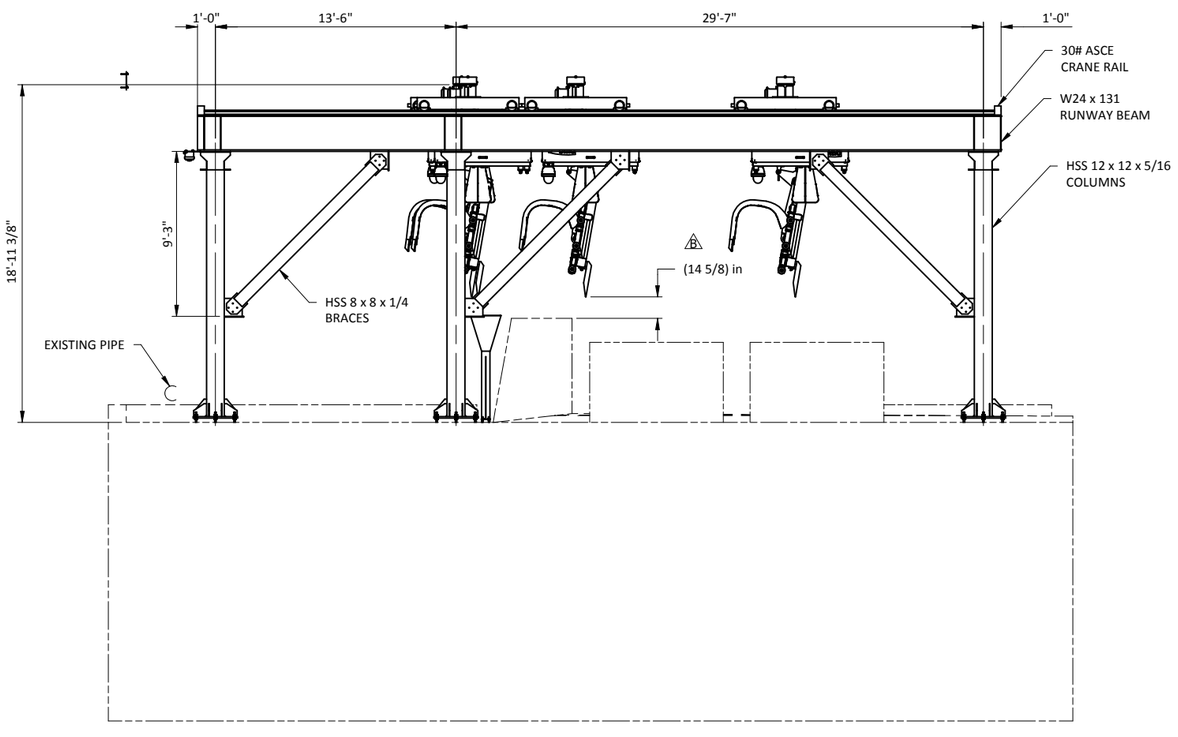


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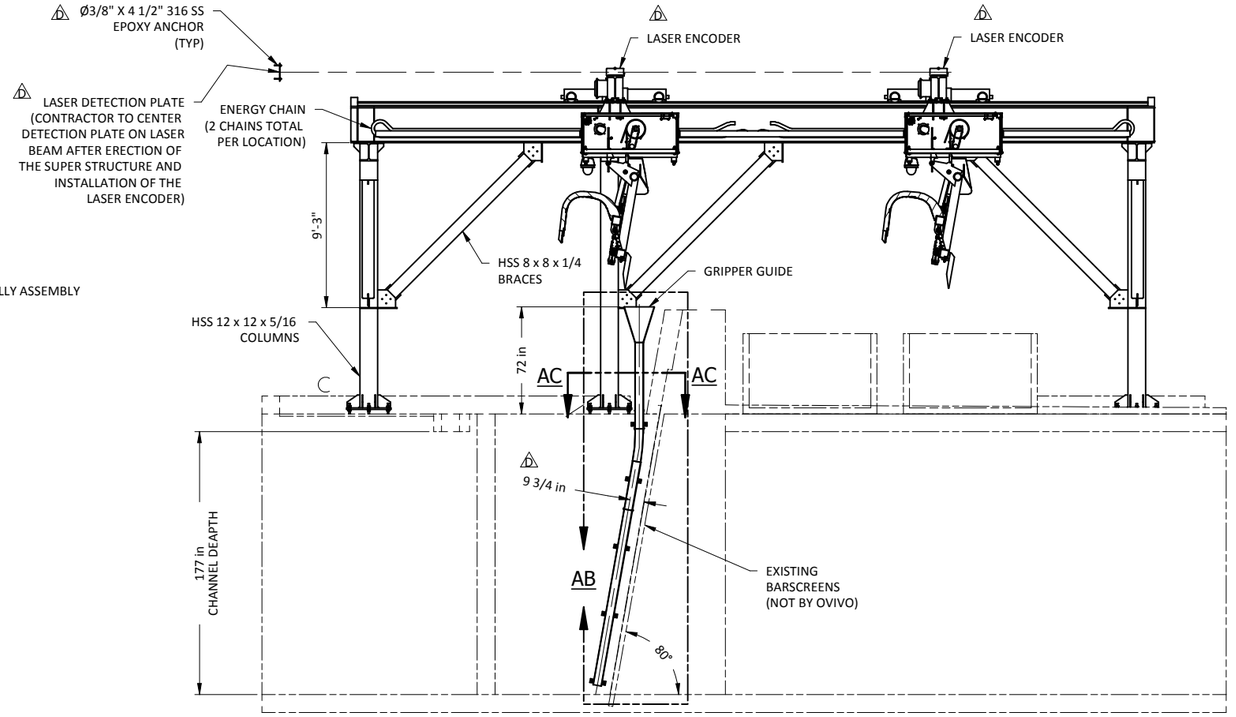
D
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THIRD ANGLE PROJECTION
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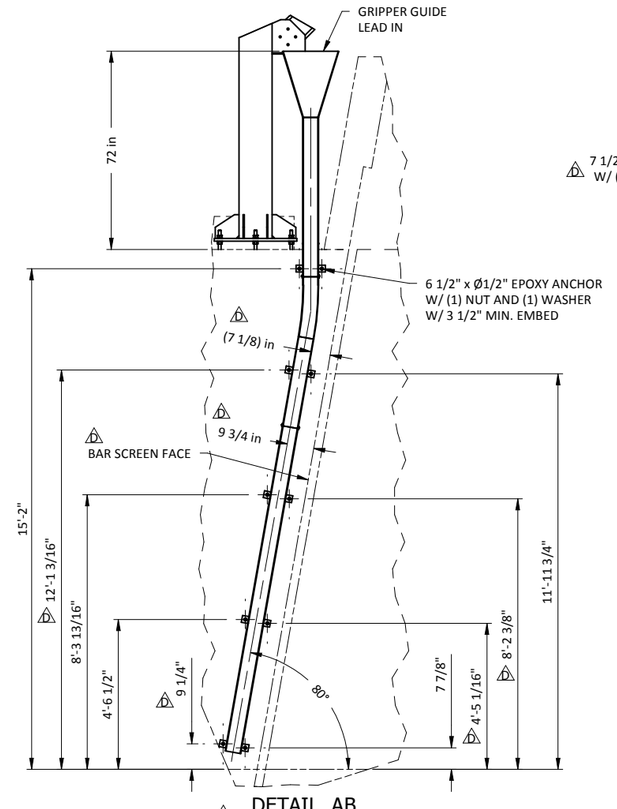
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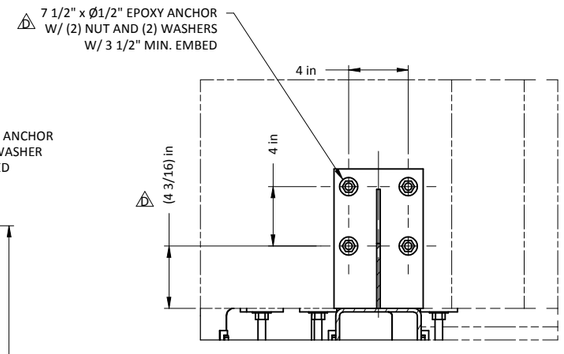
SECTION C-C
(FROM SHEET 2)



SECTION E-E

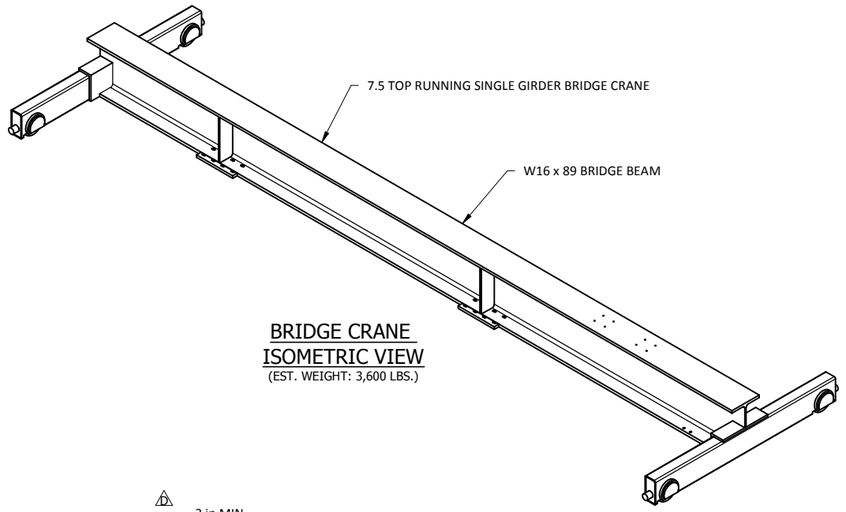


DETAIL AB
(TYP. BOTH GUIDES)

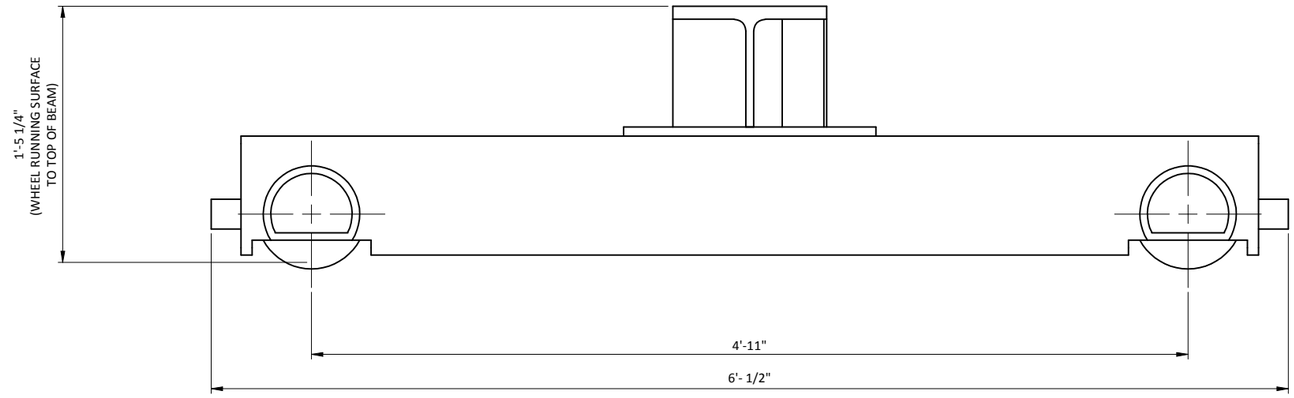


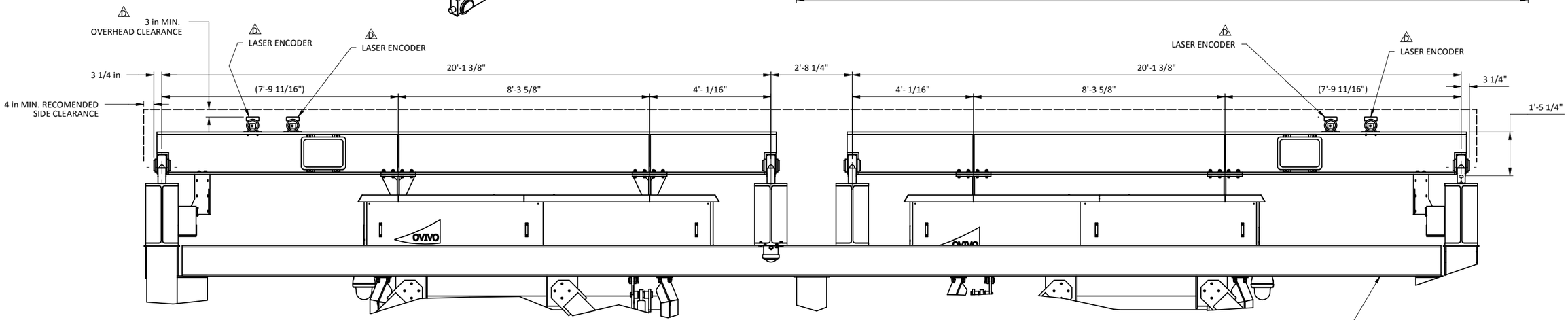
SECTION AC-AC

D SIZE SHEET DO NOT SCALE PRINTS	THIRD ANGLE PROJECTION	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 ES0001 APPLIES			

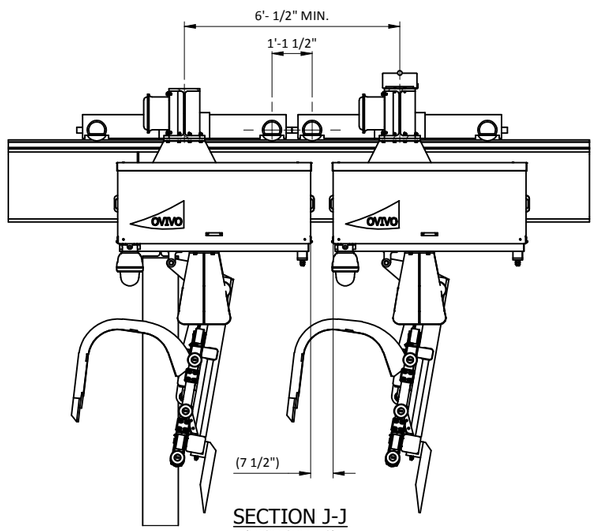


BRIDGE CRANE
ISOMETRIC VIEW
(EST. WEIGHT: 3,600 LBS.)



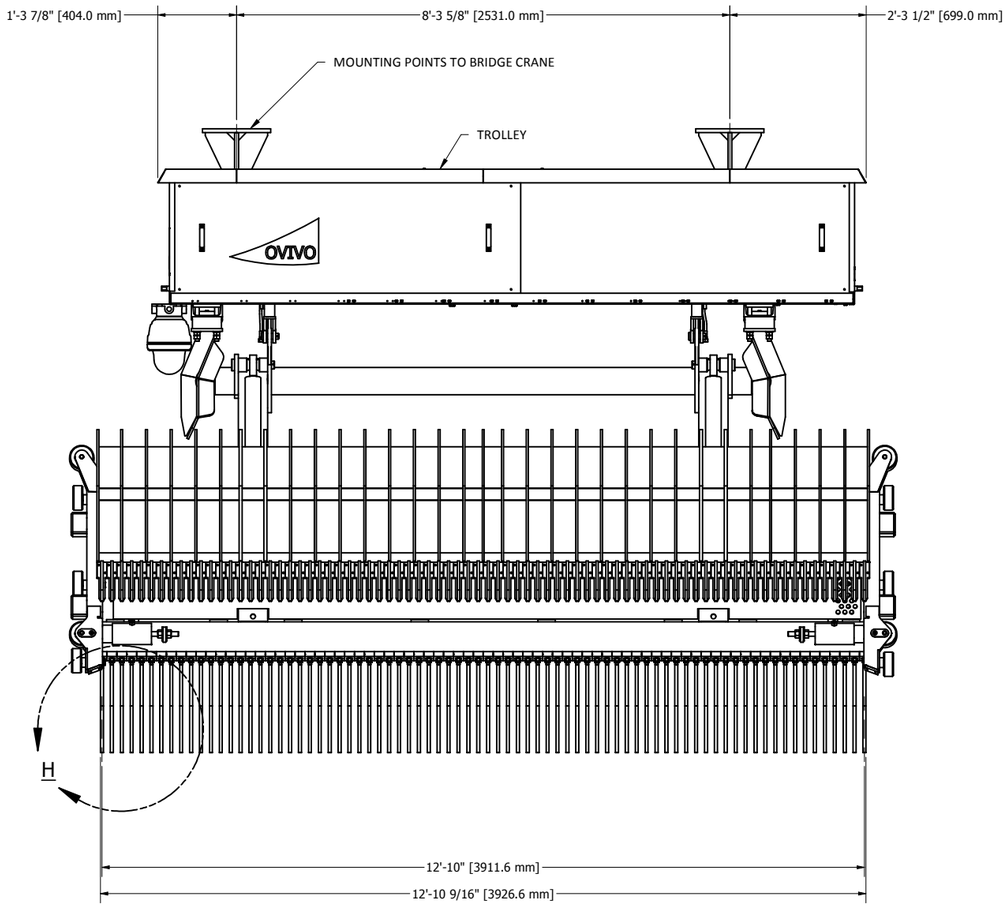


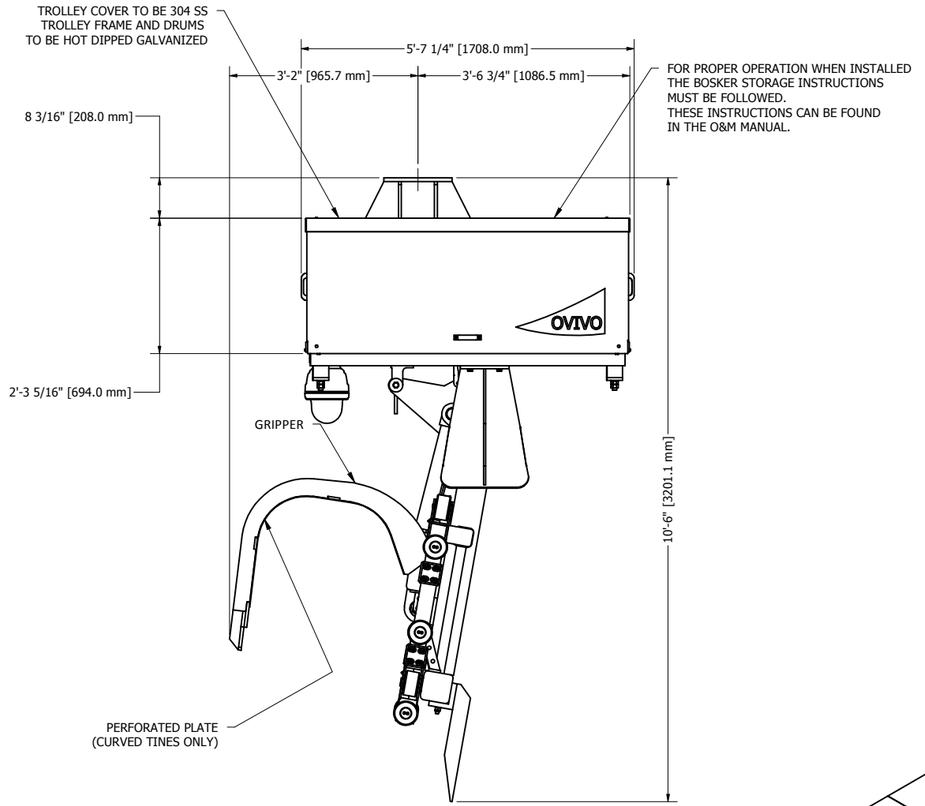
DETAIL F
(FROM SHEET 2)

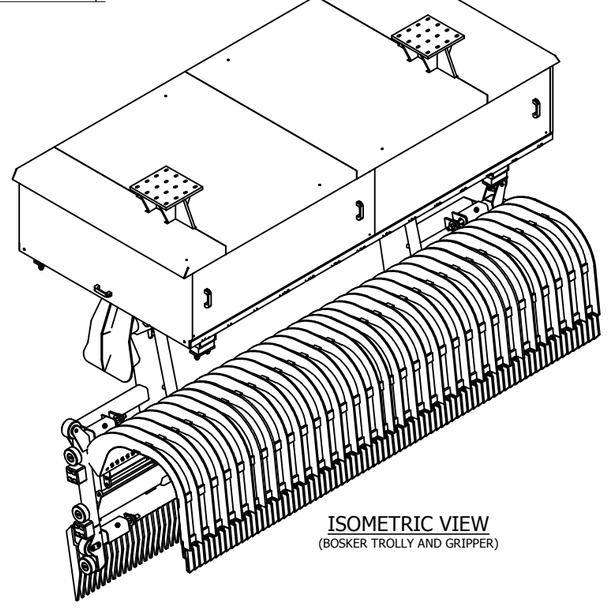


SECTION J-J
(FROM SHEET 2)

D SIZE SHEET DO NOT SCALE PRINTS	THIRD ANGLE PROJECTION	OVIVO	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 ES0001 APPLIES			SHEET 5 OF 6 — D REVISION



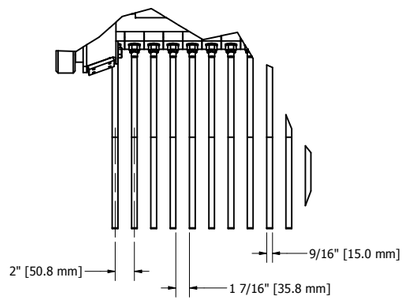




ISOMETRIC VIEW
(BOSKER TROLLY AND GRIPPER)

NOTES:

1. DIMENSIONS MAY VARY DURING FABRICATION.
2. PLEASE CONFIRM THE TINE SPACING AND OVERALL WIDTH.
3. THIS ITEM IS PURCHASED AS A LONG LEAD ITEM AND IT IS RECOMMENDED THAT IF THE TINE SPACING IS PROPER THAT THIS ITEM BE APPROVED SEPARATE FROM THE REST OF THE SUBMITTAL. ONCE APPROVED THE EQUIPMENT CAN BE PLACED WITH THE FABRICATOR AND DELAYS WILL BE AVOIDED.
4. ADDITIONAL ITEMS ARE INCLUDED ABOVE THE STANDARD EQUIPMENT. THE HORN AND BEACON ARE STANDARD.
5. **MATERIALS OF CONSTRUCTION:**
   GRIPPER RAKE MECHANISM SHALL BE 304 STAINLESS STEEL.
   HOIST CABLES TO BE 316 STAINLESS STEEL.
   TROLLEY/HOIST PARTS TO BE GALVANIZED CARBON STEEL.
   TROLLEY ENCLOSURE TO BE 304 STAINLESS STEEL.
6. ALL MOTORS TO BE:
   480/3/60 ELECTRICAL SUPPLY
   1800 RPM
   TEFC ENCLOSURE
   CLASS "F" INSULATION
7. FOR STORAGE INSTRUCTIONS, SEE BOSKER STORAGE SECTION OF THE SUBMITTAL.



DETAIL H

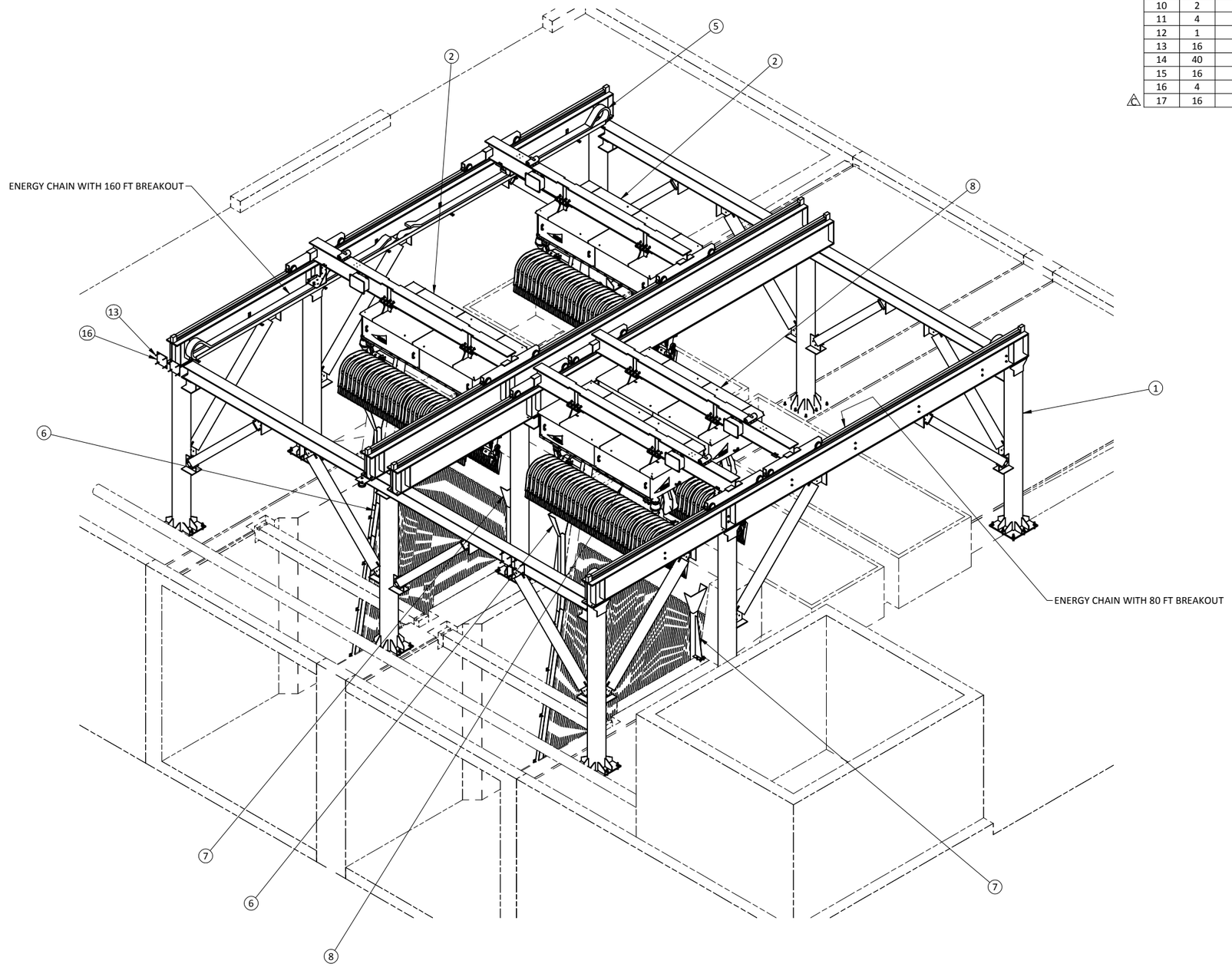
D SIZE SHEET DO NOT SCALE PRINTS	THIRD ANGLE PROJECTION	OVIVO	SHEET 6 OF 6
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General Erection
CSW1584-151 (Rev C)

REFERENCE DRAWINGS

DESCRIPTION	DRAWING NO.
BOLT TORQUE CHART	114808
GENERAL ARRANGEMENT	CSW1584-101
TROLLEY JUNCTION BOX	CSW1584-126



ISOMETRIC VIEW

PRE-RELEASE COMPONENTS

ITEM	QTY	MATERIAL	DESCRIPTION	PART NUMBER	DRAWING	WEIGHT
1	1	AS NOTED	BRIDGE CRANE AND STRUCTURE BUYOUT	CSW1584-157	CSW1584-157	61636
2	2	AS NOTED	BOSKER ASSEMBLY, RIGHT	CSW1584-158	CSW1584-158	17998
3	1	HDG STEEL	WARNING HORN MOUNTING PLATE	CSW1584-170	CSW1584-170	4
4	72	AS NOTED	EPOXY ANCHOR ASSEMBLY, 1"-8 UNC X 1'-5"	CSW1584-1006	CSW1584-1006	341
5	1	AS NOTED	ENERGY CHAIN, SERIES E4-42 CHAIN	CSW1584-1022	CSW1584-1022	1019
6	2	AS NOTED	GRIPPER GUIDE, RIGHT	CSW1584-1366	CSW1584-1366	460
7	2	AS NOTED	GRIPPER GUIDE, LEFT	CSW1584-1370	CSW1584-1370	460
8	2	AS NOTED	BOSKER ASSEMBLY, LEFT	CSW1584-1581	CSW1584-1581	17078
9	2	STEEL	BRIDGE CRANE TOW ARM WELDMENT (RIGHT)	CSW1584-1592	CSW1584-1592	33
10	2	STEEL	BRIDGE CRANE TOW ARM WELDMENT (LEFT)	CSW1584-1593	CSW1584-1593	33
11	4	AS NOTED	PROXIMITY SENSOR ASSEMBLY	771626	771626	21
12	1	VARIES	WARNING HORN	771767	771767	46
13	16	316 SS	STUD ASSEMBLY, 3/8-16NC X 4 1/2"	895343A	895343	3
14	40	316 SS	STUD ASSEMBLY, 1/2-13NC ANCHOR BOLT	594674D1-01	594674	17
15	16	316 SS	STUD ASSEMBLY, 1/2-13NC ANCHOR BOLT	594674F2-01	594674	9
16	4	A36 STL	DETECTION PLATE	CSW1467-188	CSW1467-188	20
△C 17	16	AS NOTED	ENERGY CHAIN MOUNTING BRACKET	CSW1584-1015	CSW1584-1015	53

TOTAL WEIGHT
99144

FASTENER LIST

ITEM	QTY	MATERIAL	DESCRIPTION	PART NUMBER
101	16	304 SS	HEX HD CAPSCREW, 1/4-20 UNC x 3 1/4	HCS04UNCX052-304SS
102	16	304 SS	HEX HD CAPSCREW, 3/8-16 UNC x 1 1/2	HCS06UNCX024-304SS
103	2	304 SS	HEX HD CAPSCREW, 7/16-14 UNC x 1 1/4	HCS07UNCX020-304SS
104	2	304 SS	HEX HD CAPSCREW, 7/16-14 UNC x 1 3/4	HCS07UNCX028-304SS
105	16	304 SS	HEX HD CAPSCREW, 1/2-13 UNC x 2	HCS08UNCX032-304SS
106	64	A325 HDG	HEX HEAD BOLT, 1/2-13 UNC x 2 3/4	HHB08UNCX044-A325HG
107	16	304 SS	HEX SKT CAPSCREW, 10-24 UNC x 1 1/2	SHBN10UNCX024-304SS
108	32	304 SS	PLAIN WASHER, 1/4 - SMALL OD	PNW04A-304SS
109	32	304 SS	PLAIN WASHER, 3/8 - SMALL OD	PNW06A-304SS
110	4	304 SS	PLAIN WASHER, 7/16 - SMALL OD	PNW07A-304SS
111	32	304 SS	PLAIN WASHER, 1/2 - SMALL OD	PNW08A-304SS
112	256	F436 HDG	PLAIN WASHER, 1/2	PNW08A-F436HDG
113	32	304 SS	PLAIN WASHER, No. 10 - SMALL OD	PNWN10A-304SS
114	128	F436 HDG	LOCK WASHER, 1/2	LKW08-F436HDG
115	16	304 SS	NYLON INSERT HEX NUT, 1/4-20 UNC	NHN04UNC-304SS
116	16	304 SS	NYLON INSERT HEX NUT, 3/8-16 UNC	NHN06UNC-304SS
117	4	304 SS	NYLON INSERT HEX NUT, 7/16-14 UNC	NHN07UNC-304SS
118	16	304 SS	NYLON INSERT HEX NUT, 1/2-13 UNC	NHN08UNC-304SS
119	128	A563 HDG	HEAVY HEX NUT, 1/2-13 UNC	HHN08UNC-A563HG
120	16	304 SS	NYLON INSERT HEX NUT, 10-24 UNC	NHNN10UNC-304SS
△B 121	64	A325 HDG	HEX HEAD BOLT, 1/2-13 UNC x 3 3/4	HHB08UNCX060-A325HG
△C 122	32	GR5 HDG	HEX HD CAPSCREW, 3/8-16 UNC x 1 3/4	HCS06UNCX028-GR5HDG
△C 123	64	GR5 HDG	PLAIN WASHER, 3/8	PNW06A-GR5HDG
△C 124	32	GR5 HDG	LOCK WASHER, 3/8	LKW06-GR5HDG
△C 125	32	GR5 HDG	HEAVY HEX NUT, 3/8-16 UNC	HHN06UNC-GR5HDG

NOTES:

1. ITEMS IDENTIFIED BY ⬡ ARE LISTED ON PART LIST ABOVE.
2. ITEMS IDENTIFIED BY ⬡ ARE LISTED ON FASTENER LIST ABOVE
3. THE FINAL INSTALLED TORQUE VALUES FOR BOLTS SHALL BE AS SPECIFIED IN THE TABLE PROVIDED ON DRAWING 114808.
4. WORK THIS DRAWING WITH CSW1584-101.
5. QUANTITIES SHOWN ARE FOR ONE (1) MECHANISM.
6. FOR INSTALLATION OF SUPER STRUCTURE, REFER TO AMERICAN EQUIPMENT ERECTION DRAWING.
7. FOR INSTALLATION OF THE ENERGY CHAIN, REFER TO IGUS ENERGY CHAIN INSTALLATION INSTRUCTIONS
8. IN SHOP FIT UP OF SUB ASSEMBLIES, MATCH MARK ALL SUB ASSEMBLIES PRIOR TO DISASSEMBLY FOR SHIPMENT.

REVISION DESCRIPTION	EN/ECO	BY	CHECK'D	DATE	REV
ADDED ENERGY CHAIN MOUNT BRACKET AND FASTENERS	S-019859	CLR	EJB	8/8/2022	C
UPDATE FASTENERS FOR BRIDGE CRANE TO BOSKER CONNECTION	S-019584	ES	CLR	6/16/2022	B
INITIAL RELEASE		-	-	-	A

D SIZE SHEET (DO NOT SCALE PRINTS) — THIRD ANGLE PROJECTION

DRAWN BY	ES
CHECKED BY	CLR
DATE (mm/dd/yyyy)	3/14/2022
PROJECT	CSW0001584-01
REF	CSW1466-151

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WORKMANSHIP STANDARD ES0001 APPLIES

GENERAL ERECTION

CUSTER AVENUE STATIONARY SYSTEM

ATLANTA, GA

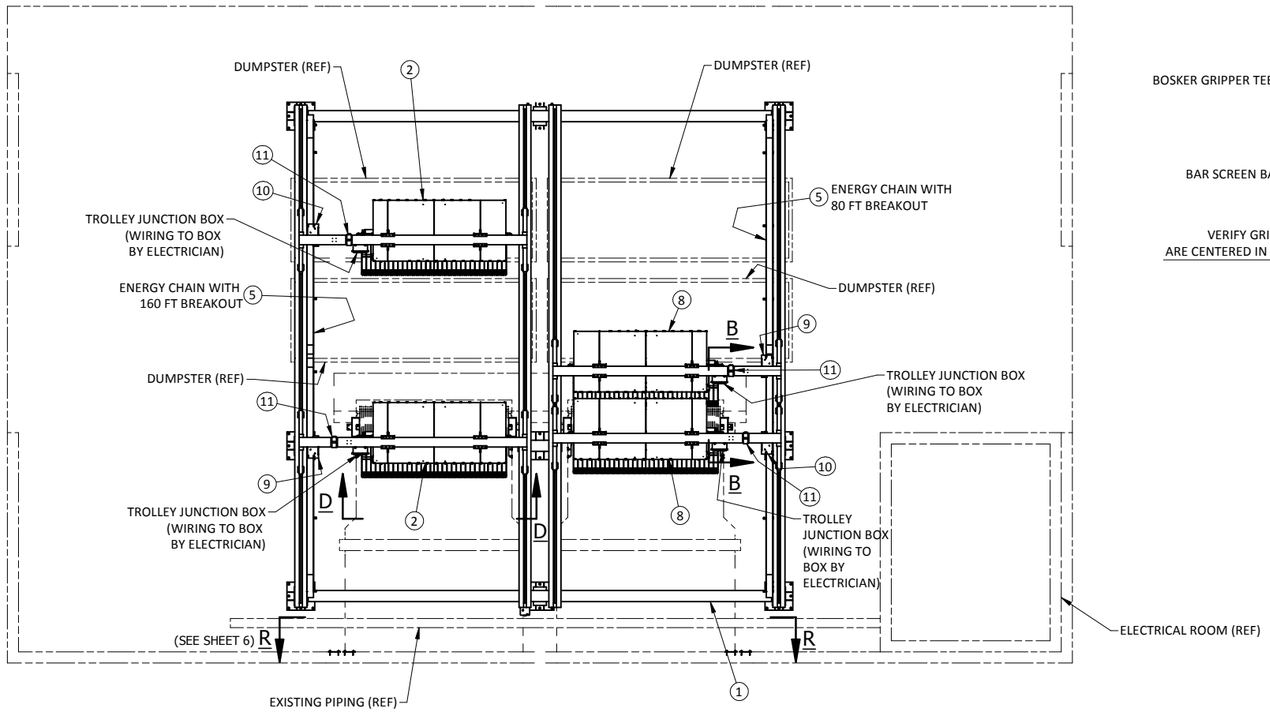
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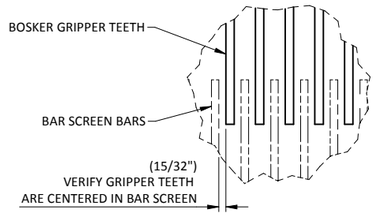
DWG NO. **CSW1584-151**

SHEET 1 OF 6

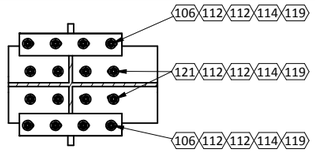
REVISION **C**



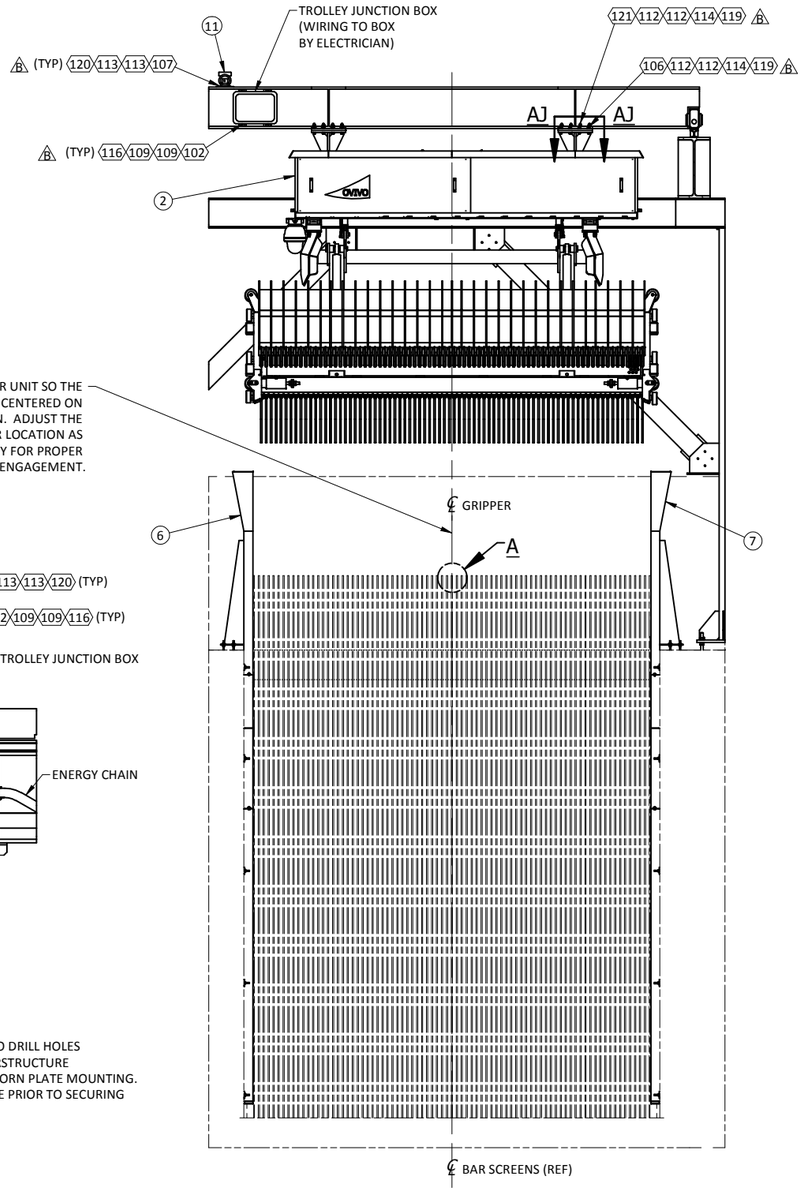
PLAN VIEW



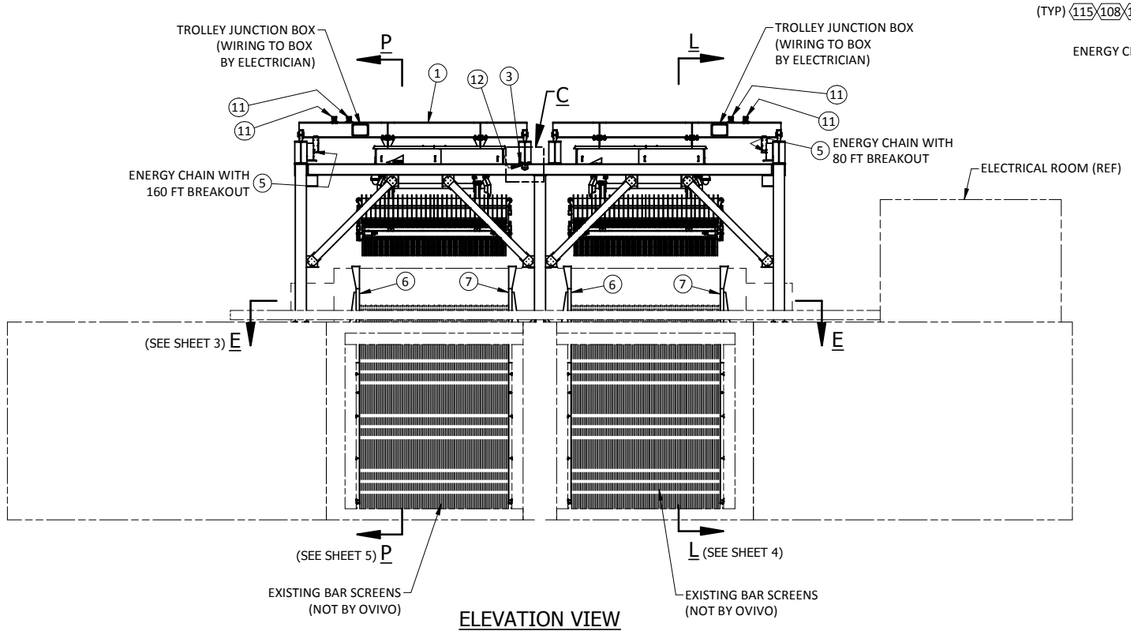
DETAIL A
(GRIPPER TOOTH TO BAR SCREEN ENGAGEMENT)



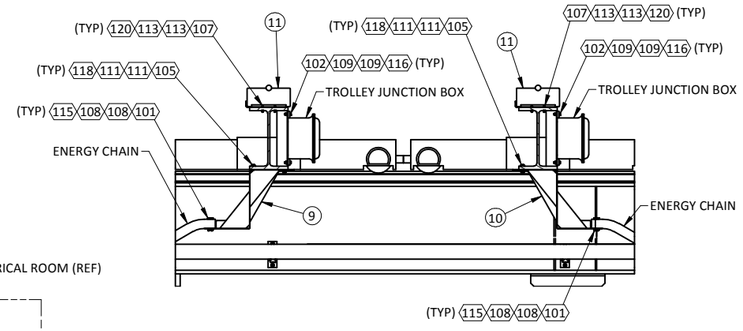
SECTION AJ-AJ (B)
(BOSKER TO BRIDGE CRANE CONNECTION)



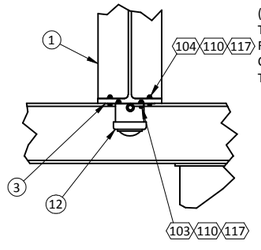
SECTION D-D



ELEVATION VIEW



SECTION B-B
(TOW ARM, JUNCTION BOX, AND LASER ENCODER MOUNTING)

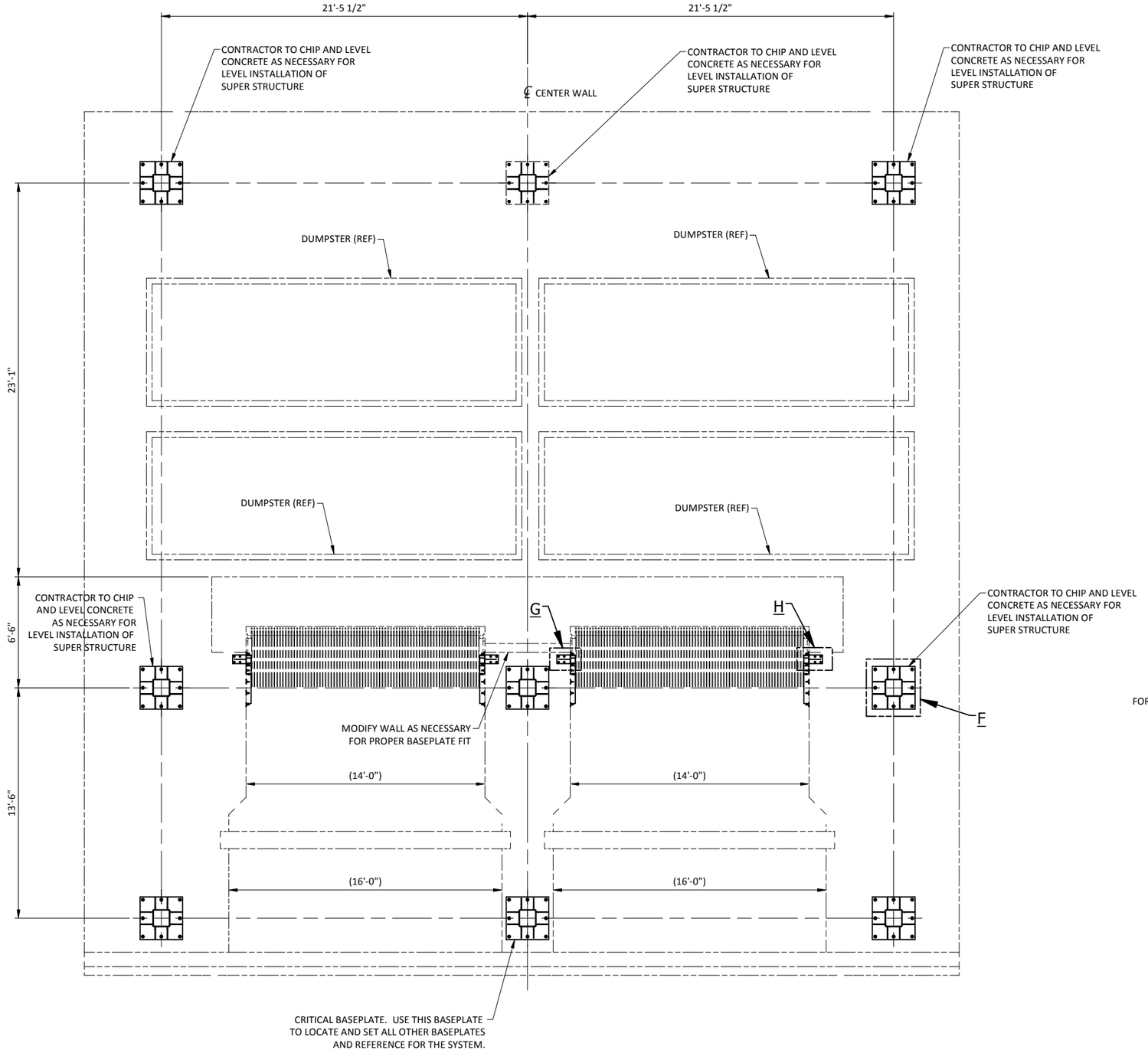


(CONTRACTOR TO DRILL HOLES THROUGH SUPERSTRUCTURE FOR WARNING HORN PLATE MOUNTING. COLD GALV. HOLE PRIOR TO SECURING THE BOLTS)

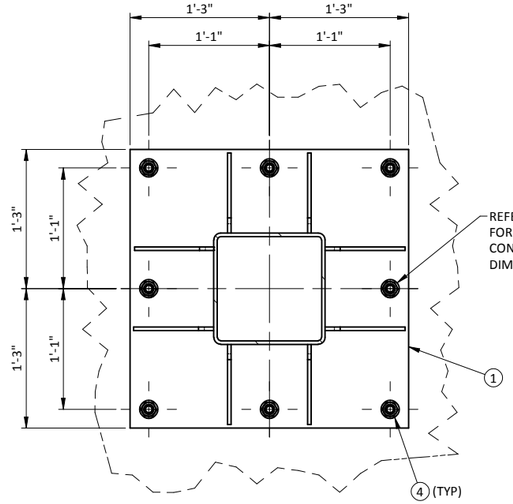
DETAIL C
(WARNING HORN MOUNTING)

D SIZE SHEET DO NOT SCALE PRINTS	THIRD ANGLE PROJECTION	OVIVO	SHEET 2 OF 6
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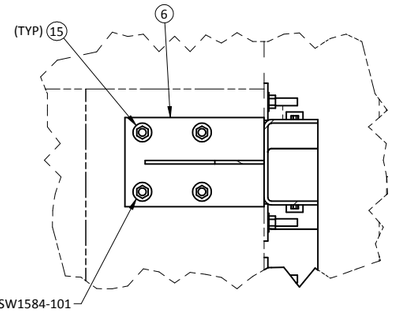
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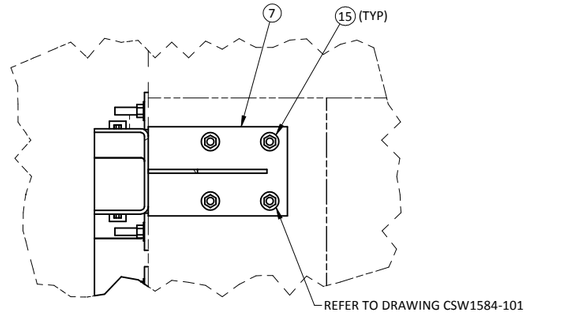
SECTION E-E
(FROM SHEET 2)



DETAIL F
(TYP BASEPLATE DETAIL)

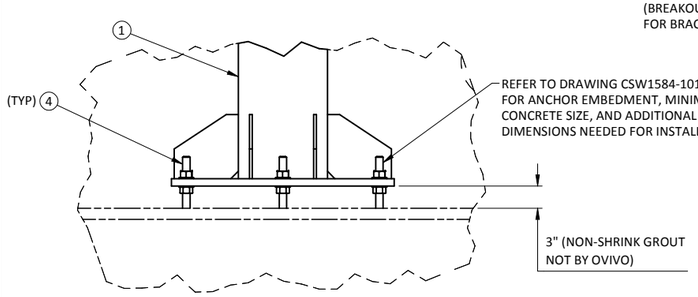


DETAIL G
(GRIPPER GUIDE TOP ANCHOR DETAIL)

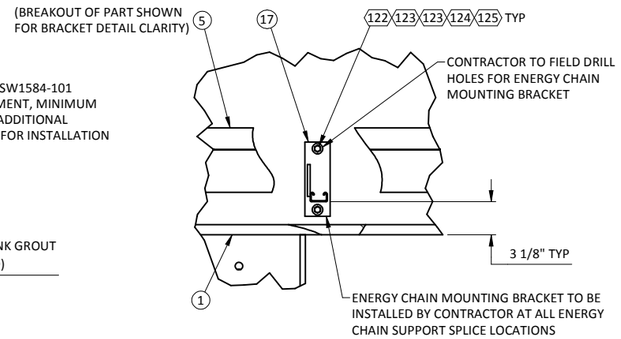


DETAIL H
(GRIPPER GUIDE TOP ANCHOR DETAIL)

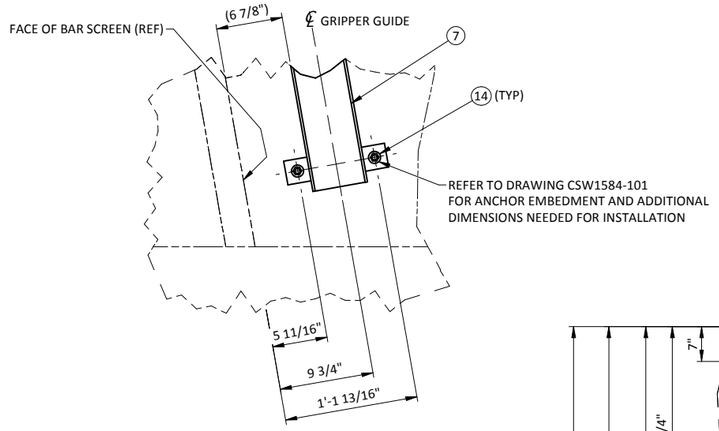
D
SIZE SHEET
DO NOT SCALE PRINTS
THIRD ANGLE PROJECTION
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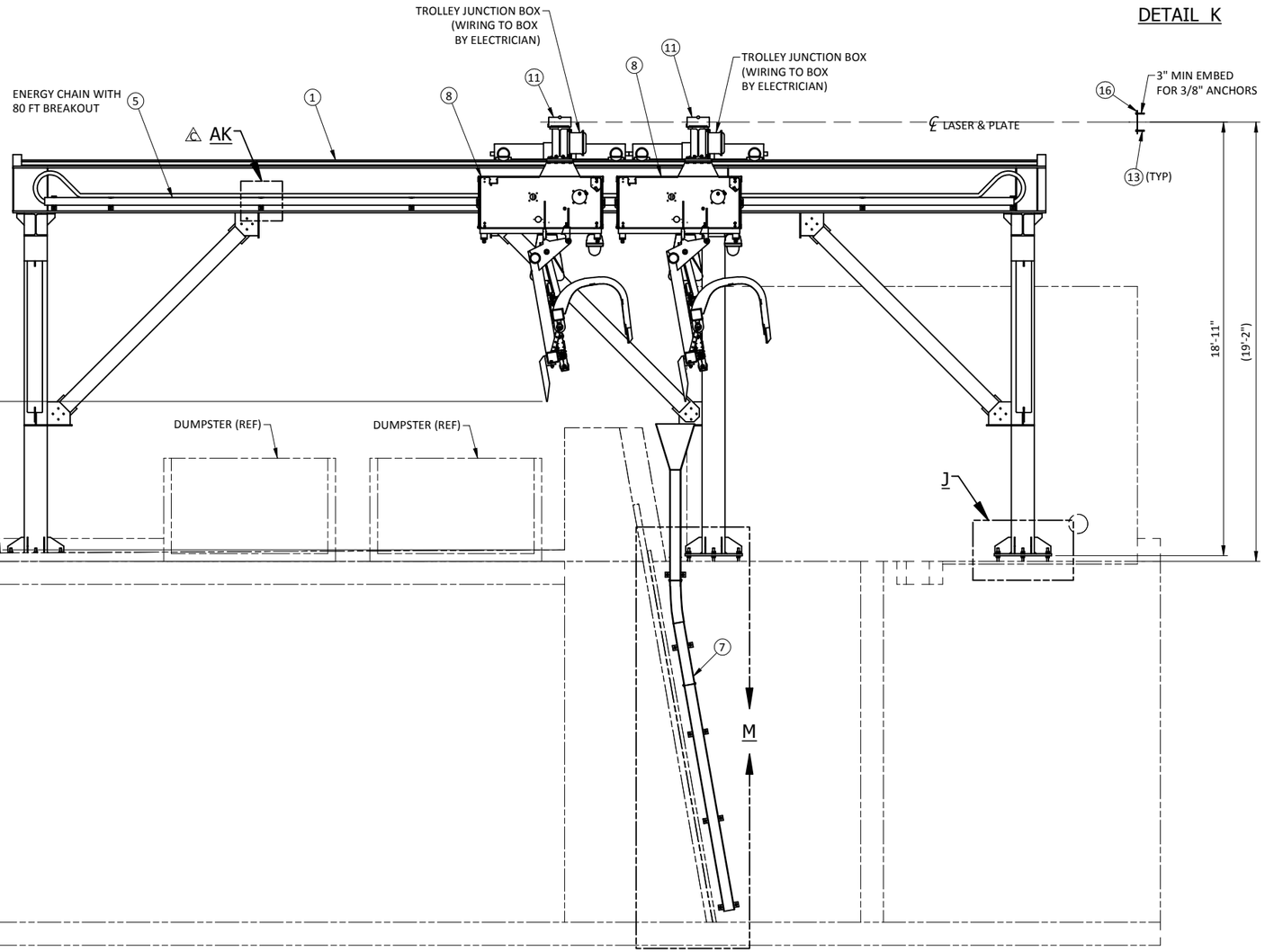
DETAIL J
(TYP BASEPLATE DETAIL)



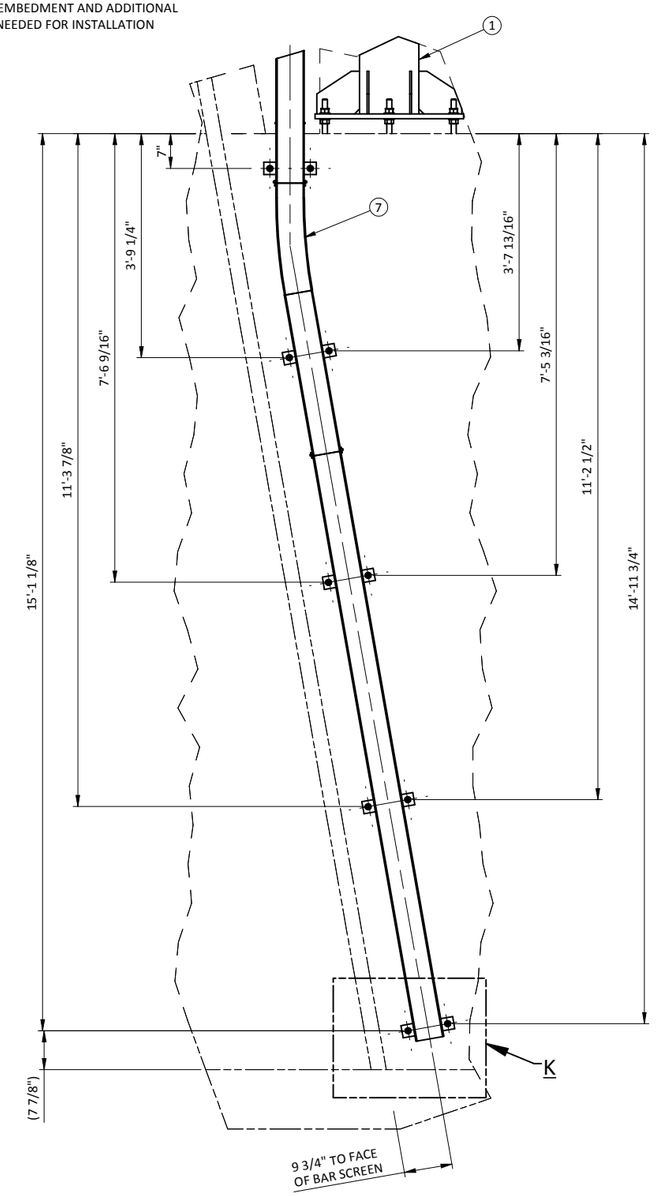
△ DETAIL AK
(TYP ENERGY CHAIN MOUNTING BRACKET DETAIL)



DETAIL K

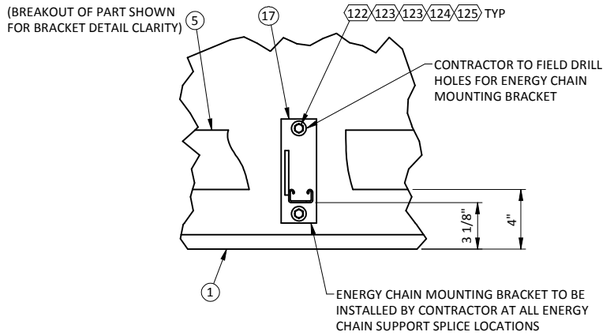


SECTION L-L
(FROM SHEET 2)

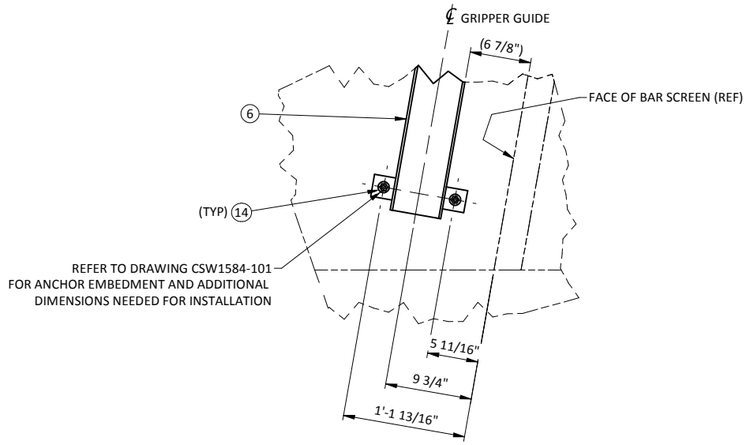


DETAIL M

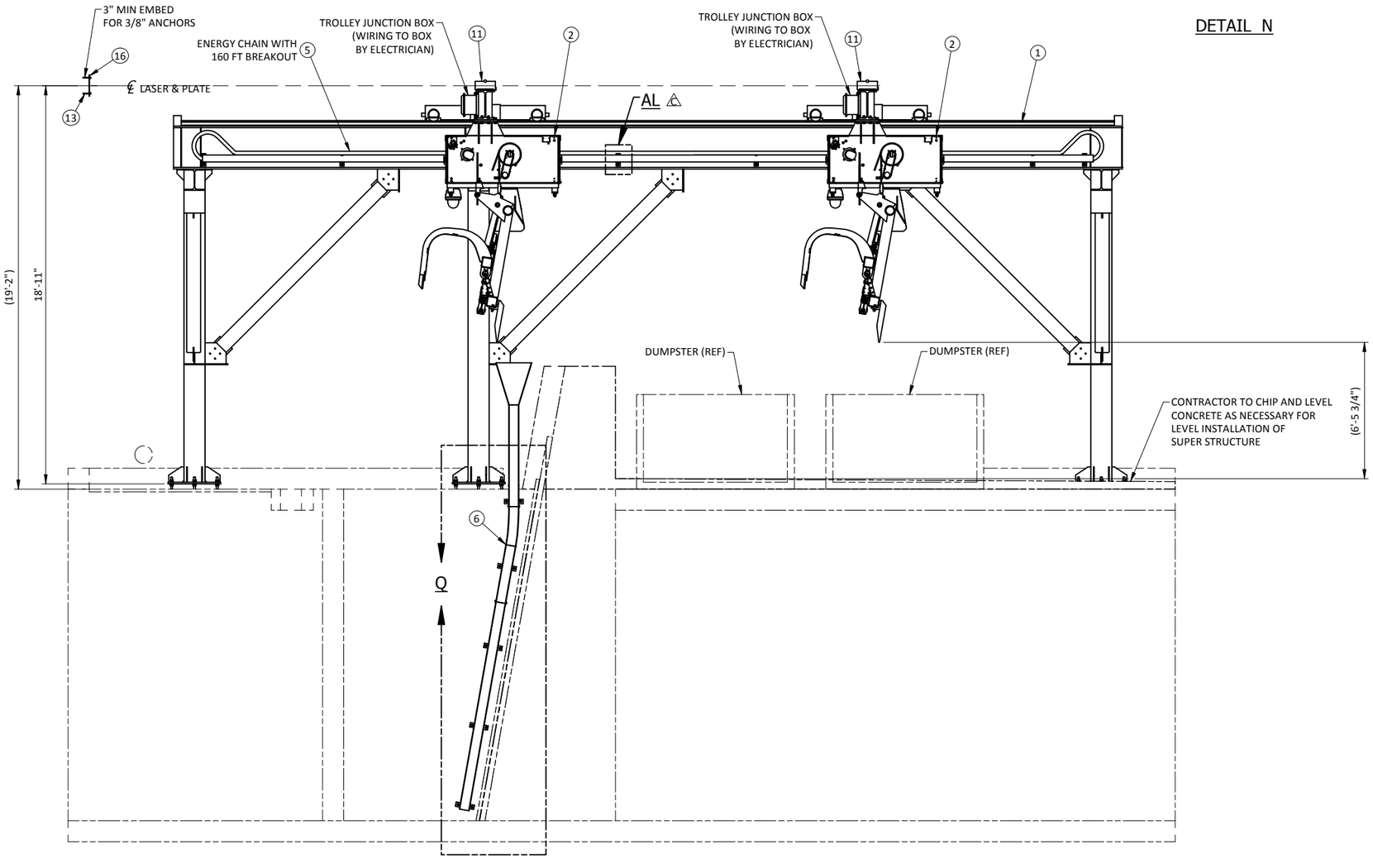
D SIZE SHEET DO NOT SCALE PRINTS	THIRD ANGLE PROJECTION	THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION OF OVIVO AND ITS AFFILIATES AND IS NOT TO BE DISCLOSED NOR TO BE USED EXCEPT FOR EVALUATING PROPOSALS OF OVIVO OR INSTALLING, OPERATING OR MAINTAINING OVIVO EQUIPMENT UNLESS OTHERWISE AUTHORIZED IN WRITING BY OVIVO. **UNCONTROLLED COPY IF PRINTED.**	
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WORKMANSHIP STANDARD ES0001 APPLIES			



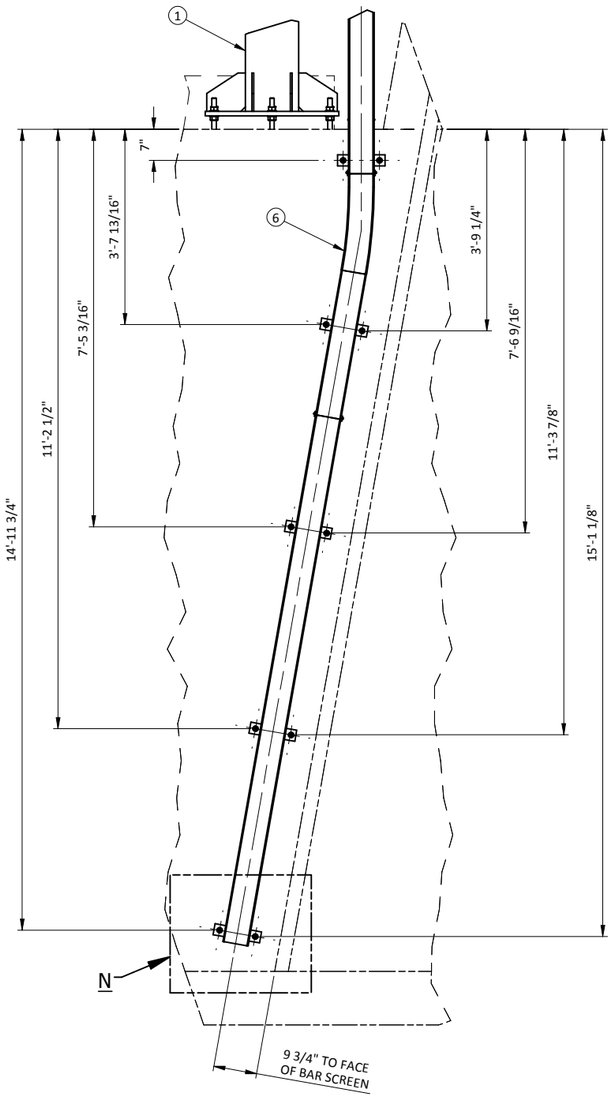
⚠ DETAIL AL
(TYP ENERGY CHAIN MOUNTING BRACKET DETAIL)



DETAIL N

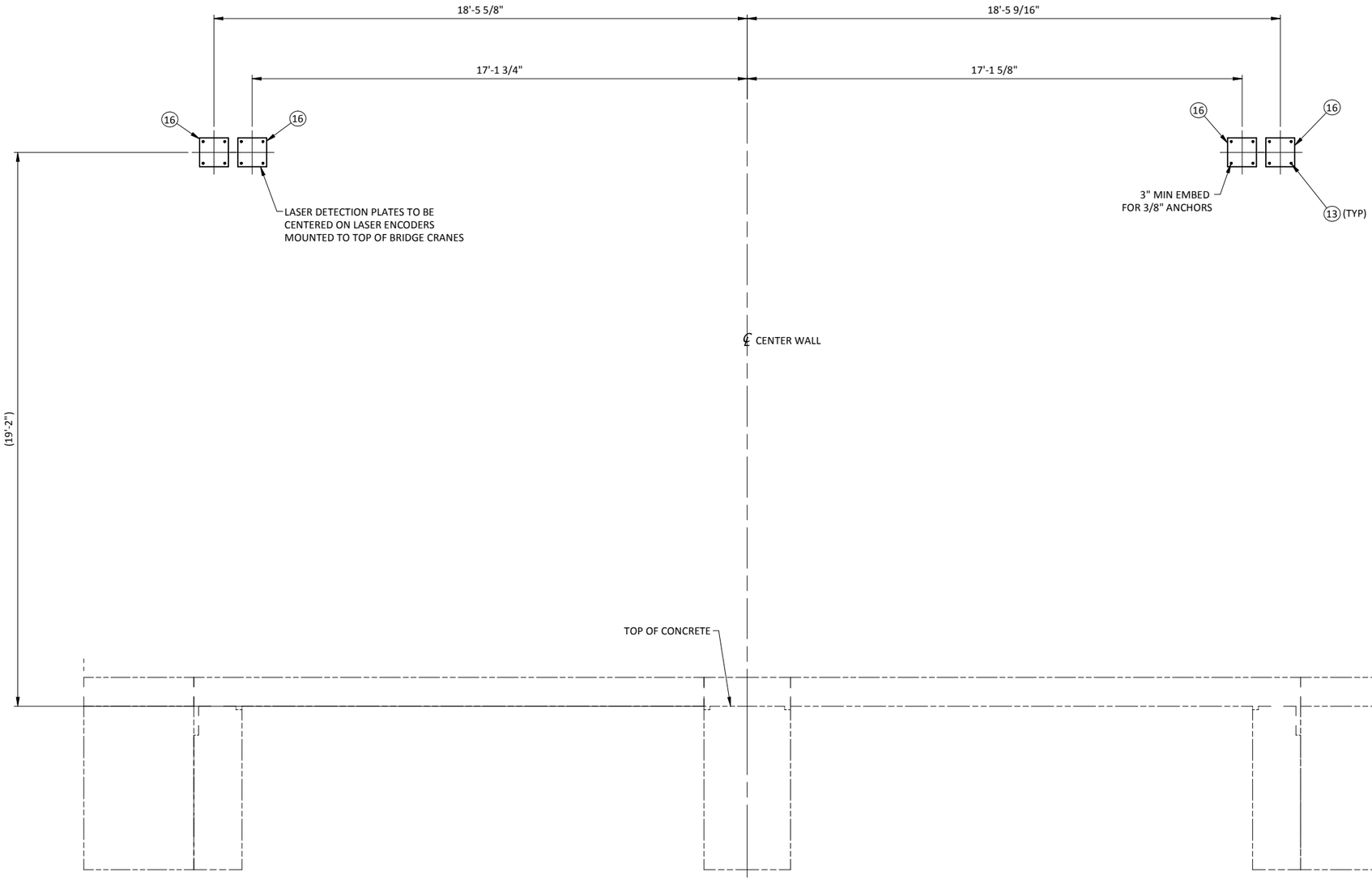


SECTION P-P
(FROM SHEET 2)



DETAIL Q

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SECTION R-R

(LASER DETECTION PLATE DETAIL)
(FROM SHEET 2)

D SIZE SHEET DO NOT SCALE PRINTS	THIRD ANGLE PROJECTION	OVIVO	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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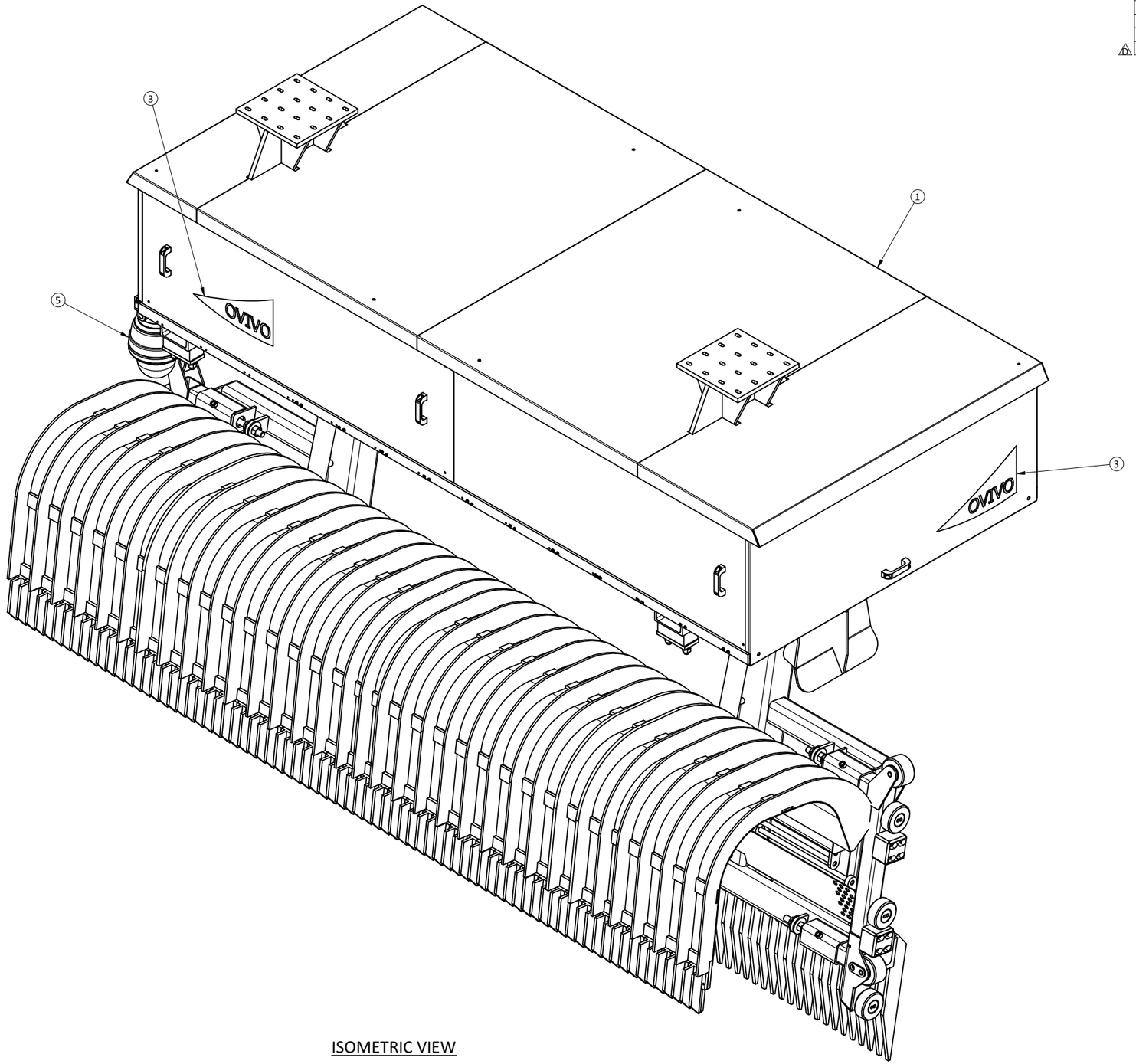
Bosker Assembly, Right
CSW1584-158 (Rev D)

REFERENCE DRAWINGS	
DESCRIPTION	DRAWING NO.
TROLLEY JUNCTION BOX	CSW1584-126

PRE-RELEASED ITEMS

ITEM	QTY	MATERIAL	DESCRIPTION	PART NUMBER	DRAWING	WEIGHT
1	1	VARIES	BOSKER, BT4250S, RIGHT MODEL	CSW1584-159A	CSW1584-159	7821
2	1	VARIES	HOIST MOTOR BRAKE	771428	771428	138
3	4	316/316L SS	OVIVO FLAG	771627	771627	4
4	8	VARIES	PEPPERL FUCHS SENSOR, M30	771678	771678	5
5	1	VARIES	LED WARNING LIGHT ASSEMBLY	772446 B	772446 B	20
6	1	VARIES	HYDRAULIC POWER UNIT	772235	772235	604
7	1	AS NOTED	HOIST MOTOR ASSEMBLY, 10 HP	CSW1584-901 C	CSW1584-901 C	347
D 8	6	304 SS	HPU SPACER	CSW1584-190	CSW1584-190	9

TOTAL WEIGHT
8999



ISOMETRIC VIEW

FASTENER LIST

D

ITEM	QTY	MATERIAL	DESCRIPTION	PART NUMBER
101	4	304 SS	HEX HD CAPSCREW, 1/4-20 UNC x 1 1/4	HCS04UNCX020-304SS
102	8	304 SS	HEX HD CAPSCREW, 5/16-18 UNC x 1 1/2	HCS05UNCX024-304SS
103	4	304 SS	HEX HD CAPSCREW, 1/2-13 UNC x 1 1/4	HCS08UNCX020-304SS
104	8	304 SS	PLAIN WASHER, 1/4 - SMALL OD	PNW04A-304SS
105	8	304 SS	PLAIN WASHER, 5/16 - SMALL OD	PNW05A-304SS
106	4	304 SS	PLAIN WASHER, 1/2 - SMALL OD	PNW08A-304SS
107	4	304 SS	LOCK WASHER, 1/2	LKW08-304SS
108	4	304 SS	NYLON INSERT HEX NUT, 1/4-20 UNC	NHN04UNC-304SS
109	8	304 SS	NYLON INSERT HEX NUT, 5/16-18 UNC	NHN05UNC-304SS

NOTES:

1. THIS DRAWING SHOWS THE OVIVO SUPPLIED ITEMS TO BE INSTALLED ON THE BOSKER.
2. SUPPLIER IS TO INSTALL TROLLEY JUNCTION BOX ON UNIT ALONG WITH PRE-RELEASED ITEMS.

REVISION DESCRIPTION	EN/ECO	BY	CHECK'D	DATE	REV
ADDED FASTENERS TO DRAWING	S-020557	CLR	LMK	1/11/2023	D
ADD MOTOR SHAFT EXTENSION	S-020346	LMK	CLR	11/18/2022	C
UPDATED LED WARNING LIGHT ASSEMBLY	S-019750	CLR	MAN	7/21/2022	B
INITIAL RELEASE		-	-	-	A

D — SIZE SHEET (DO NOT SCALE PRINTS) — THIRD ANGLE PROJECTION

DRAWN BY	ES
CHECKED BY	CLR
DATE (mm/dd/yyyy)	4/13/2022
PROJECT	CSW0001584-01
REF	CSW1533-158

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WORKMANSHIP STANDARD ES0001 APPLIES

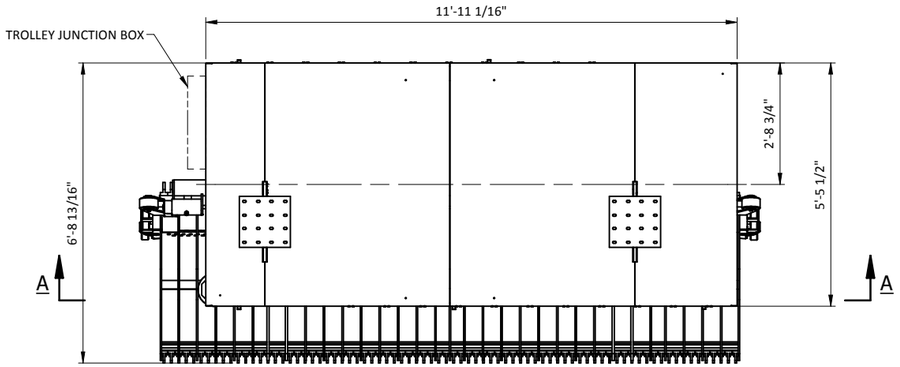
BOSKER ERECTION
RIGHT MODEL

OVIVO

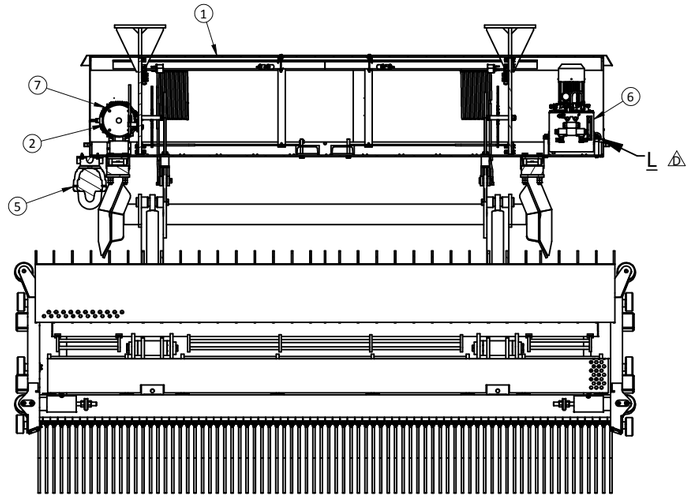
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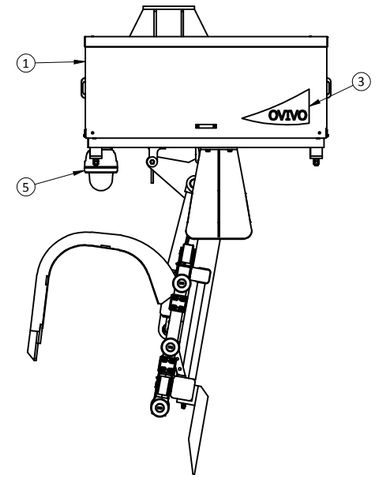
D REVISION



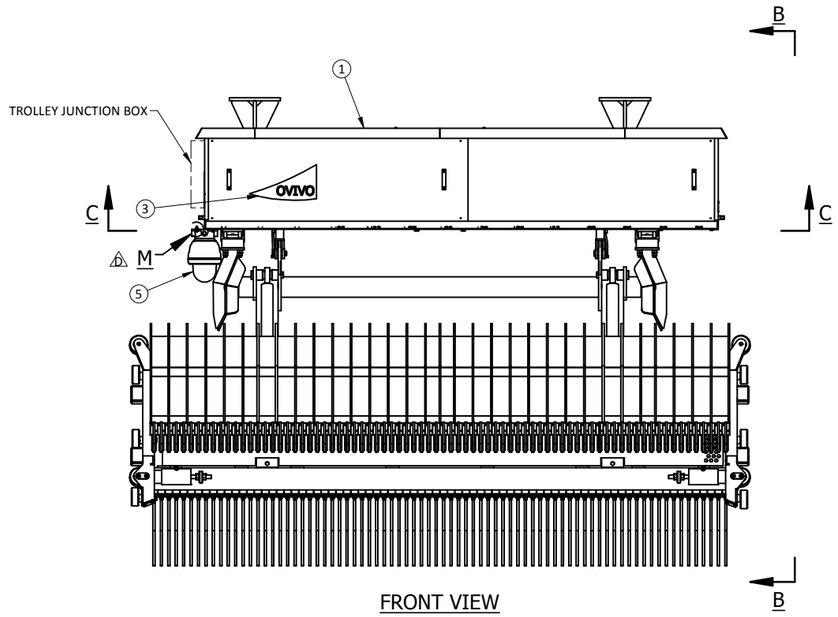
TOP VIEW



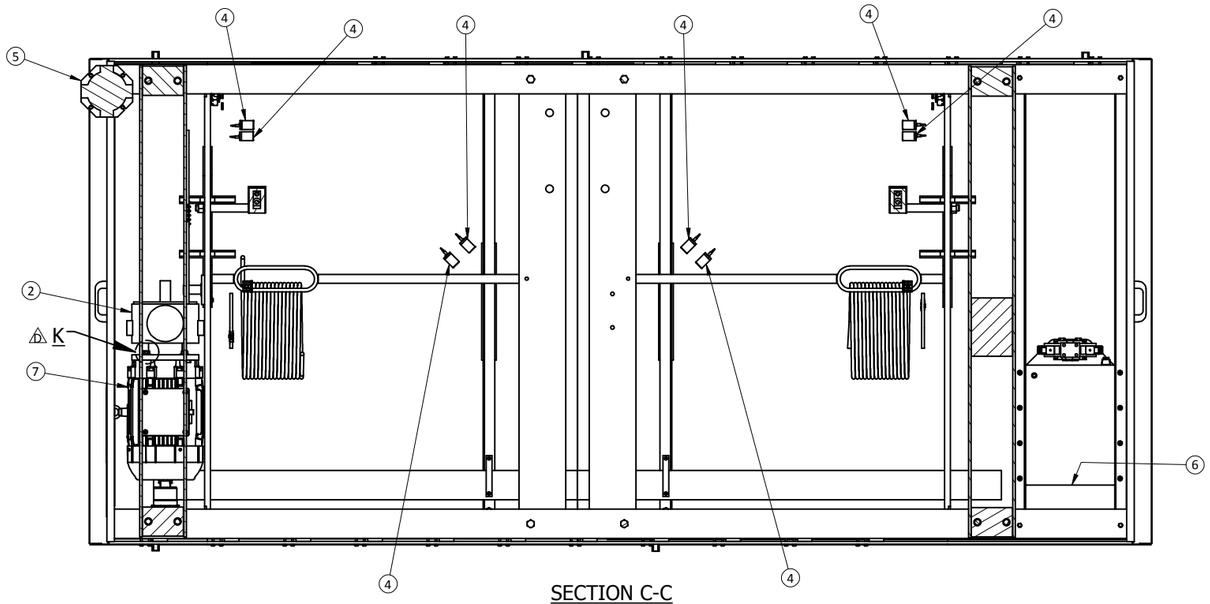
SECTION A-A



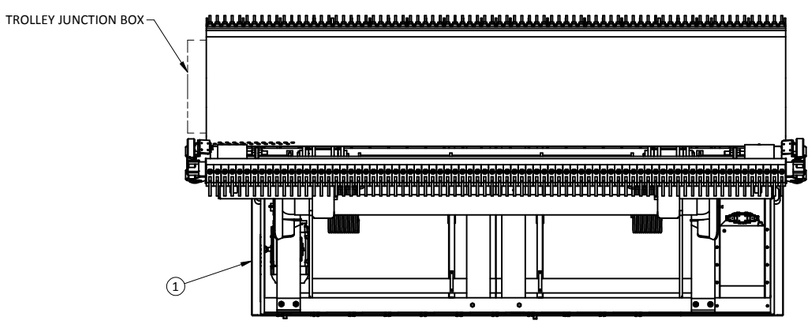
VIEW B-B



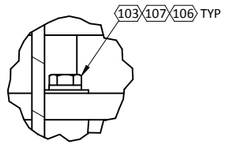
FRONT VIEW



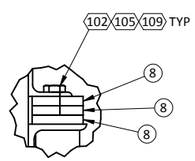
SECTION C-C



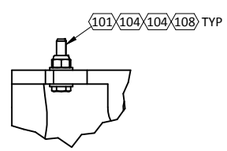
BOTTOM VIEW



DETAIL K
MOTOR TO BRAKE
CONNECTION DETAIL



DETAIL L
HPU TO TROLLEY
CONNECTION DETAIL



DETAIL M
BEACON TO TROLLEY
CONNECTION DETAIL

D
SIZE SHEET
DO NOT SCALE PRINTS
THIRD ANGLE PROJECTION

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CSW1584-158

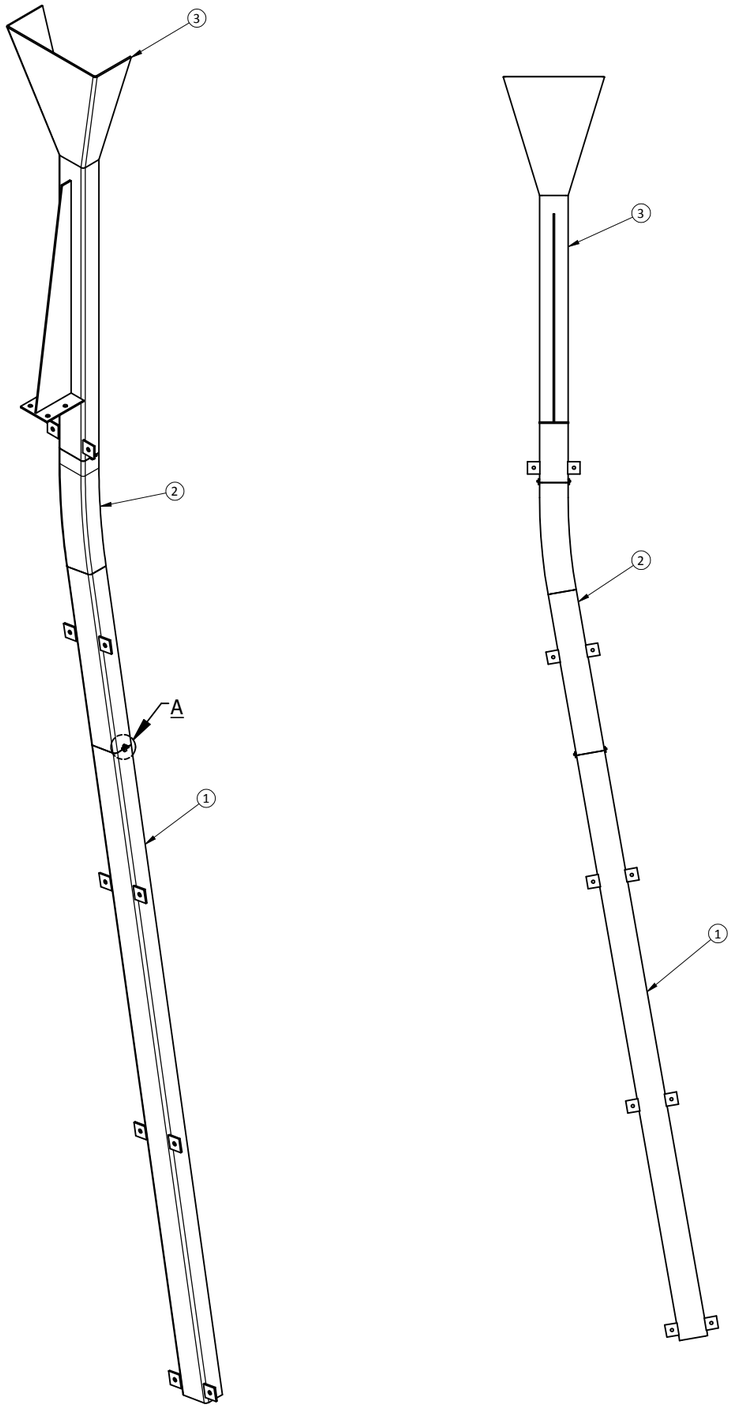
SHEET 2 OF 2

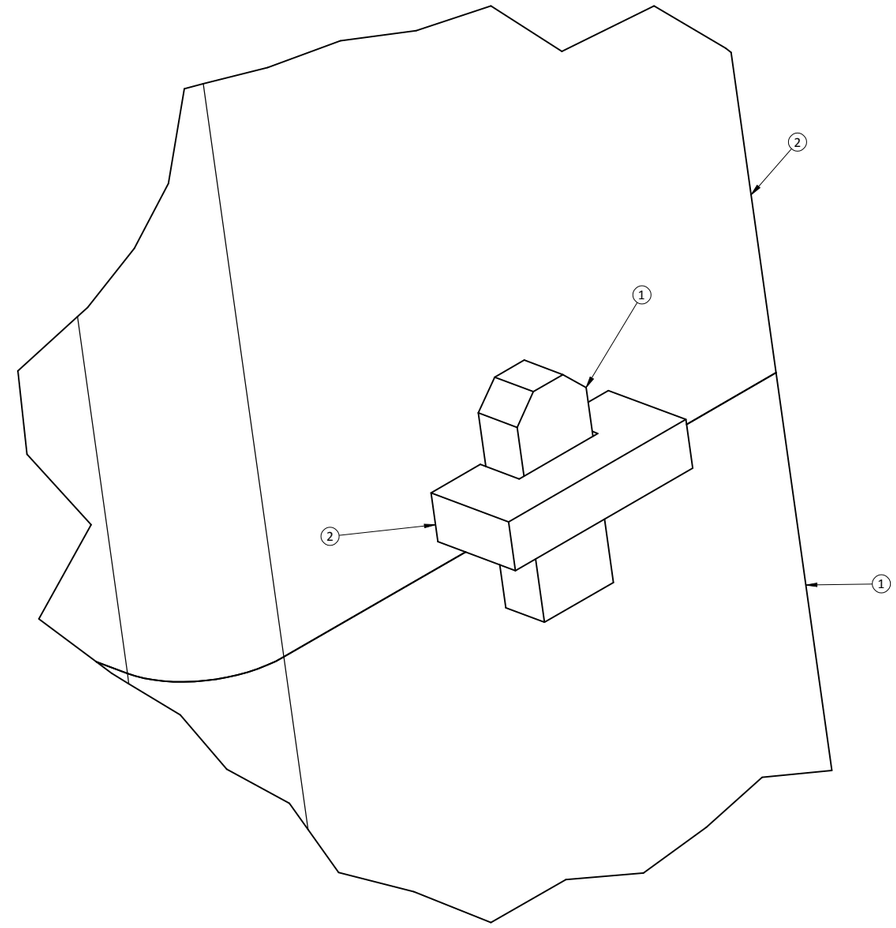
D
REVISION

Gripper Guide, Right
CSW1584-1366 (Rev A)

ITEM	QTY	MATERIAL	DESCRIPTION	PART NUMBER	DRAWING	WEIGHT
1	1	HDG STEEL	GRIPPER GUIDE 1	CSW1584-1367	CSW1584-1367	106
2	1	HDG STEEL	GRIPPER GUIDE 2	CSW1584-1368	CSW1584-1368	49
3	1	HDG STEEL	GRIPPER GUIDE INLET	CSW1584-1369	CSW1584-1369	75

TOTAL WEIGHT
229





DETAIL A

NOTE(S):

1. FABRICATOR TO TEST FIT ITEM 1 TO ITEM 2, AND ITEM 2 TO ITEM 3 TO VERIFY SLIP FIT IS ACHIEVED. FABRICATOR IS TO MODIFY TAB IF NECESSARY TO ACHIEVE SLIP FIT.

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

D
SIZE SHEET
(DO NOT SCALE PRINTS)

THIRD ANGLE PROJECTION

DRAWN BY	EJB
CHECKED BY	CLR
DATE (mm/dd/yyyy)	3/16/2022
PROJECT	CSW0001584-01
REF	CSW1467-163

GRIPPER GUIDE

OVIVO

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DWG NO. **CSW1584-1366**

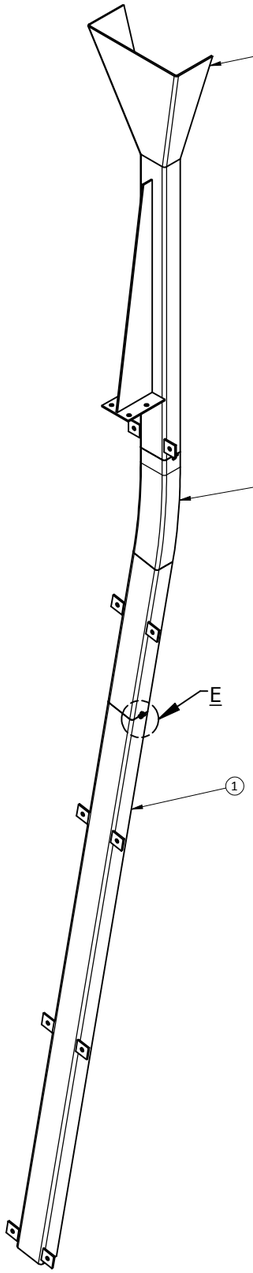
SHEET 1 OF 1

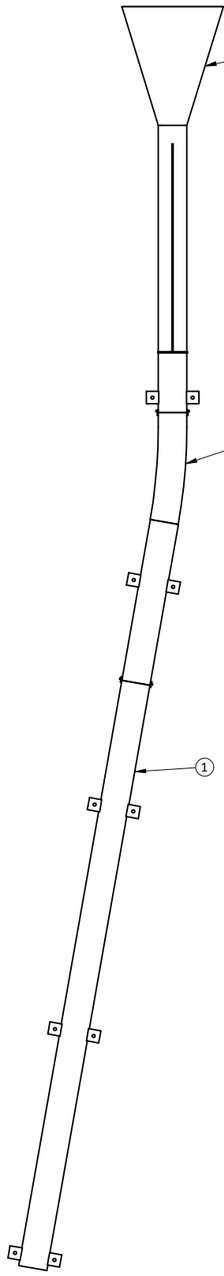
A
REVISION

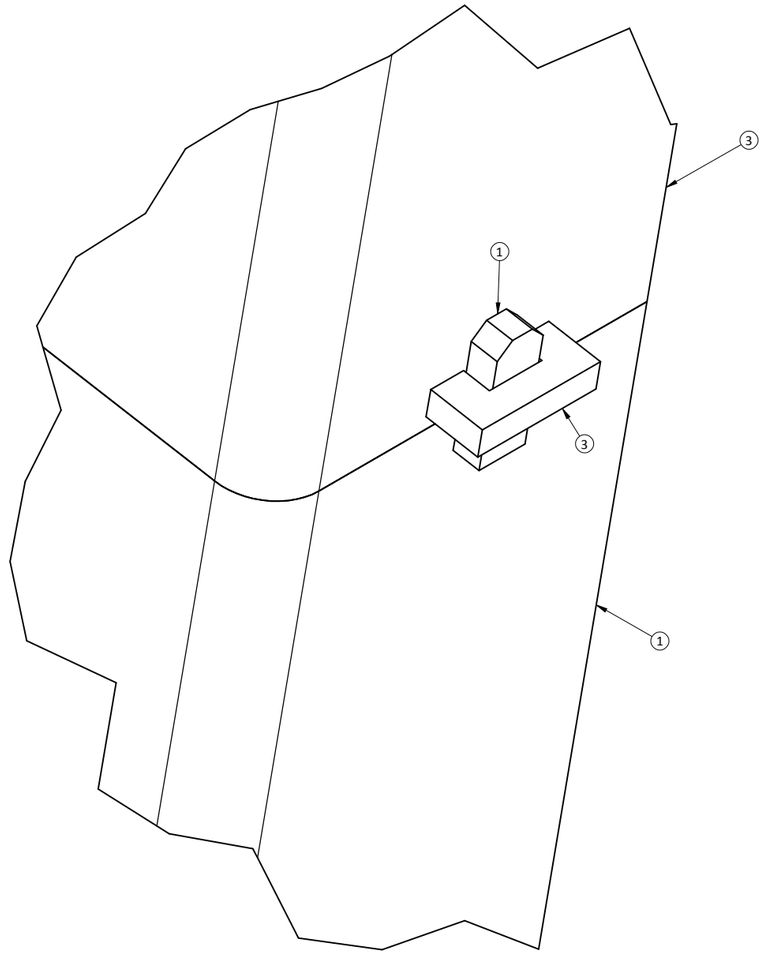
Gripper Guide, Left
CSW1584-1370 (Rev A)

ITEM	QTY	MATERIAL	DESCRIPTION	PART NUMBER	DRAWING	WEIGHT
1	1	HDG STEEL	GRIPPER GUIDE 1	CSW1584-1367	CSW1584-1367	106
2	1	HDG STEEL	GRIPPER GUIDE INLET	CSW1584-1369	CSW1584-1369	75
3	1	HDG STEEL	GRIPPER GUIDE 2 (OPP)	CSW1584-1371	CSW1584-1371	49

TOTAL WEIGHT
229







DETAIL E

NOTE(S):

1. FABRICATOR TO TEST FIT ITEM 1 TO ITEM 2, AND ITEM 2 TO ITEM 3 TO VERIFY SLIP FIT IS ACHIEVED. FABRICATOR IS TO MODIFY TAB IF NECESSARY TO ACHIEVE SLIP FIT.

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

D SIZE SHEET (DO NOT SCALE PRINTS)	THIRD ANGLE PROJECTION
DRAWN BY	EJB
CHECKED BY	CLR
DATE (mm/dd/yyyy)	3/16/2022
PROJECT	CSW0001584-01
REF	CSW0001467-163

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WORKMANSHIP STANDARD ES0001 APPLIES

GRIPPER GUIDE

OVIVO

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DWG NO. **CSW1584-1370**

SHEET 1 OF 1

A REVISION

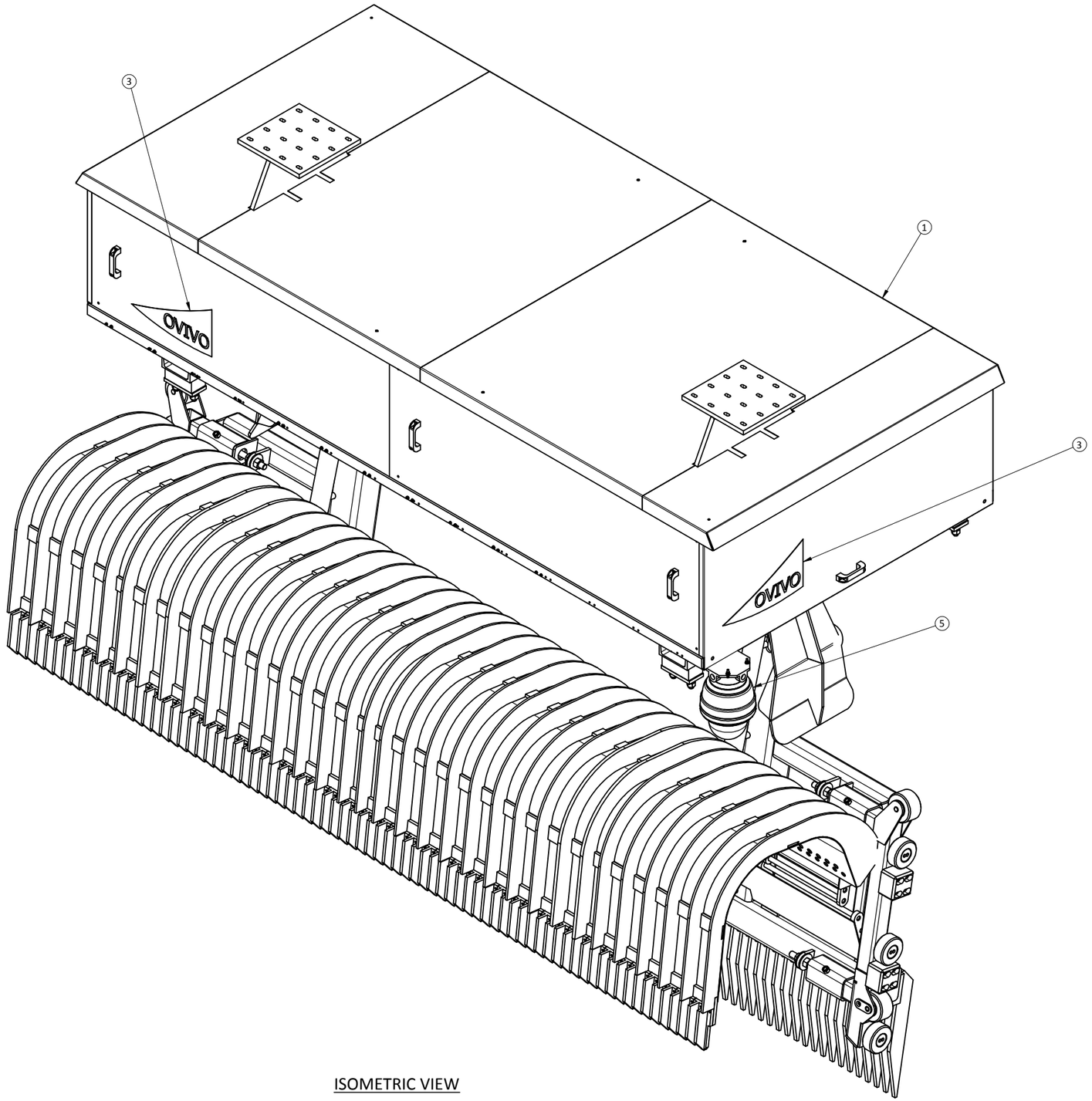
Bosker Assembly, Left
CSW1584-1581 (Rev C)

REFERENCE DRAWINGS	
DESCRIPTION	DRAWING NO.
TROLLEY JUNCTION BOX	CSW1584-126

PRE-RELEASED ITEMS

ITEM	QTY	MATERIAL	DESCRIPTION	PART NUMBER	DRAWING	WEIGHT
1	1	VARIES	BOSKER, BT4250S, LEFT MODEL	CSW1584-159B	CSW1584-159	7361
2	1	VARIES	HOIST MOTOR BRAKE	771428	771428	138
3	4	316/316L SS	OVIVO FLAG	771627	771627	4
4	8	VARIES	PEPPERL FUCHS SENSOR, M30	771678	771678	5
5	1	VARIES	LED WARNING LIGHT ASSEMBLY	772446	772446	20
6	1	VARIES	HYDRAULIC POWER UNIT	772235 B	772235 B	604
C 7	1	AS NOTED	HOIST MOTOR ASSEMBLY, 10 HP	CSW1584-901	CSW1584-901	347
C 8	6	304 SS	HPU SPACER	CSW1584-190	CSW1584-190	9

TOTAL WEIGHT
8999



ISOMETRIC VIEW

FASTENER LIST

C

ITEM	QTY	MATERIAL	DESCRIPTION	PART NUMBER
101	4	304 SS	HEX HD CAPSCREW, 1/4-20 UNC x 1 1/4	HCS04UNCX020-304SS
102	8	304 SS	HEX HD CAPSCREW, 5/16-18 UNC x 1 1/2	HCS05UNCX024-304SS
103	4	304 SS	HEX HD CAPSCREW, 1/2-13 UNC x 1 1/4	HCS08UNCX020-304SS
104	8	304 SS	PLAIN WASHER, 1/4 - SMALL OD	PNW04A-304SS
105	8	304 SS	PLAIN WASHER, 5/16 - SMALL OD	PNW05A-304SS
106	4	304 SS	PLAIN WASHER, 1/2 - SMALL OD	PNW08A-304SS
107	4	304 SS	LOCK WASHER, 1/2	LKW08-304SS
108	4	304 SS	NYLON INSERT HEX NUT, 1/4-20 UNC	NHN04UNC-304SS
109	8	304 SS	NYLON INSERT HEX NUT, 5/16-18 UNC	NHN05UNC-304SS

NOTES:

1. THIS DRAWING SHOWS THE OVIVO SUPPLIED ITEMS TO BE INSTALLED ON THE BOSKER.
2. SUPPLIER IS TO INSTALL TROLLEY JUNCTION BOX ON UNIT ALONG WITH PRE-RELEASED ITEMS.

REVISION DESCRIPTION	EN/ECO	BY	CHECK'D	DATE	REV
ADDED FASTENERS, SPACERS, AND MOTOR UPDATE	S-020557	CLR	LMK	1/12/2023	C
UPDATED WARNING LIGHT ASSEMBLY	S-019750	CLR	MAN	7/21/2022	B
INITIAL RELEASE		-	-	-	A

D SIZE SHEET (DO NOT SCALE PRINTS) — THIRD ANGLE PROJECTION

DRAWN BY	SSR/SRN
CHECKED BY	CLR
DATE (mm/dd/yyyy)	5/22/2022
PROJECT	CSW0001584-01
REF	CSW1533-158

BOSKER ERECTION
LEFT MODEL

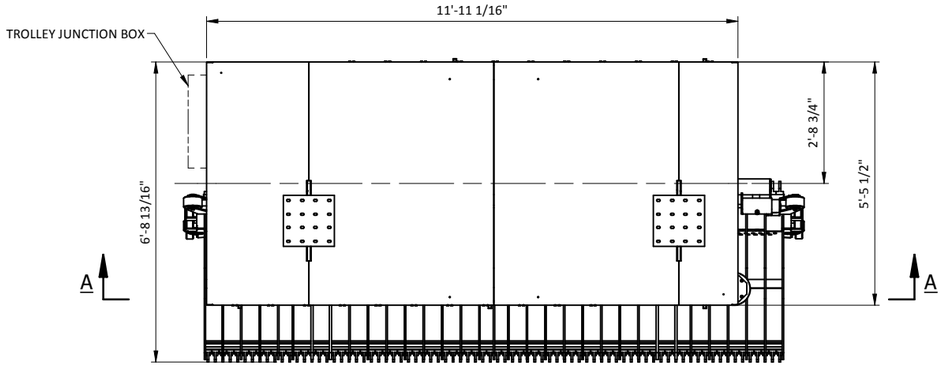
OVIVO

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WORKMANSHIP STANDARD ES0001 APPLIES

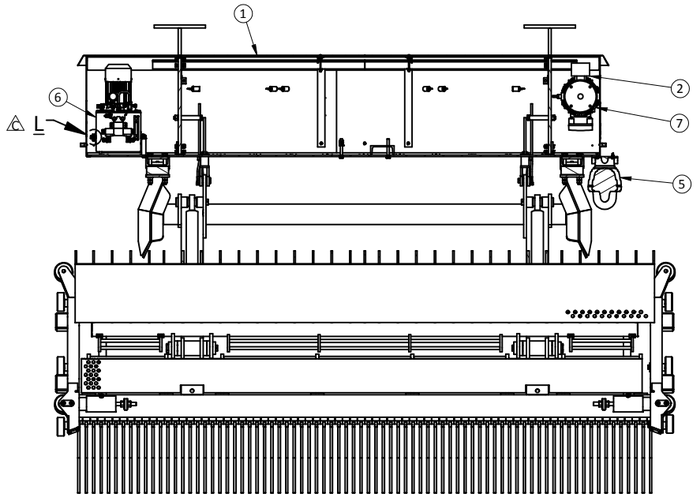
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DWG NO. **CSW1584-1581**

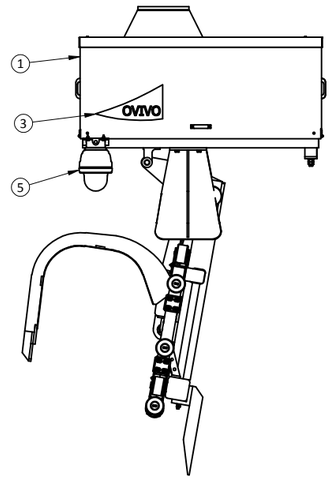
REVISION **C**



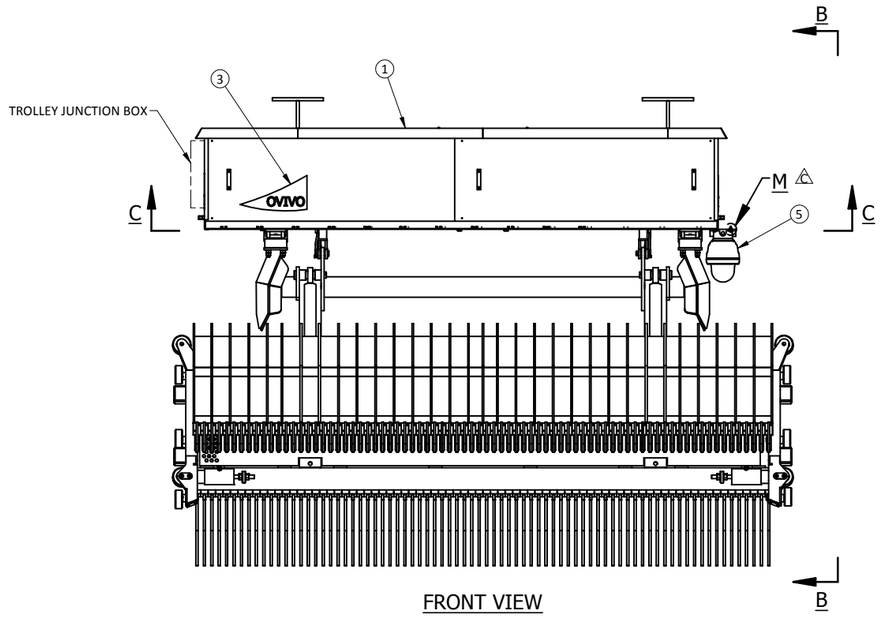
TOP VIEW



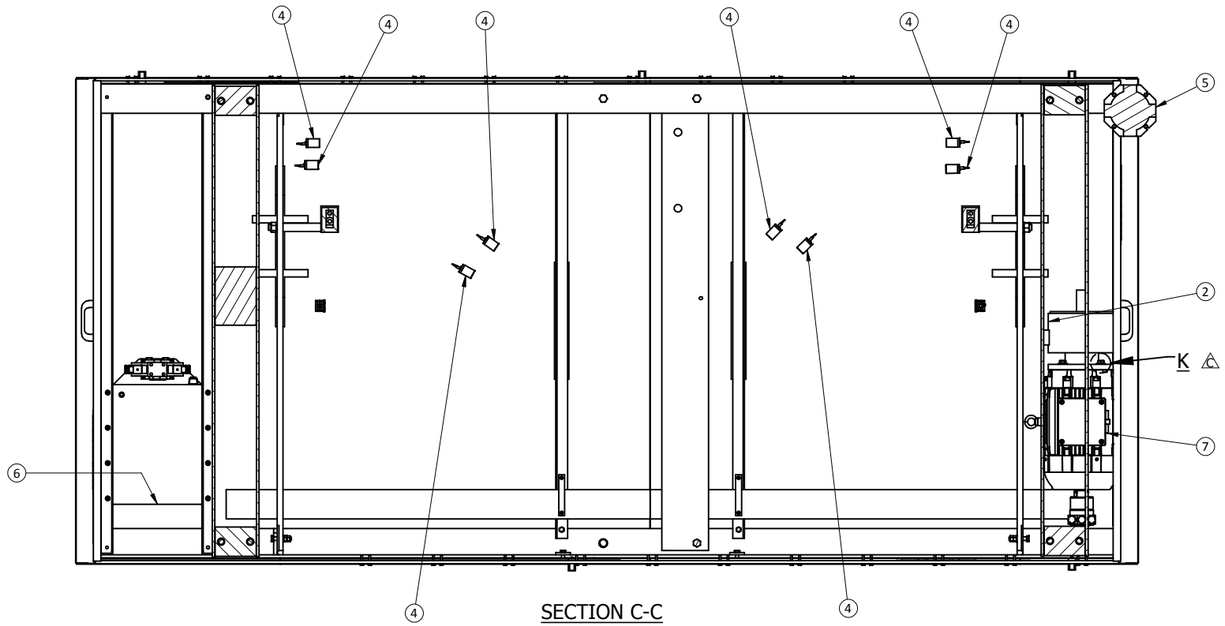
SECTION A-A



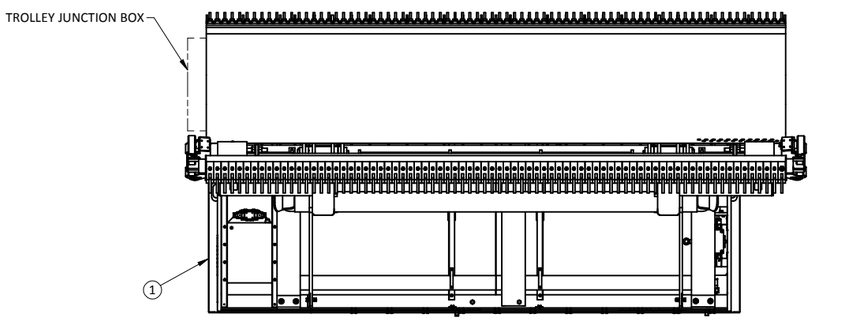
VIEW B-B



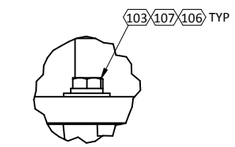
FRONT VIEW



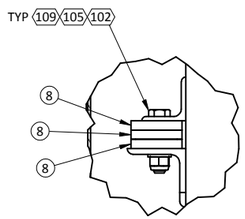
SECTION C-C



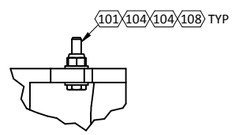
BOTTOM VIEW



DETAIL K
MOTOR TO BRAKE
CONNECTION DETAIL



DETAIL L
HPU TO TROLLEY
CONNECTION DETAIL



DETAIL M
BEACON TO TROLLEY
CONNECTION DETAIL

D SIZE SHEET DO NOT SCALE PRINTS	THIRD ANGLE PROJECTION	OVIVO	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 ES0001 APPLIES			

Trash Rake Control System
CSW1584-121 (Rev F)

OVIVO™

Worldwide Experts in Water Treatment℠

CUSTER AVENUE WWTP, GA
TRASH RAKE CONTROL SYSTEM

EQUIPMENT DESIGNATION		
ITEM	EQUIPMENT	PANEL NUMBER
1	TRASH RAKE UNIT 1	TRU01
2	TRASH RAKE UNIT 2	TRU02

ELECTRICAL DRAWING INDEX	
DWG #	SHEET
CSW1584-121 SHEET 1	COVER SHEET INCLUDING TABLE OF CONTENTS, PANEL DESIGNATIONS
CSW1584-121 SHEET 2	GENERAL DRAWING NOTES
CSW1584-121 SHEET 3	ONE LINE 480 VAC
CSW1584-121 SHEET 4	ONE LINE 120 VAC
CSW1584-121 SHEET 5	NETWORK LAYOUT 01 INCLUDING IP ADDRESSES 01
CSW1584-121 SHEET 6	NETWORK LAYOUT 01 INCLUDING IP ADDRESSES 02
CSW1584-121 SHEET 7	ASSY MAIN PANEL
CSW1584-121 SHEET 8	INTERIOR MAIN PANEL "DETAIL VIEW" 01
CSW1584-121 SHEET 9	INTERIOR MAIN PANEL "DETAIL VIEW" 02
CSW1584-121 SHEET 10	INTERIOR MAIN PANEL "DETAIL VIEW" 03
CSW1584-121 SHEET 11	BOM MAIN PANEL
CSW1584-121 SHEET 12	MAIN POWER SCHEMATIC 01
CSW1584-121 SHEET 13	MAIN POWER SCHEMATIC 02
CSW1584-121 SHEET 14	MAIN POWER SCHEMATIC 03
CSW1584-121 SHEET 15	MAIN POWER SCHEMATIC 04
CSW1584-121 SHEET 16	MAIN POWER SCHEMATIC 05
CSW1584-121 SHEET 17	MAIN POWER SCHEMATIC 06
CSW1584-121 SHEET 18	MAIN POWER SCHEMATIC 07
CSW1584-121 SHEET 19	INTENTIONALLY KEPT BLANK
CSW1584-121 SHEET 20	CONTROL POWER SCHEMATIC 01
CSW1584-121 SHEET 21	ASSY PLC PANEL
CSW1584-121 SHEET 22	INTERIOR PLC PANEL "DETAIL VIEW"
CSW1584-121 SHEET 23	INTERIOR PLC PANEL "DETAIL VIEW"
CSW1584-121 SHEET 24	BOM PLC PANEL
CSW1584-121 SHEET 25	PLC PANEL SCHEMATIC 01
CSW1584-121 SHEET 26	PLC PANEL SCHEMATIC 02
CSW1584-121 SHEET 27	PLC PANEL SCHEMATIC 03
CSW1584-121 SHEET 28	PLC PANEL SCHEMATIC 04
CSW1584-121 SHEET 29	PLC PANEL SCHEMATIC 05
CSW1584-121 SHEET 30	PLC PANEL SCHEMATIC 06
CSW1584-121 SHEET 31	PLC PANEL SCHEMATIC 07
CSW1584-121 SHEET 32	PLC PANEL SCHEMATIC 08

REVISION	EN/ECO	BY	CHECK'D	DATE
FAT UPDATES	020763	SOG	MN	02/15/23
NA REVISION UPDATE	019057	SMM	SOG	02/15/23
AS BUILT DRAWING	019148	SMM	SOG	03/24/22
UPDATED TO INCLUDE PUMP 2 PROVISIONS	018999	JG	SOG	03/08/22
UPS RELAY UPDATES	019013	KD	SOG	03/07/22
INITIAL RELEASE	018934	SMM	SOG	02/21/22

D
SIZE SHEET
(DO NOT SCALE PRINTS)

THIRD ANGLE PROJECTION

DRAWN BY SMM
CHECKED BY SOG
DATE (mm/dd/yyyy) 02/21/22
PROJECT CSW0001584-01
REF

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CUSTER AVENUE WWTP, GA
TRASH RAKE CONTROL SYSTEM
(TYPICAL OF 2)

OVIVO

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DWG NO. CSW1584-121

SHEET 1OF 32

F
REVISION

GENERAL DRAWING NOTES

CONTROL PANEL SPECIFICATIONS

1. **COMPONENTS SPECIFIC**

1.1 ENCLOSURE TO BE NEMA 12 CONSTRUCTION.

1.2 ATTACH NAMEPLATES WITH MANUFACTURER'S RECOMMENDED ADHESIVE TO MAINTAIN NEMA STANDARD OF ENCLOSURE

1.3 CONTROL PANEL SHALL BE LABELED WITH SERIALIZED UL LABEL

1.4 PANEL WILL BE LABELED WITH IDENTIFICATION PLATE AS NOTED ON ENCLOSURE DRAWING.

1.5 ALL RELAY CONTACTS ARE RATED AT 10 AMPS UNLESS OTHERWISE NOTED.

1.6 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.

1.7 SUBSTITUTIONS FOR COMPONENTS MAY BE PERMITTED UPON APPROVAL BY OVIVO ENGINEERS.

1.8 AC UNIT SHALL BE FACTORY PAINTED WHITE

2. **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/24 V - 16 AWG TYPE: MTW

3. **WIRE COLOR**

WIRE COLOR SHALL BE AS FOLLOWS (NFPA 79 SEC. 13.2.1):
AC POWER & CONTROL - BLACK AND/OR RED
DC POWER & CONTROL - DARK BLUE
DC POWER & CONTROL COMMON - WHITE W/BLUE STRIPE
NEUTRAL - WHITE
GROUND - GREEN
AC CONTROL EXTERNAL SOURCE - YELLOW
EXTERNAL NEUTRAL - WHITE W/YELLOW STRIPE
DC CONTROL EXTERNAL SOURCE - YELLOW W/BLUE STRIPE
SIGNAL, PAIR - BLACK, WHITE OR CLEAR

4. **CONNECTIONS**

4.1 ALL CONNECTIONS SHALL BE POINT TO POINT WITHOUT SPLICES. EXCEPTIONS APPLY TO SOLENOIDS AND MOTORS AND FACTORY WIRED COMPONENTS.
4.2 ALL CONDUCTORS MUST BE MARKED WITH MACHINE PRINTED TAGS AT EACH TERMINATION. MARKERS SHALL BE OF HEAT SHRINK TYPE AND BE LABLED WITH THE WIRE NUMBER DESIGNATED IN THIS DRAWING.
4.3 ALL CONDUCTORS TERMINATED AT SCREW CONNECTIONS SHALL HAVE A WIRE FERRULE ATTACHED TO THE END OF THE WIRE.
4.4 ALL CONDUCTORS TERMINATED AT SPRING CLAMP CONNECTIONS SHALL BE TERMINATED WITHOUT A WIRE FERRULE.

5. **DOCUMENTATION**

5.1 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.

5.2 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.

6. **TESTING**

6.1 OVIVO ENGINEERS OR OVIVO APPROVED FABRICATOR, WILL PERFORM A POINT TO POINT CONTINUITY TEST ON THE PANEL.

6.2 WHEN APPLICABLE, THE FABRICATOR WILL ALSO PROVIDE POWER TO THE 480VAC CIRCUITS FOR VERIFICATION AND TESTING. FABRICATOR SHALL ALLOW ACCESS TO THE CONTROL PANEL BY AN OVIVO ENGINEER FOR THIS AND ANY OTHER TESTES REQUIRED BY AN OVIVO ENGINEER.

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INCOMING POWER SUPPLY
3-PHASE, 480 VOLTS, 60 HZ
FROM CUSTOMER

MCP CONTROL PANEL FOR BRIDGE CRANE 1 & 2 (UNIT 1)

ENCLOSURE SCCR: 65kA

BREAKER
80 AMP
SCCR:65kA

BREAKER
30 AMP
SCCR:10kA

5 KVA
480V TO 120V

60 AMP
SCCR:10kA

TO CONTROL
CIRCUITS

SURGE
SUPPRESSOR

PHASE
MONITORING
RELAY

BREAKER
3.2 AMP
SCCR:65kA

VFD POWERFLEX 525
SCCR:100kA

BREAKER
1.6 AMP
SCCR:65kA

MOT. 3/4 HP

BRIDGE CRANE 1
MOTOR 1

BREAKER
1.6 AMP
SCCR:65kA

MOT. 3/4 HP

BRIDGE CRANE 1
MOTOR 2

BREAKER
2 AMP
SCCR:10kA

CONTACTOR
9AMPS

BRAKES

BRIDGE CRANE 1
MOTOR 1
BRAKE

BRAKES

BRIDGE CRANE 1
MOTOR 2
BRAKE

BREAKER
14.5 AMP
SCCR:65kA

VFD POWERFLEX 525
SCCR:100kA

MOT. 10 HP

BRIDGE CRANE 1
HOIST MOTOR

BREAKER
2 AMP
SCCR:10kA

CONTACTOR
9AMPS

BRAKES

BRIDGE CRANE 1
HOIST BREAK

BREAKER
3.4 AMP
SCCR:65kA

CONTACTOR
9AMPS

E300

MOT. 2.0 HP

HYDRAULIC PUMP 1
MOTOR

BREAKER
3.2 AMP
SCCR:65kA

VFD POWERFLEX 525
SCCR:100kA

BREAKER
1.6 AMP
SCCR:65kA

MOT. 3/4 HP

BRIDGE CRANE 2
MOTOR 1

BREAKER
1.6 AMP
SCCR:65kA

MOT. 3/4 HP

BRIDGE CRANE 2
MOTOR 2

BREAKER
2 AMP
SCCR:10kA

CONTACTOR
9AMPS

BRAKES

BRIDGE CRANE 2
MOTOR 1
BRAKE

BRAKES

BRIDGE CRANE 2
MOTOR 2
BRAKE

BREAKER
14.5 AMP
SCCR:65kA

VFD POWERFLEX 525
SCCR:100kA

MOT. 10 HP

BRIDGE CRANE 2
HOIST MOTOR

BREAKER
2 AMP
SCCR:10kA

CONTACTOR
9AMPS

BRAKES

BRIDGE CRANE 2
HOIST BREAK

BREAKER
3.4 AMP
SCCR:65kA

CONTACTOR
9AMPS

E300

MOT. 2.0 HP

HYDRAULIC PUMP 2
MOTOR

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D
SIZE SHEET
DO NOT SCALE PRINTS

THIRD ANGLE PROJECTION

OVIVO

DWG NO. CSW1584-121

SHEET 3 OF 32

F
REVISION

120 VAC 1-PHASE POWER DISTRIBUTION

MCP CONTROL PANEL (FOR UNIT 1)

FROM TRANSFORMER SECONDARY
120 VAC, 1-PHASE

BREAKER
60 AMP
SCCR:10kA

BREAKER	BREAKER	BREAKER	BREAKER	BREAKER	BREAKER	BREAKER	BREAKER	BREAKER	BREAKER	BREAKER
2 AMP SCCR:10kA	2 AMP SCCR:10kA	2 AMP SCCR:10kA	2 AMP SCCR:10kA	2 AMP SCCR:10kA	2 AMP SCCR:10kA	2.0 AMP SCCR:10kA	2.0 AMP SCCR:10kA	2 AMP SCCR:10kA	15 AMP SCCR:10kA	
BRIDGE CRANE 1 MOTORS HEATER	BRIDGE CRANE 2 MOTORS HEATER	HOIST 1 MOTOR HEATER	HOIST 2 MOTOR HEATER	HYDRAULIC PUMP 1 MOTOR HEATER	HYDRAULIC PUMP 2 MOTOR HEATER	CONTACTOR X6 RELAY X2	POWER TO E300 X 2	FAN		

PLC CONTROL PANEL (FOR UNIT 1)

BREAKER
15 AMP
SCCR:10kA

BREAKER	BREAKER	BREAKER	BREAKER	BREAKER	BREAKER
10 AMP SCCR:10kA	5 AMP SCCR:10kA	1 AMP SCCR:10kA	2 AMP SCCR:10kA	2 AMP SCCR:10kA	2 AMP SCCR:10kA
UNINTERRUPTIBLE POWER SUPPLY	PROGRAMMING RECEPTACLE	PENDANT RECEIVER	FAN	GRIPPER 1 OPEN VLV / GRIPPER 1 CLOSED VLV	GRIPPER 2 OPEN VLV / GRIPPER 2 CLOSED VLV

UPS BUS

BREAKER
10 AMP
SCCR:10kA

BREAKER	BREAKER
5 AMP SCCR:10kA	5 AMP SCCR:10kA
24 VDC SUPPLY	SA POWER TO PLC

BREAKER
25 AMP
SCCR:10kA

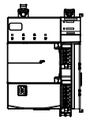
+24VDC			+24VDC				+24VDC		
1A	2A	4A	1A	1A	1A	1A	2A	2A	2A
HMI 10"	ETHERNET SWITCHES STRATIX	COMPACTLOGIX 5069-L320ER MODULE	POWER TO INTRINSIC SAFE RELAY ISR676	POWER TO INTRINSIC SAFE RELAY ISR694	POWER TO INTRINSIC SAFE RELAY ISR713	POWER TO INTRINSIC SAFE RELAY ISR731	WARNING LIGHT	WARNING LIGHT	WARNING HORN (NOTE: ONLY PROVIDED ON PANEL 01)

+24VDC

0.5A	0.5A	0.5A	0.5A	0.5A	0.5A	5A
BRIDGE CRANE 1 HOIST ENCODER	BRIDGE CRANE 2 HOIST ENCODER	BRIDGE CRANE 1 MOTOR ENCODER	BRIDGE CRANE 2 MOTOR ENCODER	BRIDGE CRANE 1 LASER DISTANCE SENSOR	BRIDGE CRANE 2 LASER DISTANCE SENSOR	440C-CR30-22BBB SAFETTY CONTROLLER

D
SIZE SHEET
DO NOT SCALE PRINTS
THIRD ANGLE PROJECTION
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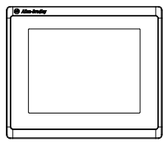
PLC CONTROL PANEL



DEVICE NAME: PLC614
EQUIPMENT: MAIN PLC
LOCATION: PLC CONTROL PANEL
TYPE: PLC PROCESSOR
PART NUMBER: 5069-L320ER
MANUFACTURER: ALLEN BRADLEY
IP ADDRESS: 192.168.1.10
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

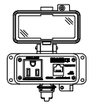
PORT 1 PORT 2

SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER



DEVICE NAME: HMI607
EQUIPMENT: MAIN HMI
LOCATION: PLC CONTROL PANEL
TYPE: HMI INTERFACE
PART NUMBER: 2713P-T10CD1
MANUFACTURER: ALLEN BRADLEY
IP ADDRESS: 192.168.1.13
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

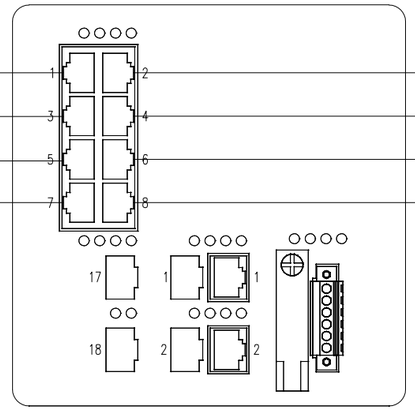
SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER



DEVICE NAME: RECPT573
EQUIPMENT: RECEPTACLE
LOCATION: PLC PANEL
TYPE: PROGRAMMING
PART NUMBER: GRACEPORT
MANUFACTURER: P-R2-F3R0
IP ADDRESS: 192.168.1.50
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER

ES609 (20-PORT SWITCH)
IP: 192.168.1.20



DEVICE NAME: ES609
EQUIPMENT: PLC PANEL 2 (TRU02)
LOCATION: PLC CONTROL PANEL
TYPE: ETHERNET SWITCH
PART NUMBER: 1783-BMS20CGN
MANUFACTURER: ALLEN BRADLEY
IP ADDRESS: 192.168.1.21
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER

DEVICE NAME: SPARE
EQUIPMENT:
LOCATION:
TYPE:
PART NUMBER:
MANUFACTURER:
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SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER

DEVICE NAME: SPARE
EQUIPMENT:
LOCATION:
TYPE:
PART NUMBER:
MANUFACTURER:
IP ADDRESS:
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER

MOTOR CONTROL PANEL

CABLES TO BE SHIELDED
CAT 5E 600 VAC RATED
(TYPICAL)

DEVICE NAME: VFD182
EQUIPMENT: BR. CRN 1 MOTORS
LOCATION: MOTOR CNTRL PNL
TYPE: AC DRIVE
PART NUMBER: 25B-D6P0N114
MANUFACTURER: ALLEN BRADLEY
IP ADDRESS: 192.168.1.30
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER

DEVICE NAME: VFD325
EQUIPMENT: BR. CRN 2 MOTORS
LOCATION: MOTOR CNTRL PNL
TYPE: AC DRIVE
PART NUMBER: 25C-D013N114
MANUFACTURER: ALLEN BRADLEY
IP ADDRESS: 192.168.1.31
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER

DEVICE NAME: VFD217
EQUIPMENT: TROLLEY HOIST 1
LOCATION: MOTOR CNTRL PNL
TYPE: AC DRIVE
PART NUMBER: 25C-D013N114
MANUFACTURER: ALLEN BRADLEY
IP ADDRESS: 192.168.1.32
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER

DEVICE NAME: VFD361
EQUIPMENT: TROLLEY HOIST 2
LOCATION: MOTOR CNTRL PNL
TYPE: AC DRIVE
PART NUMBER: 25B-D6P0N114
MANUFACTURER: ALLEN BRADLEY
IP ADDRESS: 192.168.1.33
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

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DUPLEX: FULL
TYPE: COPPER

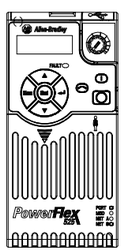
DEVICE NAME: OLR397
EQUIPMENT: HYDRAULIC MOTOR 1
LOCATION: MOTOR CNTRL PNL
TYPE: E300 RELAY
PART NUMBER: 193-ESM-VIG-30A-C23
MANUFACTURER: ALLEN BRADLEY
IP ADDRESS: 192.168.1.34
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

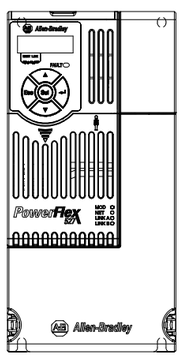
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TYPE: COPPER

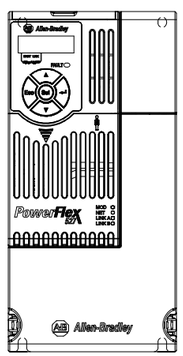
DEVICE NAME: OLR433
EQUIPMENT: HYDRAULIC MOTOR 2
LOCATION: MOTOR CNTRL PNL
TYPE: E300 RELAY
PART NUMBER: 193-ESM-VIG-30A-C23
MANUFACTURER: ALLEN BRADLEY
IP ADDRESS: 192.168.1.35
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

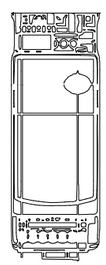
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TYPE: COPPER

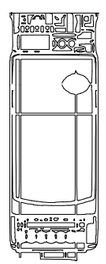












ITEM	QTY	TAG	CATALOG	MAKE	DESCRIPTION
1	4	ACCESSORIES	1MISTPH6X1MTL	PANDUIT	CAT 6A, RJ-45 CONNECTIVITY PATCHCORDS, BRAID OVER FOIL SHIELD, 600 VAC RATED, 1 METER LONG
2	7	ACCESSORIES	2MISTPH6X1MTL	PANDUIT	CAT 6A, RJ-45 CONNECTIVITY PATCHCORDS, BRAID OVER FOIL SHIELD, 600 VAC RATED, 2 METER LONG
3	2	ACCESSORIES	2.5MISTPH6X1MTL	PANDUIT	CAT 6A, RJ-45 CONNECTIVITY PATCHCORDS, BRAID OVER FOIL SHIELD, 600 VAC RATED, 2.5 METER LONG
4	1	ACCESSORIES	3MISTPH6X1MTL	PANDUIT	CAT 6A, RJ-45 CONNECTIVITY PATCHCORDS, BRAID OVER FOIL SHIELD, 600 VAC RATED, 3 METER LONG

D
SIZE SHEET
DO NOT SCALE PRINTS

THIRD ANGLE PROJECTION

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WORKMANSHIP STANDARD ES0001 APPLIES

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DWG NO. CSW1584-121

SHEET 5 OF 32

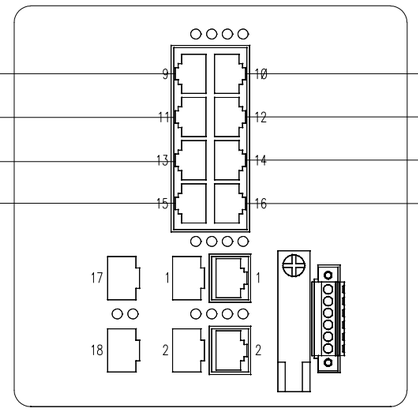
REVISION F

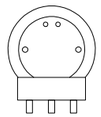
PLC CONTROL PANEL

FIELD INSTALLED

FIELD INSTALLED

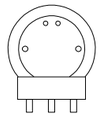
ES609 (20-PORT SWITCH)
IP: 192.168.1.20




PWS-ZE-1005A

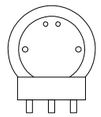
DEVICE NAME: **ENC657**
EQUIPMENT: **ENCODER**
LOCATION: BRIDGE CRN 1 HOIST
TYPE: ENCODER
PART NUMBER: 648 SERIES
MANUFACTURER: LINDE
IP ADDRESS: 192.168.1.40
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER


PWS-ZE-1005B

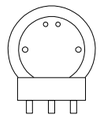
DEVICE NAME: **ENC659**
EQUIPMENT: **ENCODER**
LOCATION: BRIDGE CRN 2 HOIST
TYPE: ENCODER
PART NUMBER: 648 SERIES
MANUFACTURER: LINDE
IP ADDRESS: 192.168.1.41
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER


PWS-ZE-1005C

DEVICE NAME: **ENC661**
EQUIPMENT: **ENCODER**
LOCATION: BRIDGE CRN 1 MOT.
TYPE: ENCODER
PART NUMBER: 648 SERIES
MANUFACTURER: LINDE
IP ADDRESS: 192.168.1.42
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER


PWS-ZE-1005D

DEVICE NAME: **ENC663**
EQUIPMENT: **ENCODER**
LOCATION: BRIDGE CRN 2 MOT.
TYPE: ENCODER
PART NUMBER: 648 SERIES
MANUFACTURER: LINDE
IP ADDRESS: 192.168.1.43
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER

DEVICE NAME: **SPARE**
EQUIPMENT:
LOCATION:
TYPE:
PART NUMBER:
MANUFACTURER:
IP ADDRESS:
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GATEWAY ADDRESS:

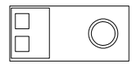
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TYPE: COPPER

DEVICE NAME: **SPARE**
EQUIPMENT:
LOCATION:
TYPE:
PART NUMBER:
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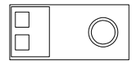
DEVICE NAME: **LASER665**
EQUIPMENT: **ENCODER**
LOCATION: TROLLEY 1
TYPE: DISTANCE SENSOR 1
PART NUMBER: 500701
MANUFACTURER: DIMETIX
IP ADDRESS: 192.168.1.44
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER


PWS-ZE-1005E

DEVICE NAME: **LASER667**
EQUIPMENT: **ENCODER**
LOCATION: TROLLEY 2
TYPE: DISTANCE SENSOR 2
PART NUMBER: 500701
MANUFACTURER: DIMETIX
IP ADDRESS: 192.168.1.45
SUBNET ADDRESS: 255.255.255.0
GATEWAY ADDRESS:

SPEED: 100 MBPS
DUPLEX: FULL
TYPE: COPPER


PWS-ZE-1005F

ITEM	QTY	TAG	CATALOG	MAKE	DESCRIPTION
1	4	ACCESSORIES	1MISTPH6X1MTL	PANDUIT	CAT 6A, RJ-45 CONNECTIVITY PATCHCORDS, BRAID OVER FOIL SHIELD, 600 VAC RATED, 1 METER LONG
2	7	ACCESSORIES	2MISTPH6X1MTL	PANDUIT	CAT 6A, RJ-45 CONNECTIVITY PATCHCORDS, BRAID OVER FOIL SHIELD, 600 VAC RATED, 2 METER LONG
3	2	ACCESSORIES	2.5MISTPH6X1MTL	PANDUIT	CAT 6A, RJ-45 CONNECTIVITY PATCHCORDS, BRAID OVER FOIL SHIELD, 600 VAC RATED, 2.5 METER LONG
4	1	ACCESSORIES	3MISTPH6X1MTL	PANDUIT	CAT 6A, RJ-45 CONNECTIVITY PATCHCORDS, BRAID OVER FOIL SHIELD, 600 VAC RATED, 3 METER LONG

D
SIZE SHEET (DO NOT SCALE PRINTS)
THIRD ANGLE PROJECTION
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WORKMANSHIP STANDARD ES0041 APPLIES

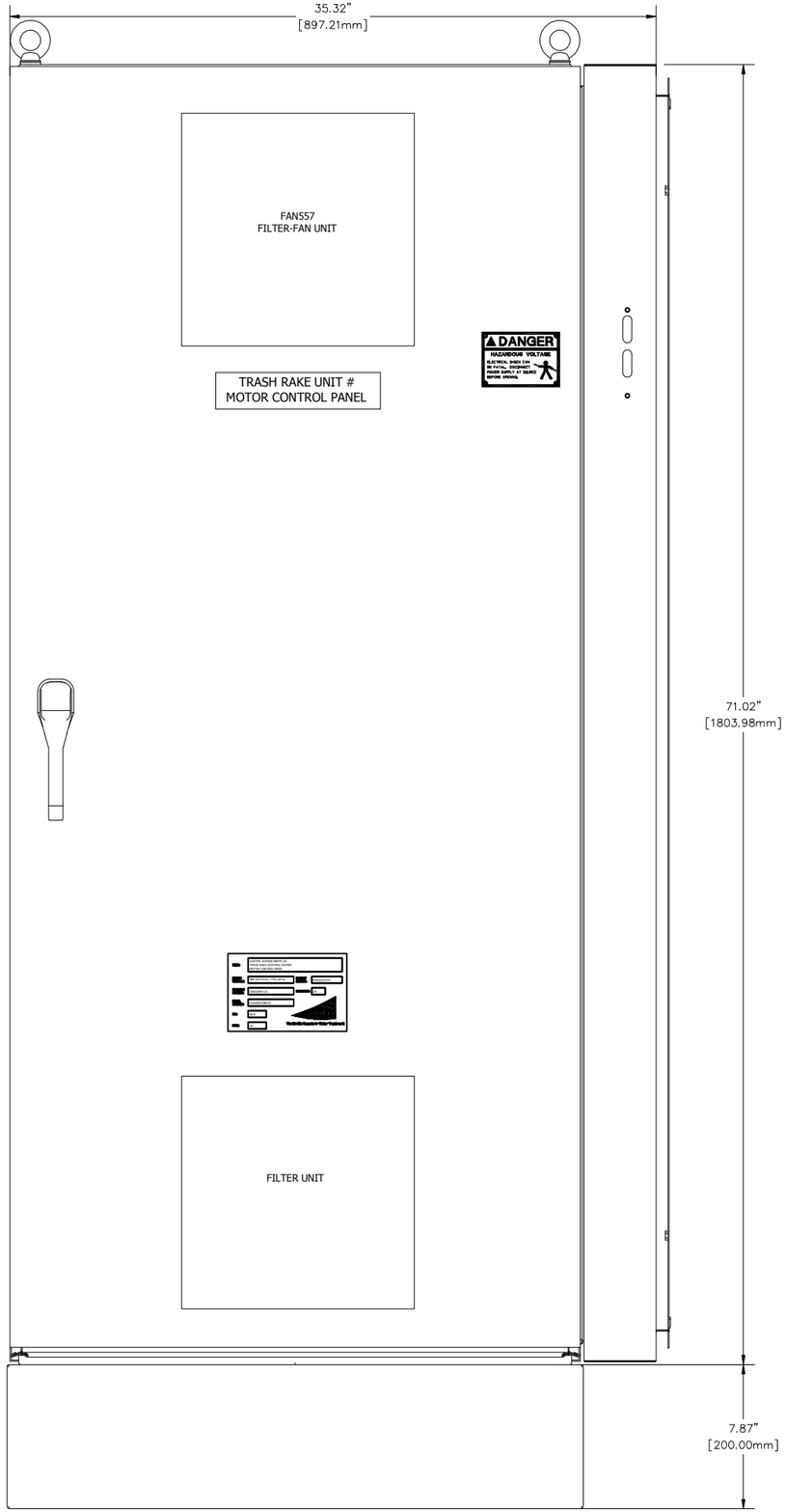
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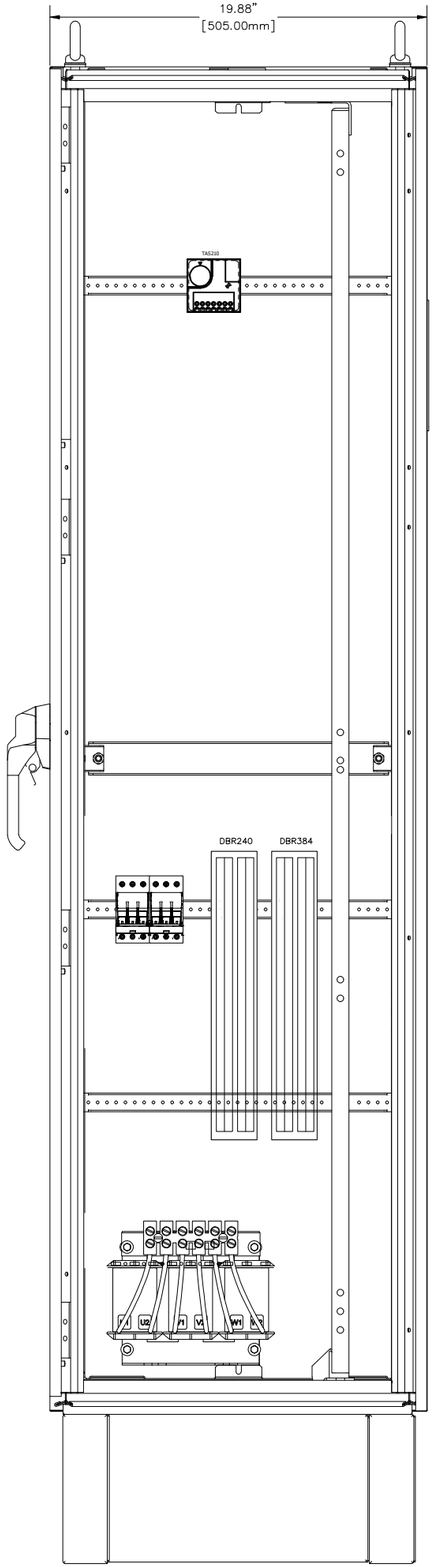
DWG NO. CSW1584-121

SHEET 6 OF 32

REVISION F

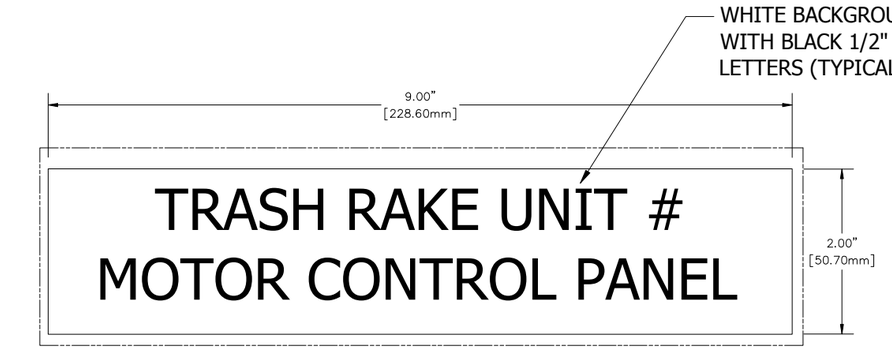


FRONT VIEW



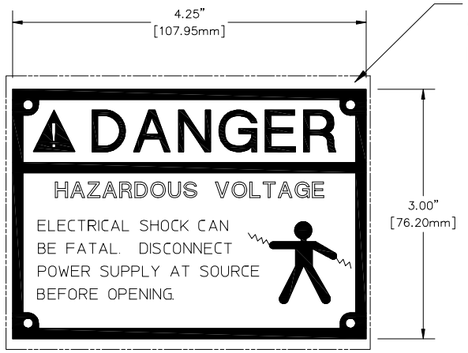
LEFT SIDE VIEW

MOTOR CONTROL PANEL ENCLOSURE LAYOUT

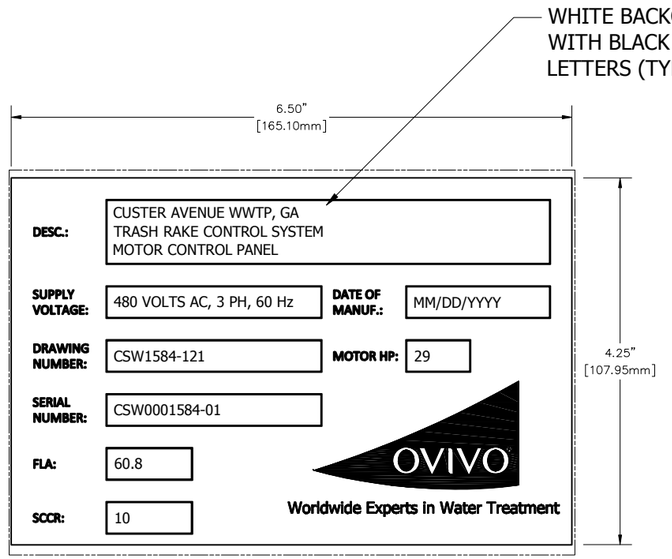


ENCLOSURE TAG

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SEE SHEET 1 FOR ENCLOSURE LABELING

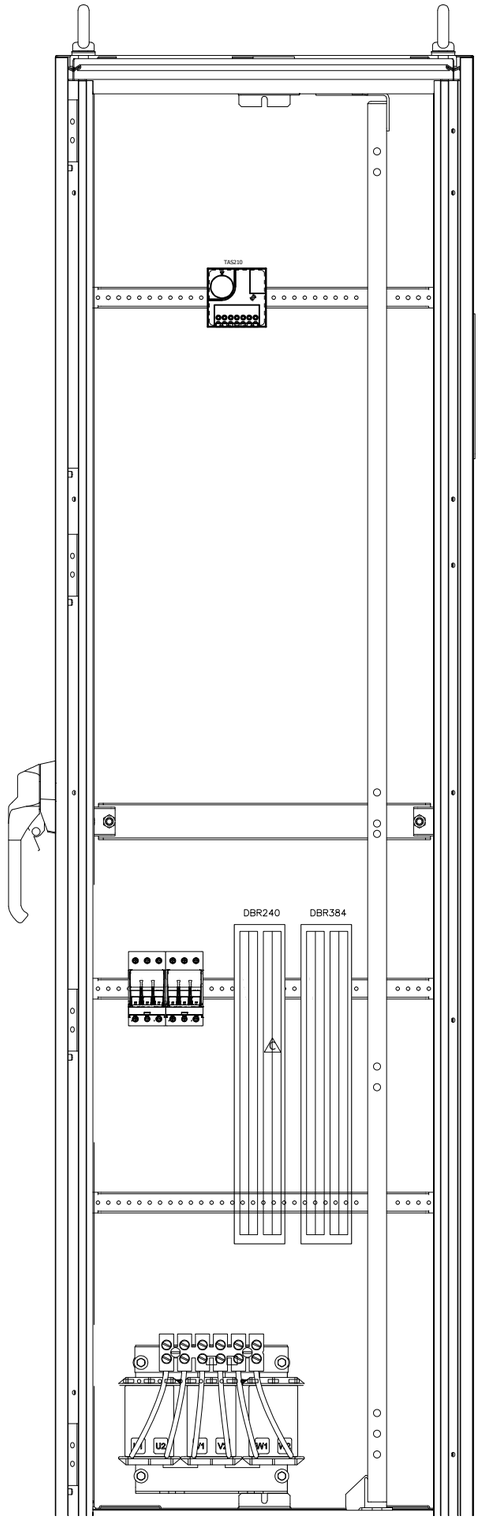


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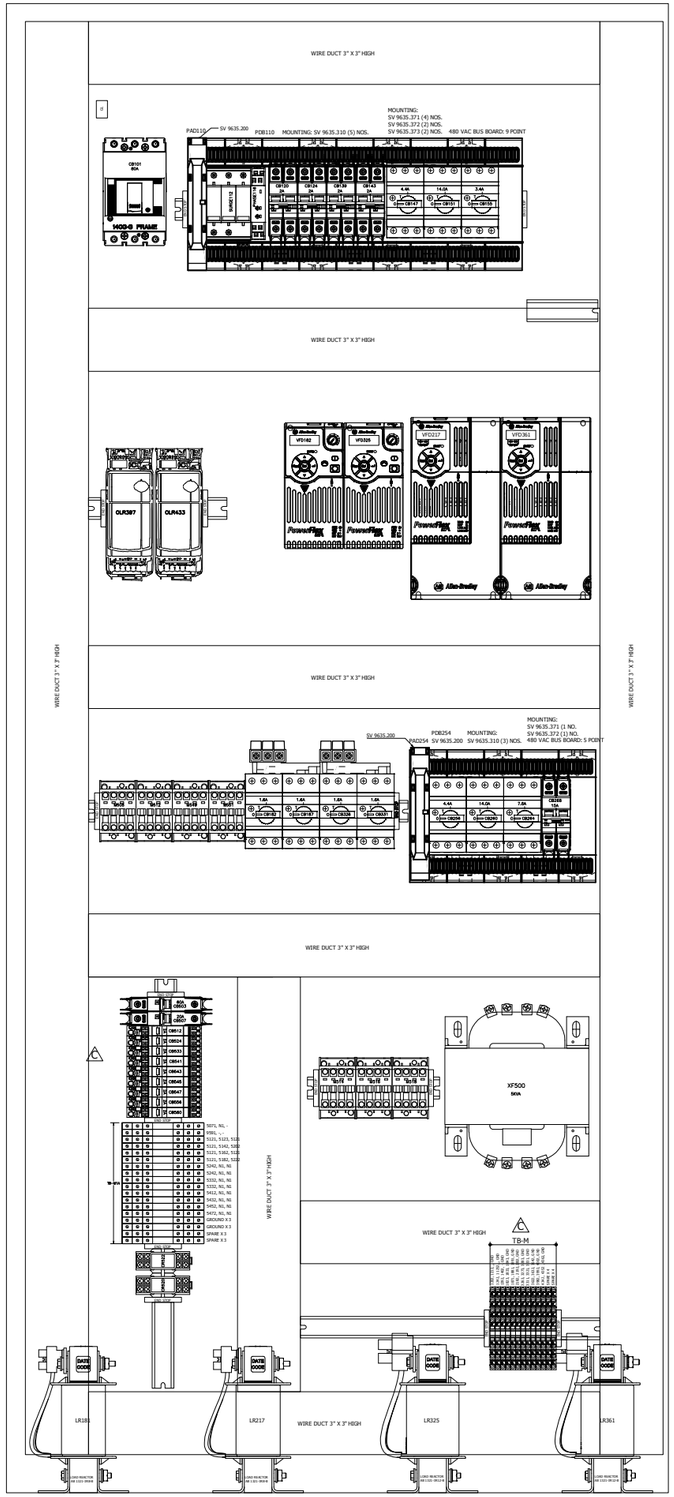


ENCLOSURE NAMEPLATE

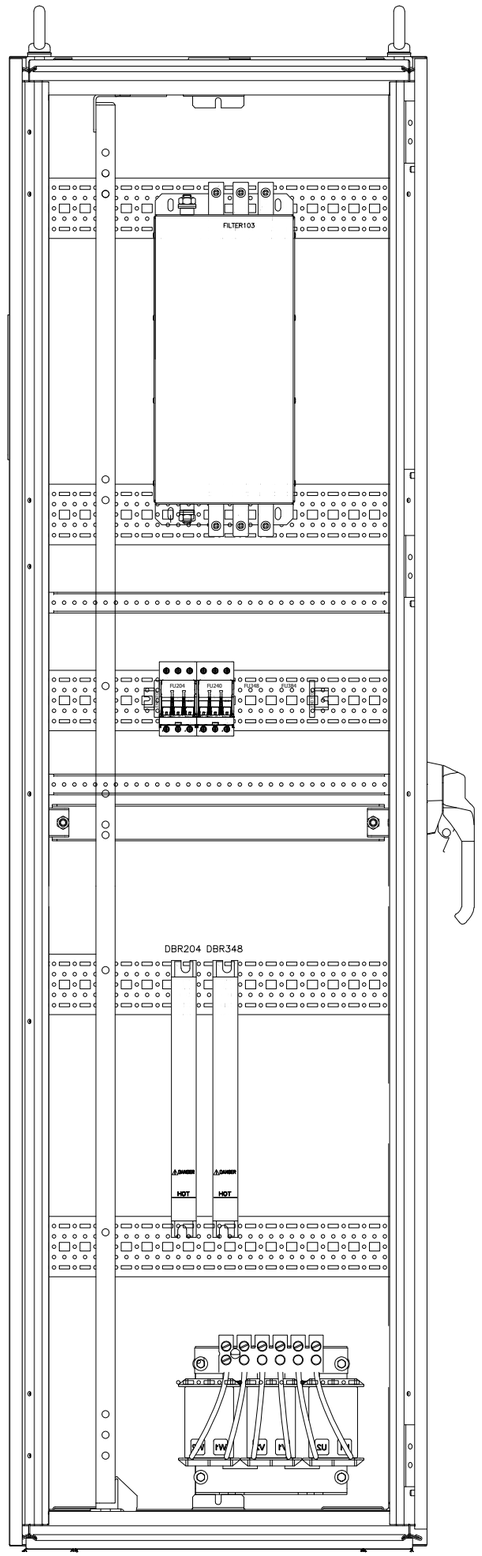
D SIZE SHEET DO NOT SCALE PRINTS	THIRD ANGLE PROJECTION	THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION OF OVIVO AND ITS AFFILIATES AND IS NOT TO BE DISCLOSED NOR TO BE USED EXCEPT FOR EVALUATING PROPOSALS OF OVIVO OR INSTALLING, OPERATING OR MAINTAINING OVIVO EQUIPMENT UNLESS OTHERWISE AUTHORIZED IN WRITING BY OVIVO. UNCONTROLLED COPY IF PRINTED.		
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WORKMANSHIP STANDARD ES9001 APPLIES				F REVISION



LEFT SIDE VIEW

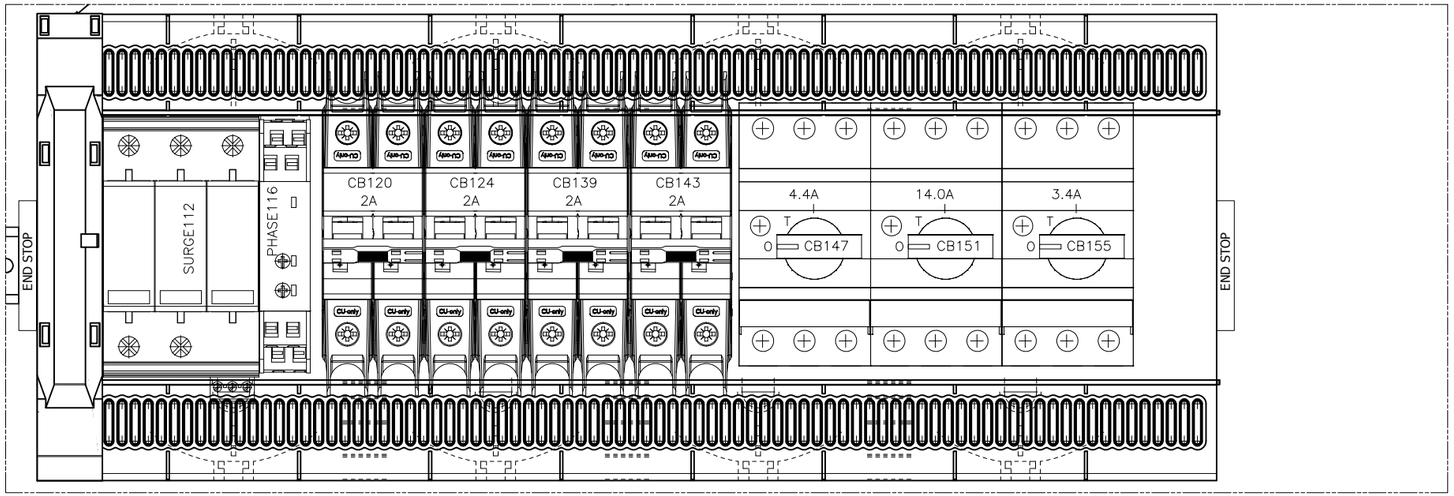


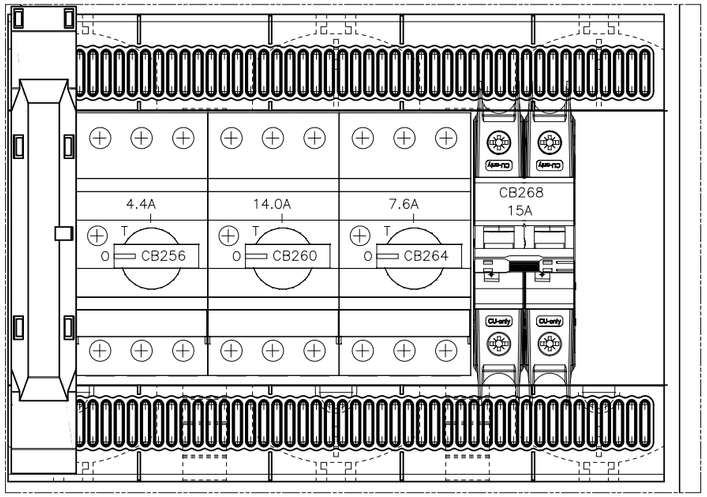
FRONT VIEW

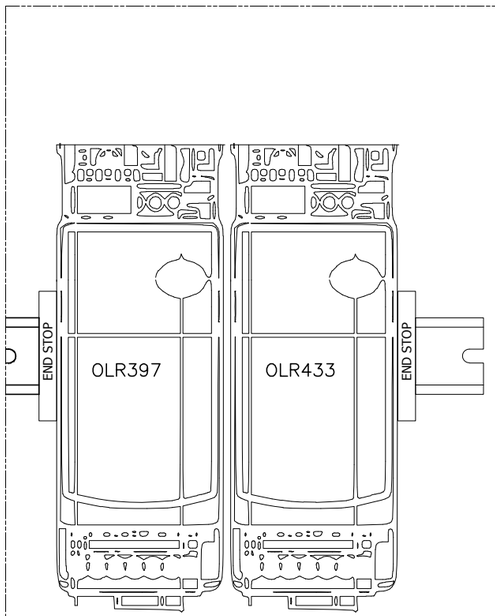


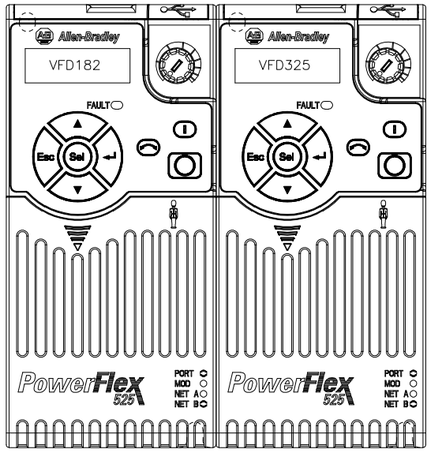
RIGHT SIDE VIEW

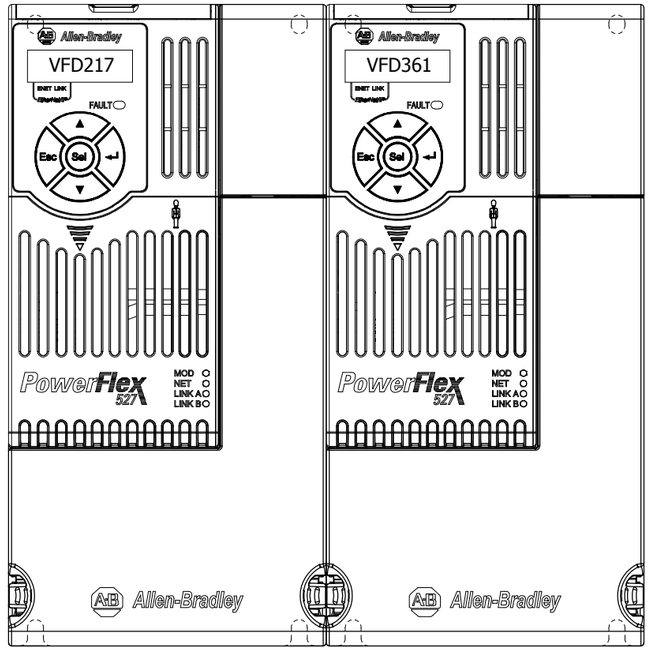
D SIZE SHEET DO NOT SCALE PRINTS	THIRD ANGLE PROJECTION		THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION OF OVIVO AND ITS AFFILIATES AND IS NOT TO BE DISCLOSED NOR TO BE USED EXCEPT FOR EVALUATING PROPOSALS OF OVIVO OR INSTALLING, OPERATING OR MAINTAINING OVIVO EQUIPMENT UNLESS OTHERWISE AUTHORIZED IN WRITING BY OVIVO. UNCONTROLLED COPY IF PRINTED.
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WORKMANSHIP STANDARD ES9001 APPLIES		DWG NO. CSW1584-121	SHEET 8 OF 32 — REVISION F

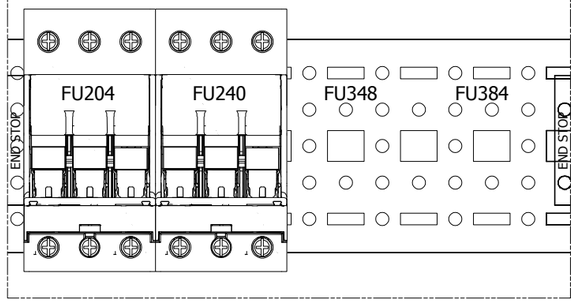


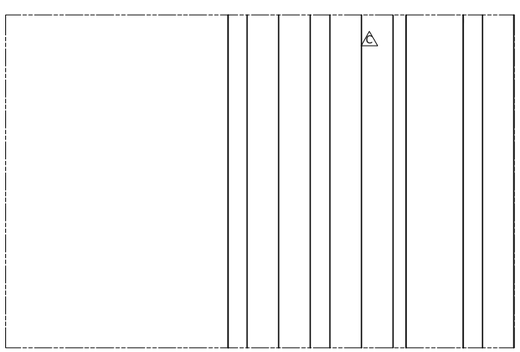












EXPANDED VIEWS

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SIZE SHEET
DO NOT SCALE PRINTS

THIRD ANGLE PROJECTION

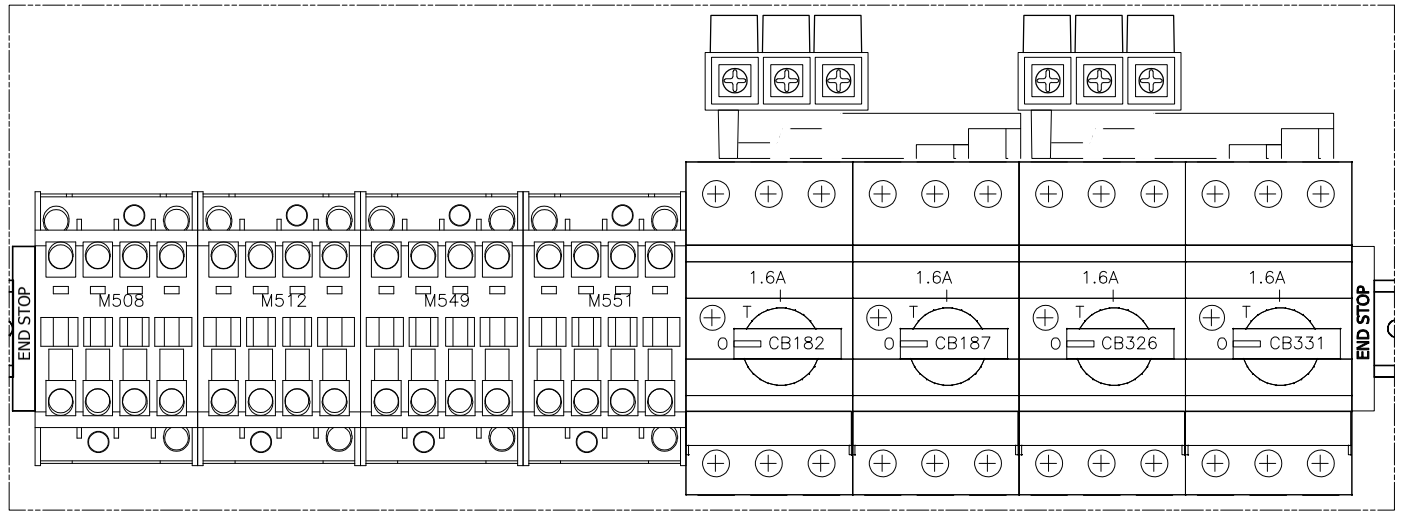
WORKMANSHIP STANDARD ISS001 APPLIES

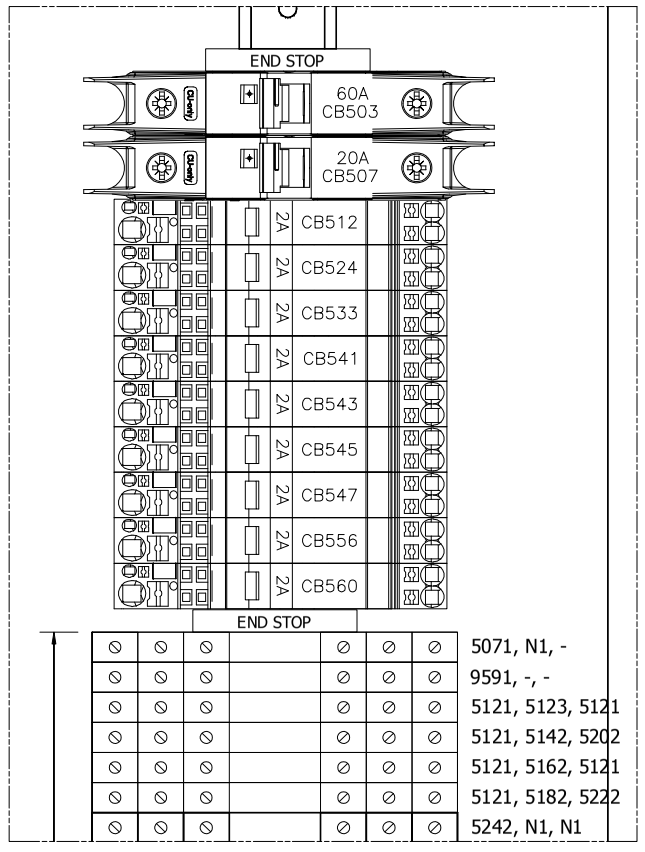
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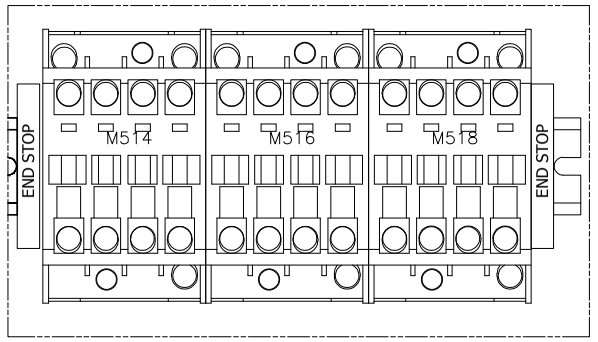
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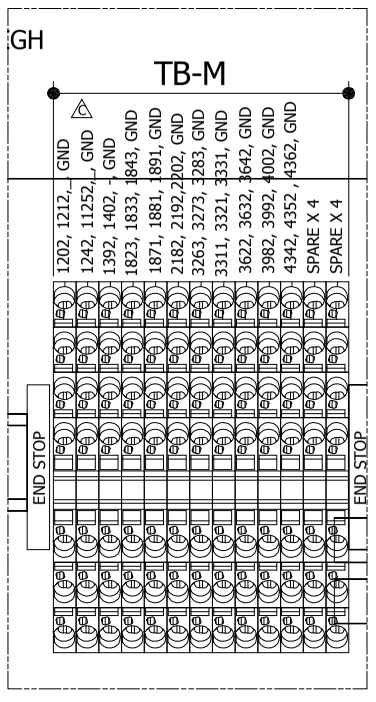
SHEET 9 OF 32

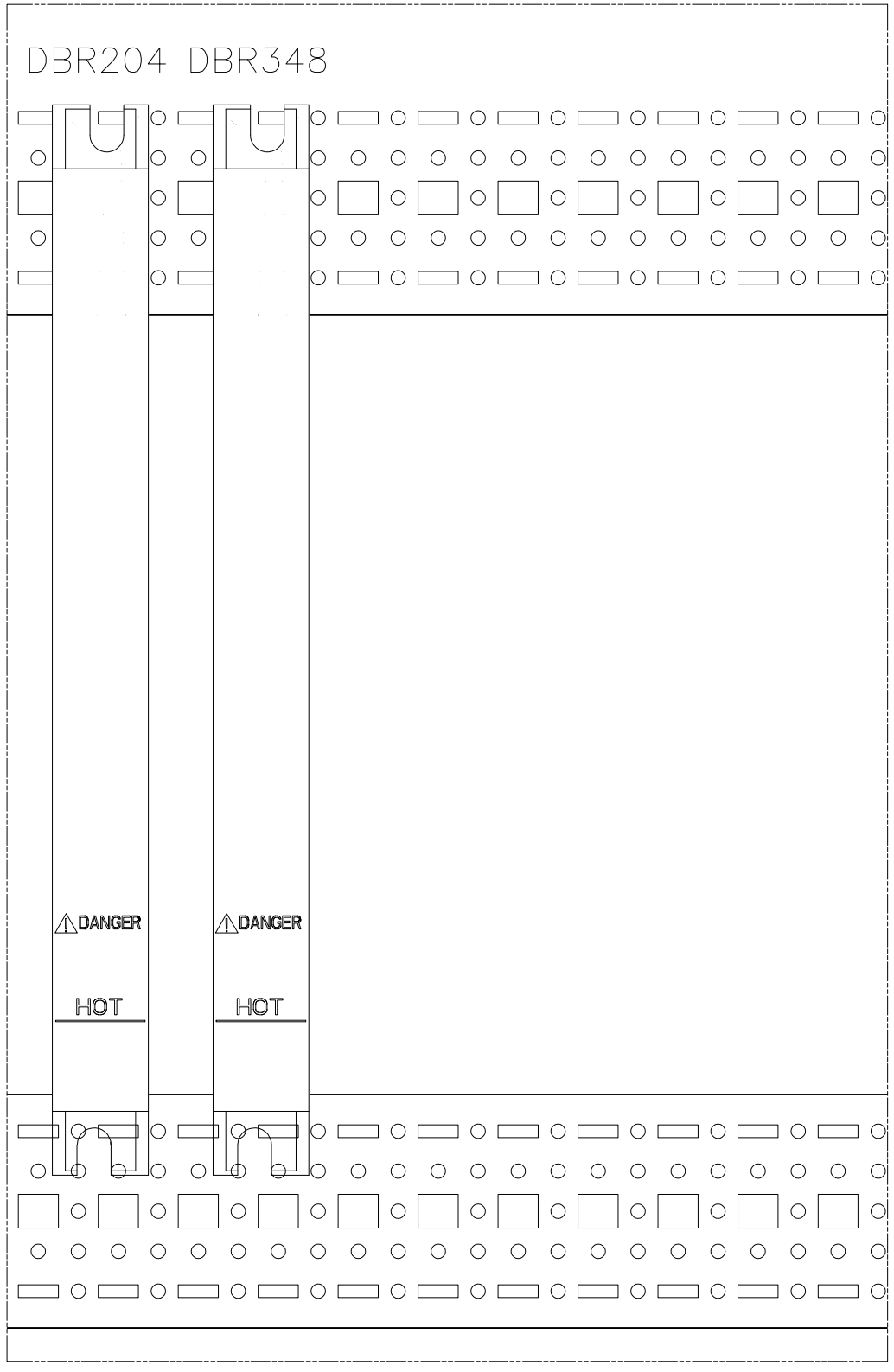
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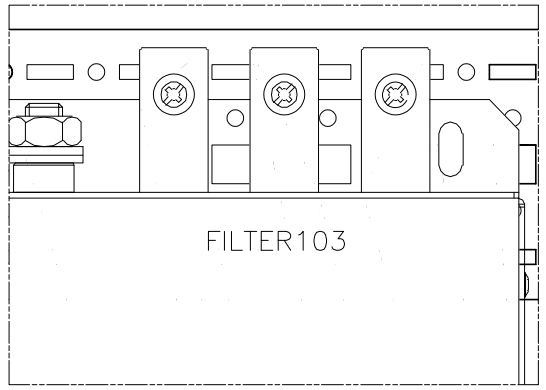












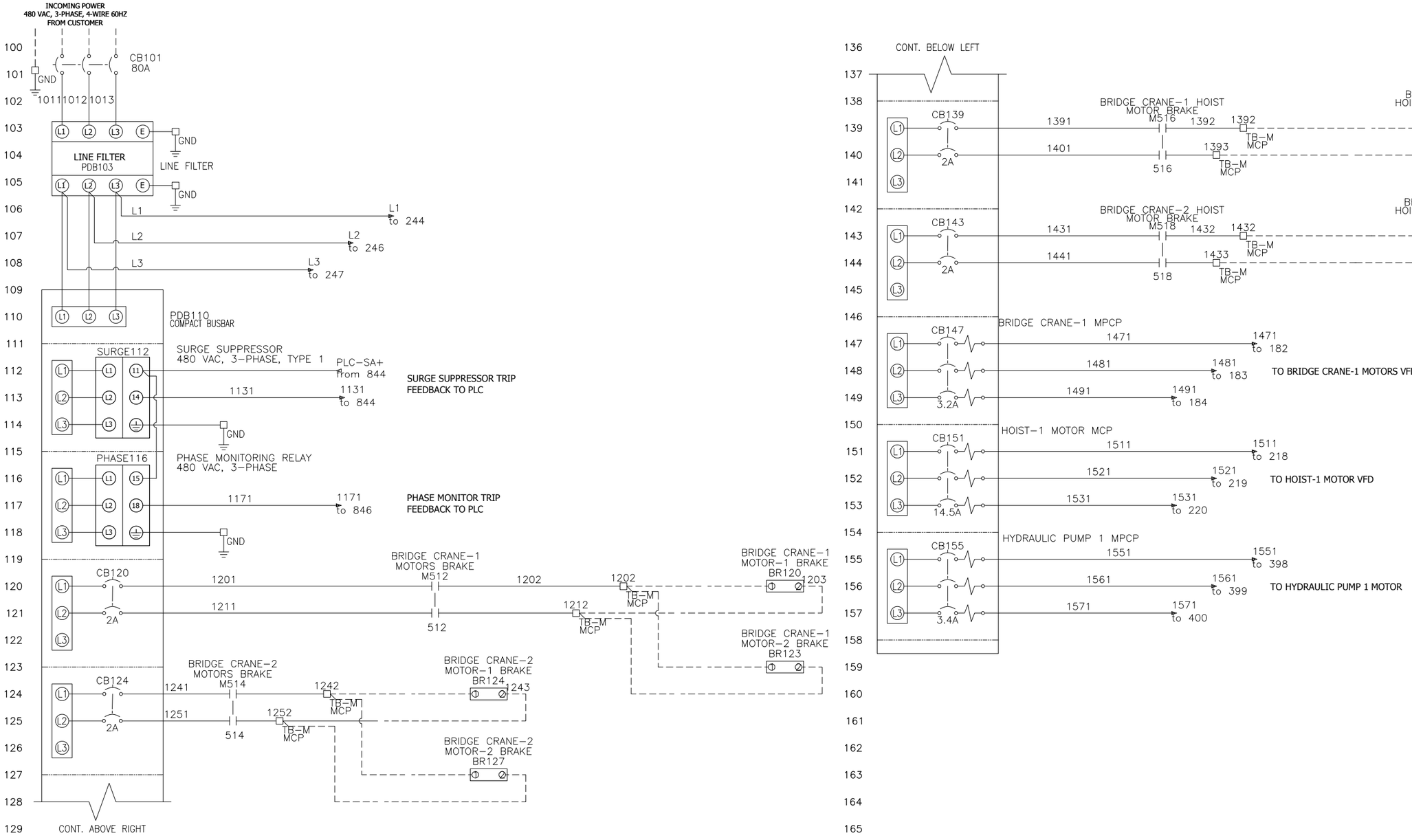
EXPANDED VIEWS

D
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BILL OF MATERIAL

ITEM	QTY	TAG	CATALOG	MAKE	DESCRIPTION
1	1	ENCLOSURE	9951.135	RITTAL	TS8 FLANGE MOUNT DISCONNECT ENCLOSURE, CARBON STEEL, NEMA 12, COLOR RAL 7035, WITH ROOF, DOOR, REAR PANEL, GLAND PLATE, 1800 MM x 800 MM x 500 MM
2	1 SET	ENCLOSURE ACCESSORY	8640.023	RITTAL	HIGH PLINTH, FRONT AND REAR
3	1 SET	ENCLOSURE ACCESSORY	8640.042	RITTAL	HIGH PLINTH, SIDES
4	1 PAIR	ENCLOSURE ACCESSORY	8185.235	RITTAL	SIDEWALLS
5	A/R	ENCLOSURE ACCESSORY	4579.000	RITTAL	SUPPORT STRIPS
6	6	ENCLOSURE ACCESSORY	8800.500	RITTAL	QUICK FIT BAYING CLAMPS
7	4	ENCLOSURE ACCESSORY	8800.430	RITTAL	ANGULAR/CORNER BAYING BRACKETS
8	1	ENCLOSURE ACCESSORY	4911.000	RITTAL	SLAVE DOOR - DEFEATER KIT
9	1	ENCLOSURE ACCESSORY	4912.000	RITTAL	INTERLOCK ACTIVATOR - FOR MAIN DOOR
10	1	ENCLOSURE ACCESSORY	4918.000	RITTAL	INTERCONNECTING RODS FOR 32" WIDE CABINETS
11	2	ENCLOSURE ACCESSORY	4365.000	RITTAL	PS SYSTEM CHASSIS WITH FLANGE, 32 INCH (PACK OF 4)
12	1	ENCLOSURE ACCESSORY	4943.000	RITTAL	C-RAIL
13	A/R	ENCLOSURE ACCESSORY	2388.150	RITTAL	EMC SHIELDING BRACKET (PER NUMBER OF CABLES, 20 MINIMUM)
14	A/R	ENCLOSURE ACCESSORY	2589.000	RITTAL	CABLE CONDUIT, FOR SECURE CABLE ROUTING
15	A/R	ENCLOSURE ACCESSORY	2591.000	RITTAL	CABLE CONDUIT HOLDER, FOR ROUTING
16	1	TAS551	3118.000	RITTAL	HYGROSTAT, FOR ACTIVATING FAN, 120VAC
17	1	FAN551	3243.110	RITTAL	FILTER-FAN UNIT, 120 VAC, TYPE 12
18	1	FAN551	3243.200	RITTAL	OUTLET FILTER, TYPE 12
19	1	CB101	140G-G6C3-C80	ALLEN BRADLEY	MOLDED CASE CIRCUIT BREAKER, 3-POLE, THERMAL MAGNETIC, 80A, G-FRAME, SCCR: 65kA, RATED TRIP CURRENT 80A
20	2	CB101	140G-G-MTL63	ALLEN BRADLEY	TERMINAL LUGS, FOR MULTIPLE CABLE, COPPER WIRE, FOR FRAME G MCCB
21	1	CB101	140G-G-FCX04	ALLEN BRADLEY	ACCESSORY FOR MCCB FOR FLANGED DISCONNECT MECHANISM, INCLUDES HANDLE, MCC OPERATOR, CABLE AND NECESSARY HARDWARE, PRE-ASSEMBLED
22	1	CB101	KA2U	BURNDY	SINGLE GROUND LUG
23	1	SURGE112	2910386	PHOENIX CONTACT	TYPE 2 SURGE PROTECTION DEVICE, 3-CHANNEL WITH REMOTE INDICATOR CONTACT FOR 480 VAC DELTA
24	1	PHASE116	2903528	PHOENIX CONTACT	PHASE MONITORING RELAY, FOR PHASE SEQUENCE AND ASYMMETRY OF 3-PHASE VOLTAGES 480VAC, 1PDT, WITH SCREW CONNECTION
25	1	FILTER103	FN 351-80-34	SCHAFFNER	GENERAL PURPOSE EMC FILTER, 3-POLE, RATED CURRENT 80 AMP
26	1	PDB110	SV 9635.010	RITTAL	SHOCK HAZARD PROTECTED BUSBAR BOARD FOR SAFE ACCOMMODATION AND CONTACTING OF COMPONENTS WITH SNAP-ON MOUNTING, 3-POLE, 9 CHANNEL, RATED CURRENT 125A
27	1	PDB254	SV 9635.000	RITTAL	SHOCK HAZARD PROTECTED BUSBAR BOARD FOR SAFE ACCOMMODATION AND CONTACTING OF COMPONENTS WITH SNAP-ON MOUNTING, 3-POLE, 5 CHANNEL, RATED CURRENT 125A
28	2	PAD110, PAD254	9635.200	RITTAL	SV CONNECTION ADAPTOR, 80 A, 690 V (AC), 600 V (DC), 3-POLE, CABLE OUTET TOP/BOTTOM
29	5	ADAPTOR	SV 9635.371	RITTAL	SV COMPONENT ADAPTOR 16 A, 690 V (AC), 1-POLE (VARIANT L1)
30	3	ADAPTOR	SV 9635.372	RITTAL	SV COMPONENT ADAPTOR 16 A, 690 V (AC), 1-POLE (VARIANT L2)
31	2	ADAPTOR	SV 9635.373	RITTAL	SV COMPONENT ADAPTOR 16 A, 690 V (AC), 1-POLE (VARIANT L3)
32	8	ADAPTOR	SV 9635.310	RITTAL	COMPONENT ADAPTOR, FOR ASSEMBLY OF SWITCHGEAR AND PROTECTIVE GEAR WITH SUPPORT RAIL ATTACHMENT
33	4	CB147, CB155, CB256, CB264	140M-C2E-B40	ALLEN BRADLEY	MOTOR PROTECTION CIRCUIT BREAKER, ADJUSTABLE THERMAL RELEASE, 3-POLE,2.5 TO 4.0A, SCCR: 65KA
34	4	CB182, CB187, CB326, CB331	140M-C2E-B16	ALLEN BRADLEY	MOTOR PROTECTION CIRCUIT BREAKER, ADJUSTABLE THERMAL RELEASE, 3-POLE, 1.0 TO 1.6A, SCCR: 65KA
35	2	CB151, CB260	140M-D8E-C20	ALLEN BRADLEY	MOTOR PROTECTION CIRCUIT BREAKER, ADJUSTABLE THERMAL RELEASE, 3-POLE, 14.5 TO 20A, SCCR: 65KA
36	2	CB182	140M-C-WTEN	ALLEN BRADLEY	MOTOR STARTER BUSBAR, FEEDER TERMINAL BLOCK
37	2	CB326	140M-C-W452N	ALLEN BRADLEY	MOTOR STARTER BUSBAR, 2 BASES
38	4	CB120, CB124, CB139, CB143	1489-M2C020	ALLEN BRADLEY	MINIATURE CIRCUIT BREAKER, 2-POLE, 2 AMP, SCCR: 10kA
39	1	CB268	1489-M2C150	ALLEN BRADLEY	MINIATURE CIRCUIT BREAKER, 2-POLE, 15 AMP, SCCR: 10kA
40	2	OLR397, OLR433	193-ESM-VIG-30A-T	ALLEN BRADLEY	E300 SENSING MODULE, 0.5 TO 30 AMPS, VOLTAGE/CURRENT/GROUND FAULT
41	2	OLR397, OLR433	193-EIO-43-120	ALLEN BRADLEY	E300 CONTROL MODULE, (4) INPUTS AND (3) OUTPUTS, 120 VAC
42	2	OLR397, OLR433	193-ECM-ETR	ALLEN BRADLEY	E300 ETHERNET/IP ADAPTER COMMUNICATION MODULE
43	2	VFD182, VFD325	25B-D4P0N104	ALLEN BRADLEY	POWERFLEX 525 AC DRIVE, 380 - 480 VOLT AC, 1.5 KW, 2 HP R, 4 AMPS, NORMAL & HEAVY DUTY, FRAME A, NO FILTER
44	4	VFD182, VFD217, VFD325, VFD361	25-COMM-E2P	ALLEN BRADLEY	DUAL PORT ETHERNET COMMUNICATION ADD ON CARD
45	2	VFD217, VFD361	25B-D017N114	ALLEN BRADLEY	POWERFLEX 525 AC DRIVE, 380 - 480 VOLT AC, 7.5 KW, 10 HORSE POWER, 17 AMPS, NORMAL & HEAVY DUTY, FRAME C, WITH INTEGRAL EMC FILTER
46	2	LR181, LR325	1321-3R8-B	ALLEN BRADLEY	LINE REACTOR FOR VFD, 3.0mH, 8A, 480VAC
47	2	LR217, LR361	1321-3R18-B	ALLEN BRADLEY	LINE REACTOR FOR VFD, 1.5mH, 18A, 480VAC
48	4	FU204, FU240, DBR348, FU384	140F-D3F-C30L	ALLEN BRADLEY	FUSE HOLDER, 30 AMP, 3-PHASE
49	4	FU240, FU384	0KLK 12	LITTLEFUSE	CLASS CC FUSE, 12 AMPS, KLK SERIES
50	4	FU204, FU348	0KLK 10	LITTLEFUSE	CLASS CC FUSE, 10 AMPS, KLK SERIES
51	2	DBR204, DBR348	AK-R2-360P500	ALLEN BRADLEY	DYNAMIC BRAKE KIT, 480VAC INPUT DRIVE, RATED UPTO 2HP DRIVES
52	2	DBR240, DBR384	AK-R2-120P1K2	ALLEN BRADLEY	DYNAMIC BRAKE KIT, 480VAC INPUT DRIVE, RATED UPTO 10HP DRIVES
53	7	M508, M512, M514, M516, M518, M549, M551	700-K40E-D100-KFA40E	ALLEN BRADLEY	MINI CONTACTOR, SCREW TYPE TERMINALS, CONTROL VOLTAGE 120VAC, 4 N.O. AUXILIARY CONTACTS
54	1	CB503	1489-M1C600	ALLEN BRADLEY	MINIATURE CIRCUIT BREAKER, 1-POLE, 60 AMP, SCCR: 10kA
55	1	CB507	1489-M1C200	ALLEN BRADLEY	MINIATURE CIRCUIT BREAKER, 1-POLE, 20 AMP, SCCR: 10kA
56	9	ALL BELOW LISTED PHOENIX CONTACT CIRCUIT BREAKER PLUG TYPE UNITS	2800929	PHOENIX CONTACT	BASE ELEMENT FOR CIRCUIT BREAKER, WITH PUSH-IN CONNECTION TECHNOLOGY, 300V, GRAY
57	9	CB512, CB524, CB533, CB541, CB543, CB545, CB547, CB556, CB560	2800837	PHOENIX CONTACT	THERMOMAGNETIC DEVICE CIRCUIT BREAKER, 2A, 1 PDT CONTACT, PLUG TYPE
58	1	JUMPERS FOR FIRST (9) CIRCUIT BREAKER BASE ELEMENTS	3030271	PHOENIX CONTACT	PLUG-IN BRIDGE, NUMBER OF POSITIONS: 10, RED COLOR, FOR CONNECTING PLUG-IN CIRCUIT BREAKERS IN COMMON INPUT
59	1	PROTECTIVE CAP FOR JUMPER	3012325	PHOENIX CONTACT	COVERING HOOD, PROTECTIVE CAP FOR JUMPER CUT TO LENGTH
60	1	XF500	SP5000ACP	HAMMOND	HPS SPARTAN SERIES CONTROL TRANSFORMER, 5000VA, 480VAC PRIMARY, 120VAC SECONDARY VOLTAGE
61	2	CR520, CR522	RH2B-ULC-120AC WITH SH2B-05	IDEC	CONTROL RELAY, 2PDT, 10 AMP CONTACTS, 120 VAC COIL, WITH LED AND PUSH-TO-TEST BUTTON, WITH SOCKET
62	18	TB-M1A	3046703	PHOENIX CONTACT	3-LEVEL TERMINAL BLOCK, SCREW CONNECTION, AWG 24-8, GRAY COLOR, 36A, 1000 VOLTS
63	13	TB-M	3038338	PHOENIX CONTACT	MOTOR TERMINAL BLOCK, 4-LEVEL, SPRING-CAGE CONNECTION, AWG 2.8-10, GRAY COLOR, 32A, 600 VOLTS
64	2	TB-M1A	3046707	PHOENIX CONTACT	END COVER, GRAY COLOR
65	16	AS SHOWN IN DRAWINGS	3022276	PHOENIX CONTACT	QUICK MOUNTING END CLAMP, DIN-RAIL MOUNT, WITH MARKING OPTION AND PARKING OPTION, GRAY COLOR
66	2	FOR TERMINAL ORGANISATION	0811969	PHOENIX CONTACT	TERMINAL STRIP MARKER CARRIER, HEIGHT ADJUSTABLE, FOR END BRACKETS CLIPFIX 15, 35, 35-5
67	A/R	AS SHOWN	0807012	PHOENIX CONTACT	DIN RAIL, PERFORATED, 35 MMx7.5 MM, 1000 MM LONG, GALVANIZED STEEL, PASSIVATED WITH A THICK LAYER, SILVER COLOR
68	A/R	ENCLOSURE ACCESSORY	TYD2X3NPW6	THOMAS & BETTS	NARROW SLOT WIRING DUCT, PVC, 2"x3" HIGH
69	A/R	ENCLOSURE ACCESSORY	TYD2CPW6	THOMAS & BETTS	WIRE DUCT COVER FOR 2" DUCTS
70	1	DANGER LABEL	49046A	OVIVO	NAME PLATE - "DANGER"
71	1	PANEL DETAILS	679002	OVIVO	NAME PLATE (ETCH AS SHOWN)
72	1	"TRASH RAKE MOTOR CONTROL PANEL"	592273	OVIVO	ENCLOSURE EQUIPMENT TAG ID, WHITE BACKGROUND WITH 3/16 INCH BLACK LETTERS, NOMINAL HEIGHT OF NAMEPLATES 2 INCHES

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WIRING LEGEND:

———— INTERNAL PANEL WIRING

– – – – – – – – FIELD WIRING (BY OTHERS, NOT OVIVO)

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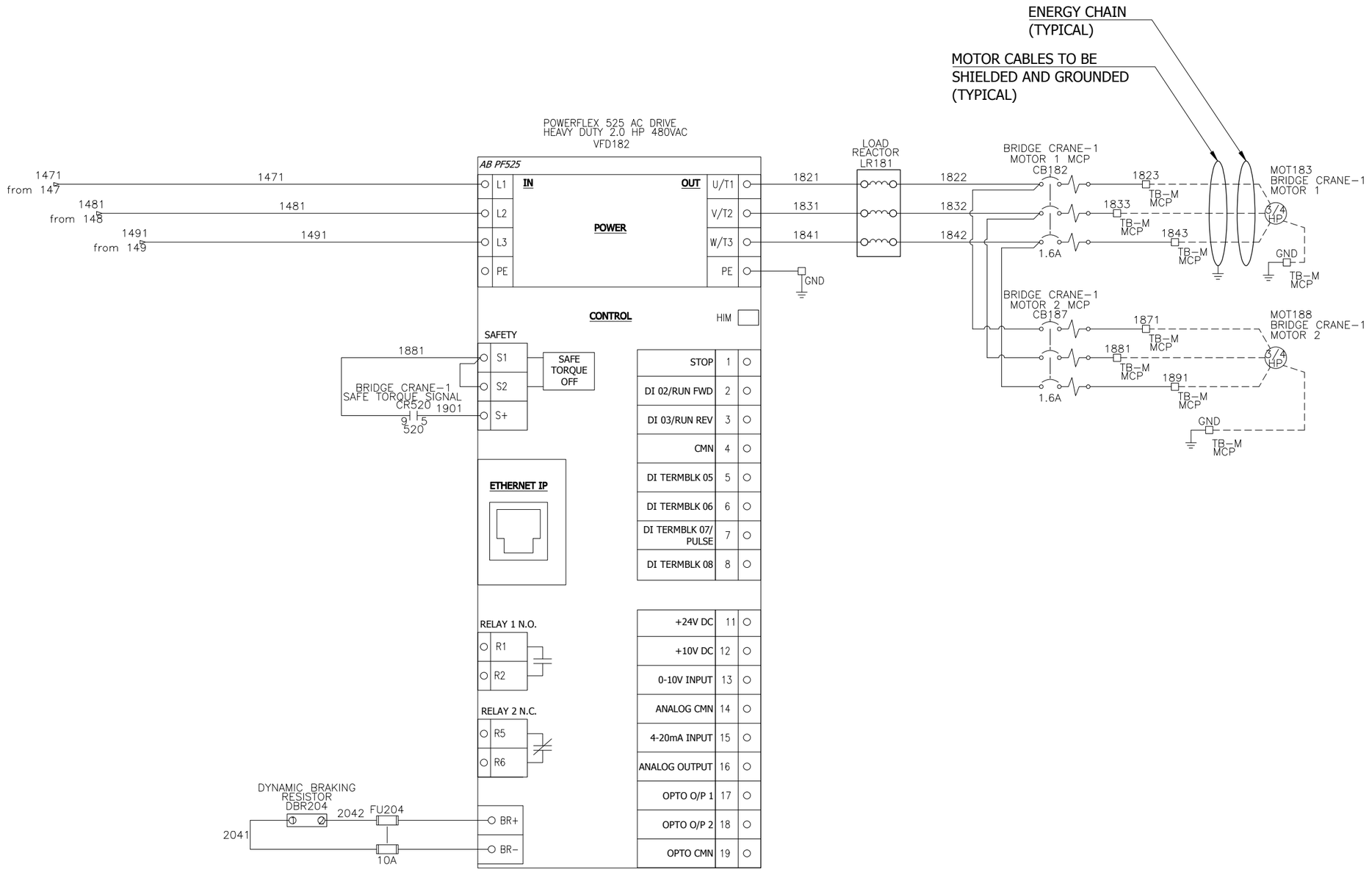
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SHEET 12 OF 32

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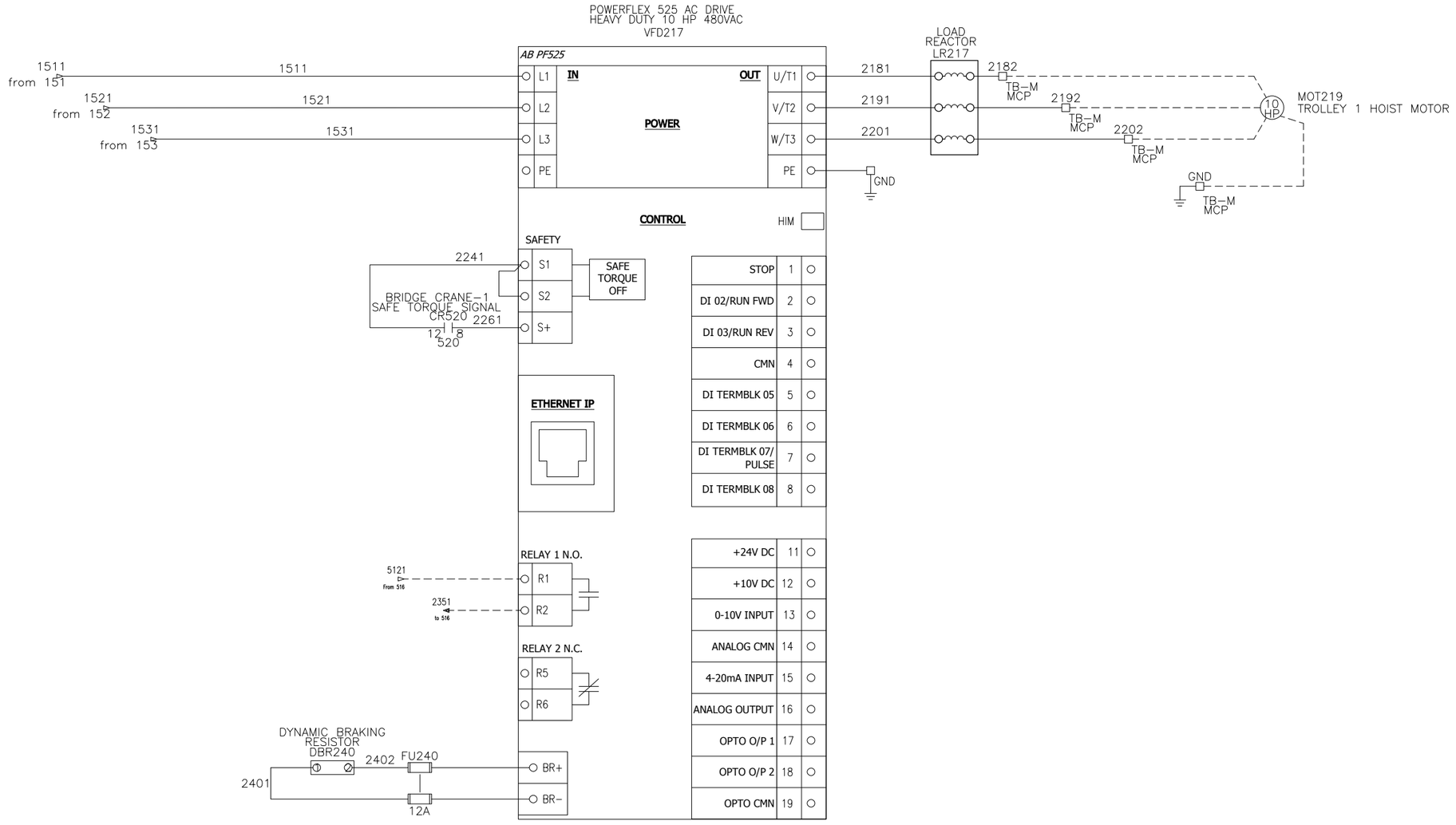
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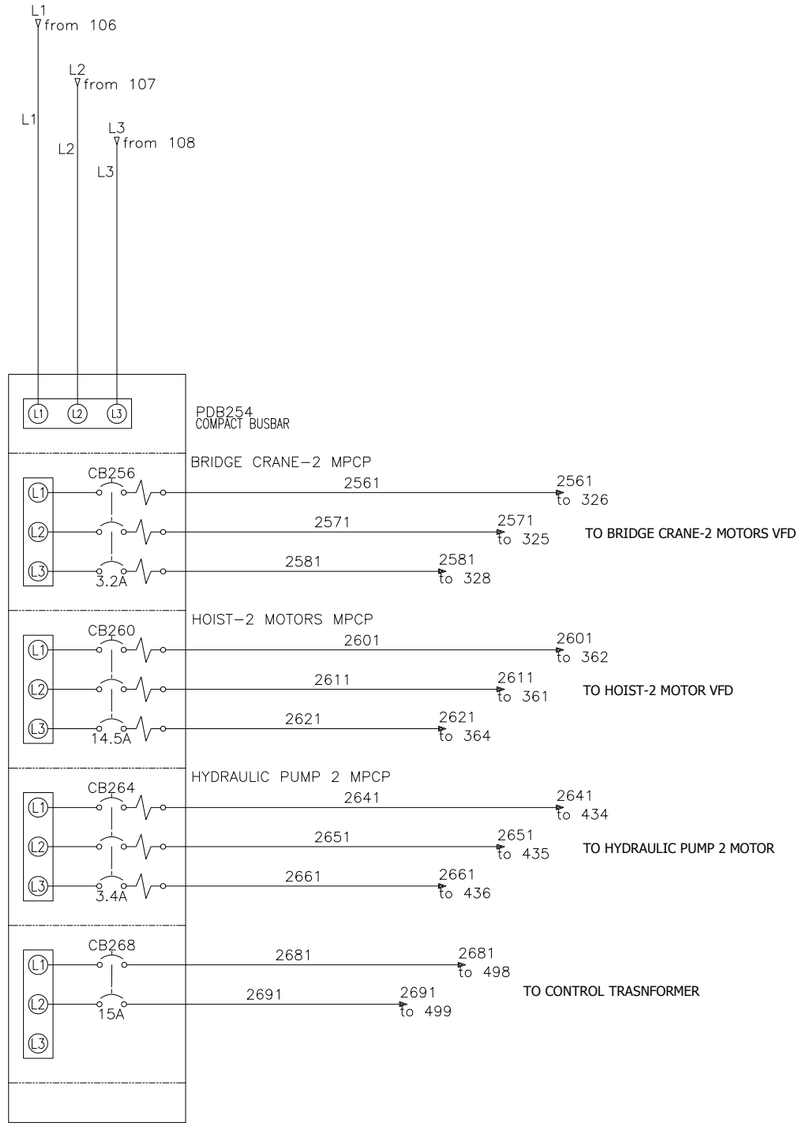


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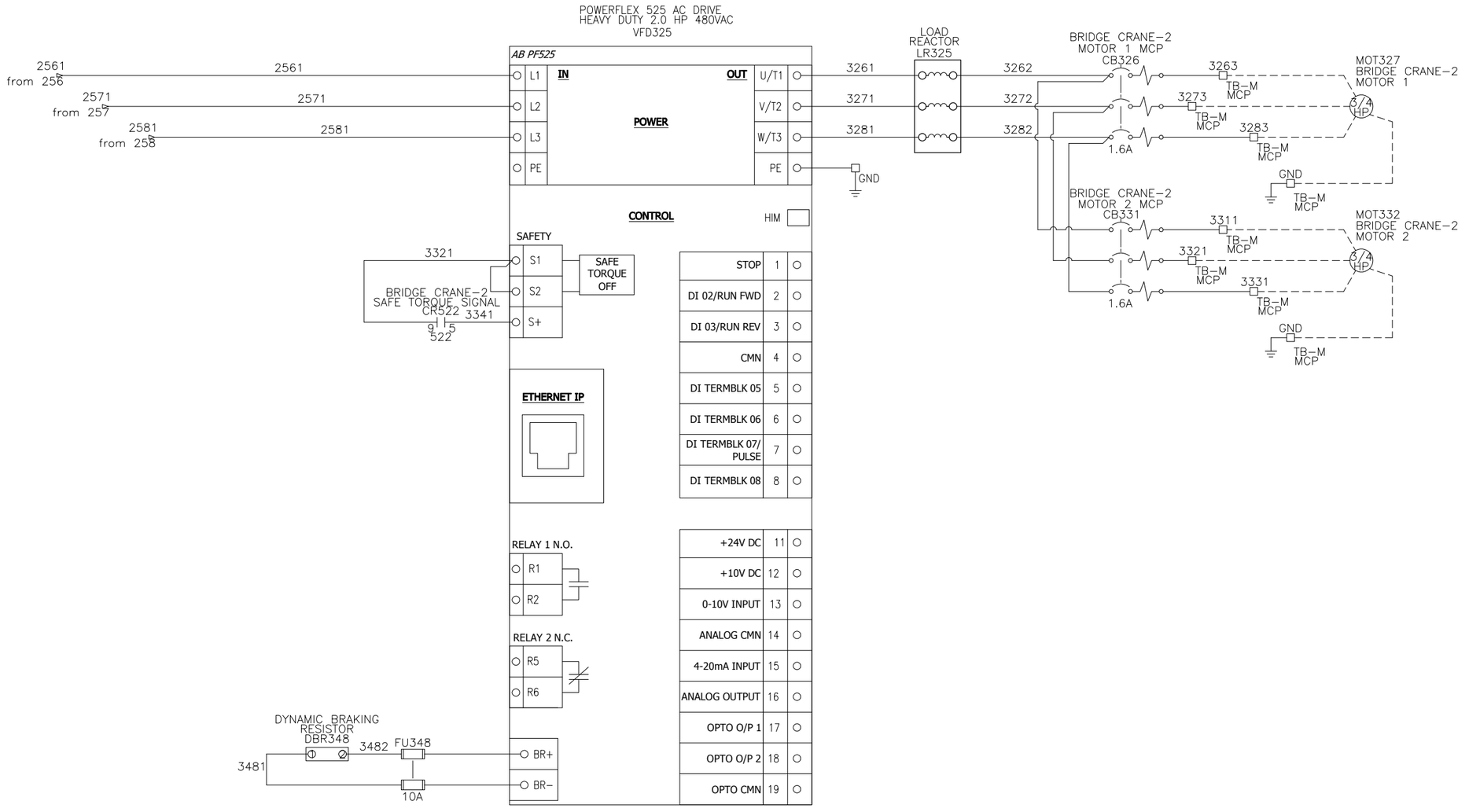
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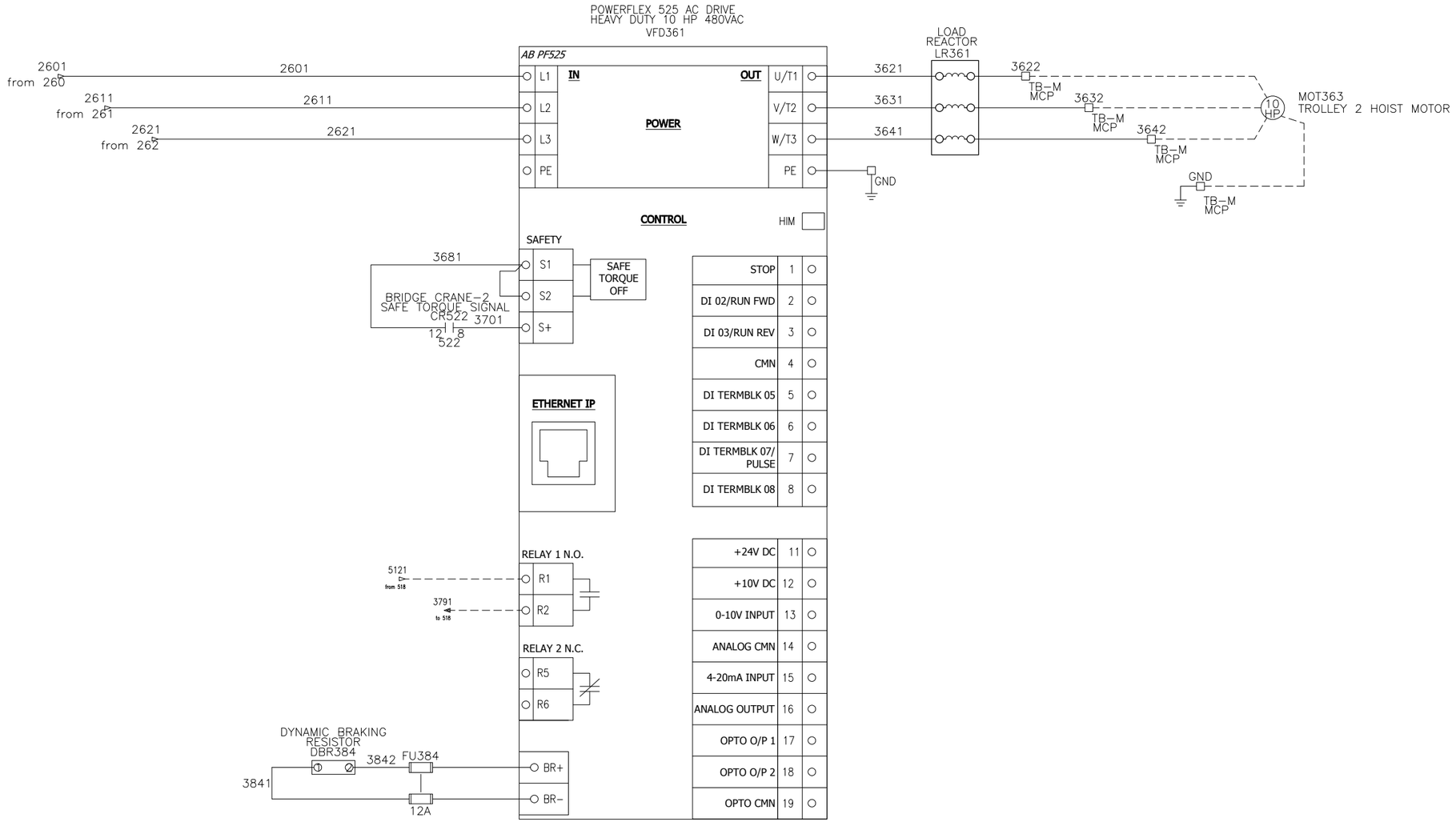
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OLR397
E300 ELECTRONIC OVERLOAD RELAY WITH ETHERNET/IP COMMUNICATIONS MODULE
CURRENT SENSING MODULE 0.5...30AMP
4 INPUT 3 RELAY OUTPUT CONTROL MODULE 120VAC

HYDRAULIC PUMP 1
START
M549

1551 from 155
1561 from 156
1571 from 157

AB E300 ELECTRONIC OVERLOAD RELAY

		IN		OUT		
○	1/L1		OLR		2/T1	○
○	3/L2		E300 SENSING MODULE		4/T2	○
○	5/L3				6/T3	○

3982 TB–M MCP
3992 TB–M MCP
4002 TB–M MCP
GND TB–M MCP
(2.0 HP)
MOT399 HYDRAULIC PUMP 1 MOTOR

E300 CONTROL MODULE

TOP SECTION INPUT/OUTPUT TERMINALS

○	A1	POWER LINE IN 1
○	R03	RELAY 0 COMMON
○	R04	RELAY 0 NO/NC
○	A2	POWER LINE IN 2
○	IN0	DIGITAL INPUT 0
○	IN1	DIGITAL INPUT 1

BOTTOM SECTION 1 POWER/PTC TERMINALS

POWER LINE IN 1	A1	○
POWER LINE IN 1	A1	○
POWER LINE IN 2	A2	○
DIGITAL INPUT 2	IN2	○
DIGITAL INPUT 3	IN3	○
UNUSED TERMINAL		○
POTENTIAL EARTH	⏚	○

5601 from 560
N1 from 560
120VAC POWER SUPPLY TO E300
GND

BOTTOM SECTION 2 RELAY TERMINALS

RELAY 1 COMMON	R13	○
RELAY 1 NO/NC	R14	○
RELAY 2 COMMON	R23	○
RELAY 2 NO/NC	R24	○

E300 ETHERNET COMMUNICATIONS MODULE

OLR433
E300 ELECTRONIC OVERLOAD RELAY WITH ETHERNET/IP COMMUNICATIONS MODULE
CURRENT SENSING MODULE 0.5...30AMP
4 INPUT 3 RELAY OUTPUT CONTROL MODULE 120VAC

HYDRAULIC PUMP 2
START
M551

2641 from 264
2651 from 265
2661 from 266

AB E300 ELECTRONIC OVERLOAD RELAY

		IN		OUT		
○	1/L1		OLR		2/T1	○
○	3/L2		E300 SENSING MODULE		4/T2	○
○	5/L3				6/T3	○

4342 TB–M MCP
4352 TB–M MCP
4362 TB–M MCP
GND TB–M MCP
(2.0 HP)
MOT435 HYDRAULIC PUMP 2 MOTOR

E300 CONTROL MODULE

TOP SECTION INPUT/OUTPUT TERMINALS

○	A1	POWER LINE IN 1
○	R03	RELAY 0 COMMON
○	R04	RELAY 0 NO/NC
○	A2	POWER LINE IN 2
○	IN0	DIGITAL INPUT 0
○	IN1	DIGITAL INPUT 1

BOTTOM SECTION 1 POWER/PTC TERMINALS

POWER LINE IN 1	A1	○
POWER LINE IN 1	A1	○
POWER LINE IN 2	A2	○
DIGITAL INPUT 2	IN2	○
DIGITAL INPUT 3	IN3	○
UNUSED TERMINAL		○
POTENTIAL EARTH	⏚	○

5601 from 562
N1 from 562
120VAC POWER SUPPLY TO E300
GND

BOTTOM SECTION 2 RELAY TERMINALS

RELAY 1 COMMON	R13	○
RELAY 1 NO/NC	R14	○
RELAY 2 COMMON	R23	○
RELAY 2 NO/NC	R24	○

E300 ETHERNET COMMUNICATIONS MODULE

WIRING LEGEND:

———— INTERNAL PANEL WIRING

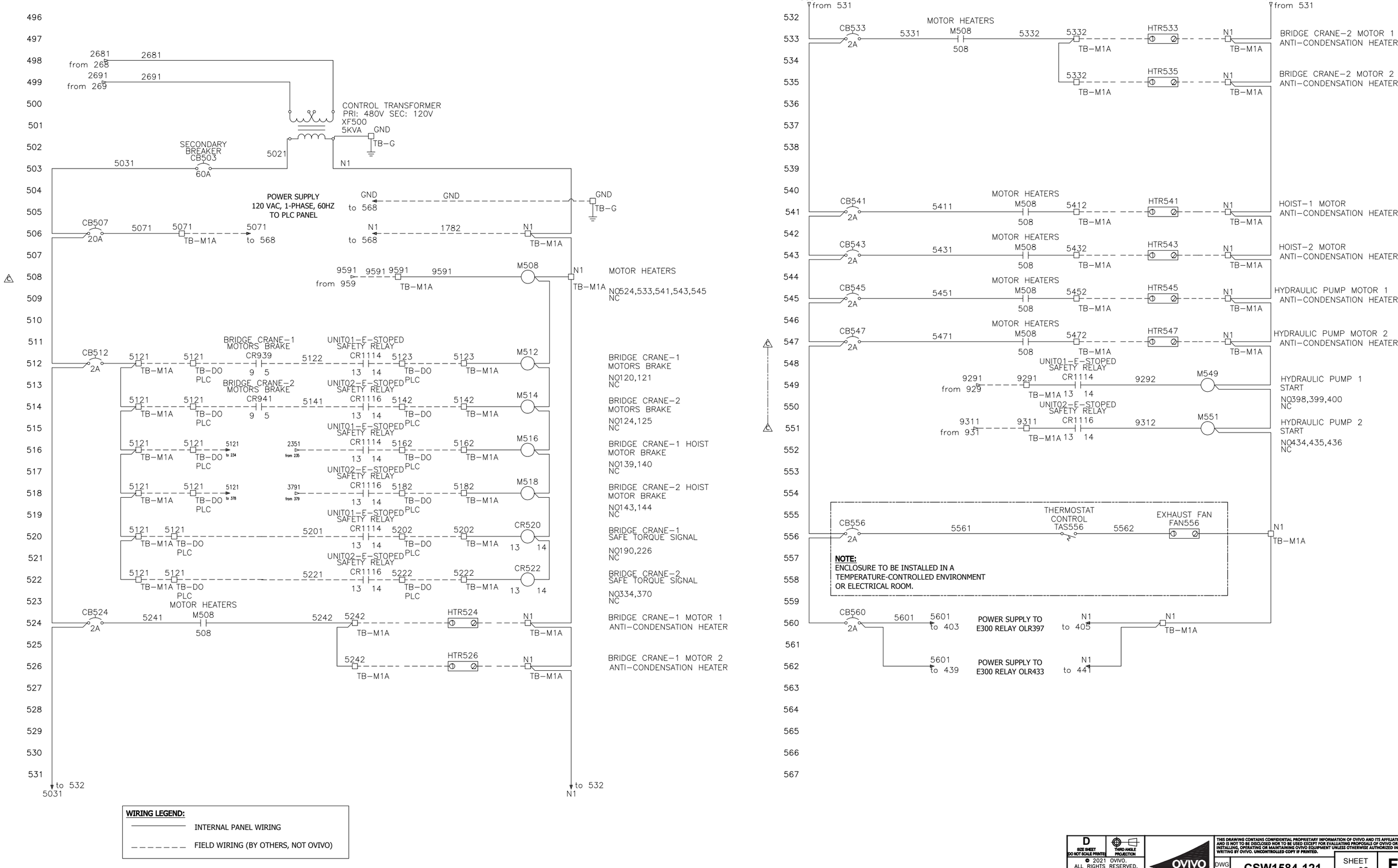
– – – – – – – – FIELD WIRING (BY OTHERS, NOT OVIVO)

D SIZE SHEET (DO NOT SCALE PRINTS) | THIRD ANGLE PROJECTION
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OVIVO
DWG NO. CSW1584-121
SHEET 18 OF 32
REVISION F

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INTENTIONALLY KEPT BLANK

D
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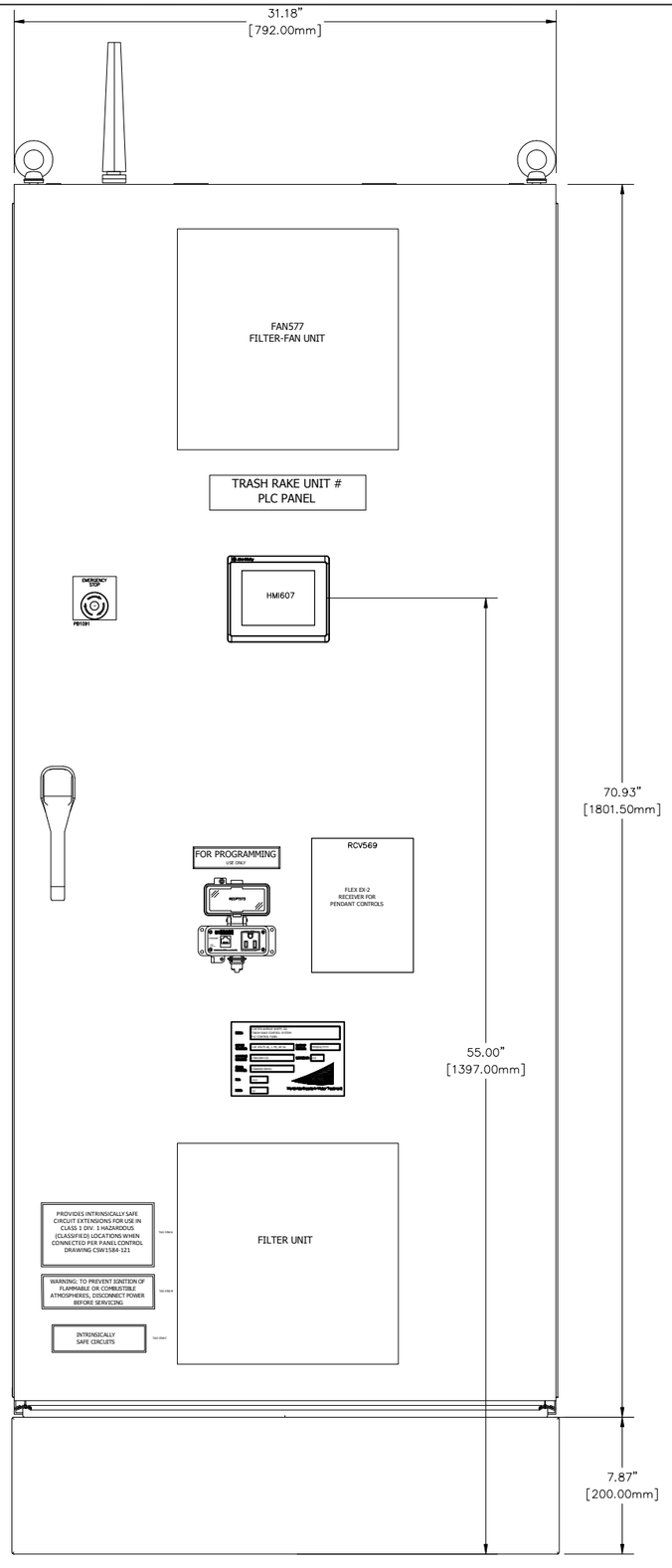
D — SIZE SHEET (DO NOT SCALE PRINTS) — THIRD ANGLE PROJECTION

OVIVO

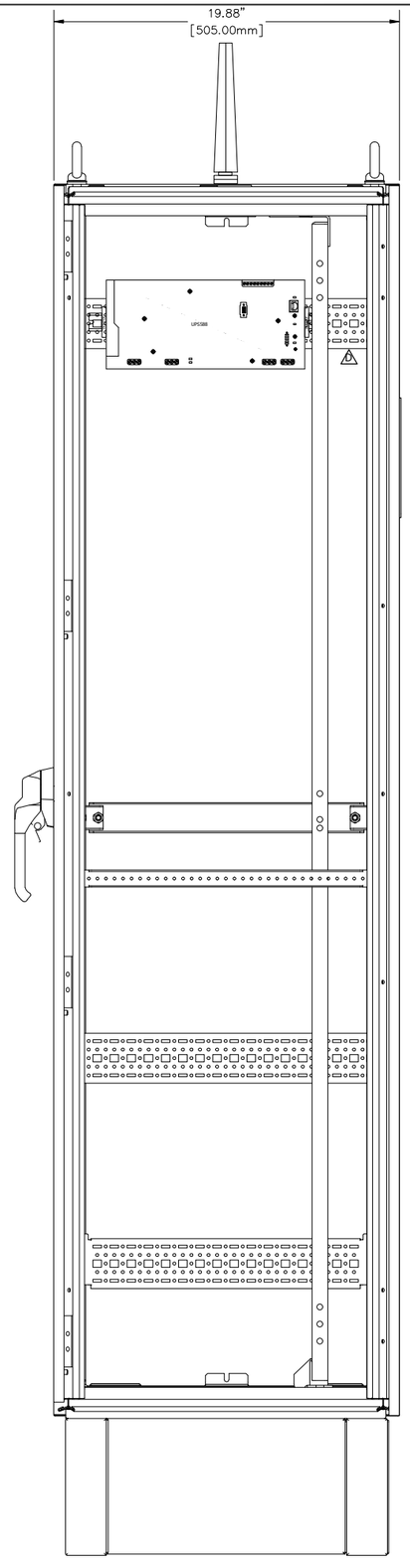
DWG NO. CSW1584-121

SHEET 20 OF 32

F — REVISION



FRONT VIEW



LEFT SIDE VIEW

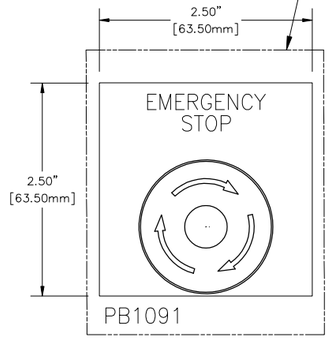
PLC PANEL ENCLOSURE LAYOUT

WHITE BACKGROUND
WITH BLACK 1/2" HIGH
LETTERS (TYPICAL)

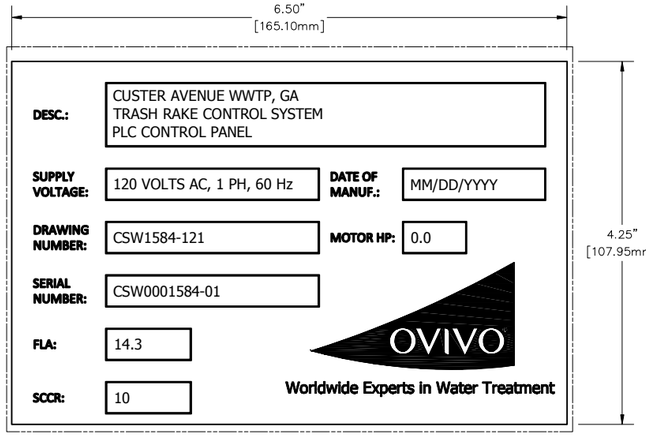


#
SEE SHEET 1 FOR ENCLOSURE LABELING

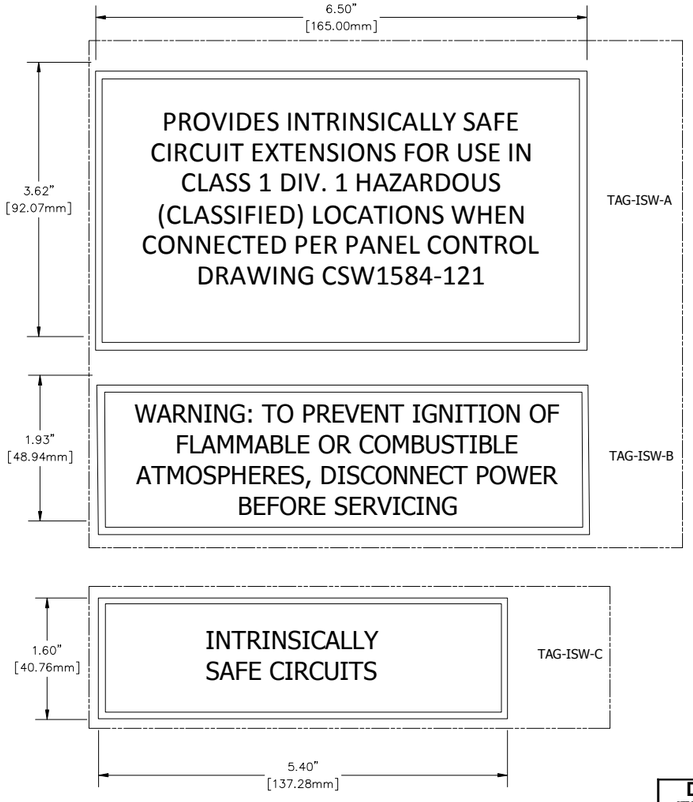
WHITE BACKGROUND
WITH BLACK 3/16" HIGH
LETTERS (TYPICAL)

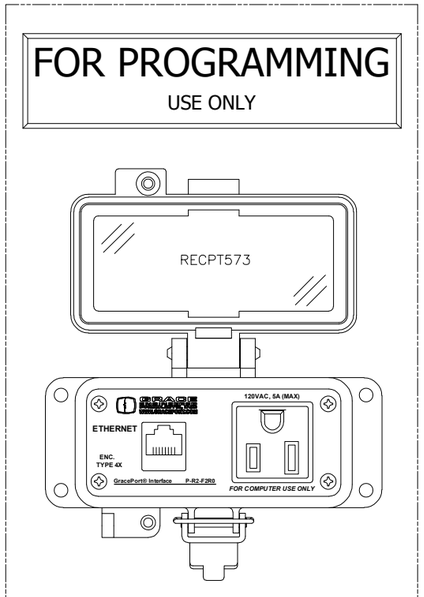


ENCLOSURE TAG



ENCLOSURE NAMEPLATE

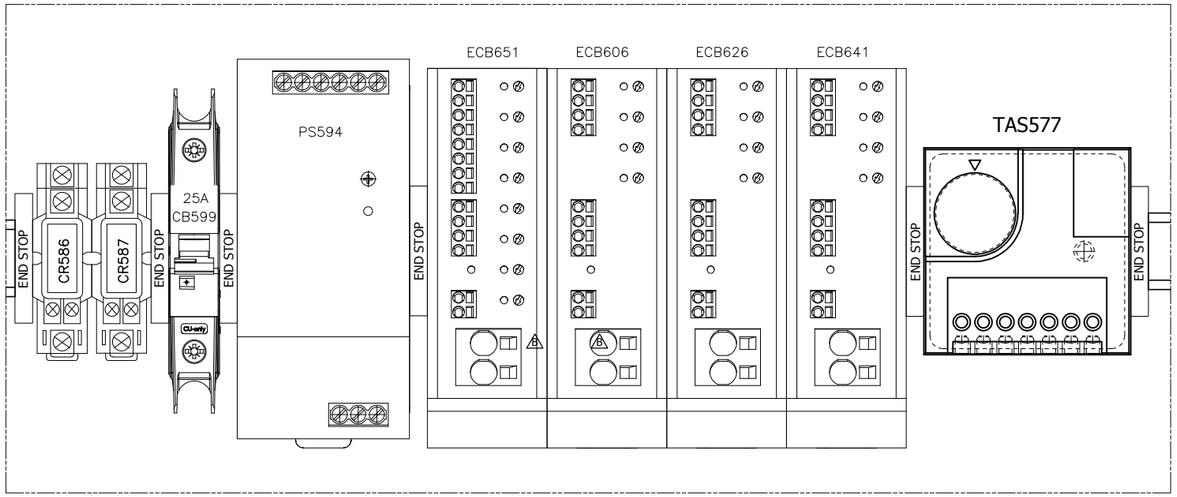




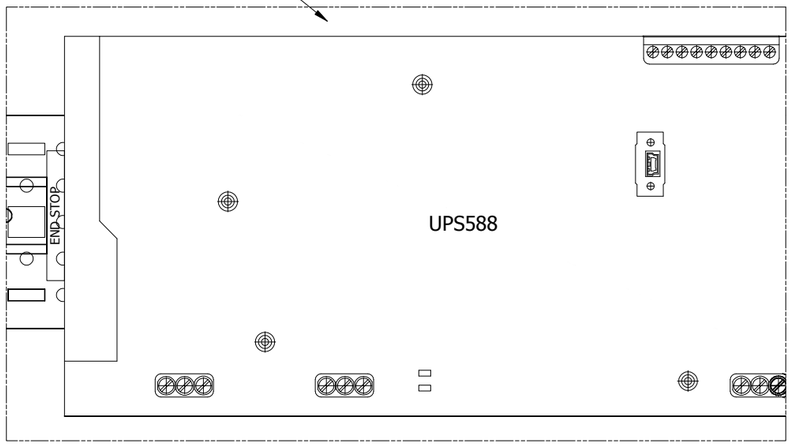
D SIZE SHEET (DO NOT SCALE PRINTS)	THIRD ANGLE PROJECTION	OVIVO	SHEET 21 OF 32
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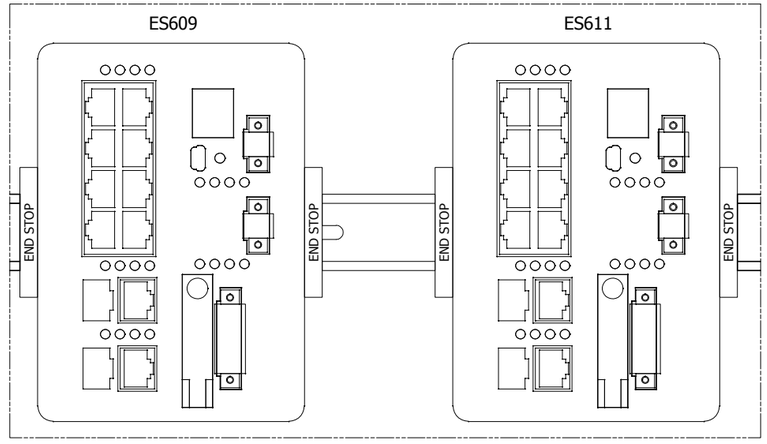
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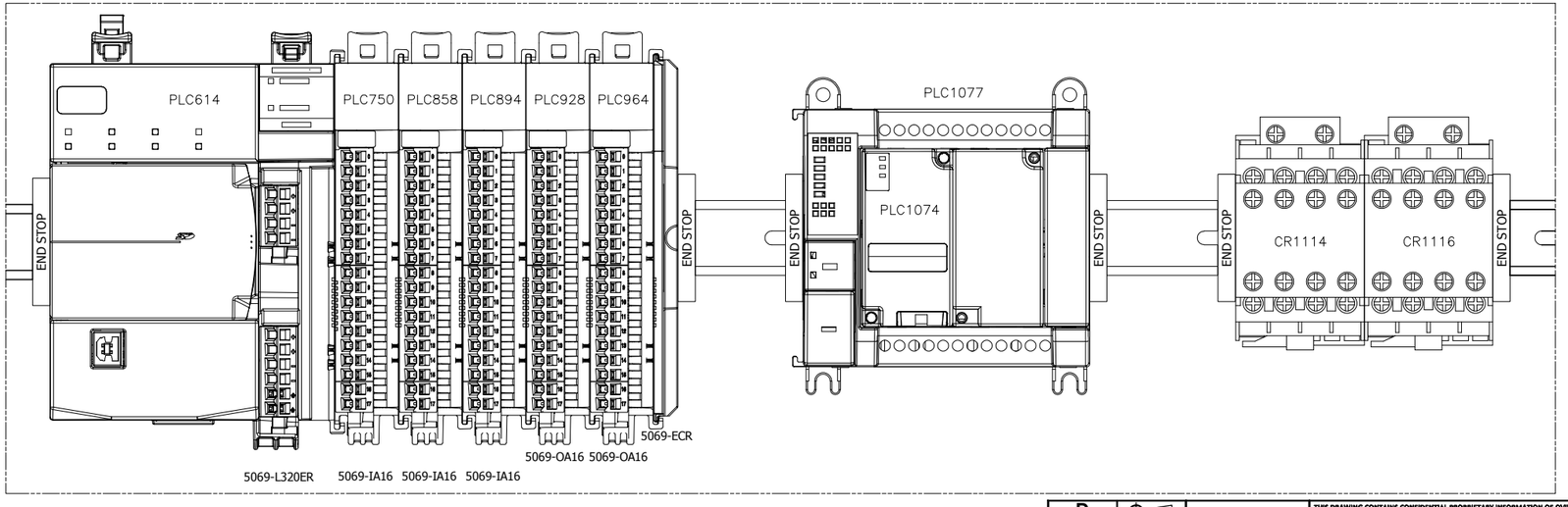
EXPANDED VIEWS

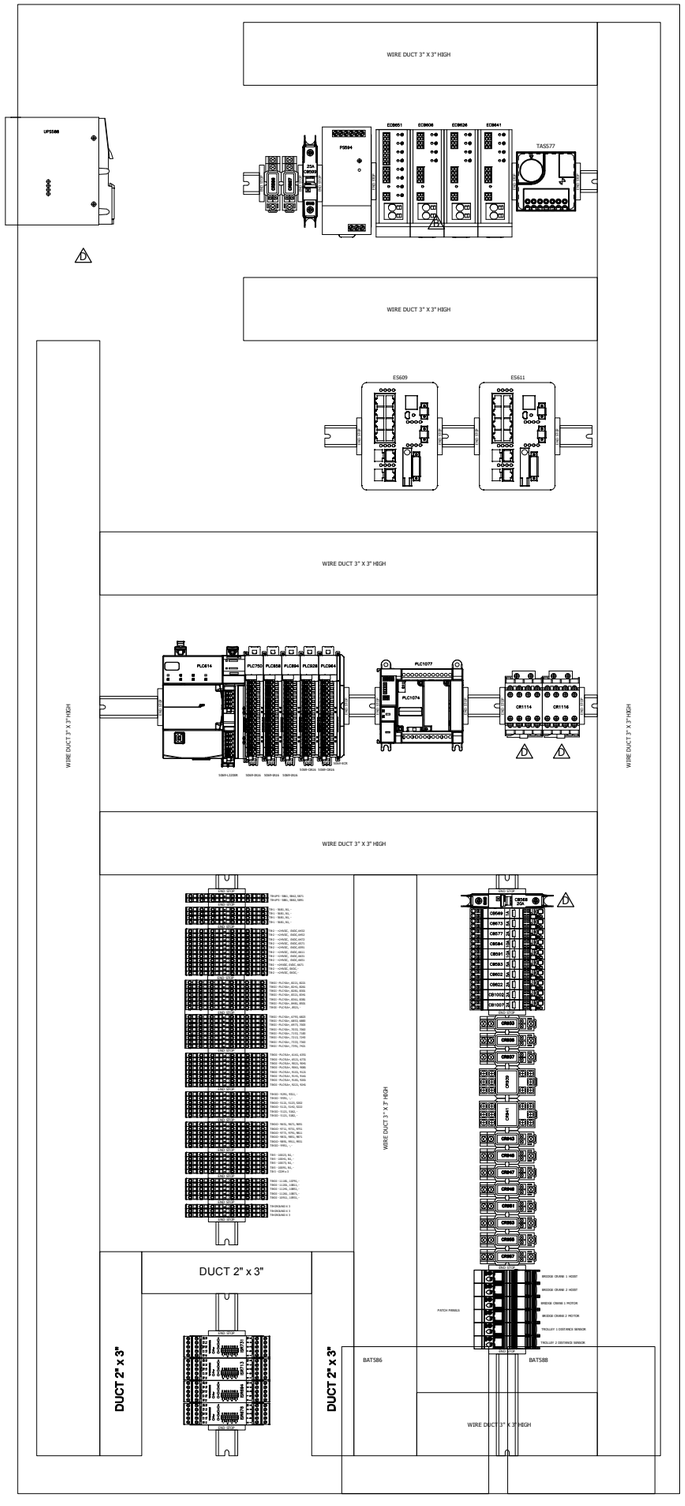


MOUNTED ON LEFT SIDE
PUNCH SECTION OF PANEL
△5

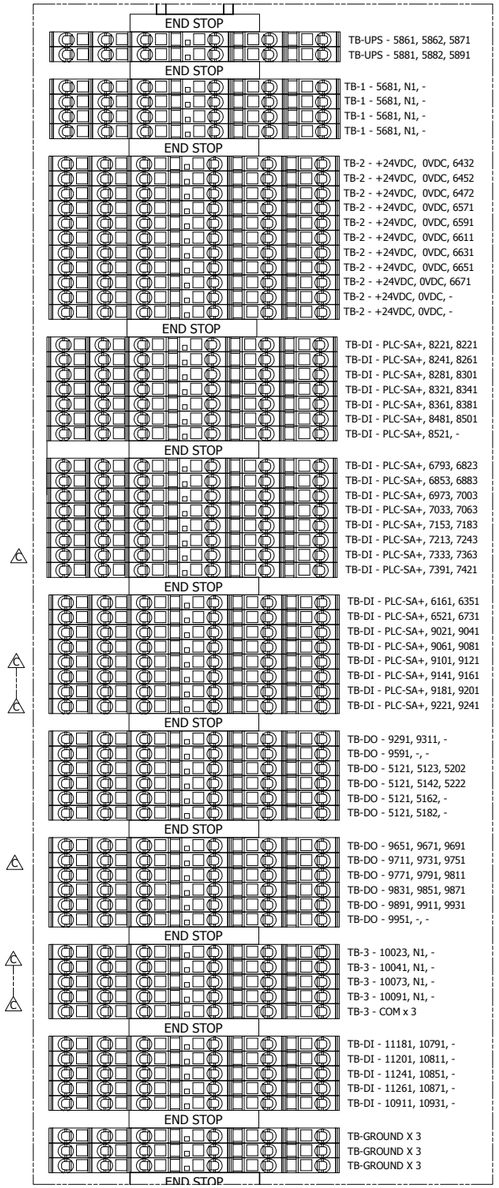


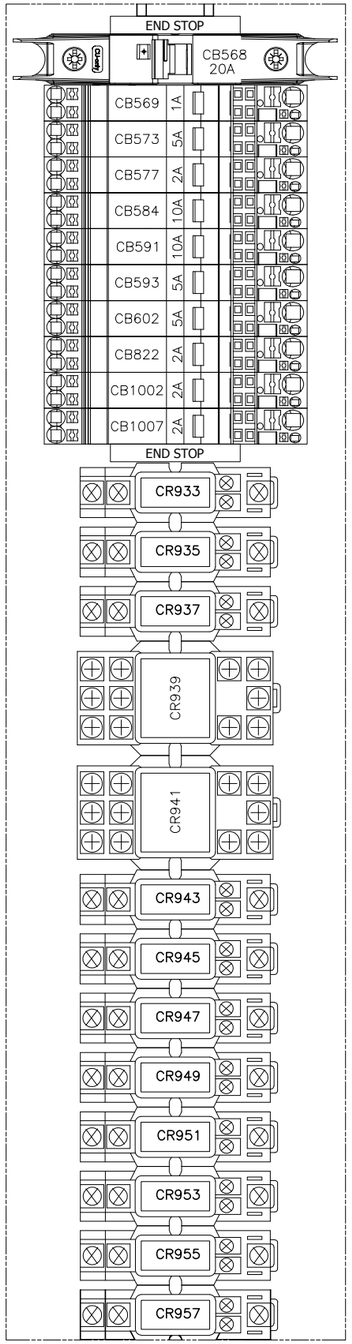


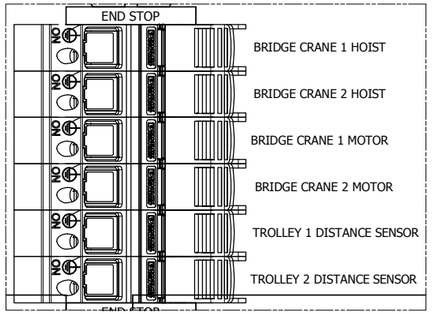


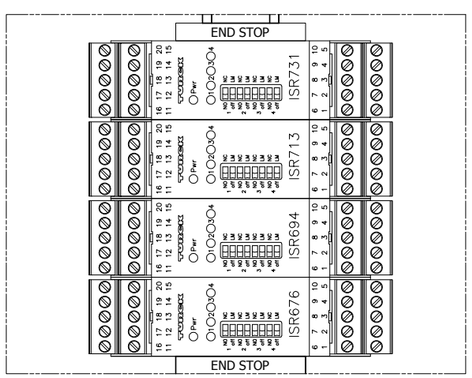


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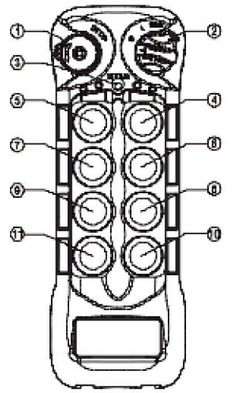






ITEM NO. 38 BUTTON DESIGNATION AND LABELLING		
BUTTON #	OPERATOR TYPE	FUNCTION / LABEL
1	ROTARY SWITCH - MAINTAINED	STOP BUTTON
2	2-POSITION SELECTOR SWITCH - MAINTAINED	START OPERATION
3	INDICATING LIGHT	STATUS INDICATION
4	MOMENTARY PUSHBUTTON	UP
5	MOMENTARY PUSHBUTTON	DOWN
6	MOMENTARY PUSHBUTTON	CRANE FORWARD
7	MOMENTARY PUSHBUTTON	CRANE REVERSE
8	MOMENTARY PUSHBUTTON	OPEN
9	MOMENTARY PUSHBUTTON	CLOSE
10	MOMENTARY PUSHBUTTON	TROLLEY 1
11	MOMENTARY PUSHBUTTON	TROLLEY 2

NOTE:
TYPICAL FOR (2) TROLLEY PANELS.



EXPANDED VIEWS

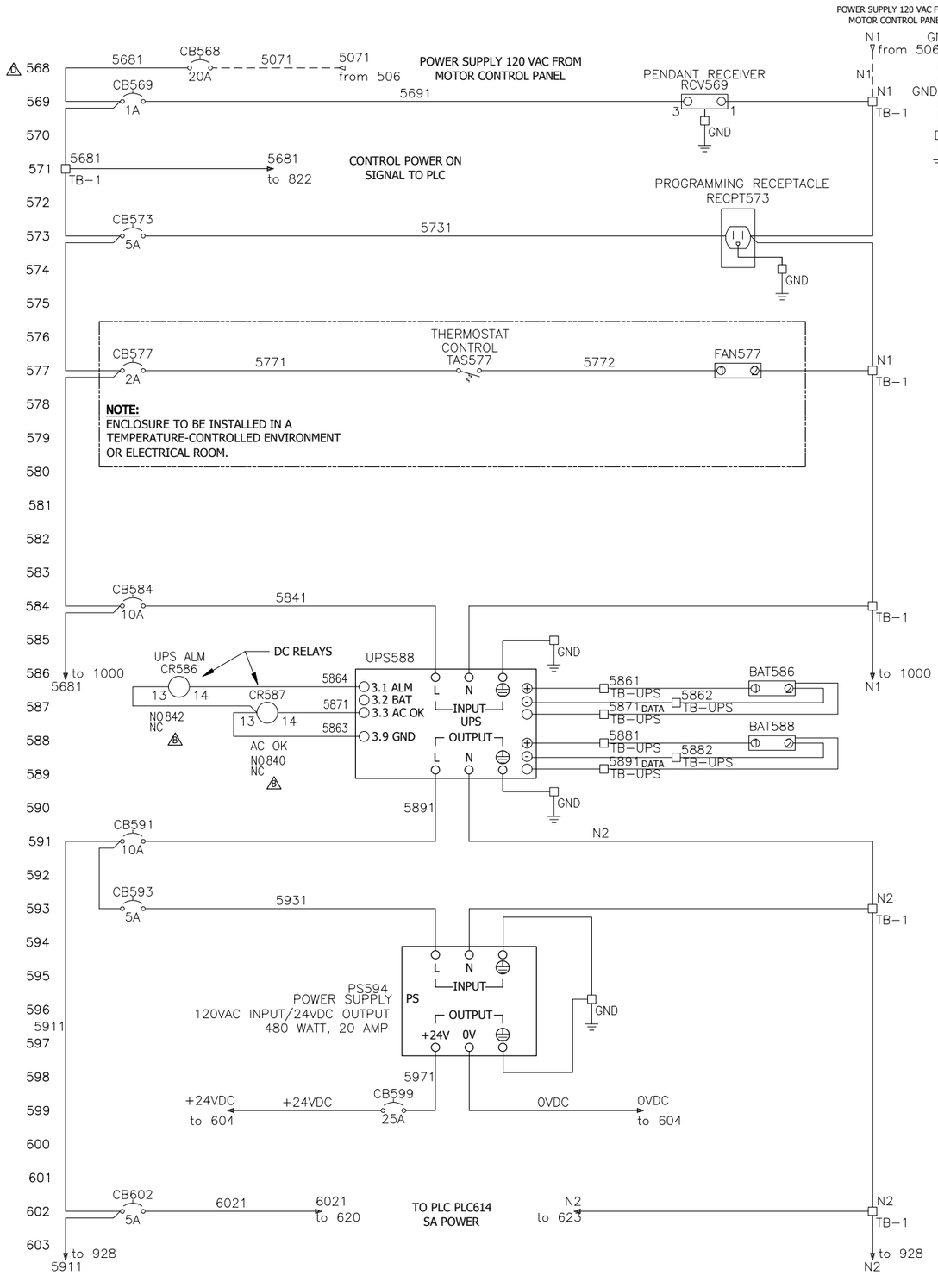
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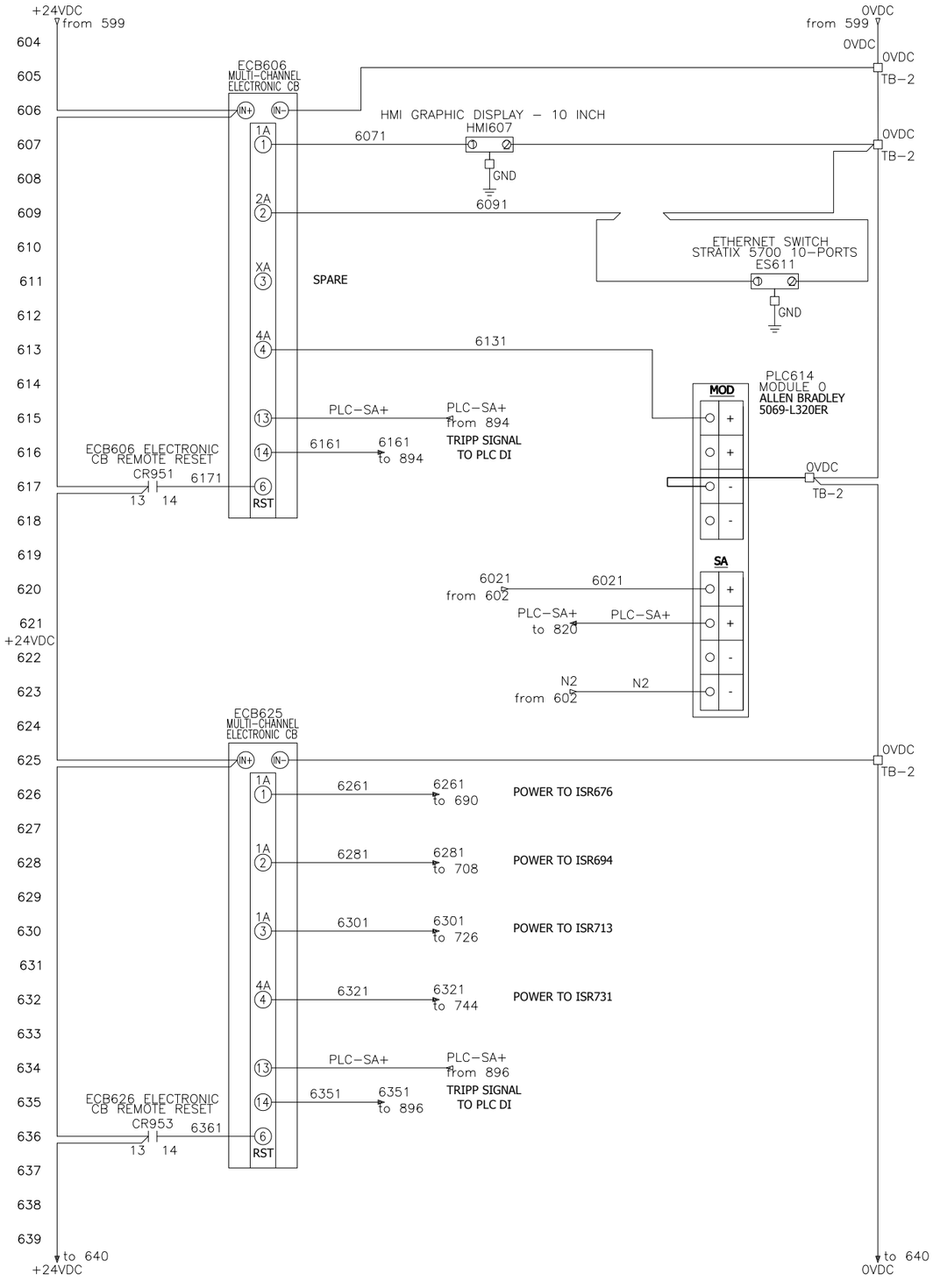
BILL OF MATERIAL

ITEM	QTY	TAG	CATALOG	MAKE	DESCRIPTION
1	1	ENCLOSURE	8885.500	RITTAL	TS8 FREE STANDING ENCLOSURE, CARBON STEEL, NEMA 12, COLOR RAL 7035, WITH ROOF, DOOR, REAR PANEL, GLAND PLATE, 1800 MM x 800 MM x 500 MM
2	1 SET	ENCLOSURE ACCESSORY	8640.023	RITTAL	HIGH PLINTH, FRONT AND REAR
3	1 SET	ENCLOSURE ACCESSORY	8640.042	RITTAL	HIGH PLINTH, SIDES
4	A/R	ENCLOSURE ACCESSORY	4579.000	RITTAL	SUPPORT STRIPS
5 △1	2	ENCLOSURE ACCESSORY	4365.000	RITTAL	PS SYSTEM CHASSIS WITH FLANGE, 32 INCH
6	1	ENCLOSURE ACCESSORY	4943.000	RITTAL	C-RAIL
7	A/R	ENCLOSURE ACCESSORY	2388.150	RITTAL	EMC SHIELDING BRACKET (PER NUMBER OF CABLES, 20 MINIMUM)
8	A/R	ENCLOSURE ACCESSORY	2589.000	RITTAL	CABLE CONDUIT, FOR SECURE CABLE ROUTING
9	A/R	ENCLOSURE ACCESSORY	2591.000	RITTAL	CABLE CONDUIT HOLDER, FOR ROUTING
10	1	TAS577	3118.000	RITTAL	HYGROSTAT, FOR ACTIVATING FAN, 120VAC
11	1	FAN577	3243.110	RITTAL	FILTER-FAN UNIT, 120 VAC, TYPE 12
12	1	FAN577	3243.200	RITTAL	OUTLET FILTER, TYPE 12
13 △1					
14	1	CB568	1489-M1C200	ALLEN BRADLEY	MINIATURE CIRCUIT BREAKER, SINGLE POLE, 20 AMPS
15	10	ALL BELOW LISTED PHOENIX CONTACT CIRCUIT BREAKER PLUG TYPE UNITS	2800929	PHOENIX CONTACT	BASE ELEMENT FOR CIRCUIT BREAKER, WITH PUSH-IN CONNECTION TECHNOLOGY, 300V, GRAY
16	2	CB584, CB591,	2800843	PHOENIX CONTACT	THERMOMAGNETIC DEVICE CIRCUIT BREAKER, 10A, 1 PDT CONTACT, PLUG TYPE
17	3	CB573, CB593, CB602	2800840	PHOENIX CONTACT	THERMOMAGNETIC DEVICE CIRCUIT BREAKER, 5A, 1 PDT CONTACT, PLUG TYPE
18	4	CB577, CB822, CB1002, CB1007	2800837	PHOENIX CONTACT	THERMOMAGNETIC DEVICE CIRCUIT BREAKER, 2A, 1 PDT CONTACT, PLUG TYPE
19	1	CB569	2800836	PHOENIX CONTACT	THERMOMAGNETIC DEVICE CIRCUIT BREAKER, 1A, 1 PDT CONTACT, PLUG TYPE
20	1	UPS588	2320283	PHOENIX CONTACT	UNINTERRUPTABLE POWER SUPPLY, QUINT 4, 1-PHASE AC TO 1-PHASE AC, 1KVA
21	1	UPS588	2908217	PHOENIX CONTACT	DATA CABLE, MINI SCREW USB TYPE, FOR COMMUNICATION FOR THE UPS
22	2	BAT586, BAT588	2320416	PHOENIX CONTACT	ENERGY STORAGE (BATTERY UNIT), FOR UPS, 24 VDC, 13 AH
23	2	BAT586, BAT588	2320788	PHOENIX CONTACT	BATTERY MOUNTING KIT
24	1	PS594	2903151	PHOENIX CONTACT	PRIMARY-SWITCHED TRIO POWER POWER SUPPLY WITH PUSH-IN CONNECTION FOR DIN RAIL MOUNTING, INPUT: SINGLE-PHASE, OUTPUT: 24 V DC/20 A, 480W
25	1	CB599	1489-M1C250	ALLEN BRADLEY	MINIATURE CIRCUIT BREAKER, SINGLE POLE, 25 AMPS
26	1	ECB651	2905744	PHOENIX CONTACT	8-CHANNEL, ELECTRONIC CIRCUIT BREAKER WITH ACTIVE CURRENT LIMITATION FOR PROTECTING EIGHT LOADS AT 24 V DC IN THE EVENT OF OVERLOAD AND SHORT CIRCUIT. WITH NOMINAL CURRENT ASSISTANT AND ELECTRONIC LOCKING OF THE SET NOMINAL CURRENTS. FOR INSTALLATION ON DIN RAILS.
27	3	ECB606, ECB625, ECB642	2905743	PHOENIX CONTACT	4-CHANNEL, ELECTRONIC CIRCUIT BREAKER WITH ACTIVE CURRENT LIMITATION FOR PROTECTING FOUR LOADS AT 24 V DC IN THE EVENT OF OVERLOAD AND SHORT CIRCUIT. WITH NOMINAL CURRENT ASSISTANT AND ELECTRONIC LOCKING OF THE SET NOMINAL CURRENTS. FOR INSTALLATION ON DIN RAILS.
28	1	PLC614	ROCKWELL AUTOMATION	5069-L320ER	CONTROLLER, COMPACTLOGIX 5380, 2 MB, 16 I/OS, 40 NODES, STANDARD
29	3	PLC750, PLC858, PLC894	5069-IA16	ALLEN BRADLEY	5069 COMPACT I/O 16 CHANNELS AC INPUT MODULES, 120 VAC
30	2	PLC928, PLC964	5069-OA16	ALLEN BRADLEY	5069 COMPACT I/O, 16 CHANNELS AC OUTPUT MODULE, 120VAC
31	1	PLC614	5069-RTB64-SPRING	ALLEN BRADLEY	TERMINAL BLOCK, COMPACT I/O 6 PIN SPRING TYPE RTB
32	5	PLC750, PLC858, PLC894, PLC928, PLC964	5069-RTB18-SPRING	ALLEN BRADLEY	TERMINAL BLOCK, COMPACT I/O, 18 PINS, SPRING CLIP TYPE
33	1	PLC ACCESSORY	5069-ECR	ALLEN BRADLEY	COMPACTLOGIX RIGHT END CAP FOR TERMINATION
34	1	PLC1077	440C-CR30-22BBB	ALLEN BRADLEY	GUARDMASTER 440C-CR30 SOFTWARE CONFIGURED SAFETY RELAY, PLE SIL 3, 22 SAFETY I/O, EMBEDDED SERIAL PORT, USB PROGRAMMING PORT, 2 PLUG-IN SLOTS, 24.0V DC
35	1	PLC1074	440C-ENET	ALLEN BRADLEY	GUARDMASTER ETHERNET PLUG-IN MODULE, SLOT 1 ONLY
36	1	HMI607	2713P-T10CD1	ROCKWELL AUTOMATION	PANELVIEW 5310, 10 IN. 4:3 ASPECT RATIO DISPLAY, TOUCH, 24V DC
37 △1	2	ES609, ES611	1783-BMS10CGN	ALLEN BRADLEY	STRATIX 5700 MANAGED ETHERNET SWITCH, 8 FAST COPPER PORTS, 2 ETHERNET COMBO PORTS
38	1 SET	RCV569	FLEX-8EX2-01-2T	MAGNETEX MATERIAL HANDLING	WIRELESS PENDANT SYSTEM 120VAC, INCLUDING ONE RECEIVER AND TWO TRANSMITTERS, WIRELESS ANTENNA, CUSTOM LABEL, E-STOP, ONE SELECTOR SWITCH
39	11	CR933, CR935, CR937, CR943, CR945, CR947, CR949, CR951, CR953, CR955, CR957	RH1B-ULC-AC120V WITH SH1B-05 SOCKET	IDEC	CONTROL RELAY, SPDT, WITH INDICATOR AND DIODE, 120VAC, 10AMP CONTACT RATING, WITH SOCKET
40	2	CR939, CR941	RH3B-ULC-AC120V WITH SH3B-05 SOCKET	IDEC	CONTROL RELAY, 3PDT, WITH INDICATOR AND DIODE, 120VAC, 10AMP CONTACT RATING, WITH SOCKET

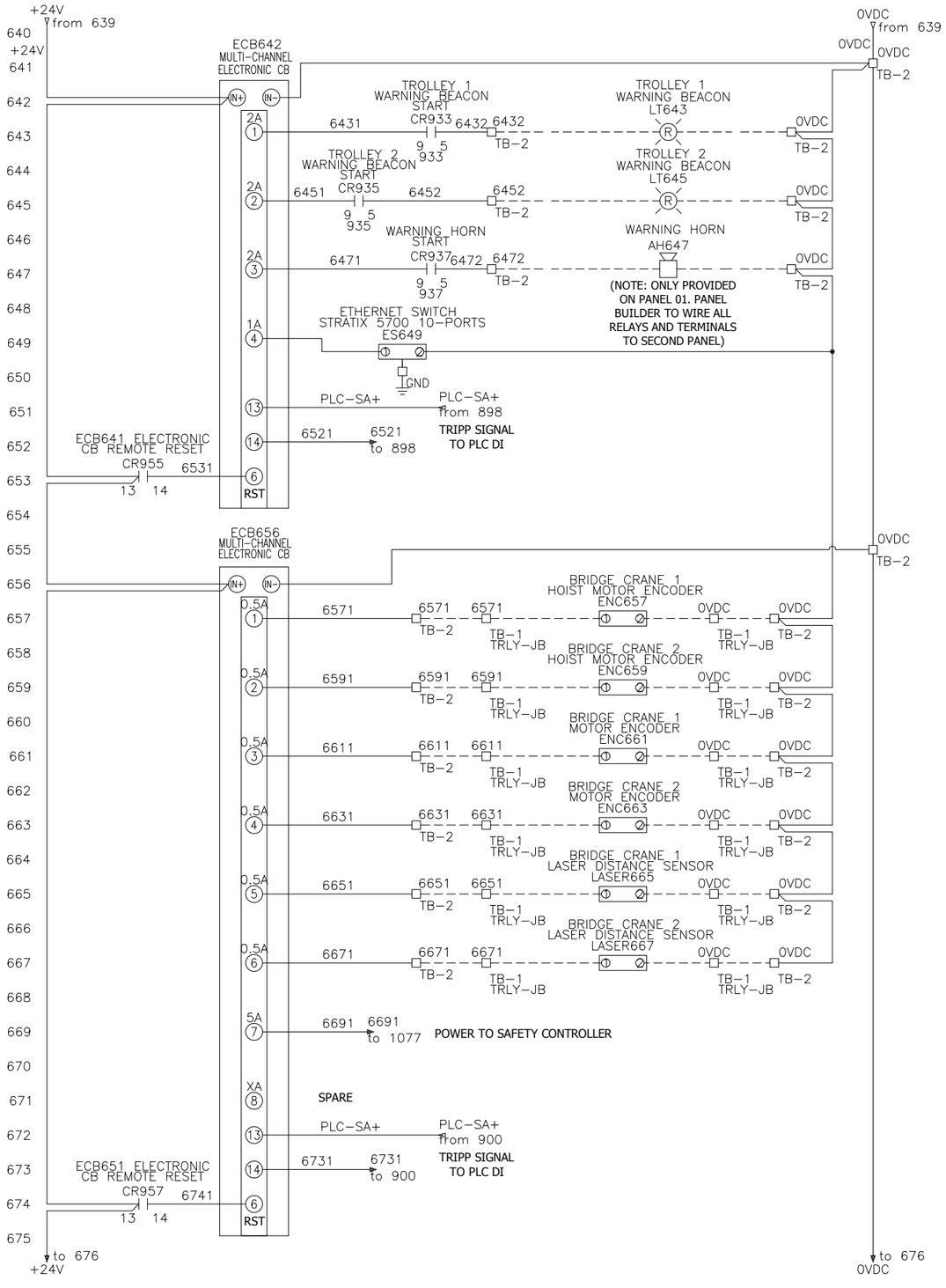
ITEM	QTY	TAG	CATALOG	MAKE	DESCRIPTION
41	1	PB1091	800H-FRXT6A5	ALLEN BRADLEY	30.5MM TYPE 4/4X/13 2 POS. PB-NON-ILLUMINATED TWIST TO RELEASE, RED, 2 NCLB
42	1	PB1091	GRAVOGRAPH	GRAVOPLY ULTRA	NAMEPLATE FOR E-STOP
43 △1	66	TB-UPS, TB-1, TB-2, TB-DI, TB-DO, TB-GND	3036042	PHOENIX CONTACT	3-LEVEL TERMINAL BLOCK, SCREW CONNECTION, AWG 28-12, GRAY COLOR, 20A, 500 VOLTS
44	12	TB-UPS, TB-1, TB-2, TB-DI, TB-DO, TB-GND	3036660	PHOENIX CONTACT	END COVER, GRAY COLOR
45	27	AS SHOWN IN DRAWINGS	1201662	PHOENIX CONTACT	QUICK MOUNTING END CLAMP, DIN-RAIL MOUNT
46	5	FOR TERMINAL ORGANISATION	0811969	PHOENIX CONTACT	TERMINAL STRIP MARKER CARRIER, HEIGHT ADJUSTABLE, FOR END BRACKETS CLIPFIX 15, 35, 35-5
47	A/R	AS SHOWN	0807012	PHOENIX CONTACT	DIN RAIL, PERFORATED, 35 MMx7.5 MM, 1000 MM LONG, GALVANIZED STEEL, PASSIVATED WITH A THICK LAYER, SILVER COLOR
48	A/R	ENCLOSURE ACCESSORY	TYD2X3NPI6	THOMAS & BETTS	INTRINSICALLY SAFE NARROW SLOT WIRING DUCT, PVC, 2"x3" HIGH
49	A/R	ENCLOSURE ACCESSORY	TYD2CPI6	THOMAS & BETTS	INTRINSICALLY SAFE WIRE DUCT COVER FOR 2" DUCTS
50	A/R	ENCLOSURE ACCESSORY	TYD3X3NPW6	THOMAS & BETTS	NARROW SLOT WIRING DUCT, PVC, 3"x3" HIGH
51	A/R	ENCLOSURE ACCESSORY	TYD3CPW6	THOMAS & BETTS	WIRE DUCT COVER FOR 3" DUCTS
52	1	PANEL DETAILS	679002	OVIVO	NAME PLATE (ETCH AS SHOWN)
53	2	"TRASH RAKE PLC CONTROL PANEL", "FOR PROGRAMMING USE ONLY" ON RECPT573	592273	OVIVO	ENCLOSURE EQUIPMENT TAG ID, BLACK BACKGROUND WITH 3/16 INCH WHITE LETTERS, NOMINAL HEIGHT OF NAMEPLATES 2 INCHES
54	A/R	TAG-ISW-A, TAG-ISW-B, TAG-ISW-C	GRAVOPLY ULTRA	GRAVOGRAPH	INTRINSIC SAFETY WARNING TAG, ENGRAVE AS SHOWN
55	2	LT643, LT645	27XST-024R -MOD	FEDERAL SIGNAL	EXPLOSION-PROOF STROBE LIGHT, RED, 24 VDC, 3/4" NPT MOUNT, FOR USE IN HAZARDOUS LOCATION
56	1	AH647	41X-024-1	FEDERAL SIGNAL	EXPLOSION-PROOF HORN, 24 VDC, FOR USE IN HAZARDOUS LOCATION
57	2	CR1114, CR1116	700S-CF620EJBC	ROCKWELL AUTOMATION	RELAY, SAFETY, CONTROL, 20 AMP, 24 VOLT DC, ELECTRONIC, WITH DIODE, 8 POLE, 6 NORMALLY OPEN, 2 NORMALLY CLOSED, MAIN STANDARD CONTACTS, FRONT GOLD-PLATED BIFURCATED
58	1	RECPT573	P-R2-F3R0	GRACEPORT	ETHERNET PORT CONNECTOR, CATEGORY 5 RJ-45 F/F BULKHEAD, AND ONE 120 VAC, 15 AMP RECEPTACLE, WITH NEMA 4X GASKETED HOUSING, WITH HINGED COVER
59	1	**REFERENCE ONLY NOT TO BE ORDERED**	DPE-30-500	DIMETIX	LASER DISTANCE SENSOR, 24 VDC, 500M, 4...20MA
60	1	**REFERENCE ONLY NOT TO BE ORDERED**	500114	DIMETIX	REFLECTION FOIL, 600MM X 1200 MM
61	1	**REFERENCE ONLY NOT TO BE ORDERED**	500701	DIMETIX	ETHERNET/IP ADAPTER FOR D-SERIES SENSORS
62	1	**REFERENCE ONLY NOT TO BE ORDERED**	000910-03	LASER VIEW TECHNOLOGIES	HAZARDOUS ENVIROMENT EXPLOSION PROOF MOUNTING ASSEMBLY
63	1	**REFERENCE ONLY NOT TO BE ORDERED**	500205	DIMETIX	SENSOR CABLE, A-CODED, 5-POLE, 5M, FEMALE
64	1	**REFERENCE ONLY NOT TO BE ORDERED**	SERIES 648 ENCODER	LINDE	EXPLOSION-PROOF ABSOLUTE ENCODER, WITH ENDAT SIGNAL OUTPUT FOR ETHERNET/IP COMMUNICATIONS
65	1	**REFERENCE ONLY NOT TO BE ORDERED**	1153130-01	LINDE	ETHERNET/IP GATEWAY FOR ENDAT ENCODERS, 24 VDC
66	1	ACCESSORIES	1585J-M8CC-C	ALLEN BRADLEY	FIELD ATTACHABLE RJ-45 CONNECTORS, FOR ENCODERS AND LASER SENSORS
67 △1					
68 △1 △5					
69	4	ACCESSORIES	IM1-451EX-R	TURCK	AMPLIFIER, ISOLATING SWITCHING, 4 CHANNEL
70 △1	6	PATCH PANEL	1100077	PHOENIX CONTACT	DIN RAIL ADAPTER INCLUDING RJ45 CABLE CONNECTION MODULE
71	2	CR586, CR587	RH1B-ULC-DC24V WITH SH1B-05	IDEC	CONTROL RELAY, SPDT, WITH INDICATOR AND DIODE, 24VDC, 10AMP CONTACT RATING, WITH SOCKET

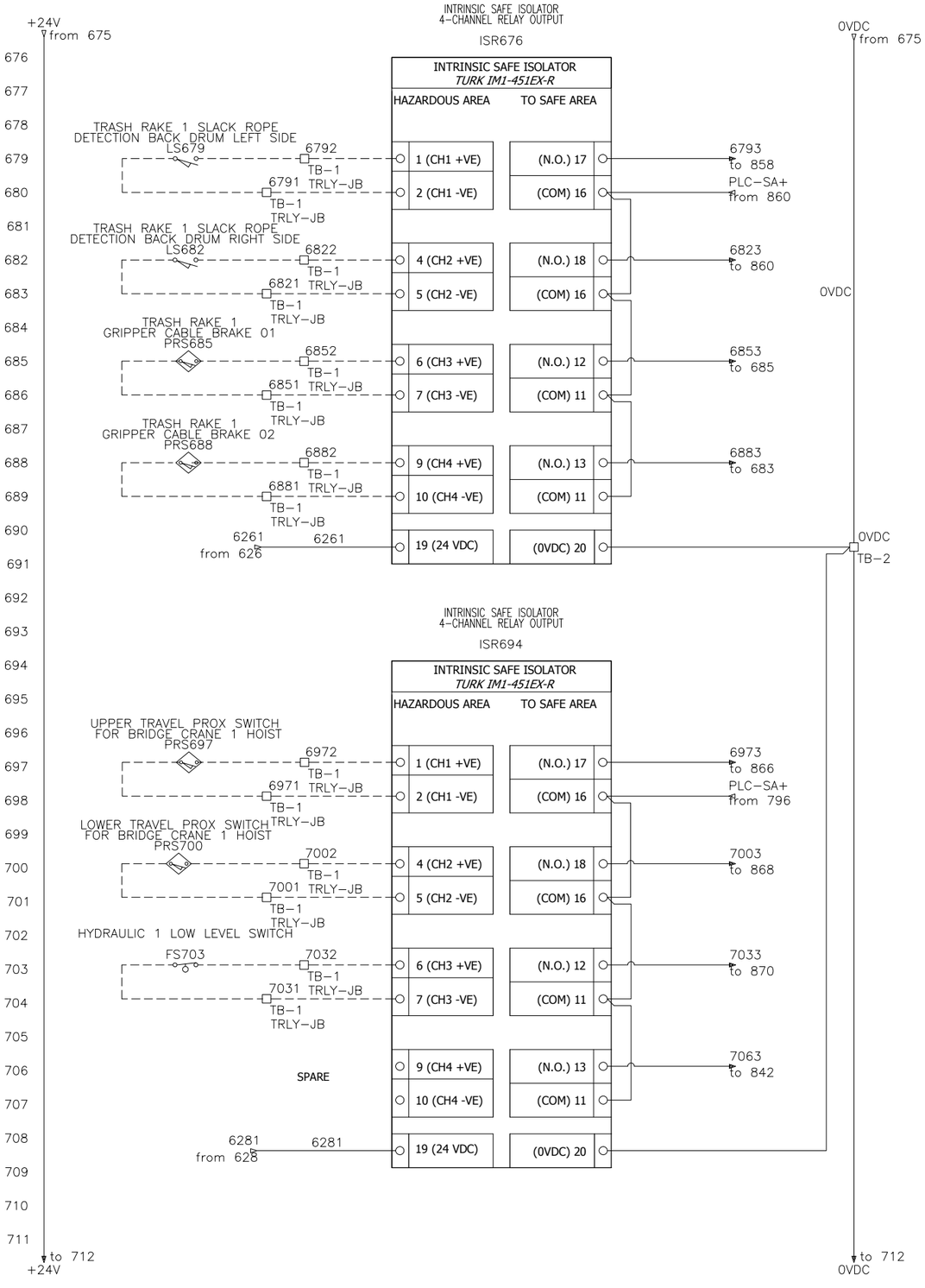
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WIRING LEGEND:

——— INTERNAL PANEL WIRING

– – – – – – – FIELD WIRING (BY OTHERS, NOT OVIVO)

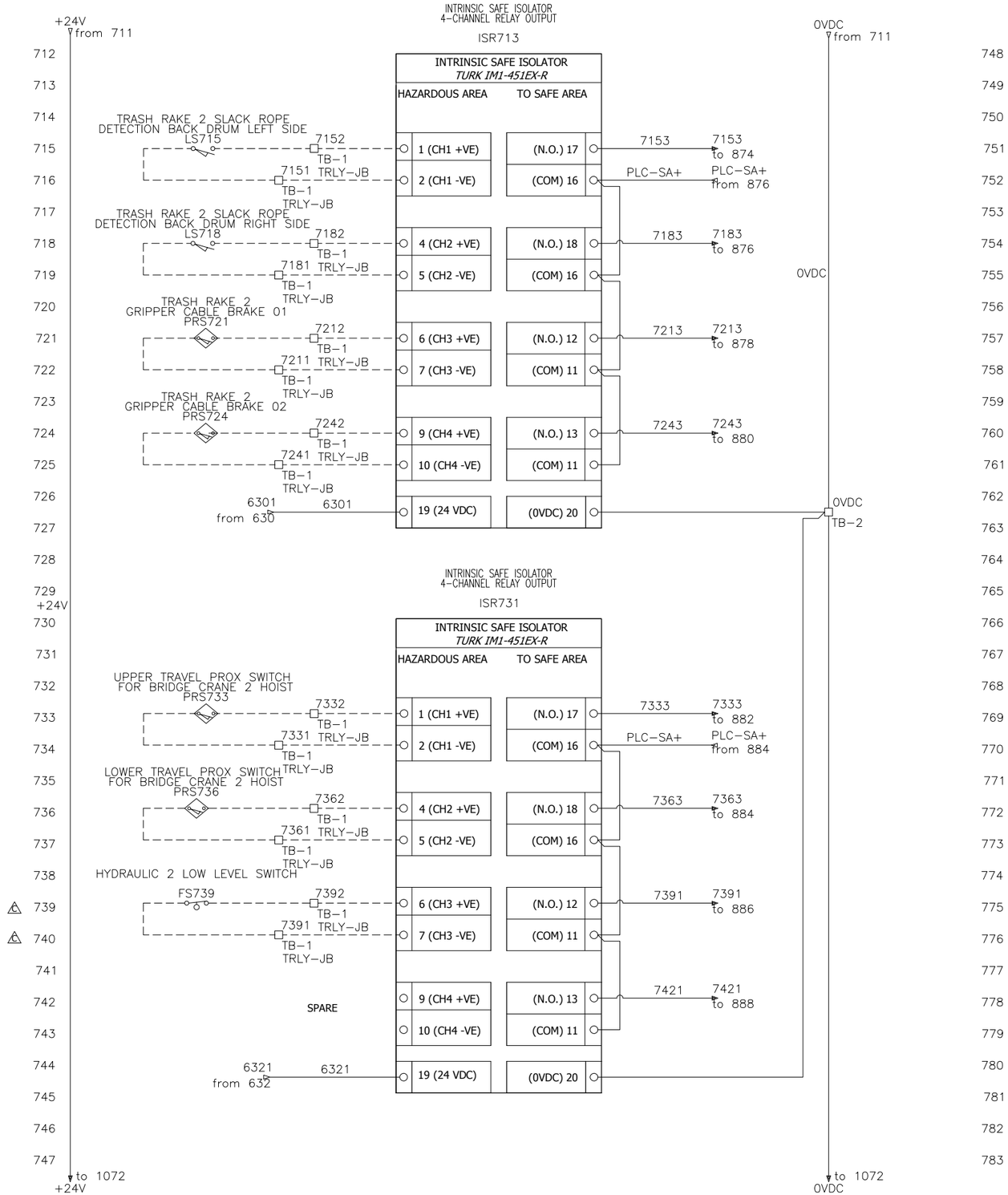
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DWG NO. **CSW1584-121**

SHEET 26 OF 32

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WIRING LEGEND:

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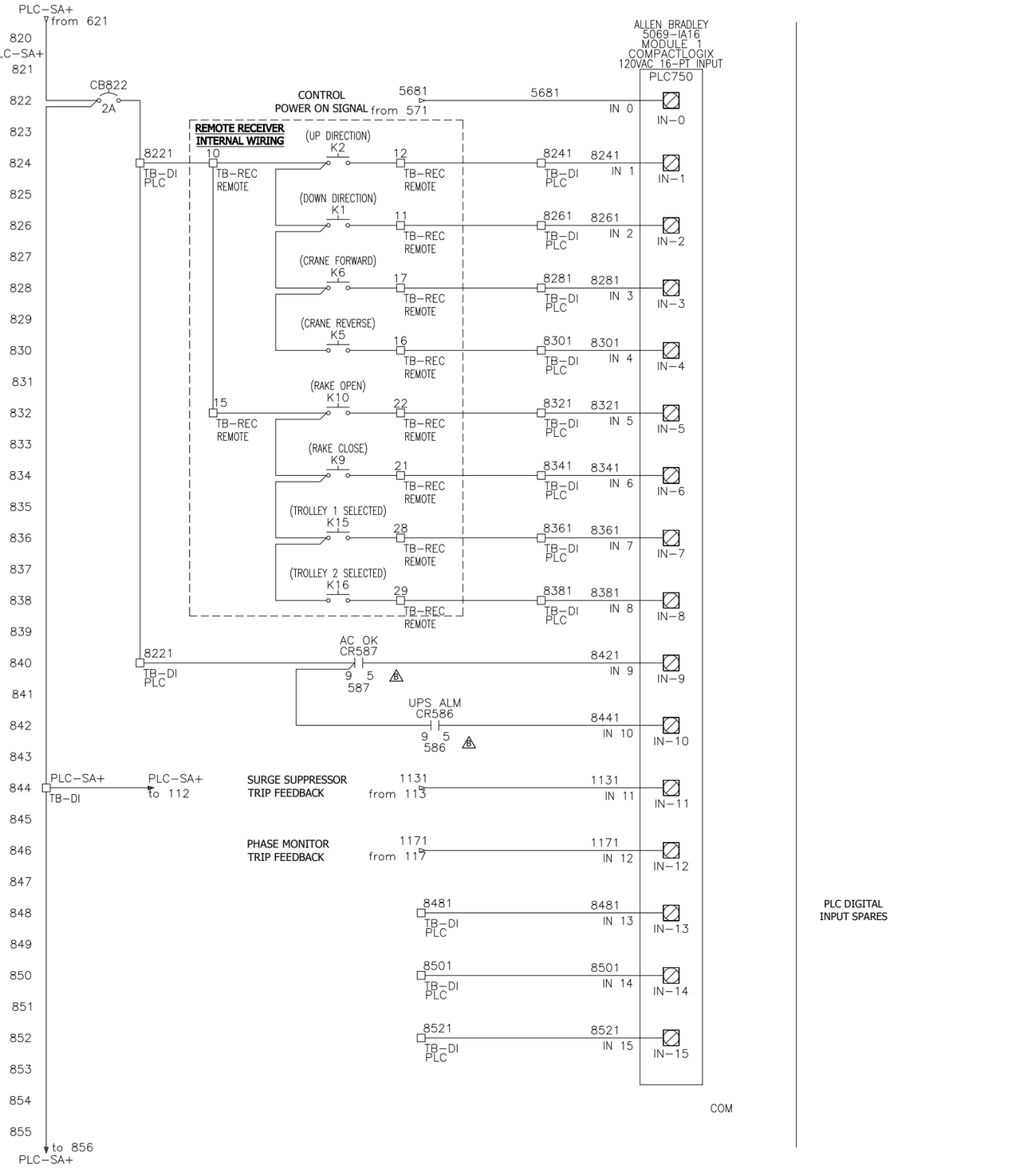
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SHEET 27 OF 32

REVISION F



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WORKMANSHIP STANDARD ES0001 APPLIES

OVIVO

DWG NO. CSW1584-121

SHEET 28 OF 32

F — REVISION

PLC-SA+
from 855

ALLEN BRADLEY
5069-IA16
MODULE 2
COMPACTLOGIX
120VAC 16-PT INPUT
PLC858

856							
857							
PLC-SA+ 858	TRASH RAKE 1 SLACK ROPE DETECTION BACK DRUM LEFT SIDE	6793 from 679	6793 TB-DI PLC	6793	IN 0	IN-0	
859							
860	TRASH RAKE 1 SLACK ROPE DETECTION BACK DRUM RIGHT SIDE	6823 from 682	6823 TB-DI PLC	6823	IN 1	IN-1	PLC-SA+ TB-DI PLC → PLC-SA+ to 680
861							
862	TRASH RAKE 1 GRIPPER CABLE BRAKE 01	6853 from 685	6853 TB-DI PLC	6853	IN 2	IN-2	
863							
864	TRASH RAKE 1 GRIPPER CABLE BRAKE 02	6883 from 688	6883 TB-DI PLC	6883	IN 3	IN-3	
865							
866	UPPER TRAVEL PROX SWITCH FOR BRIDGE CRANE 1 HOIST	6973 from 697	6973 TB-DI PLC	6973	IN 4	IN-4	
867							
868	LOWER TRAVEL PROX SWITCH FOR BRIDGE CRANE 1 HOIST	7003 from 700	7003 TB-DI PLC	7003	IN 5	IN-5	PLC-SA+ TB-DI PLC → PLC-SA+ to 698
869							
870	HYDRAULIC 1 LOW LEVEL SWITCH	7033 from 703	7033 TB-DI PLC	7033	IN 6	IN-6	
871							
872	IS SPARE INPUT	7063 from 706	7063 TB-DI PLC	7063	IN 7	IN-7	
873							
874	TRASH RAKE 2 SLACK ROPE DETECTION BACK DRUM LEFT SIDE	7153 from 715	7153 TB-DI PLC	7153	IN 8	IN-8	
875							
876	TRASH RAKE 2 SLACK ROPE DETECTION BACK DRUM RIGHT SIDE	7183 from 718	7183 TB-DI PLC	7183	IN 9	IN-9	PLC-SA+ TB-DI PLC → PLC-SA+ to 716
877							
878	TRASH RAKE 2 GRIPPER CABLE BRAKE 01	7213 from 721	7213 TB-DI PLC	7213	IN 10	IN-10	
879							
880	TRASH RAKE 2 GRIPPER CABLE BRAKE 02	7243 from 724	7243 TB-DI PLC	7243	IN 11	IN-11	
881							
882	UPPER TRAVEL PROX SWITCH FOR BRIDGE CRANE 2 HOIST	7333 from 733	7333 TB-DI PLC	7333	IN 12	IN-12	
883							
884	LOWER TRAVEL PROX SWITCH FOR BRIDGE CRANE 2 HOIST	7363 from 736	7363 TB-DI PLC	7363	IN 13	IN-13	PLC-SA+ TB-DI PLC → PLC-SA+ to 734
885							
⚠ 886	HYDRAULIC 2 LOW LEVEL SWITCH	7391 from 739	7391 TB-DI PLC	7391	IN 14	IN-14	
887							
888	IS SPARE INPUT	7421 from 742	7421 TB-DI PLC	7421	IN 15	IN-15	
889							
890							
891							

COM

to 892
PLC-SA+

PLC-SA+
from 891

ALLEN BRADLEY
5069-IA16
MODULE 3
COMPACTLOGIX
120VAC 16-PT INPUT
PLC894

892							
893							
PLC PLC-SA+ TB-DI 894	ECB606 TRIPP SIGNAL TO PLC DI	PLC-SA+ to 615	6161 from 616	6161 TB-DI PLC	6161	IN 0	IN-0
895							
PLC-SA+ 896	ECB625 TRIPP SIGNAL TO PLC DI	PLC-SA+ to 634	6351 from 635	6351 TB-DI PLC	6351	IN 1	IN-1
897							
PLC PLC-SA+ TB-DI 898	ECB642 TRIPP SIGNAL TO PLC DI	PLC-SA+ to 651	6521 from 652	6521 TB-DI PLC	6521	IN 2	IN-2
899							
900	ECB656 TRIPP SIGNAL TO PLC DI	PLC-SA+ to 672	6731 from 673	6731 TB-DI PLC	6731	IN 3	IN-3
901	BRIDGE CRAIN 1 HOIST MOTOR BRAKE M516						
PLC PLC-SA+ TB-DI 902				9021 TB-DI PLC	9021	IN 4	IN-4
903	BRIDGE CRAIN 2 HOIST MOTOR BRAKE CR943						
904				9041 TB-DI PLC	9041	IN 5	IN-5
905							
906				9061 TB-DI PLC	9061	IN 6	IN-6
907							
908				9081 TB-DI PLC	9081	IN 7	IN-7
909							
910				9101 TB-DI PLC	9101	IN 8	IN-8
911							
912				9121 TB-DI PLC	9121	IN 9	IN-9
913							
914				9141 TB-DI PLC	9141	IN 10	IN-10
915							
916				9161 TB-DI PLC	9161	IN 11	IN-11
917							
918				9181 TB-DI PLC	9181	IN 12	IN-12
919							
920				9201 TB-DI PLC	9201	IN 13	IN-13
921							
922				9221 TB-DI PLC	9221	IN 14	IN-14
923							
924				9241 TB-DI PLC	9241	IN 15	IN-15
925							
926							
927							

COM

PLC DIGITAL
INPUT SPARES

WIRING LEGEND:

———— INTERNAL PANEL WIRING

_ _ _ _ _ _ _ FIELD WIRING (BY OTHERS, NOT OVIVO)

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THIRD ANGLE PROJECTION

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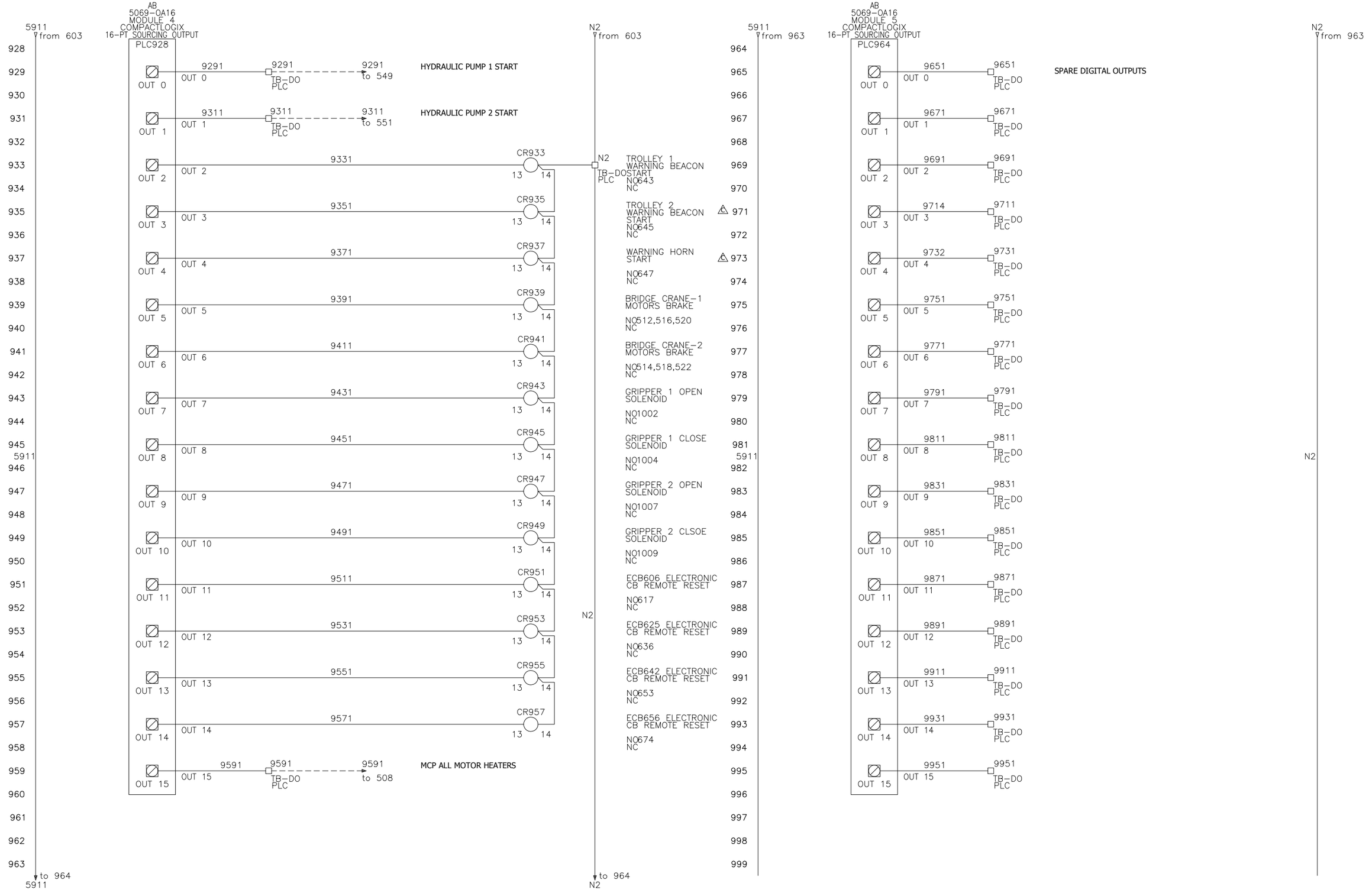
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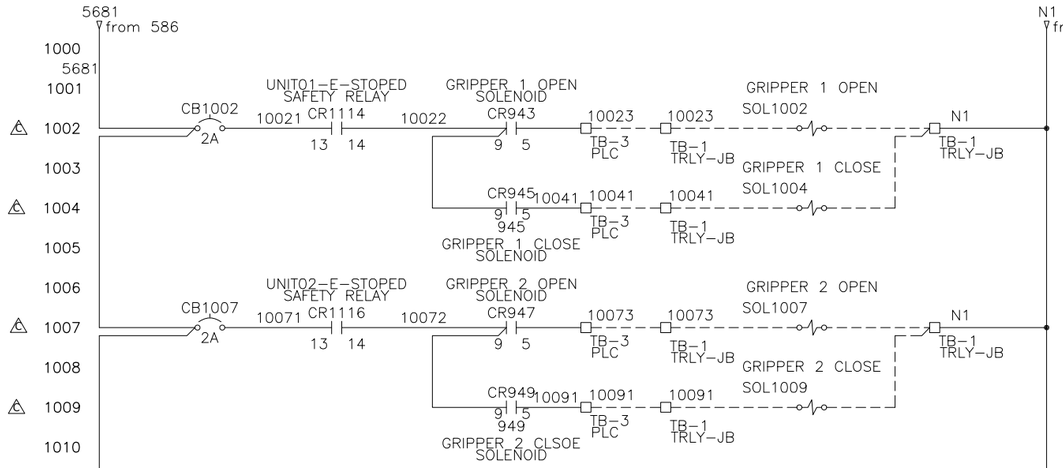


WIRING LEGEND:

———— INTERNAL PANEL WIRING

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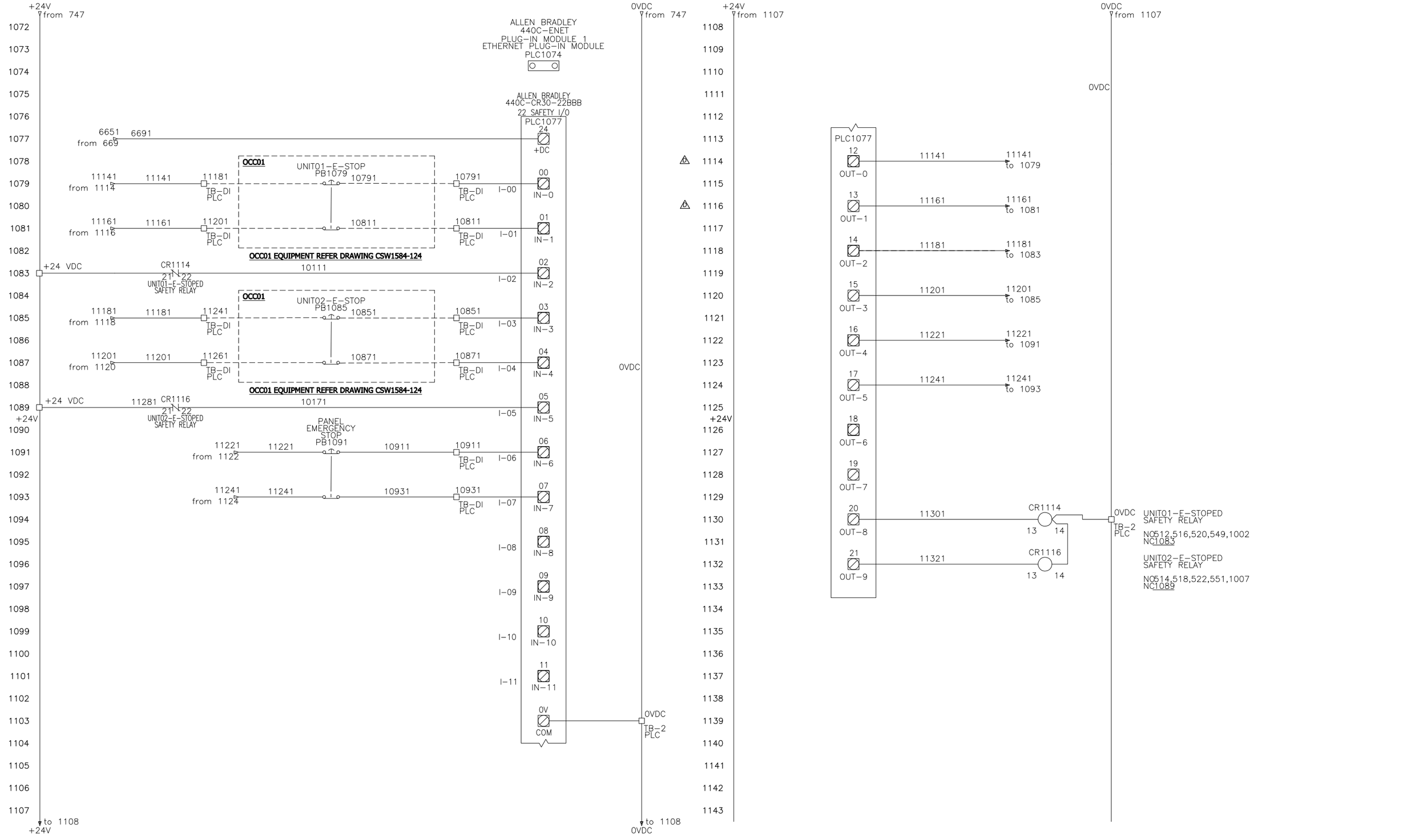
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F REVISION



WIRING LEGEND:

INTERNAL PANEL WIRING

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SHEET 32 OF 32

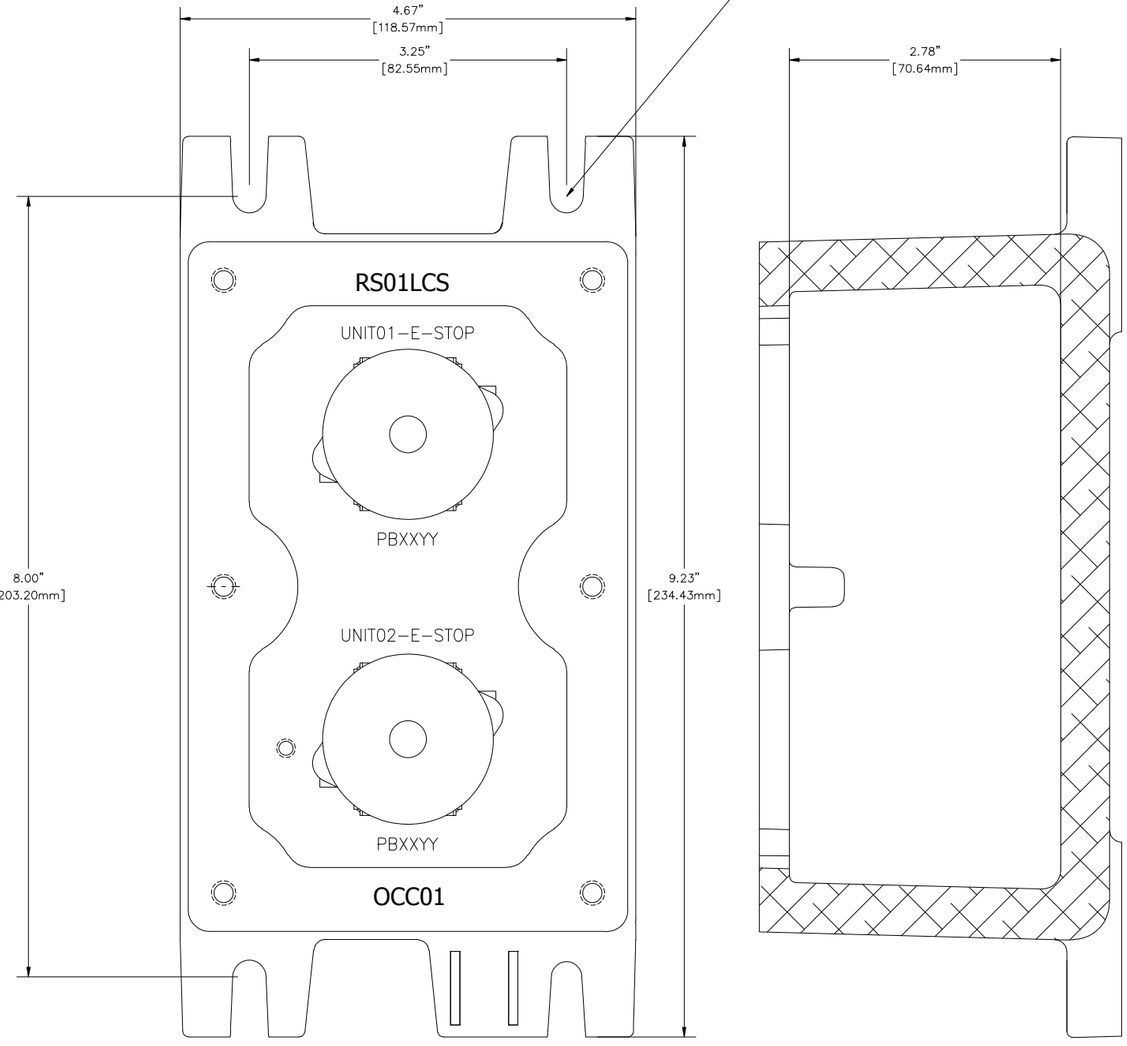
REVISION F

Rake Controls / OCC01 and OCC02 CSW1584-124 (Rev D)

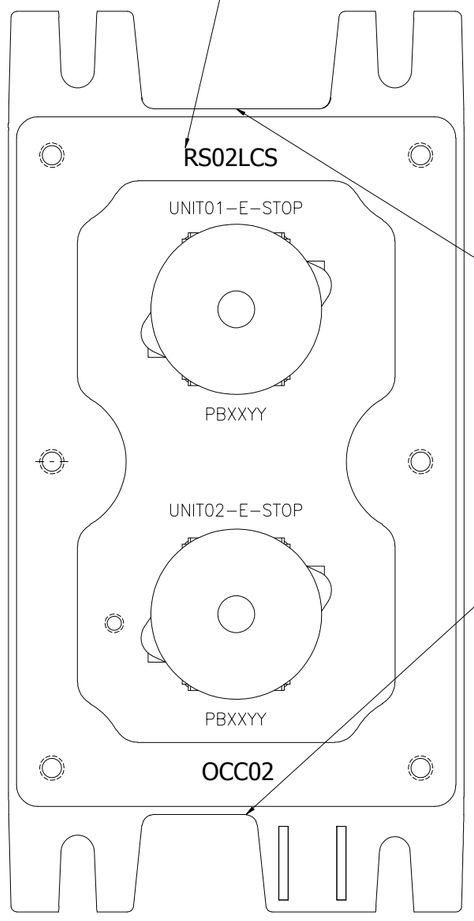
ITEM	CATALOG	MAKE	QTY	DESCRIPTION	TAG
1	X2-N4-464-464-ESTOP-ESTOP	ADALET	2	NEMA 7, ESTOP PUSHBUTTON STATION, W/ 2 NEMA 7 E-STOP PUSH BUTTONS, PUSH TO ACTIVATE, PULL TO RESET, LABLES PER DRAWING CSW1584-124	OCC01, OCC02

SEE QUOTE CD01242022A FOR ENCLOSURE DETAILS

USE $\frac{5}{16}$ MTG. BOLTS, STAINLESS STEEL



LABELS PROVIDED BY ENCLOSURE MANUFACTURE, STANDARD LABELS, NO SPECIAL REQUIREMENTS SPECIFIED, TYPICAL OF ALL LABELS



$\frac{3}{4}$ INCH PRE–DRILLED CONDUIT HOLES TYPICAL FOR OCC01 AND OCC02, TOP CONDUIT HOLE TO BE PROVIDED WITH CLASS 1 DIV. 1 CONDUIT SEAL. ALL CUSTOMER FIELD CONNECTIONS TO ME FROM BOTTOM. CUSTOMER TO PROVIDE CORRECTLY SIZED CONDUIT AND RATED FOR THE CLASS 1 DIV. 1 ENVIRONMENT (RIDGED STEEL, PVC COATED CONDUIT).

ELECTRICAL DRAWING INDEX

DWG #	SHEET DESRIPTION
CSW1584-124	LOCAL OCC CONTROL PANELS, RS01 AND RS02

1. **COMPONENTS SPECIFIC**

1.1 PART TO BE HELD AT PANEL SHOP FOR FUTURE PANEL BUILD

1.2 PUSHBUTTONS TO HAVE TWO n/c CONTACTS PER BUTTON

1.3 PUSHBUTTONS TO BE RED, MUSHROOM TYPE

2. **GENERAL NOTES**

2.1 PARTS TO BE PURCHASED PRIOR TO PANEL BUILD FOR LONG LEAD ITEMS, SEE DRAWING CSW1584-129 FOR PRE-RELEASE BOM

2.2 WIRING ACCORDING TO CSW1548-121

2.3 OCC'S MOUNTED NEXT TO EQUIPMENT AND IN LINE OF SITE OF EQUIPMENT, MOUNTING SHALL AT A HEIGHT NO LESS THAN 4 FEET AND NOT GREATER THAN 5 FEET.

2.4 OCC'S TO BE INSTALLED BY CUSTOMER, ALL WIRING TO BE INSTALLED BY CUSTOMER

LOCAL CONTROL STATIONS, OCC01 AND OCC02

REVISION	EN/ECO	BY	CHECK'D	DATE
FAT UPDATES	020763	SOG	MN	02/15/23
AS BUILT DRAWING	019148	SMM	SOG	03/24/22
UPDATED TO INCLUDE PUMP 2 PROVISIONS	018999	JG	SOG	03/08/22
INITIAL RELEASE	-	SOG	JP	1/27/2022

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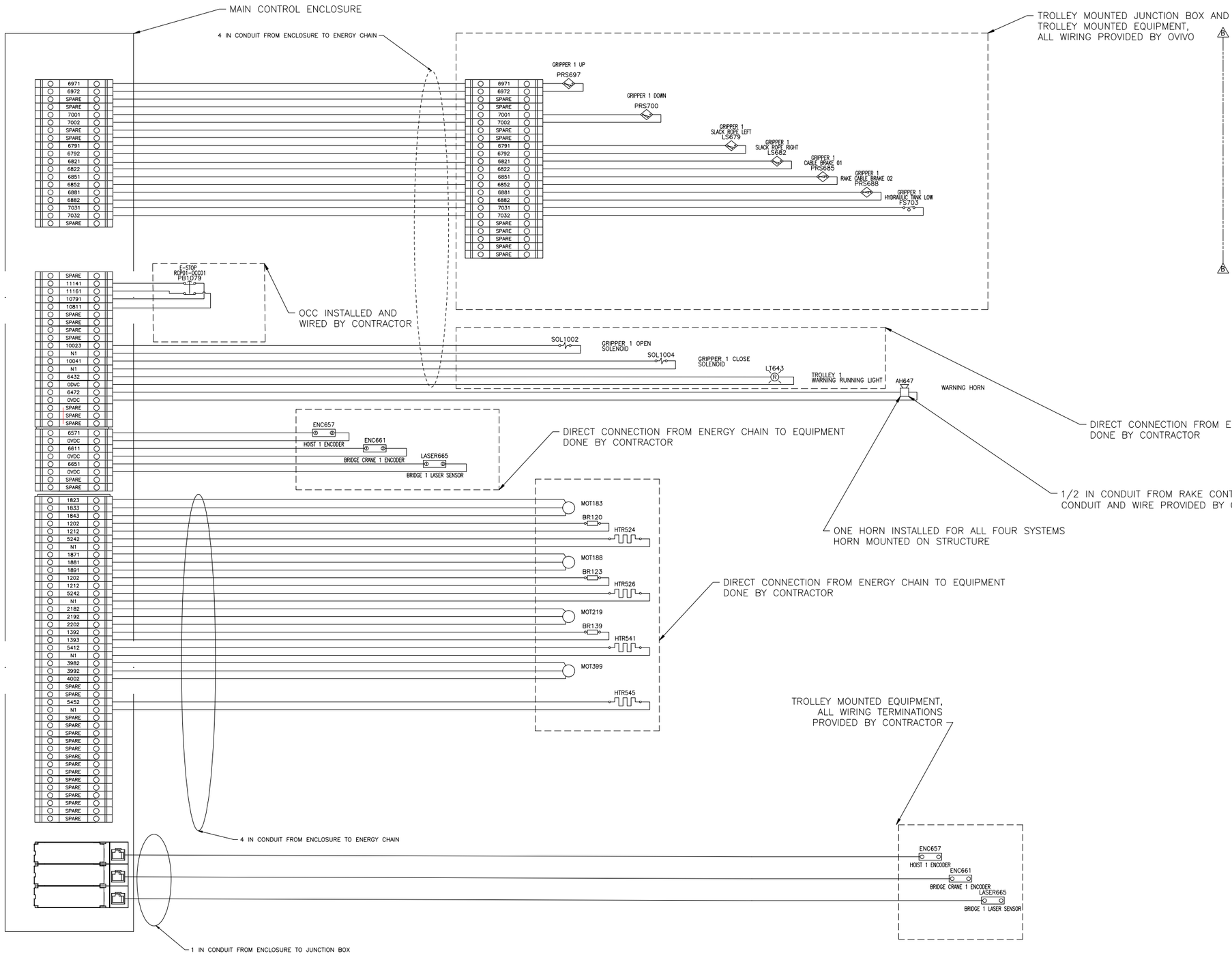
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DATE (mm/dd/yyyy)	2/7/2019	WORKMANSHIP STANDARD ES0001 APPLIES
DRAWN	SOG	ORIGINAL S.O.
CHECK'D	JP	CSW1584-01

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RAKE CONTROLS
OCC01 AND OCC02

DWG. NO.		SHEET	REV
	CSW1584-124	1 OF 1	D

Rake Control System / 01 and 02 CSW1584-125 (Rev G)



ELECTRICAL DRAWING INDEX

SHEET	SHEET DESRIPTION
1	RAKE CONTROL SYSTEM 01 (FCD)
2	SYSTEM 1 MOTOR FIELD WIRING TERMINATIONS AND FIELD INSTALLATION
3	SYSTEM 1 CONTROL AND CONTROL POWER FIELD WIRING TERMINATIONS AND FIELD INSTALLATION
4	RAKE CONTROL SYSTEM 02 (FCD)
5	SYSTEM 2 MOTOR FIELD WIRING TERMINATIONS AND FIELD INSTALLATION
6	SYSTEM 2 CONTROL AND CONTROL POWER FIELD WIRING TERMINATIONS AND FIELD INSTALLATION
7	ENERGY CHAIN CABLE LAYOUT
8	CABLE NUMBERING, LOCATION IN CHAIN AND DESCRIPTION
9	TYPICAL CONDUIT CONNECTION AND MOTOR CONDUIT CONNECTION
10	ENCODER FIELD INTERCONNECTION & CABLE CONNECTION DETAILS
11	LASER SENSOR FIELD INTERCONNECTION & CABLE CONNECTION DETAILS

1. **GENERAL NOTES**

1.1 WIRING ACCORDING TO CSW1584-121.

1.2 OCC'S TO BE MOUNTED NEXT TO EQUIPMENT AND IN LINE OF SIGHT OF EQUIPMENT, MOUNTING SHALL BE AT A HEIGHT OF NO LESS THAN 4 FEET AND NO GREATER THAN 5 FEET.

1.3 OCC'S TO BE INSTALLED BY CUSTOMER, ALL WIRING TO BE INSTALLED BY CUSTOMER, EXISTING CONDUIT CAN BE USED.

1.4 TYPICAL DRAWING FOR ONE UNIT, TWO UNITS REQUIRED PER MAIN CONTROL PANEL.

1.5 ALL CONDUIT TO BE INSTALLED PER THE CLASSIFICATION OF THE AREA, CLASSIFIED AREA CONDUIT TO BE INSTALLED USING RIGID STEEL PVC COATED PIPE.

RAKE CONTROL SYSTEM 01 (FCD)

REVISION	EN/ECO	BY	CHECK'D	DATE
FAT UPDATES	020763	SOG	MN	02/15/23
NA	-	SOG	NA	02/15/23
AS BUILT DRAWING	019148	SMM	SOG	03/24/22
UPDATED TO INCLUDE PUMP 2 PROVISIONS	018999	JG	SOG	03/08/22
PROOFREAD DOCUMENT	019075	ES	SOG	3/18/22
UPDATES AND ADDED DETAIL FOR CONTRACTOR	018999	JG	SOG	3/4/2022
INITIAL RELEASE	018934	SOG	JP	1/27/2022

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DRAWN	SOG	ORIGINAL S.O.	DWG. NO. CSW1584-125
CHECK'D	JP	CSW1584-01	SHEET 1 OF 11 REV G

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RAKE CONTROL SYSTEM
01 AND 02
FIELD CONNECTION DIAGRAMS

1. **CABLE NOTE**

1.1 IGUS VFD RATED CABLE, 14 AWG, SHIELDED, 4 3 WIRE WITH GROUND, WITH 2 PAIR 16 AWG SIGNAL CONTROL WIRES, 600 VAC RATED, CABLE TO BE ROUTED THROUGH CONDUIT FROM ENERGY CHAIN TO MAIN CONTROL ENCLOSURE.

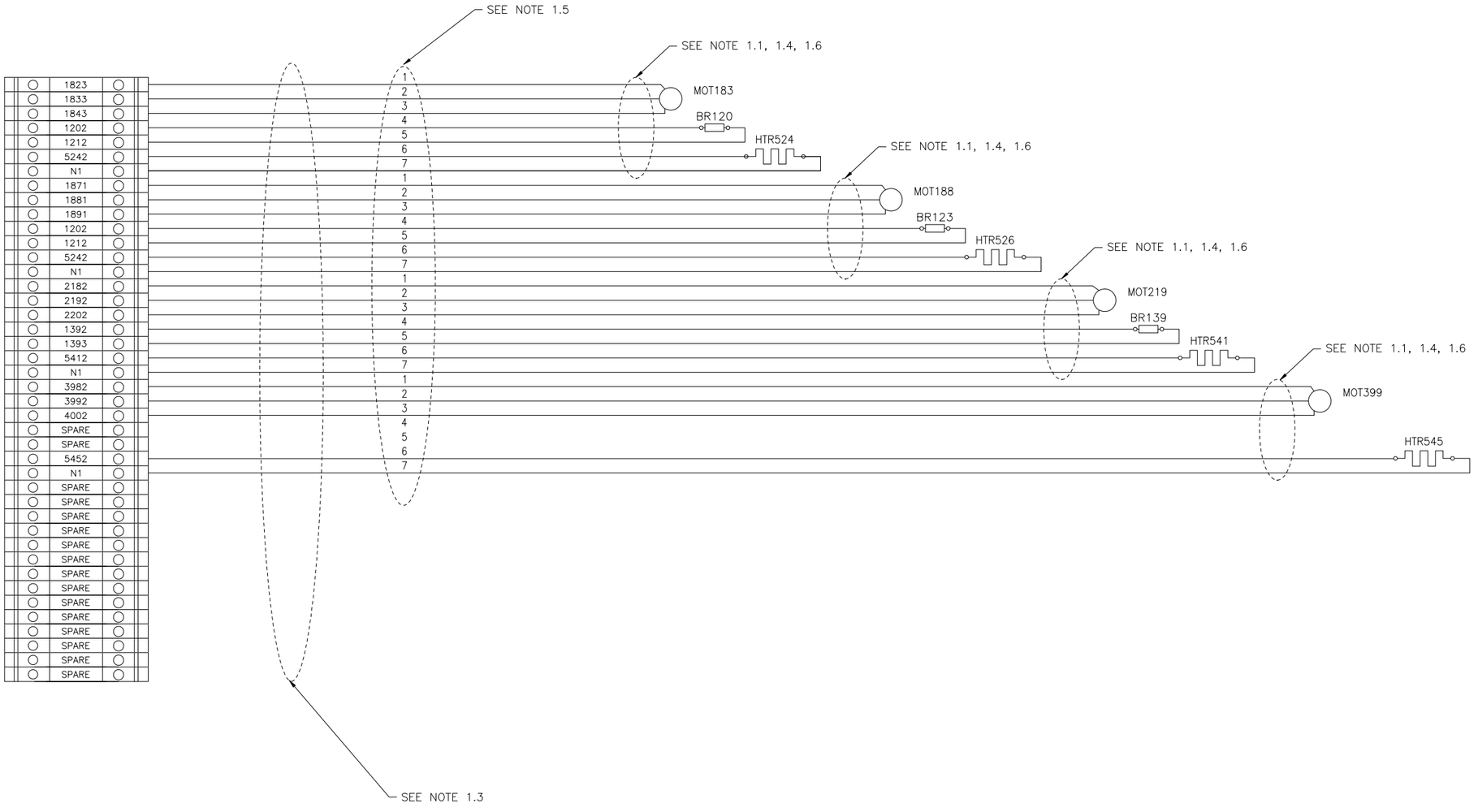
1.2 CONDUIT TO BE INSTALLED AT THE BOTTOM BASE PLATE OF THE ENCLOSURE, NO PENETRATION AT THE TOP. ENCLOSURE INSTALLED IN A NON CLASSIFIED AREA. REFER TO CSW1584-121 FOR CABLE TYPES.

1.3 CONDUIT AND TERMINATIONS TO BE INSTALLED AND WIRED BY THE ELECTRICAL CONTRACTOR.

1.4 ALL VFD CABLE SHIELDS TO BE TERMINATED AT THE ENCLOSURE END ONLY.

1.5 CABLE WIRE NUMBER DESIGNATION.

1.6 GROUND WIRES TO BE TERMINATED AT EACH END OF EQUIPMENT AND MAIN PANEL, GROUND WIRES COLOR GREEN/YELLOW.



SYSTEM 01 MOTOR FIELD WIRING TERMINATIONS AND FIELD INSTALLATION

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CHECK'D	JP	CSW1584-01

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RAKE CONTROL SYSTEM
01 AND 02
FIELD CONNECTION DIAGRAMS

DWG. NO.	SHEET	REV
CSW1584-125	2 OF 11	G

1. **CABLE NOTE**

1.1 IGUS RATED CABLE, 16 AWG, 25 WIRE WITH GROUND, 600 VAC RATED, CABLE TO BE ROUTED THROUGH CONDUIT FROM ENERGY CHAIN TO MAIN CONTROL ENCLOSURE.

1.2 CONDUIT AND TERMINATIONS TO BE INSTALLED AND WIRED BY THE ELECTRICAL CONTRACTOR.

1.3 TROLLEY CONTROL SIGNALS TO BE ROUTED IN SAME CONDUIT.

1.4 OCC'S TO BE LOCATED IN CLASSIFIED AREA IN LINE OF SITE OF EQUIPMENT, SEE CSW1584-124 FOR OCC ASSEMBLY.

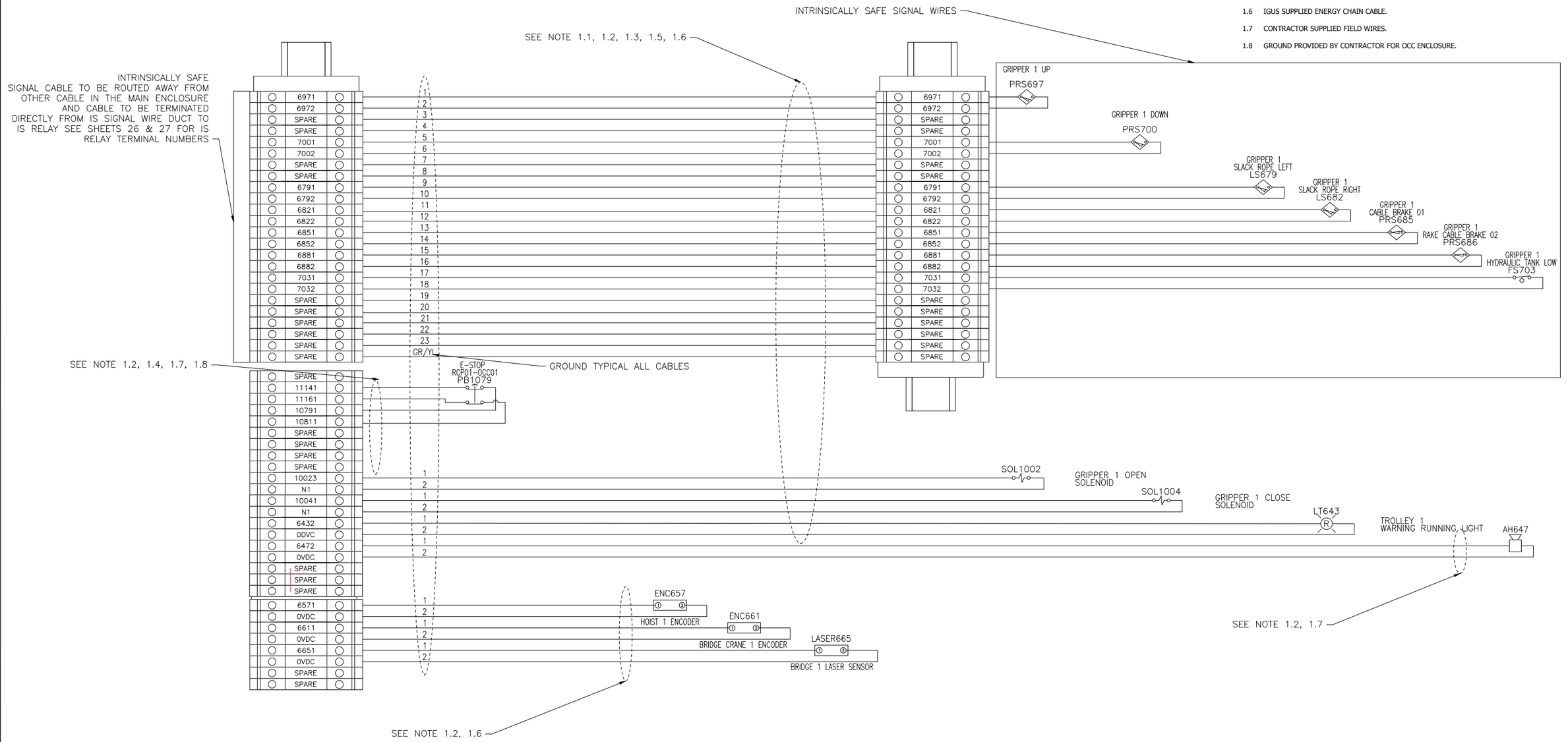
CABLE WIRE NUMBER DESIGNATION.

1.5 GROUND WIRES TO BE TERMINATED AT EACH END OF EQUIPMENT AND MAIN PANEL, GROUND WIRES COLOR GREEN/YELLOW.

1.6 IGUS SUPPLIED ENERGY CHAIN CABLE.

1.7 CONTRACTOR SUPPLIED FIELD WIRES.

1.8 GROUND PROVIDED BY CONTRACTOR FOR OCC ENCLOSURE.



SYSTEM 1 CONTROL AND CONTROL POWER FIELD WIRING TERMINATIONS AND FIELD INSTALLATION

REVISION	EN/ECO	BY	CHECK'D	DATE

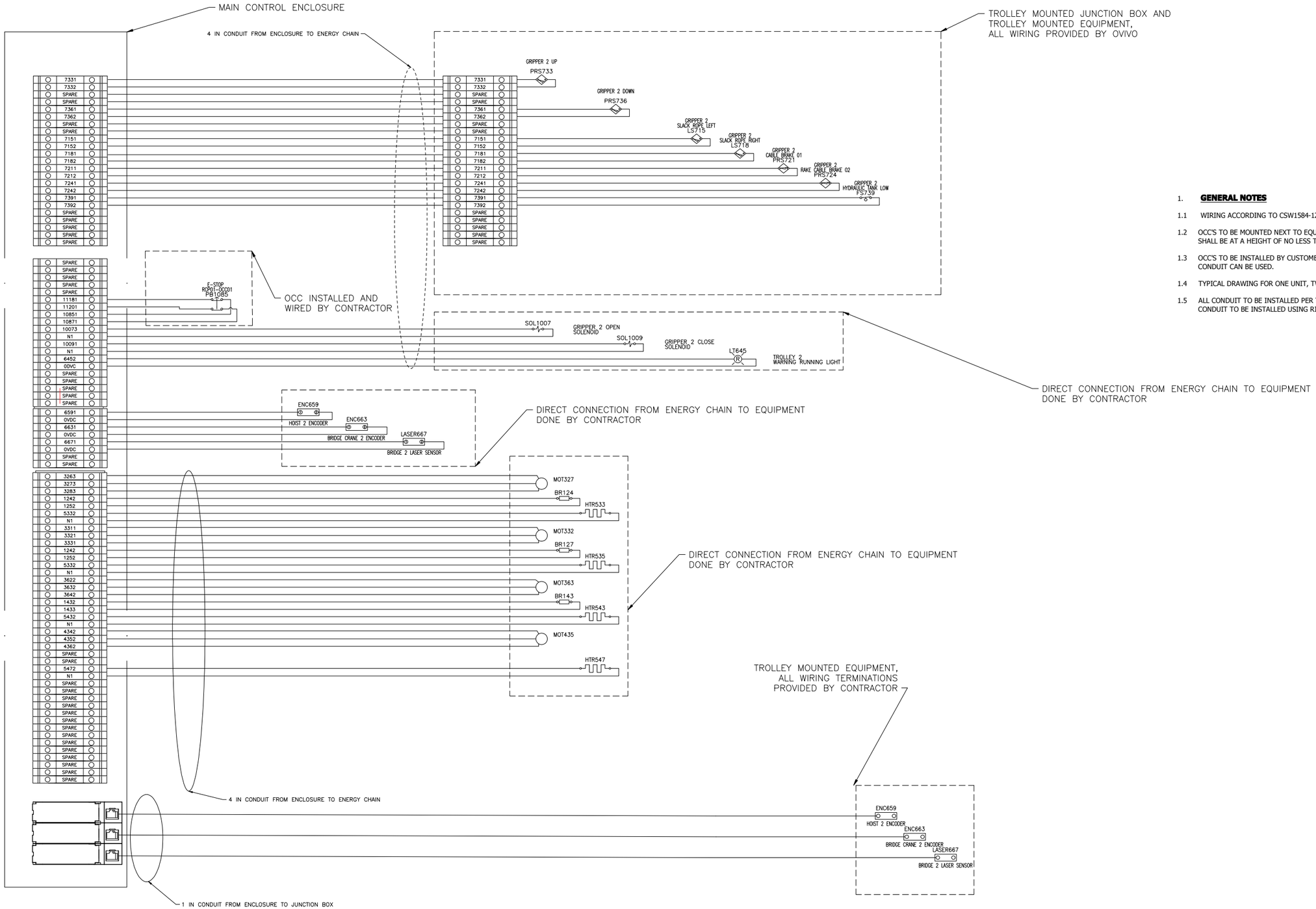
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RAKE CONTROL SYSTEM
01 AND 02
FIELD CONNECTION DIAGRAMS

DWG. NO.	SHEET	REV
CSW1584-125	3 OF 11	G



1. **GENERAL NOTES**

1.1 WIRING ACCORDING TO CSW1584-121.

1.2 OCC'S TO BE MOUNTED NEXT TO EQUIPMENT AND IN LINE OF SIGHT OF EQUIPMENT, MOUNTING SHALL BE AT A HEIGHT OF NO LESS THAN 4 FEET AND NO GREATER THAN 5 FEET.

1.3 OCC'S TO BE INSTALLED BY CUSTOMER, ALL WIRING TO BE INSTALLED BY CUSTOMER, EXISTING CONDUIT CAN BE USED.

1.4 TYPICAL DRAWING FOR ONE UNIT, TWO UNITS REQUIRED PER MAIN CONTROL PANEL.

1.5 ALL CONDUIT TO BE INSTALLED PER THE CLASSIFICATION OF THE AREA, CLASSIFIED AREA CONDUIT TO BE INSTALLED USING RIGID STEEL PVC COATED PIPE.

RAKE CONTROL SYSTEM 02 (FCD)

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RAKE CONTROL SYSTEM
01 AND 02
FIELD CONNECTION DIAGRAMS

DWG. NO.	SHEET	REV
CSW1584-125	4 OF 11	G

1. **CABLE NOTE**

1.1 IGUS VFD RATED CABLE, 14 AWG, SHIELDED, 4 3 WIRE WITH GROUND, WITH 2 PAIR 16 AWG SIGNAL CONTROL WIRES, 600 VAC RATED, CABLE TO BE ROUTED THROUGH CONDUIT FROM ENERGY CHAIN TO MAIN CONTROL ENCLOSURE.

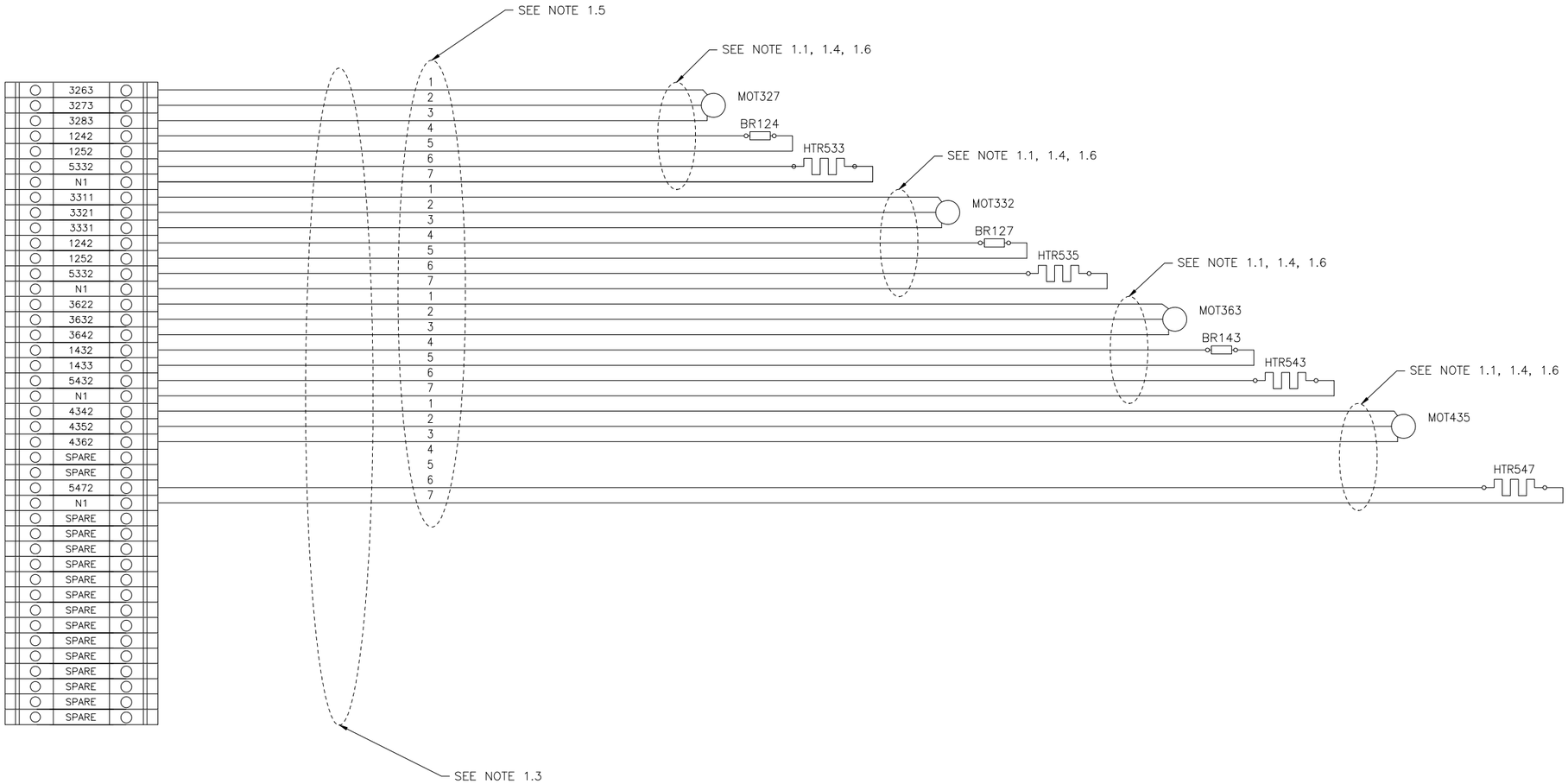
1.2 CONDUIT TO BE INSTALLED AT THE BOTTOM BASE PLATE OF THE ENCLOSURE, NO PENETRATION AT THE TOP. ENCLOSURE INSTALLED IN A NON CLASSIFIED AREA. REFER TO CSW1584-121 FOR CABLE TYPES.

1.3 CONDUIT AND TERMINATIONS TO BE INSTALLED AND WIRED BY THE ELECTRICAL CONTRACTOR.

1.4 ALL VFD CABLE SHIELDS TO BE TERMINATED AT THE ENCLOSURE END ONLY.

1.5 CABLE WIRE NUMBER DESIGNATION.

1.6 GROUND WIRES TO BE TERMINATED AT EACH END OF EQUIPMENT AND MAIN PANEL, GROUND WIRES COLOR GREEN/YELLOW.



SYSTEM 2 MOTOR FIELD WIRING TERMINATIONS AND FIELD INSTALLATION

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RAKE CONTROL SYSTEM
01 AND 02
FIELD CONNECTION DIAGRAMS

DWG. NO.	SHEET	REV
CSW1584-125	5 OF 11	G

1. **CABLE NOTE**

1.1 IGUS RATED CABLE, 16 AWG, 25 WIRE WITH GROUND, 600 VAC RATED, CABLE TO BE ROUTED THROUGH CONDUIT FROM ENERGY CHAIN TO MAIN CONTROL ENCLOSURE.

1.2 CONDUIT AND TERMINATIONS TO BE INSTALLED AND WIRED BY THE ELECTRICAL CONTRACTOR.

1.3 TROLLEY CONTROL SIGNALS TO BE ROUTED IN SAME CONDUIT.

1.4 OCC'S TO BE LOCATED IN CLASSIFIED AREA IN LINE OF SITE OF EQUIPMENT, SEE CSW1584-124 FOR OCC ASSEMBLY.

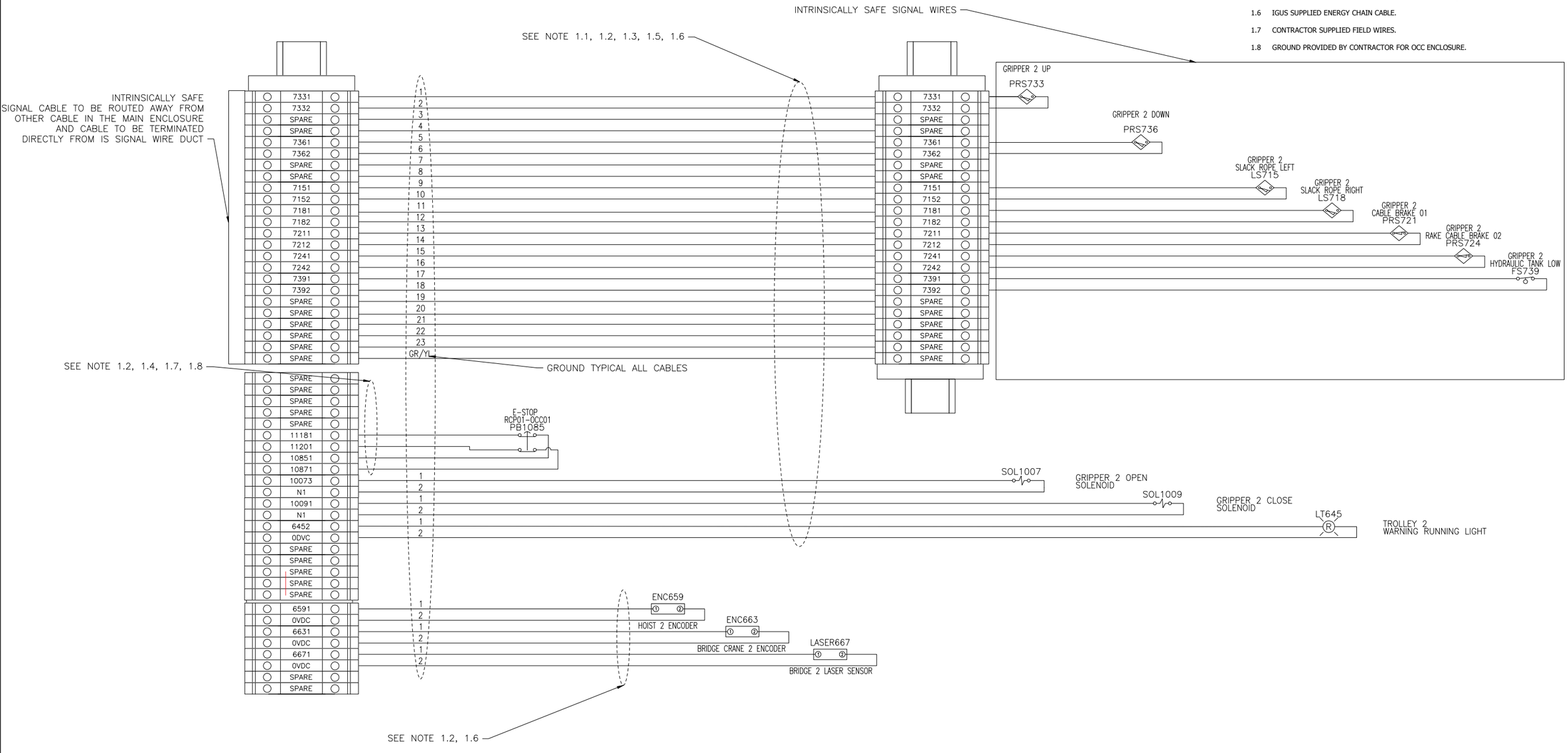
CABLE WIRE NUMBER DESIGNATION.

1.5 GROUND WIRES TO BE TERMINATED AT EACH END OF EQUIPMENT AND MAIN PANEL, GROUND WIRES COLOR GREEN/YELLOW.

1.6 IGUS SUPPLIED ENERGY CHAIN CABLE.

1.7 CONTRACTOR SUPPLIED FIELD WIRES.

1.8 GROUND PROVIDED BY CONTRACTOR FOR OCC ENCLOSURE.



SYSTEM 2 CONTROL AND CONTROL POWER FIELD WIRING TERMINATIONS AND FIELD INSTALLATION

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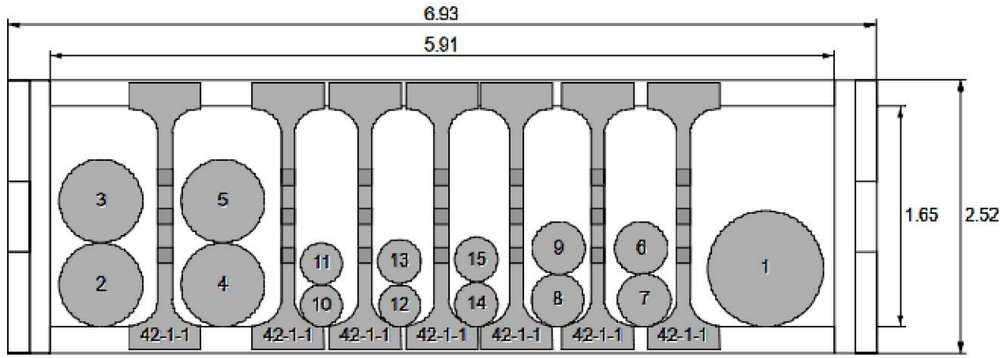
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RAKE CONTROL SYSTEM
01 AND 02
FIELD CONNECTION DIAGRAMS

DWG. NO. CSW1584-125

SHEET 6 OF 11

REV G



TO BE UPDATED TO INCLUDE 250 EXTRA FEET PER IGUS QUOTE

TO BE UPDATED TO INCLUDE 50 EXTRA FEET PER IGUS QUOTE

Pos.	Part No. Art.-Nr.	MAT No. MAT-Nr.	Length [ft] Länge [ft]	Fixed end Überstand FP [ft]	Moving end Überstand MN [ft]	CFX CFX	Index Index	Weight [lbs/ft] Gewicht [lbs/ft]	⌀ [inch] ⌀ [inch]	Lettering Beschriftung
1	CF9-UL-15-25		94.839	50	20			0.485	0.87	
2	CF27-25-15-02-02-D		94.839	50	20			0.257	0.63	
3	CF27-25-15-02-02-D		94.839	50	20			0.257	0.63	
4	CF27-25-15-02-02-D		94.839	50	20			0.257	0.63	
5	CF27-25-15-02-02-D		94.839	50	20			0.257	0.63	
6	CF34-UL-25-04-D		94.839	50	20			0.107	0.39	
7	CF34-UL-25-04-D		94.839	50	20			0.107	0.39	
8	CF34-UL-25-04-D		94.839	50	20			0.107	0.39	
9	CF34-UL-25-04-D		94.839	50	20			0.107	0.39	
10	CF34-UL-15-04-D		94.839	50	20			0.069	0.31	
11	CF34-UL-15-04-D		94.839	50	20			0.069	0.31	
12	CF34-UL-15-04-D		94.839	50	20			0.069	0.31	
13	CFBUS-045		94.839	50	20			0.056	0.33	
14	CFBUS-045		94.839	50	20			0.056	0.33	
15	CFBUS-045		94.839	50	20			0.056	0.33	

ENERGY CHAIN CABLE LAYOUT

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RAKE CONTROL SYSTEM
01 AND 02
FIELD CONNECTION DIAGRAMS

DWG. NO.	SHEET	REV
CSW1584-125	7 OF 11	G

ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER	DRAWING NO.
1	2	CONDUIT OUTLET BOX GUAT26 CROUSE-HINDS	STEEL	767758	767758
2	1	CONDUIT SEALING FITTING EYS31 CROUSE-HINDS	STEEL	767759	767759
3	1	CONDUIT GLAND CBG396 CROUSE-HINDS	STEEL	767762-D	767762-D
4	1	CONDUIT REDUCER 1" TO 3/4" NPT CROUSE-HINDS	STEEL	767765-D	767765-D

1. **GENERAL NOTES**

1.1 WIRING ACCORDING TO CSW1584-121.

1.2 ALL FITTINGS PROVIDED BY CONTRACTOR. OVIVO SUGGESTED PARTS TO BE USED.

1.3 WIRING AND INSTALLATION BY CONTRACTOR.

1.4 SEALING AND HEAT SHRINK OF FITTINGS TO BE DONE BE CONTRACTOR AFTER SYSTEM SAT IS COMPLETE.

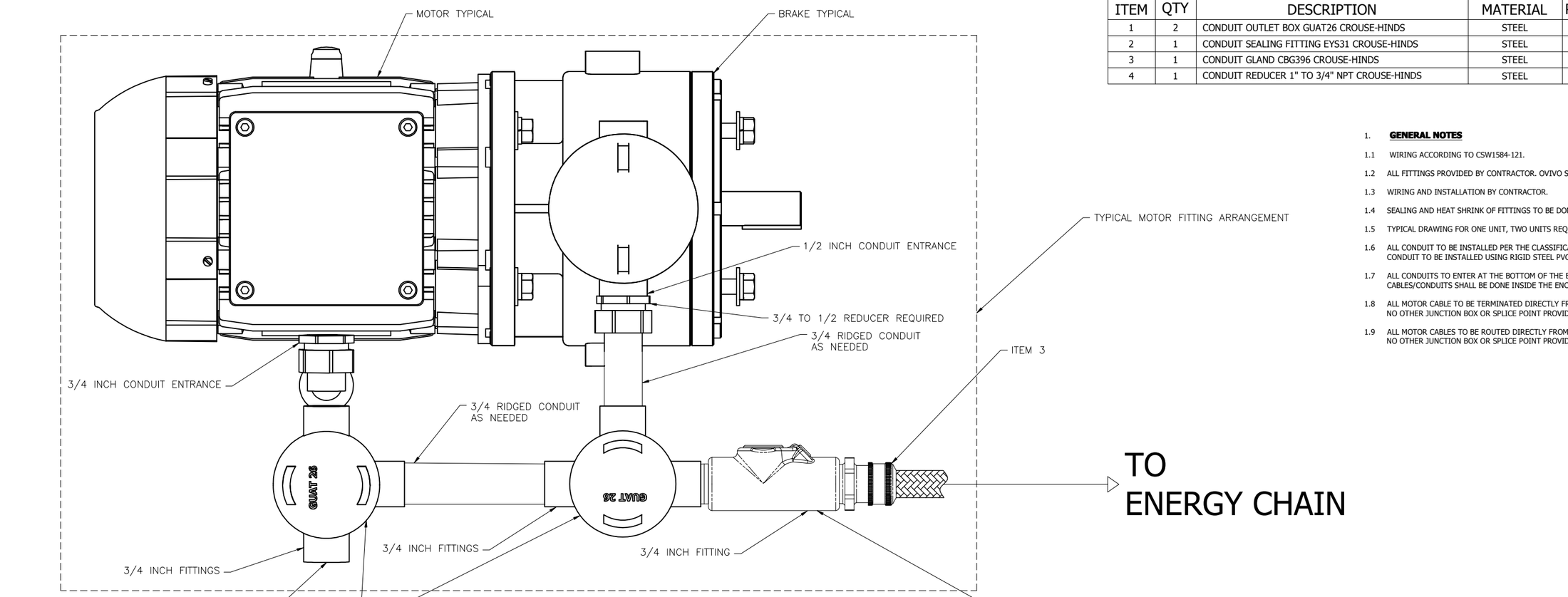
1.5 TYPICAL DRAWING FOR ONE UNIT, TWO UNITS REQUIRED PER MAIN CONTROL PANEL.

1.6 ALL CONDUIT TO BE INSTALLED PER THE CLASSIFICATION OF THE AREA, CLASSIFIED AREA CONDUIT TO BE INSTALLED USING RIGID STEEL PVC COATED PIPE.

1.7 ALL CONDUITS TO ENTER AT THE BOTTOM OF THE ENCLOSURE, NO ROUTING OF CABLES/CONDUITS SHALL BE DONE INSIDE THE ENCLOSURE.

1.8 ALL MOTOR CABLE TO BE TERMINATED DIRECTLY FROM THE ENERGY CHAIN, NO OTHER JUNCTION BOX OR SPLICE POINT PROVIDED.

1.9 ALL MOTOR CABLES TO BE ROUTED DIRECTLY FROM THE ENERGY CHAIN TO THE MAIN MCP ENCLOSURE, NO OTHER JUNCTION BOX OR SPLICE POINT PROVIDED.



TYPICAL CONDUIT CONNECTION AND MOTOR CONDUIT CONNECTION

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RAKE CONTROL SYSTEM
01 AND 02
FIELD CONNECTION DIAGRAMS

DWG. NO.	SHEET	REV
CSW1584-125	8 OF 11	G

1. **GENERAL NOTES**

1.1 WIRING ACCORDING TO CSW1584-121.

1.2 ALL FITTINGS PROVIDED BY CONTRACTOR.

1.3 WIRING AND INSTALLATION BY CONTRACTOR.

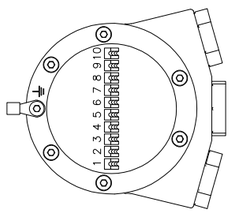
1.5 TYPICAL DRAWING FOR ONE ENCODER, TYPICAL ALL ENCODERS.

1.6 ALL FITTINGS TO BE INSTALLED PER THE CLASSIFICATION OF THE AREA, CLASSIFIED AREA CONDUIT TO BE INSTALLED USING RIGID STEEL PVC COATED PIPE, IF REQUIRED.

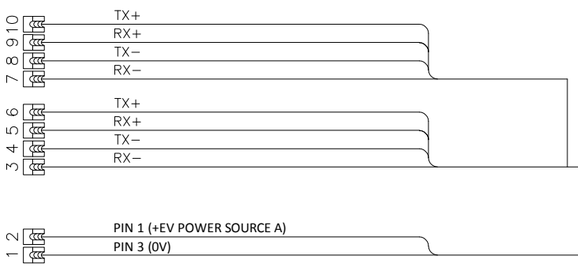
1.7 ALL ENCODER CABLES TO BE DIRECTLY TERMINATED FROM THE ENERGY CHAIN, NO OTHER JUNCTION BOX OR SPLICE POINT PROVIDED.

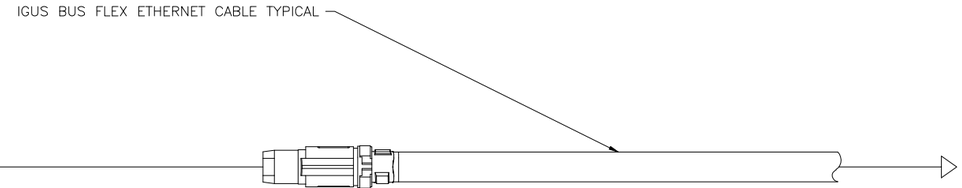
1.8 ALL ENCODER CABLES TO BE ROUTED DIRECTLY FROM THE ENERGY CHAIN TO THE MAIN PLC ENCLOSURE, NO OTHER JUNCTION BOX OR SPLICE POINT PROVIDED.

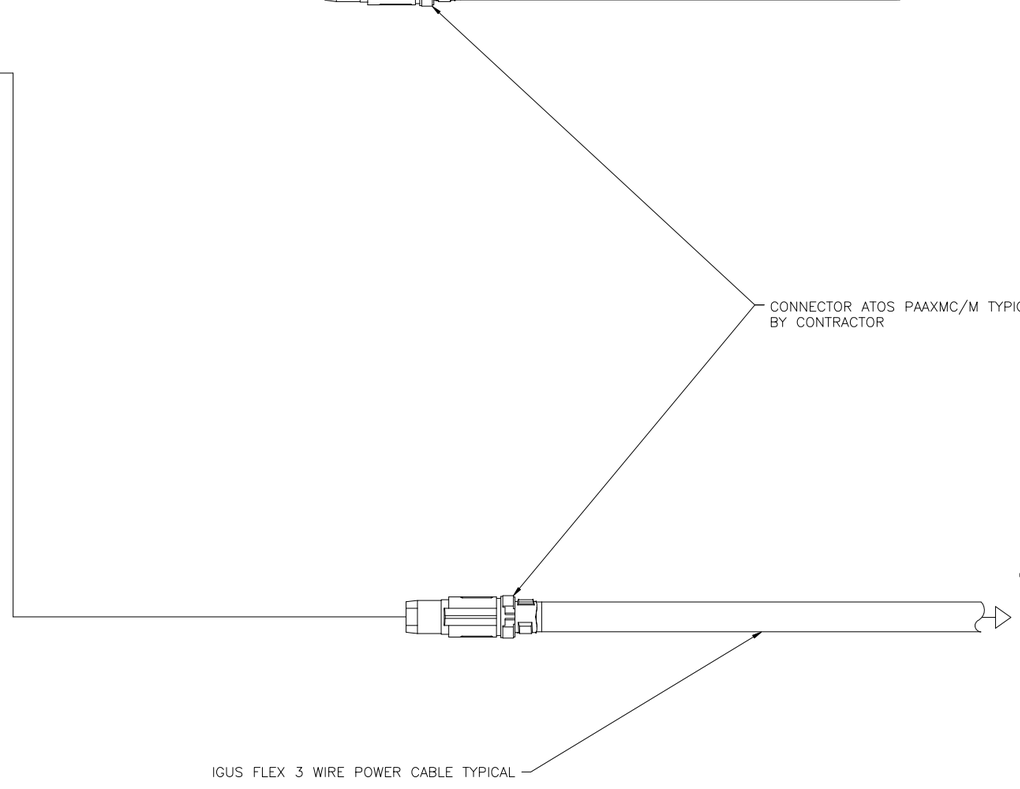
EtherNet/IP	
Function	Pin
+E Volt	1
0 Volt	2
TX+_1	3
TX-_1	4
RX+_1	5
RX-_1	6
TX+_2	7
TX-_2	8
RX+_2	9
RX-_2	10

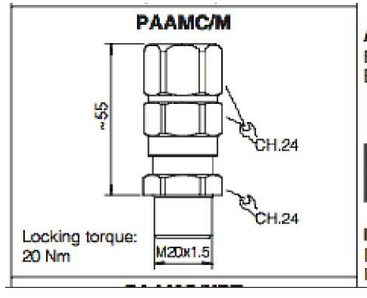


TYPICAL ENCODER
TROLLEY MOTOR
LINDE 648 SERIES









ATEX:
EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31

IECEx:
IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31

Material:
Nickel plated brass

Threaded connection:
M20x1,5 UNI-4535 (6H/6g)

cable size:
INNER sheath size 3,2 to 8 mm
OUTER sheath size 5,5 to 12 mm

On-off and proportional ex-proof valves with "M" threaded connection (solenoid and transducer)

ENCODER FIELD INTERCONNECTION & CABLE CONNECTION DETAILS

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RAKE CONTROL SYSTEM
01 AND 02
FIELD CONNECTION DIAGRAMS

DWG. NO. CSW1584-125

SHEET 9 OF 11

REV G

1. **GENERAL NOTES**

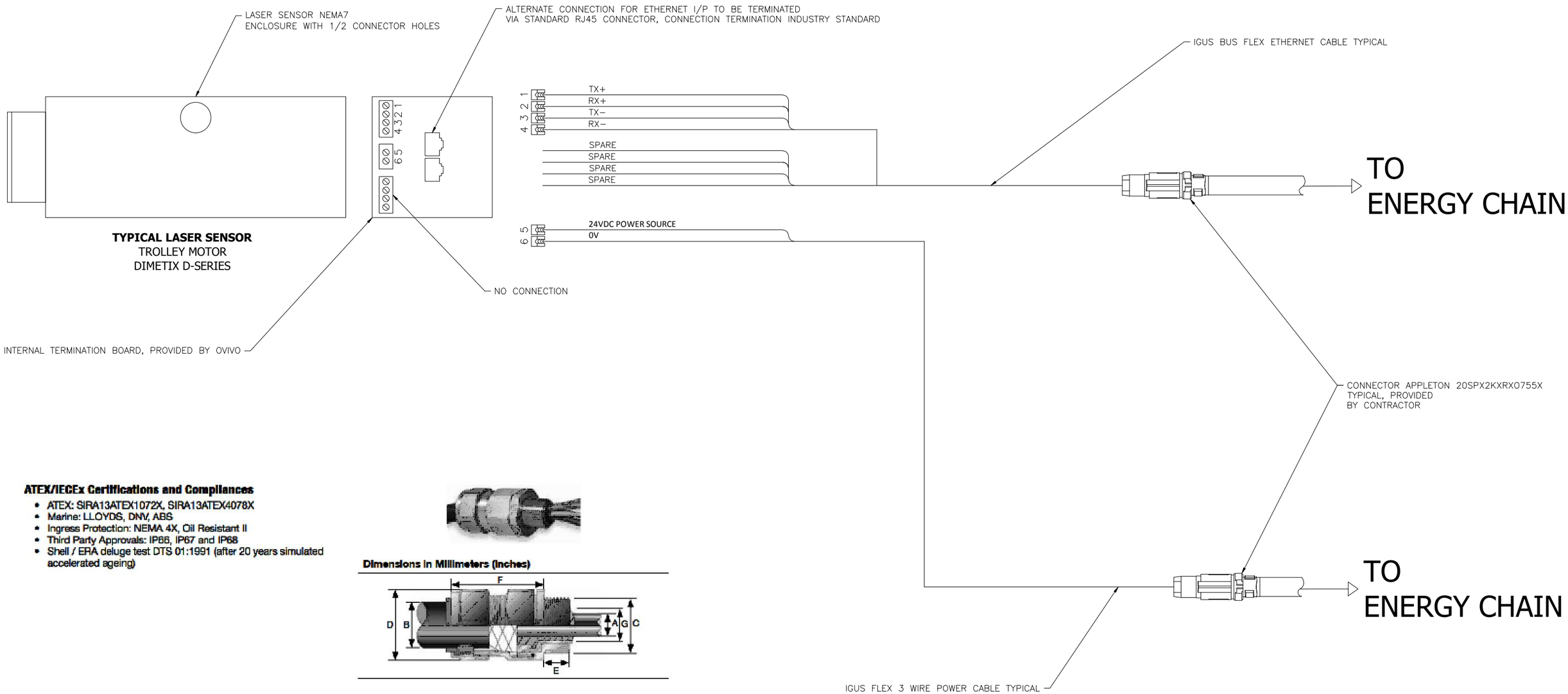
1.1 WIRING ACCORDING TO CSW1584-121.

1.2 ALL FITTINGS PROVIDED BY CONTRACTOR.

1.3 WIRING AND INSTALLATION BY CONTRACTOR.

1.5 TYPICAL DRAWING FOR ONE LASER SENSOR, TYPICAL ALL SENSORS.

1.6 ALL FITTINGS TO BE INSTALLED PER THE CLASSIFICATION OF THE AREA, CLASSIFIED AREA CONDUIT TO BE INSTALLED USING RIGID STEEL PVC COATED PIPE, IF REQUIRED.



TYPICAL LASER SENSOR
TROLLEY MOTOR
DIMETIX D-SERIES

ATEX/IECEx Certifications and Compliances

- ATEX: SIRA13ATEX1072X, SIRA13ATEX4078X
- Marine: LLOYDS, DNV, ABS
- Ingress Protection: NEMA 4X, Oil Resistant II
- Third Party Approvals: IP66, IP67 and IP68
- Shell / ERA deluge test DTS 01:1991 (after 20 years simulated accelerated ageing)

Dimensions in Millimeters (Inches)

LASER SENSOR FIELD INTERCONNECTION & CABLE CONNECTION DETAILS

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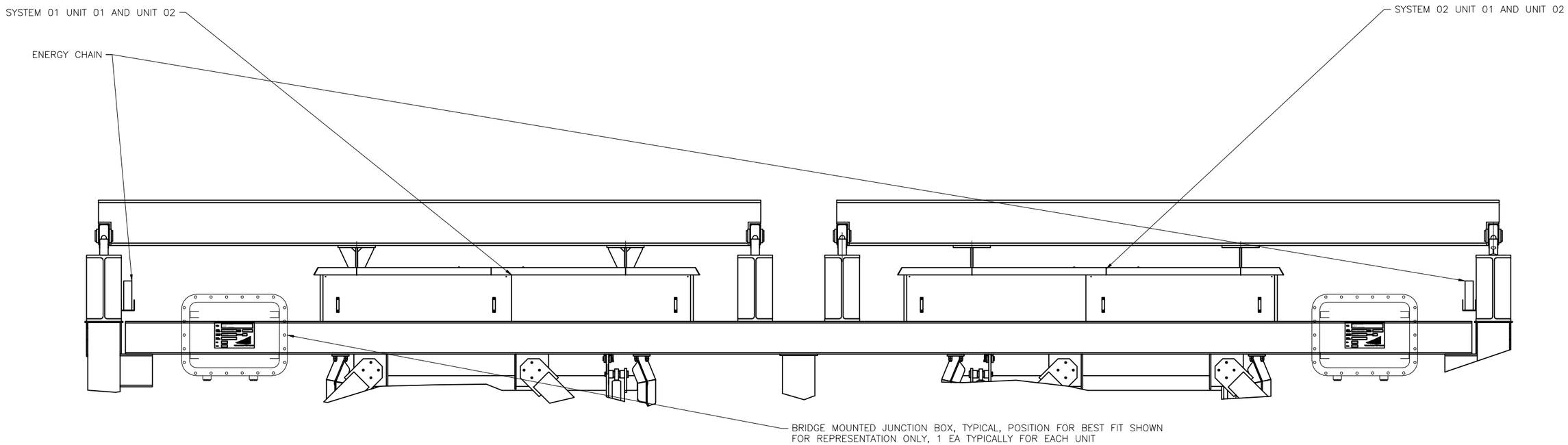
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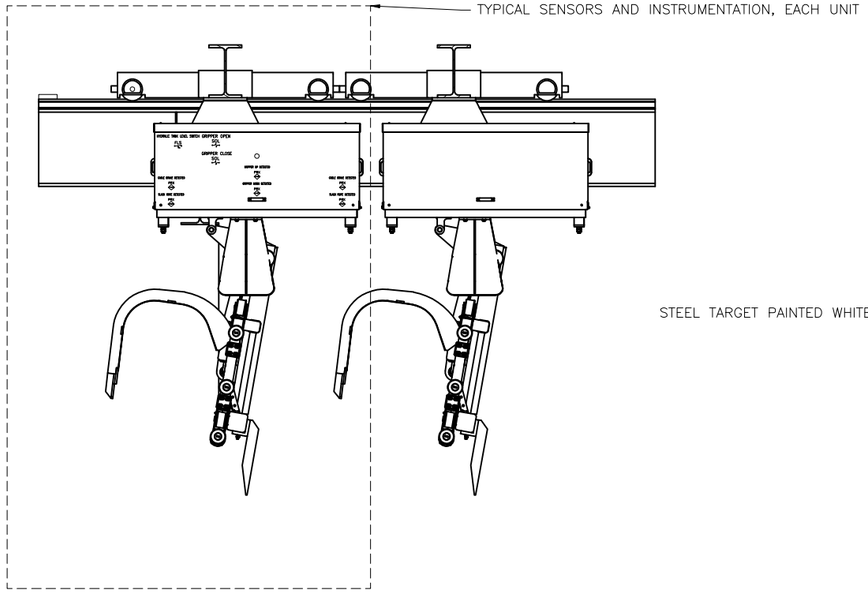
RAKE CONTROL SYSTEM
01 AND 02
FIELD CONNECTION DIAGRAMS

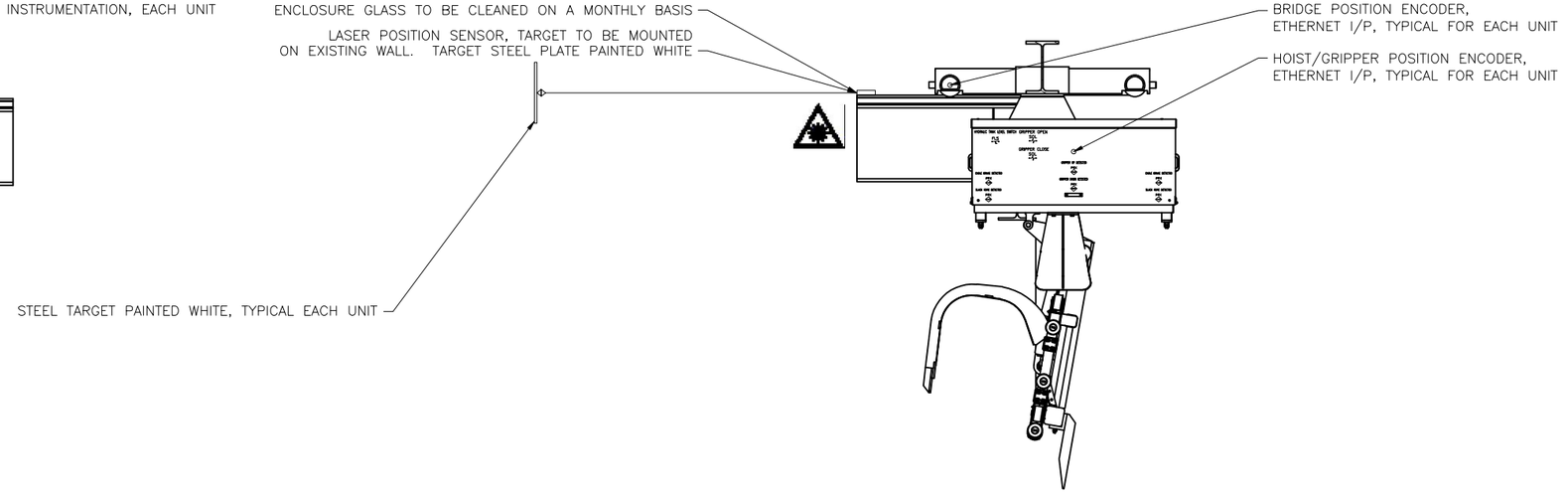
DWG. NO.	SHEET	REV
CSW1584-125	10 OF 11	G

1. **GENERAL NOTES**

1.1 TRASH RAKE SYSTEM LOCATED IN A CLASS 1 DIV 2 ENVIRONMENT, INSTALLATION AND EQUIPMENT TO BE RATED FOR ENVIRONMENT.







LASER SENSOR FIELD INTERCONNECTION & CABLE CONNECTION DETAILS

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RAKE CONTROL SYSTEM
01 AND 02
FIELD CONNECTION DIAGRAMS

DWG. NO. CSW1584-125 | SHEET 11 OF 11 | REV G

Trolley Junction Box
CSW1584-126 (Rev E)

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CUSTER AVENUE WWTP, GA
TROLLEY JUNCTION BOX
(TYPICAL OF 2)

ELECTRICAL DRAWING INDEX	
DWG #	SHEET
CSW1584-126 SHEET 1	COVER SHEET INCLUDING TABLE OF CONTENTS
CSW1584-126 SHEET 2	GENERAL DRAWING NOTES
CSW1584-126 SHEET 3	ASSY OF JUNCTION BOX 1
CSW1584-126 SHEET 4	INTERIOR JUNCTION BOX 1 "DETAIL VIEW" 01
CSW1584-126 SHEET 5	BILL OF MATERIAL
CSW1584-126 SHEET 6	ASSY OF JUNCTION BOX 2
CSW1584-126 SHEET 7	INTERIOR JUNCTION BOX 2 "DETAIL VIEW" 01
CSW1584-126 SHEET 8	BILL OF MATERIAL

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FAT UPDATES	020763	SOG	MN	02/15/23	4
AS BUILT DRAWING	019148	SMM	SOG	03/24/22	3
UPDATED TO INCLUDE PUMP 2 PROVISIONS	018999	JG	SOG	03/08/22	2
UPDATE TB LABELING	018999	JG	SOG	03/09/22	1
INITIAL RELEASE	018934	SMM	SOG	02/22/22	

D
SIZE SHEET
(DO NOT SCALE PRINTS)

THIRD ANGLE PROJECTION

DRAWN BY SMM
CHECKED BY SOG
DATE (mm/dd/yyyy) 02/22/22
PROJECT CSW0001584-01
REF

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WORKMANSHIP STANDARD ES0001 APPLIES

CUSTER AVENUE WWTP, GA
TROLLEY JUNCTION BOX
(TYPICAL OF 2)

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DWG NO. CSW1584-126

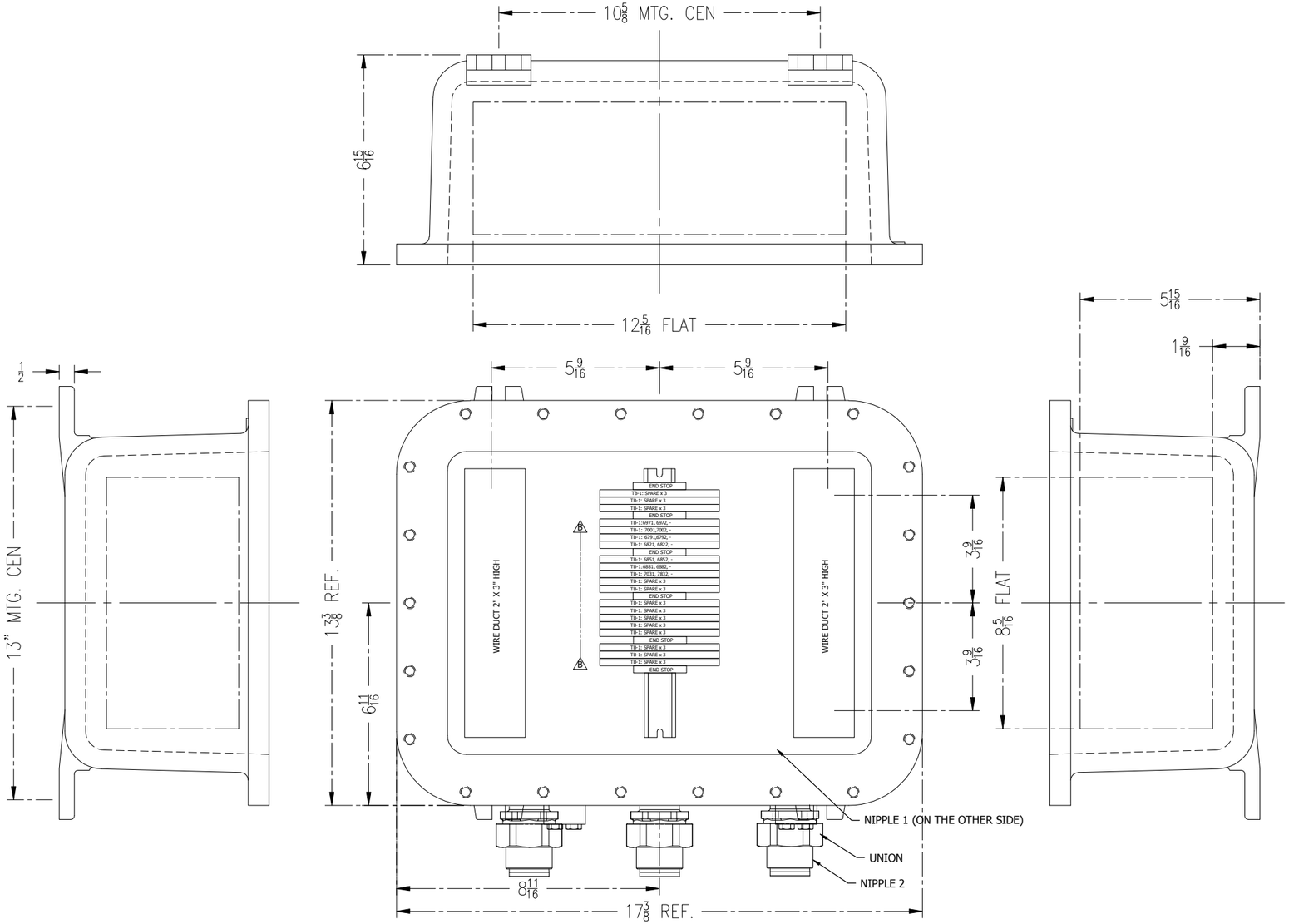
REVISION E

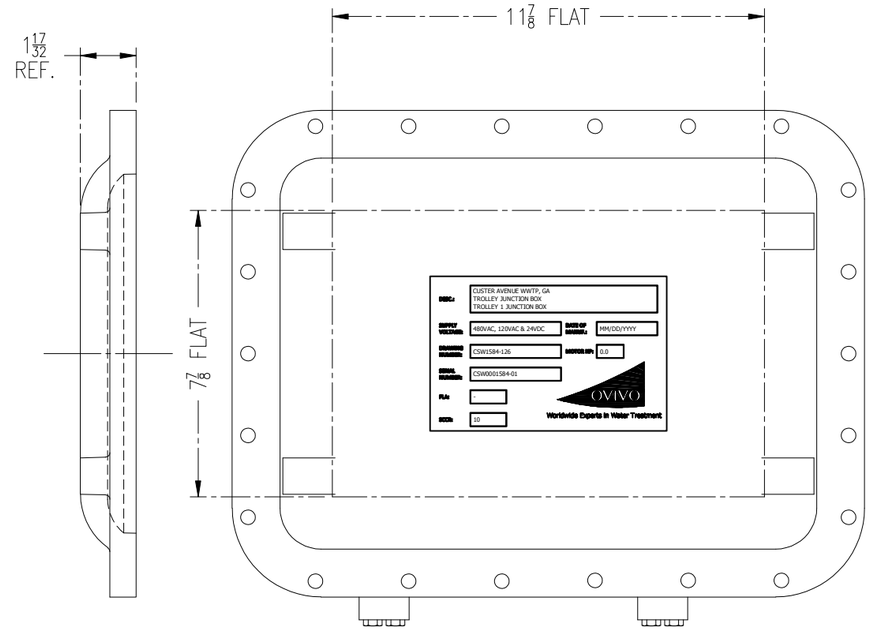
NOTES:

1. CATALOG - REFER DRAWING NUMBER CSW1584-126.
2. THIS JUNCTION BOX IS RATED FOR CLASS 1, DIVISION 1 GROUP D CLASSIFIED AREAS.
3. ENCLOSURE TEMPERATURE CLASSIFICATION: T4.
4. NOTE: SEAL IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), AND ANY APPLICABLE LOCAL CODES.

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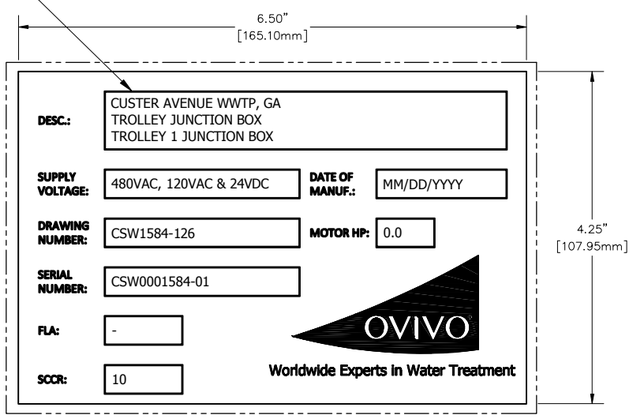
GLAND #	DESCRIPTION
1	480VAC CABLE
2	120VAC CABLE
3	24 VDC CABLE

JUNCTION BOX 1 LAYOUT

FITTINGS BOM				
ITEM	QTY	DESCRIPTION/REMARKS	PART NO.	MANF.
1	3	UNION	UNY305	CROUSE-HINDS
2	6	NIPPLE, CLOSE	4548K221	McMASTER-CARR

WHITE BACKGROUND
WITH BLACK 3/16" HIGH
LETTERS (TYPICAL)

XJF 1014 COVER



ENCLOSURE NAMEPLATE

D
SIZE SHEET
DO NOT SCALE PRINTS

THIRD ANGLE PROJECTION

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DWG NO. CSW1584-126

SHEET 3 OF 8

REVISION E

WIRE DUCT 2" X 3" HIGH

END STOP
TB-1: SPARE x 3
TB-1: SPARE x 3
TB-1: SPARE x 3
END STOP
TB-1:6971, 6972, -
TB-1: 7001,7002, -
TB-1: 6791,6792, -
TB-1: 6821, 6822, -
END STOP
TB-1: 6851, 6852, -
TB-1:6881, 6882, -
TB-1: 7031, 7832, -
TB-1: SPARE x 3
TB-1: SPARE x 3
END STOP
TB-1: SPARE x 3
TB-1: SPARE x 3
TB-1: SPARE x 3
TB-1: SPARE x 3
TB-1: SPARE x 3
END STOP
TB-1: SPARE x 3
TB-1: SPARE x 3
TB-1: SPARE x 3
END STOP
TB-1: SPARE x 3
END STOP

WIRE DUCT 2" X 3" HIGH

SUB PANEL VIEW

D
SIZE SHEET
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OVIVO
DWG NO. CSW1584-126
SHEET 4 OF 8
E
REVISION

BIL OF MATERIAL

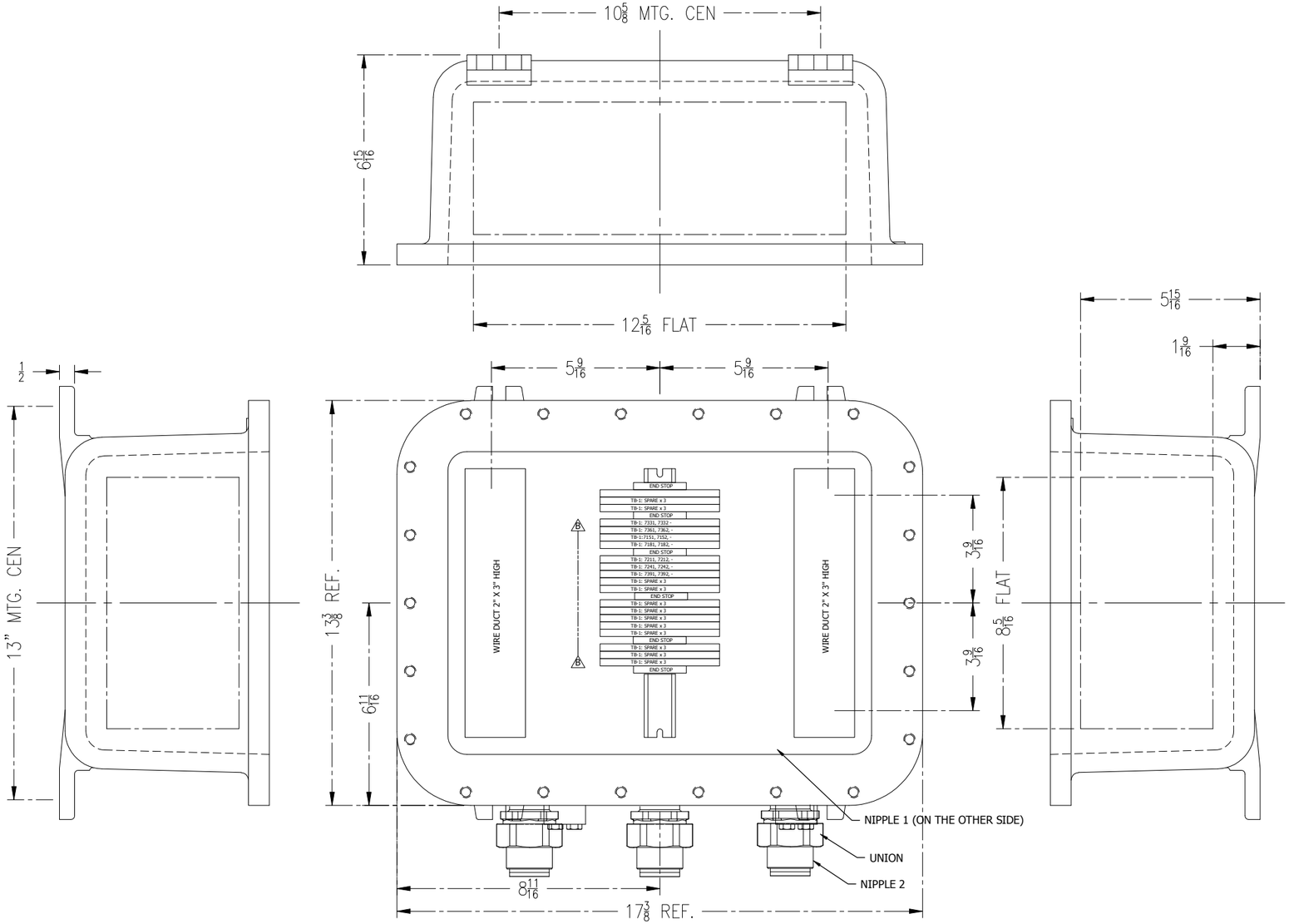
ITEM	QTY	TAG	CATALOG	MAKE	DESCRIPTION
1	1	ENCLOSURE	XJF-101406 N4	ADALET	EXPLOSION-PROOF JUNCTION BOX, 13.875", 17.875", 8.4375"
2	1	ENCLOSURE	XSM1014	ADALET	GALVANIZED STEEL BACK PANEL, 8.875", 12.875"
3	1	ENCLOSURE	XHB-2	ADALET	ALUMINUM ALLOY HINGE SET
4	20	TB-M, TB-1	3038312	PHOENIX CONTACT	3-LEVEL TERMINAL BLOCK, SCREW CONNECTION, AWG 28-12, GRAY COLOR, 24A, 500 VOLTS
5	6	TB-M, TB-1	3036660	PHOENIX CONTACT	END COVER, GRAY COLOR
6	6	AS SHOWN IN DRAWINGS	1201662	PHOENIX CONTACT	QUICK MOUNTING END CLAMP, DIN-RAIL MOUNT
7	A/R	FOR TERMINAL ORGANISATION	0811969	PHOENIX CONTACT	TERMINAL STRIP MARKER CARRIER, HEIGHT ADJUSTABLE, FOR END BRACKETS CLIPFIX 15, 35, 35-5
8	A/R	AS SHOWN	0807012	PHOENIX CONTACT	DIN RAIL, PERFORATED, 35 MMx7.5 MM, 1000 MM LONG, GALVANIZED STEEL, PASSIVATED WITH A THICK LAYER, SILVER COLOR
9	A/R	ENCLOSURE ACCESSORY	TYD2X3NPI6	THOMAS & BETTS	INTRINSICALLY SAFE NARROW SLOT WIRING DUCT, PVC, 2"x3" HIGH
10	A/R	ENCLOSURE ACCESSORY	TYD2CPI6	THOMAS & BETTS	INTRINSICALLY SAFE WIRE DUCT COVER FOR 2" DUCTS
11	1	PANEL DETAILS	679002	OVIVO	NAME PLATE (ETCH AS SHOWN)
12	1	"TRASH RAKE 1 JUNCTION BOX"	592273	OVIVO	ENCLOSURE EQUIPMENT TAG ID, BLACK BACKGROUND WITH 3/16 INCH WHITE LETTERS, NOMINAL HEIGHT OF NAMEPLATES 2 INCHES
13	40	ACCESSORIES	PAAXMC/M	ATOS	20M X1.5 CABLE GLAND, ATEX RATED, FOR ENCODERS
14	20	ACCESSORIES	ZMX-T	ATOS	20M X1.5 CABLE GLAND SEAL, ATEX RATED, FOR ENCODERS
15	12	ACCESSORIES	20SPX2KXRX0	APPLETON	3/4 NPT CABLE GLAND, EXPLOSTION PROOF, FOR LASER SENSOR
16	40	ACCESSORIES	WKC4.221T-2/TEB	TURCK	M12 CORD SET, 30 FEET LONG
17	100 FT	ACCESSORIES	7958A	BELDEN	600 VAC RATED ETHERNET CABLE, SHIELDED
18	100 FT	ACCESSORIES	221603	LAPP CABLE	3 WIRE, 16AWG TRAY RATED CABLE

B

B

D
SIZE SHEET
DO NOT SCALE PRINTS
THIRD ANGLE PROJECTION
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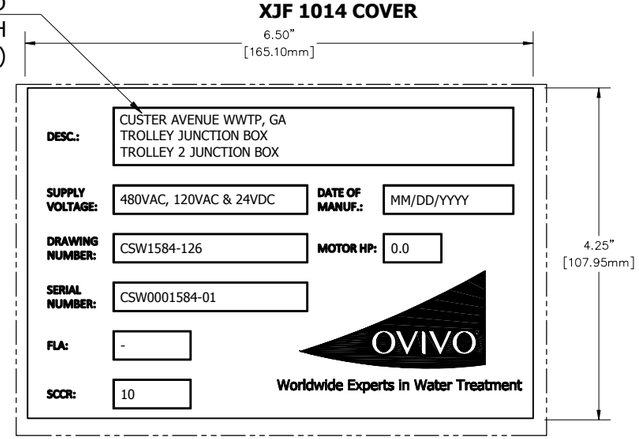
GLAND #	DESCRIPTION
1	480VAC CABLE
2	120VAC CABLE
3	24 VDC CABLE

JUNCTION 2 BOX LAYOUT

FITTINGS BOM				
ITEM	QTY	DESCRIPTION/REMARKS	PART NO.	MANF.
1	3	UNION	UNY305	CROUSE-HINDS
2	6	NIPPLE, CLOSE	4548K221	McMASTER-CARR

WHITE BACKGROUND
WITH BLACK 3/16" HIGH
LETTERS (TYPICAL)

XJF 1014 COVER



ENCLOSURE NAMEPLATE

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D
SIZE SHEET
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THIRD ANGLE PROJECTION

WORKMANSHIP STANDARD ES0001 APPLIES

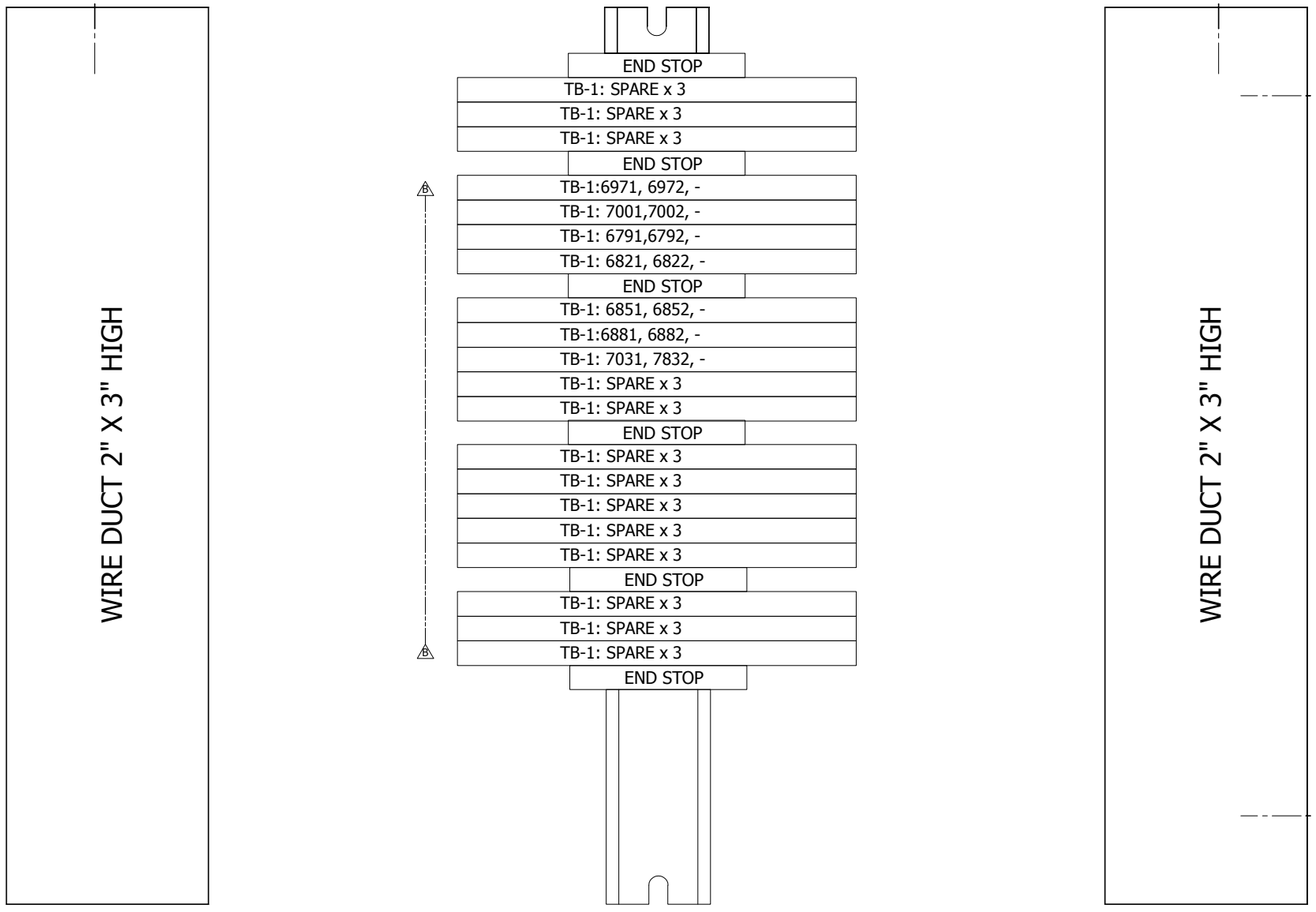
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DWG NO. CSW1584-126

SHEET 6 OF 8

REVISION E



SUB PANEL VIEW

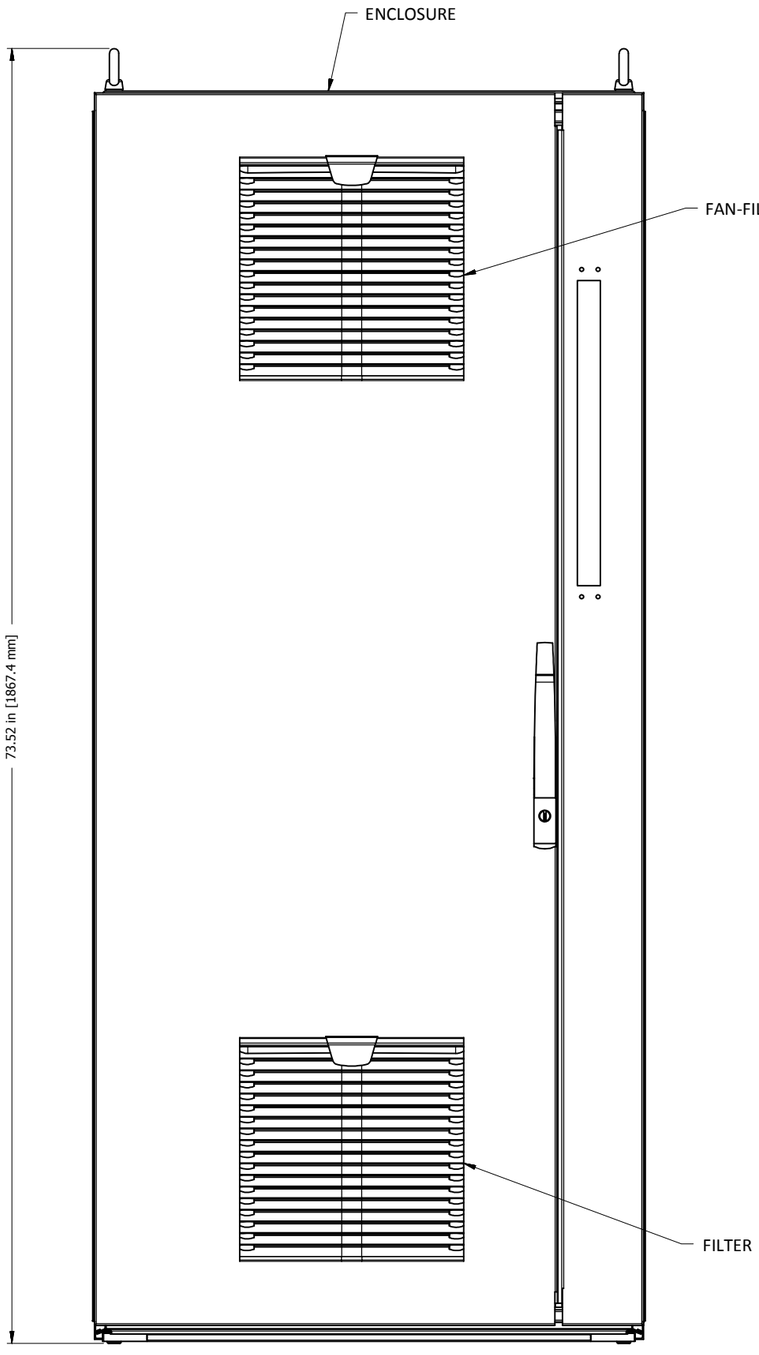
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THIRD ANGLE PROJECTION
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OVIVO
DWG NO. CSW1584-126
SHEET 7 OF 8
E
REVISION

BIL OF MATERIAL

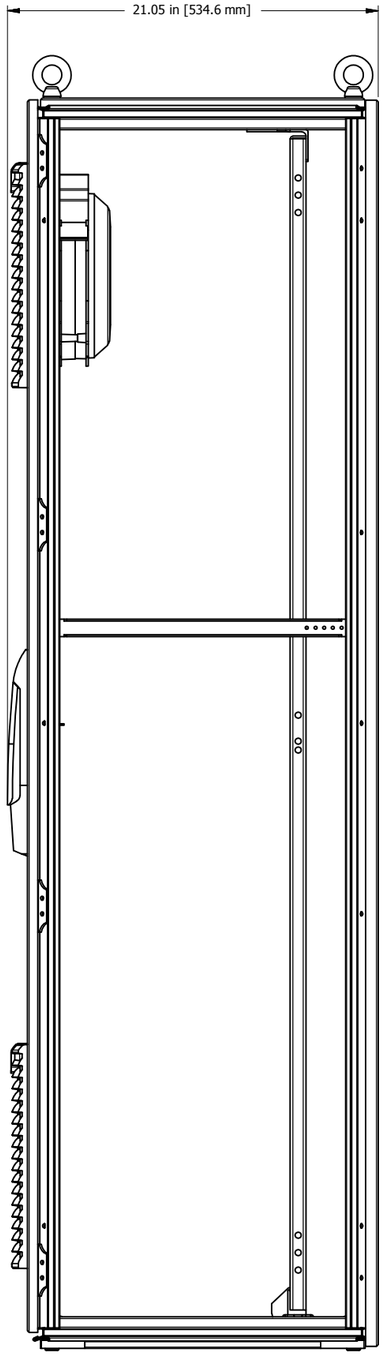
ITEM	QTY	TAG	CATALOG	MAKE	DESCRIPTION
1	1	ENCLOSURE	XJF-101406 N4	ADALET	EXPLOSION-PROOF JUNCTION BOX, 13.875", 17.875", 8.4375"
2	1	ENCLOSURE	XSM1014	ADALET	GALVANIZED STEEL BACK PANEL, 8.875", 12.875"
3	1	ENCLOSURE	XHB-2	ADALET	ALUMINUM ALLOY HINGE SET
4	20	TB-M, TB-1	3038312	PHOENIX CONTACT	3-LEVEL TERMINAL BLOCK, SCREW CONNECTION, AWG 28-12, GRAY COLOR, 24A, 500 VOLTS
5	6	TB-M, TB-1	3036660	PHOENIX CONTACT	END COVER, GRAY COLOR
6	6	AS SHOWN IN DRAWINGS	1201662	PHOENIX CONTACT	QUICK MOUNTING END CLAMP, DIN-RAIL MOUNT
7	A/R	FOR TERMINAL ORGANISATION	0811969	PHOENIX CONTACT	TERMINAL STRIP MARKER CARRIER, HEIGHT ADJUSTABLE, FOR END BRACKETS CLIPFIX 15, 35, 35-5
8	A/R	AS SHOWN	0807012	PHOENIX CONTACT	DIN RAIL, PERFORATED, 35 MMx7.5 MM, 1000 MM LONG, GALVANIZED STEEL, PASSIVATED WITH A THICK LAYER, SILVER COLOR
9	A/R	ENCLOSURE ACCESSORY	TYD2X3NPI6	THOMAS & BETTS	INTRINSICALLY SAFE NARROW SLOT WIRING DUCT, PVC, 2"x3" HIGH
10	A/R	ENCLOSURE ACCESSORY	TYD2CPI6	THOMAS & BETTS	INTRINSICALLY SAFE WIRE DUCT COVER FOR 2" DUCTS
11	1	PANEL DETAILS	679002	OVIVO	NAME PLATE (ETCH AS SHOWN)
12	1	"TRASH RAKE 2 JUNCTION BOX"	592273	OVIVO	ENCLOSURE EQUIPMENT TAG ID, BLACK BACKGROUND WITH 3/16 INCH WHITE LETTERS, NOMINAL HEIGHT OF NAMEPLATES 2 INCHES
B 13	40	ACCESSORIES	PAAXMC/M	ATOS	20M X1.5 CABLE GLAND, ATEX RATED, FOR ENCODERS
14	20	ACCESSORIES	ZMX-T	ATOS	20M X1.5 CABLE GLAND SEAL, ATEX RATED, FOR ENCODERS
15	12	ACCESSORIES	20SPX2KXRX0	APPLETON	3/4 NPT CABLE GLAND, EXPLOSTION PROOF, FOR LASER SENSOR
16	40	ACCESSORIES	WKC4.221T-2/TEB	TURCK	M12 CORD SET, 30 FEET LONG
17	100 FT	ACCESSORIES	7958A	BELDEN	600 VAC RATED ETHERNET CABLE, SHIELDED
B 18	100 FT	ACCESSORIES	221603	LAPP CABLE	3 WIRE, 16AWG TRAY RATED CABLE

D
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THIRD ANGLE PROJECTION
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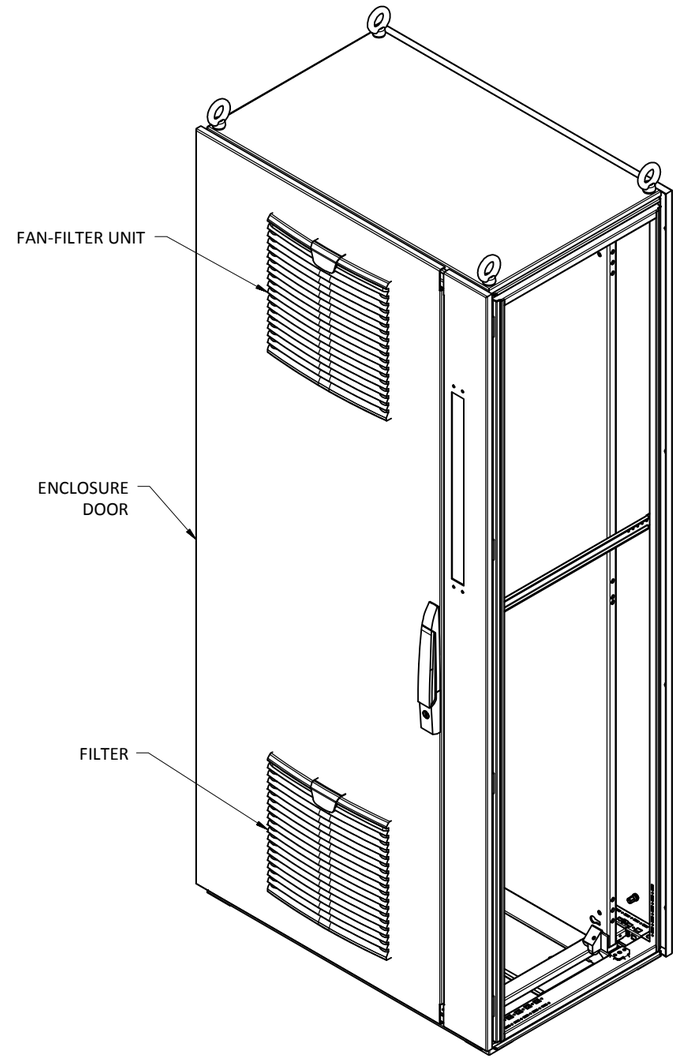
Panel Cutout Assembly / MCP and PLC Panel CSW1584-127 (Rev B)



FRONT VIEW



SIDE VIEW



ISOMETRIC VIEW
MOTOR CONTROL PANEL

MOTOR CONTROL PANEL

REVISION	EN/ECO	BY	CHECK'D	DATE
INITIAL RELEASE	018829	SEB	KD	02/15/2022 A

SIZE SHEET (DO NOT SCALE PRINTS)	D
	THIRD ANGLE PROJECTION
DRAWN BY	SSR/SRN
CHECKED BY	KD
DATE (mm/dd/yyyy)	03/03/2022
PROJECT	CSW0001584-01
REF	

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PANEL CUTOUT ASSEMBLY

MCP AND PLC PANEL

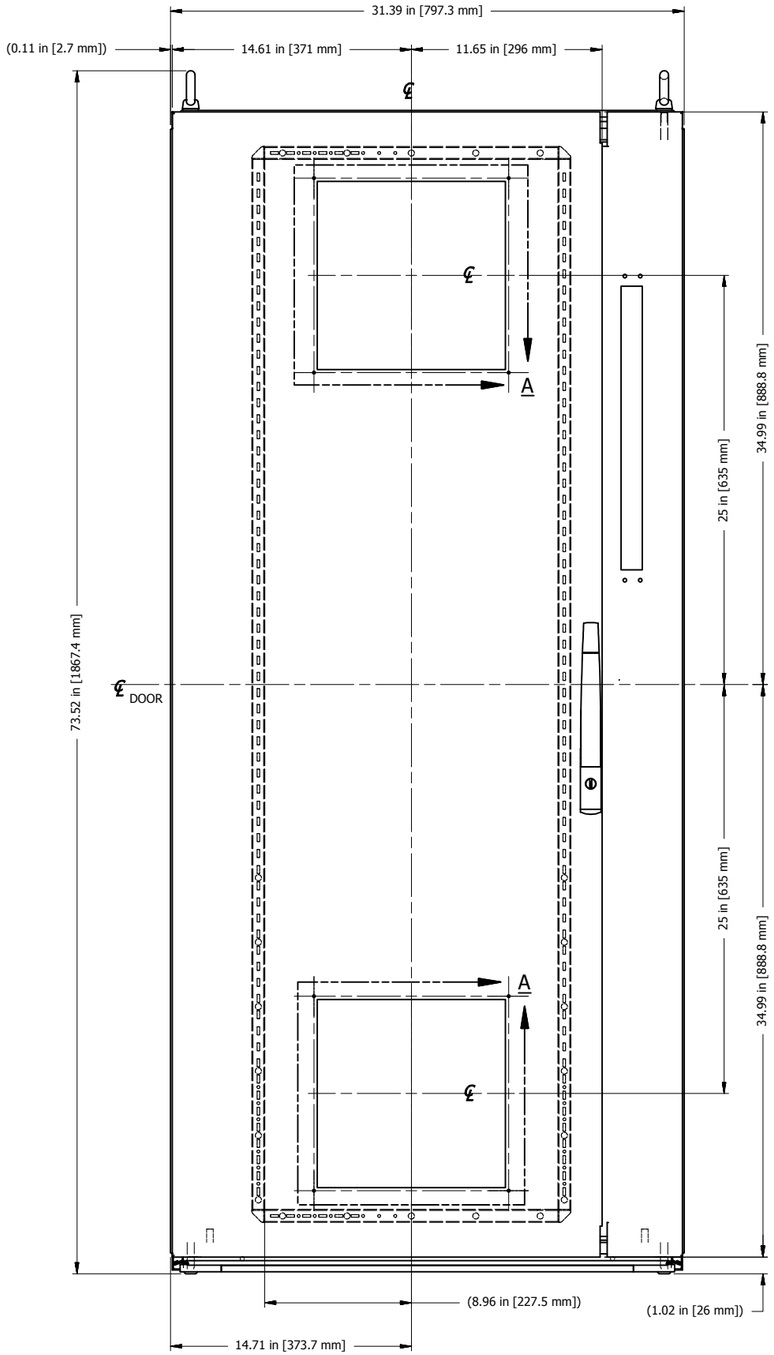
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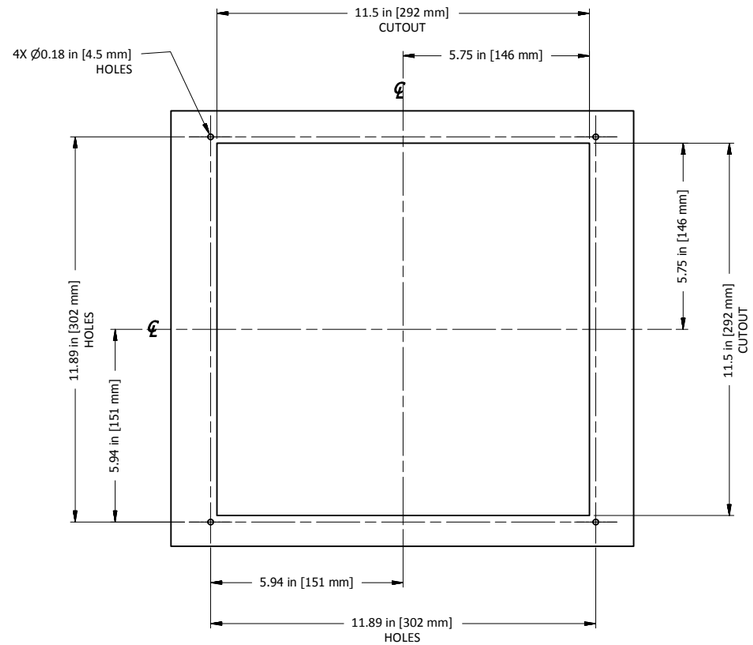
DWG NO. **CSW1584-127**

SHEET 1 OF 4

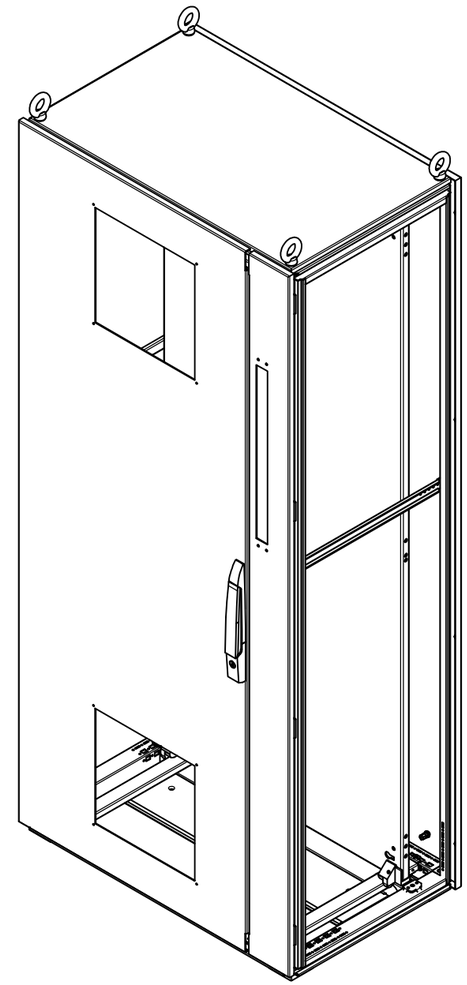
A REVISION



DETAILS OF MOTOR CONTROL PANEL
DOOR CUT-OUTS

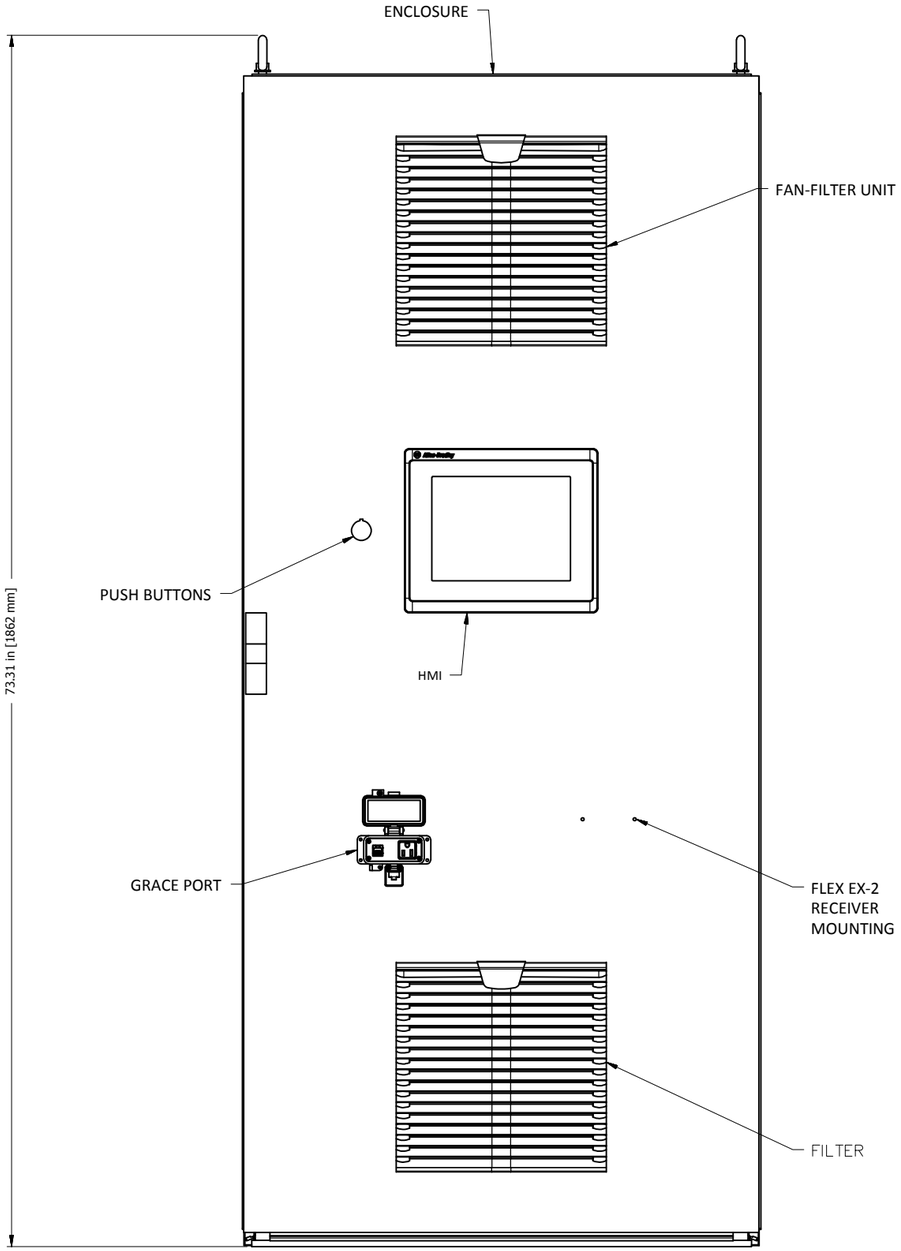


DETAIL A
(FAN AND FILTER CUT-OUT)

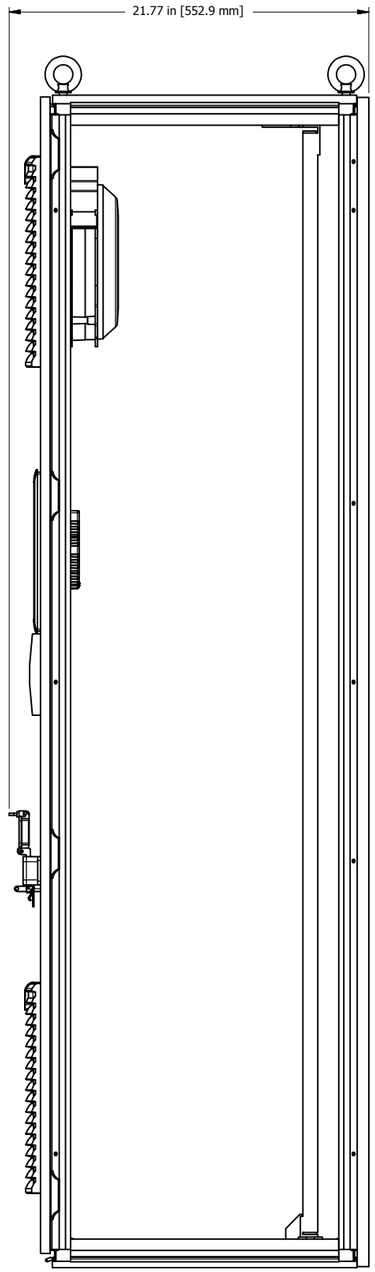


ISOMETRIC VIEW
DOOR CUT-OUTS

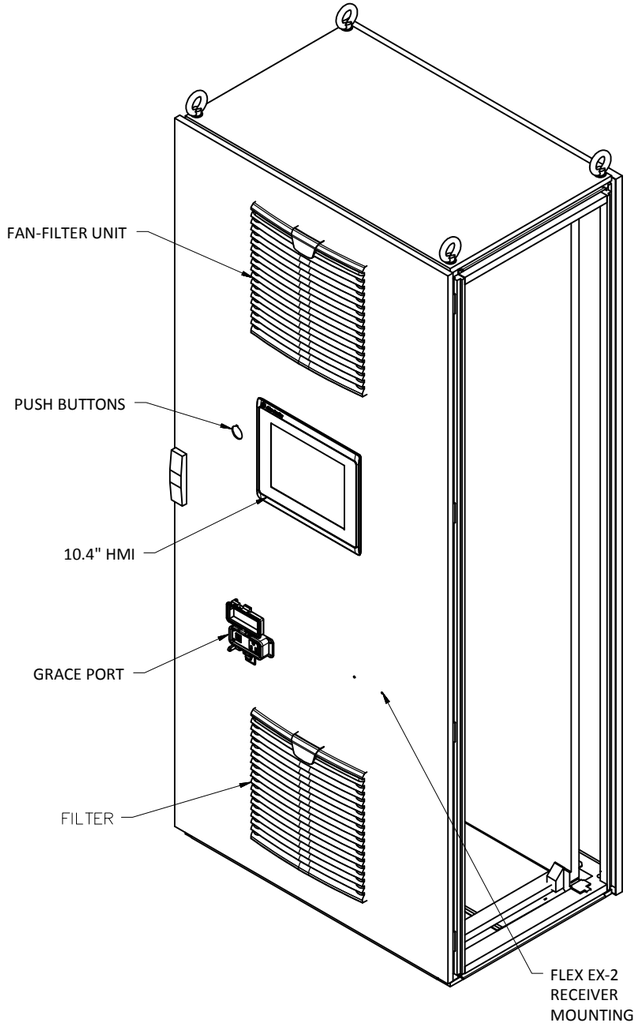
D SIZE SHEET DO NOT SCALE PRINTS	THIRD ANGLE PROJECTION	THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION OF OVIVO AND ITS AFFILIATES AND IS NOT TO BE DISCLOSED NOR TO BE USED EXCEPT FOR EVALUATING PROPOSALS OF OVIVO OR INSTALLING, OPERATING OR MAINTAINING OVIVO EQUIPMENT UNLESS OTHERWISE AUTHORIZED IN WRITING BY OVIVO. UNCONTROLLED COPY IF PRINTED.	
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WORKMANSHIP STANDARD ISO9001 APPLIES			SHEET 2 OF 4 — A REVISION



FRONT VIEW



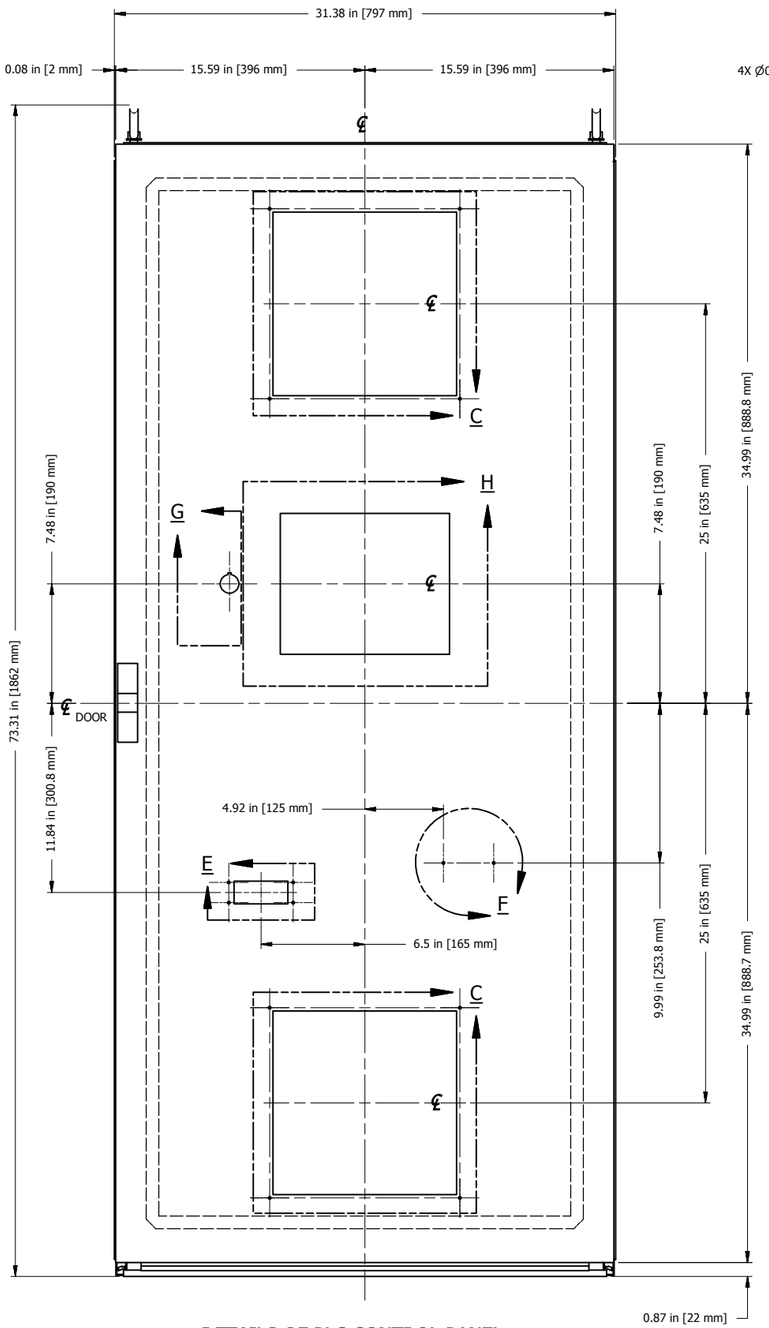
SIDE VIEW



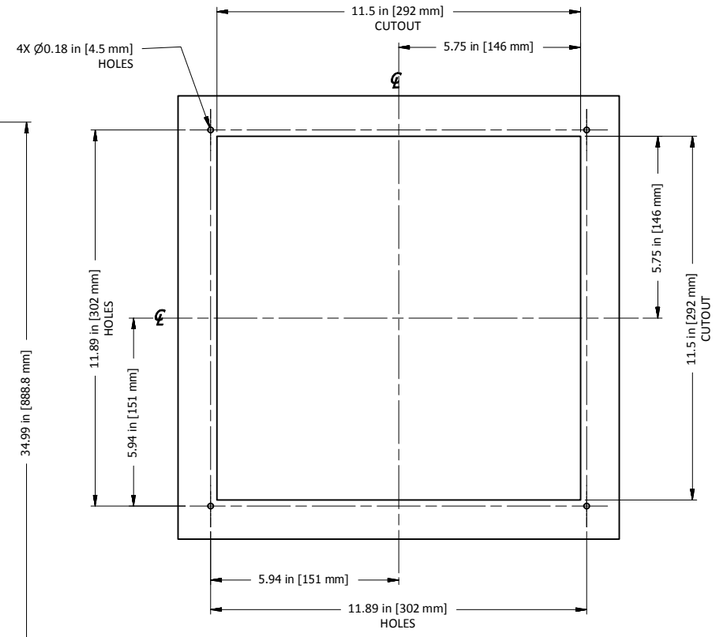
ISOMETRIC VIEW
PLC CONTROL PANEL

PLC CONTROL PANEL

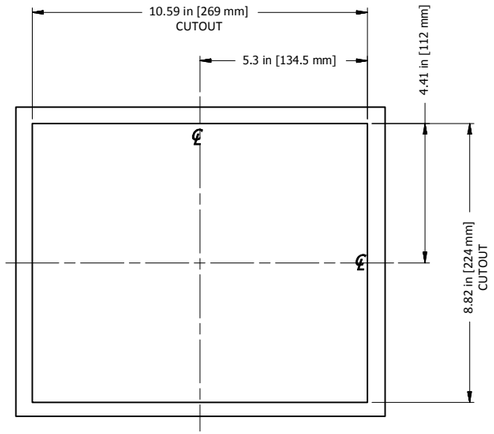
D SIZE SHEET DO NOT SCALE PRINTS	THIRD ANGLE PROJECTION	OVIVO	THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION OF OVIVO AND ITS AFFILIATES AND IS NOT TO BE DISCLOSED NOR TO BE USED EXCEPT FOR EVALUATING PROPOSALS OF OVIVO OR INSTALLING, OPERATING OR MAINTAINING OVIVO EQUIPMENT UNLESS OTHERWISE AUTHORIZED IN WRITING BY OVIVO. UNCONTROLLED COPY IF PRINTED.
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WORKMANSHIP STANDARD ES0001 APPLIES			



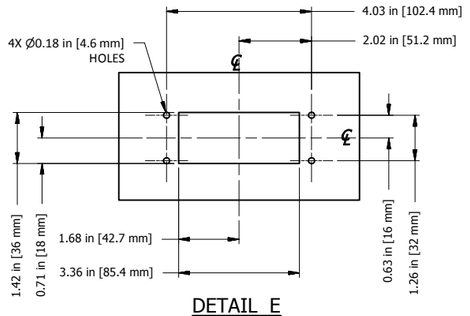
DETAILS OF PLC CONTROL PANEL
DOOR CUT-OUTS



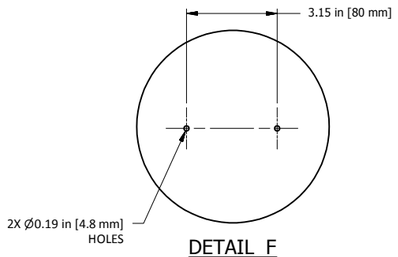
DETAIL C
(FAN AND FILTER CUT-OUT)



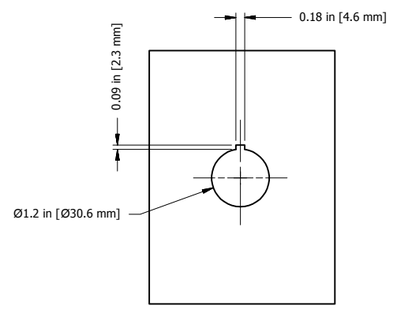
DETAIL H
(10.4" HMI CUT-OUT)



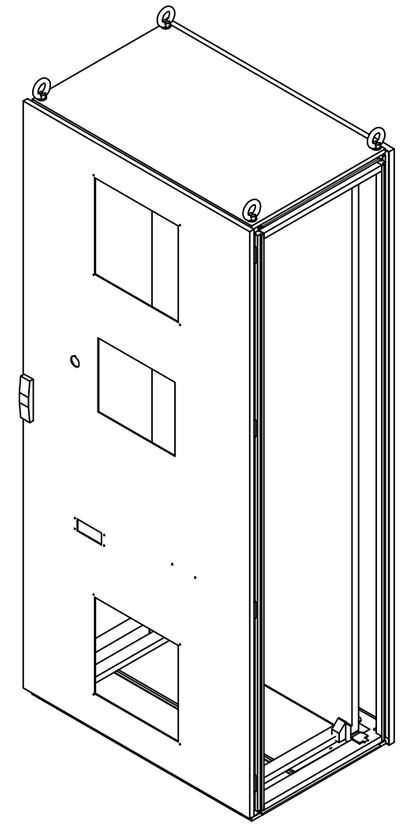
DETAIL E
(GRACEPORT CUT-OUT)



DETAIL F
(FLEX EX-2 RECEIVER MOUNTING)



DETAIL G
(PUSH BUTTONS CUT-OUT)



ISOMETRIC VIEW
DOOR CUT-OUTS

D SIZE SHEET DO NOT SCALE PRINTS	THIRD ANGLE PROJECTION	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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Cable Numbers & Wires
CSW1584-128 (Rev A)

TABLE 01: MOTOR CABLE DESIGNATION AND WIRE NUMBERS

CABLE NUMBER	CABLE DISCIPTION	WIRE DISCRIPTION	PANEL TERMINATION	MOTOR TERMINALTION	CABLE WIRE NUMBER	CABLE DETAILS
1	BRIDGE MOTOR 01					VFD RATED CABLE, 14 AWG, SHILDED, 3 WIRE WITH GROUND, W/ 2 PAIR 16 AWG SIGNAL WIRES, 600 VAC RATED
		BRIDGE MOTOR 01 POWER	XXYY	L1	1	-
		BRIDGE MOTOR 01 POWER	XXYY	L2	2	-
		BRIDGE MOTOR 01 POWER	XXYY	L3	3	-
		BRIDGE MOTOR 01 PE	GND	PE	GR/YL	-
		BRIDGE MOTOR 01 BRAKE	XXYY	TBD	4	-
		BRIDGE MOTOR 01 BRAKE	XXYY	TBD	5	-
		BRIDGE MOTOR 01 SPARE	SPARE	N/A	6	-
		BRIDGE MOTOR 01 SPARE	SPARE	N/A	7	-
		BRIDGE MOTOR 01 SHIELD	SHIELD	N/A	SHIELD	-
2	BRIDGE MOTOR 02					VFD RATED CABLE, 14 AWG, SHILDED, 3 WIRE WITH GROUND, W/ 2 PAIR 16 AWG SIGNAL WIRES, 600 VAC RATED
		BRIDGE MOTOR 01 POWER	XXYY	L1	1	-
		BRIDGE MOTOR 02 POWER	XXYY	L2	2	-
		BRIDGE MOTOR 02 POWER	XXYY	L3	3	-
		BRIDGE MOTOR 02 PE	GND	PE	GR/YL	-
		BRIDGE MOTOR 02 BRAKE	XXYY	TBD	4	-
		BRIDGE MOTOR 02 BRAKE	XXYY	TBD	5	-
		BRIDGE MOTOR 02 SPARE	SPARE	N/A	6	-
		BRIDGE MOTOR 02 SPARE	SPARE	N/A	7	-
		BRIDGE MOTOR 02 SHIELD	SHIELD	N/A	SHIELD	-
3	HOIST MOTOR					VFD RATED CABLE, 14 AWG, SHILDED, 3 WIRE WITH GROUND, W/ 2 PAIR 16 AWG SIGNAL WIRES, 600 VAC RATED
		HOIST MOTOR POWER	XXYY	L1	1	-
		HOIST MOTOR POWER	XXYY	L2	2	-
		HOIST MOTOR POWER	XXYY	L3	3	-
		HOIST MOTOR PE	GND	PE	GR/YL	-
		HOIST MOTOR BRAKE	XXYY	TBD	4	-
		HOIST MOTOR BRAKE	XXYY	TBD	5	-
		HOIST MOTOR SPARE	SPARE	N/A	6	-
		HOIST MOTOR SPARE	SPARE	N/A	7	-
		HOIST MOTOR SHIELD	SHIELD	N/A	SHIELD	-
4	HYDRAULIC MOTOR					VFD RATED CABLE, 14 AWG, SHILDED, 3 WIRE WITH GROUND, W/ 2 PAIR 16 AWG SIGNAL WIRES, 600 VAC RATED
		HYDRAULIC MOTOR POWER	XXYY	L1	1	-
		HYDRAULIC MOTOR POWER	XXYY	L2	2	-
		HYDRAULIC MOTOR POWER	XXYY	L3	3	-
		HYDRAULIC MOTOR PE	GND	PE	GR/YL	-
		HYDRAULIC MOTOR SPARE	SPARE	N/A	4	-
		HYDRAULIC MOTOR SPARE	SPARE	N/A	5	-
		HYDRAULIC MOTOR SPARE	SPARE	N/A	6	-
		HYDRAULIC MOTOR SPARE	SPARE	N/A	7	-
		HYDRAULIC MOTOR SHIELD	SHIELD	N/A	SHIELD	-
		HYDRAULIC MOTOR SPARE	SPARE	N/A	7	-
		HYDRAULIC MOTOR SHIELD	SHIELD	N/A	SHIELD	-

TABLE 02: POWER COMPONENTS CABLE LIST

CABLE NUMBER	CABLE DISCIPTION	WIRE DISCRIPTION	PANEL TERMINATION	DEVICE TERMINALTION	CABLE WIRE NUMBER	CABLE DETAILS
5	OPEN SOLINOID					14AWG, 2 WIRE WITH GROUND, 600 VAC RATED
		OPEN SOLINOID POWER	XXYY	1	1	-
		OPEN SOLINOID COMMON	XXYY	2	2	-
		OPEN SOLINOID PE	GND	PE	GR/YL	-
6	CLOSE SOLINOID					14AWG, 2 WIRE WITH GROUND, 600 VAC RATED
		CLOSE SOLINOID POWER	XXYY	1	1	-
		CLOSE SOLINOID COMMON	XXYY	2	2	-
		CLOSE SOLINOID PE	GND	PE	GR/YL	-
7	HYDRAULIC TANK HEATER					14AWG, 2 WIRE WITH GROUND, 600 VAC RATED
		HYDRAULIC TANK HEATER	XXYY	1	1	-
		HYDRAULIC TANK COMMON	XXYY	2	2	-
		HYDRAULIC TANK MOTOR PE	GND	PE	GR/YL	-
8	RUNNING BEACON					14AWG, 2 WIRE WITH GROUND, 600 VAC RATED
		RUNNING BEACON POWER	XXYY	1	1	-
		RUNNING BEACON COMMON	XXYY	2	2	-
		RUNNING BEACON PE	GND	PE	GR/YL	-
9	LASER SENSOR POWER					16AWG, 2 WIRE WITH GROUND, 600 VAC RATED
		LASER SENSOR POWER	XXYY	1	1	-
		LASER SENSOR COMMON	XXYY	2	2	-
		LASER SENSOR PE	GND	PE	GR/YL	-
10	HOIST ENCODER POWER					16AWG, 2 WIRE WITH GROUND, 600 VAC RATED
		HOIST ENCODER POWER	XXYY	1	1	-
		HOIST ENCODER COMMON	XXYY	2	2	-
		HOIST ENCODER PE	GND	PE	GR/YL	-
11	BRIDGE ENCODER POWER					16AWG, 2 WIRE WITH GROUND, 600 VAC RATED
		BRIDGE ENCODER POWER	XXYY	1	1	-
		BRIDGE ENCODER COMMON	XXYY	2	2	-
		BRIDGE ENCODER PE	GND	PE	GR/YL	-

TABLE 03: NETWORK CABLES

CABLE NUMBER	CABLE DISCIPTION	WIRE DISCRIPTION	PANEL TERMINATION	DEVICE TERMINALTION	CABLE WIRE NUMBER	CABLE DETAILS
12	LASER ENCODER ETHERNET	STANDARD ETHERNET WIREING APLIES	TBD	TBD	N/A	22 AWG, ETHERNET CABLE, 600 VAC RATED, W/ SHIELD, 8 WIRE
13	HOIST ENCODER ETHERNET	STANDARD ETHERNET WIREING APLIES	TBD	TBD	N/A	22 AWG, ETHERNET CABLE, 600 VAC RATED, W/ SHIELD, 8 WIRE
14	BRIDGE ENCODER ETHERNET	STANDARD ETHERNET WIREING APLIES	TBD	TBD	N/A	22 AWG, ETHERNET CABLE, 600 VAC RATED, W/ SHIELD, 8 WIRE

TABLE 04: IS RATED SIGNAL CABLES

CABLE NUMBER	CABLE DISCIPTION	WIRE DISCRIPTION	PANEL TERMINATION	TROLLEY JUNCTION BOX TERMINATION	CABLE WIRE NUMBER	CABLE DETAILS
15	IS CONTROL SIGNALS					16 AWG, 24 WIRE W/ GROUND, 600 VAC RATED
		HOIST SLACK ROPE 01, IS POWER	XXYY	XXYY	1	-
		HOIST SLACK ROPE 01, SIGNAL TO MAIN CONTROL PANEL	XXYY	XXYY	2	-
		HOIST SLACK ROPE 02, IS POWER	XXYY	XXYY	3	-
		HOIST SLACK ROPE 02, SIGNAL TO MAIN CONTROL PANEL	XXYY	XXYY	4	-
		HOIST TO HIGH, IS POWER	XXYY	XXYY	5	-
		HOIST TO HIGH, SIGNAL TO MAIN CONTROL PANEL	XXYY	XXYY	6	-
		HOIST HIGH, IS POWER	XXYY	XXYY	7	-
		HOIST HIGH, SIGNAL TO MAIN CONTROL PANEL	XXYY	XXYY	8	-
		HOIST TO LOW, IS POWER	XXYY	XXYY	9	-
		HOIST TO LOW, SIGNAL TO MAIN CONTROL PANEL	XXYY	XXYY	10	-
		HOIST LOW, IS POWER	XXYY	XXYY	11	-
		HOIST LOW, SIGNAL TO MAIN CONTROL PANEL	XXYY	XXYY	12	-
		HYDRALIC TANK LEVEL LOW, IS POWER	XXYY	XXYY	13	-
		HYDRALIC TANK LEVEL LOW, SIGNAL TO MAIN CONTROL PANEL	XXYY	XXYY	14	-
			SPARE	SPARE	15	-
			SPARE	SPARE	16	-
			SPARE	SPARE	17	-
			SPARE	SPARE	18	-
			SPARE	SPARE	19	-
			SPARE	SPARE	20	-
			SPARE	SPARE	21	-
			SPARE	SPARE	22	-
			SPARE	SPARE	23	-
			SPARE	SPARE	24	-
		IS CONTROL SIGNALS PE	GND	PE	GR/YL	-

TABLE 05: CABLE QTY

NUMBER OF CABLES REQUIRED
15

ELECTRICAL DRAWING INDEX

DWG #	SHEET DESRIPTION
CSW1584-128	ENERGY CHAIN CABLES AND WIRE DESIGNATION

1. **NOTES**

1.1 ENERGY CHAIN TO BE RATED AT CLASS 1 DIV. 1 ENVIRONMENT, (ESD RATED CHAIN REQUIRED).

1.2 ALL VFD CABLES SHALL HAVE SHIELD TERMINATED AT THE MAIN CONTROL PANEL, NO CONNECTION AT MOTOR.

1.3 CABLES REQUIRED FOR EACH UNIT, TOTAL OF 4 UNIT, TOTAL OF 4 ENERGY CHAINS.

1.4 CABLES TO BE SPECIFIED BY ENERGY CHAIN MANUFACTURER FOR BEST PERFORMANCE AND FIT.

1.5 FINAL ENERGY CHAIN CABLE LIST TO BE APPROVED BY THE CONTROLS ENGINEERING DEPARTMENT

1.6 ALL CABLES TO BE RATED AT A MINIMUM OF 600 VAC

1.7 VFD CABLES SHALL ALL BE RATED AT A MINIMUM BELOW

- 1.7.1 OUTER JACKET PUR
- 1.7.2 CABLE RATED FOR OIL RESISTANCE
- 1.7.3 CABLE TO INCLUDE A OVERALL SHIELD
- 1.7.4 CABLE TO BE RATED CHAIN FLEX CLASS OR EQUIVALENT PER EQUIPMENT PROVIDER
- 1.7.5 CABLE SHALL BE FLAME RETARDANT

1.8 ETHERNET CABLES SHALL ALL BE RATED AT A MINIMUM BELOW

- 1.8.1 OUTER JACKET TPE
- 1.8.2 CABLE RATED FOR OIL RESISTANCE
- 1.8.3 CABLE TO INCLUDE A OVERALL SHIELD
- 1.8.4 CABLE TO BE RATED CHAIN FLEX CLASS OR EQUIVALENT PER EQUIPMENT PROVIDER
- 1.8.5 CABLE SHALL BE FLAME RETARDANT

1.9 CONTROL CABLES SHALL ALL BE RATED AT A MINIMUM BELOW

- 1.9.1 OUTER JACKET PUR
- 1.9.2 CABLE RATED FOR OIL RESISTANCE
- 1.9.3 CABLE TO BE RATED CHAIN FLEX CLASS OR EQUIVALENT PER EQUIPMENT PROVIDER
- 1.9.4 CABLE SHALL BE FLAME RETARDANT

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Worldwide Experts in Water Treatment

CABLE NUMBERS & WIRES

REF. FROM:	-	DO NOT SCALE PRINTS
DATE (mm/dd/yyyy)	2/7/2019	WORKMANSHIP STANDARD ES0001 APPLIES

REVISION	EN/ECO	BY	CHECK'D	DATE
INITIAL RELEASE	-	SOG	JP	1/25/2022

DRAWN	SOG	ORIGINAL S.O.
CHECK'D	JP	CSW1584-01

DWG. NO. CSW1584-128 | SHEET 1 OF 1 | REV A

Torque Values
114808 (Rev F)

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.

1. 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.
2. 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. △E
3. 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.
4. FOR STUDS, USE TORQUE VALUES CORRESPONDING TO THE SAME SIZE AND GRADE OF CAPSCREWS.

△C

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 A 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 CONNECITON AND BROUGHT TO SNUG TIGHTNESS.

ALL BOLTS IN THE JOINT SHALL BE TIGHTEDED 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)	Dispostion 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.

△D △F

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)

REVISION	ECO	BY	CHECK'D	DATE	
ADDED THE NUT TURN CHART	35895	CKT	RGP	6/26/09	△F
TITLE BLOCK UPDATE	35052	DJN	CKT	2/10/09	△E
ADDED 304 STAINLESS TO THE LIST	34901	CKT	RGP	1/19/09	△D
REVISED TO UPDATE TITLE BLOCK AND REMOVE NOTES	34709	CKT	RGP	12/11/08	△C
INITIAL RELEASE					△A

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

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D

TOTAL WT: -

ORIGINAL S.O. -

DO NOT SCALE PRINTS

REF. FROM: -

SHEET 1 OF 1

DATE 1/8/81
DRAWN GBH
CHECK'D JKM

TORQUE VALUES FOR MACHINERY CONNECTIONS FOR INDUSTRIAL CONNECTIONS

DWG. NO. 114808 REV F

7.0 ACCESSORIES

ACCESSORIES

TAB 1
Gearbox Oil
(Ovivo USA, LLC Part No. 584647)

Mobilgear 600 XP Series

GEARBOX OIL

Gear Oil

Product Description

The Mobilgear 600 XP Series are extra high performance gear oils having outstanding extreme pressure characteristics and load-carrying properties, intended for use in all types of enclosed gear drives with circulation or splash lubrication systems. Mobilgear 600 XP Series is designed to stay ahead of the changing needs of gearbox technology. Gearbox technology design trends are towards smaller units with similar power throughput. This increase in power density places increased demands on gear oils. Mobilgear 600 XP Series oils are formulated to meet the stress by providing extra protection for gears, bearings and seals.

Mobilgear 600 XP Series is formulated to protect gear teeth from wear at its earliest stages. Microscopic wear, called micropitting, can lead to significant gear tooth damage. Mobilgear 600 XP Series exceeds the industry requirement for bearing wear protection. In fact, Mobilgear 600 XP Series provides up to 15 times the wear protection as measured by the industry standard FAG FE 8 test. Mobilgear 600 XP Series' balanced formulation is able to provide maximum wear and corrosion protection while maintaining compatibility with common gearbox seal materials. Mobilgear 600 XP helps to maintain gearbox seal integrity thereby preventing oil leaks and keeping contamination out. By protecting the gears, bearings and seals, Mobilgear 600 XP can improve equipment reliability and increase productivity.

Mobilgear 600 XP Series oils are recommended for industrial spur, helical and bevel enclosed gears with circulation or splash lubrication, operating at bulk oil temperatures up to 100ºC. They are particularly suitable for gear sets working under heavy or shock loads. Mobilgear 600 XP oils also find broad application in marine gearing applications. They may also be used in non-gear applications include highly loaded and slow speed plain and rolling contact bearings.

Features and Benefits

Mobilgear 600 XP Series products are a leading member of the Mobil brand of industrial lubricants that enjoy a reputation for innovation and high performance capability. These mineral-based products are designed to provide high quality industrial gear oils, meeting the latest industry standards and with high versatility to lubricate a broad range of industrial and marine equipment.

Mobilgear 600 XP Series products offer the following features and potential benefits:

Features	Advantages and Potential Benefits
Enhanced gear wear protection from micropitting	Less gear and bearing wear resulting in less unexpected downtime
Reduced debris denting from generated wear particles	Up to 22% improvement in bearing life reducing bearing replacement costs and improving productivity
Improved bearing wear protection	Improved bearing life resulting in higher productivity
Outstanding compatibility with a range of seal materials	Reduced leakage, oil consumption and contamination ingress helping to reduce maintenance, extend gearbox reliability and higher productivity

Features	Advantages and Potential Benefits
Excellent resistance to oil oxidation and thermal degradation	Helps extend lubricant life with lower lubricant and lubrication costs and reduced scheduled downtime.
High resistance to sludge and deposit formation	Cleaner systems and reduced maintenance
Wide range of applications	Fewer grades of lubricant required because of wide range of application, leading to lower purchase and storage costs and less danger of using wrong lubricant
Optimised resistance to rust and corrosion of steel and corrosion of copper and soft metal alloys	Excellent protection of machine parts, with reduced maintenance and repair costs
Resistance to foaming and emulsion formation	Effective lubrication and problem free operation in the presence of water contamination or in equipment prone to oil foaming

Applications

Mobilgear 600 XP lubricants are used in a wide range of industrial and marine applications, especially spur, helical, bevel and worm gearing. Specific applications include:

- Industrial gearing for conveyers, agitators, dryers, extruders, fans, mixers, presses, pulpers, pumps (including oil well pumps), screens, extruders and other heavy duty applications
- Marine gearing including main propulsion, centrifuges, deck machinery such as winches, windlasses, cranes, turning gears, pumps, elevators and rudder carriers
- Non-gear applications include shaft couplings, screws and heavily loaded plain and rolling contact bearings operating at slow speeds.

Specifications and Approvals

Mobilgear 600 XP Series meets or exceeds the following industry specifications:	Mobilgear 600 XP 68	Mobilgear 600 XP 100	Mobilgear 600 XP 150	Mobilgear 600 XP 220	Mobilgear 600 XP 320	Mobilgear 600 XP 460	Mobilgear 600 XP 680
Flender BA 7300 Table A		Approved	Approved	Approved	Approved	Approved	Approved
AGMA 9005-E02	2 EP	3 EP	4 EP	5 EP	6 EP	7 EP	-
DIN 51517 Part 3	CLP 68	CLP 100	CLP 150	CLP 220	CLP 320	CLP 460	CLP 680
ISO 12925-1 Type	CKD 68	CKD 100	CKD 150	CKD 220	CKD 320	CKC 460	CKC 680
Textron Power Transmission Grade	E2	E3	E4	E5	E6	E7	E8
Mueller Weingarten DT 55 005		CLP 100 Approved	CLP 150 Approved	CLP 220 Approved	CLP 320 Approved	CLP 460 Approved	

Typical Properties

Mobilgear 600 XP	68	100	150	220	320	460	680
ISO Viscosity Grade	68	100	150	220	320	460	680
Viscosity, ASTM D 445							
mm²/s @ 40ºC	68	100	150	220	320	460	680
mm²/s @ 100ºC	8.8	11.2	14.7	19.0	24.1	30.6	39.2

Mobilgear 600 XP	68	100	150	220	320	460	680
Viscosity Index, ASTM D 2270	101	97	97	97	97	96	90
Pour Point, ºC, ASTM D 97	-27	-24	-24	-24	-24	-15	-9
Flash Point, ºC, ASTM D 92	230	230	230	240	240	240	285
Density @15.6 ºC, ASTM D 4052, kg/l	0.88	0.88	0.89	0.89	0.90	0.90	0.91
FZG Micropitting, FVA 54, Fail Stage / Rating		10 / High	10 / High	10 / High	10 / High	10 / High	10 / High
FE 8 wear test, DIN 51819-3, D7,5/80-80. Roller wear, mg	2	2	2	2	2	2	2
Timken OK Load, ASTM D 2782, lb	65	65	65	65	65	65	65
4-Ball EP test, ASTM D 2783,							
Weld Load, kg	200	200	250	250	250	250	250
Load Wear Index, kgf	47	47	47	48	48	48	48
FZG Scuffing, Fail Stage							
A/8.3/90	12+	12+	12+	12+	12+	12+	12+
A/16.6/90		12+	12+	12+	12+	12+	12+
Rust protection, ASTM D 665, Sea Water	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Copper Strip Corrosion, ASTM D 130, 3 hrs @ 100ºC	1B	1B	1B	1B	1B	1B	1B
Demulsibility, ASTM D 1401, Time to 3ml emulsion, minutes @ 82ºC	30	30	30	30	30	30	30
Foam Test, ASTM D 892, Tendency/Stability, ml/ml Sequence 1	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Sequence 2	30/0	30/0	30/0	30/0	30/0	30/0	30/0

Health and Safety

Based on available information, this product is not expected to produce adverse effects on health when used for the intended application, following the recommendations provided in the Material Safety Data Sheet (MSDS). MSDSs are available upon request through your sales contract office, or via the Internet on http://www.exxonmobil.com. This product should not be used for purposes other than its intended use. If disposing of used product, take care to protect the environment.

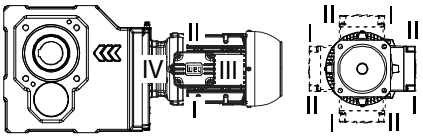
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ExxonMobil Lubricants & Specialties
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15.6 Kegelstirnradgetriebe K77 - K139 / Helical bevel gear units K77 - K139

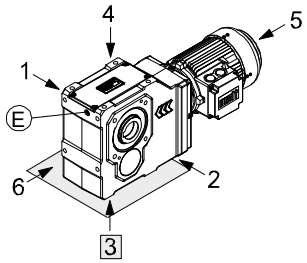
BAUFORMEN **MOUNTING POSITIONS**

KLEMMKASTENLAGE (1,2,3,4) und KABEL-EINFÜHRUNG (I, II, III, IV)
POSITION of TERMINAL BOX (1,2,3,4) and CABLE ENTRY (I, II, III, IV)

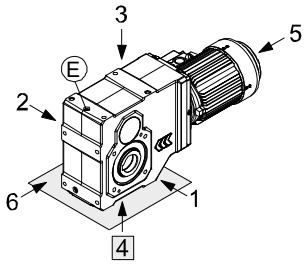


Ⓔ … Position der Entlüftungsschraube
Position of the vent plug

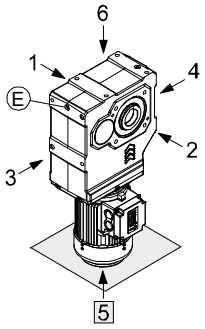
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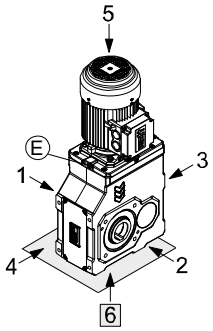
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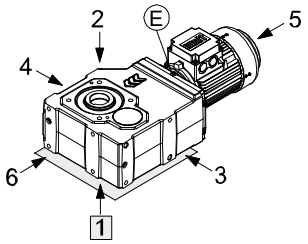
H5..



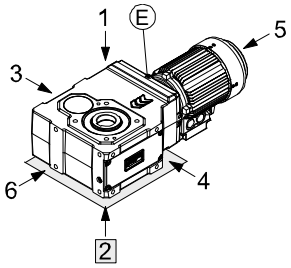
H6..



V1..



V2..



Bei allen Getriebetypen werden bei jeder Einbaulage im Standard Entlüftungsschrauben verwendet.

All parallel shaft gear units have vent plugs in all mounting positions as standard.

SCHMIERSTOFFMENGEN **LUBRICANT CAPACITY**

	Type		Bauformen / Mounting positions					
			H3	H4	V1	V2	H5	H6
3-stufig 3-stage	K.. 77A	≤ Motor 112+IA+NA+SA+WN	2,6 l	3,5 l	2,6 l		3,5 l	5,0 l
		≥ Motor 132	2,8 l	4,1 l	2,8 l		4,1 l	5,0 l
	K.. 80A	≤ Motor 112+IA+NA+SA+WN	4,5 l	6,4 l	4,5 l		5,8 l	8,8 l
		≥ Motor 132	4,7 l	7,0 l	4,7 l		6,4 l	8,8 l
	K.. 86A	≤ Motor 112+IA+NA+SA+WN	7,6 l	10,7 l	7,6 l		9,6 l	15,5 l *)
		≥ Motor 132	7,9 l	11,3 l	7,9 l		10,2 l	15,5 l *)
	K.. 110A		13,0 l	19,0 l	13,0 l		18,0 l	23,5 l *)
	K.. 136A		30,0 l	44,0 l	30,0 l		39,0 l	61,0 l *)
	K.. 139A		40,0 l	53,0 l	45,0 l		48,0 l	76,0 l *)
4-stufig 4-stage	K.. 77C		3,8 l		3,0 l		3,9 l	5,7 l *)
	K.. 80C		6,7 l		4,8 l		6,2 l	9,7 l *)
	K.. 86C		11,0 l		8,0 l		10,0 l	16,2 l *)
	K.. 110C		17,0 l	21,0 l	14,0 l		20,0 l	27,5 l *)
	K.. 136C		40,0 l	47,0 l	32,0 l		42,0 l	67,0 l *)
	K.. 139C		48,0 l	56,0 l	48,0 l		52,0 l	81,0 l *)
5-stufig 5-stage	K.. 77D		4,4 l		3,5 l		4,4 l	5,9 l *)
	K.. 80D		7,0 l		5,3 l		6,7 l	9,7 l *)
	K.. 86D		11,2 l		8,5 l		10,5 l	16,0 l *)
	K.. 110D		21,0 l	22,5 l	15,0 l		22,0 l	28,5 l *)
	K.. 136D		45,0 l	50,0 l	33,0 l		45,0 l	68,0 l *)
	K.. 139D		56,0 l	59,0 l	50,0 l		55,0 l	82,0 l *)

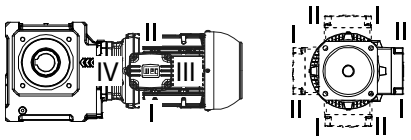
*)… Richtwerte. Auf Ölstand füllen! Siehe Seite 50.

*) … Orientative values. Fill on oil-level! See page 50.

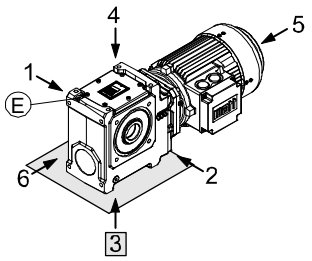
15.7 Stirnradschneckengetriebe S / Helical worm gear units S

BAUFORMEN **MOUNTING POSITIONS**

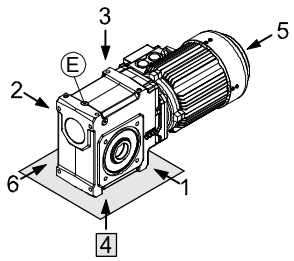
KLEMMKASTENLAGE (1,2,3,4) und KABEL-EINFÜHRUNG (I, II, III, IV)
POSITION of TERMINAL BOX (1,2,3,4) and CABLE ENTRY (I, II, III, IV)



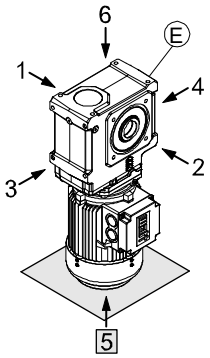
H3..



H4..

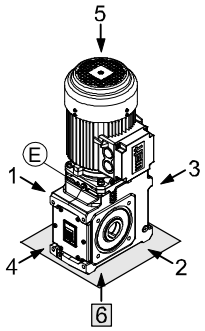


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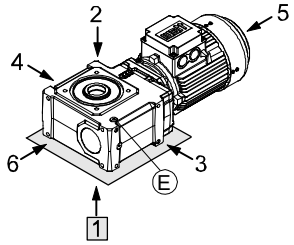


Ⓔ … Position der Entlüftungsschraube
Position of the vent plug

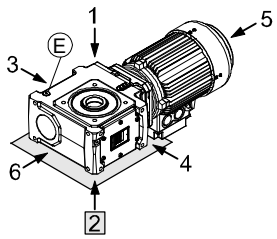
H6..



V1..



V2..



Bei allen Getriebetypen werden bei jeder Einbaulage im Standard Entlüftungsschrauben verwendet.

All helical worm gear units have vent plugs in all mounting positions as standard.

SCHMIERSTOFFMENGEN **LUBRICANT CAPACITY**

	Type	Bauformen / Mounting positions					
		H3	V1	V2	H6	H5	H4
2-stufig 2-stage	S.. 454A,B,S	0,5 l				0,55 l	
	S.. 455A,B,S	0,65 l			0,75 l	0,85 l	0,65 l
	S.. 506A,B,S	1,1 l			1,45 l		1,1 l
	S.. 507A,B,S	1,2 l			1,6 l		1,2 l
	S.. 608A,B	1,8 l			2,6 l	2,4 l	1,8 l
	S.. 609A,B ≤ Motor 112	2,1 l			3,0 l	2,7 l	2,1 l
	S.. 609A,B ≥ Motor 132	2,4 l			3,0 l	3,3 l	2,7 l
3-st. 3-st.	S.. 506C	1,35 l			1,8 l *)	1,8 l	1,35 l
	S.. 507C	1,45 l			1,9 l *)	1,9 l	1,45 l
	S.. 608C	2,1 l			3,0 l *)	2,3 l	2,1 l
	S.. 609C	2,4 l			3,5 l *)	3,1 l	2,4 l

*)… Richtwerte. Auf Ölstand füllen! Siehe Seite 50.

*) … Orientative values. Fill on oil-level! See page 50.

TAB 2
Bearing Grease
(Ovivo USA, LLC Part No. 590157)

BEARING LUBRICATION

Mobilith SHC Series

Grease

Product Description

Mobilith SHC Series greases are supreme performance products designed for a wide variety of applications at extremes of temperature. They combine the unique features of synthetic base fluids with those of a high quality lithium complex thickener. The wax-free nature of synthetic fluids and the low coefficient of traction (compared with mineral oils), provide excellent low temperature pumpability and very low starting and running torque. These products offer the potential for energy savings and can reduce operating temperatures in the load zone of spherical roller and ball bearings. The lithium complex thickener contributes excellent adhesion, structural stability and resistance to water. The greases have a high level of chemical stability and are formulated with special additive combinations to provide excellent protection against wear, rust and corrosion at high and low temperatures. Mobilith SHC Series greases are available in seven grades, varying in base oil viscosity from ISO VG 100 to 1500 and in NLGI grade from 2 to 00.

Mobilith SHC Series greases have become the products of choice for many users, in many industries worldwide. Their reputation is based on their exceptional quality, reliability, versatility and the performance benefits they deliver.

Features and Benefits

The Mobil SHC brand of oils and greases are recognized and appreciated around the world for their innovation and outstanding performance. The Mobilith SHC series symbolizes ExxonMobil's continued commitment to using advanced technology to provide outstanding products. A key factor in the development of the Mobilith SHC Series were the close contacts between our scientists and application specialists with key Original Equipment Manufacturers (OEMs) to ensure that our product offerings would provide exceptional performance in the continually evolving industrial equipment designs. Our work with equipment builders has helped confirm the results from our own laboratory tests showing the exceptional performance of the Mobilith SHC Series lubricants. These benefits include longer grease life, enhanced bearing protection and bearing life, wide temperature range of application, and the potential for improved mechanical efficiency and energy savings. To combat high thermal exposure of the oil our product formulation scientists chose proprietary synthetic base oils for Mobilith SHC Series oils because of their exceptional thermal/oxidative resistance potential. Our scientists developed a state-of-the-art lithium complex thickener technology and used specific additives to enhance the performance of each grade of the Mobilith SHC Series product family. The Mobilith SHC Series greases offer the following features and benefits:

Features	Advantages and Potential Benefits
Outstanding high temperature and low temperature performance	Wide application temperature ranges, with excellent protection at high temperatures and low torque, easy start-up at low temperatures
Excellent protection against wear, rust and corrosion	Reduced downtime and maintenance costs because of reduced wear, rust and corrosion
Excellent thermal stability and oxidation resistance	Extended service life with longer intervals between relubrication and improved bearing life

Features	Advantages and Potential Benefits
Low traction coefficient	Potential improved mechanical life and reduced energy consumption
Includes both high and low viscosity grades	Options for outstanding protection of slow speed, heavily loaded bearings, and options for good low temperature performance
Outstanding structural stability in the presence of water	Retains excellent grease performance in hostile aqueous environments
Low volatility	Helps resists viscosity increase at high temperatures to maximize relubrication intervals and bearing life

Applications

Application Considerations: While Mobilith SHC Series greases are compatible with most mineral oil based products, admixture may detract from their performance. Consequently it is recommended that before changing a system to one of the Mobilith SHC Series, it should be thoroughly cleaned out to achieve the maximum performance benefits. While the Mobilith SHC Series greases share many performance benefits, their applications are best described in terms of each product grade:

- Mobilith SHC 100 is an antiwear and extreme pressure grease primarily recommended for higher speed applications such as electric motors, where reduced friction, low wear and long service life are required. It is an NLGI 2 Grade / ISO VG 100 grease with a synthetic base fluid. Its operating temperature range is -40º C* to 150º C.
- Mobilith SHC 220 is a multi-purpose, NLGI 2 extreme pressure grease recommended for heavy-duty automotive and industrial applications. It uses an ISO VG 220 synthetic base fluid. Mobilith SHC 220 has a recommended operating temperature range of -40º C* to 150º C.
- Mobilith SHC 221 is a multi-purpose, extreme pressure grease recommended for heavy-duty automotive and industrial applications, particularly where centralized grease systems are utilized. It uses an ISO VG 220 synthetic base fluid. Mobilith SHC 221 has a recommended operating temperature range of -40º C to 150º C.
- Mobilith SHC 460 is an NLGI 1.5 Grade grease with ISO VG 460 synthetic base fluid and is an extreme pressure grease recommended for tough industrial and marine applications. It provides outstanding bearing protection under heavy loads at low-to-moderate speeds and in applications where water resistance is a critical factor. Mobilith SHC 460 has demonstrated outstanding performance in steel mills, paper mills and marine applications. The recommended operating temperature range is -30º C* to 150ºC.
- Mobilith SHC 1000 Special is an NLGI 2 Grade grease with ISO VG 1000 synthetic base fluid and strongly fortified with solid lubricants including 11% graphite and 1% molybdenum disulphide for maximum protection of plain or rolling element bearings operating under boundary lubrication regimes. This product is designed to extend bearing life under conditions of extremely slow speeds, heavy loads and high temperatures. Mobilith SHC 1000 Special has a recommended operating temperature of -20°C* to 150 °C with appropriate relubrication intervals.
- Mobilith SHC 1500 is an NLGI 1.5 Grade / ISO VG 1500 grease with a synthetic base fluid. It is intended for use in plain and rolling element bearings operating at extremely slow speeds, under heavy loads and high temperatures. Mobilith SHC 1500 has a recommended operating temperature range of -20 ºC* to 150 ºC with appropriate relubrication intervals. Continuous lubrication with Mobilith SHC 1500 has been very effective in prolonging bearing life in a severe roll press application. Mobilith SHC 1500 has also provided excellent performance in rotary kiln roller bearings and in slag transfer rail car bearings.
- Mobilith SHC 007 is an NLGI 00 Grade / ISO VG 460 grease with a synthetic base fluid; it has a recommended operating temperature range of -50º C to 150 º C with appropriate relubrication intervals. Its primary uses are in grease filled industrial gear cases subject to high temperatures, where conventional

TAB 3
Hydraulic Fluid
(Ovivo USA, LLC Part No. BB301)

Hydro Safe/ Renewable Lubricants, Inc.
476 Griggy Rd. NE, PO Box 474
Hartville, OH 44632-0474
Voice: 330.877.9982 Fax: 330.877.2266
www.renewablelube.com

Hydro-Safe Select Hydraulic Fluids

(ISO 22, 32, 46, 68)

STABILIZED ™ by Renewable Lubricants

"Biobased Lubricants that Perform Like Synthetics"

Hydro-Safe Select Hydraulic Fluids are ultimately biodegradable[1] vegetable based formulas that meets and exceeds Vickers M-2950-S, Vickers 1-286-5, U.S. Steel 126, and U.S. Steel 127. These patented biobased hydraulic fluids are formulated to perform in fleet, marine, and industrial hydraulic systems that require Anti-Wear (AW), anti-rust, anti-oxidation, anti-foam, and demulsibility properties. An environmentally friendly, zinc-free additive system has also been developed that meets or exceeds high pressure pump requirements. The anti-wear performance meets the requirements for Vickers 35VQ-25 and V-104C (ASTM D-2882) vane pump stand tests, and exceeds DIN 51524 Part 3 load stage 10 that is recommended for vane, piston and gear pumps.

Hydro Safe Select Hydraulic Fluids are the perfect choice for hydraulic equipment operating outside where higher moisture and dusty environments are more prominent. They are highly inhibited against moisture and rusting in both fresh and sea water, passed both A and B Sequences of the ASTM D-665 Turbine Oil Rust Test, and they provide excellent water separation as shown in ASTM D-1401 Demulsibility Test. Hydro Safe Select Hydraulic Fluids are the best economical choice where these unpredictable environmental conditions exist and the equipment require more frequent oil change intervals.

Incorporating the super high viscosity index (VI) of the Stabilized* High Oleic Base Stocks (HOBS) into the formula, increases the VI past synthetic levels (Energy Conserving Formulas). In addition, this super high VI naturally improves the thermal and mechanical shear stability of the formula and provides additional fluid protection under higher loads and pressures. The HOBS's extremely low volatility increases the flash and fire safety features in the formula. These biobased fluids are designed to provide seal conditioning for longer seal life and to reduce oil leakage from the system.

Hydro-Safe Select Hydraulic Fluids meet the Environmental Protection Agency (EPA) 2013 Vessel General Permit (VGP) guidelines for Environmentally Acceptable Lubricants (EALs), and should be used in hydraulic systems where **LOW TOXICITY**, **BIODEGRADABILITY** and **NON-BIOACUMMULATION** properties are required. They exceed the acute toxicity (LC-50 / EC-50 >1000 ppm) criteria adopted by the US Fish and Wildlife Service and the US EPA. Hydro-Safe Select Hydraulic Fluids are ENVIRONMENTALLY RESPONSIBLE lubricants that are formulated from renewable agricultural biobased resources. We believe Earth's environmental future rests in the use of renewable materials.

[1]Ultimate Biodegradation (Pw1) within 28 days in ASTM D-5864 Aerobic Aquatic Biodegradation of Lubricants

STABILIZED by Renewable Lubricants™* is RLI's trademark on their proprietary and patented anti-oxidant, anti-wear, and cold flow technology. High Oleic Base Stock (HOBS) are agricultural vegetable oils. This Stabilized technology allows the HOBS to perform as a high performance formula in high and low temperature applications, reducing oil thickening and deposits.

Patented Product: US Patent 6,383,992, US Patent 6,534,454 with additional Pending and Foreign Patents
™ Trademark of Renewable Lubricants™, Inc. Copyright 1999 Renewable Lubricants, Inc.

Availability	F.O.B. :Hartville, Ohio, USA	1 Gallon	5 Gallon Pail	Drum	Totes	Bulk

Hydro-Safe Select Hydraulic Fluids ISO 22, 32, 46, 68

TYPICAL SPECIFICATIONS	METHOD	ISO 22	ISO 32	ISO 46	ISO 68	Spec. Requirements
Specific Gravity @ 15.6°C	ASTM D-287	**0.88**	**0.88**	**0.88**	**0.88**	Report
Viscosity @ 40°C	ASTM D-445	**22.3**	**30.5**	**43.1**	**62.8**	Note 1
Viscosity @ 100°C	ASTM D-445	**5.27**	**6.7**	**8.8**	**11.9**	Note 1
Viscosity @ -25°C, Brookfield	ASTM D-2983	**1,000 cP**	**1,400 cP**	**3,400 cP**	**4,700 cP**	Note 1
Viscosity Index	ASTM D-2270	**182**	**186**	**190**	**189**	90 (min)
Pour Point	ASTM D-97	**-38°C**	**-35°C**	**-33°C**	**-30°C**	Note 1
Flash Point (COC)	ASTM D-92	**205°C**	**232°C**	**240°C**	**248°C**	198°C (min)
Fire Point (COC)	ASTM D-92	**230°C**	**255°C**	**264°C**	**270°C**	218°C (min)
Foam Sequence I, II, III (10 min)	ASTM D-892	**0 Foam**	**0 Foam**	**0 Foam**	**0 Foam**	0 Foam
Rust Prevention	ASTM D-665					
Distilled Water		**Pass**	**Pass**	**Pass**	**Pass**	Pass
Syn. Sea Water		**Pass**	**Pass**	**Pass**	**Pass**	Pass
Copper Corrosion Strip 3hr @ 100°C	ASTM D-130	**1A**	**1A**	**1A**	**1A**	DIN 51524 2(max)
Dielectric Strength, KV (Avg)	ASTM D-877	**46**	**40**	**40**	**40**	>35
Rotary Bomb Oxidation, (minutes)	ASTM D-2272	**270**	**272**	**270**	**260**	USS 120 (min)
Neutralization Number mg KOH/g	ASTM D-974	**0.5**	**0.5**	**0.5**	**0.5**	1.5 (max)
Swell of Synthetic NBR-L Rubber, % (Avg.)	DIN 53538, Part					
Volume Change (%)	1	**8.0**	**6.0**	**5.0**	**5.0**	0 to 12
Shore A Hardness Change (%)		**-5**	**-4**	**-4**	**-4**	0 to -7
Demulsibility, ML Oil/Water/Emulsion	ASTM D-1401	**40/40/0 <10 minutes**	**40/ 40/0 <10 minutes**	**40/ 40/0 <10 minute**	**40/ 40/0 <10 minute**	40/37/3 (max) (30 minutes)
4-Ball Wear, 1h, 167°F, 1200 RPM, 40 kg	ASTM D-4172	**0.42**	**0.40**	**0.40**	**0.40**	USS 127 0.5 (max) US.Steel 10 (min)
FZG Test A/8,3/90	DIN 51354	**11**	**11**	**11**	**11**	
Biodegradation Classification	ASTM D-5864	Ultimate PW1	Ultimate PW1	Ultimate PW1	Ultimate PW1	Ultimate PW1
Environmentally Friendly	ISO 15380	yes	yes	yes	yes	
USDA Biobased Tested	New Carbon	yes	yes	yes	yes	meets/exceeds over 50%
Note 1 Viscosity Sufficient for Application						
Note 2 Not Required						
Product Item #		7081	7082	7083	7084	

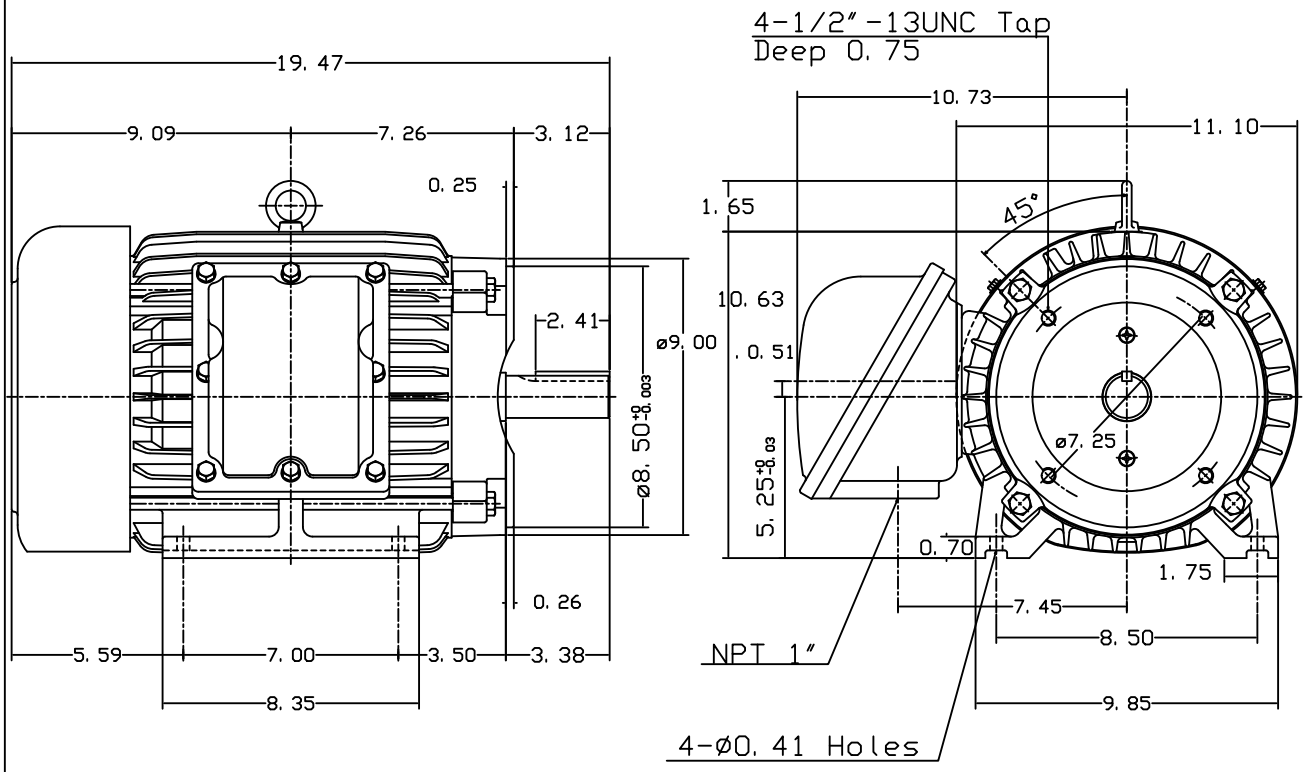
TAB 4
Hoist Motor
(Ovivo USA, LLC Part No. 772328)

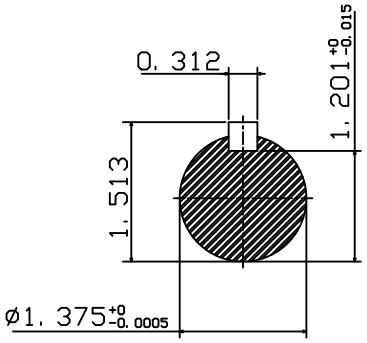
DATE	OUTLINE DIMENSIONS	MOTOR TYPE:
JULY 6, 2011	3-PHASE INDUCTION MOTOR	AEHHXF
CATALOG NO. XP0104C		FRAME NO. 215TC

Pole	HP	KW	Hz	VOLT	Syn. Speed r/min(rpm)
4	10	7.5	60	230/460	1800

Ins	Rating	Dimension in	Approx Weight	Bearings
F	CONT.	inches	241 lbs.	DE: 6308ZZ NDE: 6306ZZ

Totally Enclosed Fan-Cooled Type. Squirrel-Cage Rotor.





MODIFICATIONS:

M2X - 120V SPACE HEATER - WIRED TO MAIN BOX

Note:

1. Explosion proof:
   Class I Group C, D and
   Class II Group E, F, G.

0			

DWN.	J. H. LIANG	11·28·00
CHKD.	C. S. LO	03·22·01
APPD.	Y. B. HUANG	03·22·01

TECO Westinghouse

DWG NO. 31049M624022

TECO Westinghouse

ISSUED		ENCLOSURE
April 11, 2011	**PERFORMANCE DATA**	EXPLOSION PROOF
TYPE	**3-PHASE INDUCTION MOTOR**	CATALOG#
AEHHXF		XP0104C

NAMEPLATE INFORMATION

OUTPUT HP	OUTPUT KW	POLE	FRAME SIZE	VOLTAGE	HZ	RATED AMBIENT	INS. CLASS	NEMA DESIGN	TIME RATING	SERVICE FACTOR
10	7.5	4	215TC	230/460	60	40°C	F	B	CONT.	1.15

TYPICAL PERFORMANCE

FULL LOAD RPM	EFFICIENCY				POWER FACTOR			MAXIMUM POWER FACTOR CORRECTION
	FULL LOAD		3/4 LOAD	1/2 LOAD	F. L.	3/4 LOAD	1/2 LOAD	
	MIN. %	NOM. %	%	%	%	%	%	
1745	90.2	91.7	92	92	87.5	85	78.5	2.7 KVAR

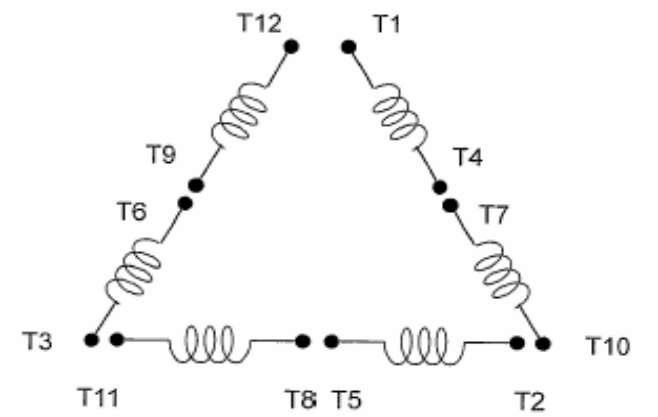
CURRENTS									NEMA KVA CODE LETTER
NO LOAD			FULL LOAD			LOCKED ROTOR			
AT 208 VOLT	AT 230 VOLT	AT 460 VOLT	AT 208 VOLT	AT 230 VOLT	AT 460 VOLT	AT 208 VOLT	AT 230 VOLT	AT 460 VOLT	
7.39	6.68	3.34	25.88	23.40	11.70	179.13	162.00	81.00	H

TORQUE				INERTIA			ACCEL TIME	
FULL LOAD lb-ft	LOCKED ROTOR %FLT	PULL UP %FLT	BREAK DOWN %FLT	ROTOR WR^2 $lb\text{-}ft^2$	NEMA LOAD WK^2 $lb\text{-}ft^2$	MAX ALLOWABLE WK^2 $lb\text{-}ft^2$	NEMA LOAD WK^2 Sec	MAX ALLOWABLE WK^2 Sec
30.09	260	210	280	0.924	51	98.00	4.02	7.65

SAFE STALL TIME IN SECONDS		ALLOWABLE STARTS PER HOUR		SOUND PRESSURE LEVEL @ 3 FT dB(A)
COLD	HOT	COLD	HOT	
17	12	2	1	60

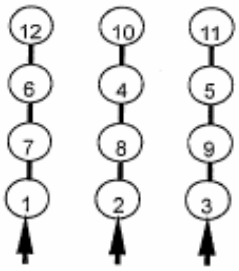
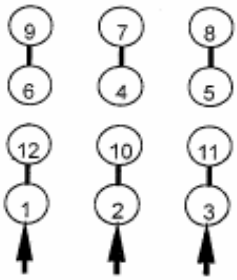
APPROVED:	M. PRATER	DRAWING NO.	31057XP0104C	REVISION 0

DATE: May 14, 2011	CONNECTION DIAGRAM	CATALOG NO.: XP0104C



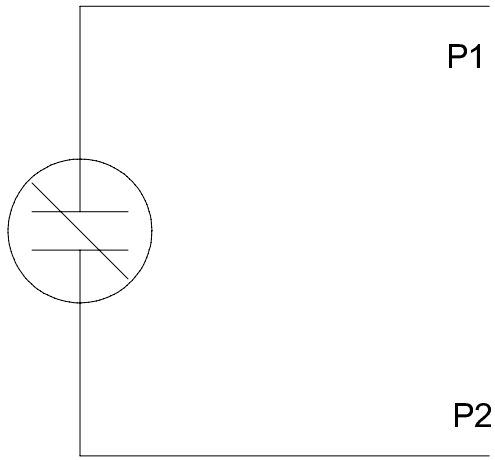
SCHEMATIC - Δ / Y CONNECTION

ACROSS THE LINE CONNECTION

	
LINE **230 VOLT CONNECTION**	**LINE** **460 VOLT CONNECTION**

***CONTACT TWMC IF YOU HAVE ANY QUESTIONS REGARDING THE MOTOR CONNECTION.**
PH: 1-800-873-8326

TECO Westinghouse	DWG NO. DAC-1565-5



NORMALLY CLOSED
OPENS ON RISING TEMP

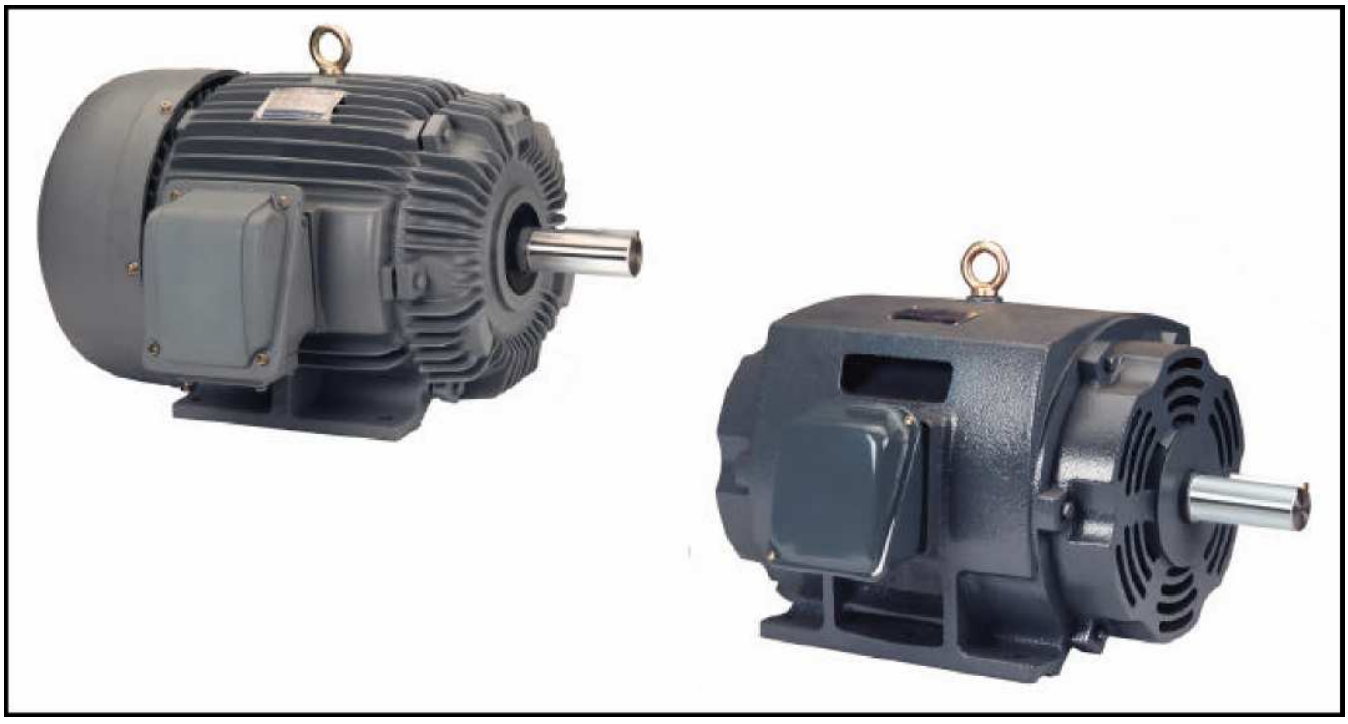
STATOR WINDING THERMOSTATS SCHEMATIC DIAGRAM

REV DATA							
				DFTM D. BRYAN	061581	S.O. 1625AA	REV
				APPD G. GODWIN	070881	D SPEC 110A75	02
		APPD J. BROWN	071481	APPD CULBERTSON	070881	DIMENSIONS IN INCHES - NTS	
	AMT; DEM; 04/30/99	APPD	_____	APPD D.F. KOSAR	071381	8629A28	

TECO-WESTINGHOUSE MOTOR COMPANY ROUND ROCK, TX USA

INSTALLATION AND MAINTENANCE INSTRUCTIONS FOR THREE PHASE INDUCTION MOTORS

Frames 143T - 449TZ



5100 North IH 35 Round Rock, Texas 78681

RECEIVING

1. Check nameplate data.
2. Check whether any damage has occurred during transportation.
3. After removal of shaft clamp, turn shaft by hand to check that it turns freely.
4. If motor is to be reshipped (alone or installed to another piece of equipment) the shaft must again be clamped to prevent axial movement.
   Note: Remove the bearing clamp before turning the shaft on 284T-449TZ frame motors.

WARNING
THE FOLLOWING SAFETY PRECAUTIONS MUST BE OBSERVED:

1. Electric rotating machinery and high voltage can cause serious or fatal injury if improperly installed, operated or maintained. Responsible personnel should be familiarized with NEMA MG-1; Safety Standards for Construction and Guide Selection. Installation and Use of Electric Motors and Generators; National Electric Code and all local safety requirements.
2. When servicing, all power sources to the motor and to the accessory devices should be de-energized and disconnected and all rotating parts should be at standstill.
3. Lifting means, when supplied, are intended for lifting the motor only. When two lifting devices are supplied with the motor a dual chain must be used.
4. Suitable protection must be used when working near machinery with high noise levels.
5. Safeguard or protective devices must not be by-passed or rendered inoperative.
6. The frame of this machine must be grounded in accordance with the National Electric Code and applicable local codes.
7. A suitable enclosure should be provided to prevent access to the motor by other than authorized personnel. Extra caution should be observed around motors that are automatically or have automatic re-setting relays as they may restart unexpectedly.
8. Shaft key must be fully captive or removed before motor is started.
9. Provide proper safeguards for personnel against possible failure of motor-mounted brake, particularly on applications involving overhauling loads.
10. Explosion proof motors are constructed to comply with the label service procedure manual, repair of these motors must be made by TECO-Westinghouse Motor Company or U/L listed service center in order to maintain U/L listing.

LOCATION

1. Drip-proof motors are intended for use where atmosphere is relatively clean, dry, well ventilated and non-corrosive.
2. Totally enclosed motors may be installed where dirt, moisture, or dust are present and in outdoor locations.
3. Explosion-proof motors are built for use in hazardous locations as indicated by Underwriters' label on the motor.
4. Chemical duty enclosed motors are designed for installation in high corrosion or excessive moisture locations.

   Note: in all cases, no surrounding structure should obstruct normal flow or ventilating air through or over the motor.

MOUNTING

1. Mount motor securely on a firm, flat base. All ball bearing normal thrust motors up to and including 256T frame size may be side-wall or ceiling mounted; all others check nearest TECO-Westinghouse office for mounting recommendations.
2. Align motor accurately, using a flexible coupling if possible. For drive recommendations, consult with drive or equipment manufacturer, or TECO-Westinghouse.
3. Mounting bolts must be carefully tightened to prevent changes in alignment and possible damage to the equipment. The recommended tightening torque's for medium carbon steel bolts, identified by three radial lines at 120 degrees on the head, are:

Bolt Size	Recommended Torque (Ft-lb.)	
	Minimum	Maximum
2/8	25	37
1/2	60	90
5/8	120	180
3/4	210	320

4. V-belts Sheave Pitch Diameters should not be less than those shown in Table 1 (NEMA recommended values)
5. Tighten belts only enough to prevent slippage. Belt speed should not exceed 5000 ft. per min.

TABLE 1. V-Belt Sheave Pitch Diameters (MG1-14.42)

Frame Number	Horsepower at Synchronous Speed, RPM				V-Belt Sheave			
					Conventional A, B, C, D AND E		Narrow 3V, 5V, AND 8V	
	3600	1800	1200	900	Minimum Pitch Diameter Inches	*Maximum Width Inches	Minimum Outside Diameter Inches	**Maximum Width Inches
143T	1.5	1	.75	.5	2.2	4.25	2.2	2.25
145T	2-3	1.5-2	1	.75	2.4	4.25	2.4	2.25
182T	3	3	1.5	1	2.4	5.25	2.4	2.75
182T	5	...	...	...	2.6	5.25	2.4	2.75
184T	...	...	2	1.5	2.4	5.25	2.4	2.75
184T	5	...	...	...	2.6	5.25	2.4	2.75
184T	7.5	5	...	...	3.0	5.25	3.0	2.75
213T	7.5-10	7.5	3	2	3.0	6.5	3.0	3.375
215T	10	...	5	3	3.0	6.5	3.0	3.375
215T	15	10	...	...	3.8	6.5	3.8	3.375
254T	15	...	7.5	5	3.8	7.75	3.8	4
254T	20	15	...	...	4.4	7.75	4.4	4
256T	20-25	...	10	7.5	4.4	7.75	4.4	4
256T	...	20	...	...	4.6	7.75	4.4	4
284T	...	...	15	10	4.6	9	4.4	4.625
284T	...	25	...	...	5.0	9	4.4	4.625
286T	...	30	20	15	5.4	9	5.2	4.625

TABLE 1. V-Belt Sheave Pitch Diameters (MG1-14.42)

Frame Number	Horsepower at Synchronous Speed, RPM				V-Belt Sheave			
					Conventional A, B, C, D AND E		Narrow 3V, 5V, AND 8V	
	3600	1800	1200	900	Minimum Pitch Diameter Inches	*Maximum Width Inches	Minimum Outside Diameter Inches	**Maximum Width Inches
324T	...	40	25	20	6.0	10.25	6.0	5.25
326T	...	50	30	25	6.8	10.25	6.8	5.25
364T	...	...	40	30	6.8	11.5	6.8	5
364T	...	60	...	...	7.4	11.5	7.4	5.785
365T	...	...	50	40	8.2	11.5	8.2	5.785
365T	...	75	...	...	9.0	11.5	8.6	5.785
404T	...	...	60	...	9.0	14.25	8.0	7.25
404T	...	...	...	50	9.0	14.25	8.4	7.25
404T	...	100	...	...	10.0	14.25	8.6	7.25
405T	...	...	75	60	10.0	14.25	10.0	7.25
405T	...	100	...	...	10.0	14.25	8.6	7.25
405T	...	125	...	...	11.5	14.25	10.5	7.25
444T	...	...	100	...	11.0	16.75	10.0	8.5
444T	...	...	...	75	10.5	16.75	9.5	8.5
444T	...	125	...	...	11.0	16.75	9.5	8.5
444T	...	150	...	...	...	16.75	10.5	8.5
445T	...	...	125	...	12.5	16.75	12.0	8.5
445T	...	...	...	100	12.5	16.75	12.0	8.5
445T	...	150	...	...	...	16.75	10.5	8.5

*****Max. Sheave width = 2(N-W) - .25

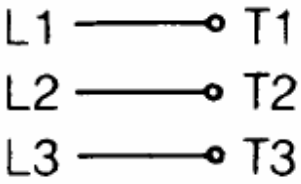
**Max Sheave width = N-W

***Sheave ratios grater than 5:1 and center-to-center distance less than the diameter of the large sheave should be referred to TECO-Westinghouse.

POWER SUPPLY & CONNECTIONS

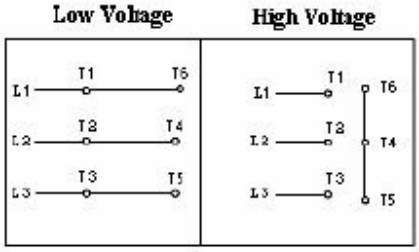
1. Wiring of motor and control, overload protection and grounding should be in accordance with National Electrical Code and all local safety requirements.
2. Nameplate voltage and frequency should agree with power supply. Motor will operate satisfactorily on line voltage within ±10% of nameplate voltage; or frequency with ±5% and with a combined variation not to exceed ±10%. 230-volt motors can be used on 208-volt network systems, but with slightly modified performance characteristics as shown on the nameplate.
3. Dual voltage and single voltage motors can be connected for the desired voltage by following connection diagram shown on the nameplate or inside of the conduit box.
4. All Explosion Proof motors have Temperature Limiting Devices in the motor enclosure to prevent excessive external surface temperature of the motor in accordance with U/L standards. Terminals of thermal protectors (P1 & P2) should be connected to the motor control equipment, according to the connection diagram inside of the conduit box.
5. Standard connection diagram for three phase, not thermally protected, dual rotation motors are shown in diagrams A through E. **(Note: To change rotation, Interchange any two line leads)**

A. 3 Lead, Single Voltage

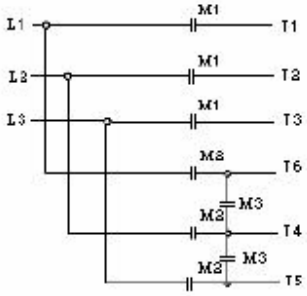


B. 6 Lead, Dual Voltage & Voltage Ration 1 to 3

B-1 Across the Line Start & Run



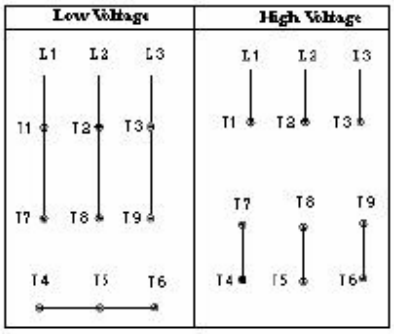
B-2 Wye Start & Delta Run
(Low Voltage only)



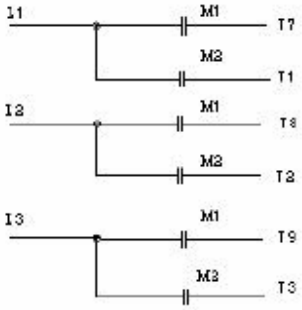
	START	RUN
M1	CLOSE	CLOSE
M2	OPEN	CLOSE
M3	CLOSE	OPEN

C. 9 Leads; Dual Voltage & Voltage Ratio 1 to 2, Wye Connected

C-1 Across the Line Start & Run



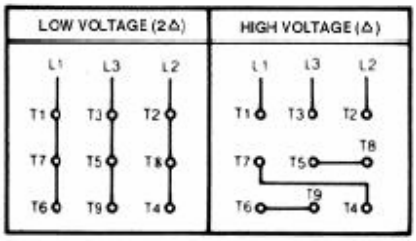
C-2 Part Winding Start
(Low Voltage only)



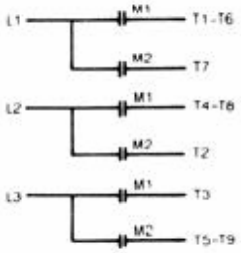
	START	RUN
M1	CLOSE	CLOSE
M2	OPEN	CLOSE
Tie Together	(T4-T5-T6)	

D. 9 Leads; Dual Voltage & Voltage Ration 1 to 2, Delta Connected

D-1 Across the Line Start & Run



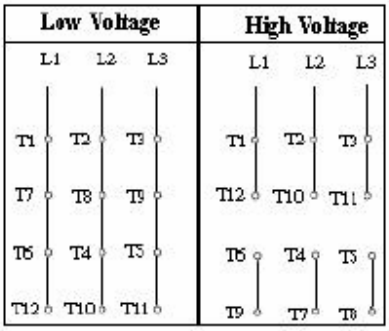
D-2 Part Winding Start
(Low Voltage only)



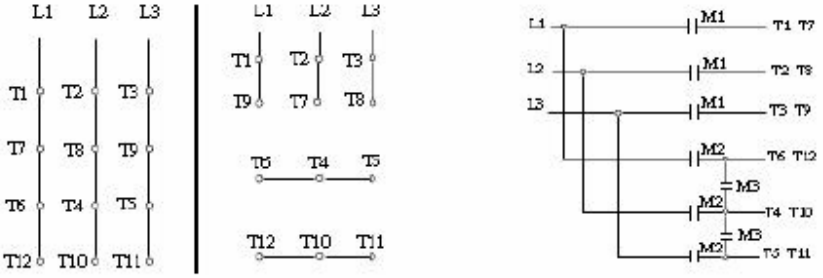
	START	RUN
M1	CLOSE	CLOSE
M2	OPEN	CLOSE

E. 12 Leads, Dual Voltage

E-1 Across the Line Start & Run

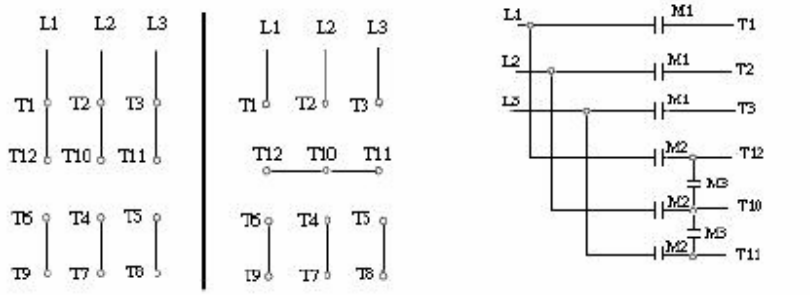


E-2-1 Wye Start & Delta Run (Low Voltage only)



	START	RUN
M1	CLOSE	CLOSE
M2	OPEN	CLOSE
M3	CLOSE	OPEN

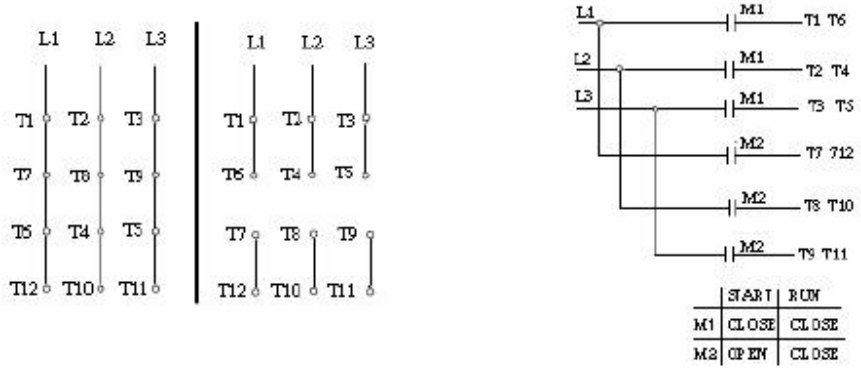
E-2-2 Wye Start & Delta Run (High Voltage only)



	START	RUN
M1	CLOSE	CLOSE
M2	OPEN	CLOSE
M3	CLOSE	OPEN

Tie Together (T4-T7); (T5-T8); (T6-T9)

E-3 Part Winding Start (Low Voltage only)



*Important: For Part Winding Start, M2 contactor should be closed within two (2) seconds after M1 contactor is closed.
Only 4 pole and above (e.g., 6P, 8P...) motors are satisfactory for Part Winding Start at low voltage.

START UP

1. Disconnect load and start motor. Check direction of rotation. If rotation must be changed, ALLOW THE MOTOR TO STOP COMPLETLEY. Interchange any two leads of a three-phase motor.
2. Connect load. The motor should start quickly and run smoothly. If no, shut power off at once. Recheck the assembly including all connections before restarting.
3. If excessive vibration is noted, check for loose mounting bolts too flexible motor support structure or transmitted vibration from adjacent machinery. Periodic vibration checks should be made; foundations often settle.
4. Operate under load for short period of time and check operating current against nameplate.

TESTING

If the motor has been in storage for an extensive period or has been subjected to adverse moisture conditions, it is best to check the insulation resistance of the stator winding with a megometer. Depending on the length and conditions of storage it may be necessary to regrease or change rusted bearings.
If the resistance is lower than one megohm the windings should be dried in one of the following two ways:

1. Bake in oven at temperatures not exceeding 194°F until insulation resistance becomes constant.
2. With rotor locked, apply low voltage and gradually increase the current through windings until temperature measured with a thermometer reaches 194°F. Do not exceed this temperature.

MAINTENANCE

INSPECTION

Inspect motor at regular intervals. Keep motor clean and ventilation openings clear.

LUBRICATION

1. Frame 143T-256T: Double shielded and pre-lubricated ball-bearing motors without grease fittings and don't need re-lubrication, except on MAX-E1® and MAX-E2® products which have re-greasable features.
2. Frames 280TS, 320-449TZ(TS): Motors having grease fittings and grease discharge devices at brackets. Motors are shipped with grease for initial running. It is necessary to re-lubricate anti-friction bearing motors periodically, depending on size and type of service. See Table 2 to provide maximum bearing life. Excessive or too frequent lubrication may damage the motor.

TABLE 2

Horsepower	Standard Conditions	Severe Conditions	Extreme Conditions
1 Thru 30 Hp, 1800 rpm and below	7 years	3 years	180 days
40 Thru 75 Hp, 1800 rpm and below	210 days	70 days	30 days
100 Thru 150 Hp, 1800 rpm and below	90 days	30 days	15 days
1 Thru 20 Hp, 3600 rpm	5 years	2 years	90 days
25 Thru 75 Hp, 3600 rpm	180 days	60 days	30 days
100 Thru 150 Hp, 3600 rpm	90 days	30 days	15 days

Note:

A. Standard conditions: 8 hours operation per day, normal or light loading, clear and 40°C ambient conditions.
B. Severe conditions: 24-hour operation per day or light shock loading, vibration or in dirty or dusty conditions.
C. Extreme conditions: With heavy shock loading or vibration or dusty conditions.
D. For double shielded bearings, above data (lubrication frequency) means that the bearing must be replaced.

3. Be sure fittings are clean and free from dirt. Using a low-pressure grease gun, pump in the recommended grease until new grease appears at grease discharge hole.
4. Use the POLYUREA grease unless special grease is specified on the nameplate.
5. If re-lubrication is to be performed with the motor running, stay clear of rotating parts. After re-greasing, allow the motor to run for ten to thirty minutes.

RENEWAL PARTS

1. Use only genuine TECO-Westinghouse renewal parts or as recommended by TECO-Westinghouse Motor Company.
2. When you order renewal parts please specify complete information to TECO-Westinghouse office/agent such as type, frame no., poles, horsepower, voltage, series no., quantity, etc.

FOR FURTHER INFORMATION PLEASE CONTACT

TECO-WESTINGHOUSE MOTOR COMPANY

Round Rock, TX **800-873-8326**

TECO Westinghouse

OPERATION
&
MAINTENANCE
MANUAL
FOR
THREE PHASE
INDUCTION
MOTORS

5100 North IH-35
Round Rock, Tx. 78681

56 thru 449T
Frame Motors

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1. INTRODUCTION

This and the following instruction address the more common situations encountered in motor installation, operation and maintenance. For the TWMC motor warranty to be and to remain in effect, the motor must be installed and operated in strict accordance with the outline drawing, motor nameplates and these instructions and must not be altered or modified in any unauthorized manner.

During the installation and operation of motors in heavy industrial applications there is a danger of live electrical parts and rotating parts. Therefore, to prevent injury and/or damage, the basic planning work for installation, transportation, assembly, operation, etc. needs to be done and checked by authorized and competent personnel only.

Since these instructions cannot cover every eventuality of installation, operation and maintenance, the following points should be considered and checked.

- The technical data and information on permissible use such as assembly, connection, ambient and operating conditions given in the related catalogue, operating instructions, nameplates and other production documentation.
- The general erection and safety regulations.
- The local and plant-specific specifications and requirements.
- The proper use of transport, lifting devices and tools.
- The use of personal protective equipment.

Following indications should be observed when reading these instructions.

Safety instructions are marked as follows:



Warning of electric hazards for personnel.



Warning of dangers for personnel.

ATTENTION!
Warning of damage for the motor or installation.

2. ACCEPTING, INSPECTION, STORAGE, TRANSPORTATION

Inspection upon receipt

Check the following points upon receipt:

- Are the nameplate ratings identical with what you ordered?
- Are dimensions and color in compliance with your specifications?
- Are the nameplate ratings for space heater, thermal protector, temperature detector, etc. identical with what you ordered?
- Is there any damage?
- Are all accessories and accompanying instruction manuals in good order?
- Please ensure that the arrow head indicator really indicates direction of rotation.
- If there are any specific requirements, please ensure they are in conformity with your specifications.
- Motor stator housing may be outfitted with condensation drain holes that are either open holes, drain holes with plugs or drain holes with breather drains. For horizontally mounted motors position the drain holes at the lowest point possible to allow for the egress of condensation. For vertical shaft installations the lower end bracket must be outfitted with drains at the lowest point possible. Prior to installation remove drain plugs if fitted.

2.1 Storage

When motors are not in operation, the following precautionary measures should be undertaken to assure best performance.

2.2 Place

(a) High and dry, well ventilated without direct sun, dust or corrosive gas.
(b) Not located near to a boiler or freezer.
(c) Entirely free from vibration and easily accessible.
(d) Motors should be put on pallets to prevent moisture.

2.3 Moisture prevention

Since moisture can be very detrimental to electrical components, the motor temperature should be maintained about 37°F (3℃) above the dew point temperature by providing either external or internal heat. If the motor is equipped with space heaters, they should be energized at the voltage shown by the space heater nameplate attached to the motor. Incandescent light bulbs can be placed within the motor to provide heat. However, if used, they must not be allowed to come in contact with any parts of the motor because of the concentrated hot spot that could result.

2.4

Even during storage, the insulation resistance should be kept above the specified values.

(a) For measurement of insulation resistance and acceptable standard values, please refer to measures stated in 4.1.2 “Measurement of insulation resistance”.

(b) Insulation resistance test should be performed once every three months.

2.5

If the motor is not in operation for a long period (one week and above) after installation or has been in operation but stopped for a period of time, the following precautions must be taken.

(a) Protect the motor in accordance with measures stated in 2.3.

(b) Insulation resistance test should be performed as stated in 2.4.

2.6 Bearing protection

(a) If the motor has been provided with a shaft shipping brace to prevent shaft movement during transit, it must be removed before operating the motor. It is very important that this brace be re-installed exactly as it was originally, before the motor is moved from storage or any time when the motor is being transported. This prevents axial rotor movement that might damage the bearings.

(b) Motors equipped with sleeve bearings are shipped from the factory with the bearing oil reservoirs drained. In storage, the oil reservoirs should be properly filled to the center of the oil level gauge with a good grade of rust inhibiting oil. To keep the bearing journals well oiled and to prevent rusting, the motor shaft should be rotated several revolutions about every month ensuring the shaft does not come to rest in its original position. While the shaft is rotating, it should be pushed to both extremes of the endplay.

(c) Motors with anti-friction bearings are properly lubricated with the correct grade of grease at the factory and no further greasing is required in storage. The shaft should be rotated several revolutions about every month to maintain proper distribution of the grease within the bearings. **However, re-greasing is required if a significant period of time has elapsed between manufacture and use, or while in storage for extended time. It is a good practice to always replenish and purge with fresh grease at start up.**

(d) Tilt-pad bearings are a type of sleeve bearing used in special design applications. Due to the nature of this bearing, a loose oil ring for delivering lubricant cannot be provided. Therefore, during the storage interval, oil must be periodically manually introduced into the pads and housing to prevent the occurrence of oxidation of the precision machined components.

(1) Remove the pipe plug from the bearing cap located above the tilt-bearing shell.

(2) Pour in approximately one cup of oil every month and rotate the shaft a few revolutions about every two (2) weeks.

(3) For long periods of storage, the oil that accumulates in the housing should be removed.

ATTENTION!

Care should be taken to keep parts such as fitting surfaces, key, shaft extension and axial central hole free from any foreign matter. Grease should also be generously applied to prevent rusting.

2.7 Transportation

To keep the rotating parts of motors from moving, thus preventing damage and scratching during transportation, they should be held securely with a locking device. Remove all transit clamps before operating the motor. It is very important that this device be reinstalled exactly as it was originally, before the motor is moved from storage or any time when the motor is being transported. The vertical mounting type motors should be transported in the vertical position.

Do not use the hoisting hook/eyebolts to lift more that the motor itself. They are designed to support the motor only. Make sure the hoisting hook is correctly attached to the eyebolt(s)/lug(s) and they are fully screwed in before hoisting. Also note such parts as fan cover, ventilation box, bracket, slip-ring, etc. may have their own hoisting lugs which can only carry their own weight. Nothing extra should be attached while hoisting.
Do not twist the steel wires and make sure the eyebolts have been firmly screwed in and the sling angle is correct. See figure 1.

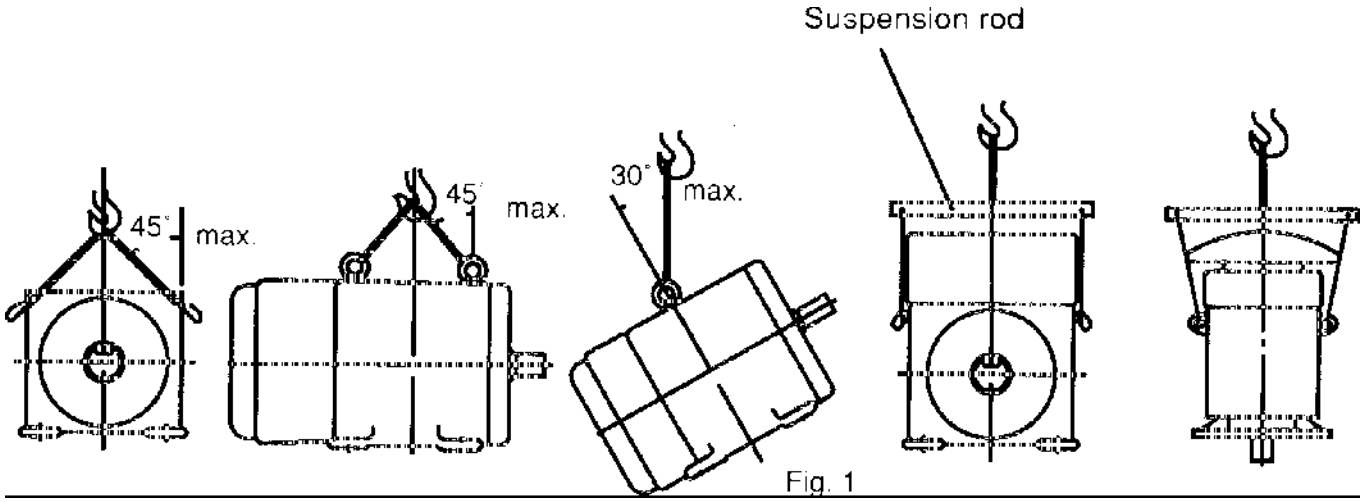


Fig. 1

3 INSTALLATION

Site and environment for motor installation

3.1.1

Standard environment and site conditions for the installation of motors are usually set as follows:

(a) Ambient temperature: -14~104°F (-10~40℃)
(b) Humidity: Relative humidity below 90%RH for totally enclosed types, and below 80%RH for semi-enclosed types.
(c) Elevation: below 3,300 feet (1,000 meters).
(d) Harmful gases, liquids, dusts, high moisture should be absent.
(e) Foundations should be strong and free of vibration.

If there are any special environmental conditions, please inform TWMC prior to ordering.

3.1.2 Ventilation and space

(a) Installation area should be well ventilated.
(b) The installation space should be large enough to facilitate heat dissipation and maintenance.

3.2 Foundation

3.2.1

Use rigid and solid sole plate or common bed as foundation.

For best motor performance, it is advisable to use a sole plate or common bed, particularly when using a shaft coupling. See figure 2.

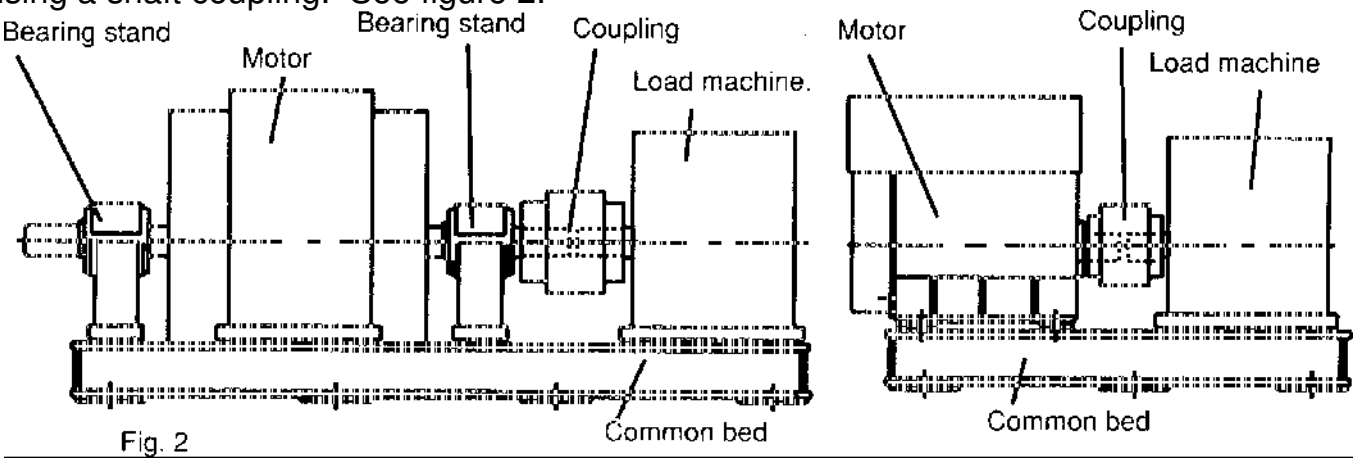


Fig. 2

3.2.2 Installation

(a) Select an appropriate foundation surface for the sole plate or common bed, which will be considered the final level.

(b) Align the position of the common bed with reference to that level.

(c) Align the level accuracy at a minimum of four points such as bearing mounting, shaft extension etc. The accuracy should be within 0.015 inches (0.04mm).

(d)Sole plate or common bed should be embedded in concrete foundation as illustrated in Fig. 3. Stiff pads should also be installed beneath the wedges, which are welded together at various spots about 15.75-19.70 inches (400-500mm) apart etc., to enable the foundation to carry evenly the weight of the whole motor.

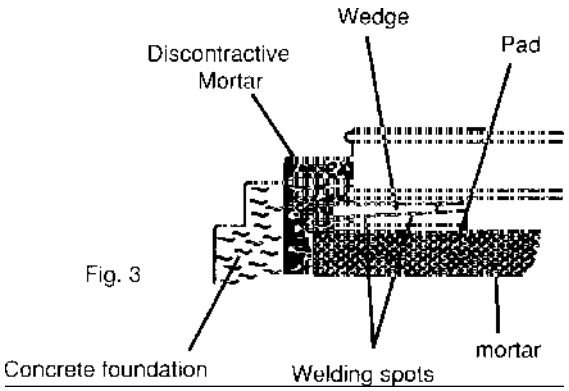


Fig. 3

(e) The base should be sturdy and rigid to keep it flat and level.

(f) Make sure the mortar and concrete are completely dry, and the precision of the level is acceptable, and then set the motor on the mounting foundation.

(g) Accurately install shaft couplings, belt sheaves etc., then weld the wedges solid to prevent untoward change in position.

3.2.3 The foundation of vertical induction motors: (Also the foundation of pump)

(a) Foundation of motor/pump must be rigid and secure to provide adequate support. There must be no vibration, twisting, misalignment etc. due to inadequate foundations.

(b) A massive concrete foundation is preferred in order to minimize vibration. Rigidity and

stability are enhanced by prop plate and foundation bolt. As shown in Fig. 4.

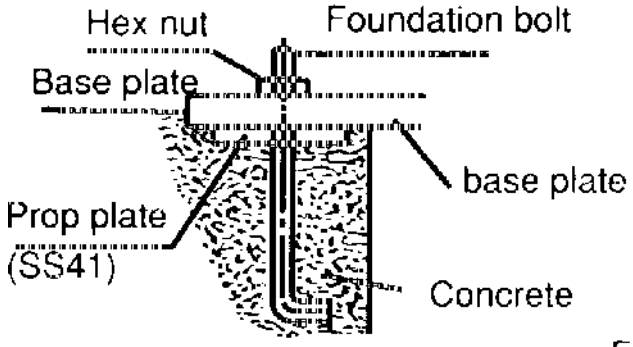


Fig. 4

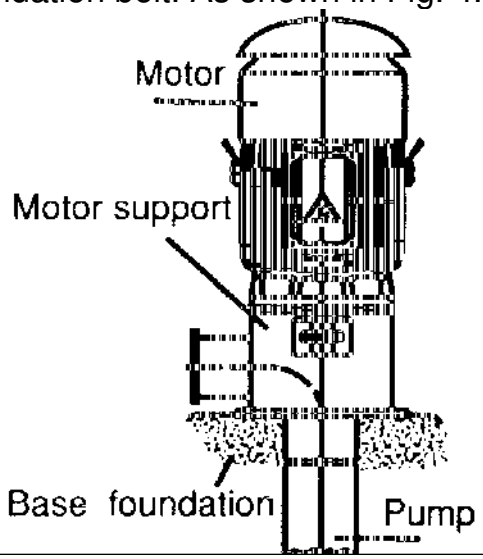


Fig. 5

3.2.4 Installation of vertical motors:

(a) All mounting surfaces must be clean and level.
(b) Foundation must be leveled at least at 4 points and guaranteed to be below .0015 in. (0.04mm) flat and level.
(c) Make sure the mortar and concrete are completely dry, and the precision of the level is acceptable, and then set the motor on the mounting foundation.
(d) Accurately install shaft couplings.

3.3 Installation of shaft coupling

ATTENTION!
Motors must always be accurately aligned, and this applies especially where they are directly coupled.
Incorrect alignment can lead to bearing failure, vibration and even shaft fracture. As soon as bearing failure or vibration is detected, the alignment should be checked.

3.3.1
Field application of a coupling to the motor shaft should follow the procedures recommended by the coupling manufacturer. The motor shaft extension must not be subjected to either extreme heat or cold during coupling installation.

ATTENTION!
Basically, the coupling should be heated and pushed onto the shaft extension with slight axial force. Do not hammer coupling to prevent bearing damage.

3.3.2
Although the sleeve bearings are equipped with thrust faces, these are intended only to provide momentary axial restraint of rotor movement either during start-up or when operating the motor disconnected from the driven equipment. They must not be operated under a constant thrust load unless they were originally designed for this condition.

Motors with either sleeve or anti-friction bearings are suitable for connection to the driven load through a flexible coupling. Coupling solidly to the load is not acceptable. With sleeve bearings, the flexible coupling should be of the limited end float type to prevent the possibility of any end thrust from the load being transmitted to the motor bearings, which could cause bearing damage. The recommended limits of end float are as follows:

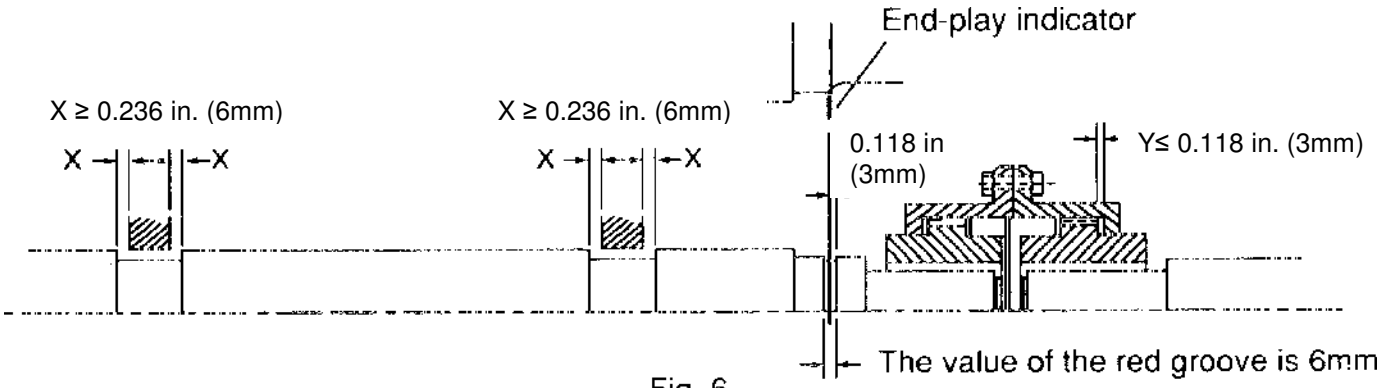


Fig. 6

(a) When the motor is in operation after installation, be sure that the end-play indicator is within the 0.236 in. (6mm) of the groove on the shaft or aligned to the shaft shoulder immediately outboard of the drive-end bearing to assure there is low friction between shaft and bearing.

(b) Unless otherwise specified, the designed end-play value X of the groove for TWMC motors in general is within 0.236 in. (6mm) as illustrated in Fig. 6. In essence, the endplay indicator is adjusted to point at the center of the groove or the drive-end shaft shoulder; thus X equals to ±0.236in (6mm) so, and the endplay value (Y) of the couplings should equal or be smaller than 0.118 in. (3mm).

(c) If the desired value Y is greater than 0.118 in. (3mm) caused for instance by a thrust load and/or load machine with large end-play, please inform TWMC prior to entering an order.

3.3.3

In aligning the motor (and rotor) axially with the driven equipment, consideration should be given not only to the endplay indicator position but also to axial shaft expansion and increase in shaft centerline height due to thermal effects. In general, the axial shaft growth for motors can be disregarded since either bearing is fixed, and any shaft growth due to temperature increase will produce an elongation away from the coupling.

Shaft height growth (change in shaft centerline elevation) for TEFC machines can be calculated as follows:

L1=(0.0005”) x (motor foot to shaft centerline dimension)

For non-TEFC machines, divide the number by 2.

3.3.4

In normal operation, it is desirable that the motor operates on its magnetic center, so that no axial force is exerted on the coupling.

The motor shaft and the driven shaft should be aligned within the following tolerances in both angular and parallel alignment:

Unit: inches (mm)

TIR	Range of rotating speed	Solid coupling	Flexible coupling
C	2500 rpm and above	0.0012” (0.03)	0.0012” (0.03)
	Below 2500 rpm	0.0016” (0.04)	0.0020” (0.05)
A	2500 rpm and above	0.0012” (0.03)	0.0012” (0.03)
	Below 2500 rpm	0.0012” (0.03)	0.0016” (0.04)

Angular misalignment is the amount by which the centerlines of driver and driven shafts are skewed. It can be measured using a dial indicator set up as shown in Fig. 7. The couplings are rotated together through 360 degrees so that the indicator does not measure runout of the coupling hub face. The shafts should be forced against either the in or out extreme of their end float while being rotated.

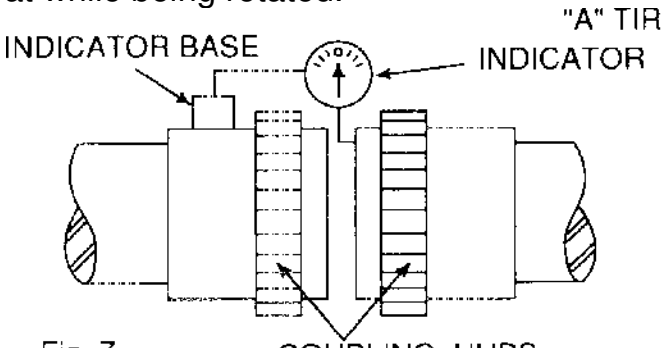


Fig. 7

TIR=Total indicator reading (by dial indicator)

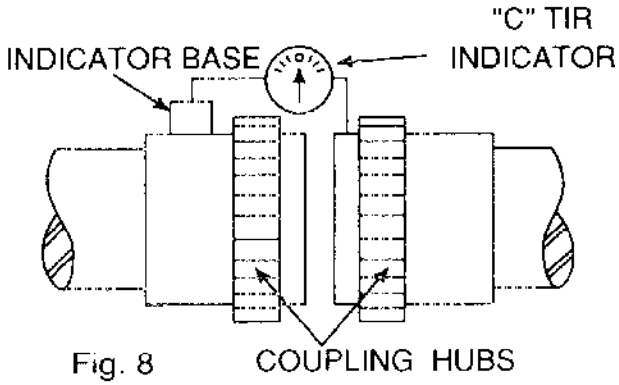


Fig. 8

Parallel misalignment is the amount by which the centerlines of the driver and driven shafts are out of parallel. It can be measured using a dial indicator set up as shown in Fig. 8. Again, the couplings are rotated together through 360 degrees so that the indicator does not measure runout of the coupling hub outside diameter.

3.3.5

After the motor has been properly aligned with the driven equipment and the hold-down bolts have been installed and tightened, for motors with fabricated frames, at least two dowel pins should be installed in two diagonally opposite motor feet.

3.3.6 Installation of shaft coupling: (Vertical hollow shaft motor only)

(a) Bearings are provided to absorb some upward shaft thrust when the coupling is fitted.
(b) The coupling is fastened with bolts.
(c) This coupling type is not auto-release type.

Note: Standard high thrust motors can absorb momentary up-thrust load up to 30% of the standard down thrust load. If the up-thrust is long in duration (over 10 Seconds) and/or exceeds 30% of the standard high thrust rating, special design arrangements are required and standard motor is not suitable.

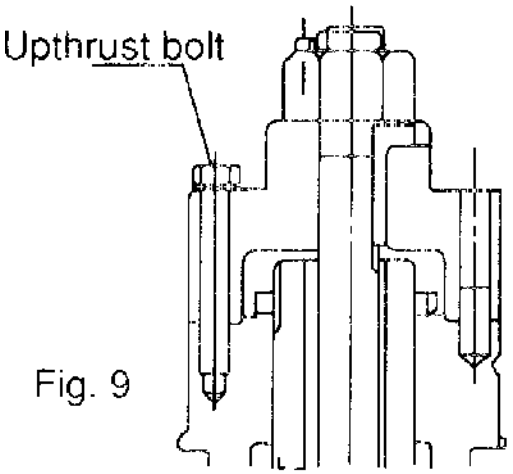


Fig. 9

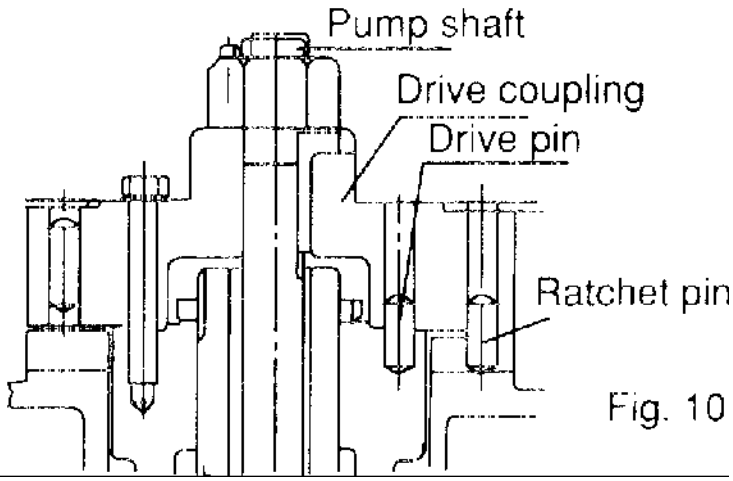


Fig. 10

3.3.7 Non-reverse ratchet/coupling: (If necessary)

The non-reverse coupling is also a bolted type and,

(a) It prevents the pump and motor from rotating in the reverse direction.
(b) It also prevents damage from over speeding and damage to pump shaft and bearings.
(c) The ratchet pins are lifted by the ratchet teeth and are held clear by centrifugal force and friction as the motor comes up to speed.
(d) When power is removed, speed decreases, and the pins fall. At the instant of reversal, a pin will catch in a ratchet tooth and prevent backward rotation.
(e) When installing the non-reverse coupling, do not use lubricant. Lubricant will interfere with proper operation. The top half of the coupling should seat solidly on the lower half and the pins should touch the bottom of the pockets between the teeth in the plate.
(f) As with the bolted coupling, the up-thrust capabilities are 30% of the standard high thrust rating for down thrust.

ATTENTION!
Do not apply non-reverse ratchets on applications in which the pump reversal time from shutdown (the instant the stop button is pressed) to zero speed is less than one second.

3.4 Installation for belt drive

In general, power transmission through direct flexible coupling is appropriate for large motors. Such motors are not suitable for belt, chain or gear connection unless specially designed for such service. However, for small and medium motors of outputs within the ranges shown on table below, it is acceptable to use belt transmission as indicated. Beyond these ranges, do not apply belt sheaves unless specially designed.

3.4.1

The diameter ratio between conveyance sheaves should not be greater than 5 to 1 for flat belts, and 8 to 1 for V-belts. It is also advisable to limit the belt velocity to under 115 ft/sec (35m/sec) to limit belt abrasion and vibration. The smaller the outer diameter of the V-belt sheave, the greater the shaft bending stress will be. If the bending stress is in excess of the shaft fatigue stress, the shaft may break. Therefore, please inform TWMC when you have decided the size of the sheaves and the length of the belts upon ordering.

ATTENTION!
Place the sheave and belt as close as possible to the motor body (it is advisable to make x as shown in Fig. 11 equal to 0) to reduce the bending moment and improve shaft life.

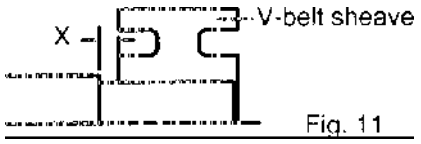


Fig. 11

3.4.2 Table of belt-sheave application for general electric motors

Output (KW/HP)			V-Belt Sheave							
			Conventional V-Belts				Narrow V-Belts			
4P	6P	8P	V-Belt Type	Number Of Belts	Min. PCD (mm)	Max Width (mm)	V-Belt Type	Number Of Belts	Min. PCD (mm)	Max Width (mm)
11/15	-	-	B	4	160	82	3V	4	125	48
-	11/15	-	B	5	170	101	3V	5	140	59
-	-	11/15	B	5	190	101	3V	6	160	69
15/20	-	-	B	5	170	101	3V	6	125	69
-	15/20	-	B	5	224	101	3V	6	160	69
-	-	15/20	C	4	224	111	5V	3	180	60
18.5/25	-	-	B	5	200	101	3V	6	140	69
-	18.5/25	-	C	4	224	111	5V	3	180	60
-	-	18.5/25	C	5	224	136	5V	4	180	78
22/30	-	-	B	5	224	101	5V	6	160	69
-	22/30	-	C	5	224	136	3V	4	180	78
-	-	22/30	C	5	250	136	5V	4	200	78
30/40	-	-	C	5	224	136	5V	4	180	78
-	30/40	-	C	5	265	136	5V	4	224	78
-	-	30/40	C	6	265	162	5V	5	224	95
37/50	-	-	C	6	224	162	5V	4	200	78
-	37/50	-	C	6	265	162	5V	4	224	78
-	-	37/50	C	7	280	187	5V	5	250	95
45/60	-	-	C	6	265	162	5V	4	224	78
-	45/60	-	C	7	280	187	5V	5	224	95
-	-	45/60	C	7	315	187	5V	6	250	113
55/75	-	-	C	7	265	187	5V	5	224	95
-	55/75	-	C	8	300	213	5V	6	250	113
-	-	55/75	D	5	355	196	5V	6	280	113
75/100	-	-	C	8	315	213	5V	6	250	113
-	75/100	-	D	6	355	233	5V	6	315	113
-	-	75/100	D	6	400	233	5V	6	355	113
-	90/120	-	D	6	400	233	5V	6	355	113
-	-	90/1 20	D	6	425	233	8V	4	355	124
-	110/150	-	D	7	400	270	8V	4	355	124
-	132/175	110/150	D	7	450	270	8V	4	400	124
-	160/200	132/1 75	D	9	450	344	8V	4	450	124

3.5 Conveyance with chain or gear

3.5.1

Make sure the loading capacity of shaft and bearings is appropriate for the size and installation position (overhang) of chain and gear. If necessary, please contact us to ensure the shaft and bearings will meet your requirements.

3.5.2
Pay close attention to ensure the parallelism of shafts.

3.5.3
The teeth of couplings should be correctly and precisely matched; the force conveyance centers should lie on the same line.

3.5.4
There should be no skip, jumping, vibration or unusual noises.

ATTENTION!
Do not hammer the conveyance devices such as couplings, belt sheaves, chain wheels, gears etc. onto the shaft. Those shaft fitments should be fitted and removed only by means of suitable devices. Heat shrinking may be a better alternative to avoid damaging bearings and components.



The exposed rotating parts should be covered to prevent accidents.

3.6 Electrical connections

All interconnecting wiring for controls and grounding should be in strict accordance with local requirements such as the USA National Electrical Code and UK IEE wiring regulations. Wiring of motor and control, overload protection and grounding should follow the instructions of connection diagrams attached to the motor.

3.6.1 Power

The rated conditions of operation for the motor are as shown on the nameplate. Within the limits given below of voltage and frequency variation from the nameplate values, the motor will continue to operate but with performance characteristics that may differ from those at rated conditions:

±10% of rated voltage
±5% of rated frequency
±10% combined voltage and frequency variation so long as frequency variation is no more than ±5% of rated.

Operating the motor at voltages and frequencies outside of the above limits can result in both unsatisfactory motor performance and damage to, or failure of, the motor.

3.6.2
The main lead box furnished with the motor has been sized to provide adequate space for the make-up of the connections between the motor lead cables and the incoming power cables.



The bolted joints between the motor lead and the power cables must be made and insulated in a workman-like manner following the best trade practices.

3.6.3
Either fabricated motors or fan cooled cast frame motors are all provided with grounding pads or bolts.



The motor must be grounded by proper connection to the electrical system ground.

3.6.4

The rotation direction of the motor will be as shown by either a nameplate on the motor or the outline drawing. The required phase rotation of the incoming power for this motor rotation may also be stated. If either is unknown, the correct sequence can be determined in the following manner: While the motor is uncoupled from the load, start the motor and observe the direction of rotation. Allow the motor to achieve full speed before disconnecting it from the power source. Refer to the operation section of these instructions for information concerning initial start-up. If resulting rotation is incorrect, it can be reversed by interchanging any two (2) incoming cables.

3.6.5 Auxiliary devices

Auxiliary devices such as resistance temperature detectors, thermocouples, thermoguards, etc., will generally terminate on terminal blocks located in the auxiliary terminal box on the motor. Other devices may terminate in their own enclosures elsewhere on the motor. Such information can be obtained by referring to the outline drawing. Information regarding terminal designation and the connection of auxiliary devices can be obtained from auxiliary drawings or attached nameplates.

If the motor is provided with internal space heaters, the incoming voltage supplied to them must be exactly as shown by either a nameplate on the motor or the outline drawing for proper heater operation.



Caution must be exercised anytime contact is made with the incoming space heater circuit as space heater voltage is often automatically applied when the motor is shutdown.

4. OPERATION

4.1 Examination before start

4.1.1

When motors are installed in good manner, ensure the wiring is according to the diagram. Also, the following points should be noted:

(a) Make sure all wiring is correct.
(b) Ensure the sizes of cable wires are appropriate and all connections are well made for the currents they will carry.
(c) Ensure all connections are properly insulated for the voltage and temperature they will experience.
(d) Ensure the capacity of fuses, switches, magnetic switches and thermo relays etc. are appropriate and the contactors are in good condition.
(e) Make sure the frame and terminal box are grounded.
(f) Make sure that the starting method is correct.
(g) Make sure switches and starters are set at their correct positions.
(h) Motor heaters must be switched off when the motor is running.

4.1.2 Measurement of insulation resistance



During and immediately after measuring, the terminals must not be touched as they may carry residual dangerous voltages. Furthermore, if power cables are connected, make sure that the power supplies are clearly disconnected and there are no moving parts.

(a) For rated voltage below 1000V, measured with a 500 VDC megger.

(b) For rated voltage above 1000V, measured with a 1000VDC megger.

(c) In accordance with IEEE 43, clause 9.3, the following formula should be applied:

$$R\sim \left(\frac{\text{Rated voltage (v)}}{1000} + 1\right) \times 10(MQ)$$

(d) On a new winding, where the contaminant causing low insulation resistance is generally moisture, drying the winding through the proper application of heat will normally increase the insulation resistance to an acceptable level. The following are several accepted methods for applying heat to the winding:

(1) If the motor is equipped with space heaters, they can be energized to heat the winding.

(2) Direct current (as from a welder) can be passed through the winding. The total current should not exceed approximately 50% of rated full load current. If the motor has only three leads, two must be connected together to form one circuit through the winding. In this case, one phase will carry the fully applied current and each of the others, one-half each. If the motor has six leads (3 mains and 3 neutrals), the three phases should be connected into one series circuit.



Ensure there is adequate guarding so live parts cannot be touched.

(3) Heated air can either be blown directly into the motor or into a temporary enclosure surrounding the motor. The source of heated air should preferably be electrical as opposed to fueled (such as kerosene) where a malfunction of the fuel burner could result in carbon entering the motor.

ATTENTION!
Caution must be exercised, when heating the motor with any source of heat other than self contained space heaters, to raise the winding temperature at a gradual rate to allow any entrapped moisture to vaporize and escape without rupturing the insulation. The entire heating cycle should extend over 15-20 hours.

Insulation resistance measurements can be made while the winding is being heated. However, they must be corrected to 104°F (40°C) for evaluation since the actual insulation resistance will decrease with increasing temperature. As an approximation for a new winding, the insulation resistance will approximately halve for each 50°F (10°C) increase in insulation temperature above the dew point temperature.

(e) Should the resistance fail to attain the specified value even after drying, careful examination should be undertaken to eliminate all other possible causes, if any.

4.1.3 Power Source

(a) Ensure the capacity of the power source is sufficient.

(b) Ensure the supply voltage and frequency ratings are identical to those on the nameplate.

(c) Voltage variation should be confined to within ±10% of the rated value and the phase to phase voltages should be balanced.

4.1.4 Bearing lubrication

(a) For sleeve bearing motors, the oil reservoir must be filled with oil to the correct level. On

self-lubricated bearings, the standstill oil level will be at the center of the oil gauge. The proper oil is a rust and oxidation inhibited, turbine grade oil. Refer to the lubrication nameplate for the recommended viscosity.

(b) Motors, which are supplied with provision for flood lubrication, have an inlet orifice to meter the oil flow to the bearing. Refer to the outline drawing for these values. If the supply pressure does not match that stated on the outline, the orifice size must be adjusted to produce the specified flow rate. The drain adapter (also provided) has a weir plate fixed to the inside of the pipe to permit the establishment of the proper oil level. This weir plate must be located at the bottom of the pipe and must be parallel to the plane of the motor feet. To ensure optimum flow, the drain line should be vented to the atmosphere.

Oil inlet temperature: Normal below 122°F (50°C)
Alarm 140°F (60°C)
Trip 149°F (65°C)

(c) If the motor is in storage for over three (3) months, refilling of some new oil should be undertaken before operation to prevent bearing damage due to dry friction. The oil level should be kept at the center of the oil gauge. If necessary, drain some oil after refilling.

(d) Motors that have been designed with anti-friction bearings for use with an oil mist lubrication system have been packed at the factory with a small amount of grease for short test runs. Continuous running should not be considered unless the oil mist system is installed and operating.

(e) Grease lubricant type

(1) The bearings have been well greased at the factory before delivery. However, regreasing is required if a significant period has elapsed between manufacture and use **or while in storage for extended time. It is a good practice to always replenish and purge with fresh grease at start up.**

(2) All motors with ZZ, or sealed bearings will have SHELL Alvania R3, or Multitemp SRL (*Lithium base grease). Always check nameplate first.* All motors with open regreasable bearings will have Mobil Polyrex EM (polyurea base grease).

ATTENTION!
Do not mix different kinds of grease.
Mixing grease with different type of thickeners may destroy its composition and physical properties. Even if the thickeners are of the same type, possible differences in the additive may cause detrimental effects.

4.1.5 Cooling water for the cooler on water-cooled motors

Make sure the quality, volume and inlet temperature of cooling water for the motors are normal before the machine is in operation.

Water: General tower water or industrial water.
Volume: Please see outline drawing
Inlet temperature: Normal below 86°F (30°C)
Alarm 95°F (35°C)
Trip 104°F (40°C)

ATTENTION!
Make sure all locks, which fasten the movable parts of the motors during transportation, are dismantled and the shaft can rotate freely.

ATTENTION!
Ensure there is no foreign matter or tools inside the motors before starting motors

4.1.6

Make sure the transmission system, including belts, screws, bolts, nuts and set pins are in good condition.



The keys fitted to the shaft extensions are held by plastic tape only to prevent them from falling out during transportation or handling. The shaft key shall be removed to avoid flying out, when the motor is operated prior to the couplings etc. being fitted to the shaft extension.

4.1.7

Make sure the items above are examined. Test the motor running with or without load. Record and check according to "Maintenance" at 15-minute intervals during the first three hours of operation. Then regular examinations should take place at longer intervals. If all goes well, the motor can be classified as "in good order".

4.2 Starting operation

4.2.1 Starting load

Initially run the motor unloaded prior to coupling to other machines. Unless otherwise specified, a motor usually starts with light load, which is then gradually increased, proportional to the square of the speed and at last reaches 100% load at full load speed.

4.2.2 Starting

Too frequent starts can be harmful to the motors. The following restrictions should be observed:

(a) Motor can be restarted should the initial start fail. Two starts are generally permissible when the motor is cold.

(b) Motor can be started only once when it is at normal running temperature.

(c) Should additional starts be necessary beyond the conditions stated above, the following restrictions should be noted:

(1) Let the motor cool down for 60 minutes before restarting, fully loaded.

(2) Let the motor cool down for 30 minutes before restarting, unloaded.

(3) Two inching starts can be regarded as one normal start.

ATTENTION!
If the motor rotor fails to start turning within one or two seconds, shut off the power supply immediately.
Investigate thoroughly and take corrective action before attempting a restart.

Possible reasons for not starting are:

(1) Too low a voltage at the motor terminals.

(2) The load is too much for the rotor to accelerate.

(3) The load is frozen up mechanically.

(4) All electrical connections have not been made.

(5) Single-phase power has been applied.
(6) Any combination of the above.

4.2.3 Rotating direction

(a) Most TWMC motors are bi-directional. However, when some special types, such as high speed 2-Pole, certain large capacity motors, those with a non-reversing ratchet etc., should rotate in one direction, please ensure the rotation is in conformity with the directional arrow-mark shown on the attached nameplate.
(b) To reverse a bi-directional motor, cut the power and wait until the motor stops. Then interchange any two of the three phases.

4.2.4 Power Source, Voltage, Current

(a) Ensure the voltage and frequency of the power source are identical to the ratings shown on the nameplate.
(b) Voltage variation should be confined to within ±10% of the rating and the three phase voltages should be in full balance
(c) Ensure the motor phase currents, when without load, are within ±5% of the average values.

4.2.5

Frequency variation should be confined to within ±5% of the rating. The aggregate variation of voltage and frequency should be confined to within ±10% of the absolute value of the ratings.

Starting time and unusual noises

ATTENTION!
Starting time is longer for the motors with large inertia. However, if starting time is longer than usual, or if there is difficulty in starting, or there is abnormal noise, do not run the motor and refer to TWMC Service representative.

4.2.6 Sleeve bearing oil rings (sleeve bearing types only)

As the oil ring is used to carry lubricant to sleeve bearings, frequently check to ensure the oil ring is in motion.

4.2.7 Bearing temperature rise

Following the initial start-up, the bearing temperatures should be closely monitored. The rate of rise in bearing temperature is more indicative of impending trouble than is the actual temperature.

ATTENTION!
If the rate of rise in temperature is excessive or if the motor exhibits excessive vibration or noise, it should be shut down immediately and a thorough investigation made as to the cause before it is operated again.

If the bearing temperature rise and motor operation appear to be normal, operation should continue until the bearing temperature stabilizes.

Recommended limits on bearing temperature are as follows:

Sleeve Bearings	**Total measured temperature**
• By permanently installed detector	194°F (90°C)

• By temporary detector on top of the bearing sleeve near the oil ring	185°F (85°C)
Anti-Friction Bearings	**Total measured temperature**
• By permanently installed detector	212°F (100°C)
• By temporary detector measuring the outside of the bearing housing	203°F (95°C)

ATTENTION! (For sleeve bearing)

(1) It must be noted that when operating flood lubricated sleeve bearings without outside lubrication supplied, the bearing temperature must not be allowed to exceed 185°F (85°C) total temperature

(2) Under normal condition, for the self-lube bearing, the rate of temperature rise should be from 52°F to 57°F (11°C to 14°C) for the first ten (10) minutes after starting up and approximately 72°F (22°C) at thirty (30) minutes. The rate of bearing temperature rise is a function of the natural ventilation and operating conditions.

(3) When the rate of bearing temperature rise is less than 34°F (1°C) per half-hour, the bearing temperature is considered to be stabilized.

(4) If the total bearing temperature exceeds 203°F (95°C), the motor should be shut down immediately.

Noise and Vibration

ATTENTION!

Any abnormal noise or vibration should be immediately investigated and corrected. Increased vibration can be indicative of a change in balance due to mechanical failure of a rotor part, a stator winding problem or a change in motor alignment.

5. MAINTENANCE

5.1 Major points in regular inspections and maintenance.



For safety, maintenance and repairs must only be carried out by properly trained personnel.



Some testing, such as insulation resistance, usually requires the motor to be stopped and isolated from power supply.

Routine inspection and maintenance are usually performed by looking, listening, smelling and simple meters.



High temperature may arise under operating conditions on the motor surfaces, so touching should be prevented or avoided. Keep away from moving and live parts. Unless deemed necessary, do not remove guards whilst assessing the motor.

Timely replacement of worn parts can assure longevity and prevent breakdown.

Routine inspection and regular inspection and maintenance are important in preventing breakdown and lengthening service life.

Owing to the varied time and circumstances motors are used, it is difficult to set the items and periods for regular inspection and maintenance. However, as a guide, it is recommended to be performed periodically according to the factory maintenance program. Generally, the inspection scope is determined by the following factors:

(a) Ambient temperature.
(b) Starting and stopping frequency.
(c) Troublesome parts usually affecting motor functions.
(d) Easily abraded parts.
(e) The important position of a motor in the operational system of a factory should be duly recognized. Therefore, its health and wellbeing should be fully protected especially when it is operating in severe conditions.

5.2 Motor windings:

(a) For measurement of insulation resistance and standards to determine quality of insulation resistance, please refer to measures stated in 4.1.2 “Measurement of insulation resistance”.
(b) Inspection of coil-ends:
  (1) Grease and dust accumulated on coils may cause insulation deterioration and poor cooling effect.
  (2) Moisture must not accumulate. Keep coils warm when motor is not in use if moisture can be seen.
  (3) Discoloring. This is mainly caused by overheating.
(c) Ensure no movement of wedges from their original position.
(d) Ensure the binding at the coil end is in its normal position.

5.3 Clean the interior of the motor:

(a) After a motor is in operation for some time, accumulation of dust, carbon powder and grease etc., on the inside is unavoidable, and may cause damage. Regular cleaning and examination is necessary to assure top performance.
(b) Points to note during cleaning:
  (1) If using compressed air or blower:
    (a) Compressed air should be free of moisture.
    (b) Maintain air pressure at 57psig (4 kg/cm^2) since high pressure can cause damage to coils.
  (2) Vacuum
    Vacuum cleaning can be used, both before and after other methods of cleaning, to remove loose dirt and debris. It is a very effective way to remove loose surface contamination from the winding without scattering. Vacuum cleaning tools should be non-metallic to avoid any damage to the winding insulation
  (3) Wiping
    Surface contamination on the winding can be removed by wiping using a soft, lint-free wiping material. If the contamination is oily, the wiping material can be moistened (not dripping wet) with a safety type petroleum solvent. In hazardous locations, a solvent such as inhibited methyl chloroform may be used, but must be used sparingly and immediately removed. While this solvent is non-flammable under ordinary conditions, it is toxic and proper health and safety precautions should be followed while using it.

ATTENTION!
Solvents of any type should never be used on windings provided with abrasion protection. Abrasion protection is a gray, rubber-like coating applied to the winding end-turns.



Adequate ventilation must always be provided in any area where solvents are being used to avoid the danger of fire, explosion or health hazards. In confined areas (such as pits) each operator should be provided with an airline respirator, a hose mask or a self-contained breathing apparatus. Operators should wear goggles, aprons and suitable gloves. Solvents and their vapors should never be exposed to open flames or sparks and should always be stored in approved safety containers.

(4) Keep core ducts completely clean. The difference in temperature rise could be around 50℉ (10℃) before and after cleaning

5.4 Clean the exterior of the motor:

(a) On open ventilated motors, screens and louvers over the inlet air openings should not be allowed to accumulate any build-up of dirt, lint, etc. that could restrict free air movement.

ATTENTION!
Screens and louvers should never be cleaned or disturbed while the motor is in operation because any dislodged dirt or debris can be drawn directly into the motor.

(b) If the motor is equipped with air filters, they should be replaced (disposable type) or cleaned and reconditioned (permanent type) at a frequency that is dictated by conditions. It is better to replace or recondition filters too often than not often enough.

(c) Totally enclosed air to air cooled and totally enclosed fan cooled motors require special cleaning considerations. The external fan must be cleaned thoroughly since any dirt build-up not removed can lead to unbalance and vibration. All of the tubes of the air-to-air heat exchanger should be cleaned using a suitable tube brush having synthetic fiber bristles (not wire of any type).

5.5 Maintenance of anti-friction bearings

5.5.1 Frequency of re-lubrication:

The life of grease varies greatly as a result of types of model, revolution speed, temperature, operational conditions etc. It is, therefore, impossible to be precise about replenishment intervals. However, for normal direct coupling transmission, the periods shown in Table 1 may be used as a guide.

Remarks:

(a) The periods shown in Table 1 should be halved where bearings are used for belt drive and/or in dirty or high ambient temperature or high humidity environments.

(b) Please refer to the lubrication nameplate, if attached to the motor.

(c) For bearing numbers outside the range of Table 1, please contact TWMC

(d) If the periods referred to in Table 1 for drive-end bearing and opposite drive-end are

different, for the convenience of maintenance operations, please take the shorter of the required grease replenishment periods of these bearings.

5.5.2 Kinds of grease:

All motors with ZZ, or sealed bearings will have SHELL Alvania R3, or Multitemp SRL (lithium base grease). All motors with open bearings will have Mobil Polyrex EM (polyurea base grease).
Certain T-frame models will utilize special grease and will be noted on the lubrication nameplate. Please use identical grease or its equivalents when maintaining lubrication schedule.

ATTENTION!
Do not mix different kinds of grease.
Mixing grease with different types of thickeners may destroy its composition and physical properties. Even if the thickeners are of the same type, possible differences in the additive may cause detrimental effects.

5.5.3 Grease quantity

The amount of grease per replenishment depends on the type, size and construction of the bearings. The maximum amount of one replenishment for each bearing is shown in Table 2. This replenishment amount is also the amount used at the time the motor is initially started.

5.5.4 Re-greasing



If re-lubrication is to be performed when the motor is running, stay clear of rotating parts.

It is advisable to re-grease when the motor is running to allow the new grease to be evenly distributed inside the bearing. Before re-greasing, the inlet fitting should be thoroughly cleaned to prevent any accumulated dirt from being carried into the bearing with the new grease. The outlet for grease drainage should be opened to allow the proper venting of old grease. Use a grease gun to pump grease through the grease nipple into the bearings. After re-greasing, operate the motor for 10-30 minutes to allow any excess grease to vent out.

TABLE 1.

Bearing Number		600 RPM	720 RPM	750 RPM	900 RPM	1000 RPM	1200 RPM	1500 RPM	1800 RPM	3000 RPM	3600 RPM
	6202									2000 Hrs	
	03										
	04										
	05										
	06										
	07										
	08										
	09										
	10										
	12										
62XX	13	3000 Hrs								1000 Hrs	
63XX	14										
72XX	15							2000 Hrs		720 Hrs	
73XX	16										
	17										
	18										
	20										
	22							1500 Hrs			
	24										
	26					2000 Hrs		1000 Hrs			
	28										
	30							500 Hrs			
	32					1500 Hrs					
	34										
	36			2000 Hrs		1000 Hrs					
	38										

Bearing Number		600 RPM	720 RPM	750 RPM	900 RPM	1000 RPM	1200 RPM	1500 RPM	1800 RPM
	NU214							2000 Hrs	
	15								
	16								
	17							1500 Hrs	
	18	3000 Hrs							
	20							1000 Hrs	
	22					2000 Hrs			
	24								
NU2XX	26							500 Hrs	
NU3XX	28								
	30			2000 Hrs		1000 Hrs			
	32								
	34								
	36	2000 Hrs							
	38			1000 Hrs					
	40								
	44	1000 Hrs							
	48								

TABLE 1 CONTINUED.

Bearing Number		600 RPM	720 RPM	750 RPM	900 RPM	1000 RPM	1200 RPM	1500 RPM	1800 RPM
	22220							300 Hrs	
	22	1000 Hrs				500 Hrs			
	24								
	26								
222XX	28								
223XX	30					300 Hrs			
	32			500 Hrs					
	34								
	36	500 Hrs							
	38			300 Hrs					
	40								
	44	300 Hrs							
	48								

MAINTANCE GREASING QTY.
d = Bore (mm)
D = OD (mm)
B = Width (mm)
G = Grease Qty (g)

G = D*B*0.005

TABLE 2.

BRG#	d	D	B	G	Full Qty	BRG#	d	D	B	G	Full Qty
	mm	*mm*	*mm*	*grams*	*grams*		*mm*	*mm*	*mm*	*grams*	*grams*
2 SERIES						**3 SERIES**					
NU202/6202	15	35	11	2	8	NU302/6302	15	42	13	3	10
NU203/6203	17	40	12	3	10	NU303/6303	17	47	14	4	13
NU204/6204	20	47	14	4	13	NU304/6304	20	52	15	4	13
NU205/6205	25	52	15	4	15	NU305/6305	25	62	17	5	17
NU206/6206	30	62	16	5	15	NU306/6306	30	72	19	7	25
NU207/6207	35	72	17	6	15	NU307/6307	35	80	21	8	25
NU208/6208	40	80	18	7	20	NU308/6308	40	90	23	10	30
NU209/6209	45	85	19	8	25	NU309/6309	45	100	25	13	35
NU210/6210	50	90	20	9	30	NU310/6310	50	110	27	15	40
NU211/6211	55	100	21	11	35	NU311/6311	55	120	29	17	50
NU212/6212	60	110	22	12	40	NU312/6312	60	130	31	20	60
NU213/6213	65	120	23	14	50	NU313/6313	65	140	33	23	80
NU214/6214	70	125	24	15	50	NU314/6314	70	150	35	26	80
NU215/6215	75	130	25	16	60	NU315/6315	75	160	37	30	100
NU216/6216	80	140	26	18	60	NU316/6316	80	170	39	33	100
NU217/6217	85	150	28	21	80	NU317/6317	85	180	41	37	120
NU218/6218	90	160	30	24	80	NU318/6318	90	190	43	41	120
NU219/6219	95	170	32	27	90	NU319/6319	95	200	45	45	140
NU220/6220	100	180	34	31	100	NU320/6320	100	215	47	51	160
NU221/6221	105	190	36	34	110	NU321/6321	105	225	49	55	190
NU222/6222	110	200	38	38	120	NU322/6322	110	240	50	60	220
NU224/6224	120	215	40	43	120	NU324/6324	120	260	55	72	270
NU226/6226	130	230	40	46	140	NU326/6326	130	280	58	81	300

*Fill new grease until it overflows and the old grease is entirely replaced.

5.5.5 Oil re-lubrication (For oil lubrication types only)

Maintain proper lubrication by checking the oil level periodically and adding oil when necessary. Because of the initial clearing action of the bearing and the expansion of the oil as it comes up to operating temperature, the oil level will be higher after the motor has been in operation for a while than it is with the motor at standstill.

Overfilling should be avoided not only because of the possibility that expansion may force the oil over the oil sleeve and on to the rotor, but also because too high an operating oil level prevents the bearing from clearing itself of excess oil. The resultant churning can cause extra loss, high temperatures, and oxidized oil. If, during operation, the oil level goes above the maximum shown on the sight gauge, drain enough oil to bring the level back within the recommended operating range. **Do not permit the operating level to fall below the minimum shown on the gauge.**

ATTENTION!
Should it ever become necessary to add excessive amounts of make-up oil, investigate immediately for oil leaks.

Change the oil at regular intervals. The time between oil changes depends upon the severity of operating conditions and, hence, must be determined by the motor user. Two or three changes a year is typical, but special conditions, such as high ambient temperature, may require more frequent changes. Avoid operating the motor with oxidized oil.

Use only good grade, oxidation-corrosion-inhibited turbine oils produced by reputable oil companies.The viscosity of the oil to be used depends upon the type and size of the bearings, its load and speed, the ambient temperature, and the amount and temperature of the cooling water (if used). The lubrication nameplate or instructions with each motor specifies the viscosity range of oil suitable for average conditions. The usual oil viscosity recommendations are summarized in Table 3. Operation in ambient temperatures that are near or below freezing may require preheating the oil or the use of special oil. Whenever the motor is disassembled for general cleaning and reconditioning, the bearing housing may be washed out with a suitable cleaning solvent. Be sure that the oil-metering hole is clear, and then dry the housing thoroughly before re-assembly, and ensure all traces of cleaning solvent have been removed.

TABLE 3 Oil Viscosity**

Bearing function and location	Bearing Type / size	Oil Viscosity - SSU	
		@ 100℉ (38℃)	@ 200℉ (93℃)
Thrust Bearing	72XX, 73XX Angular contact ball And/or (62XX, 63XX)	150	45
	Spherical roller	300	53
	Plate (Kingsbury Type)	300	53

**Remark: When a lubrication nameplate is attached to the motor, use the lubrication oil it stipulates.

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5.5.6 Cleaning and installation of bearings

(a) Apply the proper amount of grease to the disassembled parts of the bearing after they have been thoroughly cleaned with high quality cleaning oil. Then protect them from contamination before and during assembly.

(b) Bearing installation

ATTENTION!
Before installing the bearings, make sure that the shaft mounted parts inside the bearings are in place before installation.

Since the bearing is a high precision component, it is important to avoid ingress of dust and foreign matter, and hammering during cleaning and installation. Use extreme care and ensure clean conditions during installation and assembly.

ATTENTION!
The best way for bearing installation is heat shrinking. Knocking and hammering during installation should be absolutely avoided.

The bearings should be heated in a bath of clean oil at a temperature of approximately 176℉ (80℃). After warming, slide the bearings in place quickly and nimbly so they do not shrink before being fully in position.
Grease the bearing after the temperature returns to normal, and then reassemble the motor.

5.6 Maintenance of sleeve bearings

5.6.1 Daily inspections

(a) Ensure the volume and quality of lubrication oil are in compliance with specifications. See figure 12.

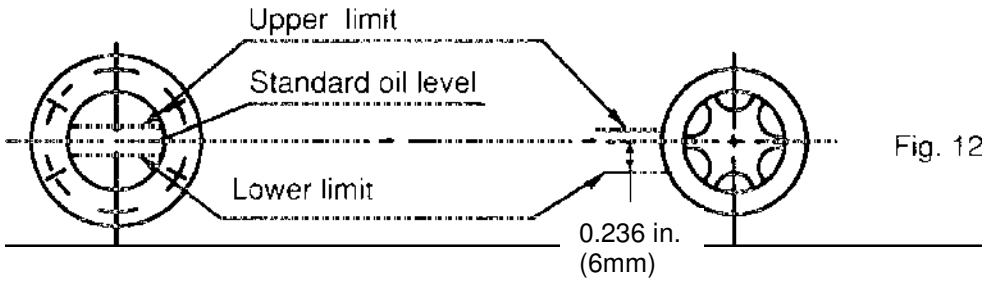


Fig. 12

(b) Ensure there is motion of the oil ring and it is not clamped.

(c) The indicator of the shaft endplay should be restricted within the specified range of the red groove of the shaft as shown in Figure 13. Or the ±0.118 in. (±3mm) range of the drive-end shaft shoulder, or the bearing may be damaged.

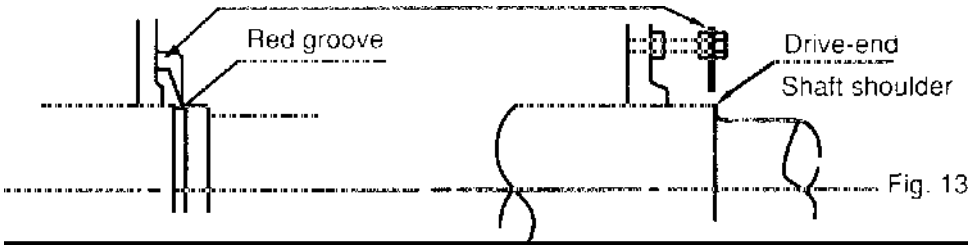


Fig. 13

5.6.2 Regular examination

(a) Periodical change of oil

The oil reservoirs of self (not flood) lubricated bearings should be drained and refilled about every six (6) months. More frequent changes may be needed on high speed (3600 rpm) motors or if severe oil discoloration or contamination occurs. In conditions where contamination does occur, it may be advisable to flush the reservoir with kerosene to remove any sediment before new oil is added. Proper care must be taken to thoroughly drain the reservoir of the flushing material before refilling with the new oil.

Refill the reservoir to the center of oil sight glass with a rust and oxidation inhibited turbine grade oil. Refer to the outline and lubrication nameplate for the correct viscosity.

(b) Quantity of lubrication oil

Please refer to the lubrication nameplate for oil quantity.

(c) Oil viscosity

ISO	Equivalents	Viscosity (SUS/100℉ (38℃)
VG32	Esso Teresso 32	150
VG46	Esso Teresso 46	200
VG68	Esso Teresso 68	300

5.6.3 Disassembly

Prior to disassembling, ensure the power supplies are disconnected and there are no moving parts.

The bearing sleeve is of the spherically seated, self-aligning type. The opposite drive end bearing is normally insulated for larger motors (or when specified). On some motors, the insulation is bonded to the spherical seat of the bearing housing.

ATTENTION!
Extreme care must be exercised in removing the bearing sleeve from the insulated support to avoid damaging this insulation.

The following is the recommended procedure for removing the bearing sleeve:

(a) Remove the oil drain plug in the housing bottom and drain the oil sump.

(b) Remove all instrumentation sensors that are in contact with the bearing sleeve. These would include resistance temperature detectors, thermocouples, thermometers, etc..

(c) Remove the socket head bolts holding the bearing cap and the inner air seal. The end cover plate must also be removed if the non-drive end bearing is being disassembled. Remove the bearing cap and top half of the inner air seal. Place them on a clean, dry surface to avoid damage to the parting surfaces.

(d) Remove the top half of the bearing sleeve using suitable eyebolts in the tapped holes provided. Lift the bearing top straight up and avoid any contact with the shoulders of the shaft journals that might damage the thrust faces of the bearing. Place on a clean, dry surface taking care to prevent damage to either the parting surfaces or the locating pins that are captive in the top bearing half.

(e) Remove the screws at the partings in the oil ring and dismantle the ring by gently tapping the dowel pin ends with a soft face mallet. Remove the ring halves and immediately reassemble them to avoid any mix up with parts or damage to the surfaces at the partings.

(f) Pull up on the garter spring surrounding the floating labyrinth seal and carefully slip out the top half. Rotate the garter spring until the lock is visible. Twist counter-clockwise to disengage the lock, remove the garter spring then rotate the lower half of the seal out of the groove in the bearing housing. Note the condition of these floating labyrinth seals. If they are cracked or chipped, they must be replaced. Do not attempt to reuse a damaged seal.

(g) To remove the bottom bearing half, the shaft must be raised a slight amount to relieve pressure on the bearing. On the drive end, this can be done by jacking or lifting on the shaft extension. Protect the shaft. On the non-drive, jacking or lifting can be done using bolts threaded into the tapped holes provided in the shaft end.

(h) Roll the bottom bearing half to the top of the shaft journal and then lift it using suitable eyebolts threaded into the holes provided. Again avoid any contact with the shaft shoulders that could damage the bearing thrust faces. Place the lower bearing half on a clean, dry surface to protect the parting surfaces.



Use extreme care when rolling out the lower bearing half. Keep hands and fingers well clear of any position where they might be caught by the bearing half if it were accidentally released and rotated back to its bottom position. Serious personal injury could result.

(i) Protect the shaft journal by wrapping it with clean, heavy paper or cardboard.

5.6.4 Re-assembly

Bearing re-assembly is basically a reverse of the disassembly procedures outlined above, with the following suggestions:

(a) The interior of the bearing housing should be cleaned and then flushed with clean oil or kerosene.

(b) The bearing halves and the shaft journal should be wiped clean using a lint-free cloth soaked with clean oil.

(c) All parts should be carefully inspected for nicks, scratches, etc., in any contact surfaces. Such imperfections should be removed by an appropriate method such as stoning, scraping, filing, etc., followed by thorough cleaning.

(d) Before installing the floating labyrinth seal halves, observe their condition. Do not attempt to use a cracked or chipped seal. The bottom half seal has a set of drilled holes in its side face. These must be placed at the bottom toward the inside of the bearing so that accumulating oil may drain back into the housing.

(e) Put a bead of Curil-T around the seal half O.D.'s on both sides adjacent to the garter spring groove. This will prevent oil by-passing the seal around its outside.

(f) Place the bottom seal half on top of the shaft and roll it into position. Install the top half and insert the garter spring pulling up on both ends to permit engaging the lock. Run a bead of Curil-T around the O.D's on both sides adjacent to the garter spring groove on this half also.

(g) Carefully reassemble the two oil ring halves. Inspect the dowel pins for burrs and straightness and make any corrections required. Do not force the ring halves together. Excessive force may alter the roundness or flatness of the oil ring which can change its oil delivery performance.

(h) Some of the pipe plugs in the housing are metric thread type and have a copper, lead, or similar material washer. If these plugs are removed, be careful not to lose the washers. Before re-assembly, inspect the washers and replace them as required.

(i) Before installing the bearing cap, observe the position of the floating labyrinth seal. The "tab" must be on top to engage the pocket. Failure to position the seal properly will result in damage when the cap is assembled.

ATTENTION!

(1) Curil-T is the only approved compound for use in the assembly of the bearings on this motor. Other products may harden and impede operation.

(2) During the re-assembly of the bearing parts, a thin layer of Curil-T should be applied to all gaskets and machined interface surfaces. This suggestion does not apply to the machined surfaces of the bearing liner halves.

(3) When seating the bearing shell, apply a thin layer of lube oil at the spherical surface of the liner. Slowly roll the lower bearing liner into the bearing housing making sure that the splined surface of the liner and the housing are flush. Gradually lower the shaft onto the bearing. The weight of the shaft will help rotate the bearing liner so that the babbitt surface of the liner will match the slope of the journal. Sometimes it is required to use a rubber mallet to tap lightly on the bearing housing while slowly rolling the shaft to help this seating operation.

5.7 Maintenance of slip ring (For Wound Rotor Motors only)



Ensure motor is disconnected from power supplies and there are no accessible moving parts before maintenance operation.

5.7.1 Adjustment of carbon brush

(a) Brush pressure for normal operation:

- Electro-graphite brush 2.8 to 3.6 psi (0.2~0.25 kg/cm^2)

  When frequent vibrations are evident or the brush is small (area below 0.08 sq. in. (0.5 cm^2), the pressure should be greater than as shown.

(b) Adjustment of brush pressure:

The brush pressure should be adjusted to keep normal operation as it wears.

- The brush pressure may be reduced after use, so it is necessary to re-adjust. For adjustment, please turn adjusting screw, pressure adjusting pin or pressure adjusting plate as shown in Fig. 14 to obtain the correct tension (= 3.27 x brush cross sectional area in inches^2) +/- 0.2 lbs" (=0.23 x brush cross sectional area in cm^2) ±10% kg).

(c) Brush pressure need not be adjusted if constant force spring is used as shown in Fig. 15 and Fig. 16.

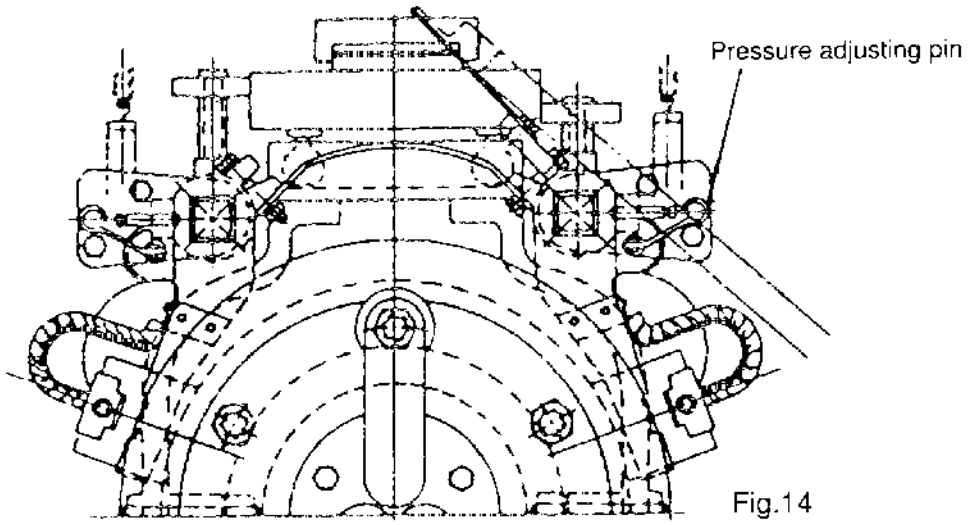
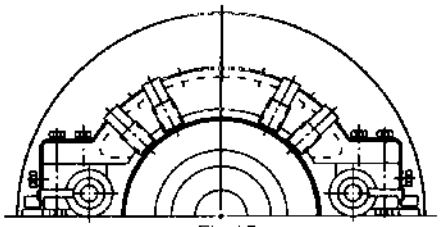


Fig.14


Fig.15

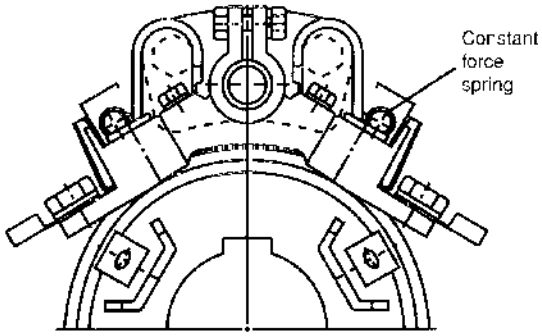


Fig.16

5.7.2 Brush replacement

The carbon brush is a part of the equipment which is easily worn away, replace it after it is worn to 1/2 ~ 3/4 of original size.

(a) Brush material

The brush material is important to the performance of the motor. Only the most appropriate materials are chosen by TWMC, and are listed on the nameplate of the motor. It is important to know this when you replace the brush, so a recommended type is used.

(b) Dimensions

Brush, holder and gap between them, please refer to CNS 2322 C4051 or JIS C2802.

ATTENTION!
The gap between a brush and its holder is important for good performance and safety of the motor.

(c) Adjustment of new brushes (Shown in Fig. 17)

(1) Polish the new brush with a file until is assumes the appropriate contour of the slip ring which it touches.

(2) Place sand-paper (JIS R6252 No. 40... 50) on the slip ring with the abrasive face of the paper against the brush to induce a closer contact by rubbing against each other.
(3) Repeat item 2 with fine sandpaper (JIS R6252 No. 100 to 200) until the contact surface between brush and slip ring exceeds 80%.
(4) Finally, clean the contaminated slip ring and brush with a clean cloth or compressed air.

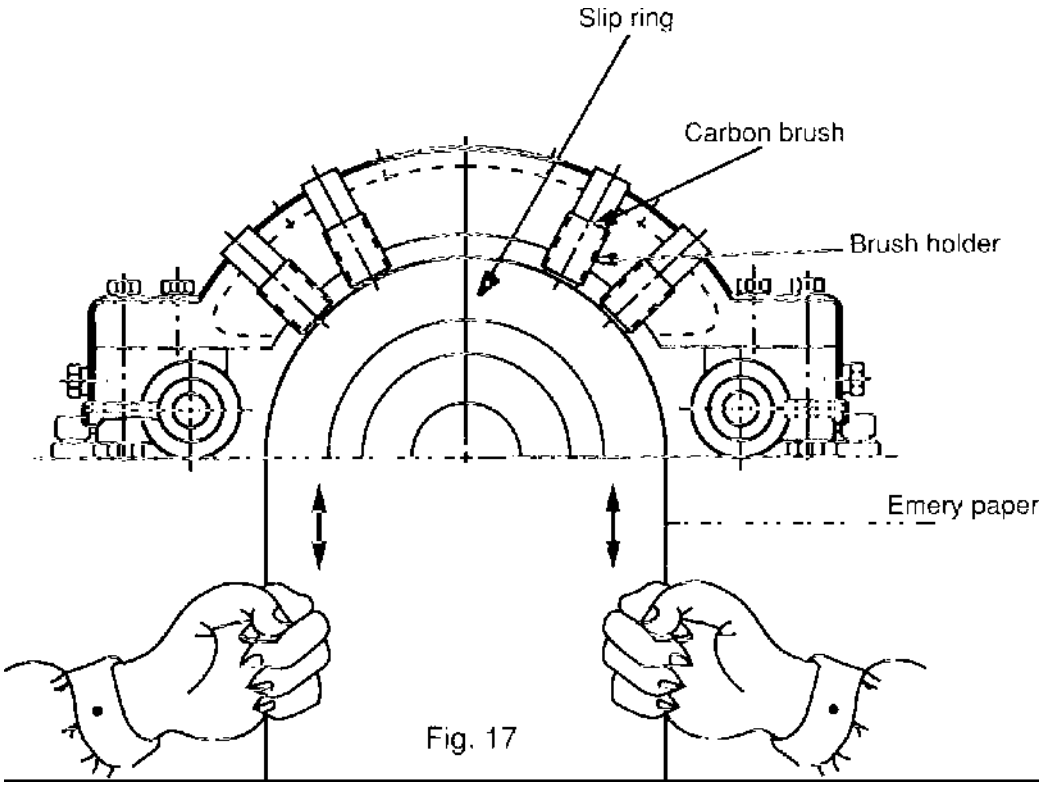


Fig. 17

5.8 Maintenance of non-reverse ratchet mechanism (For Vertical high Thrust Motor only)

5.8.1

In the pump piping system, a check valve and a stop valve should be installed in the discharge line. The check valve, placed between the pump and the stop valve, is to protect the pump from reverse flow and excessive backpressure. The stop valve is used in priming, starting and when shutting down the pump. It is advisable to close the stop valve before stopping the pump. This is especially important when the pump is operated against a high static head.

TWMC vertical high thrust motors are equipped with a non-reverse ratchet (N.R.R.) mechanism only when requested by the pump manufacturer. Typical construction of the N.R.R. mechanism is shown as Fig 18 below.

The N.R.R. mechanism keeps the pump and motor from rotating in the reverse direction. This prevents damage from over-speeding and damage to water-lubricated pump shaft bearings

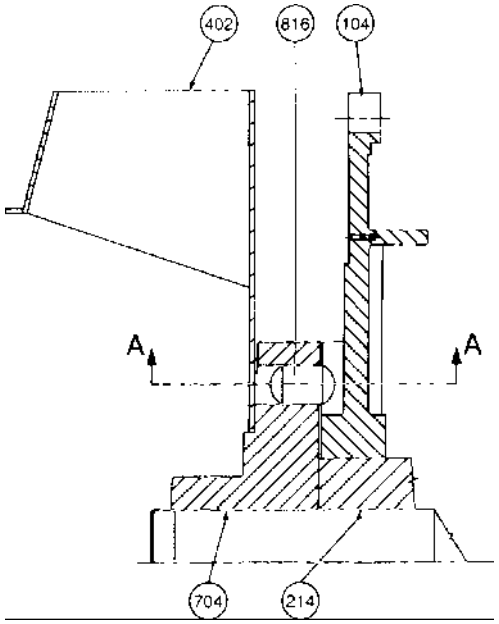
when, on shutdown, the falling water column tends to drive the pump in the reverse direction. In normal operation, the ratchet pins are lifted by the ratchet teeth and are held clear by centrifugal force and friction as the motor comes up to speed. When power is removed, the speed decreases and the pins fall. At the instant of reversal, a pin will catch in a ratchet tooth and prevent backward rotation.

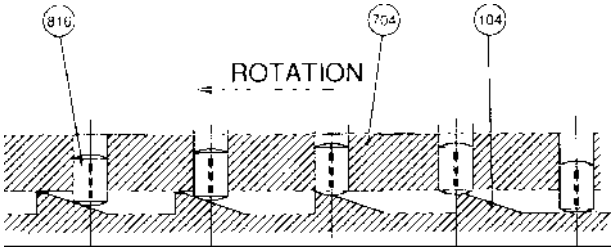
5.8.2

The service life of ratchet pins depends not only on the reverse shock load between the pin and ratchet tooth when the pump is stopped but also the frequency of pump starting and stopping while in service. If the pins are deformed due to this reverse shock load, then the up and down motion of the ratchet pins could be sluggish or jammed and unusual noises shall arise.

The recommended replacement period for these ratchet pins is every three (3) years. If the reverse shock load is greater than 30% of motor rated torque or the starting frequency is more than twice per day, then the replacement period should be halved.

ATTENTION!
The check valve and stop valve in the discharge line should be regularly inspected and maintained to assure the normal function of these valves. This is important to protect the pump and motor from damage and increase the service life of the N.R.R. mechanism.





SECTION A-A

ITEM	NAME
104	RATCHET
214	BEARING SEAT
402	EXTERNAL FAN
704	RATCHET PIN CARRIER
816	RATCHET PIN

Fig. 18

6. FAULT FINDING AND RECOGNITION

Kinds of Breakdown	Symptoms	Possible Causes	Remedies
Fail to start without load	Motionless and soundless	Power-off	Consult power company
		Switch-off	Switch-on
		No fuse	Install fuse
		Broken wiring	Check wiring and repair
		Broken lead	Check wiring and repair
		Broken windings	Check windings and repair
	Fuse blowing. (Automatic switch trips off, slow start with electromagnetic noise)	Short circuit of circuit switches	Check circuit switches and replace
		Incorrect wiring	Check wiring according to nameplate
		Poor contact at terminal	Lock tightly
		Windings grounded	Factory repair
		Broken windings	Factory repair
		Poor contact of circuit switches	Check and repair
		Broken wiring	Check and repair
		Poor contact of starting switches	Check and repair
		Short circuit of starting switches	Check and repair
		Incorrect connections of starting switches	Connect according to nameplate
Loading after start	Fuse blowing. Fail to restart due to trip-off of automatic switch	Insufficient capacity of fuse	Replace fuse if wiring permits
		Overload	Lighten load
		High load at low voltage	Check circuit capacity and reduce load
	Overheating motor	Overload or intermittent overload	Lighten load
		Under-voltage	Check circuit capacity and power source
		Over-voltage	Check power source
		Ventilation duct clogged	Remove the foreign matter in the duct
		Ambient temperature exceeds 104°F (40°C)	Correct insulation class to B or F, or lower ambient temperature
		Friction between rotor and stator	Factory repair
		Fuse blown (Single-phase rotating)	Install the specified fuse
		Poor contact of circuit switches	Check and repair
		Poor contact of circuit starting switches	Check and repair
		Unbalanced three-phase voltage	Check circuit or consult power company

Kinds of Breakdown	Symptoms	Possible Causes	Remedies
Loading after start	Speed falls sharply	Voltage drop	Check circuit and power source
		Sudden overload	Check machine
		Single-phase rotating	Check circuit and repair
	Switch overheat	Insufficient capacity of switch	Replace switch
		High load	Lighten load
	Bearing over-heating	High belt tension	Adjust belt tension
		Slack belt tension	Adjust belt tension
		Misalignment between motor and machine shafts	Re-align
		Over speed of bearing outer-ring	Adjust bracket
		High bearing noise	Replace the damaged bearing
Noise	Electromagnetic noise induced by electricity	Occurrence from its first operation	May be normal
		Sudden sharp noise and smoking	Short circuit of windings should be repaired at the factory
	Bearing noise	Noise of low shishi or Thru-Thru	May be normal
		Kala-Kala as a result of poor lubrication	Grease
		Kulo-Kulo as a result of poor lubrication	Clean bearing and grease
		Sa-Sa or larger noise	Replace the damaged bearing
	Mechanical noise caused by machinery	Loose belt sheave	Adjust key and lock the screw
		Loose coupling or skip	Adjust the position of couplings, lock key and screw
		Loose screw on fan cover	Lock fan cover screw tightly
		Fan rubbing	Adjust fan position
		Rubbing as a result of ingress of foreign matter	Clean motor interior and ventilation ducts
		Wind noise	Noise induced by air flowing through ventilation ducts
		Induced by conveyance machine	Repair machine
Vibration	Electromagnetic vibration	Short circuit of winding	Factory repair
		Open circuit of rotor	Factory repair
	Mechanical vibration	Unbalanced rotor	Factory repair
		Unbalanced fan	Factory repair
		Broken fan blade	Replace fan
		Unsymmetric centers between belt sheaves	Align central points
		Central points of couplings do not lie on the same level	Adjust the central points of couplings to the same level
		Improper mounting installation	Lock the mounting screws
		Motor mounting bed is not strong enough	Reinforce mounting bed

Remarks:

(1) Circuit switches: These include knife switches, electromagnetic switches, fuses and other connection switches etc.

(2) Starting switches: These include Delta-Star starters, compensate starters, reactance starters, resistor starters, starting controller's etc.

TAB 5
Hoist Brake
(Ovivo USA, LLC Part No. 771428)

VIS

FLAMEPROOF BRAKES

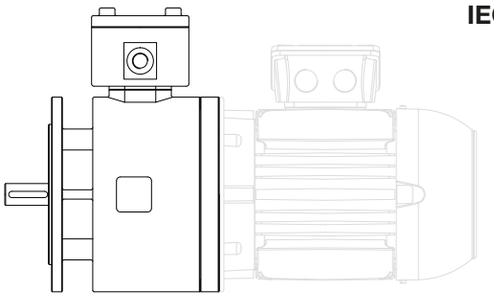


YOUR MOTORS

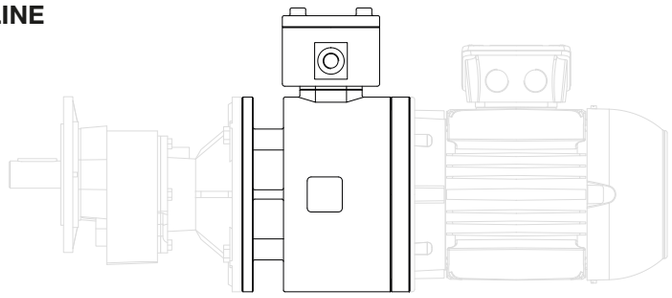
OUR BRAKES

APPLICATION EXAMPLE

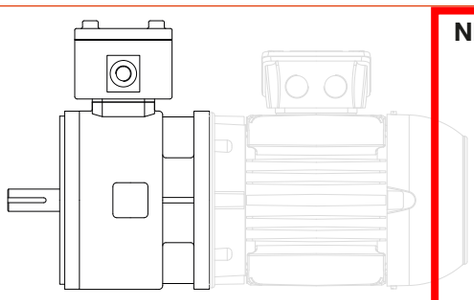
IEC LINE



Standard IEC motor + VIS brake

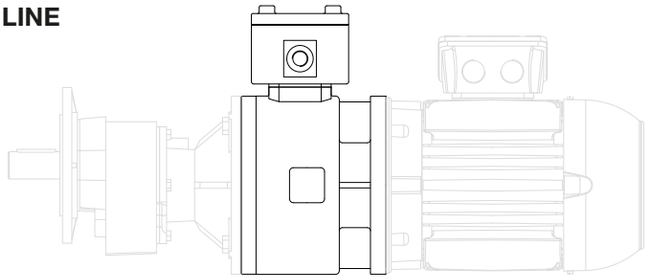


Standard IEC motor + VIS brake + gearbox unit



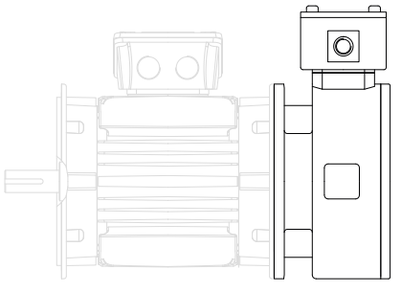
Standard NEMA motor + VIS brake

NEMA LINE

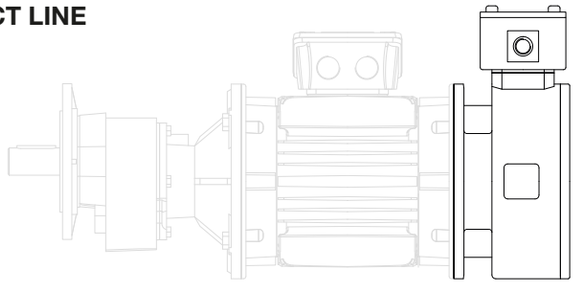


Standard NEMA motor + VIS brake + gearbox unit

COMPACT LINE



Standard motor + VIS brake



Standard motor + VIS brake + gearbox unit

MAIN FEATURES

- Patent pending design and concept system
- Three phase AC or single phase DC electromagnets*
- Totally closed
- IP66
- Power supply VAC24 to 690 50-60Hz three phase or VDC 24 to 300 with built in rectifier*
- F class insulation
- Thermally protected with bimetal protectors as standard
- Large terminal box with terminal board
- Very high resistance structure
- Designed for S1 duty without ventilation*
- Cast iron construction (Steel frame for IEC 315 type)

*depending on frames and sizes

	ATEX certification	IECEx certification	INMETRO certification	KTL certification	TCRU certification	CSA US certification
IEC						
63 71	s	a	a	a	a	na
80 90	s	a	a	a	a	na
100 112	s	a	a	a	a	na
132 160	s	a	a	a	a	na
180 200 225	s	a	a	a	a	na
250 280	s	a	a	a	a	na
315	s	a	na	na	na	na
NEMA						
56 143	na	na	na	na	na	s
182 213	na	na	na	na	na	s
254 284	na	na	na	na	na	s
324 364	na	na	na	na	na	s
404	na	na	na	na	na	s
COMPACT						
25 150	s	a	na	na	na	na
350	s	a	na	na	na	na
750	s	na	na	na	na	na
D18	s	a	na	na	na	na
D216	s	a	na	na	na	na
	Ineris 06ATEX0047X	Ine 11.0037X	NCC 11.0574X	13-027793-03	TC RU C-IT AA87.B	2542839

s = standard
a = available
na = not available

ATEX and IECEx brakes are approved for the following areas:

GAS
II 2 G Ex db P 1 T P 2 Gb Tamb. : -50°C ÷ +55(for T5 Tamb:+60°C) or -20°C ÷ +55(for T5 Tamb: +60°C).

DUSTS
II 2 D Ex tb IIIC T P 3 Db IP66 Tamb. : -50°C ÷ +55(for classe T100°CTamb: +60°C) or -20°C ÷ +55(for class T100°C Tamb: +60°C).

GAS and DUST
II 2 GD Ex db II P 1 T P 2 Gb
Ex tb IIIC T P 3 Db IP66
Tamb. : -50°C ÷ +55(for class T5 or T100°C Tamb: +60°C) or -20°C ÷ +55(for class T5 or T100°C Tamb: +60°C).

MINE gr I
I M2 Ex db Mb Tamb. : -50°C ÷ +55°C oppure -20°C ÷+55°C (not applicable for VIS II P25-P150-P350-P750)-(-50°C not applicable for VIS II 250/280).

Marking mine gr I
Ex db I Mb $T_{amb.}$: -50°C ÷ +55°C oppure -20°C ÷+55°C (not applicable for VIS II P25-P150-P350-P750)-(-50°C not applicable for VIS II 250/280).

Marking for gas
Ex db II P_1 T P_2 Gb $T_{amb.}$: -50°C ÷ +55(for the class T5 Tamb: +60°C) or -20°C ÷ +55(for the class T5 Tamb: +60°C).

Marking for dust
Ex tb IIIC T P_3 Db IP66 $T_{amb.}$: -50°C ÷ +55(for the class T100°C Tamb: +60°C) or -20°C ÷ +55(for the class T100°C Tamb: +60°C).

Marking of gas and dust
Ex db II P_1 T P_2 Gb Ex tb IIIC T P_3 Db IP66
$T_{amb.}$: -50°C ÷ +55(for the class T5 or T100°C Tamb: +60°C) or -20°C ÷ +55(for the class T5 o T100°C Tamb: +60°C).

0051 = *number organism notified surveillance* ATEX (IMQ)
II = group II (surface)
III =zone 21

Pn are subjected to the following variations:

P1 for GAS groups if:
- P1 = B : gas group IIB.
- P1 = C : gas group IIC.

P2/P3 for temperature classes/surface temperature:
- P2 = T3 (not applicable for VIS II P25-P150-P350-P750) P3 = T200°C (not applicable for VIS II P25-P150-P350-P750)
- P2 = T4 P3 = T135°C
- P2 = T5 P3 = T100°C

- -20°C or -50°C/50°C ÷ +55°C (for class T5 o T100°C Tamb: +60°C) = Amb Temp. for VISII 63/71 , VISII 80/90, VISII 100/112, VISII 132/160, VIS II 180/200, VIS II P25,VIS II P150,VIS II P350,VIS II P750.
- -20°C÷+55°C (for class T5 o T100°C Tamb: +60°C)=Amb Temp. for VISII 250/280,VIS II 315.

T.cable : 80°C= Cable temperature

Notes:
INMETRO, KTL, TCRU approvals are related to IECEx specification.

NEMA LINE

Nema brakes are CSAus approved in the following areas
Class I, Div 1, Groups C, D. Class II, Div 1, Groups E, F, G; Class III

FRAME IEC	Nm (min/max)*	W (DC)	VA (Ac 3ph)	Engagement time (ms)**	Braking time DC magnet**	Braking time AC magnet	Maximum rpm S1 duty	Maximum rpm S3 40 duty
63 71	3 to 8	40	na	na	20	na	3600	4320
80 90	12 to 22	50	100	18	40	8	3600	4320
100	30 to 40	80	240	18	90	9	3600	4000
112	30 to 60	80	240	18	90	9	3600	4000
132	70 to 150	105	320	23	180	12	3600	4000
160	100 to 180	105	320	23	180	12	3600	2900
180	180 to 335	180	na	na	230	na	2500	2800
200 225	300 to 460	180	na	na	230	na	2500	2800
250	700 to 1000	240	na	na	360	na	1800	2200
280	700 to 1200	240	na	na	360	na	1800	2200
315	1500 to 2200	340	na	na	420	na	1800	2200

*factory adjustment and relative values are related to a tolerance of + - 10% **values obtained with WR2008 type rectifier

FRAME NEMA	NM (min/max)*	W (DC)	Engagement time (ms)**	Braking time DC magnet**	Maximum rpm S1 duty	Maximum rpm S3 40% duty
56	10 to 15	50	12	20	3600	4100
143	15 to 25	50	20	20	3600	4200
182	25 to 50	65	25	9	3600	4200
213	50 to 80	65	30	90	3600	4200
254	100 to 160	75	40	180	3600	4000
284	160 to 240	100	50	180	2400	3600
324	250 to 370	210	90	230	1800	2200
364	400 to 650	210	90	230	1800	2200
404	560 to 780	220	160	360	1800	2200

*factory adjustment and relative values are related to a tolerance of + - 10% **values obtained with WR2008 type rectifier

FRAME COMPACT	Nm (min/max)*	W (DC)	Engagement time (ms)**	Braking time DC magnet**	Maximum rpm S1 duty	Maximum rpm S3 40% duty
25	10 to 25	50	35	40	3600	4500
150	80 to 150	85	50	90	3600	4200
350	180 to 350	115	80	150	3000	3800
750	350 to 750	180	110	180	1800	2200
D18	750 to 1200	210	140	250	1800	2200
D216	2000 to 3600	360	180	360	1800	2200
E14***	1000 to 4000	160	110	150	300	300
E18***	4000 to 8000	210	150	180	300	300
E216***	8000 to 16000	360	240	310	300	300

*factory adjustment and relative values are related to a tolerance of + - 10% **values obtained with WR2008 type rectifier

***brake must be inspected after every operation if used as emergency braking device or as safety brake with dynamic application having sliding of the disc over 3 seconds

Note: for braking time or number of starts and stops allowed, please contact us

IEC and NEMA line

IEC and NEMA VIS brakes line is designed to be mounted in front of a flanged motor; the bearing used in the input shaft has the only function to support the coupling between the motor and brake shafts and cannot be subjected to additional axial or radial loads.

COMPACT line brakes are designed without output traction shaft.

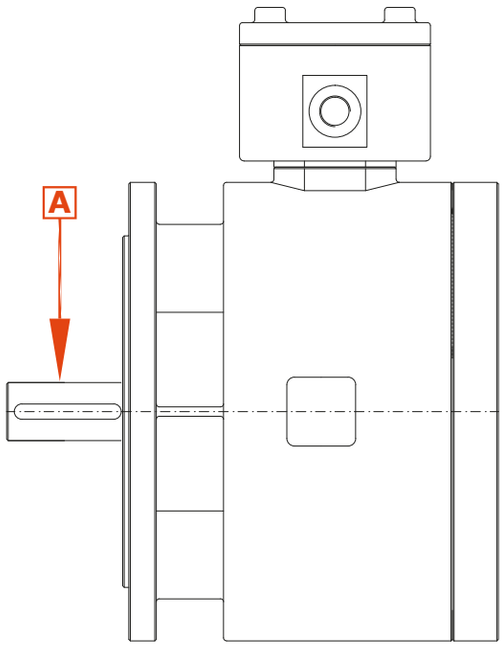
The output shaft admissible radial loads of IEC and NEMA and input shaft COMPACT LINE allowed radial loads are described in the following tab.

IEC	N (A)
63 71	250
80 90	380
100 112	550
132 160	790
180 225	1700
250 280	3400
315	3800

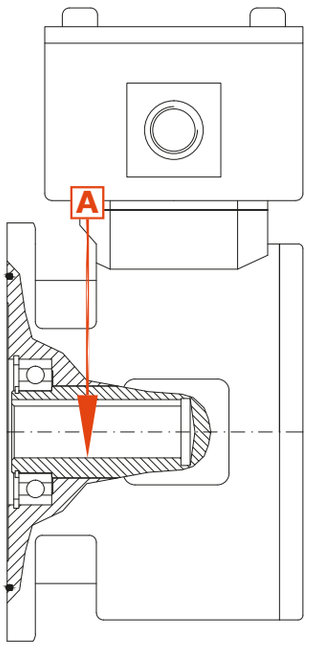
NEMA	N (A)
56 146	400
182 213	610
254 284	790
324 364	1700
404	2600

COMPACT	N (A)
25	310
150	550
350	810
750	1500
D18	1450
D216	1580
E14	580
E18	1450
E216	1580

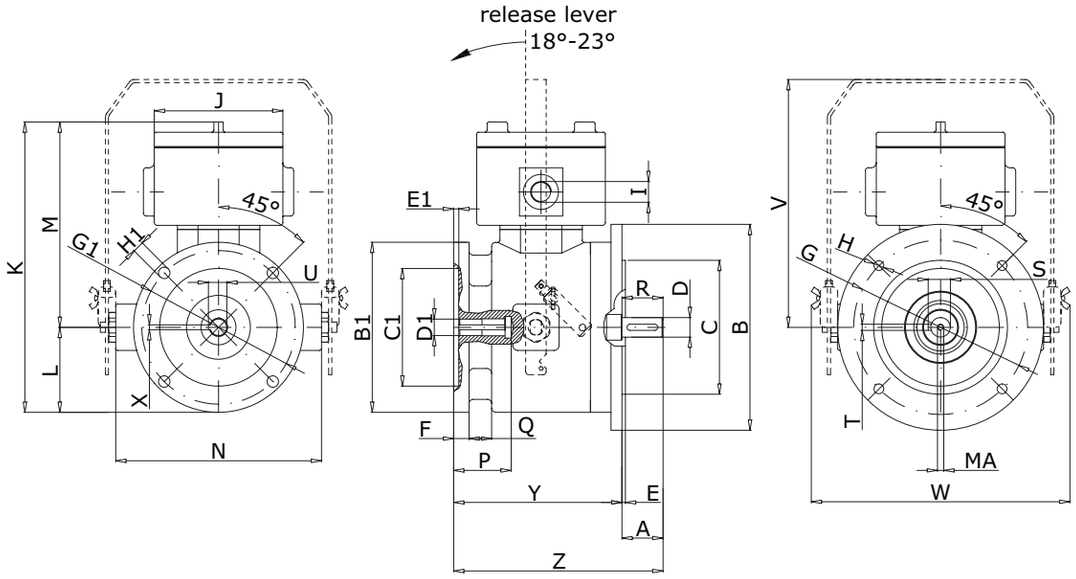
IEC LINE - NEMA LINE



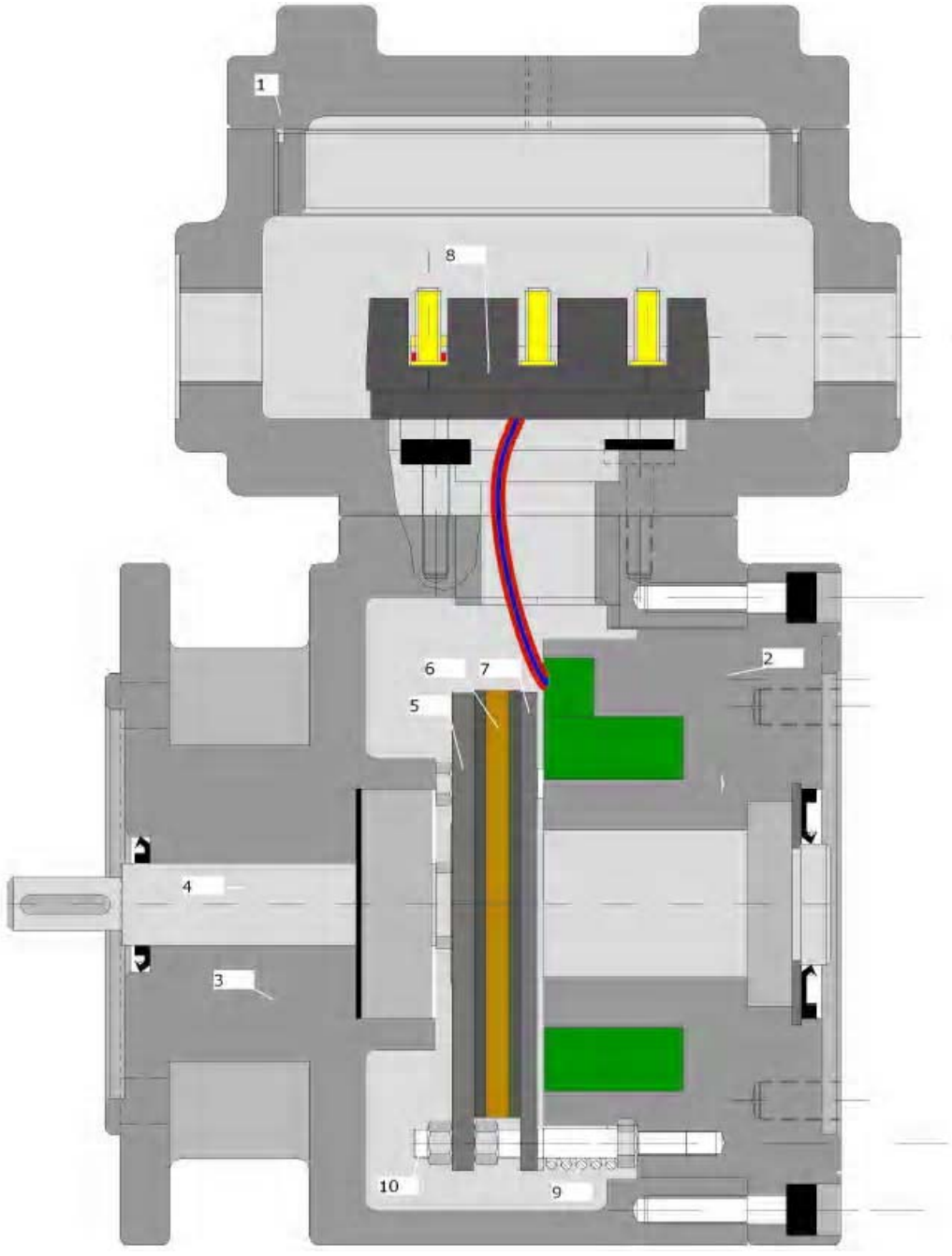
COMPACT LINE



NEMA LINE
C face to C face



NEMA FRAME	56	143/145	182/184	213/215	254/256	284/286	324/326	364/365	404/405
(Kg)	20,5	20,5	42	42	51	78,8	133	134	135,5
A	2-1/16	2-1/8	2-5/8	3-1/8	3-3/4	4-3/8	5	5-5/8	7
ØB	6-1/2	6-1/2	9	9	10	11-1/4	13-3/8	13-3/8	13-7/8
ØB1	6-1/2	6-1/2	9	9	10	11-1/4	13-3/8	13-3/8	13-7/8
ØC	4-1/2	4-1/2	8-1/2	8-1/2	8-1/2	10-1/2	12-1/2	12-1/2	12-1/2
ØC1	4-1/2	4-1/2	8-1/2	8-1/2	8-1/2	10-1/2	12-1/2	12-1/2	12-1/2
ØD	5/8	7/8	1-1/8	1-3/8	1-5/8	1-7/8	2-1/8	2-3/8	2-7/8
ØD1	5/8	7/8	1-1/8	1-3/8	1-5/8	1-7/8	2-1/8	2-3/8	2-7/8
E	1/8	1/8	1/4	1/4	1/4	1/4	1/4	1/4	1/4
E1	0,196''	0,196''	0,220''	0,220''	0,220''	0,220''	0,220''	0,220''	0,220''
F	0,59''	0,59''	0,71''	0,71''	0,71''	0,79''	0,79''	0,79''	0,79''
ØG	5-7/8	5-7/8	7-1/4	7-1/4	7-1/4	9	11	11	11
ØG1	5-7/8	5-7/8	7-1/4	7-1/4	7-1/4	9	11	11	11
H	3/8''-16NC	3/8''-16NC	1/2''-13NC	1/2''-13NC	1/2''-13NC	1/2''-13NC	5/8''-11NC	5/8''-11NC	N° 8 X 5/8''-11NC
ØH1	0,43''	0,43''	0,550''	0,550''	0,550''	0,550''	0,669''	0,669''	N° 8 X 0,669''
I	1/2''NPT	1/2''NPT	1/2''NPT	1/2''NPT	1/2''NPT	1/2''NPT	1/2''NPT	1/2''NPT	1/2''NPT
ØJ	4,92''	4,92''	4,92''	4,92''	4,92''	4,92''	4,92''	4,92''	4,92''
K	11,1''	11,1''	13,48''	13,48''	14,53''	15,785''	17,6775''	17,6775''	17,9275''
L	3,25''	3,25''	4,5''	4,5''	5''	5,625''	6,6875''	6,6875''	6,9375''
M	7,85''	7,85''	8,98''	8,98''	9,53''	10,16''	10,99''	10,99''	10,99''
N	7,87''	7,87''	10,35''	10,35''	11,10''	12,59''	/	/	/
P	2,244''	2,401''	2,972''	3,326''	4,094''	4,625''	5,393''	5,925''	7,16''
Q	0,86''	0,86''	1,57''	1,57''	1,57''	1,73''	1,81''	1,81''	1,81''
R	1-7/8	2-1/4	2-3/4	3-3/8	4	4-5/8	5-1/4	5-7/8	7-1/4
S	33/64	49/64	63/64	1-13/64	1-13/32	1-19/32	1-27/32	2-1/64	2-29/64
T	3/16	3/16	1/4	5/16	3/8	1/2	1/2	5/8	3/4
U	0,714''	0,965''	1,246''	1,527''	1,802''	2,105''	2,356''	2,657''	3,215''
V	9,85''	9,85''	10,98''	10,98''	11,53''	12,16''	/	/	/
W	10,44''	10,44"	12,92''	13,66''	13,66"	15,16''	/	/	/
X	3/16	3/16	1/4	5/16	3/8	1/2	1/2	5/8	3/4
Y	6,023''	6,023''	7,322''	7,322''	7,244''	8,832''	11,844''	11,844''	11,844''
Z	8,086''	8,148''	10,197''	10,697''	11,244''	13,286''	16,844''	17,469''	18,844''



Componenti:

1	scatola morsettiera
2	elettromagnete
3	contenitore flangiato
4	albero freno
5	piastra d'attrito
6	disco freno
7	ancora mobile
8	morsettiera
9	molle
10	colonnette

Components:

1 - terminal box
2 - electromagnet
3 - flanged box
4 - brake shaft
5 - friction disk
6 - brake disk
7 - mobile anchor
8 - connection board
9 - springs
10 - guide stud bolt

Certificate of Compliance

Certificate:	70207169	**Master Contract:**	186833
Project:	70207169	**Date Issued:**	2019-07-18

Issued To: **Coel Motori S.r.l.**
Via Campania 40
Fizzonasco Di Pieve Emanuele
Fizzonasco (MI), Milan, 20090
Italy

Attention: Moreno Mozzati

Issued by: *Zafar Iqbal*
Zafar Iqbal

PRODUCTS

CLASS - C422881 - MOTORS AND GENERATORS For Hazardous Locations - Certified to US Standards

Class I, Division 1, Groups C, D;
Class II, Division 1, Group E, F and G; Class III;

Component Type Electromagnetic Brakes, Insulation Class F, Models VIS N xxx-xxx, rated 24 to 600Vac, 50 / 60 Hz or 24 to 300 Vdc, 15 A max.

Ambient temperature range is -20°C… +55°C or -50°C… +55°C depending on the casting.

Class II, Division 2, Group F and G;

Component Type Electromagnetic Brakes, Insulation Class F, Models VSTDN xxx-xxx, rated 24 to 600Vac, 50 / 60 Hz or 24 to 300 Vdc, 15 A max.

Ambient temperature range is -10 to 40 °C.

Notes:

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1. The subject electromagnetic brakes have been evaluated as Components for electrical safety only: mechanical tests and braking force have not been evaluated. Final combination might be subject to further evaluation by local authorities having jurisdiction.
2. Equipment for use in Class II locations shall not exceed the ignition temperature of the specific rated dust or 165°C, whichever is lower, when installed in locations which are classified due to organic dusts that may dehydrate or carbonize.
3. The automatic reset thermal protectors are to be used in a certified external control circuit of 250 Vac or less, 15A max.

APPLICABLE REQUIREMENTS

FM 3600:2011	Approval Standard for Electrical Equipment for use in Hazardous (Classified) Locations General Requirements
FM 3616:2011	Dust-Ignition proof Electrical Equipment General Requirements
FM 3615 : 2006	Explosion proof Electrical Equipment
ANSI/IEC 60529:2004	Degrees of Protection Provided by Enclosures (IP Code) (identical national adoption)
FM 3810: 2005	Approval Standard for Electrical Equipment for Measurement, Control, and Laboratory Use
ANSI/ ISA-61010-1 (82.02.01): 2004	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1 General Requirements
UL/ CSA 12.12.01-2017	Non incendive electrical equipment for use in Class I and II, Division 2 and Class III, Divisions 1 and 2 hazardous

MARKINGS

The manufacturer is required to apply the following markings:

- Products shall be marked with the markings specified by the particular product standard.
- Products certified for Canada shall have all Caution and Warning markings in both English and French.

Additional bilingual markings not covered by the product standard(s) may be required by the Authorities Having Jurisdiction. It is the responsibility of the manufacturer to provide and apply these additional markings, where applicable, in accordance with the requirements of those authorities.

The products listed are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US (indicating that products have been manufactured to the requirements of both Canadian and U.S. Standards) or with adjacent indicator 'US' for US only or without either indicator for Canada only.

The following markings are applied on a metal nameplate, secured by rivets:

1. Manufacturers name, tradename or CSA Master Contract number “186833” adjacent to the CSA mark.
2. Complete electrical ratings in Volts (Vdc or Vac), frequency (Hz) and amperes (A).

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3. Duty Service if different than 1
4. Model number
5. The CSA mark with adjacent indicator ‘US’
6. Serial number.
7. Hazardous locations designation
8. “Warning: Explosion hazard, Do not disconnect power unless power has been switched off or the area is known to be non-hazardous”
9. “Warning: Seals shall be installed at enclosure wall”

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Supplement to Certificate of Compliance

Certificate: 70207169 **Master Contract:** 186833

The products listed, including the latest revision described below, are eligible to be marked in accordance with the referenced Certificate.

Product Certification History

Project	Date	Description
70207169	2019-07-18	Update to CSA-us Report 2542839 to add a new variation of model VSTDN xxx-xxx for Class II, Division 2, Groups F & G for component type electromagnetic brakes with insulation Class F.

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www.coel-is.com

Safety instructions
Rev.6
Date: 06 / 03 / 2019

Safety instructions VIS II Brakes ATEX – IECEX / ktl 13-027793

Introduction:
These safety instructions refer to the installation, operation and maintenance of the VIS II flameproof brakes, certified for use in areas where there is a presence of potentially explosive atmospheres.
They consist in a case and a terminal box in cast iron or steel in some cases.
The VIS II brakes are explosion proof made and they are manufactured in the following versions/frames:

Types VIS II: 63-71-80-90-100-112-132-160-180-200-250-280-315-P25-P150-P350-P750

Description:
The VIS II electromagnetic brakes are built in various models described in the dedicated chart of this document.
They consist of a brake compartment and a junction box compartment both defining a single enclosure.
Inside the enclosures it is possible to insert electronic devices suitable to drive the brakes, a rectifier, an encoder, switches and heaters.
For Atex and IECEx zones are 1, 2, 21, 22 .
The enclosures are made of cast iron.
The VIS II 315 frame is made of steel and its terminal Box is made of cast iron;
VIS II P25/P150/P350/P750 are made of cast iron; the rear part is made of steel.
The VIS II brakes can be equipped with hand lever for releasing the brakes (hand opening).
The VIS II brakes are negative disc brakes. Inside the brake there is a disc brake axially free mounted on the shaft and dragged by the same, an electromagnet and a mobile anchor. In absence of power supply the mobile anchor is pressed by the springs on the disc locked by an additional friction track mounted on the opposite side. When the magnet is energized, the mobile anchor is attracted releasing the disc and allowing the rotation of the shaft.

The VIS II Brakes series is built for ATEX-IECEx / ktl in conformity with:
ATEX:
EN 60079-0:2012/A11:2013
EN 60079-1:2014
EN 60079-31:2014
IECEx/ktl:
IEC 60079-0:2011
IEC 60079-1:2014
IEC 60079-31: 2013
ATEX is in conformity with 2014/34/EU.

Marking and Nomenclature VIS II ATEX:

GAS
II 2 G Ex db P 1 T P 2 Gb Tamb. : -50°C ÷ +55(for T5 Tamb:+60°C) or -20°C ÷ +55(for T5 Tamb: +60°C).
DUSTS
II 2 D Ex tb IIIC T P 3 Db IP66 Tamb. : -50°C ÷ +55(for classe T100°CTamb: +60°C) or -20°C ÷ +55(for class T100°C Tamb: +60°C).
GAS and DUST
II 2 GD Ex db II P 1 T P 2 Gb
Ex tb IIIC T P 3 Db IP66
Tamb. : -50°C ÷ +55(for class T5 or T100°C Tamb: +60°C) or -20°C ÷ +55(for class T5 or T100°C Tamb: +60°C).
MINE gr I
I M2 Ex db I Mb Tamb. : -50°C ÷ +55°C oppure -20°C ÷+55°C (not applicable for VIS II P25-P150-P350-P750) – (-50°C not applicable for VIS II 250/280).

Marking and Nomenclature VIS II IECEx:

Marking for gas
Ex db II P_1 T P_2 Gb $T_{amb.}$: -50°C ÷ +55(for the class T5 Tamb: +60°C) or -20°C ÷ +55(for the class T5 Tamb: +60°C).

Marking for dust
Ex tb IIIC T P_3 Db IP66 $T_{amb.}$: -50°C ÷ +55(for the class T100°C Tamb: +60°C) or -20°C ÷ +55(for the class T100°C Tamb: +60°C).

Marking of gas and dust
Ex db II P_1 T P_2 Gb Ex tb IIIC T P_3 Db IP66
$T_{amb.}$: -50°C ÷ +55(for the class T5 or T100°C Tamb: +60°C) or -20°C ÷ +55(for the class T5 o T100°C Tamb: +60°C).

Marking mine gr I
Ex db I Mb $T_{amb.}$: -50°C ÷ +55°C oppure -20°C ÷+55°C (not applicable for VIS II P25-P150-P350-P750)-(-50°C not applicable for VIS II 250/280).

The marking provided for the brakes series VIS II is the following:
0051 = *number organism notified surveillance* ATEX (IMQ)
II = group II (surface)
III =zone 21

Pn are subjected to the following variations:

P1 for GAS groups if:
- P1 = B : gas group IIB.
- P1 = C : gas group IIC.

P2/P3 for temperature classes/surface temperature:
- P2 = T3 (not applicable for VIS II P25-P150-P350-P750) P3 = T200°C (not applicable for VIS II P25-P150-P350-P750)
- P2 = T4 P3 = T135°C
- P2 = T5 P3 = T100°C

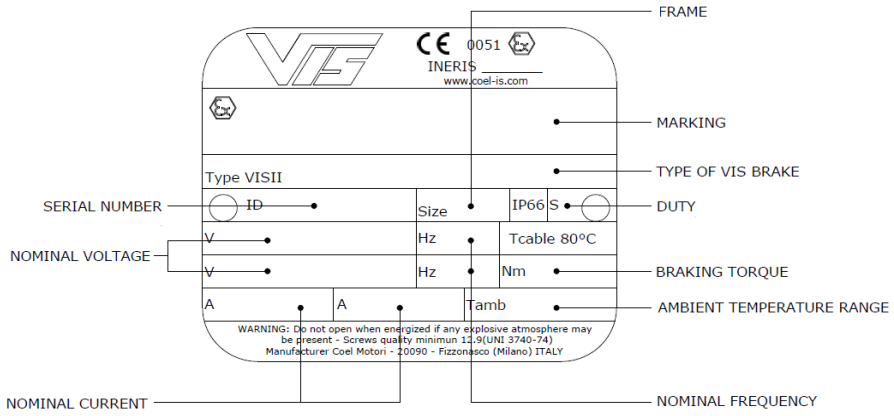
- -20°C or -50°C/50°C ÷ +55°C (for class T5 o T100°C Tamb: +60°C) = Amb Temp. for VISII 63/71 , VISII 80/90, VISII 100/112, VISII 132/160, VIS II 180/200,VIS II P25,VIS II P150,VIS II P350,VIS II P750.
- -20°C÷+55°C (for class T5 o T100°C Tamb: +60°C)=Amb Temp. for VISII 250/280,VIS II 315.

T.cable : 80°C= Cable temperature.

Marking and Nomenclature VIS II ktl:

번호	안전인증대상 기계·기구명	형식(규격)	용량(등급)	인증일	인증번호
1	Electromagnetic brake	VIS II 250/280	Ex d IIB or IIC T5/T4/T3	2013-06-27	13-KB4BO-0364
2	Electromagnetic brake	VIS II 63171~180/200	Ex d IIB or IIC T5/T4/T3	2013-06-27	13-KB4BO-0365
3	Electromagnetic brake	VIS II 250/280	Ex tb IIIC T100/T135/T200	2013-06-27	13-KB4BO-0366
4	Electromagnetic brake	VIS II 63171~180/200	Ex tb IIIC T100/T135/T200	2013-06-27	13-KB4BO-0367

Name plate is made of steel and placed on the brakes by rivets; (the Ex, INERIS,0051 mark is not stamped on the IECEx / ktl plate).
Example:



Performance:
The brakes are suitable to be coupled to motors or any transmission unit and are suitable to be used in service S1 (continuous) ÷ intermittent S2, S3 or S4.

In case of dynamic application, please contact us in order to evaluate the applied inertia to the brake and so define the admissible work cycle.
Limit duty cycles in case of sliding of the brake disk for a maximum 0,5 second for 1 time :

TYPE VIS II	*CYCLE TIMES OF BRAKING (n/h)*	*BRAKING TORQUE max. (Nm)*
63/71	1.800	8
80/90	1.800	22
100/112	1300	60
132/160	900	180
180/200	600	460
250/280	600	1200 (S1), 2000 (S2, S3, S4)
315	280	2200 (S1), 3600 (S2, S3, S4)
P25	1800	25
P150	900	150
P350	600	350
P750	600	750

Limit duty cycles in case of sliding of the brake disk for a maximum 0,8 second for 1 time :

TYPE VIS II	*CYCLE TIMES OF BRAKING (n/h)*	*BRAKING TORQUE max. (Nm)*
63/71	900	8
80/90	900	22
100/112	650	60
132/160	450	180
180/200	300	460
250/280	300	1200 (S1), 2000 (S2, S3, S4)
315	100	2200 (S1), 3600 (S2, S3, S4)
P25	900	25
P150	450	150
P350	300	350
P750	300	750

Joins and safety issues:
They are in conformity to EN 60079-1:2014 IEC 60079-1:2014.
The joints between the box and lid are made of threaded joints in accordance with ISO 965-3 and ISO 965-1.
The joint between the box and the housing of the brake is a spigot joint and are covered with white lithium grease.
This grease does not contain any solvent and does not harden over time.

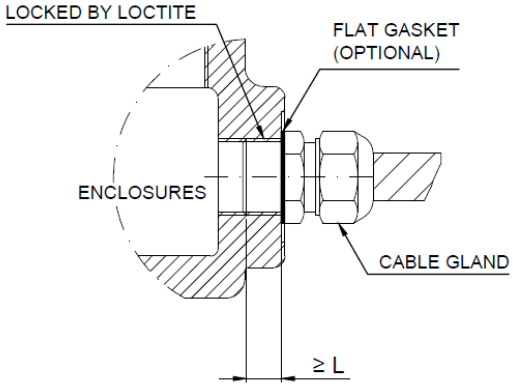
Main characteristics:
The electromagnetic brake VIS II is negative type disc. Inside the brake assembly is located a braking disc capable of sliding axially on the shaft and dragged from the tree itself, an electromagnet and a mobile anchor. In the absence of current, the armature is pushed by the springs to the brake disc that the other side is another surface friction, causing the brake locking.
The winding wires are connected to the terminal by means of lugs.
The terminal board is available in three versions: standard six terminals for normal use and eight terminals or ten terminals when are required in the case of auxiliaries, such as PTC or heating elements.

Ground terminals:
There are two ground connections, one inside the terminal box and one outside on the housing of the brake. The system of internal and external grounding is made of stainless steel and provided with washer. Both must be connected to the ground of the conductor with a suitable section.
Section of cable must be in conformity with EN/IEC 60079-0.

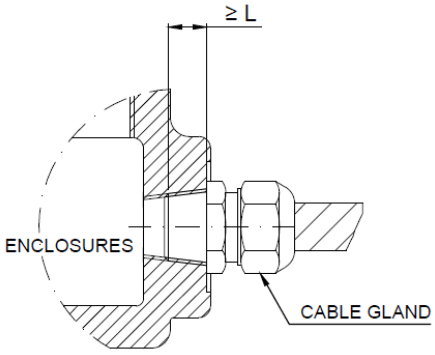
Cable entry:
VIS II brakes are supplied with 1 or 2 cable entry.
All the devices for cable entry (cable gland, adapters) must be certified with minimum certification level as per valid certification of the brakes.

Threading must guarantee minimum 5 complete threads. Entry cable must be in conformity with EN/IEC 60079-0, 60079-1, (Ex-db EN/IEC 60079-31)
A label or a stamp nearby the hole will indicate the type of threading.

CABLE GLAND WITH CILINDRICAL THREAD:
M20X1,5-M25X1,5 TOLLERANCE MEDIUM 6H/6g
AS PER ISO965-3 AND ISO965-1.



CABLE GLAND WITH CONICAL THREAD:
NPT 1/2 OR 3/4 ANSI/ASME B1.20.01.



Safety instructions:
VIS II brakes are intended for operation in hazardous areas (Zones 1, 2, 21, 22); user must verify that installation area group and the temperature class comply with the area rating.
The brakes are supplied ready for use, according to the specifications indicated in the purchase order. If any braking torques, work cycles, or inertia applied are different than those indicated in the purchase order are, please contact us.
VIS II brakes must be installed and maintained following the norms of maintenance in explosive location: **IEC/EN 60079-14, IEC/EN 60079-17.**
The electromagnets can be wound for three-phase AC between 24 V and 690 V 50/60Hz , or DC single-phase voltages between 24 V to 300 V, insulation class F .
Brakes are supplied with a thermal protector that must be connected to the control panel to prevent overheating.
Use cable with temperature range of 80°C and cable glands with separated IECEX/ATEX certification only-we recommend to use cable glandes with internal compound seal.

USE SCREWS OF MINIMUM QUALITY A12.9.

WARNING: DO NOT OPEN IF EXPLOSIVE ATMOSPHERES ARE PRESENT.
AFTER OPENING PUT AGAIN GREASE ON THE JOINTS.
USE ONLY LITHIUM WHITE GREASE.

The user must keep the brake clean in order to avoid the dust storing up to max 5 mm thickness.

- The flameproof joints have different values from those specified in the tables of the IEC/EN 60079-1 standard, contact the manufacturer for any repair.
- For group I, the user shall take into consideration that the equipment underwent only a shock test corresponding to a low risk energy.

General Safety Warnings:
Improper use, lack of inspection and maintenance can create serious damages. The installer staff must be informed of any danger caused by contact dangerous parts, rotating parts and hot surfaces. In normal working conditions the brake exceeds +50°C.
The VIS II brake must be handled, installed, put in service, inspected, maintained and repaired only by qualified personnel.
The VIS II brake is a component made to be mechanically connected to another machine. It is responsibility of the person responsible for the installation to guarantee that during operation there is an adequate level of protection for people and things against the danger of accidental contact with moving parts.

Storage:
The brakes are shipped ready for installation. Upon receipt, remove packaging and control the shaft to check that the brake has not been damaged; also check all physical aspect of the machine to avoid damage. In the case where the brake is damaged an immediate notification must be given to COEL within 3 days. Brakes must be stored in dry place, lacking in powders, vibrations , gas and corrosive smoke, with constant temperature and held in normal position.
The temperature of the brakes stocking place must be between 5°C and 45°C, with relative humidity not over 60%; the storing time does not have to exceed 18 months.

Installation:

WARNING: Work on the VIS II brake must be carried out when the machine has stopped and been disconnected from the power supply (including auxiliary parts). Adequate precautions must be taken to avoid excess voltages or peak voltages. The cables must not be crushed or exposed to mechanical loading. Use cables with sufficient section to bear the maximum current absorbed, avoid overheating and/or drops in voltage.
Connect the cables to terminals by following the instructions on the connection diagrams. Check that terminal nuts are tightened.
Connections to the terminals must be made in order to guarantee safe distances between live uncovered parts. The area of contact of connections must be cleaned and protected against corrosion.

***Grounding Connections*:**
Two grounding connections are provided, one inside the terminal box, the other one on the brake case. Both of them must be connected to the plant earth with at least one conductor with an adequate cross section area.
Reassembling the terminal box it is necessary to replace the layer of grease. The terminal box cover must be tightened to ensure it is properly sealed.
THE AUXILIARY THERMAL PROBES MUST BE PRESENT TO ENSURE THE PROTECTION MODE

Putting into operation:
It is the responsibility of the installer to establish the brakes to be used in a certain plant, after analyzing the characteristics of danger existing in the installation area with respect to current provisions of the low and to those issued for safety purposes.
Make sure that the brakes is suited for use in the working conditions defined in order.
Before starting the brake it is important to check that:

-INSTALLATION HAS BEEN CARRIED OUT PROPERLY;
-THE BEARINGS HAVE NOT BEEN DAMAGED DURING INSTALLATION;
-THE DESIGN DATA CORRESPONDS TO THOSE GIVEN ON THE PLATE AND IN TECHNICAL DOCUMENTATION.

Maintenance:
VIS II brakes are designed in order to avoid difficult maintenance operations.
The inspections and maintenance of flameproof VIS II brakes shall be executed in compliance with the criteria of the IEC/EN 60079-17 standard, while repairs in compliance with the criteria specified in the IEC/EN 60079-19 standard.

“MODIFICATIONS NOT AUTHORIZED FROM THE CONSTRUCTOR ARE NOT ADMITTED. IN CASE OF MODIFICATIONS THE GUARANTEE AND THE RESPONSIBILITY OF THE CONSTRUCTOR IS NOT VALID”.

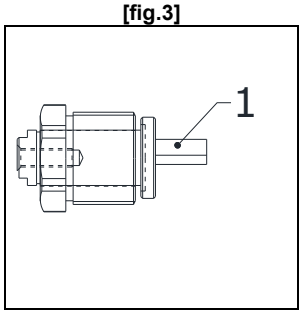
If repair work has to be performed on parts that influence the protection against explosions, the brake construction data must not be changed (for example: dimensions of joints, bearings characteristics, etc.) and if parts are replaced, this must be with original components.
The type of maintenance and frequency of checks depends on the ambient and working conditions. Especially wear on the brake disk depends on various factors: load inertia, brake rotation speed, and frequency of engaging.
Anyway, please find the following instructions:
-Periodically clean the external surface of the brakes and remove dust in particular around the terminal box.
-Check that nominal current consumption is respected.
-In case of non function of the brake, please supply it to an authorized assistance workshop for repairing.

Assembly:
VIS II brakes are designed to be connected to electric motors or any kind of transmission units already certified ATEX or IECEx/ktl. VIS II brakes can be made with variants of input or output coupling (flanges and shafts) or with other special unification mechanical (NEMA for example) not changing the flame joints and / or other features related to the type of protection Ex d or other internal features or mechanical key.

System release lever:
This system allows to rotate the shaft manually in the absence of power. Once lever is actuated, the disc is free to rotate; when the lever is put to the original position, the brake returns to lock state.
it consists of an operating lever that acts on two pivots release positioned on two opposite sides of the housing of the brake. The lever is made of stainless steel, while the pins of unlocking steel which rotates on a bearing bush made of brass.
VIS II brakes can be supplied with (or ready for) hand release lever for the brake.
It allows the shaft to rotate even when the power is off. Pulling the hand release, when the end of the stroke is reached you have to increase the strain slightly until the shaft is released. Do not apply excessive force to the
hand release lever. Releasing force on the mechanism, the brake automatically returns to the fail safe position.
When the brake is fitted with a manual brake release lever it must be installed so as to avoid any accidental activation of the release unit.

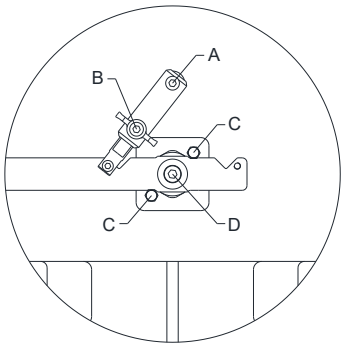
When the brake is ready for hand release lever **[fig.3]**, on the brake case there are two opposite housing for release device covered by two screw plugs (N.1). To install the levers, before removing the screw plugs then screwing the release hinges (N.1) through the hexagonal nut.

[fig.3]

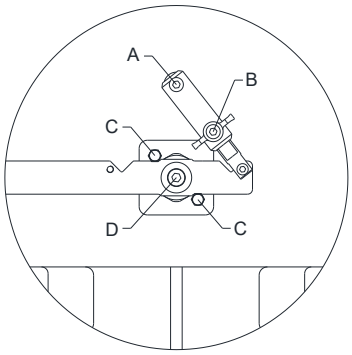


HAND RELEASE:

Drawing A - Output side release

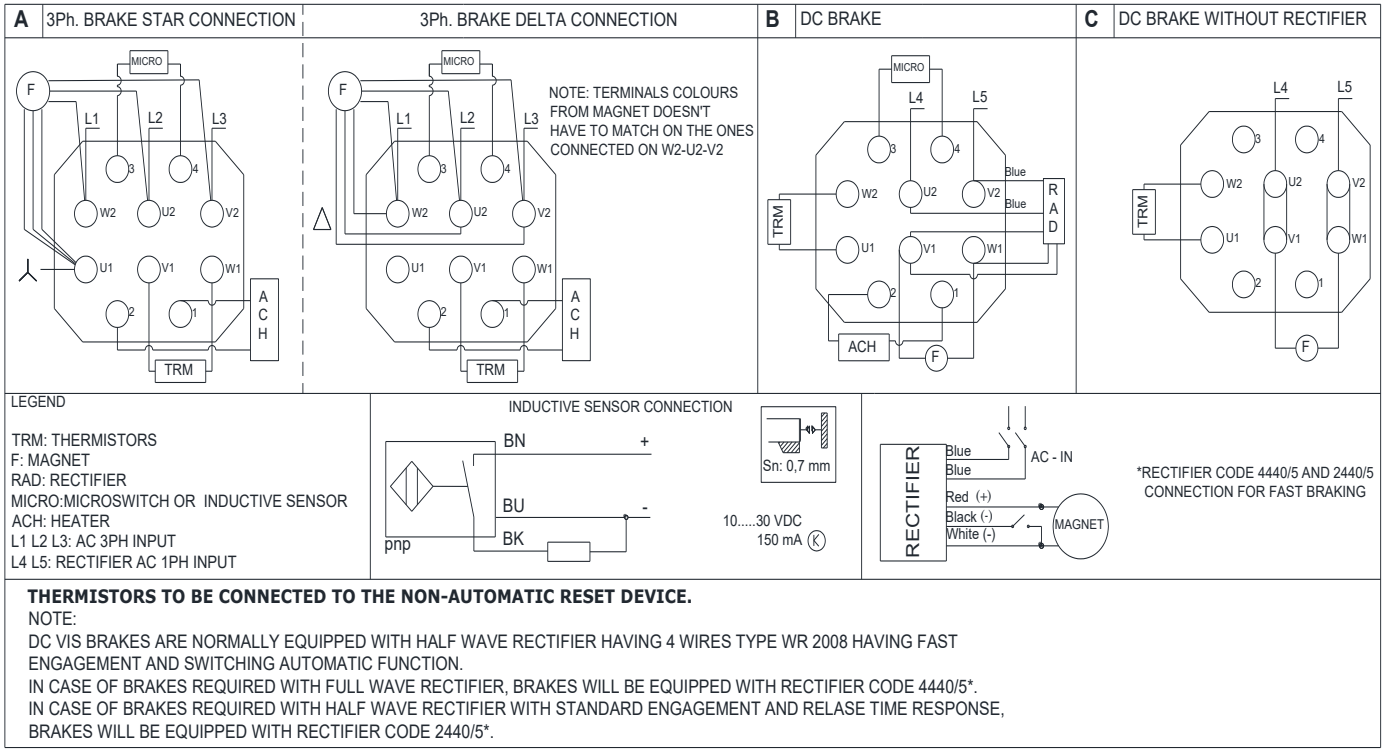


Drawing B - Input side release



1-Assemble hand release and fix the screws D
2-Fix A type screw and position C screws
3-Release screws B
4-Release manually the brake operating on the lever
5-Fix B screws

Connection systems:



THERMISTORS TO BE CONNECTED TO THE NON-AUTOMATIC RESET DEVICE.
NOTE:
DC VIS BRAKES ARE NORMALLY EQUIPPED WITH HALF WAVE RECTIFIER HAVING 4 WIRES TYPE WR 2008 HAVING FAST ENGAGEMENT AND SWITCHING AUTOMATIC FUNCTION.
IN CASE OF BRAKES REQUIRED WITH FULL WAVE RECTIFIER, BRAKES WILL BE EQUIPPED WITH RECTIFIER CODE 4440/5*.
IN CASE OF BRAKES REQUIRED WITH HALF WAVE RECTIFIER WITH STANDARD ENGAGEMENT AND RELASE TIME RESPONSE, BRAKES WILL BE EQUIPPED WITH RECTIFIER CODE 2440/5*.

Declaration of conformity *VIS II Brakes ATEX – IECEx / KTL*

The manufacturer COEL Motori Srl declares under own sole responsibility that the product Electromagnetic flameproof brakes types VIS II:

63-71-80-90-100-112-132-160-180-200-250-280-315-P25-P150-P350-P750

Certified: INERIS 06 ATEX 0047X /IECEx INE 11.0037X / KTL 13-027793 is built in conformity with:

ATEX:	**IECEx / KTL:**
EN 60079-0:2012/A11:2013	IEC 60079-0:2011
EN 60079-1:2014	IEC 60079-1:2014
EN 60079-31:2014	IEC 60079-31: 2013

ATEX is in conformity with 2014/34/EU.

Marking and Nomenclature VIS II ATEX:

GAS

II 2 G Ex db P1 T P2 Gb Tamb. : -50°C ÷ +55(for T5 Tamb:+60°C) or -20°C ÷ +55(for T5 Tamb: +60°C).

DUSTS

II 2 D Ex tb IIIC T P3 Db IP66 Tamb. : -50°C ÷ +55(for classe T100°CTamb: +60°C) or -20°C ÷ +55(for class T100°C Tamb: +60°C).

GAS and DUST

II 2 GD Ex db II P1 T P2 Gb
Ex tb IIIC T P3 Db IP66
Tamb. : -50°C ÷ +55(for class T5 or T100°C Tamb: +60°C) or -20°C ÷ +55(for class T5 or T100°C Tamb: +60°C).

MINE gr I

I M2 Ex db I Mb Tamb. : -50°C ÷ +55°C oppure -20°C ÷+55°C (not applicable for VIS II P25-P150-P350-P750) – (-50°C not applicable for VIS II 250/280).

Marking and Nomenclature VIS II IECEx :

Marking for gas

Ex db II P1 T P2 Gb $T_{amb.}$: -50°C ÷ +55(for the class T5 Tamb: +60°C) or -20°C ÷ +55(for the class T5 Tamb: +60°C).

Marking for dust

Ex tb IIIC T P3 Db IP66 $T_{amb.}$: -50°C ÷ +55(for the class T100°C Tamb: +60°C) or -20°C ÷ +55(for the class T100°C Tamb: +60°C).

Marking of gas and dust

Ex db II P1 T P2 Gb Ex tb IIIC T P3 Db IP66
$T_{amb.}$: -50°C ÷ +55(for the class T5 or T100°C Tamb: +60°C) or -20°C ÷ +55(for the class T5 o T100°C Tamb: +60°C).

Marking mine gr I

Ex db I Mb $T_{amb.}$: -50°C ÷ +55°C oppure -20°C ÷+55°C (not applicable for VIS II P25-P150-P350-P750)-(-50°C not applicable for VIS II 250/280).

The marking provided for the brakes series VIS II is the following:

0051 = number organism notified surveillance ATEX (QAN IMQ 05 ATEXQ 0002)
II = group II (surface)
III = zone 21

Pn are subjected to the following variations:

P1 for GAS groups if:
- P1 = B : gas group IIB.
- P1 = C : gas group IIC.

P2/P3 for temperature classes/surface temperature:
- P2 = T3 (not applicable for VIS II P25-P150-P350-P750) P3 = T200°C (not applicable for VIS II P25-P150-P350-P750)
- P2 = T4 P3 = T135°C
- P2 = T5 P3 = T100°C
- -20°C or -50°C/50°C ÷ +55°C (for class T5 o T100°C Tamb: +60°C) = Amb Temp. for VISII 63/71 , VISII 80/90, VISII 100/112, VISII 132/160, VIS II 180/200,VIS II P25,VIS II P150,VIS II P350,VIS II P750.
- -20°C÷+55°C (for class T5 o T100°C Tamb: +60°C)=Amb Temp. for VISII 250/280,VIS II 315.

T.cable : 80°C= Cable temperature.

Marking and Nomenclature VIS II KTL:

번호	안전인증대상 기계·기구명	형식(규격)	용량(등급)	인증일	인증번호
1	Electromagnetic brake	VIS II 250/280	Ex d IIB or IIC T5/T4/T3	2013-06-27	13-KB4BO-0364
2	Electromagnetic brake	VIS II 63171~180/200	Ex d IIB or IIC T5/T4/T3	2013-06-27	13-KB4BO-0365
3	Electromagnetic brake	VIS II 250/280	Ex tb IIIC T100/T135/T200	2013-06-27	13-KB4BO-0366
4	Electromagnetic brake	VIS II 63171~180/200	Ex tb IIIC T100/T135/T200	2013-06-27	13-KB4BO-0367

Date: 14/12/2018 Managing director

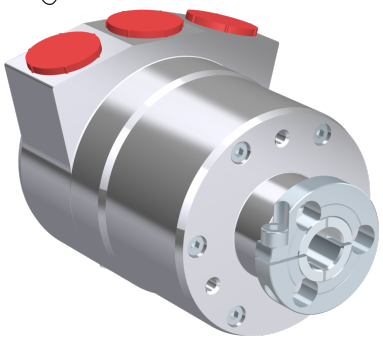
TAB 6
Radial Encoder
(Ovivo USA, LLC Part No. 771759)

Encoder model

IHA 648

Part number

1234999-05



Inductive Hollow shaft encoder, Absolute

- Certified according to ATEX and IECEx*
- 78 mm diameter
- 31 bit Multiturn resolution
- Inductive scanning
- Stainless steel A4, EN 1.4404/AISI 316L
- *Please refer to web page for other possible options/performances

EtherNet/IP™

Mechanical data

Operating temperature	-40 °C...+60 °C
Ingress protection class [IEC 60529]	IP 66 and IP 67
Vibration [IEC 60068-2-64]	≤ 20 g, 55-2000 Hz
Shock [IEC 60068-2-27]	100 g, 11 ms / 200 g, 6 ms
Shaft load (axial/radial)	50 / 60 N
Rotational speed max	2000 rpm
Shaft material	Stainless steel A4, AISI 316L/EN 1.4404
Cover material	Stainless steel A4, AISI 316L/EN 1.4404
Weight	3000 g

Encoder configuration

Code key	648140270
Type	IHA
Model	648 Multiturn stainless steel
Shaft type	Ø14 mm blind hollow shaft
Flange type	Clamping flange
Power supply	9-30 Vdc
Output interface	EtherNet/IP
Absolute resolution	31 bit (19 bit singleturn + 12 bit multiturn)
Connection type	Push Terminals 10-pin
Certification ATEX	EX II 2G Ex db IIC T5, EX II 2D Ex tb IIIC T100 °C
Certification IECEx	Ex db IIC T5, Ex tb IIIC T100 °C
Connecting direction	Radial

Electrical data

Polarity protected	Yes
Current consumption (No load)	100 mA at 24 Vdc
Absolute accuracy	± 100 arcsec
Supported profile	Encoder device profile 0x22
Baud rate	100 Mbit/s
RPI	1 ms
IP Adress	Assigned dynamically via BOOTP

24 Mar 2023 Specification can be changed without prior notice.

LEINE LINDE

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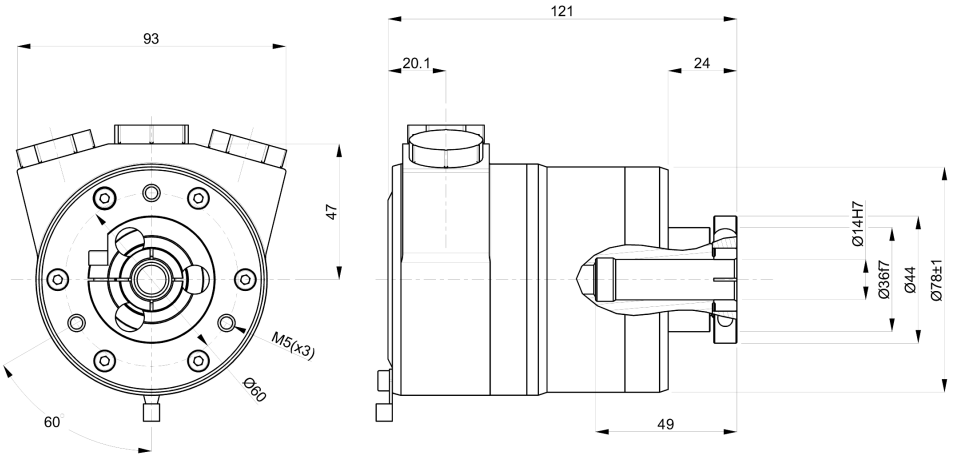
Encoder model

IHA 648

Part number

1234999-05

Dimensions



Supported functions

Preset, Free scaling, Code sequence, Velocity, Acceleration, Warnings, ACD

Pin Configuration

Function	Terminal
+E Volt	1
0 Volt	2
TX+_1	3
TX-_1	4
RX+_1	5
RX-_1	6
TX+_2	7
TX-_2	8
RX+_2	9
RX-_2	10

Order information

Part number	1234999-05

24 Mar 2023 Specification can be changed without prior notice.

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Encoder models

647
648



Mounting instructions

LEINE LINDE

1088015-01, ver. 03
1088015-03-A-01

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F +358-(0)9-561 72 020 www.leinelinde.fi

Leine & Linde is a Swedish company dedicated to production of encoders for heavy duty applications. Some of the values offered by Leine & Linde are local technical support and possibility of 24 hours express delivery.

On our website **www.leinelinde.com** you can find
- data sheets and other product information
- detailed manuals and software for use with products with PROFIBUS®, PROFINET®, CANopen®, DeviceNet™ or EtherNet/IP™.







Before installation please read this manual carefully.
Failure to follow the instructions in this manual will render the ATEX/IECEx certifications **INVALID**.



The following models are fully covered by these mounting instructions:

ISA 647
ISA 648
IHA 647
IHA 648

Contents

1. General information _____ page 6
2. Encoder types _____ 8
3. Certification according to ATEX and IECEx _____ 10
4. Specific conditions for safe use _____ 12
5. Risk of bodily injury _____ 14
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8. Information before mounting of encoder _____ 20
9. Information before mounting of cable _____ 21
10. Check points for mechanical mounting _____ 22
11. Mounting of cable _____ 24
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1

General information

General data	
Ingress protection class [EN 60 529]	IP66 and IP67
Force (axial/radial)	50/60 [N]
Vibration [IEC 60 068-2-6]	20 g
Shock [IEC 60 068-2-27]	100 g/11 ms, 200 g/6 ms
Material	AISI 316L/EN 1.4404 stainless steel housing, flange and shaft.
Atmosphere pressure	0,8-1,1 bar

The inductive absolute encoder IXA 64XXXXXXX is intended for use on e.g. synchronous motors in a hazardous area, for measuring speed and position. The enclosure is flameproof and designed for dust ignition protection. Flange, housing, back cover and shaft consist of stainless steel. The housing material has a high resistance to corrosion and therefore suitable in demanding environments such as those common within marine and offshore applications.

The cover of the flameproof enclosure is screwed on by six hexagon socket head cap screws (M4x0,7x50) of stainless steel. These screws, and six other screws of the same type, to fasten the flange to the housing (M4x0,7x14 for clamping flange or M4x0,7x25 for synchro flange), have property class A4-70.

The enclosure (the plastic labels) shall not be subjected to highly efficient charging mechanism (stronger than manual rubbing of the surfaces) to avoid incendive propagating brush discharges.

The encoder requires no service during use and is not repairable. The encoder's lifetime is limited mainly by the bearing grease lifetime.

In case information is needed on the dimensions of the flameproof joints, the manufacturer shall be contacted.

Installation and maintenance related to explosion protection, shall be performed according to applicable national provisions. For European Union, provisions based on Directive 1999/92/EC shall be considered and for European member countries of CENELEC, national standards based on EN 60079-14 and EN 60079-17 shall be considered.

2

Encoder types

I		A	6	4							

Shafts

S = Solid shaft
H = Hollow shaft

Model

7 = Singleturn 19 bit (SSI 13 bit)
8 = Multiturn 31 bit (SSI 25 bit)

Shaft size

XX = 0-99

Flange

01 = Synchro flange
02 = Clamping flange

Electronics

Electronics	Supply voltage
10 = 3 x M20 PROFIBUS	9-30 Vdc
20 = 3 x M20 PROFINET	9-30 Vdc
30 = 2 x M20 DeviceNet	9-30 Vdc
40 = 3 x M20 CANopen	9-30 Vdc
50 = 1 x M20 SSI	9-30 Vdc
60 = 1 x M20 EnDat	3.6-14 Vdc
70 = 3 x M20 EtherNet/IP	9-30 Vdc

All of the variants within the code key are certified according to ATEX and IECEx. The encoder variants IXA 64XXXXXX are certified for ATEX equipment group II, category 2 G and D (gas and dust), code Ex db IIC T6...T4 and Ex tb IIIC T85°C...T135°C for ATEX and IECEx, and may thus be used in zone 1 (gas) or 21 (dust) with potentially explosive atmospheres.

3

Certification according to ATEX and IECEx

ATEX

Certified according to the table below as per SP15ATEX3649X.
Condition for the certificate is specified in Tamb °C and rpm max.

Certification with temperature class	Tamb °C	Rpm max
II 2G Ex db IIC T6 II 2D Ex tb IIIC T85°C	-40°C...+60°C	500
II 2G Ex db IIC T6 II 2D Ex tb IIIC T85°C	-40°C...+50°C	1600
II 2G Ex db IIC T6 II 2D Ex tb IIIC T85°C	-40°C...+40°C	3600
II 2G Ex db IIC T5 II 2D Ex tb IIIC T100°C	-40°C...+70°C	900
II 2G Ex db IIC T5 II 2D Ex tb IIIC T100°C	-40°C...+60°C	2000
II 2G Ex db IIC T5 II 2D Ex tb IIIC T100°C	-40°C...+50°C	3600
II 2G Ex db IIC T5 II 2D Ex tb IIIC T100°C	-40°C...+40°C	5100
II 2G Ex db IIC T4 II 2D Ex tb IIIC T135°C	-40°C...+70°C	6000

The encoder IXA 64XXXXXXX conforms to the following standards:

- EN 60079-0:2012 + A11:2013 (SS-EN 60079-0 ed 4 + SS-EN 60079-0/A11 ed 1)
- EN 60079-1:2014 (SS-EN 60079-1 ed 3)
- EN 60079-31:2014 (SS-EN 60079-31 ed 2)

IECEx

Certified according to the table below as per SP 15.0001X.
Condition for the certificate is specified in Tamb °C and rpm max.

Certification with temperature class	Tamb °C	Rpm max
Ex db IIC T6 Ex tb IIIC T85°C	-40°C...+60°C	500
Ex db IIC T6 Ex tb IIIC T85°C	-40°C...+50°C	1600
Ex db IIC T6 Ex tb IIIC T85°C	-40°C...+40°C	3600
Ex db IIC T5 Ex tb IIIC T100°C	-40°C...+70°C	900
Ex db IIC T5 Ex tb IIIC T100°C	-40°C...+60°C	2000
Ex db IIC T5 Ex tb IIIC T100°C	-40°C...+50°C	3600
Ex db IIC T5 Ex tb IIIC T100°C	-40°C...+40°C	5100
Ex db IIC T4 Ex tb IIIC T135°C	-40°C...+70°C	6000

The encoder IXA 64XXXXXXX conforms to the following standards:

- IEC 60079-0:2011 (ed 6)
- IEC 60079-1:2014 (ed 7)
- IEC 60079-31:2013 (ed 2)

4

Specific conditions for safe use

The encoders are certified according to the ATEX Directive 2014/34/EU (certificate SP15ATEX3649X) and the IECEx-system (certificate IECEx SP 15.0001X). The following special conditions for safe use shall be considered according to the certificates:

1. The encoder is delivered with or without plastic covers in the threaded holes for cable entries. Such covers shall be replaced. The encoder shall be fitted with certified Ex Equipment cable glands, certified Ex blanking elements (blind plugs) or other equipment certified cable entry devices, in accordance with applicable installation provisions.

2. To be considered (in addition to delay 5 minutes before opening of the enclosure after de-energizing), for encoders type PROFIBUS, PROFINET, DeviceNet, CANopen and EtherNet/IP:
   To avoid possible excessive charged capacitors connected between the encoder circuit and enclosure (earth) when opening the enclosure, all conductors connected to the encoder incl. protective earth shall be short-circuited outside hazardous area before opening the enclosure.

3. The enclosure (the labels) shall not be subject to highly efficient charging mechanism (stronger than manual rubbing of the surfaces), to avoid incendive propagating brush discharges.

4. In case information is needed on the dimensions of the flameproof joints, the original manufacturer (holder of this certificate) shall be contacted. According to the standard (clause 11.3 in IEC 60079-1), the property class for the twelve hexagon socket screws by which the cover and flange is fastened to the housing, shall be specified in the certificate; their property class is A4-70.

5

Risk of bodily injury

5.1)



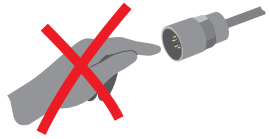
Important before mounting begins:

5.1 Make sure the machine is at a standstill. The product is to be mounted on a rotating part that can cause bodily injury when in motion.

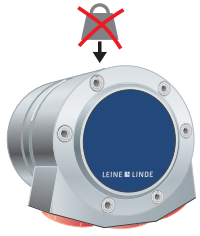
6

Risk of damage to the product

6.1)



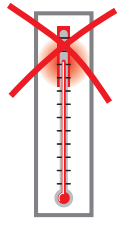
6.2)



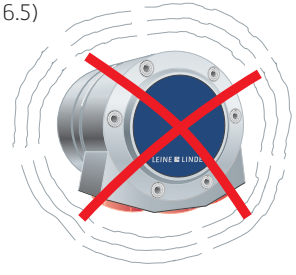
6.3)



6.4)



6.5)



6.6)



6.7)

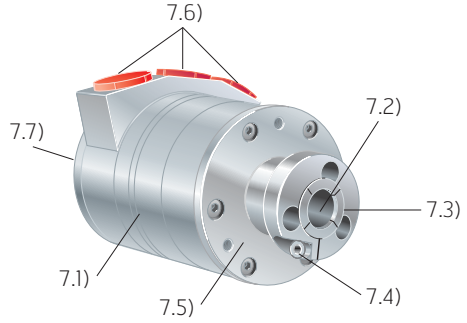


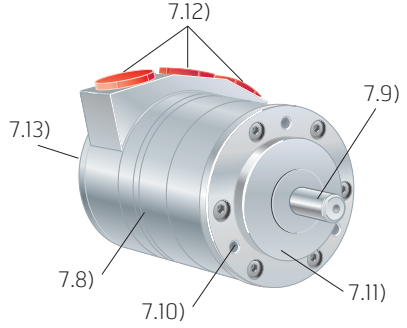
The product is a precision measuring instrument. It should be handled with care, by experienced personnel. The warnings in this chapter apply in the event of effects outside the limit values stated in chapter 1.

The product may be damaged
6.1 by ESD discharges if the electronics are touched
6.2 if the shaft is exposed to high mechanical forces
6.3 by moisture or chemical fluids (do not install cable pointing upwards)
6.4 if it is exposed to extreme temperatures
6.5 if it is exposed to powerful vibrations or shock
6.6 by short-circuits or an excessively high supply voltage
6.7 by impacts or knocks or other physical damage.

7

Parts of the products





7.1 **Hollow shaft encoder**
7.2 Hollow shaft
7.3 Clamping ring
7.4 Fixing screw
7.5 Flange
7.6 Entries for cable glands*
7.7 Back cover

7.8 **Solid shaft encoder**
7.9 Solid shaft
7.10 Fixing holes
7.11 Flange
7.12 Entries for cable glands*
7.13 Back cover

* Plastic plugs only for shipping. Must be replaced with Ex d and Ex t certified Ex Equipment cable glands or Ex blind plugs.

8

Information before mounting of encoder

Only skilled/authorized persons are allowed to install the encoder. Information on hazardous areas and the manufacturer datasheets, as well as laws or guidelines applying to the use or the intended purpose are to be followed.

Mounting of encoder
To avoid high shock and vibration impacts on the encoder, mounting of the flange according to chapter 10 are to be fulfilled.

Required tools for mounting:
- Hex key T3 for protected earth, PE, internal and external
- Hex key T3 for cover
- Hex key T4 for clamping ring
- Philips screwdriver PH2 for the connecting sockets

Warning label



9

Information before mounting of cable

Use **only** Ex d and Ex t certified Ex Equipment cable glands, which shall have correct level of protection and temperature rating according to the table below. Non-used entries to the encoder must be closed with Ex d and Ex t certified Ex Equipment blind plugs, with correct level of protection and temperature rating according to the table below. Cable, Ex d and Ex t certified Ex Equipment cable glands and Ex blind plugs are not included in the certification of the encoder.

Use appropriate cable according to certified temperature class, pages 10-11. The selected cable shall be rated for a branching point temperature and cable entry temperature according to the table below.

All cables for internal connection including cable for protective earth (PE), shall be within the range of 0,25 mm^2 to 4 mm^2, and the PE cable area shall be not less than the area for the supply cables.

For mounting of cable glands:
M20x1,5 6g with a minimum screw thread length of 9 mm and a maximum of 16 mm (excluding any washer). Please, refer to the cable gland manufacturer's mounting instructions.

Cable and gland can be included as accessories in the original delivery. Information regarding the complete accessory range can be found at **www.leinelinde.com**.

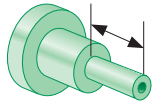
Branching point and cable entry specification

Max Tamb °C	Max rpm	Branching point °C	Cable entry °C
40	5100	85	75
50	1600	80	70
50	3600	90	80
60	500	85	75
60	2000	95	85
70	900	95	85
70	6000	115	105

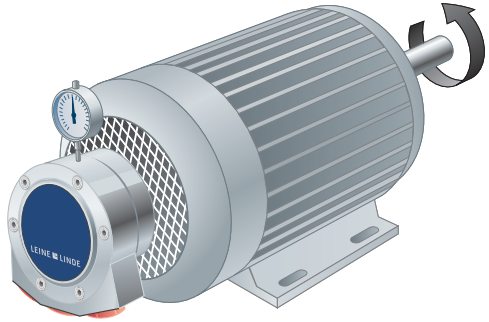
10

Check points for mechanical mounting

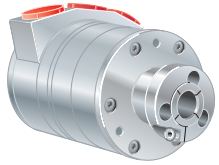
10.1)



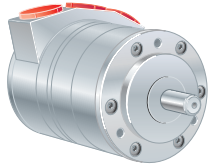
10.2)



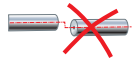
10.3)



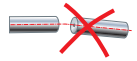
10.4)



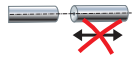
a)



b)



c)



Hollow shaft

10.1 Check that the dimensions of the mating shaft match the specifications in the encoder's data sheet.

10.2 Check the encoder's radial runout with slow rotation of complete assembly. The runout should not exceed 0.1 mm, as this may shorten the encoder's service life and influence the system accuracy.

10.3 Check that the clamping ring is loose when installing the encoder. Tightening the clamping ring with a torque of 4 Nm before operation.

Solid shaft

10.4 Minimise the displacement between the two mating shafts.
Always try to avoid a) radial displacement
b) angle displacement
c) axial movement.

Note! If the encoder is to be rotated when mounted, Ex d and Ex t certified blind plugs must be used.

Torque bracket
It is suggested that the encoder is mounted with a torque bracket to withstand movements during operation.

Maximum allowed depth of M5 screw engagement (excluding washer): 4 mm for clamping flange and 9 mm for synchro flange.

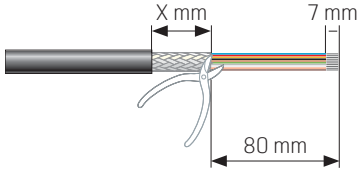
No screws are allowed to be mounted if no torque bracket is used.

For more information regarding torque brackets, please visit **www.leinelinde.com**.

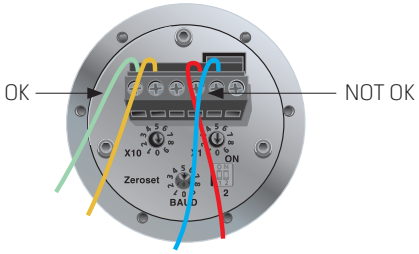
11

Mounting of cable

11.1)



11.2)



Step 1. The encoder must be disconnected from the power supply and other cables connected to the encoder before installation or replacement.
Step 2. Remove the back cover and remove the terminal strip.
Step 3. Strip the cable according to the cable gland manufacturer's instruction and strip the wires according to illustration 11.1.
Step 4. Mount the cable glands to the encoder.
Step 5. Mount the cables for protective earth, PE, with both the internal and the external earth connector screws, see drawing on page 32. Use suitable crimping tool for the external PE connector. Connect the wires according to instructions on page 30 in this manual. Make sure to insulate any unused wire. Tighten torque is 0.5 Nm.
Step 6. Connect the terminal strip to the encoder and make sure all wires are mounted correct according to illustration 11.2.
Step 7. Mount the encoder back cover with a tightening torque of 3 Nm.
Step 8. Connect the cables from the encoder to the power supply.

Dismounting of the encoder

The disconnection and voltage check has to be done **outside** the hazardous area.

Step 1. Disconnect power supply and other cables connected to the encoder.
Make sure that no voltage exists between +EV, 0V and PE due to the capacitances in the encoder, by short-circuit all conductors from the encoder.
Step 2. After de-energizing delay 5 minutes before opening.
Step 3. Follow the above instructions no. 2 and no. 5.

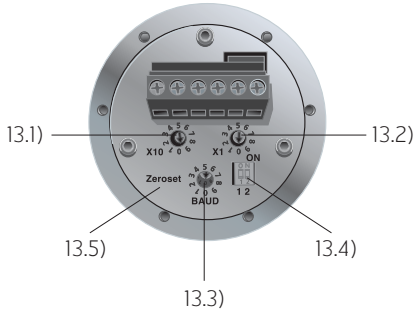
12

Power supply information

Electrical data	Current consumption	Power supply
PROFIBUS	95 mA at 24 Vdc	9-30 Vdc
PROFINET	100 mA at 24 Vdc	9-30 Vdc
CANopen	90 mA at 24 Vdc	9-30 Vdc
DeviceNet	90 mA at 24 Vdc	9-30 Vdc
EnDat	100 mA at 5 Vdc	3.6-14 Vdc
SSI	30 mA at 24 Vdc	9-30 Vdc
EtherNet/IP	100 mA at 24 Vdc	9-30 Vdc

13

Bus settings



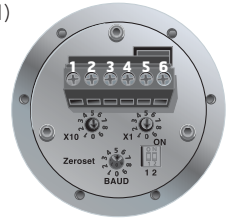
13.1, 13.2 Set a unique node address for the unit, within the range 00-99.
13.3 Set baud rate (only CANopen).
13.4 Set bus termination on or off (only CANopen and PROFIBUS).
13.5 Zeroset pushbutton (only CANopen and DeviceNet).

For information and manuals regarding the encoder interfaces (PROFIBUS, PROFINET, DeviceNet etc), please refer to separate manuals at **www.leinelinde.com**.

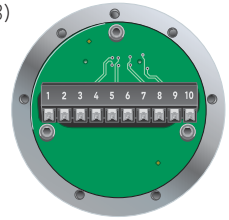
14

Terminal pinning

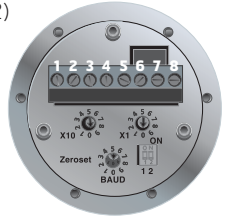
14.1)



14.3)



14.2)



14.4)

PROFIBUS DP	
Function	**Terminal**
+E Volt	1
0 Volt	2
B** (Bus in)	3
A* (Bus in)	4
B** (Bus out)	5
A* (Bus out)	6

*A terminals are connected
**B terminals are connected

CANopen, DeviceNet	
Function	**Terminal**
+E Volt	1
0 Volt	2
CAN_H	3
CAN_L	4
CAN_GND	5
CAN_GND	6
CAN_L	7
CAN_H	8

PROFINET, EtherNet/IP	
Function	**Pin**
+E Volt	1
0 Volt	2
TX+_1	3
TX-_1	4
RX+_1	5
RX-_1	6
TX+_2	7
TX-_2	8
RX+_2	9
RX-_2	10

SSI, EnDat 2.2	
Function	**Terminal, 6 screws**
A	1
A/	2
B	3
B/	4
Not used	5
Not used	6

SSI, EnDat 2.2	
Function	**Terminal, 8 screws**
0 Volt	1
0 Volt sense	2
+E Volt	3
+E Volt sense	4
Data	5
Data inv.	6
Clock	7
Clock inv.	8

The terminal has either 6 or 8 screw contacts depending on the encoder interface.

14.1 Terminal with 6 screws:
PROFIBUS DP

14.2 Terminal with 8 screws:
CANopen
DeviceNet
SSI*
EnDat*

14.3 Terminal with 10 screws:
PROFINET
EtherNet/IP

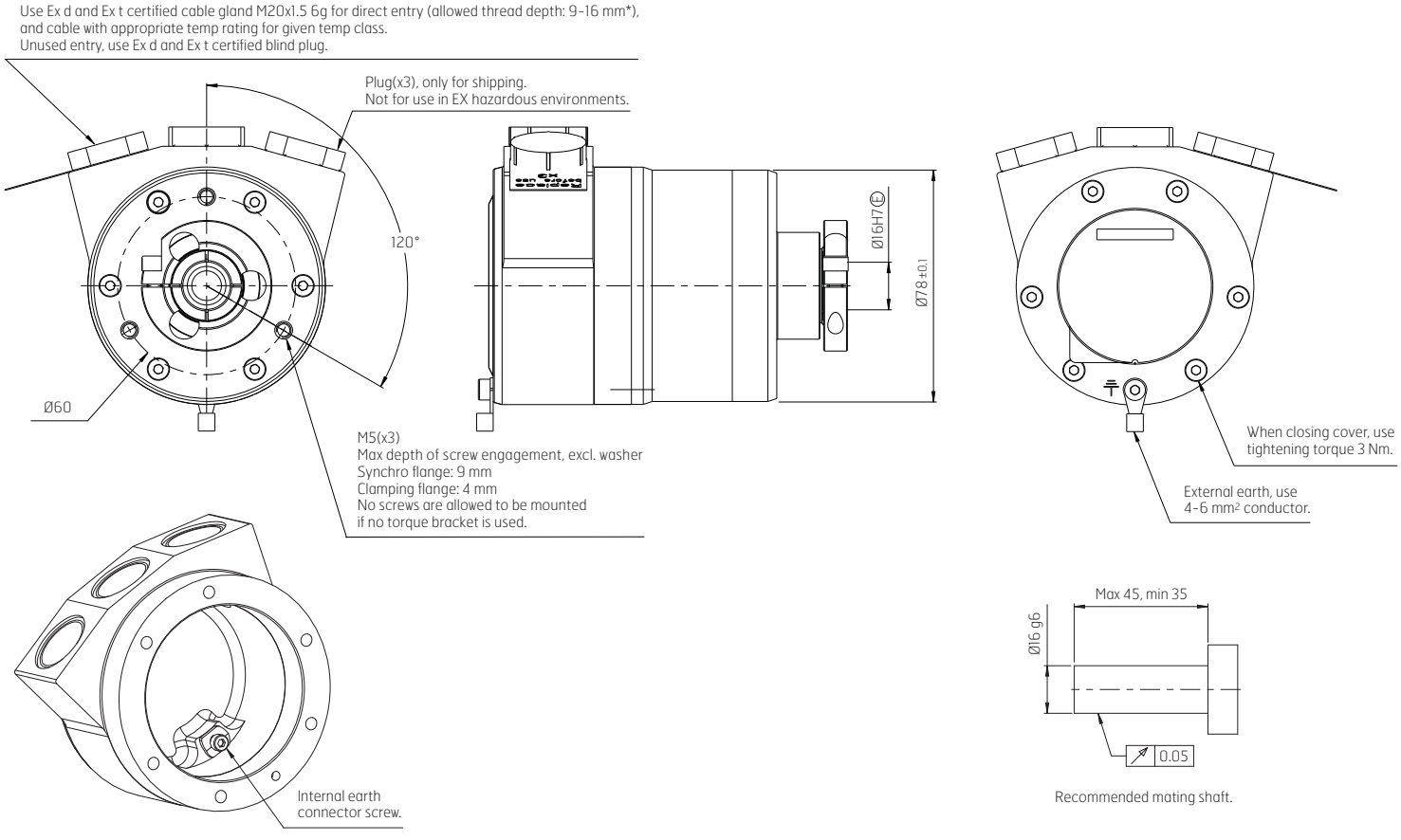
14.4 **Pinning configuration**
The interfaces are available with cable gland entry. The configuration file for each interface is to be downloaded from www.leinelinde.com/Products/Downloads.

* SSI and EnDat 2.2 have an additional screw terminal of 6 screw contacts for the incremental signal output 1 Vpp.

Ex d and Ex t certified blind plug **MUST** be used in entries where no cable gland is used.

15

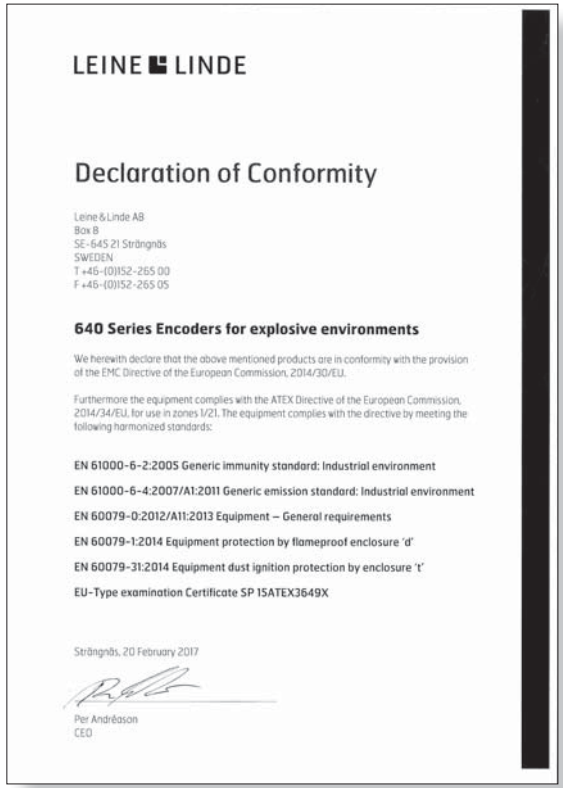
Dimensions



*Please refer to page 21 for more detailed information.

16

Declaration of Conformity



LEINE LINDE

Declaration of Conformity

Leine & Linde AB
Box 8
SE-645 21 Strängnäs
SWEDEN
T +46-(0)152-265 00
F +46-(0)152-265 05

640 Series Encoders for explosive environments

We herewith declare that the above mentioned products are in conformity with the provision of the EMC Directive of the European Commission, 2014/30/EU.

Furthermore the equipment complies with the ATEX Directive of the European Commission, 2014/34/EU, for use in zones 1/21. The equipment complies with the directive by meeting the following harmonized standards:

EN 61000-6-2:2005 Generic immunity standard: Industrial environment

EN 61000-6-4:2007/A1:2011 Generic emission standard: Industrial environment

EN 60079-0:2012/A11:2013 Equipment – General requirements

EN 60079-1:2014 Equipment protection by flameproof enclosure 'd'

EN 60079-31:2014 Equipment dust ignition protection by enclosure 't'

EU-Type examination Certificate SP 15ATEX3649X

Strängnäs, 20 February 2017

Per Andréason
CEO

The declaration document can be downloaded from **www.leinelinde.com**.

Products from Leine&Linde are usually components in larger systems. These applications require the system as a whole to be tested, and do not depend on the component specifications only.

Instructions in these mounting instructions apply to products from Leine&Linde, not for the system as a whole. If products are used in a way for which they are not intended, this is at the user's own risk.



Montageanleitungen auf weiteren Sprachen finden Sie unter **www.leinelinde.de**



Le istruzioni di montaggio sono disponibili in altre lingue nel sito **www.leinelinde.it**



Installatiehandleidingen in andere talen zijn te vinden op **www.leinelinde.com**



Monteringsinstruksjoner på andre språk kan lastes ned fra **www.leinelinde.com**

TAB 7
Laser Encoder
(Ovivo USA, LLC Part No. 771624)

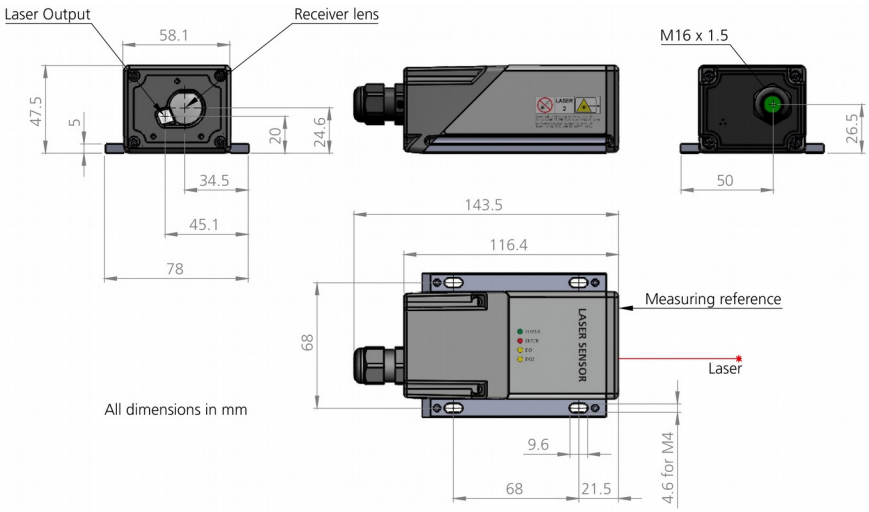
SWISS PRECISION

DIMETIX
LASER DISTANCE SENSORS

Laser Distance Sensors D-Series

Type DPE-30-500





Part No. 500636

SPECIFICATION	
Typical accuracy @ ±2σ (@ ±1σ)	±3 (±1.5) mm
Typical repeatability @ ±2σ (@ ±1σ)	±0.7 (±0.35) mm
Measuring range on natural surfaces	0.05...~100 m
Measuring range on reflective foil	~0.5...500 m
Max. measuring rate	250 Hz
Max. output rate	1 kHz
Operating temperature	-40...+60°C
Degree of protection	IP65
Power supply	12...30 VDC (0.5A @ 24 VDC)
Laser red, visible (Laser Class 2, <1mW)	✓
Typical diameter of laser dot @ 10, 50, 100 m	7 x 3 mm; 28 x 13 mm; 55 x 30 mm
Dimension (L x W x H)	140 x 78 x 48 mm
Weight	350 g

INTERFACES	
Analog output, programmable	0/4...20 mA
Max. error analog output	±0.1 %
Digital input, programmable	1
Digital output, programmable / error display (Type: NPN, PNP, Push-Pull)	2 / 1
Serial Interfaces: RS-232, RS-422 / RS-485, SSI	✓
USB, only for configuration	✓
Optional: PROFIBUS (external) / PROFINET / EtherNet/IP / EtherCAT	✓

CONNECTION	
Internal screw terminals	✓

Subject to change without notice. Further our General Terms and Conditions of Sale and Supply ("GTC") are valid.

LASER 2

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SWISS PRECISION

DIMETIX
LASER DISTANCE SENSORS

D-Series – Laser Distance Sensor

DPE-10-500 | DPE-30-500
DEN-10-500 | DEH-30-500
DAN-10-150 | DAN-30-150 | DAE-10-050
DBN-50-050



Technical Reference Manual

V1.14

21.03.2023

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1 Document scope

This document covers the Dimetix D-Series Laser Distance Sensors. The available senor types are listed in chapter 3.1 Product identification.

The following topics are discussed:

- Safety instructions
- Technical information

2 Safety instructions



- The following instructions are to enable the person responsible for the D-Series device, and the user of the instrument, to anticipate and avoid operational hazards.
- The D-Series device is made to be integrated into technical systems. Basic technical training is therefore essential. This device may only be operated by trained personnel.
- The person responsible for the instrument must ensure that all users understand these instructions and adhere to them.
- If the D-Series device is part of a system, the manufacturer of such a system is responsible for all safety-related issues, such as the manual, labeling and instruction.

2.1 Explanation of symbols

⚠ DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a potentially harmful situation which, if not avoided, may lead to property damage.
	High lights important information, product features and application hints.
	Means that the eye can be damaged by laser radiation, if precautions are not taken.
	Means that the device can be damaged by electrostatic discharge, if precautions are not taken.

2.2 Permitted use

The permitted use of the D-Series device is: Measuring distances in an atmosphere appropriate for permanent human habitation.

2.3 Prohibited use/Limits to use

Prohibited use or ignoring limits to use can lead to injury, malfunction, and material damage.

- It is the duty of the person responsible for the instrument to inform the user about hazards and how to counteract them.
- The D-Series devices must not be operated until the user has been adequately instructed.

Prohibited use:

- Use of the instrument without instruction
- Use outside the stated limits
- Deactivation of safety systems and removal of explanatory and hazard labels
- Opening of the equipment, except to open the cover for access to the screw terminal
- Carrying out modification or conversion of the product
- Operation after failure in operation
- Use of accessories from other manufacturers without the express approval of Dimetix
- Aiming directly into the sun
- Deliberate dazzling of third parties; also in the dark
- Inadequate safeguards at the surveying location (e.g. when measuring on roads, etc.)

⚠ WARNING

NOTICE

Environmental limits to use. The device must not be used in environments such as but not limited to:

- Aggressive vapor or liquids (salt, acid, poison, etc.)
- Snow and rain
- Radiation (radioactive, heat, etc.)
- Explosive atmosphere
- High-gloss measurement surfaces

Limits to use by application. The device must not be used in applications such as but not limited to.

- Aerospace (Aviation & Space flight)
- Nuclear technology

Further limits to use. See chapter 4 Technical data on page 12.

2.4 Areas of responsibility

Responsibilities of the manufacturer of the original equipment Dimetix AG, CH-9100 Herisau (Dimetix):

Dimetix is responsible for supplying the product, including the Technical Reference Manual and original accessories, in a completely safe condition.

Responsibilities of the manufacturer of non-Dimetix accessories:

The manufacturers of non-Dimetix accessories for the D-Series devices are responsible for developing, implementing and communicating safety concepts for their products. They are also responsible for the effectiveness of these safety concepts in combination with the Dimetix equipment.

Responsibilities of the person in charge of the instrument:

The person in charge of the instrument has the following duties:

- To understand the safety instructions for the product and the instructions in the Technical Reference Manual.
- To be familiar with local safety regulations relating to accident prevention.
- To inform Dimetix immediately if the equipment becomes unsafe.



The person responsible for the instrument must ensure that the equipment is used in accordance with the instructions. This person is also accountable for the deployment of personnel and for their training and for the safety of the equipment when in use.

2.5 Hazards in use

⚠ WARNING

NOTICE

The absence of instruction, or the inadequate provision of instruction, can lead to incorrect or prohibited use, and can give rise to accidents with far-reaching personal, material and environmental consequences.

- All users must follow the safety instructions given by the manufacturer and the directions of the person responsible for the instrument.

⚠ WARNING

NOTICE

Beware of erroneous distance measurements if the instrument is defective or if it has been dropped or has been misused or modified.

- Carry out periodic test measurements, particularly after the instrument has been subject to abnormal use, and before, during and after important measurements.
- Make sure the D-Series device optics are kept clean.

⚠ WARNING

If labels are hidden when the D-Series device is installed, this could lead to dangerous situations.

- Always ensure the visibility of D-Series device labels at all times or add labels in accordance with the local safety regulations.

⚠ WARNING

NOTICE

When using the instrument for distance measurements or for positioning moving objects (e.g. cranes, building equipment, platforms, etc.) unforeseen events (e.g. breaking the laser beam) may cause erroneous measurements.

- Only use this product as a measuring sensor, not as a control device. The system must be configured and operated in such a way that no damage will occur in the event of an erroneous measurement, malfunction of the device or power failure due to installed safety measures (e.g. safety limit switch).

⚠ WARNING

NOTICE

Operate the equipment appropriately in accordance with the regulations in force.

- Always prevent access to the equipment by unauthorized personnel.

⚠ WARNING

NOTICE

Be careful when pointing a telescope towards the sun, because the telescope functions as a magnifying glass and can injure eyes and/or cause damage inside the D-Series device.

- Do not point the telescope directly at the sun.

2.6 Laser classification

The D-Series device produces a visible laser beam, which emerges from the front of the instrument.

It is a Class 2 laser product in accordance with:

- IEC/EN 60825-1:2014 "Radiation safety of laser products"

It is a Class II laser product in accordance with:

- FDA 21 CFR 1040.10 and Laser Notice 50 (US Department of Health and Human Service, Code of Federal Regulations)

Laser Class 2/II products

Do not stare into the laser beam or direct it towards other people unnecessarily. Eye protection is normally afforded by aversion responses including the blink reflex.



⚠ WARNING

Looking directly into the beam with optical aids (binoculars, telescopes) can be hazardous.



⚠ WARNING

Looking into the laser beam may be hazardous to the eyes.

- Do not look into the laser beam. Make sure the laser is aimed above or below eye level. (particularly with fixed installations, in machines, etc.).

2.7 Laser specification

Standard applied	IEC/EN 60825-1:2014
Emitted wavelength	620...690 nm (typical 655 nm)
Beam divergence	0.16 x 0.6 mrad
Pulse duration	0.2...0.8 x 10^{-9} s
Max. radiant power	1 mW
Laser power measurement uncertainty	±5%

2.8 Electromagnetic compatibility (EMC)

The term "electromagnetic compatibility" is taken to mean the capability of the D-Series devices to function smoothly in an environment where electromagnetic radiation and electrostatic discharges are present, and without causing electromagnetic interference to other equipment.

NOTICE

Electromagnetic radiation can cause interference in other equipment.

- Although the D-Series device meets the strict regulations and standards that are in force in this respect, Dimetix cannot completely exclude the possibility that interference may be caused to other equipment.

2.9 Producer standards

Dimetix hereby certifies that the product has been tested and complies with the specifications as stated in this 'Technical Reference Manual'. The test equipment used is in compliance with national and international standards. This is established by our Quality Management System. Further, the D-Series devices are produced in compliance with 2011/65/EU «RoHS».

2.10 Disposal



This symbol on the product or on its packaging indicates that this product must not be disposed of with your other household waste. Instead, it is your responsibility to dispose of the equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or the dealer where you purchased the product.

In countries in which Dimetix has no subsidiaries, Dimetix delegates the duty for the disposal in compliance with 2012/19/EU«WEEE» to the local dealer or to the customer, if no dealer is present.

2.11 Labeling

The labeling of the D-Series devices is shown in figure 1. The existing device type labels and the complete flat label with device type are shown in figure 2 and 3.

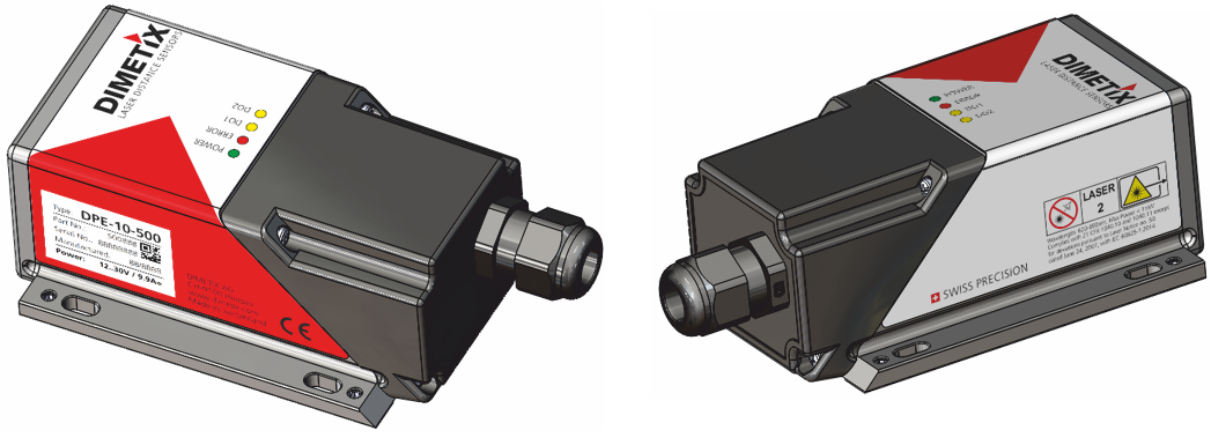


Figure 1: Labeling of the D-Series devices (Label position and view)

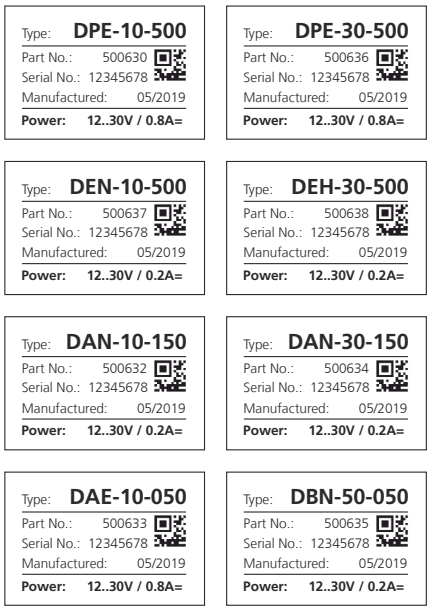


Figure 2: Existing D-Series device type labels

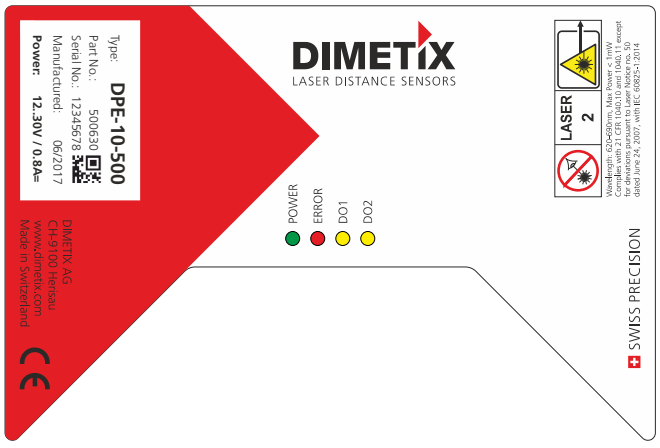


Figure 3: Complete D-Series label with device type

2.12 Maintenance

The D-Series device is almost maintenance free. The only thing you have to do is to clean the surfaces of the lenses.

NOTICE

Dirty sensor optics can cause erroneous measurements.

- The sensor can be contaminated by dust, oel, eis, water etc.
- In dirty environments try to reduce contamination by design.
- Regularly check sensor optics and clean if necessary.

NOTICE

Inadequate cleaning methods can damage the sensor optics.

- Look after the surfaces of the lenses with same care that you would apply to spectacles, cameras and field glasses.
- Clean the optical parts (small laser output glass and the round lens) only with a clean soft glasses cleaning cloth and avoid scratching of the optical parts. All other cleaner or resolvent are not allowed.

2.13 Service

If you need to service the device, please contact Dimetix for instructions.



The warranty is void if the device is opened except the exchangeable cover of the screw terminal. Removing the label is also understood as opening.

3 Introduction

The D-Series sensors are powerful distance-measuring instruments for integration into industrial applications. They allow accurate and contactless distance measurement over a wide range using the laser beam reflection on a measuring surface / target (see the illustration in figure 4).

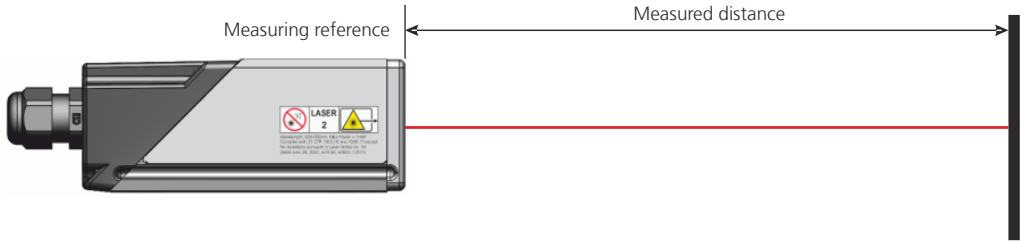


Figure 4: Standard application for measuring distances

Key features:

- Measurement range 0.05 up to 500 m
- Measuring accuracy up to ±1.0 mm (@ 2σ)
- High measurement speed (up to 250 Hz, 1000 Hz output rate)
- Several serial interfaces (RS-232, RS-422 / RS-485, SSI and USB)
- Exchangeable cover for Industrial Ethernet (PROFINET®, ETherNet/IP™ or EtherCAT® interface as accessorie)
- Connection of up to 100 sensors on a single RS-422 / RS-485 line
- Wide range of power supply (12...30 VDC)
- Programmable analog output (0/4...20 mA)
- One programmable digital input (DI1)
- Two programmable digital outputs (DO1 and DO2)
- Digital output for error signalization (DOE)
- Selectable digital output type (NPN, PNP, Push-Pull)
- 4 LED's for status signaling
- ASCII protocol to control external displays
- Screw terminal for easy connection of the D-Series sensors
- IP65 (protected against ingress of dust and water)
- Wide range of operating temperature (down to -40°C and up to +60°C, for devices with extended temperature range)
- Visible red laser, laser class II (<0.95 mW)
- Configuration software available from Dimetix website (www.dimetix.com)
- Accessories for easy use of the sensor



Use of controls, adjustments or performance of procedures other than those specified in this Technical Reference Manual may result in hazardous radiation exposure.



For easy starting with the D-Series sensors you can use our free configuration software "Laser Sensor Utility" from our website: www.dimetix.com.

3.1 Product identification

The Dimetix sensor products are identified by the label on the top of the sensors. The identification on the label shows the main properties of each sensor. It contains the sensor series, the sensor class, the temperature range, the accuracy and the maximum distance range. For more details see figure 5.

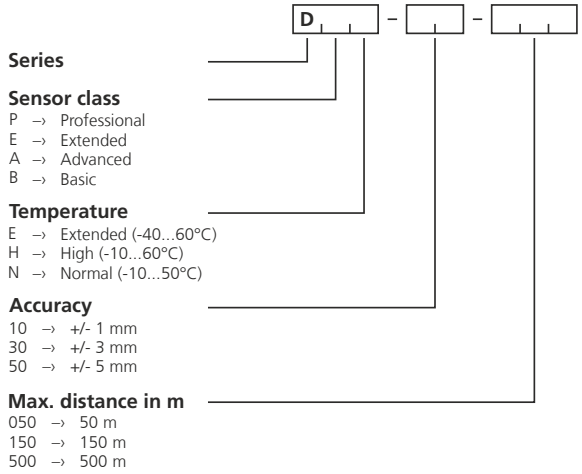


Figure 5: Product identification

Available sensor products

- DPE-10-500
- DPE-30-500
- DEN-10-500
- DEH-30-500
- DAN-10-150
- DAN-30-150
- DAE-10-050
- DBN-50-050

For detailed specifications of every sensor product, see 4.1 Specifications.

3.2 Components

The components with some helpful detail information of the D-Series devices are marked in figure 6.

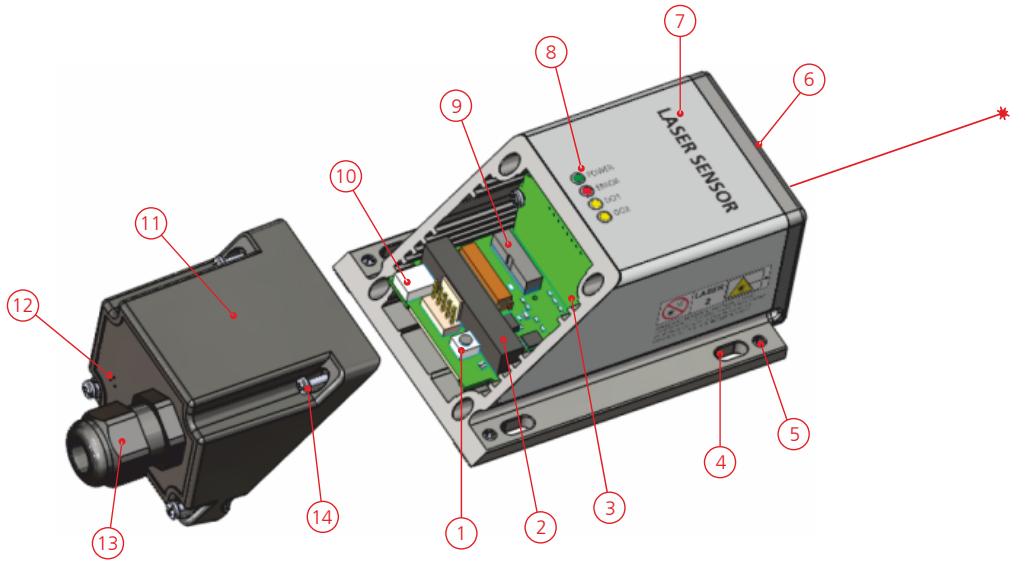


Figure 6: Sensor components with detail information

1) Reset push button
2) Screw terminal block & plug. For conductor cross section 0.14...1.5 mm². (Power supply, digital input / output, analog output, RS-232 and RS-422 / RS-485 / SSI)
3) Shield tab for an adequate receptacle (Contact size: 2.8 x 0.5 mm)
4) Slot hole for installation and alignment (M4 or M3 screws)
5) Hexagon socket set screw for sensor alignment
6) Sensor front (Laser beam output and receiver lens)
7) Product label (for more details, see in chapter 2.11)
8) Status LED's (Power, error, digital outputs)
9) Industrial Ethernet interface
10) USB 2.0 Mini-B
11) Exchangeable cover (Used for optional interfaces)
12) Valve diaphragm
13) Cable gland M16 x 1.5 mm (Cable diameter: 5...10 mm, tool size: 20 mm)
14) Screws, Philips Slotted Combo (Philips size 1, slot size 2). The target torque for these screws is 1.6 Ncm.



Take precaution against electrostatic discharge (ESD) when exchangeable cover is open.

- Generally the sensor with removed exchangeable cover is a sensitive device and can be damaged by electrostatic discharge.
- Only handle the device properly grounded and with care.
- No warranty will be granted on improper handling and / or ESD caused problems.



The warranty is void if the device is opened except the exchangeable cover. Removing the label is also understood as opening.

3.3 Validity

This manual is valid for D-Series devices with the following software version:

- Interface software version: **V1.21 or later**
- Module software version: **V4.1 or later**

To get the software version use the command described in 8.5.1 Get software version (sNsv) on page 53.

4 Technical data

4.1 Specifications

	DPE-10-500	DPE-30-500	DEN-10-500	DEH-30-500	DAN-10-150	DAN-30-150	DAE-10-050	DBN-50-050
Part number	500630	500636	500637	500638	500632	500634	500633	500635
Typical measuring accuracy [1] [2] @ 2σ (95.4% confidence level) @ 1σ (68.3% confidence level)	 ±1.0 mm ±0.5 mm	 ±3.0 mm ±1.5 mm	 ±1.0 mm ±0.5 mm	 ±3.0 mm ±1.5 mm	 ±1.0 mm ±0.5 mm	 ±3.0 mm ±1.5 mm	 ±1.0 mm ±0.5 mm	 ±5.0 mm ±2.5 mm
Typical repeatability [1] [2] @ 2σ (95.4% confidence level) @ 1σ (68.3% confidence level)	 ±0.3 mm ±0.15 mm	 ±0.7 mm ±0.35 mm	 ±0.3 mm ±0.15 mm	 ±0.7 mm ±0.35 mm	 ±0.3 mm ±0.15 mm	 ±0.7 mm ±0.35 mm	 ±0.3 mm ±0.15 mm	 ±1.8 mm ±0.9 mm
Measuring range on natural surfaces [3]	0.05...100 m	0.05...100 m	0.05...100 m	0.05...100 m	0.05...100 m	0.05...100 m	0.05...50 m	0.05...50 m
Measuring range on orange (reflective) foil	0.5...500 m	0.5...500 m	0.5...500 m	0.5...500 m	~40...150 m	~40...150 m	- [10]	- [10]
Measuring reference	From front edge (see 4.2 Physical dimensions)							
Smallest unit displayed	0.1 mm							
Accuracy of analog output (12 Bit, programmable span)	±0.1%	±0.1%	±0.1%	-	±0.1%	±0.1%	±0.1%	±0.2%
Max. measuring rate [1]	250 Hz	250 Hz	100 Hz [11]	100 Hz [11]	100 Hz [11]	100 Hz [11]	100 Hz [11]	10 Hz
Max. output rate for tracking measurement [1]	1 kHz	1 kHz	100 Hz [11]	100 Hz [11]	100 Hz [11]	100 Hz [11]	100 Hz [11]	10 Hz
Typical time for a measurement [1] Single measurement Tracking	 0.05...4 s 0.004...4 s	 0.05...4 s 0.004...4 s	 0.05...4 s 0.01...4 s	 0.05...4 s 0.01...4 s	 0.05...4 s 0.01...4 s	 0.05...4 s 0.01...4 s	 0.05...4 s 0.01...4 s	 0.1...4 s 0.1...4 s
Light source	Laser diode 620-690 nm (red, typical 650 nm), see chapter 2.7 Laser specification for details IEC/EN 60825-1:2014; Class 2 FDA 21 CFR 1040.10 and Laser Notice 50							
Typical laser life time	50'000 h @ 20°C (see 7.5 Laser life time consideration)							
Typical diameters (elliptic) of laser spot on target at a defined distance [4]	4 mm / 2 mm @ 5 m; 7 mm / 3 mm @ 10 m; 17 mm / 9 mm @ 30 m; 28 mm / 13 mm @ 50 m; 55 mm / 30 mm @ 100 m							
Electromagnetic compatibility (EMC)	IEC/EN 61000-6-4 / 61000-6-3; IEC/EN 61000-6-2 / 61000-6-1							
Power supply Voltage range [5] Current consumption (@ 24 VDC / 12 VDC) [6]	 12...30 VDC 0.5 A / 0.8 A	 12...30 VDC 0.5 A / 0.8 A	 12...30 VDC 0.15 A / 0.2 A	 12...30 VDC 0.15 A / 0.2 A	 12...30 VDC 0.15 A / 0.2 A	 12...30 VDC 0.15 A / 0.2 A	 12...30 VDC 0.5 A / 0.8 A	 12...30 VDC 0.15 A / 0.2 A
Temperature range during operation [7] [8]	-40...+60°C	-40...+60°C	-10...+50°C	-10...+60°C	-10...+50°C	-10...+50°C	-40...+60°C	-10...+50°C
Temperature range during storage	-40...+70°C							
Relative humidity (operation / storage)	up to 85% (RH), non-condensing							
Degree of protection	IP65							

	DPE-10-500	DPE-30-500	DEN-10-500	DEH-30-500	DAN-10-150	DAN-30-150	DAE-10-050	DBN-50-050
	IEC 60529 (Protected against ingress of dust and water)							
Shock and vibration testings	IEC 60068-2-27 (Shock); IEC 60068-2-6 (Vibration)							
Dimensions	140 x 78 x 48 mm							
Weight	350 g							
Material Main sensor body Sensor front & Standard exchangeable cover	Aluminum Alloy EN-AW 6060 (Anodized 20um) Mineral reinforced nylon resin [9]							
Standard integrated interfaces of sensor Analog output 0/4...20 mA Digital output / Error output (programmable) Digital input (programmable) RS-232 RS-422/485 with ID 0..99 SSI USB	 1 2 / 1 1 1 1 1 1	 1 2 / 1 1 1 1 1 1	 1 2 / 1 1 1 1 1 1	 - - / 1 1 1 1 1 1	 1 2 / 1 1 1 1 1 1	 1 2 / 1 1 1 1 1 1	 1 2 / 1 1 1 1 1 1	 1 2 / 1 1 1 - - 1
Possibility to install optional extended interfaces PROFINET / EtherNet/IP / EtherCAT	 Yes	 Yes	 Yes	 Yes	 Yes	 Yes	 Yes	 -

1) The accuracy and measurement speed depend on the configuration of the measurement characteristic, see 6.3 Measuring characteristic and environmental conditions, see 7.3 Measuring performance influence.

2) Confidence level description, see 4.3 Measuring accuracy definition according the ISO-recommendation ISO/R 1938-1:2015.

3) Performance on natural surfaces depends on target reflectivity, background light and atmospheric conditions (see also 7.3 Measuring performance influence).

4) The spot size can vary depending on production lot. Approximation about spot size: Increase about 0.6 mm / m for long and 0.3 mm / m for short diameter of laser spot ellipse.

5) Voltage range 12...30 VDC can be extended to about 9...30 VDC but with limitations using analog output. If analog output is used consider the min. needed input voltage according the following guideline: $V+_{min} \geq R_{AO_LOADmax} * I_{AOmax} + 3.5$ V (for more details see 5.6 Analog output).

6) The current consumption of the device is defined without connected analog and digital outputs (AO, DO1, DO2 and DOE). The current consumption of analog and / or digital outputs has to be considered in addition.

7) In case of permanent measurement (continuous distance measurement) the max. temperature during operation may be reduced.

8) For D-Series devices with an optional Industrial Ethernet interface (exchangeable cover) the max. operating temperature is limited to +50°C.

9) Material with high mechanical strength, excellent balance of stiffness/toughness, good temperature performance and chemical resistance

10) Measuring on orange (reflective) foil possible from at least approx. 40 m to maximum distance of 50 m.

11) 100 Hz valid for production date 09/2022 or newer. Before this date 50 Hz.

4.2 Physical dimensions

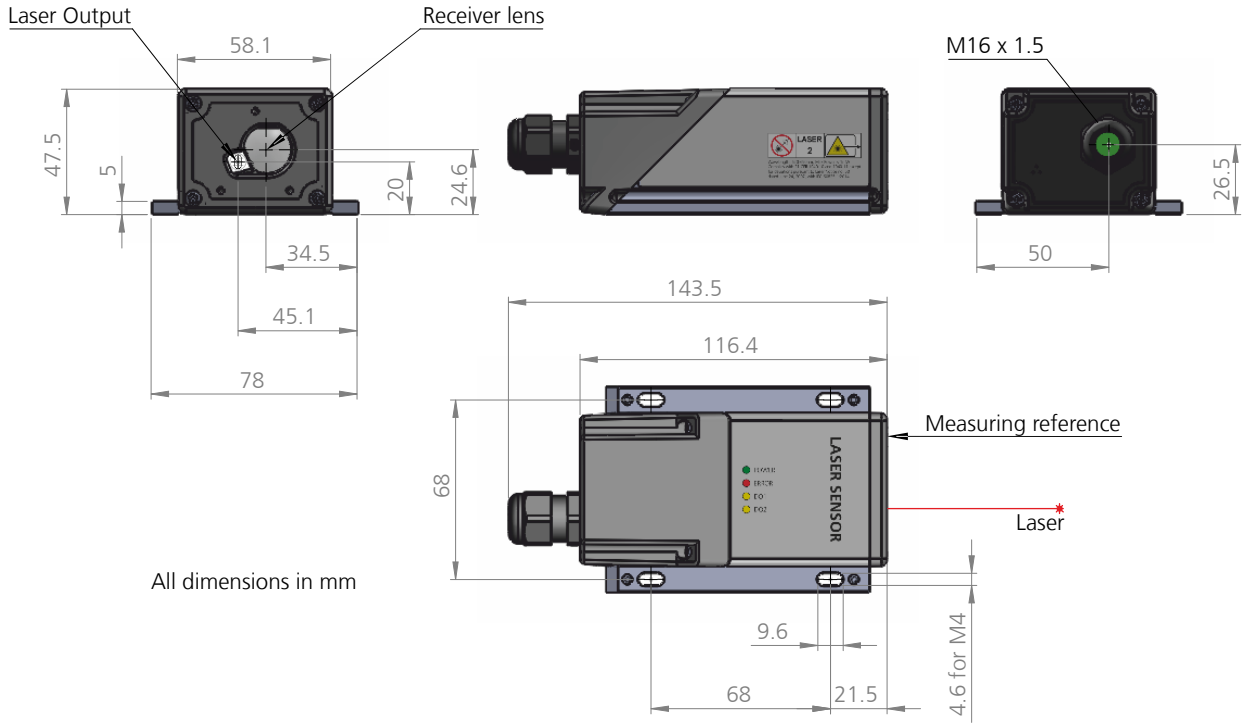


Figure 7: Physical dimensions of sensor

For CAD data of the D-Series sensors please check our website or contact us (Website and contact information see www.dimetix.com).

4.3 Measuring accuracy definition

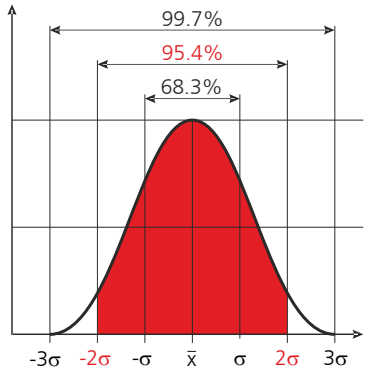


Figure 8: Measuring accuracy definition

The measuring accuracy corresponds to the ISO-recommendation ISO/R 1938-1:2015 with a statistical confidence level of 95.4% (i.e. ± twice the standard deviation σ, see figure 8 on the left). The typical measuring accuracy relates to average conditions for measuring. It is ±1.0 mm for the Dxx-10-xxx and ± 3.0 mm for the Dxx-30-xxx valid in the tracking mode.

Maximum deviation may occur under unfavorable conditions such as bright sunlight or when measuring to poorly reflecting or very rough surfaces. Measuring accuracy may deteriorate by approximately ±0.02 mm/m for distances above 30m.

The D-Series laser sensors do not compensate changes of atmospheric environment. These changes can influence the accuracy if measuring long distances (>150 m) under conditions very different from 20°C, 60% relative humidity and 953 mbar air pressure. The influences of the atmospheric environment are described in H. Kahmen & W. Faig: "*Surveying*", (1988).

5 Electrical components

The main electrical components of the D-Series sensors are described in this chapter. The overview of the components are labeled in figure 9.

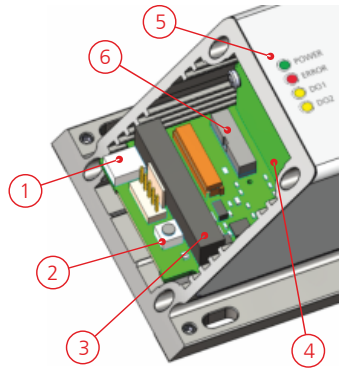


Figure 9: Overview electrical components

1) USB 2.0 Mini-B
(see chapter 5.10 for details)
2) Reset push button
(see chapter 5.2 for detailed reset process description)
3) Screw terminal block & plug (Pitch: 3.5 mm, conductor cross section: 0.14...1.5 mm²).
(Power supply and sensor interfaces, see chapter 5.1, 5.4, 5.5, 5.6, 5.7, 5.8 and 5.9)
4) Shielding tab
(suitable for receptacle, see chapter 5.1 for details)
5) Status LED's (POWER, ERROR, DO1, DO2)
(see chapter 5.3 for detailed LED status)
6) Industrial Ethernet interface (Exchangeable cover)
(see chapter 5.11 for details)

The connection overview of the screw terminal block & plug is shown in the following table. The power supply and all available sensor interfaces (Power, DI/DO's, AO, RS-422 / 485 / SSI) can be accessed.

#	Designation	Description	#	Designation	Description	#	Designation	Description
1	V+	Power supply VCC / V+	5	DOE	Digital error output	9	T-	RS-422 / 485 / SSI interface
2	GND	Power supply 0 V / V-	6	AO	Analog output (0 / 4...20 mA)	10	T+	
3	DO1	Digital output / input 1	7	RX	RS-232 interface	11	R-	
4	DO2	Digital output 2	8	TX		12	R+	



Take precaution against electrostatic discharge (ESD) when exchangeable cover is open.

- Generally the sensor with removed exchangeable cover is a sensitive device and can be damaged by electrostatic discharge.
- Only handle the device properly grounded and with care.
- No warranty will be granted on improper handling and / or ESD caused problems.

5.1 Power supply

5.1.1 Specifications & Wiring

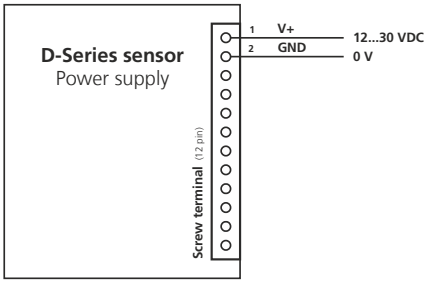


Figure 10: Connection of power supply (V+ and GND)

All the D-Series devices are overvoltage and reverse voltage protected. But for proper operation of the sensors consider the power supply requirements and the corresponding specifications.

Specifications for power supply:

- Voltage requirement: 12...30 VDC
- Current requirement: Depends on sensor type
(for details see chapter 4.1)

The green status LED (POWER) indicates a powered and running device.



Over voltage on power supply terminal can damage the device

- Check wiring and nominal voltage of power supply before initial operation.

NOTICE

Reverse polarity voltage on power supply terminals can damage the device

- Check wiring before initial operation

⚠ CAUTION

NOTICE

Only use high-quality power supply equipment and consider the voltage and current requirements of the D-Series sensors.

- For trouble-free operation it's recommended to use a separate power supply for the sensors.

5.1.2 Shielding

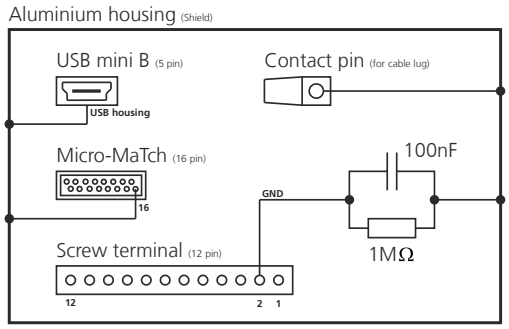


Figure 11: Shielding concept of the sensors

The shielding concept of the D-Series sensors is shown in figure 11. The aluminum housing of the sensor corresponds to shield and is also connected to the housing of the USB interface, to the Micro-MaTch connector and the shield tab. The shield tab can be used to connect the shield of a cable to the sensor shield (use an adequate receptacle).

The general GND of the device is connected to the shield / sensor housing by an R-C element (for details about the R-C element, see figure 11).

NOTICE

Inadequate shielding can cause inexplicable interference of the sensor, the control system or other problems.

- Implement a proper shielding concept .

5.2 Reset push button

The reset procedure sets the sensor configuration back to factory default (see 6.6 Factory settings). This also may helps if there is a problem with the sensor e.g. no communication over serial interfaces. The following steps show the reset procedure with the reset push button inside the D-Series sensors.

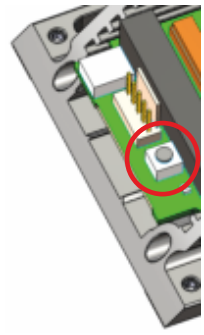


Figure 12: Reset push button

Reset procedure:

1) Switch off the power supply used for the device
2) Press the reset push button and keep it pressed
3) Switch on the power supply used for the device
4) Keep the reset push button pressed until all status LED's (POWER, ERROR, DO1, DO2) flash for a short time (about 0.5 seconds)
5) Release the reset push button
6) Switch off the power supply and wait 5 seconds
7) Switch on the power supply and wait until the green status LED (POWER) is on.
8) Reset procedure executed successfully

5.3 Status LED

The four status LED's (POWER, ERROR, DO1, DO2) on the top of the D-Series device show the operating status of the sensor and the digital outputs (DO1, DO2). The possible LED status with the appropriate status description and some useful references are described in the table below.

POWER	ERROR	DO1	DO2	Status of sensor – Description
🟢				The device is powered and ready for operation –› Normal sensor operation.
🟢	🔴			The device is powered but an error occurred during the normal sensor operation. The error code is transmitted over the serial interfaces. For information about the error code number, see chapter 8.6.
🟢		🟡	🟡	The device is powered and running –› Normal sensor operation. One and / or both digital output (DO1, DO2) can be ON or OFF depending on the configured switching levels (for more details see chapter 5.4 and 6).
🟢	🔴	🟡	🟡	Flash for about 0.5 seconds during reset procedure with the reset push button (see chapter 5.2)
	🔴	🟡	🟡	The device is in error state. See the error code on the serial interface and contact Dimetix if error persists after power cycle and reset. Normal case if power LED is off –› Sensor supply voltage too low / high. For information about the error code number, see chapter 8.6.
			🟡	The device is ready for interface board firmware download. For the download procedure use the "Laser Sensor Utility" software. See the Dimetix website www.dimetix.com.

5.4 Digital output

The D-Series sensors contains two (or one) digital outputs (DO1 and DO2) for level monitoring and one digital output (DOE) for error signalization. These outputs can be configured as NPN, PNP or Push-Pull output type. The digital outputs are able to drive up to 150 mA and are specified for an output voltage of 30 VDC. The details about the output specifications and types are described in 5.4.1 Specifications.

5.4.1 Specifications

	Properties / Possibilities
Output voltage LOW (active) NPN, Push-Pull	0.2 V @ 10 mA (max.) 1.5 V @ 100 mA (max.) 2 V @ 150 mA (max.)
Output voltage HIGH (active) PNP, Push-Pull	(V+) - 0.2 V @ 10 mA (max.) (V+) - 1.5 V @ 100 mA (max.) (V+) - 2 V @ 150 mA (max.)
Output voltage OPEN (inactive, high impedance) NPN, PNP	12...30 VDC (max.)
Output current	up to 150 mA
Output slew rate	max. 40 V/µs
Output types	**Types** / **Output ON** / **Output OFF** NPN / LOW (GND / 0 V) / OPEN (high impedance) PNP / HIGH (V+) / OPEN (high impedance) Push-Pull / HIGH (V+) / LOW (GND / 0 V)
Protections	Reverse polarity Over-voltage Current limited (max. 450 mA) Short circuit (thermal shutdown)
Cable length[1]	< 30 m unshielded cable possible (indoor only) ≥ 30 m or outdoor use shielded cables only

The typical connections for the configurable digital output types are shown in figure 13. The load marked in the figure is a place holder for a specific load for example a relay or indicator light. If the digital output signal of the D-Series sensor is used as a digital input signal e.g. for a PLC, the push-pull output has to be used. But it's also possible to use the NPN or PNP output type with an additional pull-up / pull-down resistor.

1 Max. cable length of Analog Output (AO) interface depends on cable quality and ambient conditions

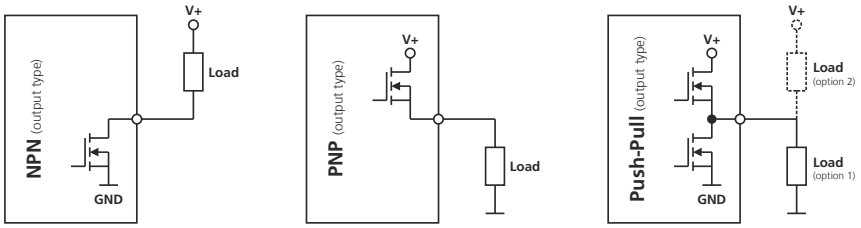


Figure 13: Digital output types (NPN, PNP, Push-Pull) with typical load connection

5.4.2 Wiring

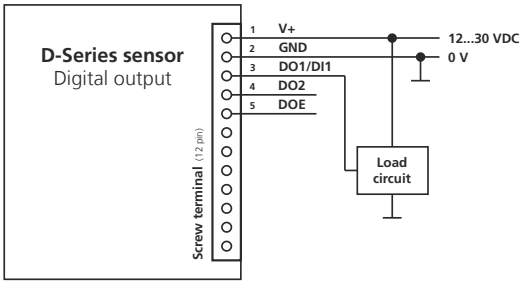


Figure 14: Connection for digital output (DO1, DO2, DOE)

The connection to use the digital outputs of the D-Series laser sensors is shown in figure 14 (example with DO1, analogous for DO2 and DOE outputs).

For detailed information about the load circuit, see the descriptions of the digital output types in chapter 5.4.1 and figure 13.

5.5 Digital input

The digital output (DO1/DI1) can also be used as digital input. This digital input allows triggering or start / stop measurements by an external digital signal. There are different configuration possibilities available, for more details see the configuration command 8.3.8 Set/Get digital input function (sNDI1).

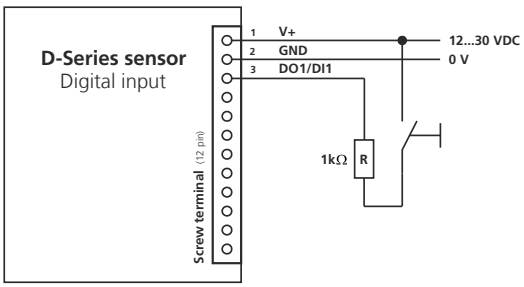


Figure 15: Connection of digital input for external triggering

Specifications for digital input signals:

- Low level: $U_{DI1} < 2$ VDC
- High level: 9 VDC $< U_{DI1} <$ 30 VDC

To protect the digital input / output against short circuit always use a 1 kΩ resistor before DO1/DI1 terminal.

The connection and wiring to use the digital input is shown in figure 15.

NOTICE

Improper wiring of digital input / output (DO1/DI1) can damage the sensor:

- Before initial operation configure input / output over USB or one of serial Interfaces, and check that wiring corresponds to the input/output configuration.

5.6 Analog output

The analog output of the D-Series sensors is a current source and is capable of driving loads up to 500 Ω. The current range is programmable to 0...20 mA or 4...20 mA. For more details see the specifications.

5.6.1 Specifications

	Properties / Possibilities
Potential / reference	No galvanic isolation (signal referenced to GND of the sensor)
Max. load resistance	≤ 400 Ω (≤ 500 Ω with limitations) Generally the following guideline for min. device input voltage has to be considered: $V+_{min} \geq R_{AO_LOADmax} * I_{AOmax} + 3.5\ V$ (e.g. $V+_{min}$ = 500 Ω * 20 mA + 3.5 V= 13.5V)
Accuracy	0.1% (of programmable distance span)
Resolution	12-Bit
Current range Minimum Maximum Error level	 0 mA / 4 mA (programmable min. current level) 20 mA 0...20 mA (programmable)
Cable length[1]	< 30 m unshielded cable possible (indoor only) ≥ 30 m or outdoor use shielded cables only

$$e_{Dist} = Accuracy_{Device} + \frac{(MaxDist_{Conf} - MinDist_{Conf}) * Accuracy_{AO}}{100}$$

$Accuracy_{Device}$	Device accuracy in mm
$MaxDist_{Conf}$	Configured max. distance in mm
$MinDist_{Conf}$	Configured min. distance in mm
$Accuracy_{AO}$	Accuracy of the analog output (e.g. 0.1 for 0.1%)
e_{Dist}	Total error in mm

Calculation example:

$$e_{Dist} = 1\,mm + \frac{(10'000\,mm - 0\,mm) * 0.1}{100} = \mathbf{\pm 11\,mm}$$

DPE-10-500 (device specifications and configurations):

$Accuracy_{Device}$	±1 mm
$MaxDist_{Conf}$	10'000 mm
$MinDist_{Conf}$	0 mm
$Accuracy_{AO}$	0.1%
e_{Dist}	**±11 mm** (Calculation see left side)



The stated errors include all possible errors as temperature drift, linearity, surface color and measurement distance.



The best accuracy for the D-Series devices can only be achieved by using the digital serial interfaces (RS-232, RS-422/485, SSI or Industrial Ethernet).

5.6.2 Wiring

The connection of the analog output with a PLC (or other device) is shown in figure 16. Consider that the analog output of the D-Series sensors are not galvanic isolated and the GND (power supply 0 V) of the sensors are used for the analog output too.

1 Max. cable length of Analog Output (AO) interface depends on cable quality and ambient conditions

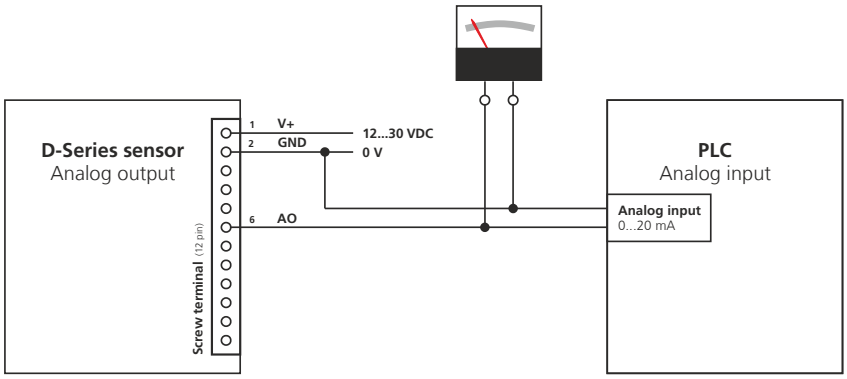


Figure 16: Connection of the analog output with a PLC (or other devices)

5.7 RS-232 interface

The RS-232 digital serial interface is mainly used for the device configuration. It allows the connection with a host (e.g. PC) to do the configuration with a terminal program (e.g. HTerm[1], HyperTerminal[2]) or the Laser Sensor Utility software (for details see www.dimetix.com).

The communication protocol is ASCII based, easy to understand and simple to use. For more details about the communication protocol and the available commands see 8 Command set on page 41. The factory settings of the RS-232 interface are specified in chapter 6.6 Factory settings.



Measurement rates faster than about 100 Hz are only possible if the baud rate is set to the maximum of 115'200 Baud. Lower baud rates reduce the measurement speed.

5.7.1 Specifications

The following specifications are in addition to the RS-232 standard specification (Standard specifications / guidelines are free available online).

	Properties / Possibilities
Voltage level	See RS-232 standard specifications / guidelines
Max. baud rate	115'200
Max. cable length (typical)[3]	≤ 15 m (unshielded cable for indoor use only)

5.7.2 Wiring

The connection of a D-Series sensor over the RS-232 interface with a host (e.g. PC or PLC) is shown in figure 17. With the RS-232 interface only point-to-point communication is possible.

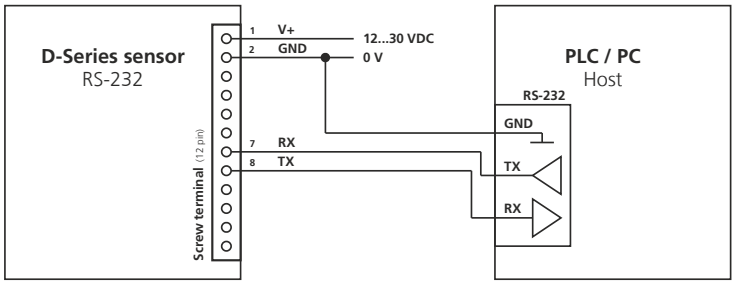


Figure 17: Connection of the RS-232 interface

1 HTerm is a free communication terminal software

2 HyperTerminal is a free communication terminal software from Microsoft (only available on Windows XP systems)

3 Max. cable length of RS-232 interfaces depend on communication speed, cable quality and ambient conditions



Never connect multiple D-Series devices on a single RS-232 line.

5.8 RS-422/485 interface

The RS-422/485 digital serial interface is made for industrial applications due to their robustness, max. cable length and the possibility of connection multiple devices on the same line. For this interface a shielded cable with twisted pairs for the data signals have to be used (see 5.8.1 Specifications for further information).

The communication protocol is unchanged and identical with the protocol for the RS-232 interface. For more details about the communication protocol and the available commands see 8 Command set on page 41. The factory settings of the RS-422/485 interface are specified in chapter 6.6 Factory settings.

It's important that the host has the control of the whole communication and never initiates a new communication before terminating the previous one (always waiting for the answer of the D-Series device or timeout).



The RS-422/485 interface cannot be used simultaneous with the SSI interface.



For more than one device on a single line, never use commands with continuous answers (e.g. single sensor tracking). Only use tracking with buffering (see 8.2.5 Tracking with buffering – Start (sNf)).



Measurement rates faster than about 100 Hz are only possible if the baud rate is set to the maximum of 115'200 Baud. Lower baud rates reduce the measurement speed.

5.8.1 Specifications

The following specifications are in addition to the RS-422/485 standard specifications. The standard specifications / guidelines are free available e.g. online..

	Properties / Possibilities
Voltage level	See RS-422/485 standard specifications / guidelines
Max. baud rate	115'200
Max. load for driver	≥ 100 Ω
Cable characteristics Cable type Characteristic impedance Z_0 (typical)	 Use shielded twisted pair cables only (twisted pairs: T+/T- and R+/R-) 100...150 Ω (typical)
Termination resistor R_T	100...150 Ω / 0.5 W (typical), should be equal to cable impedance Z_0
Cable length vs baud rate (typical)[1]	≤ 500 m → ≤ 200'000 Baud (all baud rates possible) ≤ 1000 m → ≤ 100'000 Baud

5.8.2 Wiring RS-422

The connection of one or more D-Series devices (up to 100) over the RS-422 interface with a host (e.g. PC or PLC) is shown in figure 18. To use more than one D-Series sensor on a single RS-422 line the device ID of every device has to be configured with different ID's. Available and configurable ID's are form 0 to 99 (see 8.3.2 Set device ID (sNid)).

For proper operation use termination resistors R_T as shown in figure 18. The termination resistor should be equal to the cable impedance Z_0 (typical 100...150 Ω.

1 Max. cable length of RS-422 / RS-485 interfaces depend on communication speed, cable quality and ambient conditions

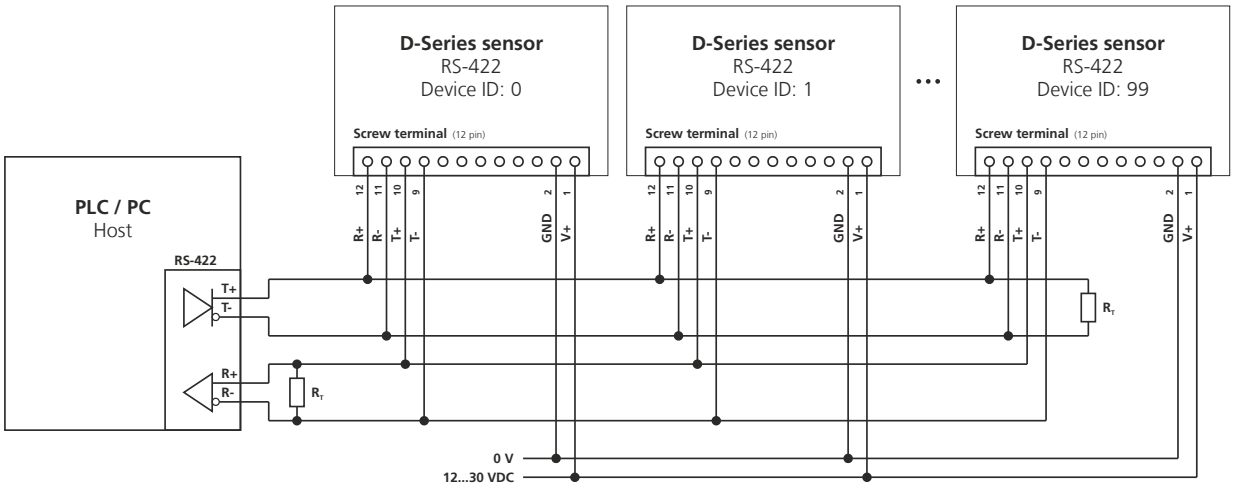


Figure 18: Connection of one or more RS-422 devices on one line, R_T –› Termination resistors

If there are multiple devices on the same RS-422 line ensure that all devices have different device ID's.

NOTICE

Using unshielded cables can cause communication problems or long term damage to the sensor

- Use shielded twisted pairs cables only. For details see 5.8.1 Specifications.

5.8.3 Wiring RS-485

The connection of one or more D-Series devices (up to 100) over the RS-485 interface with a host (e.g. PC or PLC) is shown in figure 19. To use more than one D-Series sensor on a single RS-485 line the device ID of every device has to be configured with different ID's. Available and configurable ID's are form 0 to 99 (see 8.3.2 Set device ID (sNid)).

For proper operation use termination resistors R_T as shown in figure 19. The termination resistor should be equal to the cable impedance Z_0 (typical 100...150 Ω.

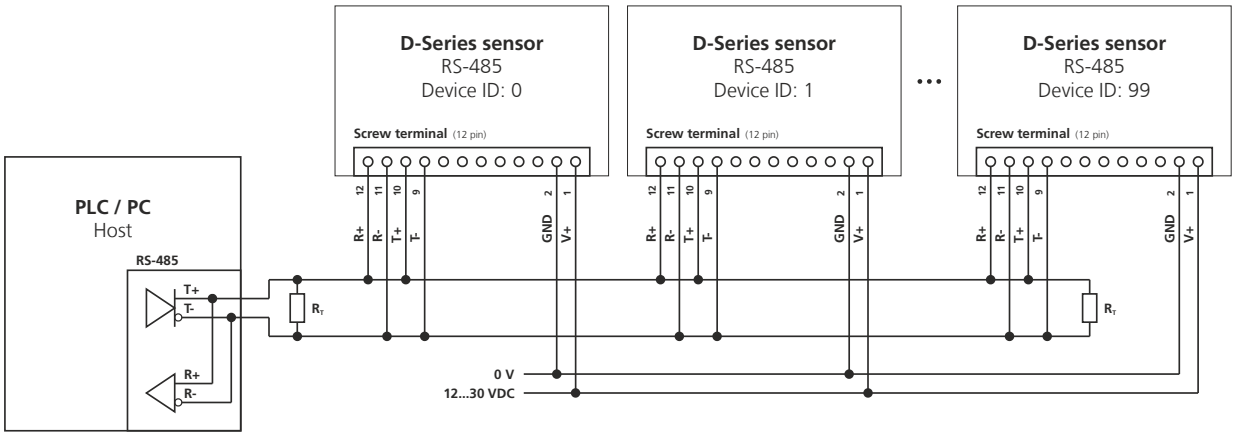


Figure 19: Connection of one or more RS-485 devices on one line, R_T –› Termination resistors

If there are multiple devices on the same RS-485 line ensure that all devices have different device ID's.

NOTICE

Using unshielded cables can cause communication problems or long term damage to the sensor

- Use shielded twisted pairs cables only. For details see 5.8.1 Specifications.

5.9 SSI interface

The SSI interface is also made for industrial applications due to their synchronous communication, the robustness (because of differential signals) and max. possible cable length. For this interface a shielded cable with twisted pairs for the data signals have to be used (see 5.9.1 Specifications for further information).

It's possible to configure the SSI interface with different data formats / sizes, data coding (Binary or gray) and some other options. For detailed information see the configuration command in chapter 8.3.10 Set/Get configuration of RS-422/485 and SSI (sNSSI) and 8.3.11 Set/Get error value of SSI output (sNSSIe). The factory settings of the SSI interface are specified in chapter 6.6 Factory settings.



The SSI interface cannot be used simultaneous with the RS-422/485 interface.

5.9.1 Specifications

	Properties / Possibilities
Distance output values	0...16777215 1/10 mm (max. 1.67 km)
Resolution	0.1 mm
Data coding	Binary or gray, MSB first (configurable)
Data format / size Distance data State / Error data	 23 / 24-Bit (configurable) 0 / 1-Bit error state (configurable) 0 / 8-Bit error code (configurable)
Error value behavior	-2 / -1 / 0...16777215 (configurable)
Read out rate	≤ 1 kHz
Clock frequency (Clock from master device)	83 kHz to 1 MHz, depending on cable length
Pause time t_p (Time lag between two data packets)	≥ 1 ms
Monoflop time t_m	25 µs
Voltage level	See RS-422/485 guidelines (differential signals)
Cable characteristics	Use shielded twisted pair cables only (twisted pairs: T+/T- and R+/R-)
Cable length vs data rate (typical)[1]	≤ 100 m → ≤ 1000 kBit/s ≤ 200 m → ≤ 600 kBit/s ≤ 500 m → ≤ 200 kBit/s ≤ 1000 m → ≤ 100 kBit/s

5.9.2 Timing

The timing of the SSI interface is shown in figure 20 and described below the figure.

1 Max. cable length of SSI interfaces depend on communication speed, cable quality and ambient conditions

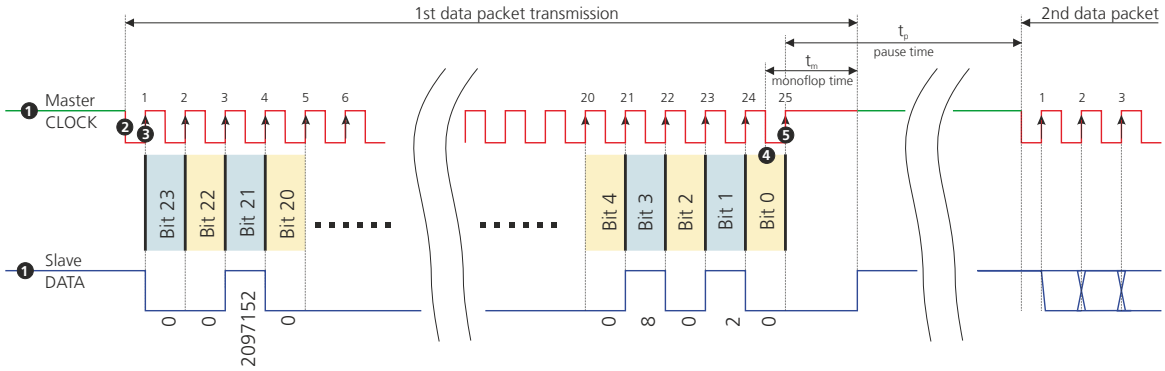


Figure 20: Timing diagram of SSI interface (t_m –› Monoflop time, t_p –› Pause time).

The SSI is initially in the idle mode, where the DATA and CLOCK lines stay HIGH ❶ and the slave keeps updating its internal data. The transmission mode is evoked when the master initiates a sequence by pulling the CLOCK line to LOW. Once, the slave receives the resulting falling edge ❷ at the CLOCK signal line, it automatically stops updating its internal data. With the first rising edge ❸ at the CLOCK line, the MSB of the sensor data is transmitted and with consequent rising edges, the data bits are sequentially transmitted over the DATA line.

After the transmission of the complete data word ❹ (e.g. LSB is transmitted), an additional last rising edge ❺ at the CLOCK line sets the CLOCK to HIGH. The slave sets or leaves the DATA line to LOW and remains there for the monoflop time t_m, to recognize the transfer timeout.

If a falling edge at the CLOCK line (Data-Output request) is received within the monoflop time t_m, the same data as before will be transmitted again (*Multiple transmission*).

If there were no clock pulses within the monoflop time t_m, the slave starts updating its internal data after setting the DATA line to HIGH (Idle mode). This marks the end of the data word transmission (*Single transmission*). Once the slave receives a clock signal at a time t_p (>=t_m,), the updated position data is frozen and the transmission of the new data begins as described earlier.

5.9.3 Wiring

The connection of the D-Series devices to use the SSI interface with a SSI master (e.g. PLC) is shown in figure 21. For details about the cable characteristics and the possible cable length (depends on data rates) see the specifications in chapter 5.9.1. The data rates must be set at the SSI master side.

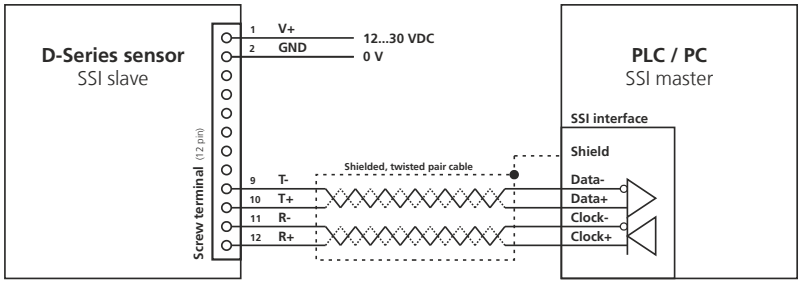


Figure 21: Connection of SSI interface with a master device



Never connect multiple D-Series devices on a single SSI line.

NOTICE

Using unshielded cables can cause communication problems or long term damage to the sensor

- Use shielded twisted pairs cables only. For details see 5.8.1 Specifications

5.10 USB interface

The USB interface is also mainly used for the device configuration. It allows the connection with a USB host (e.g. PC) to do the configuration with a terminal program (e.g. HTerm[1], HyperTerminal[2]) or the Laser Sensor Utility software (for more details see www.dimetix.com).

1 HTerm is a free communication terminal software

2 HyperTerminal is a free communication terminal software from Microsoft (only available on Windows XP systems)

The communication protocol is ASCII based, easy to understand and simple to use. It's the same protocol used for all configuration and other serial interfaces (RS-232, RS-422/485 and USB). For more details about the communication protocol and the available commands see 8 Command set on page 41.

5.10.1 Specifications & Wiring

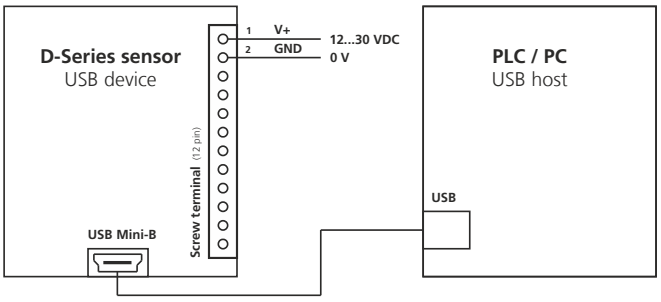


Figure 22: Connection of USB interface

Specifications for USB interface:

- USB Mini type B
- USB 2.0 FS (Full speed, max. 12 Mbps)
- Virtual COM port for D-Series device
- D-Series devices are not powered over USB interface (use separate power supply for the sensors)
- For other information not mentioned at this point, see the USB specifications and guidelines

The connection and wiring to use the USB Mini-B interface is shown in figure 22.

5.10.2 Installation

The USB interface of the D-Series laser sensor needs a basic USB driver installed on the host system. This has to be done only one time. If the driver installation was successful the D-Series laser sensor will be identified correctly by the host system. For downloading the USB driver please see the Dimetix website www.dimetix.com.

The D-Series laser sensor is identified as a virtual COM port device with the device name "D-Series USB Serial Port (COMxx)". Check the device manager for the COM port number. This number is required to connect to the sensor with a terminal program or the Dimetix Laser Sensor Utility software (for more details see www.dimetix.com). The baud rate is the same as the baud rate configured for the other serial interfaces (RS-232 and RS-422/485).



Only use the Dimetix USB driver in conjunction with the D-Series USB port. Use the same baud rate for the USB interface as for the other serial interfaces (RS-232 and RS-422 / 485).

5.11 Industrial Ethernet interface

The Industrial Ethernet interface extends the available interfaces with PROFINET®, EtherNet/IP™ or EtherCAT®. These optional interfaces are designed as exchangeable covers and can be connected (over the Industrial Ethernet interface connector) and attached to the back of the D-Series sensors. The D-Series laser sensor is configurable in its entirety over the Industrial Ethernet interface. For detailed information about the available Industrial Ethernet interfaces, see the corresponding technical reference manual on the Dimetix website www.dimetix.com.

5.11.1 Specifications

	Properties / Possibilities
Industrial Ethernet protocol (For detailed specifications see the technical reference manual of the Industrial Ethernet)	PROFINET® EtherNet/IP™ EtherCAT®
Control and configuration	Over Industrial Ethernet - Cyclic process data (Control of D-Series laser sensor) - Acyclic parameter / data (Configuration of D-Series laser sensor)
Cable and connector	20 pin ribbon cable to connect exchangeable cover Use only original Dimetix connector cable and connector assembly.

5.11.2 Wiring

The connection of the D-Series device to use the Industrial Ethernet interface with the exchangeable cover is shown in figure 23. To use the exchangeable cover with one of the Industrial Ethernet protocol (PROFINET®, EtherNet/IP™ or EtherCAT®) all other sensor connectors and interfaces have to be disconnected otherwise the sensor may damage.

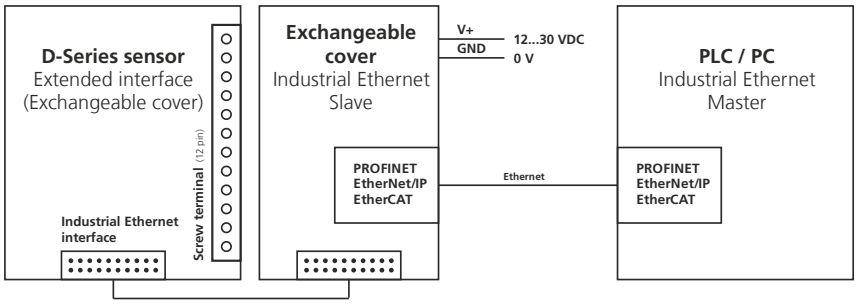


Figure 23: Connection of the exchangeable cover for Industrial Ethernet interfaces

NOTICE

Connecting the exchangeable cover for Industrial Ethernet simultaneously with one of the other interfaces of the sensor may damage one of these components.

- Disconnect all other interface cables before connecting the exchangeable cover for Industrial Ethernet to the sensor.



Only use the original Dimetix flat ribbon cable to connect the D-Series Sensor with the exchangeable cover for Industrial Ethernet.

6 Configuration

The D-Series sensors have a multiplicity of configuration options. On the one hand the integrated interfaces can be configured (e.g. baud rate of the serial interfaces) to reach a wide range of application requirements. Otherwise it's also possible to configure the behavior of the sensors (e.g. measurement characteristic).

The following table shows an overview of all configuration options and the corresponding references to the commands or chapters.

Interfaces / Features	Configuration possibilities	Commands
Digital input	Input functions (Trigger single measurement, trigger tracking, etc.)	8.3.8 Set/Get digital input function (sNDI1)
Digital output	Output type (NPN, PNP, Push-Pull)	8.3.6 Set/Get digital output type (sNot)
	Hysteresis level (ON, OFF), data source (Distance, speed, signal or temperature) and function (single hysteresis or pulse) configuration (see description in chapter 6.5)	8.3.7 Set/Get digital output hysteresis (sN1, sN2) 8.4.6 Set/Get additional digital output configuration (sNado)
Analog output	Distance range (min. and max.) for 0/4...20 mA	8.3.5 Set/Get analog output distance range (sNv)
	Min. current level 0 mA or 4 mA	8.3.3 Set/Get analog output min level (sNvm)
	Current level in error case	8.3.4 Set/Get analog output value in error case (sNve)
RS-232, RS-422 / RS-485	Communication settings (Baud rate, etc.)	8.3.1 Set communication settings (sNbr)
	Sensor ID	8.3.2 Set device ID (sNid)
SSI	Communication settings (Data format, coding, etc.)	8.3.10 Set/Get configuration of RS-422/485 and SSI (sNSSI)
	Error behavior	8.3.11 Set/Get error value of SSI output (sNSSIe)
Industrial Ethernet	Configuration over Industrial Ethernet interface	-
Sensor behavior	Operation mode (see description in chapter 6.2)	8.3.14 Set/Get auto start configuration (sNA) 8.4.4 Set/Get user mode (sNum)
	Measurement characteristic (see description in chapter 6.3)	8.3.12 Set/Get measuring characteristic (sNmc)
	Data output (Filter, gain, offset, format) (see description in chapter 6.4)	8.3.13 Set/Get measurement filter configuration (sNfi) 8.4.2 Set/Get user distance offset (sNuof) 8.4.3 Set/Get user distance gain (sNuga) 8.4.1 Set/Get user output format (sNuo) 8.4.5 Set/Get additional measurement filter configuration (sNafi)

6.1 Configuration process

The configuration process describes how the sensors can be configured. There are different interfaces for connection available and also two configuration types. The configuration example in 6.1.3 shows a possible analog output configuration and gives an impression of the configuration process.

6.1.1 Connection

To be able to configure a D-Series device it has to be powered and connected to a host (usually a PC). On the host side a terminal program (e.g. HTerm[1], HyperTerminal[2]) can be used to communicate with the sensor. A configuration utility software is also available on the Dimetix web page (see Laser Sensor Utility software at www.dimetix.com).

Connections available for configuration (see figure 24 for details):

1) RS-232 interfaces
2) USB interface

1 HTerm is a free communication terminal software

2 HyperTerminal is a free communication terminal software from Microsoft (only available on Windows XP systems)

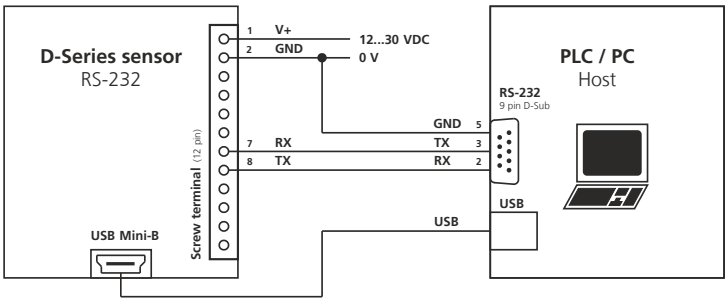


Figure 24: Connection of the RS-232 or USB interface for sensor configuration

The specifications for the RS-232 or the USB interface are described in 5.7 RS-232 interface or 5.10 USB interface. The connection for using the RS-232 or the USB interface for configuration is shown in figure 24.

RS-232 / USB default settings of the D-Series device:

COM port: depends on PC / PLC[3]
Baud rate: 19'200 Baud
Data bits: 7
Parity: Even
Stop bits: 1

6.1.2 Configuration types

The D-Series sensors can be configured with or without saving the configuration changes in the internal memory by using the save command (see 8.3.16 Save configuration parameters (sNs)). So there exist two types of using the configurations, volatile or non-volatile. To find out what configuration type should or can be used for a specific application see the description below.

The D-Series sensors support two configuration types (volatile and non-volatile, see the table below):

- Volatile (after every power up cycle, the configuration will be set)
- Non-volatile (only one-time configuration, the configuration will be set and saved in sensor memory)

Steps		Volatile	Non-volatile
Power up			
Configuration	1	Configuration (all used features)	Configuration (all used features)
	2	- (no save, volatile configuration)	Save configuration (save configuration in sensor memory)
Measurement	3	Measurement 0	Measurement 0
	4	Measurement 1	Measurement 1
	5	...	...
	n	Measurement n	Measurement n
Power down			
Power up			
Configuration	1	Configuration (all used features)	- (not required)
Measurement	2	Measurement 0	Measurement 0
	3	Measurement 1	Measurement 1
	4	...	...
	n	Measurement n	Measurement n

6.1.3 Configuration example

The configuration example in the table below shows the differences of the volatile and non-volatile configuration type on the basis of the analog output. The analog output will be configured to 4...20 mA for the distance range of 0...10 m. In error case, the analog output level has to be 0 mA.

3 The serial COM port number depends on host system. Check the serial COM port number in the device manager of the host system.

Steps		Volatile	Non-volatile	Description
Power up				
Configuration	1	s0vm+1 s0v+0+100000 s0ve+0	s0vm+1 s0v+0+100000 s0ve+0	–› Set min. current level to 4 mA –› Set distance range to 0...10 m (for 4...20 mA) –› Set current level in error case to 0 mA
	2	-	s0s	–› s0s for saving configuration in sensor memory
Measurement	3	s0g	s0g	–› s0g for single distance measurement and update of analog output
	n	...	...	
Power down				
Power up				
Configuration	1	s0vm+1 s0v+0+100000 s0ve+0	-	–› New configuration if not saved before power down (only for volatile configuration type)
Measurement	2	s0g	s0g	
	n	...	...	

6.2 Operation modes

The D-Series laser sensors offer two types of operation modes, the controlled mode and the stand-alone mode to cover a wide range of applications. While the controlled mode provides maximum flexibility and needs to be triggered by a host system, the stand-alone mode can operate autonomous. Often it's not suitable or welcome to control a device by the host system in an existing environment. In such cases the stand-alone mode might be preferred. The two types of operation modes are described in the table below.

Controlled mode	Stand-alone mode	
	Auto start	Manual start
The distance measurement is controlled / triggered by a host system. The available commands are listed bellow: • sNg –› Distance measurement • sNh –› Single sensor tracking • sNf –› Tracking with buffering	The distance measurement starts automatically after a power on cycle. The available commands are listed bellow: • sNA –› Auto start configuration • sNum –› User mode configuration	An external signal triggers distance measurements. This is possible by configuring the digital input DI1. The available command is listed bellow: • sNDI –› Digital input functions
See 6.2.1 Controlled mode for more details.	See 6.2.2 Stand-alone mode for more details.	See 6.2.2 Stand-alone mode for more details.

All interfaces of the laser sensor are updated internally (with new distance measurements or error codes) independently of the operation mode.

6.2.1 Controlled mode

In controlled mode each action / operation of the D-Series sensor is triggered by a command sent from a host system over a serial interface (RS-232, RS-422 / 485 or USB). The basic configuration steps to use the controlled mode are listed in the table below.

Steps	Action	Description	Commands
1	Clear device	Clear the device before using the controlled mode by doing a clear followed by a save command. It's also possible to do a device reset (Factory default of the laser sensor)	8.2.1 Stop / Clear command (sNc) 8.3.16 Save configuration parameters (sNs) 5.2 Reset push button
2	Set communication parameters	Configure the desired communication parameters and device ID.	8.3.1 Set communication settings (sNbr) 8.3.2 Set device ID (sNid)
3	Operation	Use the operation commands to do distance measurements or to use other sensor functionality.	8.2 Operation commands

For this operation mode a host software is required to controll the D-Series laser sensor. Check the Dimetix website for software sample code or Application Notes (see www.dimetix.com). Careful testing of the host software together with the device is strongly recommended prior to installation.

6.2.2 Stand-alone mode

The stand-alone mode is grouped in auto start configuration and manual start configuration. For details about the functionality and the configuration steps see the following sections.

Auto start configuration

The following steps are needed to configure the D-Series device for the stand-alone mode with auto start configuration. In this mode the distance measurement is started automatically after every power-up cycle. No external trigger or command is required to start measurement. All sensor interfaces are updated internally with distance or error data. For the default auto start configuration there is no serial output on the RS-232, RS-422/485 and USB interface. Optionally this output can also be activated by the user mode configuration command. See the configuration steps in the table below.

Steps	Action	Description	Commands
1	Clear device	Clear the device before using the stand-alone mode by doing a clear followed by a save command. It's also possible to do a device reset (Factory default of the laser sensor).	8.2.1 Stop / Clear command (sNc) 8.3.16 Save configuration parameters (sNs) 5.2 Reset push button
2	Set user mode	Do this step if auto start configuration with serial output on RS-232, RS-422/485 and USB interface is required (User mode 2 to activate serial output).	8.4.4 Set/Get user mode (sNum)
3	Set the auto start configuration	Configure the D-Series device to the stand-alone mode with auto start. It's possible to select a desired sample rate. For more details see the command description.	8.3.14 Set/Get auto start configuration (sNA)

Manual start configuration

The following steps are needed to configure the D-Series device for the stand-alone mode with manual start configuration. In this mode the distance measurement can be triggered by an external signal event on the digital input (DI1). There are different actions of the D-Series laser sensor available. All sensor interfaces are updated internally with distance or error data.

Steps	Action	Description	Commands
1	Clear device	Clear the device before using the stand-alone mode by doing a clear followed by a save command. It's also possible to do a device reset (Factory default of the laser sensor)	8.2.1 Stop / Clear command (sNc) 8.3.16 Save configuration parameters (sNs) 5.2 Reset push button
2	Set the digital input function	Configure the D-Series device to react on a trigger event on the digital input (DI1) with a distance measurement. There are different actions available. For more details see the configuration command.	8.3.8 Set/Get digital input function (sNDI1)
3	Save configuration	The save configuration command stores this configuration in a non-volatile memory. The configuration persist in the device after a power cycle.	8.3.16 Save configuration parameters (sNs)

6.2.3 Error behavior

In case of a device, configuration or measurement error the D-Series laser sensor show the error on the available sensor interfaces (Status LED's, analog output, digital outputs, RS-232, etc.). On the configurable interfaces the error code is transmitted according this configuration.

The error will be automatically cleared after another successful distance measurement, performing a stop / clear command (see chapter 8.2.1 Stop / Clear command (sNc)) or a power cycle.

The D-Series devices automatically store the occurred measurement errors in a non-volatile error stack. After power-cycle the last errors are still available for diagnostic purpose. The error stack can be read or cleared with the Read/Clear error stack (sNre, sNce) command. For more details about the command, see chapter 8.2.9.

6.3 Measuring characteristic

Multiple measuring characteristics are available in the D-Series measuring devices to meet different requirements for various applications. With these measuring characteristics measuring rate and accuracy can be optimized for specific application requirements.

The available measurement characteristic with the main properties (measuring rate and typical accuracy) are described in the table below. These characteristics can be configured for all D-Series devices except the DBx-xx-xxx type. Please consider for the DBx-xx-xxx only the *Normal* measurement characteristic is available.

Measuring characteristic		**Max. measuring rate / output rate**		**Typical accuracy @ 2σ**		**Description**
No.	Name	**DP**x-xx-xxx	**DA**x-xx-xxx **DE**x-xx-xxx	Dxx-**10**-xxx	Dxx-**30**-xxx	
0	Normal	20 Hz [1) 2)]	20 Hz [1) 2)]	±1 mm	±3 mm	Normal measuring characteristic covers a wide range of applications. Measuring range on natural surface: Typical up to 100 m (depends on device type, see the specifications in 4.1). Configuration command: s*N*mc+0 [3)]
1	Fast	250 Hz [1) 2) 5)]	100 Hz [1) 2) 6)]	~±1.5 mm	~±4.5 mm	Increase measuring rate up to 100 Hz / 250 Hz (depends on device type, see the specifications in 4.1). Configuration command: s*N*mc+1 [3)]
2	Precise	10 Hz [1) 2)]	10 Hz [1) 2)]	~±0.8 mm	~±2.4 mm	Increase accuracy with longer measurement to ~±0.8 mm / ~±2.4 mm (depends on measuring conditions). To generally increase measuring performance, consider 7.3 Measuring performance influence. Configuration command: s*N*mc+2 [3)]
3	Timed	User programmed 250 Hz [2) 5)]	User programmed 100 Hz [2) 6)]	variable	variable	Timed measuring characteristic allows user defined measuring rates. The device does not consider measuring conditions to reach the specified accuracy. The measuring rate is fixed and the accuracy is variable (depends on measuring conditions). Configuration command: s*N*mc+3 [3)]
4	Moving target	250 Hz / 1 kHz [4) 5)]	100 Hz [6)]	±1 mm	±3 mm	Moving target measuring characteristic is specific designed for measurements on fast continuous moving targets. For reliable measuring results a good measuring signal is mandatory (good measuring conditions). Target speed up to 10 m/s. Configuration command: s*N*mc+4 [3)]
5	Not used	-	-	-	-	-

1) The measuring rate depends on environmental conditions such as target surface, distance, background light (e.g. sun light), for more details see 7.3 Measuring performance influence. For good conditions (e.g. white target surface or orange reflective target plate and dark environment) the specified max. measuring rate can be reached. For bad conditions the measuring rate decrease.

2) For all measuring characteristic instead of Moving Target the output rate is identical to the measuring rate. After every measurement the output will be updated.

3) For more details about the configuration command, see 8.3.12 Set/Get measuring characteristic (sNmc).

4) Output rate is fixed to 250 Hz for serial interfaces, 500 Hz for Industrial Ethernet and 1 kHz for SSI, analog output and digital outputs.

5) Note that for measuring rates above about 100 Hz, the maximum baud rate 115'200 must be used for the serial interfaces (RS-232, RS-422/485), otherwise the measuring speed will be reduced.

6) 100 Hz valid for production date 09/2022 or newer. Before this date 50 Hz.

6.4 Data output

The data output of the D-Series device is configurable with a wide range of possibilities (output format, user gain, user offset and some filter options). The details about the available configurations are described in the following chapters.

The figure 25 gives an overview of the configuration possibilities and shows the effect on the D-Series device interfaces. Please consider not all interfaces are affected in the same manner. For example, the user output format and user gain / offset are only available on the serial interfaces RS-232, RS-422/485 and USB.

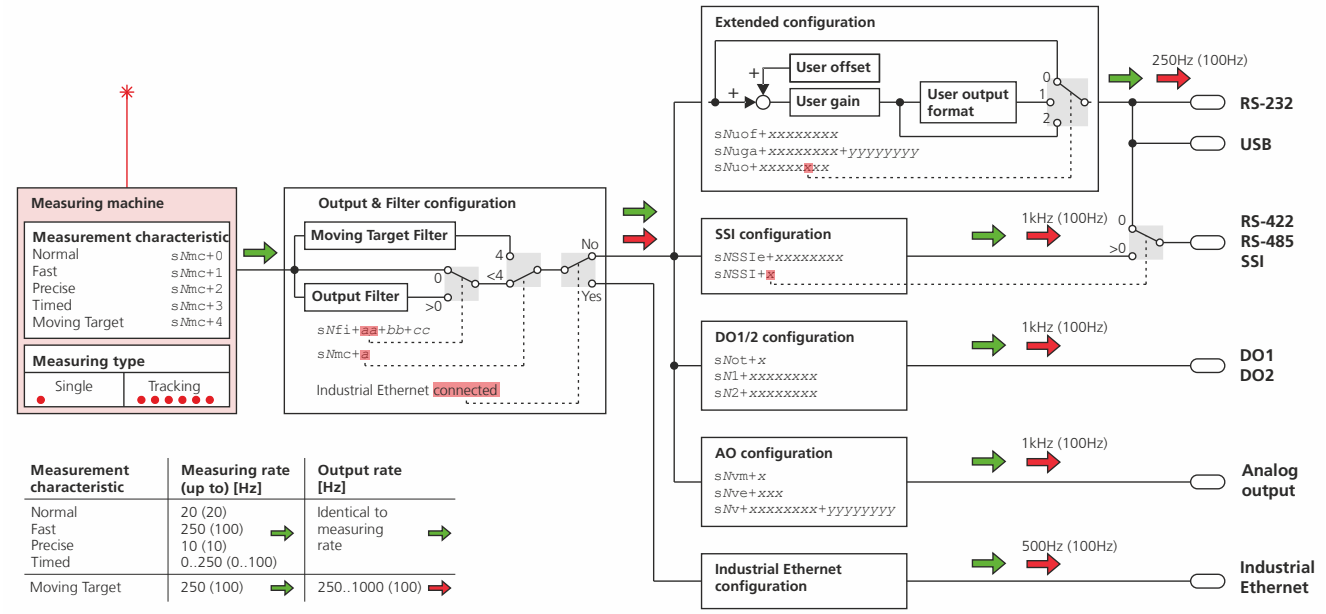


Figure 25: Configuration possibilities and flow chart of data output. Colored arrows show the interface update rate depending on the available measurement characteristics. The measuring and output rates without parenthesis are for DPx-xx-xxx device types. The measuring and output rates with parenthesis are for DAx-xx-xxx and DEx-xx-xxx device types. Please see also the specifications in chapter 4.1 for the corresponding sensor type. Note that for measuring rates above about 100 Hz, the maximum baud rate 115'200 must be used for the serial interfaces (RS-232, RS-422/485), otherwise the measuring speed will be reduced.

6.4.1 User output format / protocol

The configurable output format / protocol of the D-Series laser sensor allows the connection of an external ASCII display, to add some additional measurement information or the possibilities to set an individual user distance offset and / or user gain. The user output format is only available on the serial interface RS-232, RS-422/485 and USB.

The configuration command s*N*uo can be used to select the desired output format and to set some additional settings used for the external ASCII display (field length and position of decimal point). For more details see 8.4.1 Set/Get user output format (sNuo) and check the Dimetix website for appropriate Application Notes (see www.dimetix.com).

The available output format with an example are listed bellow:	**Configuration example**	**Output**
• Default output format (Factory default)	sNuo+0 (User offset / gain configuration ignored)	"gNg+00012345\r\n"
• Display output format (For external ASCII display, not applicable for RS-485)	sNuo+139, sNuga+1+10, sNuof+0 (User offset / gain configuration considered)	" 1.234"
• Default format with user offset / gain active	sNuo+200, sNuga-1+1, sNuof-10000 (User offset / gain configuration considered)	"gNg-00002345\r\n"
• Extended distance format with signal and temperature data and user offset / gain active	sNuo+300, sNuga+1+1, sNuof+0 (User offset / gain configuration considered)	"gNg+00012345+008384+254\r\n"
• Extended distance format with signal, temperature and speed data and user offset / gain active	sNuo+301, sNuga+1+1, sNuof+0 (User offset / gain configuration considered)	"gNg+00012345+008384+254+000500\r\n"



The user output format is only available on the serial interface RS-232, RS-422/485 and USB. The display output format is not applicable for RS-485.

6.4.2 User gain / offset

The user gain and offset configuration of the D-Series device allow individual and application dependent offset and gain settings. For example, an individual gain configuration enables the conversion to other distance units (e.g. m, inch, etc.). The calculation of the user distance with user offset and user gain (Defined by numerator and denominator) is shown below.

$$Distance_{User} = (Distance + Offset_{User}) \frac{Gain\,Num_{User}}{GainDen_{User}}$$

$Distance_{User}$	User distance with offset and gain in 1/10 mm
$Distance$	Measured raw distance of D-Serie device in 1/10 mm
$Offset_{User}$	User offset (+/-) in 1/10 mm
$GainNum_{User}$	User gain numerator
$GainDen_{User}$	User gain denominator in 1/10 mm

The commands to configure the user offset and user gain are described in 8.4.2 Set/Get user distance offset (sNuof) and 8.4.3 Set/Get user distance gain (sNuga).

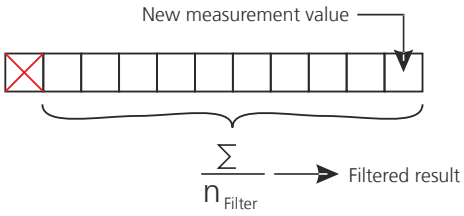
6.4.3 Output filter (Distance / error)

The D-Series laser sensor has a configurable output filter for the measurement values (Distance and error codes). There are different filter types available to allow a lot of filter possibilities.

The output filter is available on the following measuring characteristics (for more details about the measuring characteristics, see 6.3 Measuring characteristic):

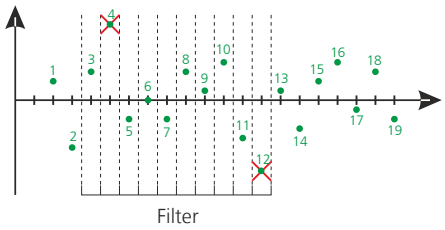
- Normal
- Fast
- Precise
- Timed

The output value filter is based on a moving average filter and supports in addition a spike suppression filter and error suppression filter. The filter functionality are described in the table below. The configuration command of the supported filter types are described in 8.3.13 Set/Get measurement filter configuration (sNfi).



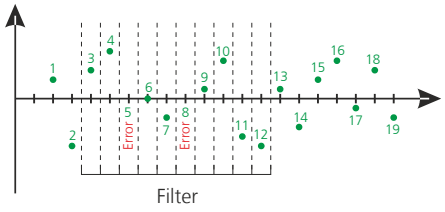
Moving average filter

The moving average filter averages a specified number of measurements. A maximum of 32 measurement values can be averaged (Length of filter is configurable). If a new measurement value is present, this value will be added to the filter values, while the latest value will be removed. The sum of all measurement values divided by the size of the filter is the filtered measurement value and transmitted to all outputs.



Spike suppression filter

The spike suppression filter eliminates pairs of minimum and maximum values inside the filter values (Number of eliminated minimum / maximum pairs is configurable). Always the lowest and highest values are removed from the average filter calculation.



Error suppression filter

A maximum number of errors inside the average filter values can be suppressed (Number of suppressed errors is configurable). If the number of errors inside the average filter values is smaller than the specified number of error suppression, no error is shown at the output.

6.4.4 Moving Target filter

The D-Series laser sensor has a specific Moving Target filter optimized for measuring on a continuous moving target. In such applications typically no distance jumps occur.

This filter is automatically switched on for Moving Target measurement characteristic configurations. Consider no other filer can be used simultaneously (compare chapter 6.4.3 Output filter (Distance / error) for other filter options).

6.4.5 Additional filter functionality

The D-Series laser distance sensors provide some additional measurement filter configurations. These configurations can be used at the same time than the output filter (see chapter 6.4.3) or the Moving Target filter (see chapter 6.4.4) unless otherwise stated. The corresponding command can be found in chapter 8.4.5 Set/Get additional measurement filter configuration (sNafi).

The configuration possibilities allow special functionalities e.g. for positioning applications in the logistics. For more details about the available additional filter configurations, see the table below.

No.	Description measurement filter configurations:	Configuration example
1	Distance jump detection (plausibility check of measured distance). 0 –› Filter disabled, >0 –› Max. allowed distance change in [0.1 mm] Every new measured distance will be automatic checked against max. configured allowed distance jump / change. This feature is only available for tracking measurement. See also the corresponding Application Note AN2007 on the Dimetix website.	s*N*afi+1+5000 Max. allowed distance jump / change: ±500 mm.
2	Additional calming filter for distance measurements in Moving Target configuration. This filter smooths distance readings needed in some applications. 0 –› Filter disabled, 1...400 –› Calming filter length High filter lengths results in more distance calming / smoothing. Note that the response time of the sensor decreases accordingly when using long filter lengths. It's recommended to start with low filter lengths. See also the corresponding Application Note AN2011 on the Dimetix website.	s*N*afi+2+100 Calming filter length of 100.
3	Additional plausibility check of the signal measurement data (signal monitoring). The max. allowed signal change / jump can be configured in %. 0 –› Filter disabled, >0 –› Max. allowed signal change in [%] Signal change check between the last and newest measurement is done according above configuration. See also the corresponding Application Note AN2008 on the Dimetix website.	s*N*afi+3+30 Max. allowed signal change against last valid signals +/-30%. Remark: Linear signal output configuration via s*N*um+5 command.
4..n	Not used.	

6.5 Digital output

The digital outputs of the D-Series laser distance sensors allows a wide range of configurations to be flexible for many applications. The following configurations are available for the digital output 1 and 2 independently:

- Data source: Distance (Default), speed, signal or temperature
- Switching function: Hysteresis (Default) or pulse
- Pulse width: Only for pulse function

In figure 26 the configuration possibilities with the corresponding commands are shown for both digital outputs. The descriptions of the commands can be found in chapter 8.4.6 Set/Get additional digital output configuration (sNado) and 8.3.7 Set/Get digital output hysteresis (sN1, sN2).

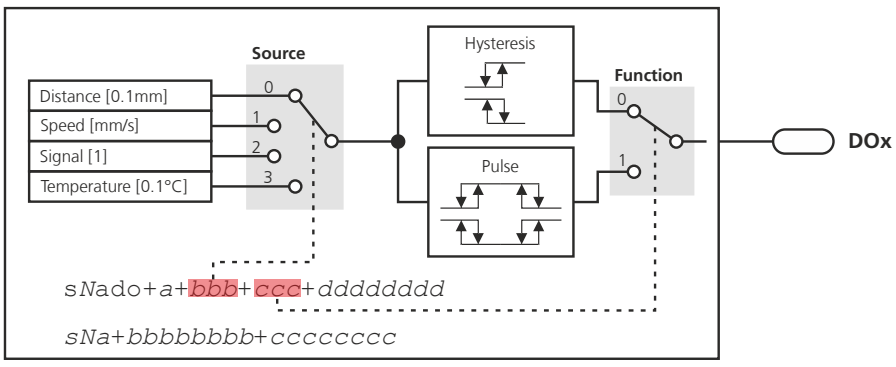


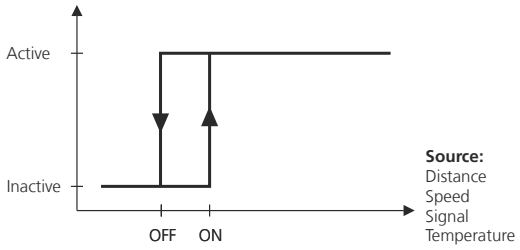
Figure 26: Configuration possibilities of the digital output 1 and 2 (Data source and switching function). Remark: Configuration independently for digital output 1 and 2.

Note, the digital output type can also be configured if needed. However, this always applies to all outputs. For more details see chapter 5.4 Digital output and 8.3.6 Set/Get digital output type (sNot) for the corresponding configuration command.

6.5.1 Switching functions

There is a hysteresis and a pulse switching function available. Both of them can be configured with two polarities also shown in figure 26. The polarity will be selected by the values of the ON and OFF level of the first hysteresis. A total of four different configurations are thus possible. See the following four point 1) to 4).

1) Hysteresis: ON level > OFF level

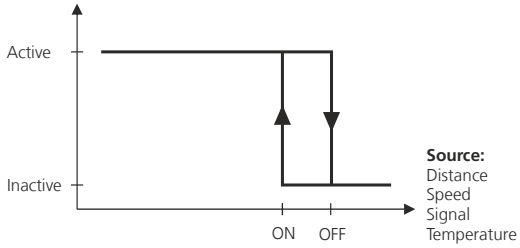


This description and figure is valid for hysteresis configuration and if the configured ON level of the hysteresis is greater than the OFF level.

Switching behavior of the shown hysteresis:

With a rising value (x-axis), the digital output is switched active as soon as the value exceeds the ON level. With a falling value, the digital output is switched inactive as soon as the value falls below the OFF level again.

2) Hysteresis: ON level < OFF level

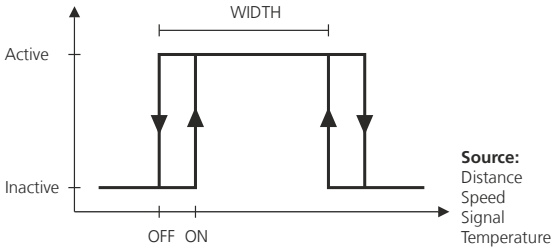


This description and figure is valid for hysteresis configuration and if the configured OFF level of the hysteresis is greater than the ON level.

Switching behavior of the shown hysteresis:

With a rising value (x-axis), the digital output is switched inactive as soon as the value exceeds the OFF level. With a falling value, the digital output is switched active as soon as the value falls below the ON level again.

3) Pulse: ON level > OFF level

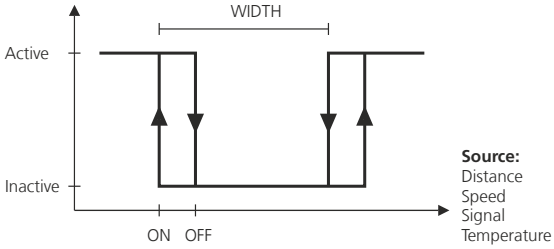


This description and figure is valid for pulse configuration and if the configured ON level of the first hysteresis is greater than the OFF level.

Switching behavior of the shown pulse:

With a rising value (x-axis), the digital output is switched active as soon as the value exceeds the ON level, but only until the value also exceeds the ON + WIDTH level. With a falling value, the digital output is switched active as soon as the value falls below the OFF + WIDTH level, but only until the value also falls below the OFF level.

4) Pulse: OFF level > ON level



This description and figure is valid for pulse configuration and if the configured OFF level of the first hysteresis is greater than the ON level.

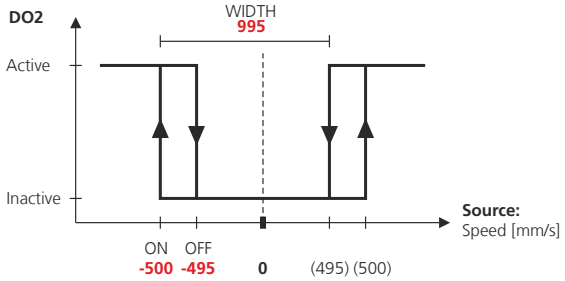
Switching behavior of the shown pulse:

With a rising value (x-axis), the digital output is switched inactive as soon as the value exceeds the OFF level, but only until the value also exceeds the OFF + WIDTH level. With a falling value, the digital output is switched inactive as soon as the value falls below the ON + WIDTH level, but only until the value also falls below the ON level.

6.5.2 Example

In this example the digital output 2 (DO2) will be configured to supervise the moving speed of the sensor or accordingly of the measuring target. In case of a detected speed greater than ±500 mm/s (±0.5 m/s), the digital output 2 must indicate this by switching to the active state.

The digital output 2 switch to active state if the detected speed rise above ±500 mm/s. This behavior can be configured by using the pulse function of the digital output. The pulse is defined over the first hysteresis with ON and OFF level and the pulse WIDTH. This three parameters (numbers marked in red) defines the pulse function used for the behavior in this example.



Used commands for this example:

1. Set additional digital output configuration:
(Number: 2, Source: Speed, Function: Pulse, Pulse width: 995)

s*N*ado+2+1+1+995

2. Set digital output hysteresis:
(Number: 2, ON level: -500, OFF level: -495)

s*N*2-500-495

6.6 Factory settings

The following table shows the Dimetix default sensor configuration (factory settings). These configurations are set in a new sensor or after a successful reset. To reset the device to the factory default, see the reset process described in 5.2 Reset push button on page 16.

Configuration parameter	Factory default
Digital input 1 (DO1/DI1)	Inactive
Digital output type (DO1, DO2, DOE)	NPN output type
Digital output 1 hysteresis (DO1/DI1)	ON level: 2005 mm OFF level: 1995 mm
Digital output 2 hysteresis (DO2)	ON level: 995 mm OFF level: 1005 mm
Digital output data source and function (DO1 / DO2)	Data source: 0 (Distance, unit for hysteresis levels in [0.1mm]) Function: 0 (Hysteresis)
Analog output	4...20 mA for 0...10 m distance 0 mA in error case
Sensor ID	0
Serial communication settings (RS-232, RS-422 / RS-485)	7 (19'200 Baud, 7 data bits, parity even, 1 stop bit)
RS-422 / RS-485	RS-422 / RS-485 active
SSI interface	SSI Inactive Data coding: Binary Data format: 24-Bit No error state and error code added Error value: 0
Sensor behavior – Operation mode	Controlled mode (Auto start and user mode inactive) User mode inactive
Sensor behavior – Measurement characteristic	0 (Normal)
Sensor behavior – Data output	Gain: 1 Offset: 0 mm Format: 0 (Default commands answers, no display output format) Filter: Inactive Additional filter: All inactive

7 Operation

7.1 Measurement overview

The D-Series laser sensors supports different measurement possibilities to cover high variety of applications. The table below shows the available distance measurement commands and some basic commands. The distance measurement commands are separated in two groups. The "Distance measurement" group commands can be used for one or more sensors on a single line (e.g. multiple sensors on the RS-422 interface). The other command group "Single distance measurement" is only for one sensor on a single line. Otherwise there could be communication problems.

Group	Measurement possibilities	Commands
Basic measurement (one or more sensors on a single line)	Clear sensor / Stop measurement	8.2.1 Stop / Clear command (sNc)
	Laser on (Pointing for sensor adjustment)	8.2.10 Laser on (sNo)
	Signal measurement (Single tracking possible)	8.2.7 Signal measurement (sNm)
	Temperature measurement	8.2.8 Temperature measurement (sNt)
	Read / Clear error stack	8.2.9 Read/Clear error stack (sNre, sNce)
Distance measurement (one or more sensors on a single line)	Distance measurement	8.2.2 Distance measurement (sNg)
	Tracking distance measurement with buffering	8.2.5 Tracking with buffering – Start (sNf) 8.2.6 Read out – Tracking with buffering (sNq)
Single distance measurement (**only** one sensor on a single line)	Single tracking distance measurement	8.2.3 Single sensor tracking (sNh)
	Single tracking distance measurement with timer	8.2.4 Single sensor tracking with timer (sNh)

7.2 Installation

7.2.1 Connection of the device

The connection of the D-Series laser sensor is done with two screw terminal plugs. It's essential to do the connections of the device according the following sequence:

1) Check if power supply is off and used interfaces do not already transmit data
2) Wiring of the screw terminal plugs with used ports (Power supply and used device interface)
3) Connect the screw terminal plugs (First the screw terminal plug with power supply)
4) Assemble the exchangeable cover and the D-Series laser sensor carefully.
   - Before tighten the exchangeable cover: Check that the cover is properly aligned with the housing of the D-Series device. Make sure the four centering bolts are in position before tighten the screws.
   - Tighten the four screws over cross to have an equably pressure on the gasket. The target torque for these screws (Philips Slotted Combo, Philips size 1, slot size 2) is 1.6 Ncm.
5) Switch on the power supply
6) The device is read for operation

NOTICE

Connect the screw terminal plugs under voltage or while some interfaces are already transmitting data can damage the device.

- Make sure that the sensors power supply and also the power supplies off all other devices connected to the senor are switched off when connection the screw terminals.
- No warranty will be granted on improper handling.

NOTICE

If the exchangeable cover or the cable gland is not assembled properly IP65 protection is not reached and the device can be damaged by entering water.

- Check if cover closes properly and that screws are turned tight. Use a target torque of 1.6 Ncm.
- Check if cable gland closes tight around the cable**.**

7.2.2 Mounting of the device

Four slotted holes for M4 (or M3) screws and four additional threaded holes with hexagon socket set screws on the sensor side make it easy to mount the D-Series sensors.

Generally for outdoor applications it's recommend to use a protection against water, rain, snow, pollution, direct sunlight, etc. Since the D-Series sensor is an optical measuring system with lenses, the sensor optics must always be clean to ensure reliable distance measurements. Install a roof or a housing to protect the sensors. See also our accessories on www.dimetix.com for an example housing (air cooling housing).

Always follow all applicable safety regulations and never use the device outside the specifications stated under 4 Technical data on page 12.

NOTICE

When D-Series laser sensors are mounted with the exchangeable cover facing upwards drooping water could enter through the valve diaphragm and damage the device.

- Cover the sensor to prevent water from dropping on the valve diaphragm.

7.2.3 Mounting of reflective plate

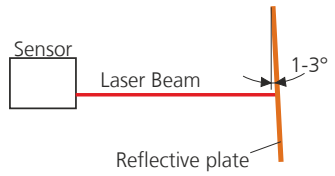


Figure 27: Mounting of reflective plates

Measuring to the reflective plate may generate erroneous measurements, if the reflective plate is mounted exactly at an angle of 90° to the laser beam. Therefore mount the reflective plate like shown in figure 27. This prevents the device from too high reflections direct to the receiver lens or laser output.

Avoid direct sunlight on the reflective plate to increase measurement performance.



The measuring range (min. / max. distance) on the reflective plate depends on the D-Series device type. Please check the device specifications in chapter 4.1 for detailed information.

7.2.4 Alignment of the laser beam

The D-Series sensor provides four hexagon socket set screw for easy sensor alignment. For more details see chapter 3.2.

But alignment of the laser beam is often difficult when the target is far away. As a hint: As a coarse alignment at a nearer target distance may helps for such difficulties. For additional accessories, see the Dimetix website www.dimetix.com.

For applications with two or more sensors measuring in the same or opposite direction ensure enough clearance between the laser spots. The laser must not point to another laser sensor directly.

NOTICE

Never point with a laser sensor direct to the optics of another laser sensor. This may damage the sensor.

- No warranty will be granted on improper handling.

7.3 Measuring performance influence

The D-Series devices are optical instruments, whose operation is influenced by environmental conditions. Therefore the measuring range and speed achieved in a specific application may vary. The following conditions can influence the measuring range and speed in a positive or negative manner:

Keywords	Factors increasing range / speed	Factors reducing range / speed
Target surface	Bright, matt and flat natural surfaces. Optimal natural surfaces: white, matt and flat Reflective surfaces such as the orange target plates (see accessories on www.dimetix.com)	Rough and dark surfaces
Airborne particles	Clean air	Dust, fog, heavy rainfall, heavy snowfall
Sunlight	Darkness, no sunlight	Bright sunlight on the target

The measurement range may also be influenced by the configuration of the measurement characteristic. See the descriptions of the measuring characteristics in 6.3 Measuring characteristic on page 30.

The D-Series laser sensor does not compensate the influence of the atmospheric environment, which may be relevant when measuring long distances (e.g. > 150 m). These effects are described in H. Kahmen & W. Faig: "*Surveying*", (1988).

7.4 Prevention of erroneous measurements

This chapter should help to prevent erroneous measurement with the D-Series sensors. Please consider the following notes in the corresponding applications. There are further information on the knowledge base on the Dimetix website (www.dimetix.com).

7.4.1 Rough surfaces

On a rough surface (e.g. coarse plaster) measure against the center of the illuminated area. To avoid measuring to the bottom of gaps in the surface use a target plate or board (see accessories on www.dimetix.com).

7.4.2 Transparent surfaces

To avoid measuring errors, do not measure against transparent surfaces such as colorless liquids (such as water) or (dust-free) glass. In case of unfamiliar materials and liquids, always carry out a trial measurement.



Erroneous measurements can occur when aiming through glass panes or if there are several objects in the line of sight.

7.4.3 Wet, smooth or high-gloss surfaces

- Aiming at an "acute" angle deflects the laser beam. The D-Series device may receive a signal that is too weak (error message 255) or it may measure the distance targeted by the deflected laser beam.
- If aiming at a right angle, the D-Series device may receive a signal that is too strong (error message 256).

NOTICE

Do not measure on high-gloss surfaces e.g. mirrors or other high reflective material. This may damage the sensor.

- No warranty will be granted on improper handling.

7.4.4 Inclined, round surfaces

Measurement is possible as long as there is enough target surface area for the laser spot. On irregular and round surfaces the arithmetic average of the illuminated surfaces will be measured.

7.4.5 Multiple reflections

NOTICE

Erroneous measurements may occur if the laser beam is reflected by other objects than the target.

- Avoid any reflective object along the measurement path.

7.4.6 Influence of other laser beams, sun light and others

NOTICE

Sunlight, flashlights or similar may disturb the distance measurement

- Shading the sensor from the top and the sides can help to reduce these disturbances.

NOTICE

Aiming directly to the sun or the sun is exactly behind the target may disturb the distance measurement or damage the D-Series laser sensor.

NOTICE

Air flickers may disturb the distance measurement.

NOTICE

Laser beams of other sensors or devices may disturb the distance measurement or damage the D-Series laser sensor.

- Other laser beams must be aligned with enough clearance to the D-Series sensor optic.
- No warranty will be granted on improper handling.

7.5 Laser life time consideration

Since the life time of the laser is limited, operate the device in a way, that the laser is switched on only when necessary. The laser life time stated under 4.1 Specifications on page 12 relates to the time while the laser is on.

The following conditions affects the laser life time in a positive manner:

- Low ambient temperature (high temperatures reduce laser life time)
- Switch laser off if possible (only do continuous measurements if necessary)

7.6 Heating functionality

This chapter is only relevant for devices with heating option used to extend the min. temperature range. To enable proper functionality with such devices the following points have to be considered:

- Consider the required supply current, see the specifications in 4.1
- The sensor heating procedure takes some heating time before distance measurements are possible. The heating time depends on operating temperature (e.g. $T_{Operating}$: -40°C –› Heating time: ~2...4 min).
- For application with continuous attached power supply (D-Series device powered, green power LED on) the heating procedure is running automatically. There is no heating time to wait before distance measurement is possible.

7.7 Application Notes / Examples

For various Application Examples and also Application Note, see the Dimetix website www.dimetix.com. There are several notes on the usage of the sensor interfaces and some example how to use the sensor in a specific application.

8 Command set

8.1 General

8.1.1 Command termination

Every command for the D-Series devices are ASCII based and terminated with <CrLf>[1] at the end of every command. The D-Series devices command answers are terminated in the same manner (<CrLf>).

8.1.2 Device identification *N*

The D-Series device can be addressed with a configurable device ID. This ID is represented in the commands by the placeholder *N*. At the location of *N* insert the Device ID.

8.1.3 Parameter separator

The command syntax uses the '+' sign as parameter separator. The '+' sign can be replaced by the minus '−' sign if applicable by the command.

8.1.4 Set/Get commands

All configuration commands of the D-Series device are used to set new configuration values. The same command without a configuration value can also be used to read the set value. The corresponding command syntax is described with an example command (s*N*eg) below:

	Set command	***Get command***
Command	s*N*eg+*aaaaaaaa*<CrLf>	s*N*eg<CrLf>
Return successful	g*N*eg?<CrLf>	g*N*eg+*aaaaaaaa*<CrLf>
Return error	g*N*@E*zzz*<CrLf>	g*N*@E*zzz*<CrLf>
Parameters	*N* Device ID *aaaaaaaa* Command parameter / configuration value; + positive / - negative *zzz* Error code	

As an example for a device with the ID of 3 (Device ID → 3) the command above looks like the following: s3eg+100<CrLf> where '3' is the device ID and '+100' the command parameter.

8.1.5 Startup sequence

After power-on, the D-Series device does the initialization and afterward a startup string g*N*? over the serial interfaces. As described before, *N* is the placeholder for the device ID of the connected D-Series sensor. After sending this startup string, the D-Series device is ready to use.

8.2 Operation commands

8.2.1 Stop / Clear command (s*N*c)

Stops the current execution and resets the status LEDs as well as the digital outputs.

	Command	
Command	s*N*c<CrLf>	
Return successful	g*N*?<CrLf>	
Return error	g*N*@E*zzz*<CrLf>	
Parameters	*N* Device ID *zzz* Error code	

8.2.2 Distance measurement (s*N*g)

Triggers simple measurement of distance. Each new command cancels an active measurement.

1 <CrLf>: Cr ⇀ Carriage return, Lf ⇀ Line feed

	Command	
Command	sNg<CrLf>	
Return successful	gNg+aaaaaaaa<CrLf>	
Return error	gN@Ezzz<CrLf>	
Parameters	*N* Device ID *aaaaaaaa* Distance in 1/10 mm *zzz* Error code	

8.2.3 Single sensor tracking (s*N*h)

Triggers continuous measurements of the distance. The measurements are made as fast as possible (Measurement speed depends on target conditions). The measurements are continued until the Stop / Clear command (sNc) is issued. The status LEDs and the digital outputs are updated corresponding to the new measured distance. Due to the continuous measurement output the following notes / cautions have to be considered on a RS-422 / RS-485 line:



Do not use this command on a RS-485 line. On RS-485 it is only possible to stop continuous measurement with a power off/on cycle.



For more than one device on a RS-422 line first stop tracking before communicating with an other device.

	Command	
Command	sNh<CrLf>	
Return successful	gNh+aaaaaaaa<CrLf>	
Return error	gN@Ezzz<CrLf>	
Parameters	*N* Device ID *aaaaaaaa* Distance in 0.1 mm *zzz* Error code	

8.2.4 Single sensor tracking with timer (s*N*h)

This command does the same as the sNh command but with the possibility to set a desired sampling time / timer. The timer triggers continuous measurements in the set interval time. For Moving Target characteristic only sample time 0 is allowed. The measurements are continued until the Stop / Clear command (sNc) is issued. Due to the continuous measurement output the following notes / cautions have to be considered on a RS-422 / RS-485 line:



Do not use this command on a RS-485 line. On RS-485 it is only possible to stop continuous measurement with a power off/on cycle.



For more than one device on a RS-422 line first stop tracking before communicating with an other device.

	Command	
Command	sNh+aaaaaaaa<CrLf>	
Return successful	gNh+bbbbbbbb<CrLf>	
Return error	gN@Ezzz<CrLf>	
Parameters	N Device ID aaaaaaaa Sampling time in 1 ms (Range: 0...86'400'000 ms, 0 –› max possible rate) bbbbbbbb Distance in 0.1 mm zzz Error code	

8.2.5 Tracking with buffering – Start (s*N*f)

Triggers continuous measurements of the distance with internal buffering in the device (buffer for one measurement). The rate of measurements is defined with the sampling time. If the sampling time is set to zero, the measurements are executed as fast as possible (Measuring speed depends on target conditions). For Moving Target characteristic only sample time 0 is allowed. The latest measurement can be read out from the D-Series sensor with the command sNq. The measurements are continued until the sNc command is issued.

	Set command	Get command
Command	sNf+aaaaaaaa<CrLf>	sNf<CrLf>
Return successful	gNf?<CrLf>	gNf+aaaaaaaa<CrLf>
Return error	gN@Ezzz<CrLf>	gN@Ezzz<CrLf>
Parameters	N Device ID aaaaaaaa Sampling time in 1 ms (Range: 0...86'400'000 ms, 0 –› max possible rate) zzz Error code	

8.2.6 Read out – Tracking with buffering (s*N*q)

After starting "tracking with buffering" with the command sNf, the latest measurement can be read out from the sensor with the command sNq. This command does not work if the tracking with buffering is not started.

	Command	
Command	sNq<CrLf>	
Return successful	gNq+aaaaaaaa+b<CrLf>	
Return error	gN@Ezzz+b<CrLf>	
Parameters	N Device ID aaaaaaaa Distance in 0.1 mm b 0 –› No new measurement since last sNq command 1 –› One new measurement since last sNq command, not overwritten 2 –› More than one measurement since last sNq command, overwritten zzz Error code	

8.2.7 Signal measurement (s*N*m)

Signal measurement can be done continuously or with a single measurement. The signal strength is returned as a relative number in the typical range of 0 to ~25'000. The value for the signal strength is just an approximate value, it differs from device to device, device series and also depends on environment conditions. The repetitive signal measurements are continued until the Stop / Clear command (sNc) is issued. Due to the continuous measurement output possibility the following notes / cautions have to be considered on a RS-422 / RS-485 line:



Do not use the repetitive signal measurement command on a RS-485 line. On RS-485 it is only possible to stop continuous signal measurement with a power off/on cycle.



For more than one device on a RS-422 line first stop repetitive signal measurement before communicating with an other device.

	Command	
Command	sNm+a<CrLf>	
Return successful	gNm+bbbbbbbb<CrLf>	
Return error	gN@Ezzz<CrLf>	
Parameters	*N* Device ID *a* 0 –› Single measurement 1 –› Repetitive measurements (Warning: Consider the listed notes and cautions!) *bbbbbbbb* Signal strength (range 0.. ~25'000) *zzz* Error code	

8.2.8 Temperature measurement (s*N*t)

Triggers measurement of the temperature of the device.

	Command	
Command	sNt<CrLf>	
Return successful	gNt+aaaaaaaa<CrLf>	
Return error	gN@Ezzz<CrLf>	
Parameters	*N* Device ID *aaaaaaaa* Temperature in 0.1°C *zzz* Error code	

8.2.9 Read/Clear error stack (s*N*re, s*N*ce)

Reads or clears the error stack of the device. The errors in the error stack are stored permanently until a clear error stack command (sNce) is done.

	Read command	***Clear command***
Command	sNre<CrLf>	sNce<CrLf>
Return successful	gNre+aaa+aaa+aaa+..<CrLf>	gNce?<CrLf>
Return error	gN@Ezzz<CrLf>	gN@Ezzz<CrLf>
Parameters	*N* Device ID *aaa* List of occurred error codes (stored since last error stack clear command sNce) First list entry is the last occurred error code, 0 –› No error). *zzz* Error code	

8.2.10 Laser on (s*N*o)

Switches the laser beam on for easy sensor adjustment. The laser is on until the Stop / Clear command (sNc) is issued.

	Command	
Command	sNo<CrLf>	
Return successful	gN?<CrLf>	
Return error	gN@Ezzz<CrLf>	
Parameters	*N* Device ID *zzz* Error code	

8.3 Configuration commands

Generally the configuration commands are volatile until the configurations of the device are saved with the 8.3.16 Save configuration parameters (sNs) command. There exist some exceptions where the configurations will be saved automatically but these are explicitly mentioned.

For details about the configuration process and the possible configuration types see chapter 6.1.



Use the Save configuration parameters (sNs) command to save device configurations permanently.

8.3.1 Set communication settings (s*N*br)

Sets the communication settings for the serial interface RS-232 / RS-422 / RS-485. The settings number 7 (marked with gray) is the default communication setting (factory default or after a device reset).



A change in the communication setting number will be activated after power off sequence.

	Command	
Command	sNbr+aa<CrLf>	
Return successful	gN?<CrLf>	
Return error	gN@Ezzz<CrLf>	
Parameters	*N* Device ID *aa* Number of communication setting:	

aa	**Baud rate**	**Data bits**	**Parity**	**Stop bits**
1	9600	8	None	1
2	19200	8	None	1
6	9600	7	Even	1
7	19200	7	Even	1
10	115200	8	None	1
11	115200	7	Even	1

zzz Error code

8.3.2 Set device ID (s*N*id)

Sets the device identification *N*. The device ID *N* is used for the most of all commands.

	Command	
Command	sNid+aa<CrLf>	
Return successful	gN?<CrLf>	
Return error	gN@Ezzz<CrLf>	
Parameters	*N* Device ID *aa* New device ID, range 0...99 *zzz* Error code	

8.3.3 Set/Get analog output min level (s*N*vm)

This command sets the minimum analog output current level (0 or 4 mA).

	Set command	Get command
Command	sNvm+a<CrLf>	sNvm<CrLf>
Return successful	gNvm?<CrLf>	gNvm+a<CrLf>
Return error	gN@Ezzz<CrLf>	gN@Ezzz<CrLf>
Parameters	N Device ID a Minimum current for analog output 0 –› Minimum current is 0 mA 1 –› Minimum current is 4 mA zzz Error code	

8.3.4 Set/Get analog output value in error case (sNve)

This command sets the analog output current level in mA in case of an error. This level can be lower than the minimum level set with the sNvm command.

	Set command	Get command
Command	sNve+aaa<CrLf>	sNve<CrLf>
Return successful	gNve?<CrLf>	gNve+aaa<CrLf>
Return error	gN@Ezzz<CrLf>	gN@Ezzz<CrLf>
Parameters	N Device ID aaa Value in case of an error in 0.1 mA, range 0...200 If the value is set to 999, in case of an error keep the last valid distance zzz Error code	

8.3.5 Set/Get analog output distance range (sNv)

Sets the minimum and maximum distances corresponding to the minimum and maximum analog output current levels.

0...20mA

$$Aout = \frac{DIST - D_{min}}{D_{max} - D_{min}} * 20mA$$

4...20mA

$$Aout = \frac{DIST - D_{min}}{D_{max} - D_{min}} * 16\,mA + 4\,mA$$

Aout –› Analog current output
DIST –› Actual measured distance
D_{min} –› Distance programmed for the minimum output current
D_{max} –› Distance programmed for the maximum output current

	Set command	Get command
Command	sNv+aaaaaaaa+bbbbbbbb<CrLf>	sNv<CrLf>
Return successful	gNv?<CrLf>	gNv+aaaaaaaa+bbbbbbbb<CrLf>
Return error	gN@Ezzz<CrLf>	gN@Ezzz<CrLf>
Parameters	N Device ID aaaaaaaa Minimum distance in 1/10 mm corresponding to 0 mA / 4 mA bbbbbbbb Maximum distance in 1/10 mm corresponding to 20 mA zzz Error code	

8.3.6 Set/Get digital output type (sNot)

Sets the output type for all digital outputs. It's possible to select NPN, PNP or Push-Pull outputs.



The configuration of the output type takes effect on all digital outputs (DO1, DO2, DOE).

	Set command	***Get command***
Command	sNot+*a*<CrLf>	sNot<CrLf>
Return successful	gNot?<CrLf>	gNot+*a*?<CrLf>
Return error	g*N*@E*zzz*<CrLf>	g*N*@E*zzz*<CrLf>
Parameters	*N* Device ID *a* Digital output type (for all digital outputs): 0 –› NPN (Low driven, load between V+ and DOx output) 1 –› PNP (High driven, load between DOx output and GND) 2 –› Push-pull (Low & High driven) *zzz* Error code	

8.3.7 Set/Get digital output hysteresis (s*N*1, *sN*2)

Sets or gets the individual digital output hysteresis of the two digital outputs 1 and 2. For every output a switching ON and OFF level must be configured. For details about the configuration possibilities and its functionality see chapter 6.5.

	Set command	***Get command***
Command	s*Na*+*bbbbbbbb*+*cccccccc*<CrLf>	s*Na*<CrLf>
Return successful	g*Na*?<CrLf>	g*Na*+*bbbbbbbb*+*cccccccc*<CrLf>
Return error	g*N*@E*zzz*<CrLf>	g*N*@E*zzz*<CrLf>
Parameters	*N* Device ID *a* Digital output number (1 or 2) *bbbbbbbb* ON level of the hysteresis (unit depends on data source, [0.1mm], [mm/s], [1] or [0.1°C]) *cccccccc* OFF level of the hysteresis (unit depends on data source, [0.1mm], [mm/s], [1] or [0.1°C]) *zzz* Error code	

8.3.8 Set/Get digital input function (s*N*DI1)

The digital output DO1/DI1 of the D-Series sensors can also be used as digital input. The command sNDI1 configures a function / event for the device. The level of the digital input can be read with the command sNRI.



Activation of a digital input function of DI1, deactivate the digital output DO1 automatically.

	Set command	***Get command***
Command	s*N*DI1+*aaaaaaaa*<CrLf>	s*N*DI1<CrLf>
Return successful	g*N*DI1?<CrLf>	s*N*DI1+*aaaaaaaa*<CrLf>
Return error	g*N*@E*zzz*<CrLf>	g*N*@E*zzz*<CrLf>
Parameters	*N* Device ID *aaaaaaaa* Digital input functions: 0 –› Digital input DI1 deactivated (Digital output DO1 activated). 2 –› Trigger Distance measurement (sNg) 3 –› Start/Stop Single sensor tracking (sNh) 4 –› Start/Stop Tracking with buffering and time (sNf+)[1] 8 –› Start/Stop Single sensor tracking with time (s*N*h+)[2] *zzz* Error code	

1 sNf+: Uses the tracking time set by a previous tracking command sNf+aaaaaaaa / sNh+aaaaaaaa (a –› Measuring time)

2 sNh+: Uses the tracking time set by a previous tracking command sNh+aaaaaaaa / sNf+aaaaaaaa (a –› Measuring time)

8.3.9 Get digital input (s*N*RI)

Reads the digital input level (low / high) of DO1/DI1. Note for the use of DO1 instead of DI1, this command reads the logical level of the digital output.

	Command	
Command	`sNRI<CrLf>`	
Return successful	`gNRI+a<CrLf>`	
Return error	`gN@Ezzz<CrLf>`	
Parameters	*N* Device ID *a* 0 –› Input Off (Signal Low) 1 –› Input On (Signal High) *zzz* Error code	

8.3.10 Set/Get configuration of RS-422/485 and SSI (s*N*SSI)

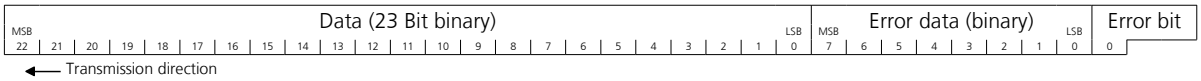
The SSI interface is not available on all D-Series devices (check the device specification for details, see chapter 4.1) and is deactivated by default. The SSI and the RS-422/485 interfaces uses the same differential output driver, so only one of them can be activated at the same time.



Only one interface (RS-422/485 or SSI) can be activated at the same time.

	Set command	***Get command***
Command	`sNSSI+aaa<CrLf>`	`sNSSI<CrLf>`
Return successful	`gNSSI?<CrLf>`	`gNSSI+aaa<CrLf>`
Return error	`gN@Ezzz<CrLf>`	`gN@Ezzz<CrLf>`
Parameters	*N* Device ID *aaa* Binary coded settings: Bit0 0 –› Activate RS-422/485 interface (SSI is deactivated) 1 –› Activate SSI interface with settings below (RS-422/485 is deactivated) Bit1 0 –› Binary coded (applied for: All data) 1 –› Gray coded (applied for: 23/24-Bit data value, attached 8-Bit error data) Bit2 0 –› No error bit output 1 –› Error bit attached to the output data value Bit3 0 –› No additional error data output 1 –› Attach 8-Bit error data (Calculation: Error data = Error code[1] - 200)[2] Bit4..5 00 –› 24-Bit data value 01 –› 23-Bit data value 10 –› 25-Bit data value Bit5..15 –› Not used *zzz* Error code	

Configuration example: SSI activated, 23-Bit data (binary), 8-Bit error data (binary) and error bit



Configuration:	Binary data: 11101_2 –› 29 Bit0 –› 1: SSI interface activated Bit1 –› 0: Binary coded data output Bit2 –› 1: Error bit attached to the output data value Bit3 –› 1: Attach 8-Bit SSI error data (Error code - 200) Bit4 –› 1: 23-Bit data value
Command:	`sNSSI+29`

1 Possible error codes of sensor, see table in chapter 8.6 Error codes.

2 Adaptation of sensor error code range for SSI transmission within 8-Bit. E.g.: @E255 (Low signal) – 200 = 55 (SSI error data for SSI transmission)

8.3.11 Set/Get error value of SSI output (s*N*SSIe)

In case of an error the SSI output will show a value corresponding to this configuration. There can be a replacement value in a range of 0 to 16777215 (24-Bit) or 0 to 8388607 (23-Bit), the last valid distance value or the error code. All values are shown either as binary value or gray coded depending on SSI configuration.

	Set command	***Get command***
Command	s*N*SSIe+*aaaaaaaa*<CrLf>	s*N*SSIe<CrLf>
Return successful	g*N*SSIe?<CrLf>	g*N*SSIe+*aaaaaaaa*<CrLf>
Return error	g*N*@E*zzz*<CrLf>	g*N*@E*zzz*<CrLf>
Parameters	*N* Device ID *aaaaaaaa* 0..2^{24}-1 / 0..2^{23}-1 –› Replacement value (depending on the SSI settings, the value will be converted to gray code). In case of an error, the data value will be replaced by this replacement value. -1 –› In case of an error the last distance value will stay at the output. -2 –› In case of an error, the error code will be at the output. *zzz* Error code	

8.3.12 Set/Get measuring characteristic (s*N*mc)

The D-Series device provides different measuring characteristics to allow an adjustment of the measuring process of the device. This functionality makes it possible to optimize measuring accuracy and measuring speed for a specific application and its requirement. For detailed information about the available measuring characteristics, see 6.3 Measuring characteristic.

	Set command	***Get command***
Command	s*N*mc+*aaaaaaaa*<CrLf>	s*N*mc<CrLf>
Return successful	g*N*mc?<CrLf>	g*N*mc+*aaaaaaaa*<CrLf>
Return error	g*N*@E*zzz*<CrLf>	g*N*@E*zzz*<CrLf>
Parameters	*N* Device ID *aaaaaaaa* 0 –› Normal 1 –› Fast 2 –› Precise 3 –› Timed 4 –› Moving target *zzz* Error code	

8.3.13 Set/Get measurement filter configuration (s*N*fi)

The filter applied to the distance measurement values can be configured with the following parameters and guidelines.

	Set command	***Get command***
Command	s*N*fi+*aa*+*bb*+*cc*<CrLf>	s*N*fi<CrLf>
Return successful	g*N*fi?<CrLf>	g*N*fi+*aa*+*bb*+*cc*<CrLf>
Return error	g*N*@E*zzz*<CrLf>	g*N*@E*zzz*<CrLf>
Parameters	*N* Device ID *aa* Filter length (0 –› Filter off, 2…32 –› Allowed filter length) *bb* Number of spikes to suppress (always pairs of min and max value) *cc* Maximum number of errors to suppress. Condition: 2*bb + cc <= 0.4*aa *zzz* Error code	

8.3.14 Set/Get auto start configuration (s*N*A)

This command activates the stand-alone mode with auto start of the D-Series devices. It triggers continuous measurements of the distance. The analog, digital and SSI outputs are updated according to the measured distance values. The sampling time defines the measurement rate. If the sampling time is set to zero, the measurements are executed as fast as possible (depending on target conditions). For Moving Target characteristic only sample time 0 is allowed. The stand-alone mode with auto start is active until the Stop / Clear command (s*N*c) is received by the device. The Stop / Clear command only suspends the stand-alone mode with auto start temporarily. To deactivate this mode permanently a Save configuration (s*N*s) command after the Stop / Clear command is necessary.



The stand-alone mode with auto start is stored permanently in the device and activated immediately. This mode is activated automatically after power on.



To stop / clear the stand-alone mode with auto start permanently a Save configuration (sNs) command after the Stop / Clear command is necessary.



Internally, "Tracking with buffering" is started (see command: sNf). Therefore, the latest measurement can also be read out from the device with the command sNq.

	Set Command	***Get Command***
Command	sNA+aaaaaaaa<CrLf>	sNA<CrLf>
Return successful	gNA?<CrLf>	gNA+aaaaaaaa<CrLf>
Return error	gN@Ezzz<CrLf>	gN@Ezzz<CrLf>
Parameters	*N* Device ID *aaaaaaaa* Sampling time in 1 ms (Range: 0...86'400'000 ms, 0 → max possible rate) *zzz* Error code	

8.3.15 Set configuration parameters to factory default (s*N*d)

This command restores all configuration parameters to their factory default values. The parameters are written to the flash memory and therefore permanently saved.



This will also reset the communication settings to the factory default.

	Command	
Command	sNd<CrLf>	
Return successful	gN?<CrLf>	
Return error	gN@Ezzz<CrLf>	
Parameters	*N* Device ID *zzz* Error code	

8.3.16 Save configuration parameters (s*N*s)

This command saves all configuration parameters, which are set by the configuration commands above. The parameters are written to the flash memory.

	Command	
Command	sNs<CrLf>	
Return successful	gNs?<CrLf>	
Return error	gN@Ezzz<CrLf>	
Parameters	*N* Device ID *zzz* Error code	

8.4 Extended configuration commands

8.4.1 Set/Get user output format (s*N*uo)

This command allows the configuration of a user specific output format. The configuration only affects the selected serial interface RS-232, RS-422/485 and USB. For more details about the data output of the D-Series sensor, see 6.4 Data output.

The user output format can be configured to fit the requirement of an external ASCII display. A parameter for the output format between 100 and 199 defines the format for an external display (User gain / offset are used too). The parameter (b) defines the field length of the ASCII display (including decimal point). The decimal point will be inserted at the position (counted from the right) defined by the parameter (a). The distance on the display will be right aligned. This format configuration is not applicable for RS-485.

It is also possible to use the default output format / protocol (Factory default) with a configured user gain and offset. The command parameter value of 200 sets this default format with activated user gain and offset (8.4.2 Set/Get user distance offset (sNuof) and 8.4.3 Set/Get user distance gain (sNuga).

With some extended distance output format configurations (`sNuo+300`, `sNuo+301`), it's possible to add signal, temperature and speed information to the default distance output format. The configured user gain and offset are considered for these output formats too.

	Set command	***Get command***
Command	`sNuo+aaaaaaaa<CrLf>`	`sNuo<CrLf>`
Return successful	`gNuo?<CrLf>`	`gNuo+aaaaaaaa<CrLf>`
Return error	`gN@Ezzz<CrLf>`	`gN@Ezzz<CrLf>`
Parameters	*N* Device ID *aaaaaaaa* Output format 0 –› Default format (Factory setting), e.g. “g0g+00001234\r\n” 1ab –› Display output format (For external display), e.g. “1.234\r\n” a –› Number of digits after decimal point b –› Field with (sign included) must be greater than 0 Conditions: a≤b, if a=b, no decimal point is output. 200 –› Default format with user offset / gain active, e.g. “g0g-00000234\r\n” Distance output = (Distance + Offset) * Gain 300 –› Extended distance format and user offset / gain active. Format: Distance [0.1 mm] + Signal [1] + Temperature [0.1°C] e.g. “g0g+00000234+008384+254\r\n” 301 –› Extended distance format with additional speed data and user offset / gain active Format: Distance [0.1 mm] + Signal [1] + Temperature [0.1°C] + Speed [mm/s]) e.g. “g0g+00000234+008384+254+000500\r\n” Remark: Speed value of +999999 indicates invalid speed data (only in Moving Target with distance jumps). *zzz* Error code	

8.4.2 Set/Get user distance offset (s*N*uof)

The user can set an individual user offset to create a user defined distance output value. This configuration takes effect in all distance measurement commands but only if the corresponding user output format is activated (see 8.4.1 Set/Get user output format (sNuo) for more details). The calculation of the user offset is described in 6.4.2 User gain / offset.



The user distance offset is only considered for the corresponding user output format and on the selected serial interface RS-232, RS422/485 and USB.

	Set command	***Get command***
Command	`sNuof+aaaaaaaa<CrLf>`	`sNuof<CrLf>`
Return successful	`gNuof?<CrLf>`	`gNuof+aaaaaaaa<CrLf>`
Return error	`gN@Ezzz<CrLf>`	`gN@Ezzz<CrLf>`
Parameters	*N* Device ID *aaaaaaaa* Offset in 0.1 mm (+/- offset possible) *zzz* Error code	

8.4.3 Set/Get user distance gain (s*N*uga)

The user can set an individual user gain to create a user defined distance output value. This configuration takes effect in all distance measurement commands but only if the corresponding user output format is activated (see 8.4.1 Set/Get user output format (sNuo) for more details). The calculation of the user gain is described in 6.4.2 User gain / offset.



The user distance offset is only considered for the corresponding user output format and on the selected serial interface RS-232, RS422/485 and USB.

	Set command	***Get command***
Command	sNuga+*aaaaaaaa*+*bbbbbbbb*<CrLf>	s*N*uga<CrLf>
Return successful	g*N*uga?<CrLf>	g*N*uga+*aaaaaaaa*+*bbbbbbbb*<CrLf>
Return error	g*N*@E*zzz*<CrLf>	g*N*@E*zzz*<CrLf>
Parameters	*N* Device ID *aaaaaaaa* GainNum –› Numerator of gain calculation *bbbbbbbb* GainDen –› Denominator of gain calculation (Attention: GainDen ≠ 0, must not be zero) *zzz* Error code	

8.4.4 Set/Get user mode (s*N*um)

This command allows the configuration of special user modes.

	Set command	***Get command***
Command	s*N*um+*a*<CrLf>	s*N*um<CrLf>
Return successful	g*N*um?<CrLf>	g*N*um+*aaaaaaaa*<CrLf>
Return error	g*N*@E*zzz*<CrLf>	g*N*@E*zzz*<CrLf>
Parameters	*N* Device ID *a* User mode number: 0 –› Default mode, no user mode active 2 –› Activate user mode for auto start with serial output enable (RS-232, RS-422/485, USB) 5 –› Activate user mode for linear signal output (e.g. used for signal monitoring function) Other –› Not used *zzz* Error code	

8.4.5 Set/Get additional measurement filter configuration (s*N*afi)

This command allows additional measurement filter / feature configurations. For more details about the available configurations see the corresponding chapter 6.4.5.

	Set command	***Get command***
Command	s*N*afi+*a*+*bbbbbbbb*<CrLf>	s*N*afi+*a*<CrLf>
Return successful	g*N*afi+*a*?<CrLf>	g*N*afi+*a*+*bbbbbbbb*<CrLf>
Return error	g*N*@E*zzz*<CrLf>	g*N*@E*zzz*<CrLf>
Parameters	*N* Device ID *a* Additional filter / feature number: 1 –› Max. allowed distance change / jump configuration 2 –› Calming filter configuration for distance measurements in Moving Target 3 –› Max. allowed signal change (signal monitoring) configuration Other –› Not used *bbbbbbbb* If a = 1 –› Max. allowed distance change / jump in 0.1 mm (0 –› Filter / Feature disabled) If a = 2 –› Calming filter length 1...400 (0 –› Filter disabled) If a = 3 –› Max. allowed signal change / jump in % (0 –› Filter / Feature disabled) *zzz* Error code	

8.4.6 Set/Get additional digital output configuration (s*N*ado)

This command allows additional digital output configuration possibilities (data source, function and pulse width) for the digital output 1 and 2. For every output the data source, switching function and pulse width can be configured. For details about the configuration possibilities and its functionality see the corresponding chapter 6.5.

	Set command	***Get command***
Command	sNado+*a*+*bbb*+*ccc*+*dddddddd*<CrLf>	sNado+*a*<CrLf>
Return successful	gNado+*a*?<CrLf>	gNado+*a*+*bbb*+*ccc*+*dddddddd*<CrLf>
Return error	g*N*@E*zzz*<CrLf>	g*N*@E*zzz*<CrLf>
Parameters	*N* Device ID *a* Digital output number (1 or 2) *bbb* Data source used for the corresponding digital output: 0 –› Distance. Digital output levels (ON, OFF) and pulse width in [0.1 mm] 1 –› Speed. Digital output levels (ON, OFF) and pulse width in [mm/s] 2 –› Signal. Digital output levels (ON, OFF) and pulse width in [1] 3 –› Temperature: Digital output levels (ON, OFF) and pulse width in [0.1°C] *ccc* Switching function of the corresponding digital output: 0 –› Hysteresis. Digital output levels (ON, OFF) used. 1 –› Pulse. Digital output levels (ON, OFF) and pulse width used. *dddddddd* Pulse width in [0.1 mm], [mm/s], [1] or [0.1°C] (only used for pulse switching function) *zzz* Error code	

8.5 Information commands

8.5.1 Get software version (s*N*sv)

Reads the software version of the D-Series device.

	Command	
Command	sNsv<CrLf>	
Return successful	gNsv+*aaaabbbb*<CrLf>	
Return error	g*N*@E*zzz*<CrLf>	
Parameters	*N* Device ID *aaaa* Internal measuring module software version *bbbb* Interface software version *zzz* Error code	

8.5.2 Get serial number (s*N*sn)

Reads the serial number of the D-Series device.

	Command	
Command	sNsn<CrLf>	
Return successful	gNsn+*aaaaaaaa*<CrLf>	
Return error	g*N*@E*zzz*<CrLf>	
Parameters	*N* Device ID *aaaaaaaa* Serial number of the device *zzz* Error code	

8.5.3 Get device type (s*N*dt, dt)

Reads the device type of D-Series device.



Never use dt command if more than one device is connected to the serial interfaces.

	Command	
Command	`sNdt<CrLf>` `dt<CrLf>`	
Return successful	`gNdt+0xyy<CrLf>`	
Return error	`gN@Ezzz<CrLf>`	
Parameters	*N* Device ID *x* Device series number *yy* Device number Output for *0xyy* 0401 → D-Series laser sensor *zzz* Error code	

8.5.4 Get device generation and type (dg)

Reads the device generation & type of the D-Series devices. The answer includes the device type, device generation and the active communication setting. Works only for newer sensor generations (starting from device generation C).



Never use this command if more than one device is connected to the serial interfaces.

	Command	
Command	`dg<CrLf>`	
Return successful	`gNdg+aaa+bc<CrLf>`	
Return error	`gN@Ezzz<CrLf>`	
Parameters	*N* Device ID *aaa* Bit coded number to identify the device: 0x54 (84) → D-Series sensor *b* Internal information *c* Communication settings (see command `sNbr`) *zzz* Error code	

8.6 Error codes

The following table lists the most important error codes of the D-Series devices. For not listed error codes, please contact Dimetix.

No.[1)]	**Format**	**Description**	**Troubleshooting**
0		No error	No troubleshooting
200		Boot-up event of sensor	Used for error stack to see boot-up of the sensor
203	`@E203`	Wrong command, parameter or syntax	Check command, parameter and communication settings (Baud rate, stop bits, parity and termination).
210	`@E210`	Sensor not in tracking mode	Start tracking measurement first.
211	`@E211`	Tracking measurement time too short	Tracking measurement time of the device is too short for the measurement conditions. Increase measurement time or improve measurement conditions.
212	`@E212`	Command cannot be executed, while tracking measurement is active	Measurement has to be stopped with Stop / Clear command s*N*c before execute the new command.
220	`@E220`	Error in the serial communication	Check communication settings (Baud rate, stop bits, parity and termination).
230	`@E230`	Distance value overflow caused by wrong user configuration.	Check user offset / gain configuration.
233	`@E233`	Number cannot be displayed	Check output format
234	`@E234`	Distance not in measurement range	Check measurement setup and distance to the measuring surface / target.

No.[1)]	Format	Description	Troubleshooting
236	@E236	Conflict in digital input / output DI1/DO1 configuration	Check digital input / output DI1/DO1 configuration. Only input or output possible, otherwise input / output conflict.
252	@E252	Temperature too high	Reduce ambient temperature. Contact Dimetix if the error occurs at room temperature.
253	@E253	Temperature too low	Increase ambient temperature. For device with heater functionality, wait until heater increased temperature. Contact Dimetix if the error occurs at room temperature.
255	@E255	Received signal too low or distance not in range	Check measurement setup and use a higher reflective measuring surface. Contact Dimetix if the error persist after checking the measurement setup.
256	@E256	Received signal too high	Check measurement setup and use a lower reflective measuring surface. Prevent measuring high reflective / high glossy surfaces, for details see chapter 7.4 Prevention of erroneous measurements. Contact Dimetix if the error persist after checking the measurement setup.
257	@E257	Signal to Noise (SNR) too low (Background light too strong)	Increase signal from measuring target (check measuring target) and / or reduce background lights / noise (sunlight or other strong light source).
258	@E258	Power supply voltage is too high	Check the supply voltage against the device specification.
259	@E259	Power supply voltage is too low	Check the supply voltage against the device specification.
260	@E260	Signal too unstable for a distance measurement	Check the measurement setup and use stable measuring surface.
261	@E261	Distance change/jump higher than set limit	Check the application for not allowed distance jumps or adapt the configured limit. Restart measurement to clear the error condition.
262	@E262	Signal change/jump higher than set limit	Check the application for not allowed signal changes or adapt the configured limit. Restart measurement to clear the error condition.
284	@E284	Signal disturbance in the laser output	Check the small laser output glass for pollution. Clean the optical part carefully with a clean soft glasses cleaning cloth or cotton buds and avoid scratching.
290	@E290	Signal disturbance in the sensor optic e.g. laser output or receiver lens	Check the small laser output glass and the receiver lens for pollution. Clean the optical parts carefully with a clean soft glasses cleaning cloth and avoid scratching. Contact Dimetix if the error persist after checking the measurement setup.
400	@E400	Firmware download for Industrial Ethernet module not possible, module is busy	Check connection and power of the D-Series device. Proceed a power cycle and restart firmware download.
401	@E401	Firmware download for Industrial Ethernet module not possible, no module connected	Connect the Industrial Ethernet to the D-Series device before starting firmware download.
402	@E402	Firmware download for measurement module not possible	Check connection and power of the D-Series device. Proceed a power cycle and restart firmware download.
Not listed		Please contact Dimetix	

[1)] To calculate the error code out of the SSI error data (see 8.3.10 Set/Get configuration of RS-422/485 and SSI (sNSSI)), do the calculation as follows:
Error code = SSI error data +200.

Before contacting Dimetix, please prepare information about the following subjects. This will help to find out the cause of a failure / error.

- Device type and serial number
- Error code / codes and status LED's
- Short description of measuring setup (Used interface, configuration, measuring target, measurement conditions, etc.)
- Short description of the device behavior before, during and after error

9 Frequently asked questions (FAQ's)

For the up to date library of frequently asked questions see the knowledge base on the Dimetix website https://dimetix.com/knowledge-base/.

10 Glossary

ASCII	American Standard Code for Information Interchange (ASCII)
ESD	Electrostatic Discharge
EMC	Electromagnetic Compatibility
Industrial Ethernet	Industrial Ethernet interfaces e.g. PROFINET, EtherCAT, EtherNet/IP (Real-Time Ethernet interfaces)
PLC	Programmable Logic Controller (e.g. Siemens S7)
SSI	Serial Synchronous Interface (SSI)

11 Revision history

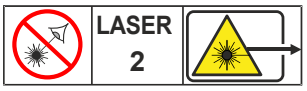
The release versions and the changes of this Technical Reference Manual are listed below.

Date	Revision	Changes
22.08.2017	V1.00	First release of the Technical Reference Manual.
26.09.2017	V1.01	Some additions in the descriptions of the electrical interfaces according EMC testings and requirements.
06.02.2018	V1.03	Some additional descriptions of user output protocol.
16.05.2018	V1.04	Some additional descriptions for Industrial Ethernet interface and data output.
02.07.2018	V1.05	Corrections in the digital input specifications. Description for heating functionality added. Support of sensor ID range 0...99 in the chapter of RS-422/485 interface. Some quality optimizations in charts and diagrams.
04.10.2018	V1.06	Revised figure about output data flow and configuration possibilities in chapter 6.4 Data output. Added chapter 6.4.4 Moving Target filter with description of filter characteristic and output rate. Added calculation guidelines in chapter 5.6 Analog output for the use of high load resistances (up to 500 Ω).
24.09.2019	V1.07	Small correction for the output filter drawings in chapter 6.4.3. Added new sensor types DEN-10-500, DEH-30-500 and DBN-50-050 in chapter 3.1 and 4.1. Added new command for configuration of user mode and overworked the auto start configuration process. See chapter 6.2, 6.2.2 and 8.4.4 for details. Completed the measurement characteristic and Corrections in conjunction with the device ID. Device ID configuration range is 0...99 and for RS-422/485 up to 100 devices can be connected.
22.10.2019	V1.08	Added new configuration possibilities for the user output format in chapter 6.4.1 and 8.4.1.
02.03.2020	V1.09	Moved chapter 2 Safety instructions (new chapter 2, old chapter 7) Moved chapter 2.7 Laser specification (new chapter 2.7, old chapter 7.10) New chapters 1 Document scope and 2.1 Explanation of symbols. New chapter 2.2 Permitted use and 2.3 Prohibited use/Limits to use replace old chapter 7.1 Use of the instrument and 7.2 Limits to use. Revised all Warning, Caution and Notice messages in the document: Symbols and text changed. Added reference to Laser specification in the Specifications table chapter 4.1 (Row: Light source).
16.03.2020	V1.10	New chapter 6.4.5 Additional filter functionality for additional configuration possibilities.
03.02.2021	V1.11	New error code @E261, @E284 and @E290 with error description in chapter 8.6. Extended troubleshooting description for error code @E256 in chapter 8.6. Added relative humidity (operation / storage) in the specification table. Revised chapter 7.2.2 Mounting of the device. Important notes for outdoor applications to protect the sensor. Added target torque value for the screws of the exchangeable cover in chapter 7.2.1 Connection of the device. New command for digital output pulse configuration in chapter 8.4.6. New get functionality for the user mode configuration command in chapter 8.4.4. Added target torque for Philips Slotted Combo screws in chapter 3.2. Added connection overview of the crew terminal block and plug in chapter 5. New digital output description in chapter 6.5 Digital output.
03.01.2022	V1.12	Error calculation formula of analog output corrected in chapter 5.6.1 Specifications. Added max. target speed for Moving Target measurement characteristic in chapter 6.3 Measuring characteristic. Added configuration value range for analog output value in error case in chapter 8.3.4. Improved description of the SSI configuration command in chapter 8.3.10. Improved and supplemented description of the extended distance format with additional speed data in chapter 8.4.1 Set/Get user output format (sNuo). New information about invalid speed data in Moving Target measurement characteristics.

		Added SSI 25 data bit configuration option in chapter 8.3.10. New additional filter configuration (s*N*afi+3) in chapter 6.4.5 Additional filter functionality and 8.4.5 Set/Get additional measurement filter configuration (sNafi). New user mode 5 in chapter 8.4.4 Set/Get user mode (sNum).
24.02.2023	V1.13	Added note "user display output format not applicable for RS-485 interface" in chapter 6.4.1 User output format / protocol and 8.4.1 Set/Get user output format (sNuo). Added recommended contact size for the shield tab in chapter 3.2. Removed reference to PROFIBUS interface (external) in specification table in chapter 4.1. Added remarks that display output format is not applicable for RS-485 interface in chapter 6.4.1 and 8.4.1. Added Application Note references in the table in chapter 6.4.5. Added text in the command table in chapter 8.4.5 for better understanding. Added error code @E262 in chapter 8.6. Added command example with device ID in chapter 8.1.4. Changed max. measuring and output rate from 50 Hz to 100 Hz and typical time for a measurement from 0.02 s to 0.01 s for sensor types DEN, DEH, DAN and DAE in the specification table in chapter 4.1.
21.03.2023	V1.14	Added footnote no. 11 in the specification table in chapter 4.1. Added footnote no. 6 in the measurement characteristic table in chapter 6.3.

Important Notice

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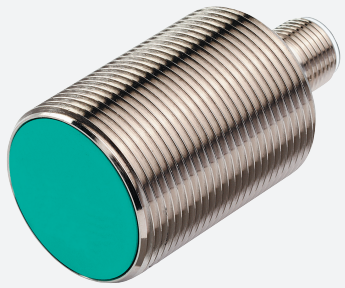
Wavelength: 620-690nm, Max Power < 1mW
Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice no. 50 dated June 24, 2007, with IEC 60825-1:2014

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TAB 8
Proximity Sensor
(Ovivo USA, LLC Part No. 771678)

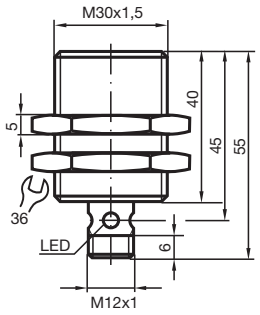


Inductive sensor

NCB15-30GM40-N0-V1

- 15 mm quasi flush
- Usable up to SIL 2 acc. to IEC 61508

Dimensions



Technical Data

General specifications		
Switching function		Normally closed (NC)
Output type		NAMUR
Rated operating distance	s_n	15 mm
Installation		quasi flush
Assured operating distance	s_a	0 ... 12.15 mm
Actual operating distance	s_r	13.5 ... 16.5 mm typ.
Reduction factor r_{Al}		0.33
Reduction factor r_{Cu}		0.29
Reduction factor r_{304}		0.76
Output type		2-wire
Nominal ratings		
Nominal voltage	U_o	8.2 V (R_i approx. 1 kΩ)
Switching frequency	f	0 ... 450 Hz

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Technical Data

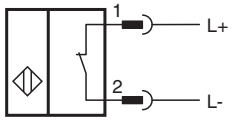
Hysteresis	H	1 ... 15 typ. 5 %
Reverse polarity protection		reverse polarity protected
Short-circuit protection		yes
Current consumption		
Measuring plate not detected		min. 2.2 mA
Measuring plate detected		≤ 1 mA
Switching state indicator		Multihole-LED, yellow
Functional safety related parameters		
Safety Integrity Level (SIL)		SIL 2
$MTTF_d$		3068 a
Mission Time (T_M)		20 a
Diagnostic Coverage (DC)		0 %
Compliance with standards and directives		
Standard conformity		
NAMUR		EN 60947-5-6:2000 IEC 60947-5-6:1999
Electromagnetic compatibility		NE 21:2007
Standards		EN 60947-5-2:2007 EN 60947-5-2/A1:2012 IEC 60947-5-2:2007 IEC 60947-5-2 AMD 1:2012
Approvals and certificates		
IECEx approval		
Equipment protection level Ga		IECEx PTB 11.0037X
Equipment protection level Gb		IECEx PTB 11.0037X
Equipment protection level Da		IECEx PTB 11.0037X
Equipment protection level Mb		IECEx PTB 11.0037X
ATEX approval		
Equipment protection level Ga		PTB 00 ATEX 2048 X
Equipment protection level Gb		PTB 00 ATEX 2048 X
Equipment protection level Da		PTB 00 ATEX 2048 X
EAC conformity		TR CU 012/2011
UL approval		
Ordinary Location		E87056
Hazardous Location		E501628
Control drawing		116-0452
CCC approval		
Hazardous Location		2020322315002258
NEPSI approval		
NEPSI certificate		GYJ16.1393X
ANZEx		18.3018X
Marine approval		DNVGL TAA00001A5
Ambient conditions		
Ambient temperature		-25 ... 100 °C (-13 ... 212 °F)
Storage temperature		-40 ... 100 °C (-40 ... 212 °F)
Mechanical specifications		
Connection type		Connector plug
Housing material		Stainless steel 1.4305 / AISI 303
Sensing face		PBT
Degree of protection		IP66 / IP67
Connector		
Threading		M12 x 1
Number of pins		4
General information		

Release date: 2022-06-20 Date of issue: 2022-06-20 Filename: 70133071_eng.pdf

Technical Data

Use in the hazardous area		see instruction manuals

Connection

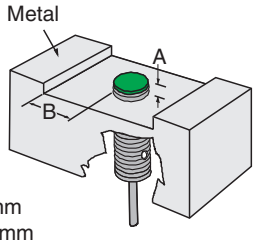


Wire colors in accordance with EN 60947-5-6

1	BN	(brown)
2	BU	(blue)

Mounting

Installation conditions



A = 5 mm
B = 15 mm

Accessories

	**BF 30**	Mounting flange, 30 mm

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Accessories

	**V1-G-N-2M-PUR**	Female cordset single-ended M12 straight A-coded, 2-pin, PUR cable blue, NAMUR
	**V1-W-N-2M-PUR**	Female cordset single-ended M12 angled A-coded, 2-pin, PUR cable blue, NAMUR
	**KCD2-E2L**	Sensor output interface terminal with lead breakage monitoring

Release date: 2022-06-20 Date of issue: 2022-06-20 Filename: 70133071_eng.pdf

Installation condition

The given values are minimum values. They cause changes of the sensing range less than 10%.

Cylindrical proximity switches

Devices with the same diameter may have different switching distances. The following table shows typical examples:

Diameter [mm]	Switching distance		
	flush	not flush	increased switching distance, flush
6.5	2	3	3
8	2	3	3
12	2	4	6
18	5	8	12
30	10	15	22

Proximity switches that are installed non-flush

The largest possible switching distance (relative to the diameter) is achieved by proximity switches that are installed non-flush. An inductive proximity switch utilizes coils for generating the electromagnetic field. To achieve a particular direction of the field these coils are wound in an encapsulated core. Nonetheless, some of this field will radiate sideways.

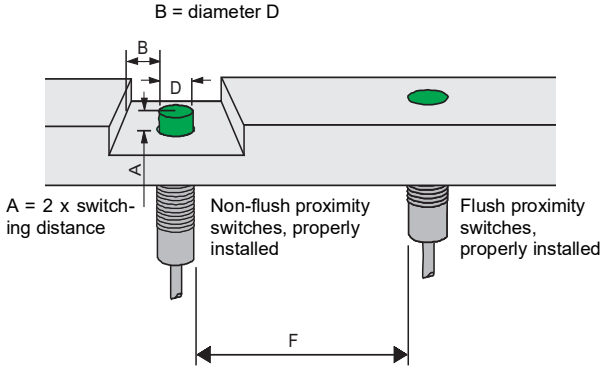
To avoid these products with a large range to be already attenuated by the environment, a clear space must be created around the sensor element complying with the minimum values in the following table.

Dimensions [mm]			
A	**B**	**C**	**F**
2 x S_n	B = D	min. 3 x S_n	flush F = D not flush F = 3 x D

Proximity switches that are installed flush

Flush installed inductive proximity switches can be used without clearance (A = 0). An advantage is that they are thus mechanically better protected and less sensitive to erroneous effects than non-flush installed types. The required reduction of the lateral field is achieved by a special internal shielding. This is at the expense of the range; these proximity switches only achieve approx. 60 % of the switching distance of designs for non-flush installation.

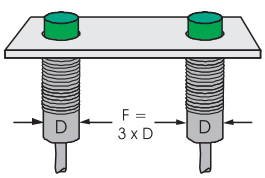
The safe assured release distance is guaranteed at a minimum distance to a measurement plate (target)/metal environment of at least 3 x S_n.



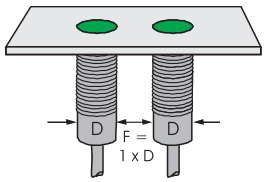
Mutual interference

The minimum distances F specified in the table above must be kept to prevent any mutual interference. If these distances cause problems with the application, then proximity switches with offset frequencies are available upon request. These can then be installed directly adjacent.

If in doubt please enquire.



Non-flush installed proximity sensors, F must be 3 times the housing diameter

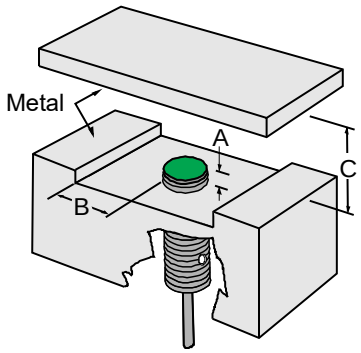


Flush installed proximity sensors, F must be equivalent to the housing diameter

Sensors with increased switching distance

These sensors with extremely increased switching distance cannot be installed fully flush in metal. They are described as semi-flush installed.

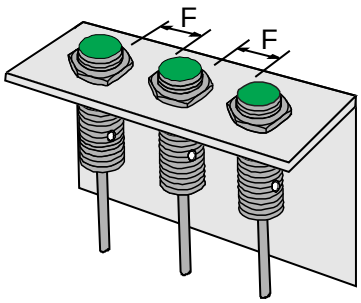
Type	Distance [mm]				
	A (steel, nonferrous heavy metal)	A (stainless steel)	B	C	F
NEB 3-8...	1	0	3	9	8
NEB 4-8...	1	0	3	9	8
NEB 6-12...	2	1	6	18	18
NEB 12-18...	4	1,5	12	36	26
NEB 22-30...	6	1,5	22	66	50
NEN 6-8...	8	8	8	18	20
NEN 10-12...	12	12	12	30	30
NEN 20-18...	22	22	22	60	60
NEN 40-30...	40	40	40	120	120



Mutual interference

To prevent the mutual interference between two similar sensors the minimum distances specified in these tables must be kept.
For applications where these distances cannot be maintained proximity switches with offset frequencies are available upon request. These can then be installed directly adjacent.

Please talk to our product specialist.

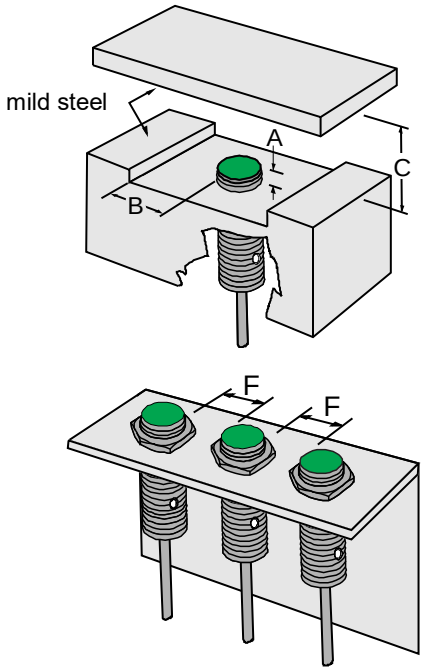


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Sensors with Reduction Factor 1

Type	Distance [mm]			
	A (for installation in mild steel)	B	C	F
NRB2-6,5…	0	5	10	20
NRN6-6,5…	10	20	20	30
NRB2-8G…	0	5	10	15
NRN6-8G…	10	20	20	25
NRB4-12G…	0	5	15	15
NRN10-12G…	20	30	30	50
NRB8-18G…	0	5	15	20
NRB12-18G…	5	15	20	20
NRN15-18G…	25	30	40	60
NRB15-30G…	0	15	20	35
NRN30-30G…	30	45	80	160



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Instruction Manual

1. Marking

Inductive sensor
NCB15-30GM40-N0-V1
ATEX marking
Ⓔx II 1G Ex ia IIC T6...T1 Ga
Ⓔx II 1G Ex ia IIC T6...T1 Ga
Ⓔx II 1D Ex ia IIIC T_{200}135°C Da
Ⓔx II 3D Ex tc IIIC T80°C Dc
IECEx marking
Ex ia IIC T6...T1 Ga
Ex ia IIC T6...T1 Ga
Ex ia IIIC T_{200}135°C Da
Ex tc IIIC T80°C Dc
Ex ia I Mb

Pepperl+Fuchs Group
Lilienthalstraße 200, 68307 Mannheim, Germany
Internet: www.pepperl-fuchs.com

The certificate may contain several Ex markings. Depending on the respective device, the Ex markings specified in the certificate may be only partially valid. You will find the Ex markings valid for the device on the respective nameplate or in this document.

2. Validity

Specific processes and instructions in this instruction manual require special provisions to guarantee the safety of the operating personnel.

3. Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismounting lies with the plant operator.

The personnel must be appropriately trained and qualified in order to carry out mounting, installation, commissioning, operation, maintenance, and dismounting of the device. The trained and qualified personnel must have read and understood the instruction manual.

4. Reference to Further Documentation

Observe laws, standards, and directives applicable to the intended use and the operating location. Observe Directive 1999/92/EC in relation to hazardous areas.

The corresponding datasheets, manuals, declarations of conformity, EU-type examination certificates, certificates, and control drawings if applicable (see datasheet) are an integral part of this document. You can find this information under www.pepperl-fuchs.com.

For specific device information, scan the QR code on the device or enter the serial number in the serial number search at www.pepperl-fuchs.com.

Due to constant revisions, documentation is subject to permanent change. Please refer only to the most up-to-date version, which can be found under www.pepperl-fuchs.com.

5. Intended Use

The device is only approved for appropriate and intended use. Ignoring these instructions will void any warranty and absolve the manufacturer from any liability.

Technical data provided in the datasheet may be partly restrained by the information given in this instruction manual.

Use the device only within the specified ambient and operating conditions.

The device is an electrical apparatus for hazardous areas.

The certificate applies only to the use of apparatus under atmospheric conditions.

If you use the device outside atmospheric conditions, consider that the permissible safety parameters should be reduced.

The device can be used in hazardous areas containing gas, vapor, and mist.

The device can be used in hazardous areas containing combustible dust.

The device can be used in underground parts of mines as well as those parts of surface installations of such mines containing firedamp and/or combustible dust.

5.1. Requirements for Equipment Protection Level Ga

Refer to the relevant certificate to see the relationship between the connected circuit type, the maximum permitted ambient temperature, the effective inner reactances, and if applicable the surface temperature or the temperature class.

The suitability for use of the device at ambient temperatures >60 °C in conjunction with hot surfaces has been checked by the notified body.

For usage according to ATEX Directive and according to EN 1127-1, the reduction of the surface temperature to 80 % is not considered.

5.2. Requirements for Equipment Protection Level Gb

Refer to the relevant certificate to see the relationship between the connected circuit type, the maximum permitted ambient temperature, the effective inner reactances, and if applicable the surface temperature or the temperature class.

The suitability for use of the device at ambient temperatures >60 °C in conjunction with hot surfaces has been checked by the notified body.

5.3. Requirements for Equipment Protection Level Da

Refer to the relevant certificate to see the relationship between the connected circuit type, the maximum permitted ambient temperature, the effective inner reactances, and if applicable the surface temperature or the temperature class.

The suitability for use of the device at ambient temperatures >60 °C in conjunction with hot surfaces has been checked by the notified body.

5.4. Requirements for Equipment Protection Level Mb

Refer to the relevant certificate to see the relationship between the connected circuit type, the maximum permitted ambient temperature, the effective inner reactances, and if applicable the surface temperature or the temperature class.

The suitability for use of the device at ambient temperatures >60 °C in conjunction with hot surfaces has been checked by the notified body.

6. Improper Use

Protection of the personnel and the plant is not ensured if the device is not used according to its intended use.

7. Mounting and Installation

Observe the installation instructions according to IEC/EN 60079-14.

Safety-relevant markings are found on the nameplate of the device or the nameplate supplied.

Attach the nameplate supplied in the immediate vicinity of the device. Attach the nameplate so that it is legible and indelible. Take the ambient conditions into account.

Do not mount a damaged or polluted device.

Mount the device so that it complies with the specified degree of protection according to IEC/EN 60529.

If you use the device in environments subject to adverse conditions, you must protect the device accordingly.

Do not remove the warning markings.

Prevent the inside of the device from becoming contaminated when the connector is disconnected.

7.1. Requirements for Usage as Intrinsically Safe Apparatus

When connecting intrinsically safe devices with intrinsically safe circuits of associated apparatus, observe the maximum peak values with regard to explosion protection (verification of intrinsic safety). Observe the standards IEC/EN 60079-14 or IEC/EN 60079-25.

The type of protection is determined by the connected intrinsically safe circuit.

7.2. Requirements for Equipment Protection Level Dc

The device is designed for use in an environment with pollution degree 3 according to IEC/EN 60664-1.

Install a series resistor R_V between the supply voltage and the device.

Alternatively, use a switch amplifier according to IEC/EN 60947-5-6.

When selecting materials for accessories consider that the temperature of the housing can rise up to 70 °C.

The maximum surface temperature of the device was determined without a dust layer on the apparatus.

7.3. Specific Conditions of Use

Mount the device so that it complies with the specified degree of protection according to IEC/EN 60529.

7.3.1. Requirements in Relation to Electrostatics

Information on electrostatic hazards can be found in the technical specification IEC/TS 60079-32-1.

Do not mount the supplied nameplate in areas that can be electrostatically charged.

You can reduce the electrostatic hazards by minimizing the generation of static electricity. For example, you have the following options to minimize the generation of static electricity:

- Control the environmental humidity.
- Protect the device from direct airflow.
- Ensure a continuous drain off of the electrostatic charges.

Avoid inadmissibly high electrostatic charge of the metal housing components on the device.

Include the metal housing components in the equipotential bonding.

Avoid inadmissibly high electrostatic charge of the metal connector components.

Include the metal connector components in the equipotential bonding.

7.3.1.1. Requirements for Equipment Protection Level Ga

Usage in Gas Group IIC:

Avoid electrostatic charges which could result in electrostatic discharges while installing, operating, or maintaining the device.

7.3.1.2. Requirements for Equipment Protection Level Da

Avoid electrostatic charges which could result in electrostatic discharges while installing, operating, or maintaining the device.

7.3.1.3. Requirements for Equipment Protection Level Dc

Avoid electrostatic charges which could result in electrostatic discharges while installing, operating, or maintaining the device.

7.3.2. Requirements to Mechanics

7.3.2.1. Requirements for Usage as Intrinsically Safe Apparatus

Protect the device from impact effects by mounting in a surrounding enclosure if it is used in the temperature range between the minimum permissible ambient temperature and -20 °C.

Mount the device with at least a degree of protection of IP20 according to IEC/EN 60529.

7.3.2.2. Requirements for Equipment Protection Level Dc

Mount the device in a way that the device is protected against mechanical hazard.

Do not connect or disconnect the electrical connection when energized.

7.3.3. Requirements in Relation to Ultraviolet Radiation

7.3.3.1. Requirements for Equipment Protection Level Dc

Mount the device in such a way that it is protected from ultraviolet radiation.

Install the cables and connection lines in such a way that they are protected from ultraviolet radiation.

7.3.4. Requirements for Connectors

7.3.4.1. Requirements for Equipment Protection Level Dc

Connect the device in compliance with the IEC/EN 60079-14 requirements.

Ensure that the device provides and maintains a degree of protection of at least IP64 according to IEC/EN 60079-0.

Ensure that the degree of protection is not violated by the connectors.

Only use connectors that are suitably certified for the application.

Observe laws, standards, and directives applicable to the intended use and the operating location.

Observe the interaction of the mating parts, see datasheet.

Use the 12FC4000-SK-ATEX connector from HTP S.r.l. for example.

8. Operation, Maintenance, Repair

Observe the specific conditions of use.

Safety-relevant markings are found on the nameplate of the device or the nameplate supplied.

Do not use a damaged or polluted device.

Do not repair, modify, or manipulate the device.

Modifications are permitted only if approved in this instruction manual and in the device-related documentation.

If there is a defect, always replace the device with an original device.

Do not remove the warning markings.

Prevent the inside of the device from becoming contaminated when the connector is disconnected.

8.1. Requirements for Usage as Intrinsically Safe Apparatus

Only operate the device with intrinsically safe circuits according to IEC/EN 60079-11.

The type of protection is determined by the connected intrinsically safe circuit.

8.2. Requirements for Equipment Protection Level Ga

Observe the temperature table for the corresponding equipment protection level in the certificate.

Also observe the maximum permissible ambient temperature stated in the technical data. Keep to the lower of the two values.

8.3. Requirements for Equipment Protection Level Gb

Observe the temperature table for the corresponding equipment protection level in the certificate.

Also observe the maximum permissible ambient temperature stated in the technical data. Keep to the lower of the two values.

8.4. Requirements for Equipment Protection Level Da

Observe the temperature table for the corresponding equipment protection level in the certificate.

Also observe the maximum permissible ambient temperature stated in the technical data. Keep to the lower of the two values.

8.5. Requirements for Equipment Protection Level Dc

Do not exceed the maximum permissible operating voltage U_{bmax}. Tolerances are not permitted.

Do not exceed the maximum permitted output current. Prevent short circuits.

8.6. Requirements for Equipment Protection Level Mb

Observe the temperature table for the corresponding equipment protection level in the certificate.

Also observe the maximum permissible ambient temperature stated in the technical data. Keep to the lower of the two values.

9. Delivery, Transport, Disposal

Check the packaging and contents for damage.

Check if you have received every item and if the items received are the ones you ordered.

Keep the original packaging. Always store and transport the device in the original packaging.

Store the device in a clean and dry environment. The permitted ambient conditions must be considered, see datasheet.

The device, built-in components, packaging, and any batteries contained within must be disposed in compliance with the applicable laws and guidelines of the respective country.

10. National Ex approvals

CCC-EX "i"	2020322315002258 Ex ia IIC T6...T1 Ga Ex ia IIC T6...T1 Gb Ex ia IIIC T_{200}135°C Da

INMETRO-EX "i"	TÜV 13.1123 X

UL-HAZLOC "i":	E501628 116-0452

ANZEx "i":	ANZEx 18.3018X

UKEx "i":	CML 21UKEX21166X

11. Safety-Relevant Technical Data

11.1. Equipment protection level Ga

Type of protection	Intrinsic safety
CE marking	CE-0102
Certificates	
Appropriate type	NCB15-30GM...-N0...
ATEX certificate	PTB 00 ATEX 2048 X
ATEX marking	Ex II 1G Ex ia IIC T6...T1 Ga
ATEX standards	EN IEC 60079-0:2018-07, EN 60079-11:2012-01
IECEx certificate	IECEx PTB 11.0037X
IECEx marking	Ex ia IIC T6...T1 Ga
IECEx standards	IEC 60079-0:2017-12, IEC 60079-11:2011-06
Effective internal capacitance C_i	max. 120 nF A cable length of 10 m is considered.
Effective internal inductance L_i	max. 150 µH A cable length of 10 m is considered.
Maximum permissible ambient temperature in °C	Also observe the maximum permissible ambient temperature stated in the general technical data. Keep to the lower of the two values.

for ATEX	U_i = 16 V, I_i = 25 mA, P_i = 34 mW T6: 74 °C T5: 89 °C T4: 100 °C T3: 100 °C T2: 100 °C T1: 100 °C U_i = 16 V, I_i = 25 mA, P_i = 64 mW T6: 69 °C T5: 84 °C T4: 100 °C T3: 100 °C T2: 100 °C T1: 100 °C U_i = 16 V, I_i = 52 mA, P_i = 169 mW T6: 51 °C T5: 66 °C T4: 74 °C T3: 74 °C T2: 74 °C T1: 74 °C U_i = 16 V, I_i = 76 mA, P_i = 242 mW T6: 39 °C T5: 52 °C T4: 52 °C T3: 52 °C T2: 52 °C T1: 52 °C
for IECEx	U_i = 16 V, I_i = 25 mA, P_i = 34 mW T6: 74 °C T5: 89 °C T4: 100 °C T3: 100 °C T2: 100 °C T1: 100 °C U_i = 16 V, I_i = 25 mA, P_i = 64 mW T6: 69 °C T5: 84 °C T4: 100 °C T3: 100 °C T2: 100 °C T1: 100 °C U_i = 16 V, I_i = 52 mA, P_i = 169 mW T6: 51 °C T5: 66 °C T4: 74 °C T3: 74 °C T2: 74 °C T1: 74 °C U_i = 16 V, I_i = 76 mA, P_i = 242 mW T6: 39 °C T5: 52 °C T4: 52 °C T3: 52 °C T2: 52 °C T1: 52 °C

11.2. Equipment protection level Gb

Type of protection	Intrinsic safety
CE marking	CE-0102
Certificates	
Appropriate type	NCB15-30GM...-N0...
ATEX certificate	PTB 00 ATEX 2048 X
ATEX marking	Ex II 1G Ex ia IIC T6...T1 Ga
ATEX standards	EN IEC 60079-0:2018-07, EN 60079-11:2012-01
IECEx certificate	IECEx PTB 11.0037X
IECEx marking	Ex ia IIC T6...T1 Ga
IECEx standards	IEC 60079-0:2017-12, IEC 60079-11:2011-06
Effective internal capacitance C_i	max. 120 nF A cable length of 10 m is considered.
Effective internal inductance L_i	max. 150 µH A cable length of 10 m is considered.
Maximum permissible ambient temperature in °C	Also observe the maximum permissible ambient temperature stated in the general technical data. Keep to the lower of the two values. U_i = 16 V, I_i = 25 mA, P_i = 34 mW T6: 74 °C T5: 89 °C T4: 100 °C T3: 100 °C T2: 100 °C T1: 100 °C U_i = 16 V, I_i = 25 mA, P_i = 64 mW T6: 69 °C T5: 84 °C T4: 100 °C T3: 100 °C T2: 100 °C T1: 100 °C U_i = 16 V, I_i = 52 mA, P_i = 169 mW T6: 51 °C T5: 66 °C T4: 74 °C T3: 74 °C T2: 74 °C T1: 74 °C U_i = 16 V, I_i = 76 mA, P_i = 242 mW T6: 39 °C T5: 52 °C T4: 52 °C T3: 52 °C T2: 52 °C T1: 52 °C

11.3. Equipment protection level Da

Type of protection	Intrinsic safety
CE marking	CE-0102
Certificates	
Appropriate type	NCB15-30GM...-N0...
ATEX certificate	PTB 00 ATEX 2048 X
ATEX marking	Ex II 1D Ex ia IIIC T_{200}135°C Da
ATEX standards	EN IEC 60079-0:2018-07, EN 60079-11:2012-01
IECEx certificate	IECEx PTB 11.0037X
IECEx marking	Ex ia IIIC T_{200}135°C Da
IECEx standards	IEC 60079-0:2017-12, IEC 60079-11:2011-06
Effective internal capacitance C_i	max. 120 nF A cable length of 10 m is considered.
Effective internal inductance L_i	max. 150 µH A cable length of 10 m is considered.

Maximum permissible ambient temperature in °C	Also observe the maximum permissible ambient temperature stated in the general technical data. Keep to the lower of the two values. U_i = 16 V, I_i = 25 mA, P_i = 34 mW 100 °C U_i = 16 V, I_i = 25 mA, P_i = 64 mW 100 °C U_i = 16 V, I_i = 52 mA, P_i = 169 mW 67 °C U_i = 16 V, I_i = 76 mA, P_i = 242 mW

11.4. Equipment protection level Dc

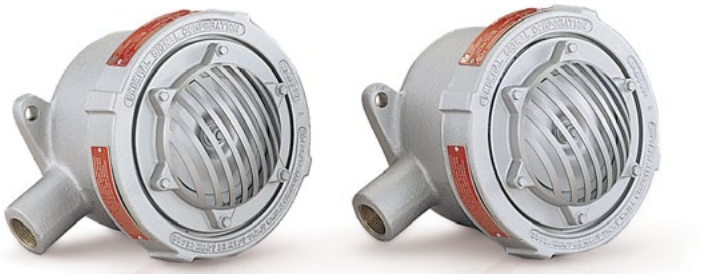
Type of protection	Protection by enclosure "tc"
CE marking	CE
Certificates	
ATEX certificate	TÜV 20 ATEX 8524 X
ATEX marking	Ex II 3D Ex tc IIIC T80°C Dc
ATEX standards	EN IEC 60079-0:2018-07, EN 60079-31:2014-07
IECEx certificate	IECEx TUR 21.0018X
IECEx marking	Ex tc IIIC T80°C Dc
IECEx standards	IEC 60079-0:2017-12, IEC 60079-31:2013-11
Minimum ingress protection	IP 6x according to IEC/EN 60529
Minimum permissible ambient temperature in °C	Ta min: -25 °C
Maximum permissible ambient temperature in °C	Also observe the maximum permissible ambient temperature stated in the general technical data. Keep to the lower of the two values. Maximum operating voltage U_{Bmax} Maximum load current I_{Lmax} Minimum series resistance R_V Maximum analog output voltage U_{Amax} Maximum analog output current I_{Amax} at U_{Bmax} = 9 V, R_V = 562 Ohm: 64 °C using an amplifier in accordance with EN 60947-5-6: 64 °C

11.5. Equipment protection level Mb

Type of protection	Intrinsic safety
Certificates	
Appropriate type	NCB15-30GM...-N0...
IECEx certificate	IECEx PTB 11.0037X
IECEx marking	Ex ia I Mb
IECEx standards	IEC 60079-0:2017-12, IEC 60079-11:2011-06
Effective internal capacitance C_i	max. 120 nF A cable length of 10 m is considered.
Effective internal inductance L_i	max. 150 µH A cable length of 10 m is considered.
Maximum permissible ambient temperature in °C	Also observe the maximum permissible ambient temperature stated in the general technical data. Keep to the lower of the two values. U_i = 16 V, I_i = 25 mA, P_i = 34 mW 100 °C U_i = 16 V, I_i = 25 mA, P_i = 64 mW 100 °C U_i = 16 V, I_i = 52 mA, P_i = 169 mW 85 °C U_i = 16 V, I_i = 76 mA, P_i = 242 mW 67 °C

TAB 9
Warning Horn
(Ovivo USA, LLC Part No. 771767)

FEDERAL SIGNAL



Models 31X and 41X

Explosion-Proof Vibrating Horns

Models 31X and 41X explosion-proof vibrating horns are constructed for safe use in hazardous environments. They are enclosed in heavy-duty copper-free cast aluminum housings tapped for 3/4-inch conduit.

Models 31X and 41X are corrosion resistant vibrating horns with stainless steel diaphragms. Model 41X is available in 24VDC. Model 31X is available in 120VAC and 240VAC and features an internal volume control. A five minute duty cycle applies to both models.

FEATURES

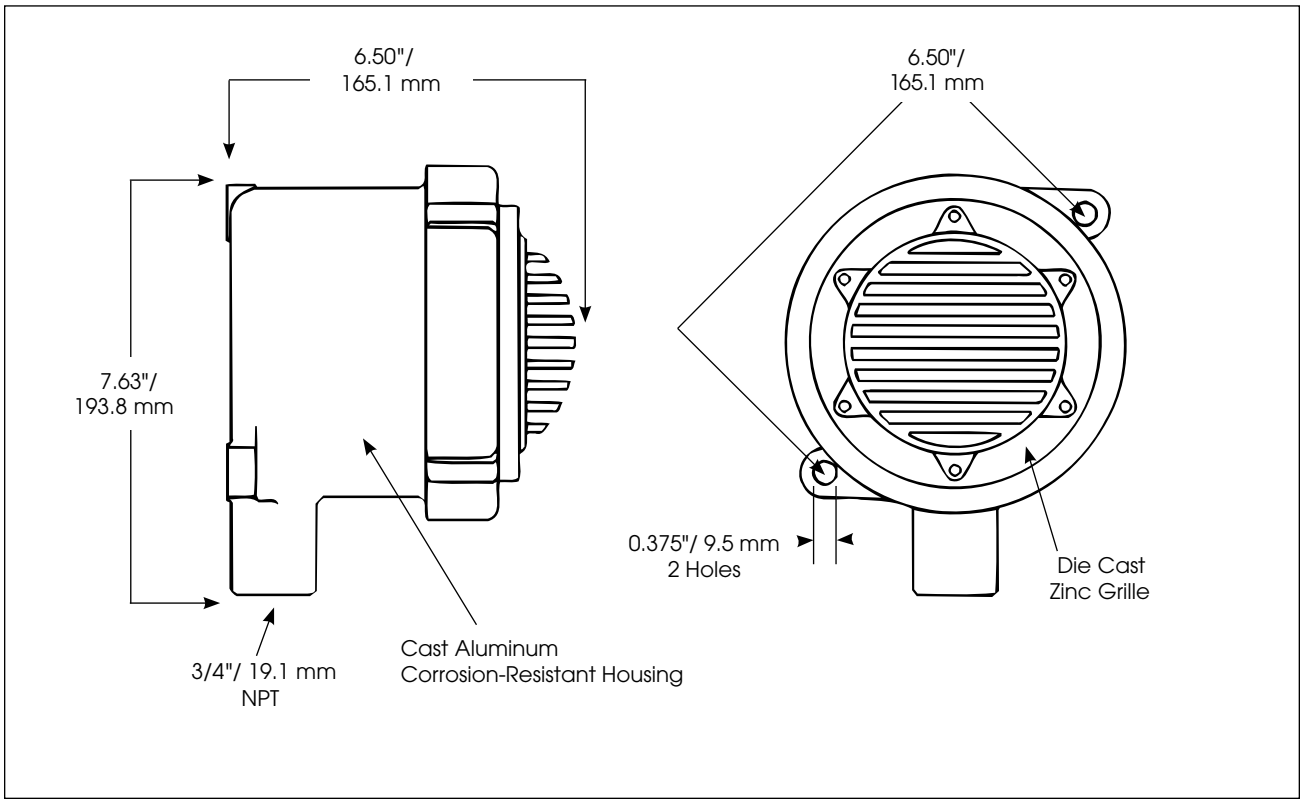
- 31X – 120VAC and 240VAC
- 41X – 24VDC
- Corrosion resistant cast aluminum housings
- Produces 100 dBa @ 10' (110 dBa @ 1m)
- 3/4" pipe or surface mount
- CSA Certified
- UL and cUL Listed for Class I, Division 1, Groups C and D; Class II, Division 1, Groups E, F, and G; Class III

MODEL	VOLTAGE	OPERATING CURRENT	DECIBELS 10'	1M
31X-120-3	120VAC 50/60Hz	0.20 amps	100	110
31X-240	240VAC 50/60Hz	0.10 amps	100	110
41X-024-1	24VDC	1.20 amps	100	110

HAZARDOUS LOCATION RATING: 31X and 41X

T-CODE AT MAXIMUM AMBIENT TEMPERATURE, °C	
Hazardous Location	**40°C**
Class I, Division 1, Groups C, D	T6
Class II, Division 1, Groups E, F, G	T6
Class III	T6

Explosion-Proof Vibrating Horns (31X and 41X)



SPECIFICATIONS

Operating Temperature:	-13°F to 104°F	-25°C to 40°C
Duty Cycle:	5 minutes ON/5 minutes OFF	
Net Weight:		
31X	7.5 lbs	3.4 kg
41X	9.0 lbs	4.1 kg
Shipping Weight:		
31X	8.1 lbs	3.7 kg
41X	10.3 lbs	4.7 kg
Height:	7.63"	193.7 mm
Depth:	6.5"	165.1 mm
Diameter:	6.5"	165.1 mm

REPLACEMENT PARTS

Description	Part Number
Cover Grille, Gray	KH6962J-01
Coil 31X, 120VAC	KFC1516C

HOW TO ORDER

31X – 120 – 3

TYPE
31X

VOLTAGE
120 (120VAC)

31X – 240

TYPE
31X

VOLTAGE
240 (240VAC)

41X – 024 – 1

TYPE
41X

VOLTAGE
024 (24VDC)

2645 Federal Signal Dr., University Park, IL 60484 Tel: +1 708.534.4756 Email: signalsupport@fedsig.com www.fedsig.com

MODEL 41X

INSTALLATION AND SERVICE INSTRUCTIONS FOR MODEL 41X EXPLOSION-PROOF HORN FOR USE IN HAZARDOUS LOCATIONS

MODELO 41X

INSTRUCCIONES DE INSTALACION Y SERVICIO PARA LA CORNETA A PRUEBA DE EXPLOSION MODELO 41X PARA USO EN AREAS PELIGROSAS

MODÈLE 41X

INSTRUCTIONS POUR L'INSTALLATION ET LE SERVICE DES KLAXONS ANTI-DEFLAGRANTS MODÈLE 41X POUR UTILISATION DANS DES ZONES DANGEREUSES

Address all communications and shipments to:
Dirija todos la correspondencia y envíos a:
Adressez toutes les communications et expéditions à:

FEDERAL SIGNAL CORPORATION
Electrical Products Division
2645 Federal Signal Drive
University Park, IL 60466-3195

INSTALLATION AND SERVICE INSTRUCTIONS FOR MODEL 41X
EXPLOSION-PROOF HORN FOR USE IN HAZARDOUS LOCATIONS

SAFETY MESSAGE TO INSTALLERS, USERS AND MAINTENANCE PERSONNEL

It is important to follow all instructions shipped with this product. This device is to be installed by a trained electrician who is thoroughly familiar with the National Electrical Code and will follow the NEC Guidelines as well as local codes.

This device should be considered a part of the warning system and not the entire warning system.

The selection of the mounting location for the device, its controls and the routing of the wiring is to be accomplished under the direction of the facilities engineer and the safety engineer. In addition, listed below are some other important safety instructions and precautions you should follow:

- Read and understand all instructions before installing or operating this equipment.
- Do not connect this unit to the system when power is on.
- Optimum sound distribution will be severely reduced if any objects are in front of the speaker. You should ensure that the front of the speaker is clear of any obstructions.
- All effective warning speakers produce loud sounds which may cause, in certain situations, permanent hearing loss. You should take appropriate precautions such as wearing hearing protection.
- After installation, ensure that all bolts and threaded joints are tightened.
- Establish a procedure to routinely check the sound system for proper activation and operation.
- Provide a copy of these instructions to the Safety Engineer, operator(s) and maintenance personnel.
- File these instructions in a safe place and refer to them when maintaining and/or reinstalling the device.

Failure to follow all safety precautions and instructions may result in property damage, serious injury, or death to you or others.

I. GENERAL.

The Model 41X Horn is an explosion-proof audible signaling device for hazardous locations and provides a 100dB tone measured at 10-feet on axis.

II. INSTALLATION.

A. Unpacking.

After unpacking the Model 41X, examine it for damage that may have occurred in transit. If the equipment has been damaged, do not attempt to install or operate it, file a claim immediately with the carrier stating the extent of the damage. Carefully check all envelopes, shipping labels and tags before removing or destroying them.

B. Mounting.

See figure l. The horn has provisions for mounting on a rigid surface. Mount the unit on the rigid surface with user-supplied hardware.

Ensure mating threads are clean and thread $^{3}/_{4}$" pipe into the horn.

C. Electrical Connections.

WARNING

To avoid electrical shock hazards, do not connect wires when power is applied.

Wiring must comply with Article 500 of the National Electrical Code and the local authority having jurisdiction.

To complete the electrical connections, proceed as follows:

CAUTION

Do NOT loosen or remove the clamp ring or any of the six screws on the front of the horn housing. Loosening or removing any of the screws may disturb the factory adjustment of the horn mechanism and cause a horn malfunction. In addition, the horn mechanism may be damaged.

Use a method approved by local building codes and connect horn wires to supply wires. If required by local building codes, provisions for attaching an earth ground are included.

CAUTION

All power wiring to all models must be routed through conduit and fittings approved for explosion-proof installation

III. MAINTENANCE.

SAFETY MESSAGE TO MAINTENANCE PERSONNEL

- Read and understand all instructions before performing any maintenance to this unit.
- To reduce the risk of electrical shock or ignition of hazardous atmospheres, do not perform maintenance/service on this device when circuits are energized.
- Optimum sound distribution will be reduced if speaker becomes clogged with a foreign substance. Periodic checks should be performed to ensure foreign substances are not packed into the speaker.
- Any maintenance to the unit MUST be performed by a trained electrician in accordance with NEC Guidelines and local codes.
- Never alter the unit in any manner. Safety in hazardous locations may be endangered if additional openings or alterations are made in units specifically designed for use in these locations.
- The nameplate, which may contain cautionary or other information of importance to maintenance personnel, should not be obscured if exterior of housings used in hazardous locations are painted.

Failure to follow all safety precautions and instructions may result in property damage, serious injury, or death to you or others.

The horn mechanism contains no user serviceable parts. Therefore, to avoid compromising the explosion-proof integrity of the horn, do NOT remove the horn mechanism from the horn housing.

IV. SERVICE.

The Federal factory will service your equipment or provide technical assistance with any problems that cannot be handled locally.

Any units returned to Federal Signal for service, inspection, or repair must be accompanied by a Return Material Authorization. This R.M.A. can be obtained from the local Distributor or Manufacturer's Representative.

At this time a brief explanation of the service requested, or the nature of the malfunction, should be provided.

Address all communications and shipments to:

FEDERAL SIGNAL CORPORATION
Electrical Products Division
Service Department
2645 Federal Signal Drive
University Park, IL 60466-3195

INSTRUCCIONES DE INSTALACION Y SERVICIO PARA LA CORNETA A PRUEBA DE EXPLOSION MODELO 41X PARA USO EN AREAS PELIGROSAS

MENSAJE DE SEGURIDAD PARA INSTALADORES, USUARIOS Y PERSONAL DE MANTENIMIENTO

Es importante seguir todas las instrucciones enviadas con este producto. Este dispositivo debe ser instalado por un electricista entrenado que esté familiarizado con el Código Eléctrico Nacional y siga sus guías así como las normas locales.

Este dispositivo debe ser considerado como una parte del sistema de alarma y no el sistema de alarma total.

La selección del sitio de montaje del dispositivo, sus controles y la ruta del alambrado, se hará bajo la dirección del Ingeniero de facilidades y el Ingeniero de seguridad. Adicionalmente, a continuación se listan otras instrucciones y precauciones de seguridad que deben seguirse:

- Lea y comprenda todas las instrucciones antes de instalar u operar este equipo.
- Desconecte la energía antes de conectar el dispositivo a la red.
- La distribución óptima del sonido se reducirá severamente si se colocan objetos en frente del parlante; por eso asegúrese de que está libre de obstáculos.
- Todos los parlantes efectivos de alarma producen sonidos fuertes que pueden causar, en ciertas ocasiones, pérdida permanente del oído. Se deben tomar precauciones tales como el uso de protectores auditivos.
- Después de la instalación, asegúrese de que todos pernos y uniones roscadas están apretados.
- Establezca un procedimiento rutinario para comprobar la operacón y activación apropiadas del sistema de sonido.
- Entregue una copia de estas instrucciones al Ingeniero de seguridad, operador(es) y personal de mantenimiento.
- Archive estas instrucciones en un lugar seguro y se refiera a ellas cuando le haga mantenimiento o reinstale el dispositivo.

El no seguir todas la instrucciones y precauciones de seguridad, puede provocar daños a la propiedad, lesiones severas y aún su muerte o la de otros.

I. GENERAL.

La corneta Modelo 41X es un dispositivo de señalización audible, a prueba de explosión, para áreas peligrosas y provee un tono de 100dB medido a 10 pies sobre el eje.

II. INSTALACION.

A. Desempaque.

Después de desempacar el Modelo 41X, examine cuidadosamente para detectar cualquier daños de transporte. Si hubo daños, ni instalar ni operarla y haga un reclamo de inmediato al transportador estableciendo el monto del daño. Revise con cuidado todas las envolturas, sellos de embarque y etiquetas antes de removerlos o destruirlos.

B. Montaje.

Vea la figura 1. La corneta está preparado para ser montado sobre una superficie rígida. Monte la unidad en la superficie rígida con soportes que suministrará el usuario.

Asegúrese de que las roscas de empalme están limpias y rosque una tuberia de $^{3}/_{4}$" en la caja de la corneta.

C. Conexiones Eléctricas.

PRECAUCION

Para evitar el peligro de los choques eléctricos, no conecte cables con corriente aplicada.

El cableado debe cumplir con el Artículo 500 del NEC y autoridades locales competentes.

Para completar las conexiones eléctricas, proceda así:

PRECAUCION

NO afloje o retire la abrazadera o alguno de los seis tornillos del frente de la caja de la corneta. Aflojar o remover uno cualquiera de los tornillos puede cambiar el ajuste de fábrica del mecanismo de la corneta y causar mal funcionamiento de esta. Además, el mecanismo de la corneta puede dañarse.

Use un modo aprobado por los Códigos de construcción locales y conecte los cables de montaje a los cables de suministro. Si lo requieren los códigos locales de construcción, se incluyen provisiones para conexión a tierra.

PRECAUCION

El cableado de potencia de todos los modelos debe ir en conduit y con accesorios aprobados para instalaciones a prueba de explosión.

III. MANTENIMIENTO.

MENSAJE DE SEGURIDAD AL PERSONAL DE MANTENIMIENTO

- Lea y comprenda todas las instrucciones antes de hacer mantenimiento a este equipo.
- Para reducir el riesgo de choques eléctricos o ignición de atmósferas peligrosas, no haga mantenimiento o servicio a este dispositivo cuando el circuito esté energizado.
- La distribución óptima del sonido se reducirá si el parlante se tapona con sustancias extrañas y hay que hacer revisiones periódicas para asegurarse de que no haya ningunas sustancias dentro del parlante.
- Cualquier mantenimiento a la unidad TIENE que ser hecho un electricista entrenado, de acuerdo con el NEC y los códigos locales.
- Nunca altere la unidad en cualquier forma. La seguridad en áreas peligrosas puede ponerse en riesgo si se hacen agujeros adicionales o alteraciones a unidades específicamente diseñadas para uso en estas áreas.
- La placa, que puede tener información de importancia o precauciones para el personal de mantenimiento, no se deberá cubrir con pintura si la carcaza exterior, de cajas usadas en áreas peligrosas, se pinta.

El no seguir todas las precauciones e instrucciones de seguridad puede resultar en daños a la propiedad, heridas graves o su muerte o la de otros.

El mecanismo de la corneta no contiene partes que puedereparar el usuario. Por tanto, para evitar poner en riesgo la integridad del sistema a prueba de explosión de la corneta, no retire el mecanismo de la corneta de su caja.

IV. SERVICIO.

La fábrica de Federal hará servicio a su equipo, o proveerá la asistencia técnica con cualquier problema que no pueda manejarse localmente.

Cualquier unidad que se devuelva a Federal Signal para servicio, inspección o reparación, debe acompañarse de una autorización de materia devuelta (R.M.A.). Esta R.M.A. puede obtenerse del representante o distribuidor local del fabricante y se adjuntará una breve explicación de la necesiadad del servicio o la naturaleza del mal funcionamiento.

Dirija todas la comunicaciones y envíos a:

FEDERAL SIGNAL CORPORATION
Electrical Products Division
Service Department
2645 Federal Signal Drive
University Park, IL 60466-3195

INSTRUCTIONS POUR L'INSTALLATION ET LE SERVICE DES KLAXONS ANTI-DEFLAGRANTS MODELE 41X POUR UTILISATION DANS DES ZONES DANGEREUSES

SAFETY MESSAGE TO INSTALLERS, USERS AND MAINTENANCE PERSONNEL

Il est important de lire, comprendre et suivre toutes les instructions expédiées avec ce produit. Ce dispositif doit être installé par des électriciens professionnels qui sont complètement au courant du Code Electrique National et respecteront les recommandations NEC ainsi que les codes locaux.

Ce dispositif doit être considéré comme faisant partie du système de signalisation et n'est pas le système complet de signalisation.

Le choix de l'endroit de montage du dispositif, de ses commandes et du passage des câbles doit être effectué sous la direction de l'ingénieur des services électriques et de l'ingénieur de sécurité. De plus, sont énumérées ci-dessous quelques autres instructions et précautions de sécurité importantes que vous devez suivre:

- Lire et comprendre toutes les instructions avant d'installer ou d'utiliser ce matériel.
- Ne connectez pas ce phare au système si la tension est présente.
- Une répartition optimale du son sera gravement réduite si des objets se trouvent devant le haut-parleur. Vous devez vous assurer que l'avant du haut-parleur est dégagé de tout obstacle.
- Tous les haut-parleurs effectifs d'avertissement produisent des sons puissants qui peuvent causer dans certaines situations une perte permanente de l'ouïe. Vous devez prendre des précautions appropriées comme le port de protection de l'ouïe.
- Après installation, assurez-vous que tous les boulons et les joints filetés sont serrés.
- Etablissez une procédure pour vérifier régulièrement le système sonore concernant son actionnement et son fonctionnement.
- Fournissez une copie de ces instructions à l'ingénieur de sécurité, aux opérateurs et au personnel d'entretien.
- Classez ces instructions dans un endroit sûr et référez-vous à elles lorsque vous entretenez et/ou réinstallez le dispositif.

Si on ne respecte pas ces précautions de sécurité, il peut en résulter des dommages aux biens, des blessures graves ou mortelles pour vous ou d'autres.

I. GENERALITES.

Le klaxon Modèle 41X est un dispositif de signalisation sonore anti-déflagrant pour zones dangereuses et fournit une tonalité de 100dB mesurée à 10 ft sur l'axe.

II. INSTALLATION.

A. Déballage.

Après déballage du Modèle 41X, inspectez-le pour voir s'il a été endommagé pendant le transport. S'il a été endommagé, faites une déclaration immédiatement auprès du transporteur en indiquant les dommages. Vérifiez soigneusement toutes les enveloppes, les étiquettes d'expédition et les étiquettes volantes avant de les retirer ou les détruire.

B. Montage.

Voir figure 1. Le klaxon est prévu pour montage sur une surface rigide. Montez l'unité sur la surface rigide à l'aide de la quincaillerie fournie par l'utilisateur.

Assurez-vous que les filetages correspondants sont propres et vissez le tuyau de $^3/_4$" dans le klaxon.

C. Connexions Electriques.

AVERTISSEMENT

Pour éviter des risques de chocs électriques, ne connectez pas les fils si la tension n'est pas coupée.

Le câblage doit être conforme à l'Article 500 du National Electrical Code et des autorités locales qui ont juridiction.

Pour effectuer les connexions électriques, procédez comme suit:

ATTENTION

Ne desserrez PAS ni retirez la bague de fixation ou aucune des 6 vis à l'avant du carter de klaxon. Le desserrage ou le retrait d'une de ces vis peut modifier le réglage d'usine du mécanisme de klaxon et causer un mauvais fonctionnement du klaxon. De plus, le mécanisme du klaxon peut être endommagé.

Utilisez une méthode approuvée par les codes locaux de construction et connectez les fils de klaxon aux fils d'alimentation. Si exigé par les codes de construction locaux, des dispositions sont incluses pour connecter une masse.

ATTENTION

Tous les câblages d'alimentation à tous les modèles doivent être passés par des conduits et des raccords approuvés pour installation anti-déflagrante.

III. ENTRETIEN.

MESSAGE DE SECURITE AU PERSONNEL D'ENTRETIEN

- Lire et comprendre toutes les instructions avant d'exécuter de l'entretien sur cet appareil.
- Pour réduire le risque de chocs électriques ou d'allumages d'atmosphères dangereuses, ne faites pas d'entretien ou de service sur ce dispositif si les circuits sont sous tension.
- La répartition optimale de son est réduite si le haut-parleur se bouche avec des produits étrangers. Des vérifications périodiques doivent être effectuées pour assurer qu'aucun produit étranger ne s'amasse dans le haut-parleur.
- Tout entretien de l'unité DOIT être fait par un électricien professionnel conformément aux recommandations NEC et aux codes locaux.
- Ne jamais modifier l'unité de quelle que manière que ce soit. La sécurité dans des zones dangereuses peut être mise en cause si des ouvertures supplémentaires ou d'autres modifications sont faites dans des unités spécifiquement conçues pour utiliser dans ces endroits.
- La plaque de caractéristiques, qui peut contenir des informations d'avertissement ou autres d'importance pour le personnel d'entretien, ne doit PAS être cachée si l'extérieur des carters utilisés dans des zones dangereuses est peint

Si on ne respecte pas ces précautions de sécurité, il peut en résulter des dommages aux biens, des blessures graves ou mortelles pour vous ou d'autres.

Le mécanisme du klaxon ne contient aucune pièce à entretenir par l'utilisateur. Donc, pour éviter de compromettre l'intégrité anti-déflagrante du klaxon, ne retirez PAS le mécanisme du klaxon du carter du klaxon.

IV. SERVICE.

L'usine de Federal Signal fera le service de votre matériel et fournira une assistance technique pour tout problème qui ne puisse être traité localement.

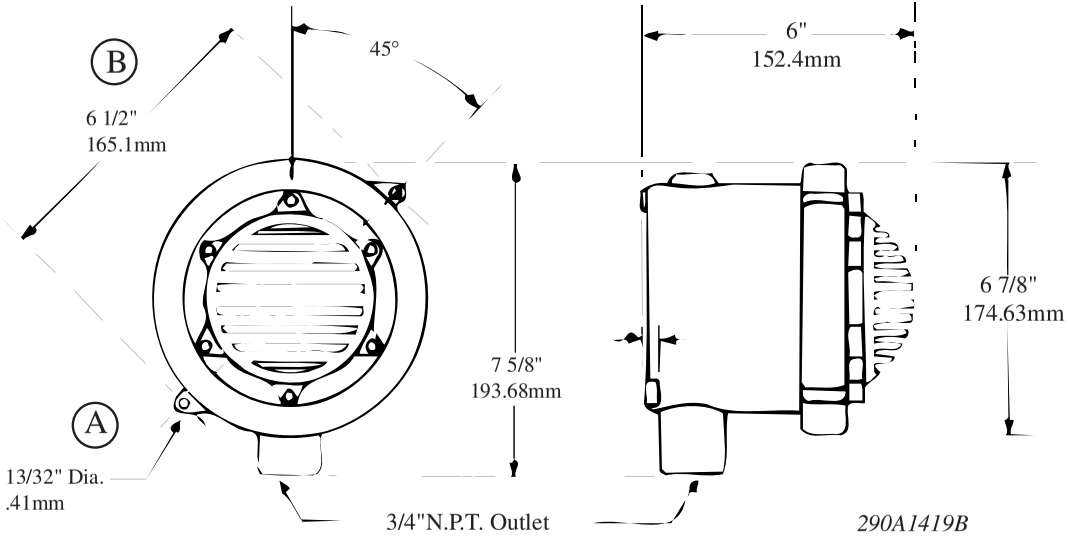
Toutes les unités renvoyées à Federal Signal pour un service, inspection ou réparation doivent être accompagnées d'une autorisation de retour de matériel. Cette R.M.A. peut être obtenue auprès du distributeur local ou du représentant du fabricant.

A ce moment, une courte explication du service demandé, ou la nature du mauvais fonctionnement doit être donnée.

Adressez toutes les communications et expéditions à:

FEDERAL SIGNAL CORPORATION
Electrical Products Division
Service Department
2645 Federal Signal Drive
University Park, IL 60466-3195

I



English

A. Mounting hole centers
B. 2 Mounting holes

Español

A. Centros de huecos de montaje
B. 2 Huecos de montaje

Français

A. Distance entre centres de trous de montage
B. 2 Trous de montage

256922E
Rev. E 4/98
Made in U.S.A.
Fabricado en USA
Fabriquè aux Etats-Unis

TAB 10
LED Warning Light
(Ovivo USA, LLC Part No. 771768)

FEDERAL SIGNAL



(Shown with pendant mount. See how to order for mounting options)



▶ Model 27XST

Explosion-Proof Strobe Light

A B C G M R

Federal Signal's Model 27XST explosion-proof strobe light features a voltage in-rush limiting PCB design that provides greater compatibility with factory automation control systems and less electrical interference with in-rush sensitive devices.

Three mounting options are available: pendant, ceiling or 90° wall mount. For easy installation, the mounting box is first installed and the fixture is then threaded onto the mounting box, making the electrical connection. Pre-install the mounting bracket and electrical continuity is made when five threads are engaged.

Federal Signal's Model 27XST is specifically designed for explosion-proof atmospheres and/or corrosive environments. Because it is easy to install and requires very low maintenance, it is ideal for use in areas such as oil rigs, mines, refineries, and chemical plants.

FEATURES

- Approved for mounting in any manner-including dome up
- Available in 24VDC, 120VAC and 240VAC
- Six lamp/lens colors: Amber, Blue, Clear, Green, Magenta and Red
- 10,000 hour strobe tube
- 3/4" NPT pendant, ceiling and wall mount options available
- Dome guard optional
- Conformal coated PCB
- Type 4X, IP66 enclosure
- IP69K compliant
- Marine Rated
- CSFM Approved
- UL and cUL Listed for Class I, Division 1 and 2, Groups C and D; Class I, Division 2, Groups A and B; Class II, Division 1, Groups E, F, and G; Class III

MODEL	VOLTAGE	OPERATING CURRENT	FLASH RATE/ MINUTE	LIGHT OUTPUT PEAK[1]	LIGHT OUTPUT ECP[2]
27XST-024 * -MOD[1]	24VDC	1.90 amps (3.0 amp In-rush)	80	2,000,000 cd	850 cd
27XST-120 * -MOD[1]	120VAC 50/60Hz	1.14 amps	80	2,000,000 cd	850 cd
27XST-240 * -MOD[1]	240VAC 50/60Hz	1.14 amps	80	2,000,000 cd	850 cd

* Indicates color: (A) Amber, (B) Blue, (C) Clear, (G) Green or (R) Red (Magenta available in 120VAC and 240VAC models only)

[1] See "how to order" for mounting options

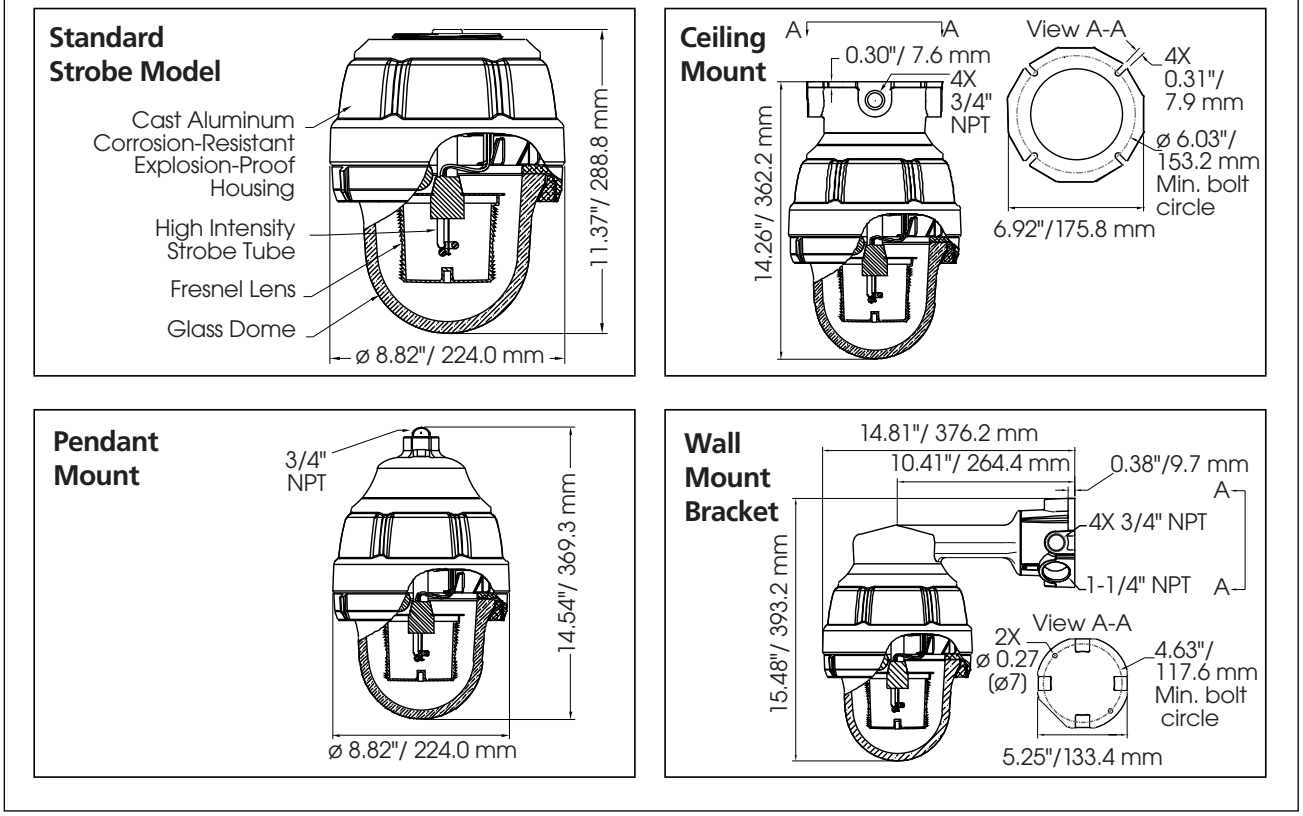
[2] Peak candela is the maximum light intensity generated by a flashing light during its light pulse

[3] ECP (Effective Candela) is the intensity that would appear to an observer if the light were burning steadily

HAZARDOUS LOCATION RATING: 27XST

T-CODE AT MAXIMUM AMBIENT TEMPERATURE, °C		
Hazardous Location	**40°C**	**65°C**
Class I, Division 1 & 2, Groups C, D	T6	T4A
Class I, Division 2, Groups A, B	T2	T2
Class II, Division 1, Groups E, F, G	T6	T4A
Class III	T6	T4A

Explosion-Proof Strobe Light (27XST)



SPECIFICATIONS

Lamp Life:		10,000 Hours
Light Source:		Strobe Tube
Operating Temperature:	-67°F to 150°F	-55°C to 65°C
Net Product Weight		
Signal without Mounting:	13.9 lbs	6.3 kg
Ceiling Mount:	4.5 lbs	2.0 kg
Pendant Mount:	2.0 lbs	0.9 kg
Wall Mount:	5.9 lbs	2.7 kg
Shipping Weight		
Signal without Mounting:	14.7 lbs	6.67 kg
Ceiling Mount:	5.3 lbs	2.40 kg
Pendant Mount:	2.8 lbs	1.27 kg
Wall Mount:	6.7 lbs	3.03 kg

REPLACEMENT PARTS

Description	Part Number
Exterior Dome Assembly, Clear	K8436147A
Interior Lens Assembly, Amber	K8550C095A-02
Interior Lens Assembly, Blue	K8550C095A-01
Interior Lens Assembly, Clear	K8550C095A
Interior Lens Assembly, Green	K8550C095A-04
Interior Lens Assembly, Magenta	K8550C095A-07
Interior Lens Assembly, Red	K8550C095A-03
24VDC Mechanism	K8436107F-03
120VAC Mechanism	K8436107E-02
Strobe Tube	K8107159A

OPTIONAL ACCESSORIES

Description	Part Number
Dome Guard	DGXC-SB

HOW TO ORDER

27XST – 024 A – MOD

TYPE
27XST

VOLTAGE
024 (24VDC)
120 (120VAC)
240 (240VAC)

COLOR
A Amber
B Blue
C Clear
G Green
M Magenta
R Red

Specify Optional Mounting:*

Description	Part Number
Ceiling Mount	CMXC-SB
Pendant Mount	PMXC-SB
Wall Mount	WMXC-SB

* Mounting kit must be ordered with unit, sold separately

FEDERAL SIGNAL
Protecting people and our planet

MODEL 27XST

INSTALLATION AND SERVICE INSTRUCTIONS FOR MODEL 27XST FOR USE IN HAZARDOUS LOCATIONS

MODELO 27XST

INSTRUCCIONES DE INSTALACIÓN Y SERVICIO PARA LOS MODELO 27XST PARA USO EN UBICACIONES PELIGROSAS

MODÈLE 27XST

CONSIGNES D'INSTALLATION ET D'ENTRETIEN DES MODÈLE 27XST POUR UTILISATION DANS LES ENDROITS DANGEREUX

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INSTALLATION AND SERVICE INSTRUCTIONS FOR FEDERAL MODEL 27XST FOR USE IN HAZARDOUS LOCATIONS

⚠ SAFETY MESSAGE TO INSTALLERS, USERS AND MAINTENANCE PERSONNEL

It is important to follow all instructions shipped with this product. This device is to be installed by a trained electrician who is thoroughly familiar with the National Electrical Code and/or Canadian Electrical Code and will follow the NEC and/or CEC Guidelines as well as local codes.

This device should be considered a part of the warning system and not the entire warning system. The selection of the mounting location for the device, its controls and the routing of the wiring are to be accomplished under the direction of the facilities engineer and the safety engineer. In addition, listed below are some other important safety instructions and precautions you should follow:

- Read and understand all instructions before installing or operating this equipment.
- Never alter the unit in any manner. Safety may be compromised if additional openings or other alterations are made to the unit.
- Do not connect the equipment when the circuit is powered or if the location is not known to be free of concentrations of ignitable concentrations.
- After installation, ensure that the set screw and threaded joints are properly tightened.
- After installation, test the light system to ensure that it operating properly.
- After testing is complete, provide a copy of this instruction sheet to all operating personnel.
- Establish a procedure to routinely check the light installation for integrity and proper operation.
- Keep the unit tightly closed when in operation.

Failure to follow all safety precautions and instructions may result in property damage, serious injury, or death.

I. GENERAL

This equipment is suitable for use in Class I, Div. I, Groups C and D; Class I, Div. 2, Groups A, B, C and D; Class II, Div. 1, Groups E, F, and G; Class III, or non-hazardous locations only.

The Model 27XST strobe light is a visual signaling device for hazardous locations and provides about 75 to 80 high-intensity flashes per minute. The effective candlepower (ECP) of the light is 850 candelas (clear dome). The unit is UL and CSA listed for indoor and outdoor use and has been found to comply with Type 4X (watertight and corrosion resistant) enclosure requirements and Marine Visual Signal Device, Outside Type (saltwater).

⚠WARNING

EXPLOSION HAZARD—This light fixture is not backward compatible with older products. Do not use this light fixture with the Series A versions of model CMXC, CMXC-R, PMXC, PMXC-R, WMXC, or WMXC-R mounting accessories. Failure to follow this warning may result in personal injury or death.

II. UNPACKING

⚠WARNING

EXPLOSION HAZARD — Damaged glass domes can lead to explosions, which could result in serious injury or death. Replace damaged domes.

After unpacking the unit, examine it for damage that may have occurred in transit. If the equipment has been damaged, do not attempt to install or operate the unit. File a claim immediately with the carrier, stating the extent of damage. Carefully check all envelopes, shipping labels and tags before removing or destroying them.

III. INSTALLATION

NOTE

The glass dome is part of the explosion proof housing. In applications where the dome requires added protection, a separately purchased metal guard (Part No. DGXC-SB) can be readily attached.

NOTE

Recommended mounting position of this light is in a vertical orientation with the dome facing down. The pendant mount has provisions for mounting to 3/4" pipe.

The instructions below are for lights using the pendant mount option (PMXC-SB). Refer to instruction manual 25500050 for the ceiling mount (CMXC-SB) or wall mount option (WMXC-SB).

Wiring must comply with the National Electrical Code or Canadian Electrical Code and the local authority having jurisdiction

For marine applications, all wiring (including supply wire) must be stranded wire and meet the USCG (CFR46) Section (110-113).

The Model 27XST strobe light should be installed per the NEC or CEC, STATE and LOCAL CODES. Alternate installation locations and/or orientations should only be performed with the approval of the authority having jurisdiction. In addition, they can be mounted using an optional ceiling mount or an optional wall mount.

To install the 27XST on 3/4" N.P.T. threaded pipe:

A. Ensure that the mating threads are clean. Thread the pendant mount onto the 3/4” pipe and secure with the set screw (see Figure 1).

B. Remove the terminal block from the pendant mount by loosening the two mount screws.

⚠WARNING

SHOCK HAZARD — To avoid electrical shock hazards, do not connect wires when power is applied.

C. Connect the supply wires to the terminal block as follows (see Figure 2):

1. DC Models

CAUTION

REVERSE POLARITY/MISWIRING — The DC units are polarity sensitive, and MAY BE DAMAGED by incorrect electrical hookup. When connecting the DC strobe unit to the voltage supply lines, POLARITY MUST BE OBSERVED. In addition, damage will result if the voltage rating of the model is exceeded.

a. Connect the positive (+) power source wire to the terminal block screw marked "L+." Connect the negative (–) power source wire to the terminal block screw marked "N–".

b. If required by local building codes, connect the earth ground wire to the green screw in the pendant mount.

2. AC Models

⚠WARNING

SHOCK HAZARD — To reduce shock hazards during maintenance POLARITY MUST BE OBSERVED when connecting AC units to the power source.

NOTE

The 120 Vac and 240 Vac strobe units are designed to operate on both 50 Hz and 60 Hz electrical power. Special modifications are NOT required for the two different AC line frequencies.

a. Connect the phase (hot) power source wire to the terminal block screw marked "L+." Connect the common (neutral) power source wire to the terminal block screw marked "N–."

b. If required by local building codes, connect the earth ground wire to the screw in the fixture mount.

D. Replace the terminal block in the pendant mount and secure with the previously loosened mounting screws.

E. To prevent galling and ease future maintenance, ensure that the threads on the pendant mount are clean and lubricated with a corrosion-inhibiting grease such as petrolatum or soap-thickened mineral oils. Thread the fixture clockwise into the mount and tighten it securely.

IV. MAINTENANCE

EXPLOSION HAZARD — Do not disconnect the equipment while the circuit is live or unless the area is known to be free of ignitable concentrations.

EXPLOSION HAZARD — Substitution of any component may impair suitability for Class I, Division 2.

⚠ SAFETY MESSAGE TO MAINTENANCE PERSONNEL

Listed below are some important safety instructions and precautions you should follow:

- Read and understand all instructions before operating this system.
- Any maintenance to the light system must be done with the power turned off.
- Any maintenance to the light system must be performed by a trained electrician in accordance with all applicable national and local codes in the country of use.
- Never alter the unit in any manner. The safety of the unit may be compromised if additional openings or other alterations are made.
- The nameplate should not be obscured. It contains cautionary and/or other information of importance to maintenance personnel. Ensure the nameplate remains readable if the housing's exterior is painted.
- If the glass dome is damaged in any way, it MUST be replaced.
- After performing any maintenance, test the light system to ensure that it is operating properly.

Failure to follow all safety precautions and instructions may result in property damage, serious injury, or death.

A. Flash Tube Replacement

As strobe lights are used, the flash tubes begin to darken, causing the light output to decrease. This darkening is characteristic of flash tubes. The darkening will begin near the base of the tube and progress upward. In addition, as flash tubes age, they may have a tendency to misfire (not fire periodically).

After extended operation, occasionally check for flash tube degradation. Should the flash tube misfire, have a noticeable decrease in light output, glow continuously or darken to a point beyond that shown in Figure 3, it should be replaced.

⚠WARNING

SHOCK HAZARD — Strobe and HID light systems generate high voltages. Disconnect power from the strobe system and wait at least 5 minutes before opening the unit. Do not apply power to the unit while the unit is open. Failure to follow this warning could result in serious injury or death.

⚠WARNING

HANDLE STROBE LAMPS CAREFULLY — Strobe lamps get hot enough to burn you. Always allow these lamps to cool before handling them. Strobe lamps are also pressurized and, if broken, can result in flying glass. Failure to follow this warning may result in personal injury.

⚠WARNING

DO NOT TOUCH LAMP WITH BARE HANDS — Oil deposits on the glass portion of the strobe lamp can cause the glass to fracture during use. If you are unsure if the glass has been handled without gloves, clean the glass using a soft cloth and isopropyl alcohol before installing the lamp.

⚠WARNING

EXPLOSION HAZARD — The effectiveness of the explosion–proof enclosure must be maintained. Do not damage the dome or threads while disassembling or reassembling unit. Lubricated joints exposed for long periods of time may attract small particles of dirt or other foreign materials. Body and cover joints should be reassembled immediately.

To change the flash tube, proceed as follows:

1. Disconnect power.

2. Remove the glass dome assembly from the main casting by rotating the dome assembly counterclockwise.

3. Loosen the lens-clip screw (1–3 turns) and rotate the clip 90°. Remove the lens to expose the flash tube.

4. With the lens removed, use a rocking motion and gently remove the tube. Replace the flash tube with the appropriate replacement part listed in the replacement parts list in paragraph IV. F. Replacement Parts.

5. Place the lens in position under two hold-down tabs. Rotate the clip into place on the lip of dome.

6. Reassemble the unit by threading the glass dome assembly into the main housing until tight.

B. Fuse Replacement for 120 Vac and 240 Vac Units

To replace the fuse:

1. Disconnect power.

2. Remove the glass dome assembly from the main casting by rotating the dome assembly counterclockwise.

3. The fuse is positioned on the component side of the PC board mounted in fuse clips. For easy removal, pry one end of the fuse out of the clip with an insulated-handled screwdriver.

4. Replace the fuse with one of the same sizes and rating only. The 120 Vac and 240 Vac units use a 1 ampere, 250 volt, slow blow GMC fuse (Littlefuse Part No. 0313001-HXP or equal).

5. Reassemble the unit by threading the glass dome assembly into the main housing until tight.

C. Cleaning the Enclosure

NOTE

Maintenance procedures sometime require fixtures to be hosed down for good housekeeping. The circuit must be turned OFF and the dome MUST be allowed to cool to ambient room temperature before cleaning.

The fixture should be cleaned periodically to maintain maximum light output. Only mild, non-abrasive cleaning agents should be used. The glass dome should be regularly inspected for scratches and chips, and if damaged, must be replaced.

D. Lubrication

The threaded joint on the pendant mount should be kept well lubricated with a corrosion-inhibiting grease such as petrolatum or soap-thickened mineral oils. If corrosive products have accumulated on explosion-proof joints and cannot readily be removed with solvents, the parts should be discarded and replaced.

⚠WARNING

EXPLOSION HAZARD — Never use an abrasive material or file to remove corrosive products from threaded surfaces. In extremely corrosive locations, equipment should be periodically inspected to guard against unusual deterioration and possible porosity, since this may weaken the enclosure structurally.

E. Service

Federal Signal will service your equipment and provide technical assistance with any problems that cannot be handled locally by Federal Signal's Distributor or Manufacturer Representative.

If any unit returned to Federal Signal for service, inspection, or repair must be accompanied by a Return Material Authorization number with a brief explanation of the service being requested and/or the nature of the malfunction. This R.M.A. can be obtained from the local Federal Signal Distributor or Manufacturer's Representative.

Address all communications and shipments to:

FEDERAL SIGNAL CORPORATION
Industrial Products Division
2645 Federal Signal Drive
University Park, IL 60484-3167
Phone: +1 877 289 3246 • +1 708-534-4756
Fax: +1 708 534 4887
www.federalsignal-indust.com

F. Replacement Parts

Description	Part Number
Fresnel Lens, Clear	K8550C095
Fresnel Lens, Blue	K8550C095-01
Fresnel Lens, Amber	K8550C095-02
Fresnel Lens, Red	K8550C095-03
Fresnel Lens, Green	K8550C095-04
Fresnel Lens, Magenta	K8550C095-07
Flash Tube	K8107159
Mechanism, 24 Vdc	K8436107-03
Mechanism, 120 Vac	K8436107-02
Mechanism, 240 Vac	K8436107-01
Glass Dome Assembly	K8436147
PCBA, Low In-Rush Board	K2001918-01

G. Optional Accessories

Description	Model
Dome Guard	DGXC-SB
Ceiling Mount	CMXC-SB
Wall Mount	WMXC-SB
Pendant Mount	PMXC-SB

Table 1. Electrical Ratings.

Operational Voltage	24Vdc	120Vac	230-240 Vac
Flashes/minute	75	80	80
Maximum Operating Current, A	1.9 A	1.14 A	0.52 A
Frequency, Hz	DC	50/60	50/60

INSTRUCCIONES DE INSTALACIÓN Y SERVICIO PARA LOS MODELO 27XST PARA USO EN UBICACIONES PELIGROSAS

⚠ MENSAJE DE SEGURIDAD PARA INSTALADORES

Es importante seguir todas las instrucciones incluidas con este producto. Este dispositivo debe ser instalado por un electricista calificado familiarizado con el Código Eléctrico Nacional (NEC) y/o el Código Eléctrico de Canadá (CEC), y deberá cumplir ambas normas, además de los códigos locales.

La selección del lugar de montaje de este aparato, sus controles y la instalación del cable de conexiones, deberán ser efectuados bajo la dirección del ingeniero de facilidades y el ingeniero de seguridad. A continuación describimos otras instrucciones de seguridad importantes y precauciones que se deberán seguir:

- Lea y entienda todas las instrucciones antes de instalar o de operar el equipo.
- Jamás modifique la unidad en ninguna forma. Puede comprometerse la seguridad si se realizan aberturas adicionales u otras modificaciones a la unidad.
- No conecte el equipo mientras el circuito esté activado o salvo que se sepa que el área está libre de concentraciones combustibles
- Después de la instalación asegúrese que los tornillos de seguridad y las uniones de roscas han sido apretadas adecuadamente.
- Después de la instalación, pruebe el sistema de luz para asegurarse que está operando apropiadamente.
- Después de que termine las pruebas, proporcione una copia de la hoja de instrucciones, a todo el personal de operaciones.
- Establezca un procedimiento para rutinariamente verificar la activación y operación adecuadas del sistema de luz.
- Mantenga la unidad herméticamente cerrada cuando durante la operación.

Fallas al seguir estas instrucciones y precauciones de seguridad pueden resultar en daños a la propiedad, lesiones serias o muerte.

I. GENERAL

Este equipo es adecuado para su uso en clase I, div. I, grupos C y D; Clase I, División 2, grupos A, B, C y D; Clase II, División 1, grupos E, F y G; Clase III, o lugares no peligrosos solamente.

El modelo de luz estroboscópica 27XST es un dispositivo de señalización visual para ubicaciones peligrosas y proporciona cerca de 75–80 destellos de alta intensidad por minuto. La intensidad lumínica efectiva (ECP) de la luz es de 850 candelas (domo transparente) La unidad está certificada por UL y CSA para empleo en interiores y exteriores y cumple con los requisitos de compartimientos tipo 4X (estancos y resistentes a la corrosión) y de Dispositivos de señalización visual marina tipo exterior (agua salada).

⚠ADVERTENCIA

PELIGRO DE EXPLOSIÓN — Esta lámpara no es compatible con productos anteriores. No utilice este aparato de luz con las versiones de la serie de accesorios de montaje de CMXC, CMXC-R, PMXC, PMXC-R, WMXC o WMXC-R modelo. Fallas al seguir esta advertencia de seguridad puede resultar en daños a la propiedad, lesiones serias o muerte a usted o terceras personas.

II. DESEMPAQUE

⚠ADVERTENCIA

PELIGRO DE EXPLOSIÓN — Domos de vidrio dañados pueden ocasionar explosiones que pueden resultar en lesiones serias o muerte. Domos dañados deben ser reemplazados.

Después de desempacar el Modelo 27XST, examínelo para detectar posibles daños que pudieran haber ocurrido durante el transporte. Si el equipo ha sido dañado ni trate de instalarlo ni de operarlo. Haga un reclamo inmediato con el transportador declarando los daños encontrados. Cuidadosamente verifique todas las marcas y documentos de embarque antes de removerlos o destruirlos.

III. INSTALACION

NOTA

El domo de vidrio es parte de la caja a prueba de explosión. En aplicaciones donde el domo requiere protección adicional, se puede comprar adicionalmente, una protección de metal (Parte número DGXC-SB) que viene lista para instalarse.

NOTA

La posición de montaje que se recomienda para esta luz es con orientación vertical y el domo hacia abajo. El montaje de la unidad viene con provisiones para montarla en tubería de 3/4".

Las instrucciones siguientes son para las luces utilizando un montaje colgante opción (PMXC-SB). Consulte el manual de instrucciones para el 25500050 opción (WMXC-SB) instalación de techo (CMXC-SB) o montaje en pared.

El cableado debe cumplir con el Código eléctrico nacional o el Código eléctrico de Canadá y la autoridad local que tenga jurisdicción.

Para aplicaciones marinas, todo el cableado (incluyendo el cable de alimentación) deberá ser alambre y también deberá cumplir con los requisitos de USCG (CFR46) sección (110-113).

El modelo estroboscópico 27XST debe instalarse de acuerdo con los CÓDIGOS NEC o CEC, ESTATALES y LOCALES. Sólo debe realizarse una ubicación u orientación alternativa con la aprobación de la autoridad correspondiente. Además, puede montarse usando un soporte de techo o de pared opcionales.

Para instalar en un tubo roscado de 3/4 pulg. N.P.T, proceda de la siguiente forma:

A. Ver figura 1. Asegúrese que las uniones y las roscas están limpias. Atornille el montaje de la unidad en la tubería de 3/4" y sujétela con tornillos de presión.

B. Remueva el bloque de la terminal del montaje de la unidad, aflojando los dos tornillos de montaje.

⚠ADVERTENCIA

PELIGRO DE CHOQUE ELÉCTRICO — Para evitar peligro de choque eléctrico no conecte los cables cuando está encendido el al sistema.

C. Conecte los cables de suministro al bloque de terminales de la siguiente forma (vea la figura 2):

1. Luz de CC

ATENCIÓN

Las unidades de VCC son sensitivas a la polaridad, y PUEDEN SER DAÑADAS si se conectan incorrectamente. Cuando conecte la luz de destello de 24 VCC a la línea de alimentación. DEBE OBSERVAR LA POLARIDAD CORRECTA. También puede dañar la unidad si el rango de voltaje de un modelo en particular se exceda.

a. Conecte el cable de alimentación positivo (+) al tornillo del bloque de terminal marcado "L+." Conecte el cable de alimentación negativo (-) al tornillo del bloque de terminal marcado "N–."

b. Si los códigos de construcción locales lo requieren, conecte el cable de tierra al tornillo verde del montaje de la unidad.

2. Luz de CA

⚠ADVERTENCIA

PELIGRO DE CHOQUE ELÉCTRICO — Para reducir la posibilidad de choques eléctricos durante mantenimiento, OBSERVE LA POLARIDAD CORRECTA cuando conecte la unidad de CA a la fuente de alimentación.

NOTA

Los 120 VCA y 240 VCA unidades de luz estroboscópica están diseñadas para funcionar con energía eléctrica tanto de 50 Hz y 60 Hz. Modificaciones especiales NO SON necesarios para las dos frecuencias diferentes de línea AC.

a. Conecte el cable de alimentación del lado fase al tornillo del bloque de la terminal marcado "L." Conecte el cable de alimentación del lado común (neutro) al tornillo del bloque de la terminal marcado "N–."

b. Si los códigos de construcción locales lo requieren, conecte el cable a tierra al tornillo verde del montaje de la unidad.

D. Reemplace el bloque de la terminal en el montaje de la unidad y sujétela con los tornillos previamente aflojados.

E. Para evitar el desgarramiento y facilitar el mantenimiento futuro, asegúrese de que el empalme roscado de la cubierta está limpio y lubricado con una grasa anticorrosiva como petrolato y aceites minerales saponificados.

IV. MANTENIMIENTO

⚠ADVERTENCIA

PELIGRO DE CHOQUE ELÉCTRICO — Existen altos voltajes en el conjunto de iluminación después de desconectar la energía. Para evitar una descarga eléctrica, desconecte el dispositivo del circuito de suministro y espere por lo menos 5 minutos antes de abrirlo.

⚠ADVERTENCIA

PELIGRO DE EXPLOSION — No desconecte el equipo mientras el circuito esté activado o salvo que se sepa que el área está libre de concentraciones combustibles.

⚠ADVERTENCIA

PELIGRO DE EXPLOSION — La sustitución de cualquier componente podría menoscabar la conformabilidad a la Clase I, División 2.

⚠ MENSAJE DE SEGURIDAD PARA EL PERSONAL DE MANTENIMIENTO

A continuación describimos algunas instrucciones de seguridad importantes y precauciones que se deberán seguir:

- Lea y entienda todas las instrucciones antes de operar el sistema.
- El sistema de luz deberá estar apagado antes de realizar cualquier actividad de mantenimiento.
- Cualquier actividad de mantenimiento deberá ser realizada por un electricista capacitado y de acuerdo a los códigos locales y el National Electrical Code–NEC.
- No efectúe alteraciones de ningún tipo en la unidad misma. Puede poner en riesgo la seguridad de las áreas clasificadas como peligrosas si añade áreas de acceso o realiza alguna otra alteración en unidades diseñadas para usarse en ciertas áreas especificas.
- La placa de identificación puede contener notas de precaución o alguna otra información importante, para el personal de mantenimiento. Asegúrese que siempre permanece legible, especialmente cuando pinte el exterior del equipo.
- Si el domo tiene cualquier tipo de daño, DEBE ser reemplazado.
- Después de realizar cualquier trabajo de mantenimiento, pruebe el sistema de luz para asegurarse que esté funcionando correctamente.

Fallas al seguir las precauciones e instrucciones de seguridad pueden resultar en daños a la propiedad, lesiones severas o muerte.

A. Reemplazo del tubo de destello.

Ya que se utilizan luces estroboscópicas, los tubos de destello comienzan a oscurecerse, causando que disminuya la salida de luz. Este oscurecimiento es típico de los tubos de destello. El oscurecimiento comenzará cerca de la base del tubo y avanzará hacia arriba. Además, con el tiempo, los tubos de destello tienden a presentar fallas de encendido (no encienden periódicamente)

Después de una operación prolongada, verifique de vez en cuando si hay degradación del tubo de destello. Si el tubo tiene fallas de encendido, si presenta una disminución evidente de la salida de luz, si brilla continuamente o si se oscurece más del punto indicado en la figura 3, debe ser reemplazado.

⚠ADVERTENCIA

PELIGRO DE CHOQUE ELÉCTRICO — Estroboscópico y sistemas de luz HID generan altos voltajes. Desconecte la alimentación del sistema de luz estroboscópica y espere al menos 5 minutos antes de abrir la unidad. Aplicar energía a la unidad mientras la unidad esté abierta. No seguir esta advertencia podría resultar en lesiones graves o la muerte.

⚠ADVERTENCIA

LÁMPARAS ESTROBOSCÓPICAS MANEJAR CUIDADOSAMENTE — Lámparas estroboscópicas Haz lo suficientemente calientes como para quemar. Siempre permita que estas lámparas se enfríen antes de manipularlos. Lámparas de luz estroboscópica también están presurizadas y, si se rompe, pueden resultar en vuelo vidrio. El incumplimiento de esta advertencia puede resultar en lesiones personales.

⚠ADVERTENCIA

HACER NO TOQUE LA LÁMPARA CON MANOS — Depósitos de aceite en la parte de vidrio de la lámpara estroboscópica pueden causar el artefacto de vidrio a romperse durante el uso. Si no está seguro si el vidrio ha sido manipulado sin guantes, limpie el vidrio con un paño suave y alcohol isopropílico antes de instalar la lámpara.

⚠ADVERTENCIA

PELIGRO DE EXPLOSIÓN — Debe mantenerse la efectividad de la caja a prueba de explosión. No dañe la pantalla ni la parte roscada al desensamblar o reensamblar la unidad. Las uniones lubricadas expuestas por largos períodos de tiempo pueden atraer pequeñas partículas de suciedad u otras materias extrañas. Las uniones del cuerpo y la cubierta deben ser reensambladas inmediatamente.

Vea la figura 3. Para cambiar el tubo de destello, proceda de la manera siguiente:

1. Desconecte la alimentación.

2. Retire el conjunto de domo de cristal de la carcasa principal al girar el conjunto de domo antihorario.

3. Afloje el tornillo de la clavija de la lente (1 a 3 vueltas) y gire la clavija 90°. Quite el domo para dejar expuesto el tubo de destello.

4. Con la lente retirada, use un movimiento de oscilación y retire el tubo con suavidad. Reemplace el tubo destellante con la pieza de repuesto indicada en la lista de piezas de repuesto en el párrafo IV.F. Piezas de repuesto.

5. Coloque la lente en su lugar debajo de las aletas de sujeción inferiores (2). Gire la clavija a su lugar en el reborde del domo.

6. Volver a montar la unidad atornillando el conjunto de domo a la carcasa principal hasta que quede apretado.

B. Reemplazo de fusible para unidades de 120 VCA et 240 VCA.

Para reemplazar el fusible proceda como se describe a continuación:

1. Desconecte la alimentación.

2. Retire el conjunto de domo de cristal de la carcasa principal al girar el conjunto de domo antihorario.

3. El fusible está ubicado del lado de los componentes de tablero de circuito impreso y está montado en unos clips. Para facilitar su desarmado, haga palanca con un destornillador de mango aislado y mueva el fusible hacia afuera del clip.

4. Sólo reemplace el fusible con uno de igual tamaño y capacidad. Las unidades de 120 VCA y 240 VCA usan un fusible de acción retardada GMC de 1 amperio, 250 voltios, (pieza de Littlefuse Nº 0313001-HXP o igual).

5. Volver a montar la unidad atornillando el conjunto de domo a la carcasa principal hasta que quede apretado.

C. Limpieza de la Unidad

⚠ADVERTENCIA

Procedimientos de mantenimiento requieren que el equipo se limpie algunas veces con una manguera. El circuito debe estar apagado y el ensamble de domo debe dejar enfriarse a temperatura ambiente antes de limpiarla.

El ensamble debe ser limpiado periódicamente para mantener la máxima intensidad de luz disponible. Utilice únicamente limpiadores suaves y no abrasivos. La fuerza de agua de una manguera no debe exceder 65 Galones por minuto, con un diámetro de 1" y a una distancia de 10 pies. El vidrio del domo debe ser inspeccionado regularmente por rayaduras o picaduras. Si se encuentran estos daños, debe ser reemplazado el domo.

D. Lubricación

El empalme roscado de la cubierta debe lubricarse correctamente con una grasa anticorrosiva como petrolato y aceites minerales saponificados. Si se acumulan productos corrosivos en los empalmes a prueba de explosiones y no se pueden remover fácilmente con solventes, las piezas deben descartarse y reemplazarse.

⚠ADVERTENCIA

PELIGRO DE EXPLOSIÓN — Nunca use ninguna materia abrasiva ni una lima para remover productos corrosivos de la superficie de las roscas. En lugares extremadamente corrosivos, el equipo debe ser inspeccionado periódicamente para protegerlo contra cualquier deterioro o posible porosidad, ya que estos pueden debilitar el ensamble estructuralmente.

E. Servicio

La fábrica de Federal Signal dará servicio a su equipo o proporcionará asistencia técnica en cualquier problema que no pueda ser manejado localmente, con satisfacción y rapidez.

Cualquier unidad devuelta para ajuste o reparación, será aceptada por Federal, será aceptada sólamente si antecede una comunicación por escrito o telefonicamente de su despacho. Esta notificación debe indicar claramente el servicio solicitado y la información pertinente, relacionada con la naturaleza de la falla y si es posible las causas que la originaron.

Envíe todas sus comunicaciones y embarques a:

FEDERAL SIGNAL CORPORATION
Industrial Systems
Service Department
Phone: +1 877 289 3246 • +1 708-534-4756
Fax: +1 708 534 4887
www.federalsignal-indust.com

F. Partes de Reemplazo

Lente, Fresnel, Transparente	K8550C095
Lente, Fresnel, Azul	K8550C095-01
Lente, Fresnel, Ambar	K8550C095-02
Lente, Fresnel, Rojo	K8550C095-03
Lente, Fresnel, Violeta	K8550C095-07
Tubo estroboscópico (Serie C)	K8422A420
Tubo estroboscópico (Serie C1)	K8107159
Mecanismo, 24 VCC	K8436107-03
Mecanismo, 120 VCA	K8436107-02
Mecanismo, 240 VCA	K8436107-01
Ensamble de domo	K8436147
PCBA, tablero de baja corriente inicial	K2001918-01

G. Accesorios

Descripción	Modelo
Protección del domo	DGXC-SB
Montaje de techo	CMXC-SB
Montaje de pared	WMXC-SB
Montaje de colgante	PMXC-SB

Tabla 1. Valores eléctricos nominales.

Voltaje operacional	24 VCC	120 VCA	230-240 VCA
Destellos / minuto	75	80	80
Corriente de funcionamiento–máxima, A	1,9 A	1,14 A	0.52 A
Frecuencia, Hz	CC	50/60	50/60

CONSIGNES D'INSTALLATION ET D'ENTRETIEN DES MODÈLE 27XST POUR UTILISATION DANS LES ENDROITS DANGEREUX

⚠ MESSAGE DE SÉCURITÉ AUX INSTALLATEURS

Il est important de suivre toutes les consignes livrées avec ce produit. Cet appareil doit être installé par un maître électricien familier avec le National Electrical Code (le code national de l'électricité) et/ou le code canadien de l'électricité ; il devra suivre les lignes directrices du NEC et/ou le CCE autant que celles des codes locaux.

Le choix de l'endroit de montage du dispositif, de ses commandes et du passage des câbles doit être effectué sous la direction de l'ingénieur de sécurité et de l'ingénieur des services électriques. De plus, sont énumérées ci-dessous quelques autres instructions et précautions de sécurité importantes que vous devez suivre:

- Lire et comprendre toutes les instructions avant d'installer ou d'utiliser ce matériel.
- Ne pas altérer l'appareil de quelque manière que ce soit. Votre sécurité pourrait être compromise si de nouvelles ouvertures ou autres modifications étaient pratiquées sur l'appareil.
- Ne pas brancher l'appareil lorsque le circuit est sous tension ni si l'endroit n'est pas notoirement libre de concentrations de produits inflammables.
- Après installation, assurez-vous que la vis de réglage est bien serrée et que les joints filetés sont bien engagés.
- Après installation, assurez-vous que toutes les vis de fixation et les joints filetés sont bien serrés.
- Après fin de l'essai, donnez un exemplaire de cette feuille d'instructions à tout le personnel utilisateur.
- Établissez une procédure pour vérifier de manière systématique l'installation d'éclairage concernant son intégrité et son fonctionnement correct.
- Garder l'appareil scellé lorsqu'il est en opération.

Si on ne respecte pas ces précautions de sécurité, il peut en résulter des dommages aux biens, des blessures graves ou mortelles.

I. GÉNÉRAL

Cet équipement est adapté à une utilisation en Classe I, Div. I, C et D, Classe I, Division 2, Groupes A, B, C et D, Classe II, Division 1, Groupes E, F et G, Classe III, ou emplacements non dangereux uniquement.

La lampe stroboscopique modèle 27XST est un dispositif de signalisation visuel pour emplacements dangereux, qui apporte environ 75–80 éclairs de haute intensité par minute. L'intensité de lumière efficace de la lampe est de 850 candelas (dôme transparent). L'unité est certifiée UL et CSA pour un usage intérieur et extérieur et est conforme aux exigences d'enceinte de Type 4X (étanche et résistant à la corrosion) et Dispositif de signalisation visuel marin, type extérieur (eau de mer).

II. DÉBALLAGE

⚠ AVERTISSEMENT

RISQUE D'EXPLOSION — Des dômes endommagés peuvent conduire à des explosions résultant en blessures graves ou mortelles. Remplacer les dômes endommagés.

Après déballage du Modèle 27XST, l'examiner pour détecter des dommages pouvant avoir eu lieu pendant le transport. Si le matériel a été endommagé, n'essayez pas de l'installer ou de l'utiliser. Déposez immédiatement une réclamation auprès du transporteur en indiquant les dommages. Vérifiez soigneusement toutes les enveloppes, les étiquettes d'expédition et les étiquettes volantes avant de les enlever ou de les détruire.

III. INSTALLATION

REMARQUE

Le dôme en verre fait partie du carter anti-explosion. Dans les applications où le domo en verre nécessite une protection supplémentaire, une protection métallique achetée séparément (pièce à DGXC-SB) peut être facilement attachée.

REMARQUE

La position recommandée pour le montage de cette lampe est dans le sens vertical avec le dôme face en bas. La monture a des dispositions pour montage sur tuyau de 3/4".

Les instructions ci-dessous pour les feux d'utiliser le support pendentif l'option (PMXC-SB). Reportez-vous au manuel d'instructions 25500050 pour le l'option (WMXC-SB) de montage au plafond (CMXC-SB) ou fixation murale.

Le câblage doit être conforme aux normes du National Electrical Code ou du Canadian Electrical Code et aux normes des autorités locales ayant juridiction.

Pour les applications marines, tout le câblage (y compris les fils d'alimentation doivent être en fil torsadé et répondre à la section USCG (CFR46) (110-113).

Les lampes stroboscopiques 27XST doivent être installées selon les codes NEC ou CEC, nationaux et locaux. Les orientations et/ou emplacements différents ne doivent être exécutés qu'après approbation préalable de l'autorité compétente. En outre, elles peuvent être montées à l'aide d'un support de plafond ou d'un support mural facultatif.

Pour installer le tube fileté NPT, effectuez les procédures ci-dessous :

A. Voir figure 1. Assurez-vous que les filets correspondants sont propres. Vissez la monture sur le tuyau de 3/4" et fixez avec la vis de fixation.

B. Démontez le bornier de la monture en desserrant les deux vis de montage.

⚠ AVERTISSEMENT

RISQUE DE CHOC ÉLECTRIQUE — Pour éviter les risques de choc électrique, ne pas connecter les fils si la tension n'est pas coupée.

C. Branchez les câbles d'alimentation au bloc de jonction comme suit (voir figure 2) :

1. Lampe CC

ATENCIÓN

Les appareils en courant continu sont sensibles à la polarité et PEUVENT ÊTRE ENDOMMAGES si on connecte mal électriquement. Lors de la connexion de l'appareil stroboscopique en 24V CC aux câbles d'alimentation, LA POLARITÉ DOIT ÊTRE RESPECTÉE. De plus, des dommages peuvent résulter d'un dépassement de tension du modèle particulier.

a. Connectez le fil de la source d'alimentation (+) à la vis du bornier marquée « L + ». Connectez le fil négatif (–) de la source d'alimentation à la vis du bornier marquée « N– ».

b. Si exigé par les codes de construction locaux, connectez le fil de terre à la vis verte dans la monture.

2. Lampes en Courant Alternatif

⚠ AVERTISSEMENT

RISQUE DE CHOC ÉLECTRIQUE — Pour réduire les risques de choc pendant l'entretien, LA POLARITÉ DOIT ÊTRE RESPECTÉE quand on fait la connexion des appareils CA à la source d'alimentation.

REMARQUE

Les appareils stroboscopiques 120 V c.a et 240 V c.c sont conçus pour fonctionner en 50 et 60 Hz. AUCUNE modification spéciale n'est nécessaire pour les deux fréquences différentes d'alimentation CA.

a. Connectez le fil de phase de la source d'alimentation à la vis du bornier marquée « L + ». Connectez le fil de la source d'alimentation commun (neutre) à la vis de bornier marquée « N– ».

b. Si exigé par les codes de construction locaux, connectez le fil de terre à la vis verte dans la monture.

D. Remettez en place le bornier dans la monture et fixez avec les vis de montage précédemment desserrées.

E. Pour éviter le grippage et faciliter l'entretien futur, assurez-vous que le joint fileté du couvercle est propre et lubrifié à l'aide d'une graisse anti-corrosion comme la gelée de pétrole ou une huile minérale épaissie au savon.

IV. MAINTENANCE

⚠ AVERTISSEMENT

RISQUE D'EXPLOSION — Ne pas débrancher l'appareil lorsque le circuit est sous tension ni si l'endroit n'est pas notoirement libre de concentrations de produits inflammables.

⚠ AVERTISSEMENT

RISQUE D'EXPLOSION — La substitution de tout composant risque de compromettre l'adéquation à la Classe I, Division 2.

⚠ MESSAGE DE SÉCURITÉ AU PERSONNEL D'ENTRETIEN

Ci-dessous une liste d'instructions importantes de sécurité et de précautions qui doivent être suivies:

- Lire et comprendre toutes les instructions avant d'utiliser ce système.
- Tout entretien du système de lampe doit être fait avec la tension coupée.
- Tout entretien du système de lampe doit être fait par un électricien professionnel conformément aux recommandations NEC et aux codes locaux.
- Ne jamais modifier l'unité de quelle que manière que ce soit. La sécurité dans des lieux dangereux peut être mise en cause si des ouvertures supplémentaires ou d'autres modifications sont faites dans des unités spécifiquement conçues pour utiliser dans ces endroits.
- La plaque de caractéristiques, qui peut contenir des informations d'avertissement ou autres d'importance pour le personnel d'entretien, ne doit PAS être cachée de manière quelconque. Assurez-vous que la plaque de caractéristiques reste lisible lorsque l'extérieur du carter est peint.
- Si le dôme est endommagé de quelque manière que ce soit, il DOIT être remplacé.
- Après avoir complété une séance d'entretien, vérifiez le système pour vous assurer de son bon fonctionnement.

Si on ne respecte pas ces instructions et précautions de sécurité, il peut en résulter des dommages aux biens, des blessures graves ou mortelles pour vous ou d'autres.

A. Remplacement de la lampe éclair.

À mesure que la lampe stroboscopique s'use, la lampe éclair noircit, faisant en sorte que l'émission de lumière diminue. Ce noircissement est caractéristique des lampes éclair. Le noircissement débutera près de la base de la lampe et progressera vers le haut. En plus, lorsqu'une lampe éclair vieillit, elle peut avoir tendance à avoir des ratés (ne pas clignoter de façon régulière).

Après une utilisation prolongée, vérifiez occasionnellement la dégradation de la lampe éclair. Est-ce que la lampe éclair a des ratés, l'émission de lumière a-t-elle diminué, luit-elle de façon continue ou est-elle noircie au-delà du point illustré en figure 3—elle doit être remplacée.

⚠ AVERTISSEMENT

RISQUE DE CHOC ÉLECTRIQUE — Systèmes de lumière stroboscopique et DHI génèrent des tensions élevées. Couper le courant et attendre 5 minutes avant d'ouvrir l'appareil. Le non-respect de cet avertissement pourrait entraîner des blessures graves ou la mort.

⚠ AVERTISSEMENT

RISQUE DE CHOC ÉLECTRIQUE — Stroboscope et DHI lumière systèmes génèrent des hautes tensions. Débranchez-le du système stroboscopique et attendre au moins 5 minutes avant d'ouvrir l'appareil. Ne s'appliquent pas courant à l'unité alors que l'appareil est ouvert. Le non-respect de cet avertissement pourrait entraîner des blessures graves ou la mort.

⚠ AVERTISSEMENT

GÉRER STROBOSCOPE LAMPES SOIGNEUSEMENT — Lampes stroboscopiques deviennent suffisamment chaudes pour vous brûler. Toujours autoriser ces lampes refroidir avant de les manipuler. Lampes stroboscopiques sont également sous pression et, si cassé, peuvent entraîner en éclats de verre. Le non-respect de cet avertissement peut entraîner des blessures corporelles.

⚠ AVERTISSEMENT

FAIRE PAS TOUCHER LAMPE À MAINS NUES — Dépôts de pétrole sur le part de verre de la lampe stroboscopique peut causer le luminaire de verre se rompe pendant l'utilisation. Si vous ne savez pas si le verre a été géré sans gants, nettoyez la vitre à l'aide d'un chiffon doux et l'alcool isopropylique avant d'installer la lampe.

⚠ AVERTISSEMENT

RISQUE D'EXPLOSION — L'efficacité du boîtier anti-explosion doit être préservée. N'endommagez pas le dôme ou les filets en démontant ou ré-assemblant l'appareil. Des joints lubrifiés exposés aux éléments pendant une longue période peuvent retenir de petites particules de saleté ou d'autres corps étrangers. Le boîtier et le couvercle doivent être ré-assemblés immédiatement.

Voir la figure 3, Pour changer la lampe éclair, procédez comme suit :

1. Déconnectez l'alimentation électrique.

2. Retirer l'ensemble de dôme à partir du boîtier principal par la rotation de l'ensemble de dôme dans le sens antihoraire.

3. Desserrer la vis de la fixation à ressort du dôme (de 1 à 3 tours) et faire pivoter la fixation de 90°. Retirer le dôme pour exposer la lampe à éclats.

4. Une fois la lentille retiré, utilisez un mouvement de bascule et retirez délicatement le tube. Remplacez le tube flash par la pièce de rechange appropriée que vous retrouverez dans la liste des pièces de rechange au paragraphe IV. F. Pièces de rechange.

5. Mettre la lentille en position sous les pattes de retenue (2). Tourner le clip en place sur le rebord de la coupole et serrer la vis.

6. Réassemblez l'appareil en vissant l'ensemble du dôme dans le carter principal jusqu'à ce que ce soit serré.

B. Fusible de remplacement pour appareils de 120 V c.a. et 240 V c.c.

Pour remplacer le fusible, procédez comme suit:

1. Déconnectez l'alimentation électrique.

2. Retirer l'ensemble de dôme à partir du boîtier principal par la rotation de l'ensemble de dôme dans le sens antihoraire.

3. Le fusible est placé sur le côté composants de la carte à circuit imprimé montée dans des crochets à fusible. Pour retirer facilement, poussez sur une extrémité du fusible pour le sortir de la fixation à l'aide d'un tournevis à poignée isolée.

4. Ne remplacez le fusible qu'avec un autre de même dimension et de même calibre. Les appareils de 120 V c.a. et 240 V c.a. utilisent un fusible GMC à action retardée de 1 ampère et 250 volt (Nº de pièce du Littlefuse 0313001-HXP ou égal).

5. Réassemblez l'appareil en vissant l'ensemble du dôme dans le carter principal jusqu'à ce que ce soit serré.

C. Nettoyage de L'enceinte

REMARQUE

Les procédures d'entretien nécessitent quelquefois que les accessoires soient lavés au jet pour les nettoyer. Le circuit doit être COUPE et le bloc de l'appareil DOIT être laissé à refroidir à la température ambiante du local avant nettoyage.

L'accessoire doit être nettoyé périodiquement pour maintenir une émission de lumière maximale. Seuls des produits non abrasifs et doux de nettoyage doivent être utilisés. Le dôme en verre doit être régulièrement inspecté pour détecter des griffures et des écailles et s'il est endommagé, il doit être remplacé.

D. Lubrification

Le joint fileté du couvercle doit être bien lubrifié en tout temps à l'aide d'une graisse anti-corrosion comme la gelée de pétrole ou une huile minérale épaissie au savon. Si des produits corrosifs se sont accumulés sur les joints anti-explosion et ne peuvent pas être rapidement supprimés à l'aide de solvants, les pièces doivent être jetées et remplacées.

⚠ AVERTISSEMENT

RISQUE D'EXPLOSION —Ne jamais utiliser de matières abrasives ou de lime pour enlever des produits corrosifs des surfaces filetées. Dans des endroits extrêmement corrosifs, le matériel doit être inspecté périodiquement pour protéger contre une détérioration inhabituelle et une porosité éventuelle car cela peut affaiblir la structure de l'enceinte.

E. Service

Federal Signal s'occupe du service de votre matériel ou fournit une assistance technique pour tout problème qui ne peut être traité localement.

Toutes les unités renvoyées à Federal Service pour service, inspection ou réparation doivent être accompagnées d'une autorisation de retour de matériel. Cette autorisation (RMA) peut être obtenue auprès du distributeur local ou des représentants du fabricant.

Adressez toutes les communications et expéditions à:

FEDERAL SIGNAL CORPORATION
Industrial Systems
Service Department
2645 Federal Signal Drive
University Park, IL 60484-3167
Phone: +1 877 289 3246

F. Pièces de Rechange

Lentille Fresnel incolore	K8550C095
Lentille Fresnel bleue	K8550C095-01
Lentille Fresnel ambre	K8550C095-02
Lentille Fresnel rouge	K8550C095-03
Lentille Fresnel magenta	K8550C095-07
Tube stroboscopique (Série C)	K8422A420
Tube stroboscopique (Série C1)	K8107159
Mécanisme 24V c.c.	K8436107-03
Mécanisme 120V c.a.	K8436107-02
Mécanisme 240V c.a.	K8436107-01
Ensemble dôme	K8436147
PCBA, planche d'appel basse	K2001918-01

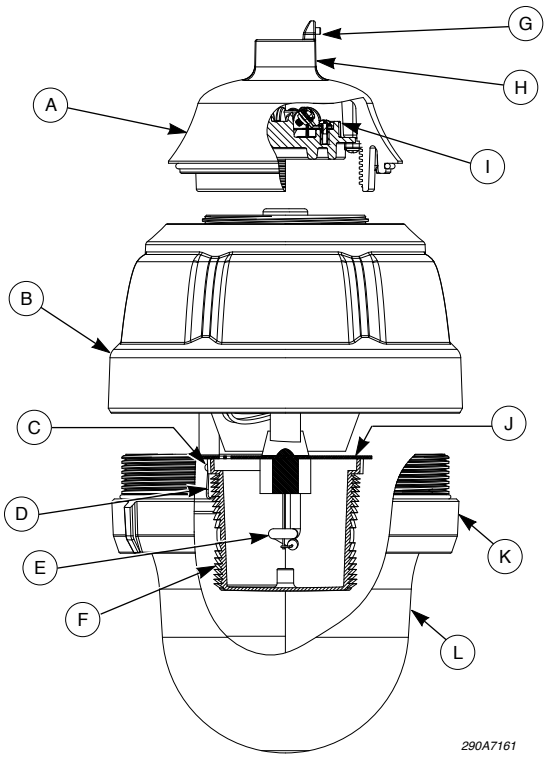
G. Accessoires

Description	Modèle
Protection du dôme	DGXC-SB
Montage plafond	CMXC-SB
Montage mural	WMXC-SB
Montage pendentif	PMXC-SB

Tableau 1. Classification électrique.

Tension opérationnelle	24V c.c.	120V c.a.	230-240V c.a.
Éclairs/minute	75	80	80
Courant opérationnel maximal, A	1,9 A	1,14 A	0.52 A
Fréquence, Hz	CC	50/60	50/60

I

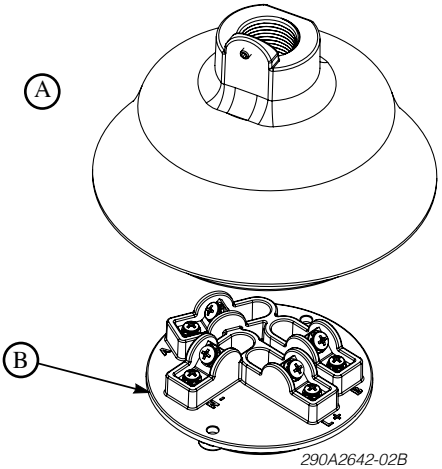


English
A. Pendant mount
B. Main housing
C. Lens clip screw
D. Lens clip
E. Strobe flash tube
F. Lens
G. Set screw
H. 3/4" N.P.T. conduit
I. Terminal block
J. Mechanism assembly
K. Glass dome assembly
L. Glass dome

Español
A. Montaje de suspensión de la lámpara
B. Caja principal
C. Tornillo de clip de lente
D. Clip de lente
E. Tubo de destellos de la luz estroboscópica
F. Lente
G. Tornillo de presión
H. Conducto N.P.T. 3/4"
I. Bloque terminal
J. Conjunto del mecanismo
K. Cúpula de vidrio montaje
L. Cúpula de vidrio

Français
A. Support de montage de suspension
B. Carter principal
C. Lentille pince à vis
D. Clip de lentille
E. Tube à éclat du stroboscope
F. Lentille
G. Vis sans tete
H. Conduit 3/4" N.P.T.
I. Bloc de bornes
J. Ensemble du mécanisme
K. Ensemble du dôme en verre
L. Dôme en verre

2



290A2642-02B

English

A. Not suitable for use with through branch circuit conductors.
B. Terminal block

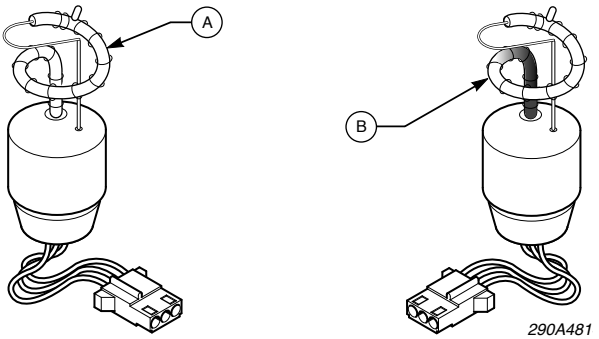
Español

A. No apropiado para conductores de circuito de canal desviada.
B. Bloque terminal

Français

A. Ne convient pas pour utilisation avec conducteurs de dérivation de passage.
B. Bloc de bornes

3



290A481

English

A. New flash tube
B. Used flash tube tends to discolor in areas shown and should be replaced.

Español

A. Tubo de destellos luminosos nuevo
B. El tubo de destellos luminosos usado tiende a descolorarse en las áreas indicadas y debe

Français

A. Tube à éclats neuf
B. Un tube à éclats usé a tendance à se décolorer à certains endroits et doit être remplacé

TAB 11
Anchor Epoxy
(Ovivo USA, LLC Part No. 594729)

Hilti HIT-RE 500 V3

qr.hilti.com/manual/?id=414865

English
Français
Español
Português



(A, B) (A, B) (A)

WARNING

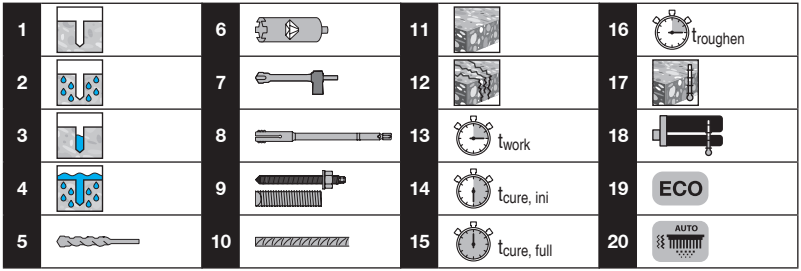
Contains: 2,2'-[(1-methylethylidene)bis(4,1-phenyleneoxymethylene)]bisoxirane (A); Butanedioldiglycidyl ether (A); 2-methyl-1,5-pentanediamine (B); m-Xylylenediamine (B)

Causes severe skin burns and eye damage. (A, B); May cause an allergic skin reaction. (A, B); May cause respiratory irritation. (B); Toxic to aquatic life with long lasting effects. (A, B)



ICC ES
ICC-ES ESR 3814

ICC ES LISTED
ICC-ES ELC 3814



EN **1** Dry concrete; **2** Water saturated concrete; **3** Waterfilled borehole in concrete; **4** Submerged borehole in concrete; **5** Hammer drilling; **6** Diamond coring; **7** Hollow drill bit; **8** Roughening tool; **9** Threaded rod / Threaded sleeve; **10** Rebar; **11** Uncracked concrete; **12** Cracked concrete; **13** Working time; **14** Initial curing time; **15** Curing time; **16** Roughening time; **17** Temperature of concrete; **18** Cartridge temperature; **19** ECO mode; **20** Automatic filter cleaning

FR **1** Béton sec ; **2** Béton saturé d'eau ; **3** Trou dans le béton rempli d'eau ; **4** Trou dans le béton immergé ; **5** Perçage avec percussion ; **6** Forage au diamant ; **7** Foret creux ; **8** Outil de rugosification ; **9** Tige filetée / Douille filetée ; **10** Armature métallique ; **11** Béton non lézardé ; **12** Béton lézardé ; **13** Temps de manipulation ; **14** Stabilité du montage ; **15** Temps de durcissement ; **16** Temps de rugosification ; **17** Température du béton ; **18** Température de la cartouche; **19** Mode ECO ; **20** Nettoyage automatique du filtre

ES **1** Hormigón seco; **2** Hormigón saturado de agua; **3** Taladro lleno de agua en hormigón; **4** Taladro sumergido en hormigón; **5** Taladrado con martillo; **6** Taladrado con diamante; **7** Taladro con broca hueca y aspiración; **8** Útil de rugosidad; **9** Varilla roscada / Manguito roscado; **10** Barras corrugadas para armado; **11** Hormigón no fisurado; **12** Hormigón fisurado; **13** Tiempo de tratamiento; **14** Resistencia de montaje; **15** Tiempo de fraguado; **16** Tiempo de rugosidad; **17** Temperatura del hormigón; **18** Temperatura del cartucho; **19** Modo ECO; **20** Limpieza automática del filtro

PT **1** Betão seco; **2** Betão saturado de água; **3** Furo em betão cheio de água; **4** Furo debaixo de água em betão; **5** Perfurar de martelo; **6** Perfurar com equipamento diamantado; **7** Broca de coroa oca; **8** Ferramenta de rugosidade; **9** Barra roscada / Casquilho roscado; **10** Ferros de armadura; **11** Betão não fissurado; **12** Betão fissurado; **13** Tempo de trabalho; **14** Resistência de montagem; **15** Tempo de cura total; **16** Tempo de rugosidade; **17** Temperatura do betão; **18** Temperatura do cartucho; **19** Modo ECO; **20** Limpeza automática do filtro

AR/ Hilti Argentina S.R.L.; Profesor Manuel García 4760; B1605 BIB - Munro; AR-Buenos Aires; Tel +54 11 4721 4400; Fax +54 11 4721 4410

BR/ Hilti do Brasil Comercial Ltda.; Al. Rio Negro, 500 -Torre A, 9º andar; 06454-000 Barueri, SP; Tel +55 11 4134 9000; Fax +55 11 4134 9072

CA/ Hilti (Canada) Corp.; 2360 Meadowpine Boulevard; Mississauga, Ontario L5N 6S2; Tel +1 905 813 9200; Fax +1 905 813 9009

CL/ Hilti Chile Ltda.; Av. Apoquindo 4501, piso 13; Las Condes 7550000; Santiago; Tel +562 655 3000; Fax +562 426 1974

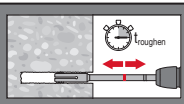
MX/ Hilti Mexicana, S.A. de C.V.; Jaime Balmes 8, Oficina 102, 1er Piso; Col. Los Morales Polanco; Del. Miguel Hidalgo; MEX-Mexico City 11510; Tel +5255 5387-1600; Fax +5255 5281 1419

PE/ Hilti Perú S.A.; Av. Javier Prado Este Nro. 499 Int. 1103; Golf los Inkas; PE- Santiago de Surco 15023; Tel +51 (0) 800 44 584

PR/ Hilti Caribe, LLC; The Palmas Village #3, Carr. 869 KM 2, Palmas Industrial Park; Cataño, PR 00962; Tel +1-787 936-7060; Fax +1 787 936-7065

US/ Hilti Inc.; Legacy Tower, Suite 1000; 7250 Dallas Parkway; US-Plano, TX 75024; Tel +1 9724035800; Fax +1 918 254 0522

VE/ Hilti Venezuela, S.A.; Calle Pascuale Giorgio, 3era. Transversal, Edf. Segre, 2do Piso, Ala Norte, Los Ruices; VE-Caracas 1071; Tel +58 212 232 42 43; Fax +58 212 203 4310



h_{ef} [inch]	h_{ef} [mm]	$t_{roughen}$
0…4	0…100	10 sec
4.01…8	101…200	20 sec
8.01…12	201…300	30 sec
12.01…16	301…400	40 sec
16.01…20	401…500	50 sec
20.01…25	501…600	60 sec

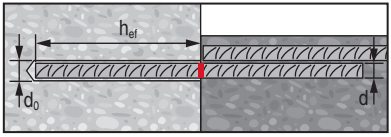
$t_{roughen}$ [sec] = h_{ef} [inch] × 2.5 $t_{roughen}$ [sec] = h_{ef} [mm] / 10

[°F]	[°C]	t_{work}	$t_{cure, ini}$	$t_{cure, full}$
23	−5	2 h	48 h	168 h
32	0	2 h	24 h	36 h
40	4	2 h	16 h	24 h
50	10	1.5 h	12 h	16 h
60	16	1 h	8 h	16 h
72	22	25 min	4 h	6.5 h
85	29	15 min	2.5 h	5 h
95	35	12 min	2 h	4.5 h
105	41	10 min	2 h	4 h

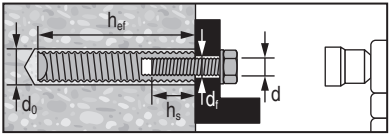
≥ +5 °C / 41 °F

= 2 × t_{cure}

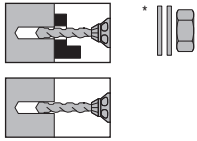
❶ Rebar



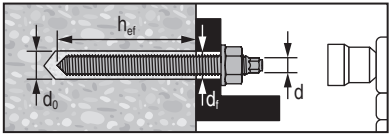
❷ HIS-N



	❶ US Rebar		❶ CA Rebar		❷ HIS-N, -RN					❸ HAS-U / HAS-E / HIT-V				
d_0 [inch]	d	h_{ef} [inch]	d	h_{ef} [mm]	d [inch]	h_{ef} [inch]	d_f [inch]	h_s [inch]	T_{inst} [lb-ft]	d [inch]	h_{ef} [inch]	d_{f1} [inch]	d_{f2} [inch]	T_{inst} [lb-ft]
7/16										**3/8**	2 3/8…7 1/2	1/2	7/16	≤15
1/2	**#3**	2 3/8…22 1/2												
9/16			**10 M**	70…678						**1/2**	2 3/4…10	5/8	9/16	≤30
5/8	**#4**	2 3/4…30												
11/16					**3/8**	4 3/8	7/16	3/8…15/16	≤15					
3/4	**#5**	3 1/8…37 1/2	**15 M**	80…960						**5/8**	3 1/8…12 1/2	13/16*	11/16	≤60
7/8	**#6**	3 1/2…15			**1/2**	5	9/16	1/2…1 3/16	≤30	**3/4**	3 1/2…15	15/16*	13/16	≤100
1	**#6**	15…45	**20 M**	90…1170						**7/8**	3 1/2…17 1/2	1 1/8*	15/16	≤125
	#7	3 1/2…17 1/2												
1 1/8	**#7**	17 1/2…52 1/2			**5/8**	6 3/4	11/16	5/8…1 1/2	≤60	**1**	4…20	1 1/4*	1 1/8	≤150
	#8	4…20												
1 1/4	**#8**	20…60	**25 M**	101…1512	**3/4**	8 1/8	13/16	3/4…1 7/8	≤100					
1 3/8	**#9**	4 1/2…67 1/2								**1 1/4**	5…25	1 1/2*	1 3/8	≤200
1 1/2	**#10**	5…75	**30 M**	120…1794										
1 3/4	**#11**	5 1/2…82 1/2												



❸ HAS-U, HIT-V





HIT-RB	HIT-SZ	HIT-DL	HIT-OHC	TE-YRT
7/16			387551	
1/2	1/2	1/2		
9/16	9/16	9/16		
5/8	5/8	9/16		
11/16	11/16	11/16		
3/4	3/4	3/4		3/4
7/8	7/8	7/8	387552	7/8
1	1	1		1
1 1/8	1 1/8	1		1 1/8
1 1/4	1 1/4	1		
1 3/8	1 3/8	1 3/8		1 3/8
1 1/2	1 1/2	1 3/8		
1 3/4	1 3/4	1 3/8		

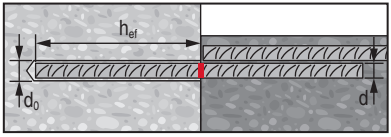
HIT-DL: h_{ef} > 10"

HIT-RB: h_{ef} > 20 × d 

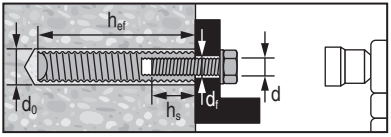
Hilti VC 140/150/300	HIT-RE-M Art. No.		HIT-OHW Art. No.
min. 61 l/s	337111	HDM 330 / 500 HDE 500	387550

d_0 [inch]	h_{ef} [inch]	Art. No. 381215	
7/16…1 1/8	2 3/8…52 1/2	✔	≥ 6 bar / 90 psi @ 6 m³/h
1 1/4…1 1/2	4…75	–	≥ 140 m³/h / ≥ 82 CFM

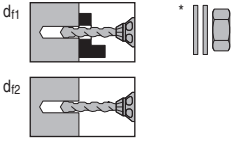
❶ Rebar



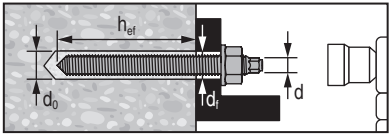
❷ HIS-N



	❶ EU Rebar		❷ HIS-N, -RN					❸ HAS-U / HAS-E / HIT-V				
d_0 [mm]	d [mm]	h_{ef} [mm]	d [mm]	h_{ef} [mm]	d_f [mm]	h_s [mm]	T_{inst} [Nm]	d [mm]	h_{ef} [mm]	d_{f1} [mm]	d_{f2} [mm]	T_{inst} [Nm]
10								**M8**	60…160	11	9	≤ 10
12	**8**	60…480						**M10**	60…200	14	12	≤ 20
14	**10**	60…600	**M8**	90	9	8…20	≤ 10	**M12**	70…240	16	14	≤ 40
16	**12**	70…720										
18	**14**	75…840	**M10**	110	12	10…25	≤ 20	**M16**	80…320	20*	18	≤ 80
20	**16**	80…960										
22	**18**	85…1080	**M12**	125	14	12…30	≤ 40	**M20**	90…400	24*	22	≤ 150
25	**20**	90…1200										
28	**22**	95…1320	**M16**	170	18	16…40	≤ 80	**M24**	100…480	30*	26	≤ 200
30								**M27**	108…540	32*	30	≤ 270
32	**24/25**	96/100…1440/1500	**M20**	205	22	20…50	≤ 150					
35	**26/28**	10/112…1560/1680						**M30**	120…600	37*	33	≤ 300
37	**30**	120…1800										
40	**32**	128…1920										



❸ HAS-U, HIT-V



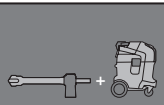


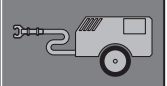
HIT-RB	HIT-SZ	HIT-DL	HIT-OHC	TE-YRT
10			#387551	
12	12	12		
14	14	14		
16	16	16		
18	18	18		18
20	20	20	#387552	20
22	22	20		22
25	25	25		25
28	28	25		28
30	30	25		30
32	32	32		32
35	35	32		35
37	37	32		
40	40	32		

HIT-DL: $h_{ef} > 250$ mm

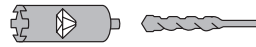
HIT-RB: $h_{ef} > 20 \times d$

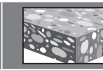


 Hilti VC 140/150/300	HIT-RE-M Art. No.		HIT-OHW Art. No.
min. 61 l/s	337111	HDM 330 / 500 HDE 500	387550

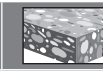
 d_0 [mm]	 h_{ef} [mm]	 Art. No. 381215	
10…32	60…1500	✔	≥ 6 bar / 90 psi
35…40	100…1920	–	≥ 140 m³/h

Rebar – $h_{ef} \geq 20d$



		h_{ef}		
HDM, HDE, HIT-P 8000D	≤ US #5	12 ½ ... 37 ½"	23 °F ... 104 °F −5 °C ... 40 °C	41 °F ... 104 °F 5 °C ... 40 °C
	≤ EU 16 mm	320 ... 960 mm		
	≤ CAN 15M	320 ... 960 mm		
HDE, HIT-P 8000D	≤ US #7	17 ½ ...52 ½"	23 °F ... 104 °F −5 °C ... 40 °C	41 °F ... 104 °F 5 °C ... 40 °C
	≤ EU 20 mm	400 ... 1200 mm		
	≤ CAN 20M	390 ... 1170 mm		
HIT-P 8000D	≤ US #10	25 ... 75"	23 °F ... 104 °F −5 °C ... 40 °C	41 °F ... 104 °F 5 °C ... 40 °C
	≤ EU 32 mm	640 ... 1920 mm		
	≤ CAN 30M	598 ... 1794 mm		

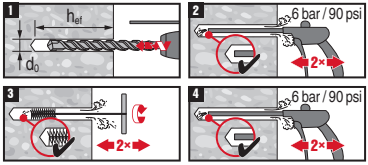


		h_{ef}		
HDM, HDE, HIT-P 8000D	≤ US #5	12 ½ ... 37 ½"	23 °F ... 104 °F −5 °C ... 40 °C	41 °F ... 104 °F 5 °C ... 40 °C
	≤ EU 16 mm	320 ... 960 mm		
	≤ CAN 15M	320 ... 960 mm		
HDE, HIT-P 8000D	≤ US #7	17 ½ ... 39 ⅜"	23 °F ... 104 °F −5 °C ... 40 °C	41 °F ... 104 °F 5 °C ... 40 °C
	≤ EU 20 mm	400 ... 1000 mm		
	≤ CAN 20M	390 ... 1000 mm		

1

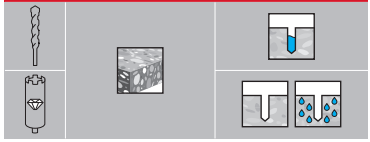


d_0: 7/16"…1¾" / 10 … 40 mm | h_{ef}: 2⅜"…75" / 60 … 1920 mm



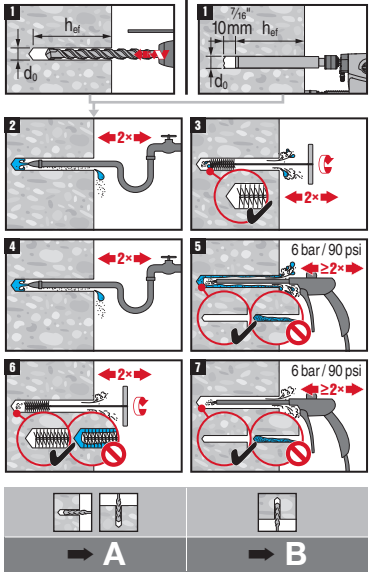


2



d_0: 7/16"…1¾" / 10 … 40 mm
h_{ef}: 2⅜"…10" / 60 … 250 mm

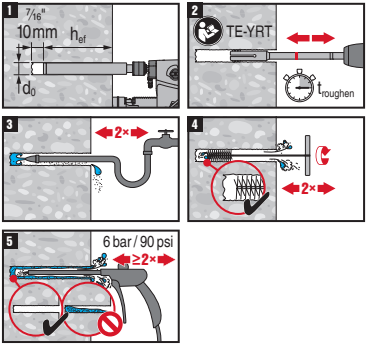
d_0: 7/16"…1¾" / 10 … 40 mm
h_{ef}: 2⅜"… 25" / 60 … 640 mm



3



d_0: ¾"…1⅜" / 18 … 35 mm | h_{ef}: 3⅛"…25" / 80 … 635 mm

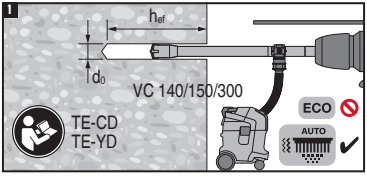




4



d_0: 7/16"…1⅜" / 10 … 35 mm | h_{ef}: 2⅜"…39⅜" / 60 … 1000 mm

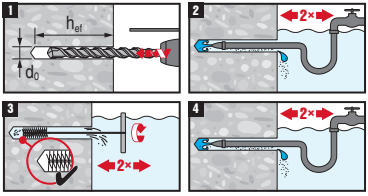


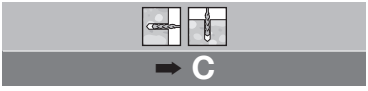


5



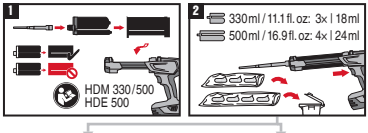
d_0: 7/16"…1¾" / 10 … 40 mm | h_{ef}: 2⅜"…25" / 60 … 640 mm

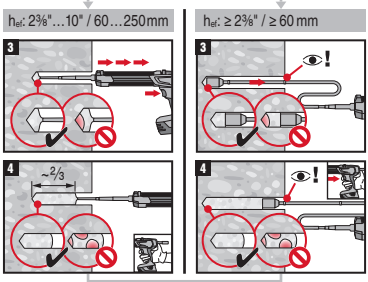




A

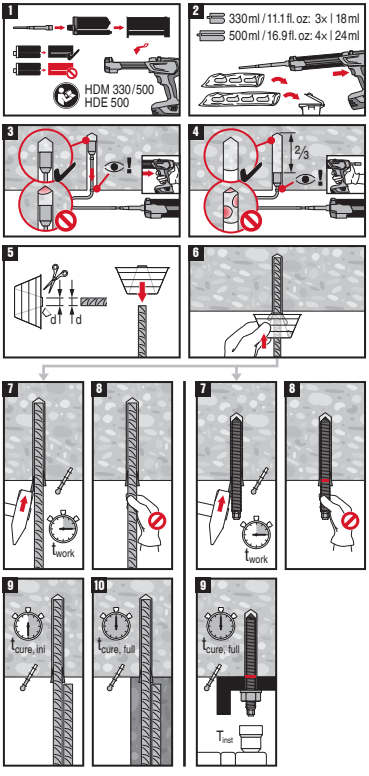


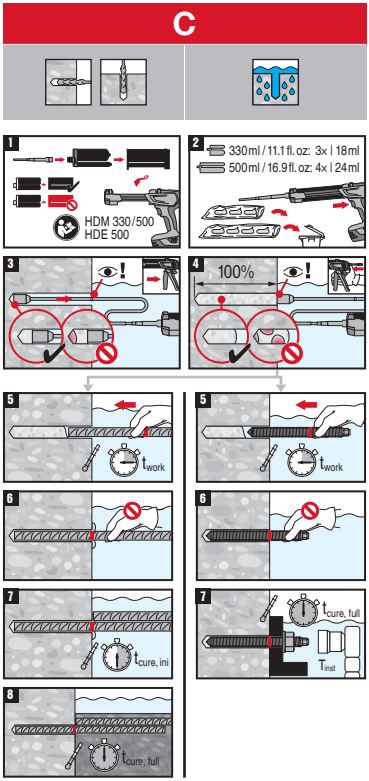

1
2
330 ml / 11.1 fl. oz: 3x | 18 ml
500 ml / 16.9 fl. oz: 4x | 24 ml
HDM 330/500
HDE 500


hef: 2⅜"…10" / 60…250 mm
hef: ≥ 2⅜" / ≥ 60 mm
3
4
~2/3
5
6
7
8
twork
tcure, ini
tcure, full
Tinst

B




1
2
330 ml / 11.1 fl. oz: 3x | 18 ml
500 ml / 16.9 fl. oz: 4x | 24 ml
HDM 330/500
HDE 500
3
4
2/3
5
d
d
6
7
8
9
10
twork
tcure, ini
tcure, full
Tinst


C
1
HDM 330/500
HDE 500
2
330ml / 11.1 fl. oz: 3x | 18ml
500ml / 16.9 fl. oz: 4x | 24ml
3
4
100%
5
t_{work}
5
t_{work}
6
6
7
$t_{cure, ini}$
7
$t_{cure, full}$
T_{inst}
8
$t_{cure, full}$

EN Adhesive anchoring system for rebar and anchor fastenings in concrete

Hilti HIT-RE 500 V3





Contains: 2,2'-[(1-methylethylidene)bis(4,1-phenyleneoxymethylene)]bisoxirane (A); Butanedioldiglycidyl ether (A); 2-methyl-1,5-pentanediamine (B); m-Xylylenediamine (B)

WARNING Causes severe skin burns and eye damage. (A, B) | **May cause an allergic skin reaction. (A, B)** | **May cause respiratory irritation. (B)** | **Toxic to aquatic life with long lasting effects. (A, B)** | **Wear protective gloves/protective clothing/eye protection/face protection.** | **Do not get in eyes, on skin, or on clothing.** | **IF ON SKIN: Wash with plenty of soap and water.** | **IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.** | **If skin irritation or rash occurs: Get medical advice/attention.** | **If eye irritation persists: Get medical advice/attention.**

Disposal considerations: **Empty packs:** Leave the Mixer attached and dispose of via the local Green Dot collecting system or EAK waste material code 15 01 02 plastic packaging. | **Full or partially emptied packs:** dispose of as special waste in accordance with official regulations. | EAK waste material code: 20 01 27* paint, inks, adhesives and resins containing dangerous substances. | or waste material code: EAK 08 04 09* waste adhesives and sealants containing organic solvents or other dangerous substances.

Failure to observe these installation instructions, use of non-Hilti anchors, poor or questionable concrete conditions, or unique applications may affect the reliability or performance of the fastenings.

Product Information: Always keep this instruction for use together with the product. | Ensure that the instruction for use is with the product when it is given to other persons. | **Safety Data Sheet:** Review the DS before use. | **Check expiration date:** See expiration date imprint on foilpack manifold (month/year). Do not use expired product. | **Foil pack temperature during usage:** +5 °C to 40 °C / 41 °F to 104 °F. | Conditions for transport and storage: Keep in a cool, dry and dark place between +5 °C to 25 °C / 41 °F to 77 °F. | For any application not covered by this document / beyond values specified, please contact Hilti. | **Partly used foil packs must be used up within 4 weeks.** Leave the mixer attached on the foil pack manifold and store under the recommended storage conditions. If reused, attach a new mixer and discard the initial quantity of anchor adhesive.

⚠ WARNING

⚠ **Improper handling may cause mortar splashes. Eye contact with mortar may cause irreversible eye damage!** Always wear tightly sealed safety glasses, gloves and protective clothes before handling the mortar! | Never start dispensing without a mixer properly screwed on. | When using an extension hose: Discard of initial mortar flow must be done through supplied mixer only (not through the extension hose). | Attach a new mixer prior to dispensing a new foil pack (snug fit). | Caution! Never remove the mixer while the foil pack system is under pressure. Press the release button of the dispenser to avoid mortar splashing. | Use only the type of mixer supplied with the adhesive. Do not modify the mixer in any way. | Never use damaged foil packs and/or damaged or unclean foil pack holders.

⚠ **Poor load values/potential failure of fastening points due to inadequate borehole cleaning. The boreholes must be dry and free of debris, dust, water, ice, oil, grease and other contaminants prior to adhesive injection.** Hilti hollow drill bits TE-CD, TE-YD must be used in conjunction with a properly maintained Hilti vacuum cleaner with model and suction capacity (volumetric flow rate) as specified in the accessory table. | For blowing out the borehole – blow out with oil free air until return air stream is free of noticeable dust. | For flushing the borehole – flush with water line pressure until water runs clear. | Important! Remove all water from the borehole and blow out with oil free compressed air until borehole is completely dried before mortar injection (not applicable to hammer drilled hole in underwater application).

⚠ **Ensure that boreholes are filled from the back of the boreholes without forming air voids.** If necessary, use the accessories/ extensions to reach the back of the borehole. | For overhead applications use the overhead accessories HIT-SZ / IP and take special care when inserting the fastening element. Excess adhesive may be forced out of the borehole. Make sure that no mortar drips onto the installer. | If a new mixer is installed onto a previously-opened foil pack, the first trigger pulls must be discarded. | A new mixer must be used for each new foil pack.

⚠ **Not adhering to these setting instructions can result in failure of fastening points.**

FR Mortier de scellement pour ancrage de chevilles et d'armatures dans le béton

Hilti HIT-RE 500 V3



Contient : 2,2-bis[p-(2,3-époxypropoxy)phényl]propane (A) ; oxyde de butanediol et de diglycidyle (A) ; 2-methyl-1,5-pentanediamine (B) ; 1,3-Benzènediméthanamine (B)

DANGER Provoque des brûlures de la peau et des lésions oculaires graves. (A, B) | **Peut provoquer une allergie cutanée. (A, B)** | **Peut irriter les voies respiratoires. (B)** | **Toxique pour les organismes aquatiques, entraîne des effets néfastes à long terme. (A, B)** | **Porter des gants de protection/des vêtements de protection/un équipement de protection des yeux/du visage.** | **Éviter tout contact avec les yeux, la peau ou les vêtements.** | **EN CAS DE CONTACT AVEC LA PEAU : laver abondamment à l'eau et au savon.** | **EN CAS DE CONTACT AVEC LES YEUX : rincer avec précaution à l'eau pendant plusieurs minutes. Enlever les lentilles de contact si la victime en porte et si elles peuvent être facilement enlevées. Continuer à rincer.** | **En cas d'irritation ou d'éruption cutanée : consulter un médecin.** | **Si l'irritation oculaire persiste: consulter un médecin.**

Indications de recyclage : Emballages vides : Laisser la buse mélangeuse vissée et procéder à l'élimination par le biais du système de collecte national Point Vert ou code déchets EAK : 15 01 02 Emballages en plastique. | **Emballages pleins/à moitié vides :** Les apporter à un centre de collecte des matières dangereuses conformément aux dispositions administratives. | Code déchets EAK : 20 01 27* Peintures, encres d'impression, colles et résines artificielles, contenant des substances dangereuses. | ou code déchets EAK : 08 04 09* Résidus de colles et composants pour joints, contenant des solvants organiques ou d'autres substances dangereuses.

Le non respect de ces instructions de pose, l'utilisation de chevilles autres qu'Hilti, la pose dans un béton faible ou matériau ou des applications particulières peuvent avoir un impact sur la sécurité et la performance de la fixation.

Information produit : Le présent mode d'emploi doit toujours être conservé avec le produit. | Ne pas donner le produit à un autre utilisateur sans lui fournir le mode d'emploi. | **Fiche de données de sécurité :** Avant toute utilisation, prendre connaissance des informations de sur les matériaux. | **Date de péremption :** Contrôler la date de péremption (mois/année) imprimée sur le raccord de la cartouche. Ne plus utiliser un produit dont la date de péremption est dépassée. | **Température des recharges en cours d'utilisation :** de +5 °C à 40 °C / 41 °F à 104 °F. | **Conditions de transport et de stockage :** dans un endroit frais, sec et à l'abri de la lumière à une température de +5 °C à 25 °C / 41 °F à 77 °F. | En cas d'applications qui ne sont pas décrites dans le présent mode d'emploi ou hors plage de valeurs spécifiées, s'adresser à Hilti. | **Les cartouches souples entamées doivent être réutilisées dans les quatre semaines.** Laisser la buse mélangeuse vissée sur la recharge entamée et stocker la recharge conformément à la réglementation. Avant réutilisation, visser une nouvelle buse mélangeuse et jeter le mortier extrudé lors des premières pressions.

⚠ AVERTISSEMENT

⚠ **En cas de maniement non conforme, il y a risque de projection du mortier. Tout contact des yeux avec le mortier peut entraîner des lésions irréversibles !** Lors du travail, porter une protection des yeux étanche, des gants et des vêtements

de protection ! | Ne jamais commencer l'extrusion si la buse mélangeuse n'est pas vissée ! | Lorsque vous utilisez le tube prolongateur: la première décharge de la résine doit se faire à partir du mélangeur (et non pas du tube prolongateur flexible). | Avant de commencer l'extrusion d'une nouvelle cartouche souple, visser une nouvelle buse mélangeuse. Vérifier qu'elle est bien en place. | Attention ! Ne jamais dévisser la buse mélangeuse lorsque le système est sous pression. Actionner préalablement la touche de déverrouillage sur le pistolet à injecter pour éviter des éclaboussures inopinées de mortier. | Utiliser exclusivement le type de mélangeur fourni avec le mortier. Ne modifier la buse mélangeuse en aucun cas. | Ne jamais utiliser de cartouches souples endommagées ni de porte-cartouches endommagés/très encrassés.

⚠ **Mauvaise fixation/défaillance du chevillage à cause d'un nettoyage insuffisant du trou foré. Avant de procéder à l'injection, s'assurer que le trou foré est exempt de déblais de perçage, poussières, eau, glace, huile, graisse ou autres contaminants.** Les mèches creuses Hilti TE-CD, TE-YD doivent être associées à un modèle d'aspirateur Hilti bien entretenu d'une capacité d'aspiration (débit volumétrique) conforme à la spécification du tableau des accessoires. | Soufflage du trou foré – souffler avec de l'air comprimé exempt d'huile, jusqu'à ce que l'air sortant soit exempt de toute poussière. | Rinçage du trou foré – rincer le trou à l'eau à pression de conduite normale jusqu'à ce que de l'eau propre ressorte. | Important ! Avant de remplir de mortier, évacuer l'eau du trou foré et le souffler avec de l'air comprimé exempt d'huile jusqu'à ce qu'il soit entièrement sec (Ne convient pas au trous forés au perforateur à percussion lors d'applications subaquatiques).

⚠ **Veiller à ce que le remplissage se fasse à partir du fond du trou foré pour éviter la formation de bulles d'air.** Si nécessaire, utiliser des prolongateurs pour atteindre le fond du trou. | En cas d'applications au plafond, utiliser l'accessoire HIT-SZ/IP et faire particulièrement attention lors de l'introduction de l'élément de fixation. L'excédent de mortier peut ressortir du trou foré. Veiller alors à ce que celui-ci ne goutte pas sur l'opérateur. | Si une nouvelle buse mélangeuse est utilisée avec une cartouche déjà entamée, jeter également les premières pressions de mortier extrudé. | Utiliser une nouvelle buse mélangeuse pour chaque cartouche souple neuve.

⚠ **Le non-respect des instructions peut entraîner une défaillance du chevillage !**

ES Resina de inyección para la fijación de anclajes y tacos en hormigón

Hilti HIT-RE 500 V3



(A, B) (A, B) (A)

Contiene: 2,2-Bis(4-hidroxifenil)propano bis{2,3- epoxipropil) éter (A); Éter diglicidílico de butanodiol (A); 2-methyl-1,5-pentanediamine (B); 1,3-Bencenodimetanamina (B)

PELIGRO Provoca quemaduras graves en la piel y lesiones oculares graves. (A, B) | **Puede provocar una reacción alérgica en la piel. (A, B)** | **Puede perjudicar la fertilidad o dañar al feto. (A)** | **Tóxico para los organismos acuáticos, con efectos nocivos duraderos. (A, B)** | **Llevar guantes/prendas/gafas/máscara de protección.** | **Evitar el contacto con los ojos, la piel o la ropa.** | **EN CASO DE CONTACTO CON LA PIEL: Lavar con agua y jabón abundantes.** | **EN CASO DE CONTACTO CON LOS OJOS: Aclarar cuidadosamente con agua durante varios minutos. Quitar las lentes de contacto, si lleva y resulta fácil. Seguir aclarando.** | **En caso de irritación o erupción cutánea: Consultar a un médico.** | **Si persiste la irritación ocular: Consultar a un médico.**

Indicaciones de reciclaje: Cartuchos vacíos: Deseche el mezclador enroscado a través los sistemas de recogida nacionales identificados con el Punto Verde o el código de residuo LER: 15 01 02 embalajes de plastic. | **Cartuchos llenos o parcialmente vacíos:** Deberán eliminarse como residuos especiales de acuerdo con las normativas oficiales. | Código de residuo LER: 20 01 27* Pinturas, tintas, adhesivos y resinas que contienen sustancias peligrosas. | o el código de residuo LER: 08 04 09* Residuos de adhesivos y sellantes que contienen disolventes orgánicos u otras sustancias peligrosas.

La inobservancia de las instrucciones de instalación, el uso de anclajes que no sean Hilti, malas o dudosas condiciones del hormigón y/o aplicaciones inadecuadas pueden afectar la fiabilidad y respuesta de las fijaciones.

Información de producto: Guarde siempre estas instrucciones de uso junto con el producto. | En caso de entregar el producto a terceros, deben incluirse siempre las instrucciones de uso. | **Hoja de datos de seguridad:** consulte la hoja de datos de seguridad antes de utilizar el producto. | **Fecha de caducidad:** compruebe la fecha de caducidad (mes/año) de la pieza de conexión del cartucho. El producto no debe utilizarse después de la fecha de caducidad. | **Temperatura del cartucho durante la utilización:** de +5 °C a 40 °C / de 41 °F a 104 °F. | **Condiciones de transporte y almacenamiento:** lugar fresco, seco y oscuro con una temperatura de +5 °C a 25 °C / de 41 °F a 77 °F. | Para aplicaciones que no se describen en las presentes instrucciones de uso o no se enmarcan en la especificación, póngase en contacto con Hilti. | **Los cartuchos que no estén completamente vacíos deberán utilizarse antes de cuatro semanas.** Para ello deberán guardarse con el mezclador enroscado en las condiciones de almacenamiento recomendadas. Antes de utilizarlo de nuevo, enroscar un nuevo mezclador y desechar la resina inicial.

⚠ ADVERTENCIA

⚠ **La resina puede salpicar si se utiliza incorrectamente. El contacto de la resina con los ojos puede causar daños oculares permanentes.** Lleve gafas protectoras herméticas, guantes de protección y ropa de trabajo durante el trabajo. | No comience a exprimir si no se ha enroscado el mezclador. | Cuando utilice la manguera de extensión: El descarte inicial de la resina se debe hacer a través del mezclador suministrado (y no a través de la manguera de extensión). | Enrosque un mezclador nuevo antes de exprimir un cartucho nuevo. Asegúrese de que el asiento sea firme. | ¡Precaución! No desatornille nunca el mezclador cuando el sistema se encuentre bajo presión. Presione de antemano la tecla de desbloqueo en el aparato para evitar que siga saliendo resina. | Utilice exclusivamente el modelo de mezclador suministrado con la resina. No modifique el mezclador en ningún caso. | No utilice cartuchos en mal estado ni portacartuchos dañados o sucios.

⚠ **Valores de sujeción deficientes/fallo de la fijación debido a limpieza insuficiente del taladro. Antes de inyectar la resina, los taladros deben estar secos y libres de restos de perforación, polvo, agua, hielo, aceite, grasa o cualquier otro agente contaminante.** Las brocas huecas TE-CD, TE-YD de Hilti deben utilizarse con una aspiradora de Hilti en buen estado de funcionamiento del modelo y la capacidad de succión (tasa de flujo volumétrico) que se especifican en la tabla de accesorios. | Soplado a presión del taladro: limpie el taladro con aire a presión sin aceite hasta que el aire de retorno esté libre de polvo. | Lavado del taladro: lave con una manguera de agua con la presión normal de la red hasta que salga agua limpia. | ¡Atención! Antes de añadir la resina es necesario extraer el agua del taladro y limpiar el taladro con aire a presión sin aceite hasta que quede completamente seco (no aplica para agujeros realizados con taladros de percusión en aplicaciones sumergidas en agua).

⚠ **Verificar que el relleno del taladro se produce desde el fondo del taladro para que no se formen burbujas de aire.** Si es necesario, utilice las prolongaciones para alcanzar el fondo del taladro. | En aplicaciones por encima de la cabeza, utilice el accesorio HIT-SZ/IP y preste especial atención al introducir el elemento de fijación. Puede salir resina sobrante del taladro. Asegúrese de que la resina no gotee sobre el usuario. | Si se enrosca un nuevo mezclador en un cartucho ya abierto, las primeras aplicaciones deben también desecharse. | Utilice un nuevo mezclador para cada cartucho nuevo.

⚠ **El incumplimiento de estas instrucciones puede llevar a una fijación incorrecta.**

PT Sistema de ancoragem química para a fixação de ferros de armadura e ancoragens em betão

Hilti HIT-RE 500 V3



Contém: 2,2-Bis(4-hidroxifenil)propano bis(2,3-epoxipropil) éter (A); Éter diglicidílico de butanodiol (A); 2-methyl-1,5-pentanediamine (B); 1,3-Benzenodimetanamina (B)

PERIGO Provoca queimaduras na pele e lesões oculares graves. (A, B) | **Pode provocar uma reacção alérgica cutânea. (A, B)** | **Pode afectar a fertilidade ou o nascituro. (A)** | **Tóxico para os organismos aquáticos com efeitos duradouros. (A, B)** | **Usar luvas de protecção/vestuário de protecção/protecção ocular/protecção facial.** | **Não pode entrar em contacto com os olhos, a pele ou a roupa.** | **SE ENTRAR EM CONTACTO COM A PELE: lavar com sabonete e água abundantes.** | **SE ENTRAR EM CONTACTO COM OS OLHOS: enxaguar cuidadosamente com água durante vários minutos. Se usar lentes de contacto, retire-as, se tal lhe for possível. Continuar a enxaguar.** | **Em caso de irritação ou erupção cutânea: consulte um médico.** | **Caso a irritação ocular persista: consulte um médico.**

Nota sobre reciclagem: Cartuchos vazios: Deixar o misturador enroscado e remover através dos sistemas de recolha nacionais, Ponto Verde ou Código CER: 15 01 02 Embalagens de plastic. | **Cartuchos semiusados/novos:** Remover de acordo com as normas e regulamentações legais sobre resíduos especiais. | Código CER: 20 01 27* Tintas, produtos adesivos, colas e resinas, contendo substâncias perigosas. | ou Código CER: 08 04 09* Resíduos de colas ou vedantes, contendo solventes orgânicos ou outras substâncias perigosas.

O não cumprimento destas instruções de colocação, a utilização de ancoragens que não sejam da Hilti, as condições fracas ou duvidosas do betão, ou aplicações fora do comum podem afectar a segurança ou a eficácia das fixações.

Dados informativos sobre o produto: Guarde estas instruções de utilização sempre em conjunto com o produto. | Entregue o produto a outras pessoas apenas juntamente com as instruções de utilização. | **Ficha de Informação de Segurança de Produtos Químicos:** antes de iniciar os trabalhos, tenha em consideração a Ficha de Informação de Segurança de Produtos Químicos. | **Prazo de validade:** veja o prazo de validade (mês/ano) na peça de junção do cartucho. Não utilize produtos cujo prazo de validade se encontre ultrapassado. | **Temperatura do cartucho durante a utilização:** entre +5 °C e 40 °C / 41 °F e 104 °F. | **Condições de transporte e armazenamento:** em lugar fresco, seco e ao abrigo da luz, entre +5 °C e 25 °C / 41 °F e 77 °F. | Em caso de aplicações que não se encontrem descritas nas presentes instruções de utilização ou estejam fora das especificações, é favor dirigir-se à Hilti. | **As sobras de cartuchos parcialmente usados devem ser utilizadas num prazo de quatro semanas.** Deixe o misturador enroscado e armazene-o juntamente com o cartucho, de acordo com as condições de armazenagem preconizadas. Quando/se reutilizados, utilize um misturador novo e não utilize novamente a resina inicial.

⚠ AVISO

⚠ **No caso de manuseamento incorrecto, é possível que seja injectada resina. O contacto da resina com os olhos pode provocar lesões oculares permanentes!** Durante a realização de trabalhos, use óculos de protecção que fiquem bem justos, luvas de protecção e roupa de trabalho! | Nunca comece a aplicação sem que o misturador esteja enroscado! | Quando utilizar a mangueira de extensão: O descarte inicial de resina deve ser feito através do misturador fornecido (e não através da mangueira de extensão). | Antes da aplicação de um novo cartucho, enrosque um misturador novo. Certifique-se de que está bem apertado. | Cuidado! Nunca desenrosque o misturador quando o sistema está sob pressão. Pressione previamente a alavanca de libertação na ferramenta para evitar projecções de resina. | Utilize apenas o tipo de misturador fornecido com a resina. Não modifique o misturador de forma alguma. | Nunca utilize cartuchos danificados e/ou suportes danificados ou sujos.

⚠ **Valores de retenção deficientes/falha da fixação devido a limpeza insuficiente do furo. Os furos devem estar secos e livres de material de perfuração, pó, água, gelo, óleo, gordura ou outras impurezas antes de efectuar a injecção.** A brocas

de perfuração ocas Hilti TE-CD e TE-YD têm de ser usadas em conjunto com um aspirador Hilti em boas condições de funcionamento e com o modelo e capacidade de aspiração (débito volumétrico) especificados na tabela dos acessórios. | Limpar o furo por sopro – limpe o furo por sopro com ar isento de óleo, até que o ar saia sem pó. | Lavar o furo – lave com uma mangueira com pressão normal, até sair água limpa. | Importante! Antes de preencher com resina, retire a água do furo e sopre com ar isento de óleo até estar totalmente seco (Não utilizável em furos subaquáticos executados com percussão).

⚠ **Certifique-se de que o enchimento do furo é efectuado a partir do fundo, para que não se formem bolhas de ar.** Se necessário, utilize os prolongadores para alcançar o fundo do furo. | No caso de aplicações em suspensão, utilize o acessório HIT-SZ/IP e preste especial atenção ao inserir o elemento de fixação. Pode sair resina em excesso do furo. Certifique-se de que não pinga resina sobre o utilizador. | Se for enroscado um misturador novo num cartucho já aberto, também não utilize o produto das primeiras bombadas. | Para cada cartucho novo deverá utilizar-se um misturador novo.

⚠ **A não observação das instruções pode conduzir à falha da fixação!**

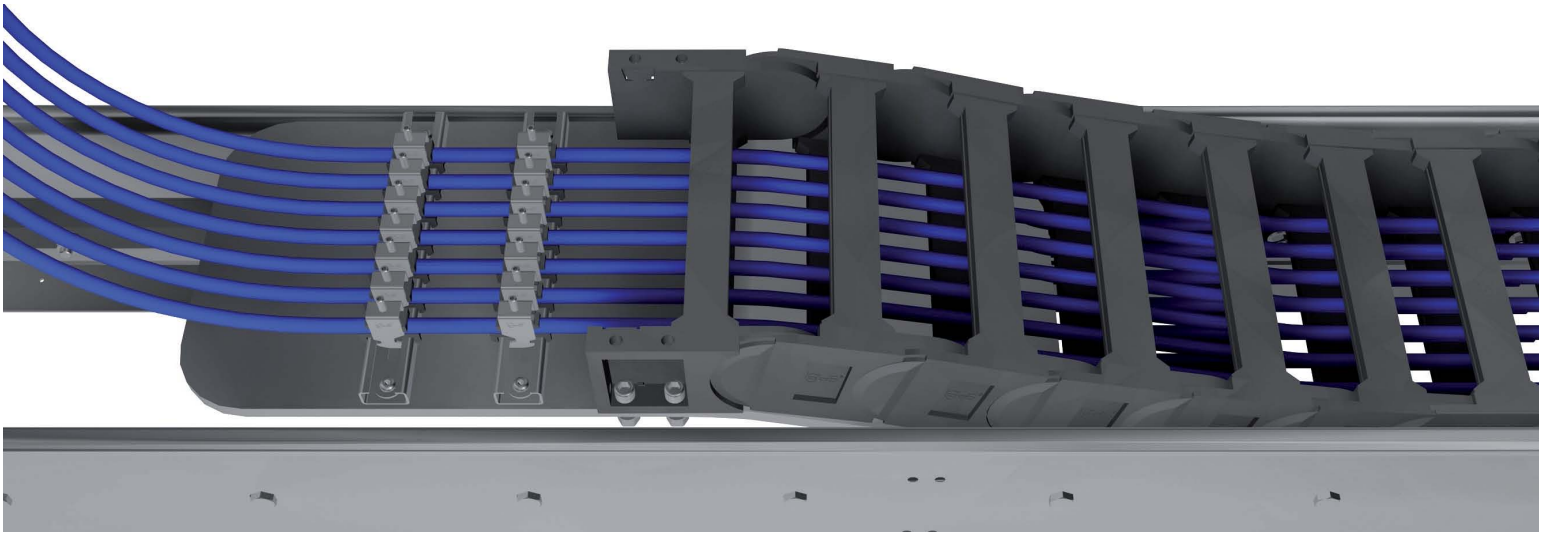
Made in Germany

Hilti = registered trademark of
Hilti Corporation, Schaan, Liechtenstein
www.hilti.group

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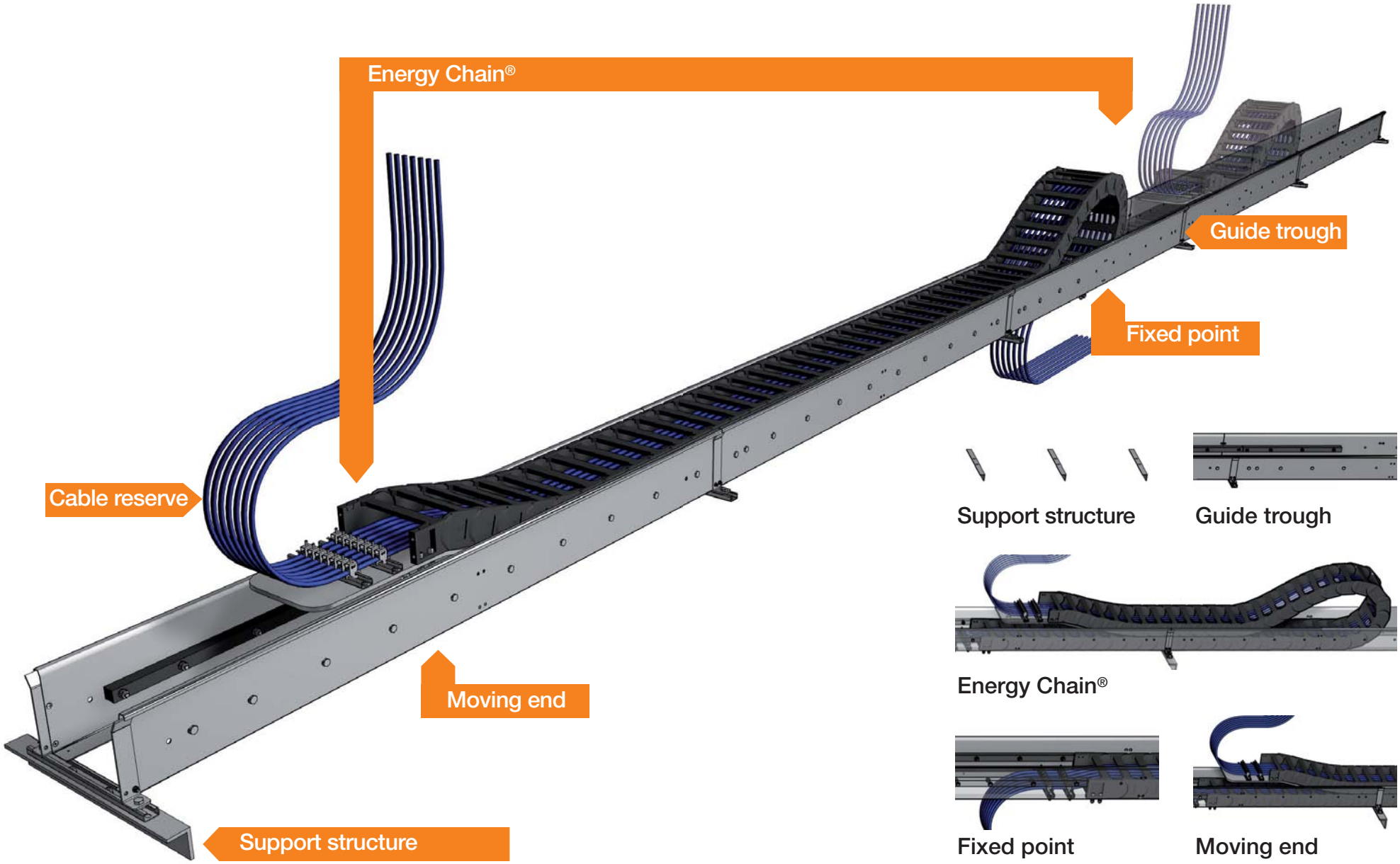
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TAB 12
Energy Chain
(Ovivo USA, LLC Part No. CSW1584-1022)



igus®
plastics for longer life®

Energy Chain System®
Installation Guide



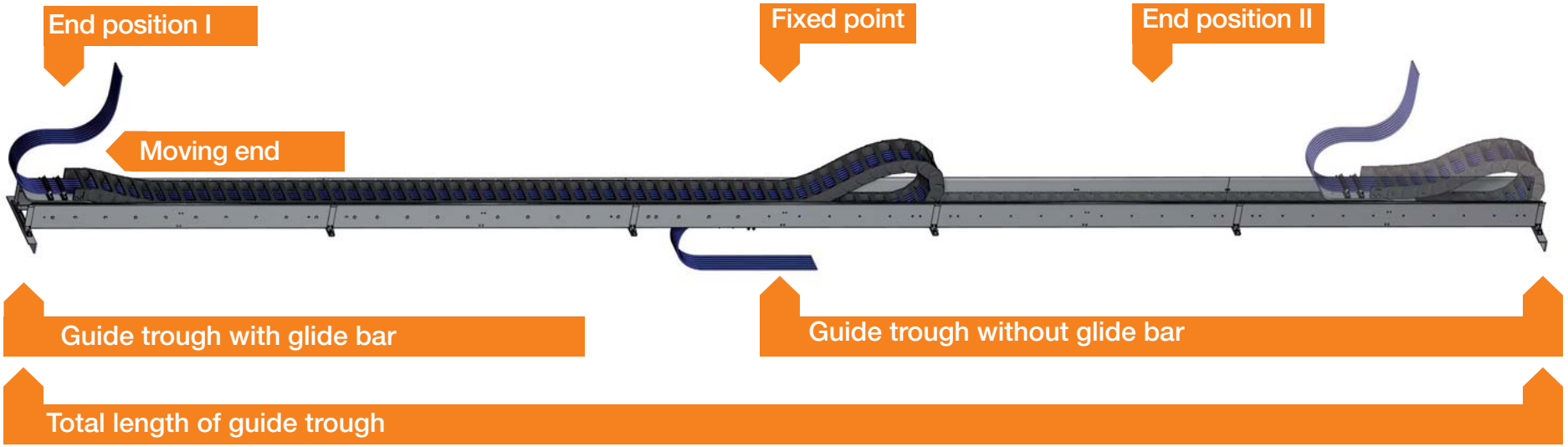
Support structure

Guide trough

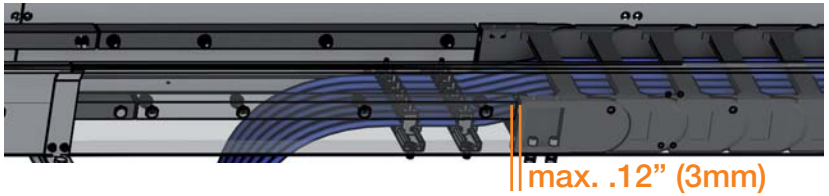
Energy Chain®

Fixed point

Moving end



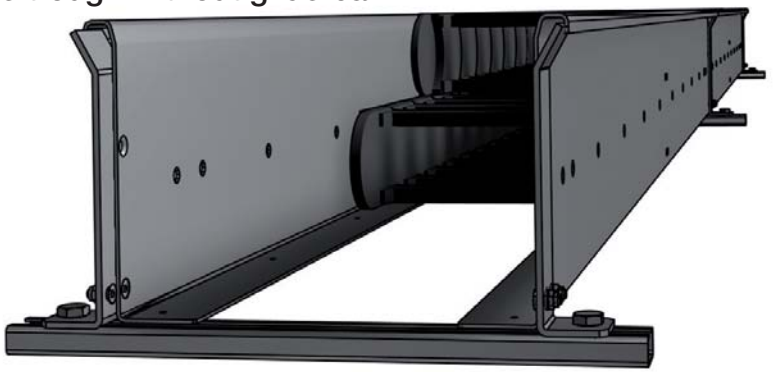
Fixed point



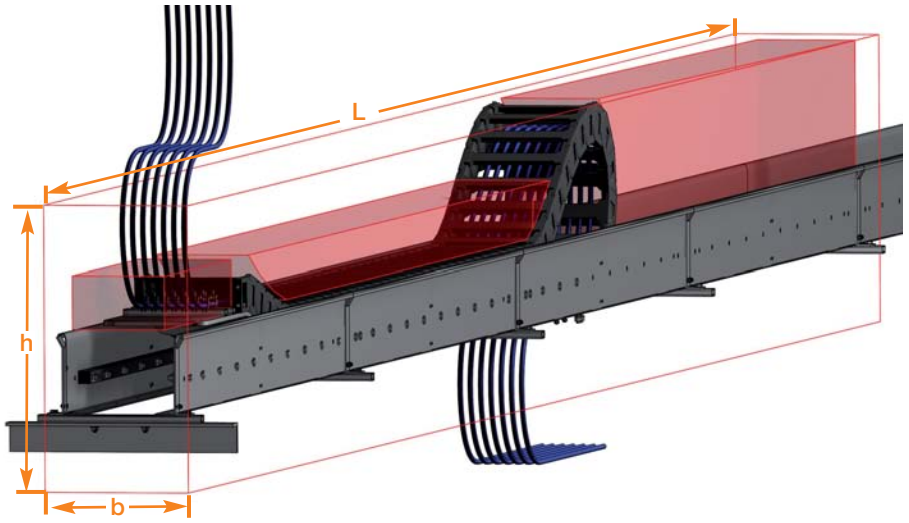
Guide trough with glide bar



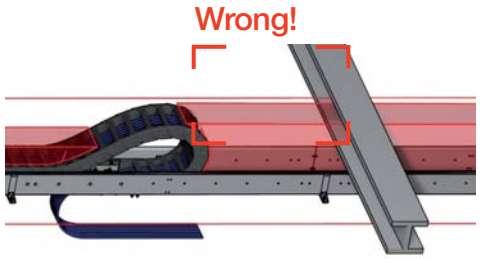
Guide trough without glide bar



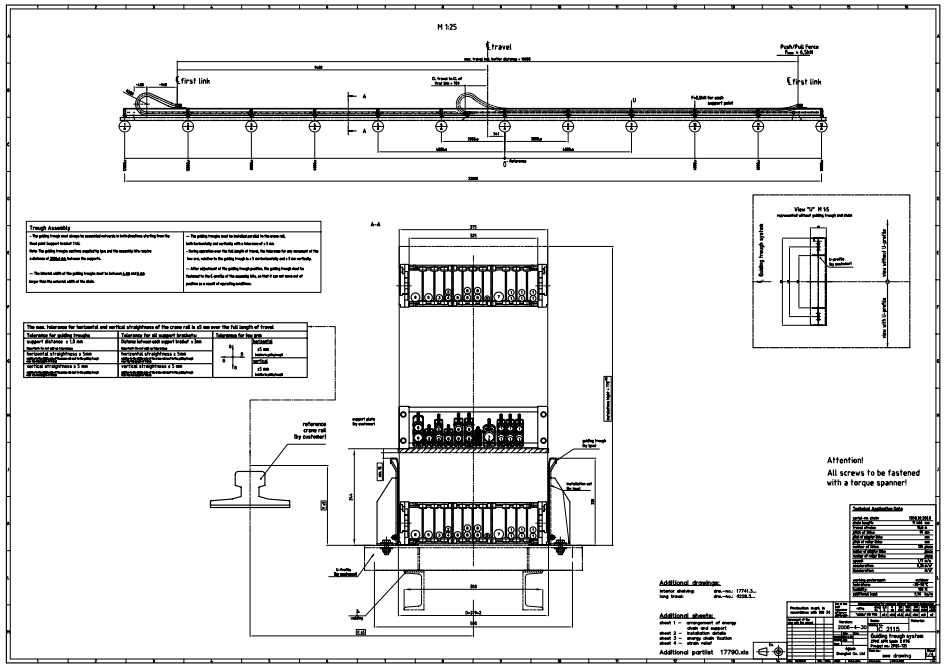
Space requirement for Energy Chain System®

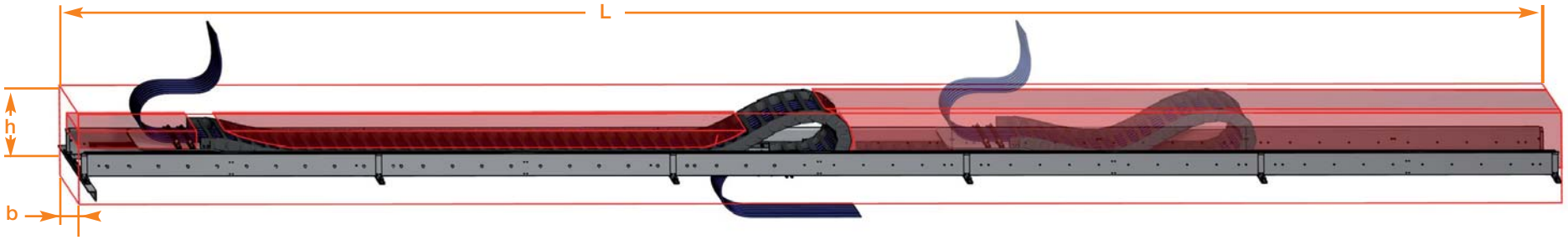


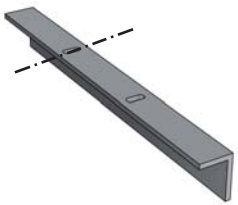
Energy Chain® has to move freely along the entire travel length. Other components or machine parts must not obstruct the operation area!



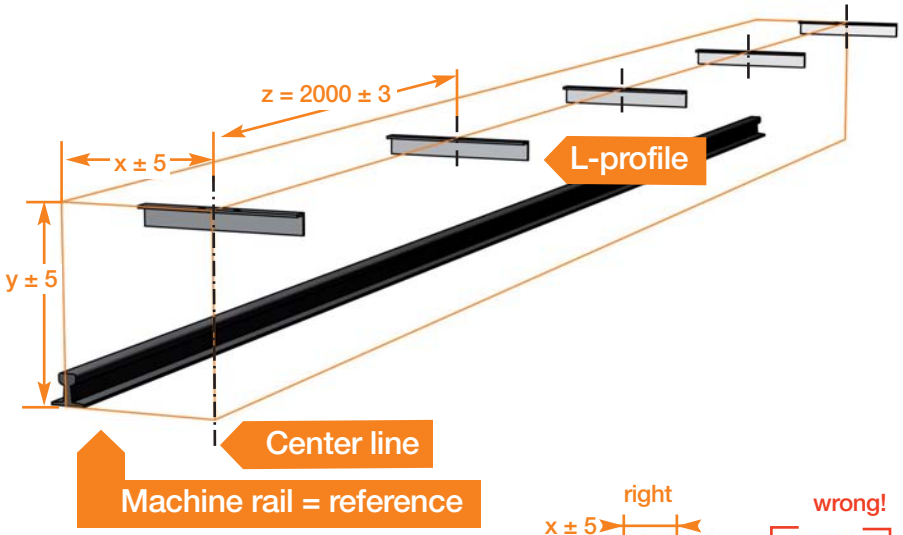
Installation has to be done according to igus® system drawings



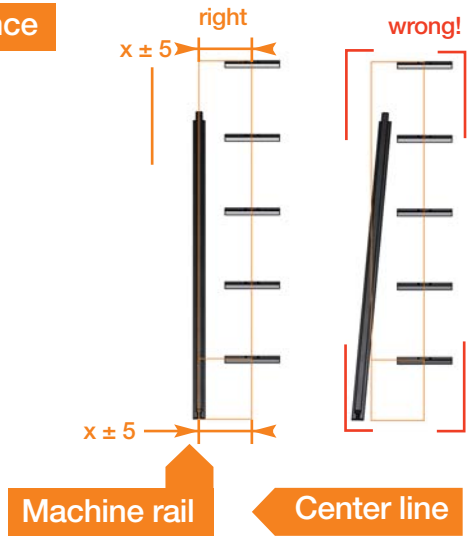




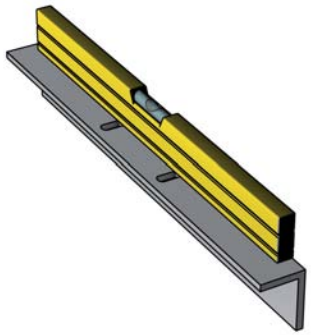
L-profile
oblong hole
drill pattern c-profile

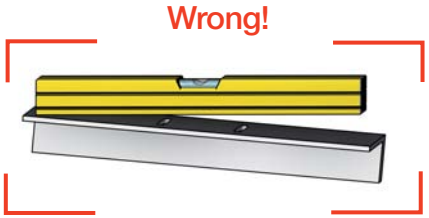


Machine rail and support structure have to be aligned.

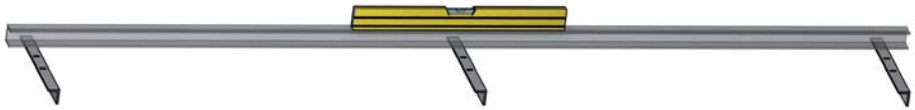


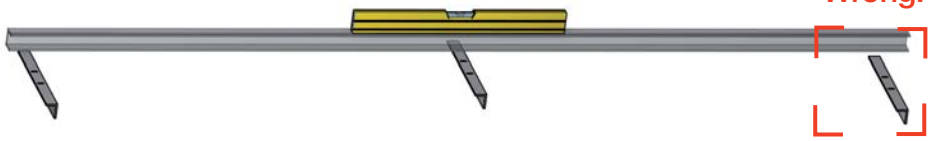
Support structure has to be aligned and level.



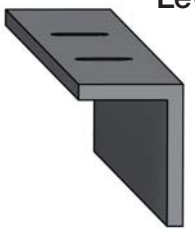


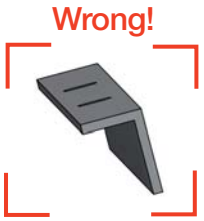
Level the support structure

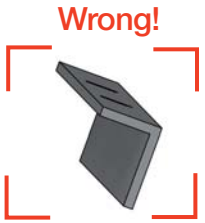




Level the L-profile





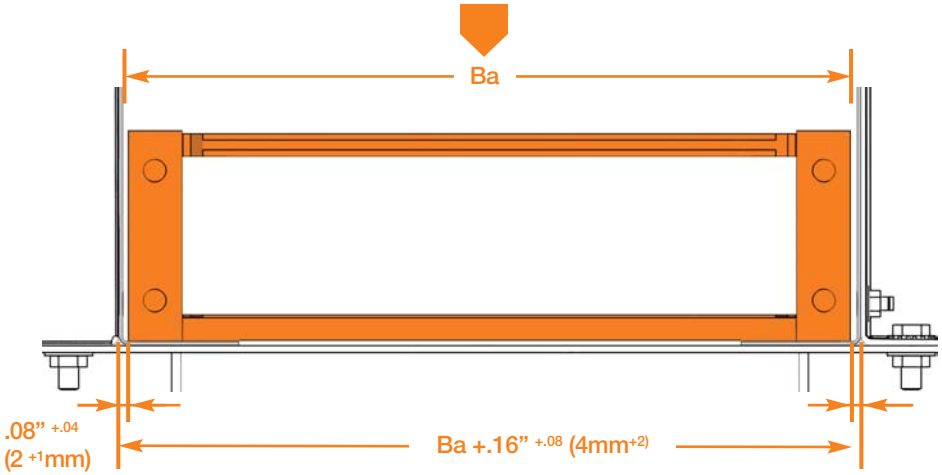


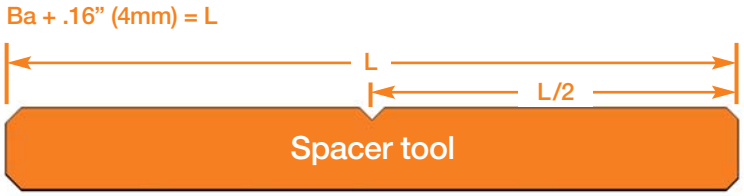


Check the support structure before trough installation. Any adjustments or corrections need to be made before next installation step.

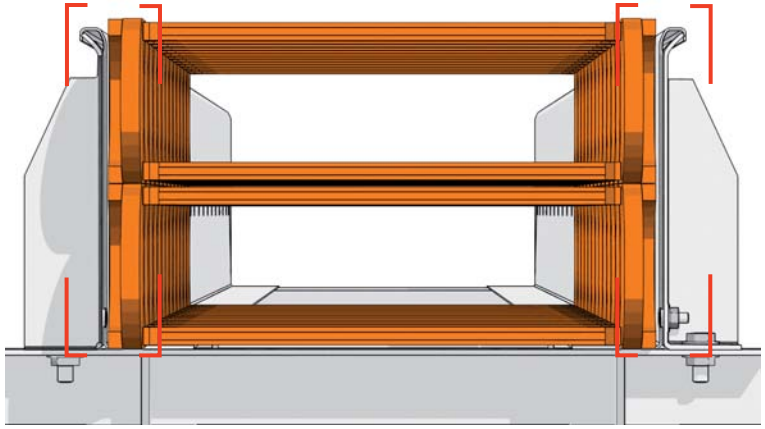
Prepare a spacer tool, to adjust the inner trough width.

Energy Chain® outer width = Ba



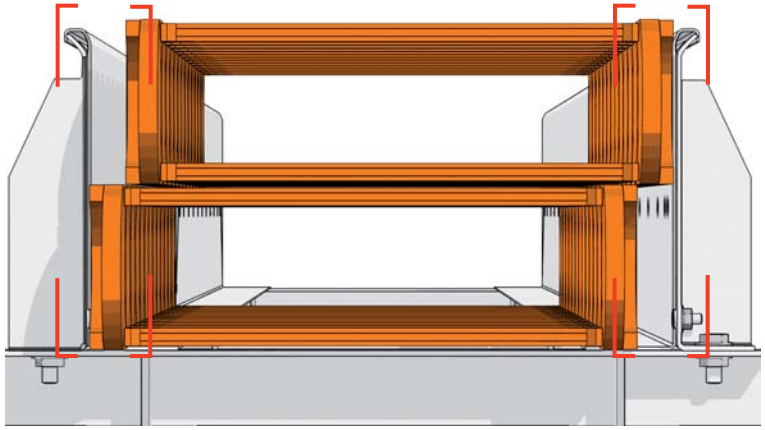


No gap = wrong!



No gap causes wear on chain links and blocks the Energy Chain®.

Big gap = wrong!



Big gap causes wear on the chain links and crossbar.

Guide Trough Installation

Important: Guiding trough has to be parallel with the machine rail, both horizontally and vertically.

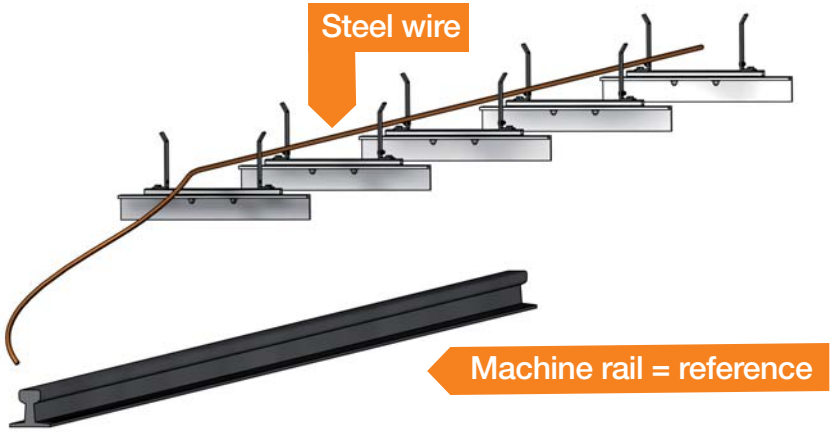
1. Mount Profile Rail



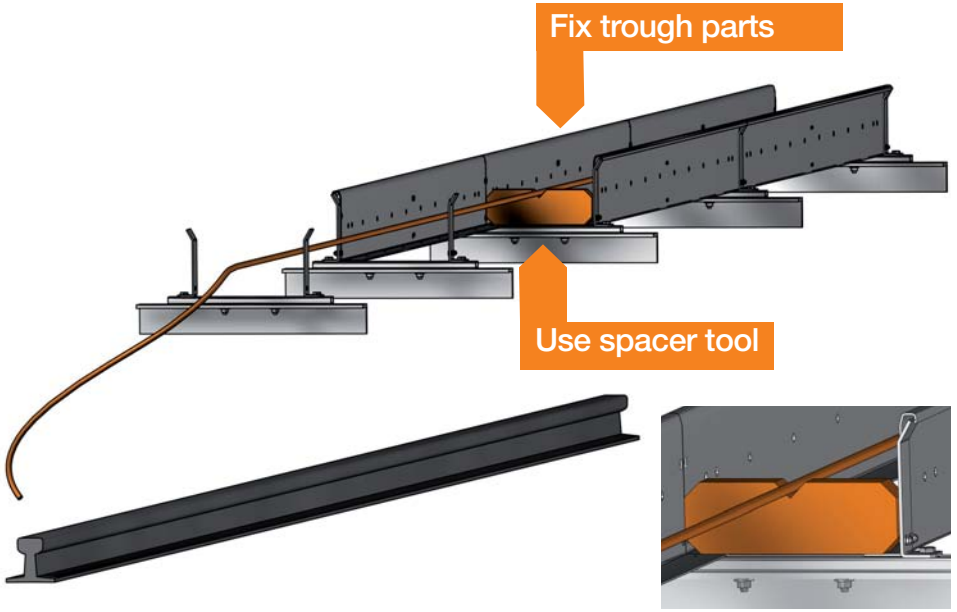
2. Preassemble installation angles



3. Install alignment wire parallel with the machine rail



3. Align trough parts and angles with steel wire and spacer tool



Use torque wrench to tighten screws

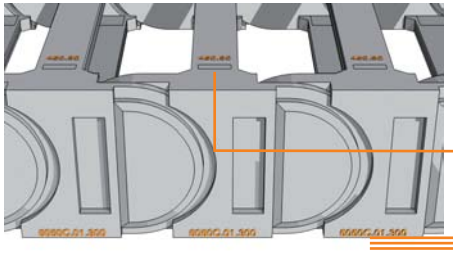
Thread size	Material	Torque
M6	8.8/A2/A4-70	10 Nm
M8	8.8/A2/A4-70	23 Nm
M10	8.8/A2/A4-70	35 Nm
M12	8.8/A2/A4-70	75 Nm
fastening of plastic slide bar		
M10	8.8/A2/A4-70	7 Nm



Check trough alignment and torque.
Make all adjustments before next installation step.

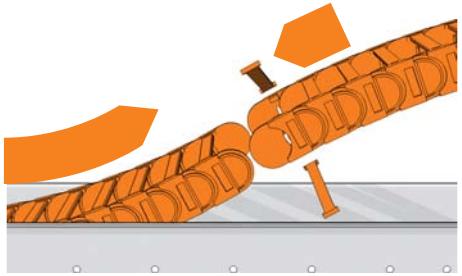
Energy Chain® Pre-Assembly

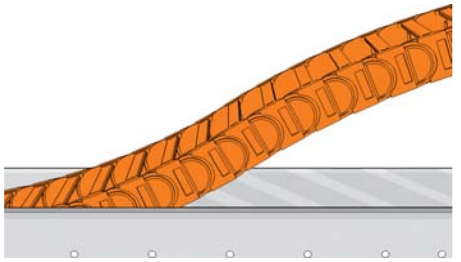
Check part no. on Energy Chain®, before assembly.
For example: 5050C- 4040C- Series



Chain s number 5050C-30-300-0

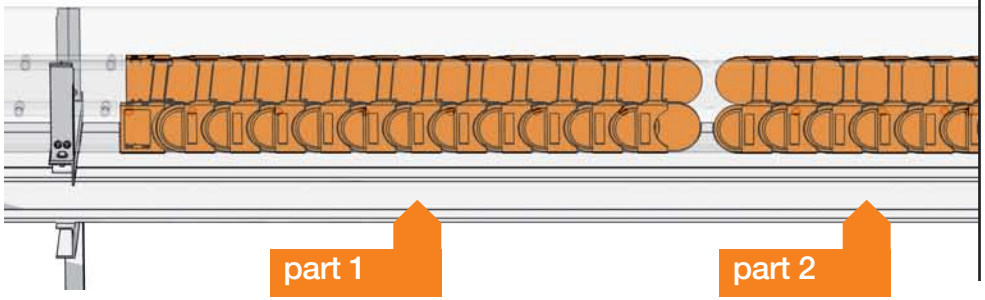
5050C	Series number
30	Width
300	Radius of chain
0	Color

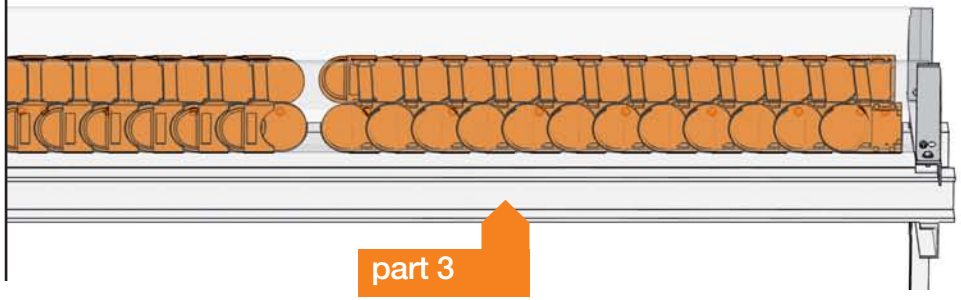




Energy Chain® assembly

Lay the fixed point (part 3) into the trough and assemble parts until you reach the mounting end.



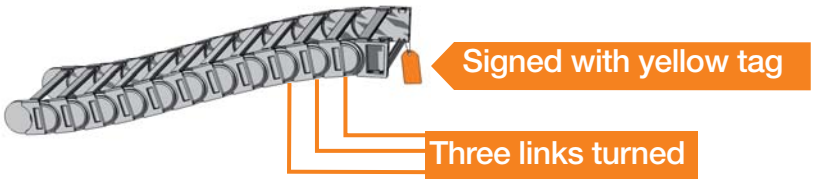




Fixed point
(KMA bracket attached)



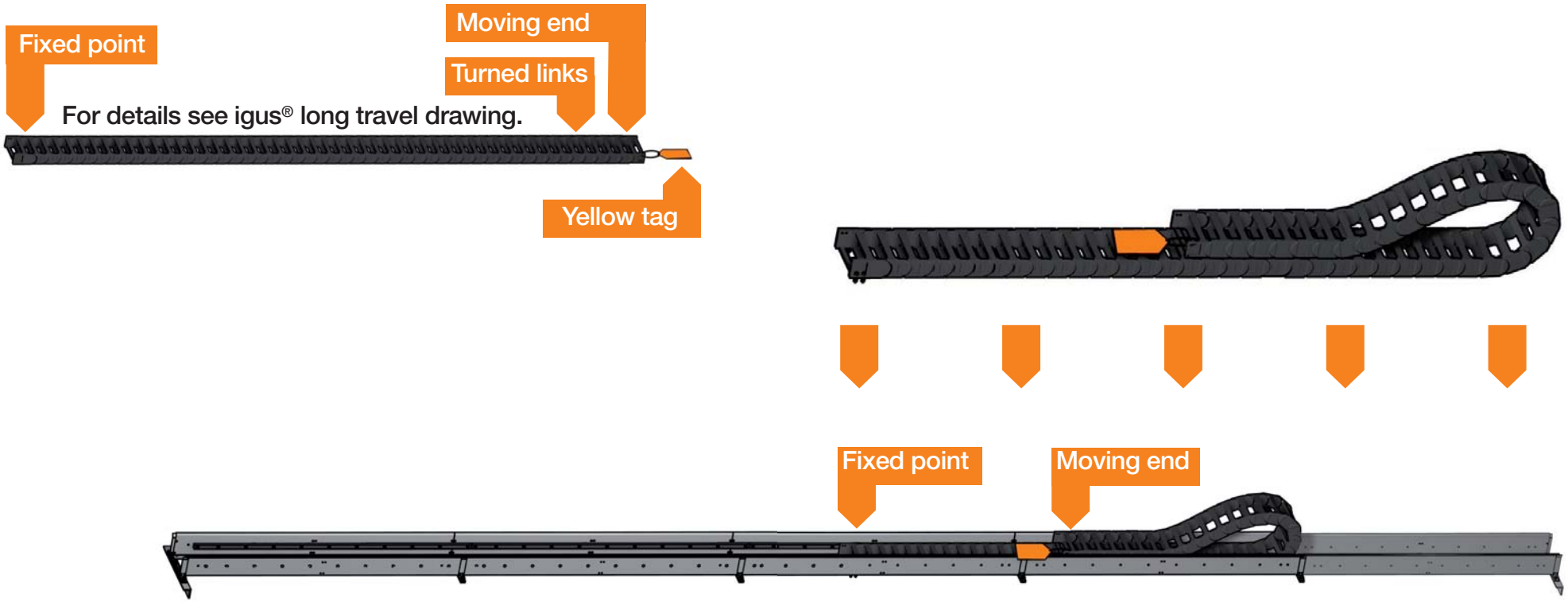
Energy Chain® parts
(meter sections)



Moving end
(KMA attached)



Make sure the fixed-point position is according to igus® drawings, relative to the travel stroke.
Lay the preassembled Energy Chain® into the guiding tough.



Check fixed point position relative to the travel stroke.

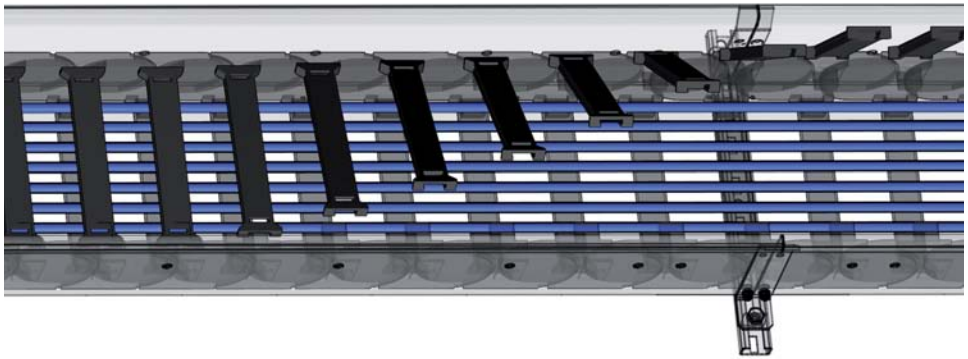
Pull Cables Into Energy Chain®

Make sure cable arrangement is according to igus® interior shelving drawing.

Installation methods:
Pull cables into Energy Chain®



Alternative installation method:
Open the crossbars, lay the cables in the Energy Chain® and close it



Corkscrew or
Cable damage

Wrong!



Correct!

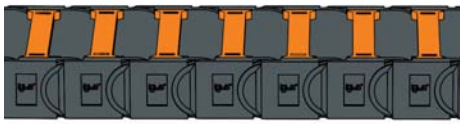


Wrong!

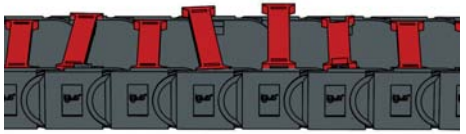


All crossbars snapped in? Any broken parts?

Correct!



Wrong!

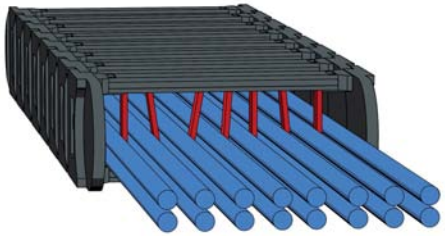


Check the interior separation of the Energy Chain®.
Are all separators plumb and tight?

Correct!

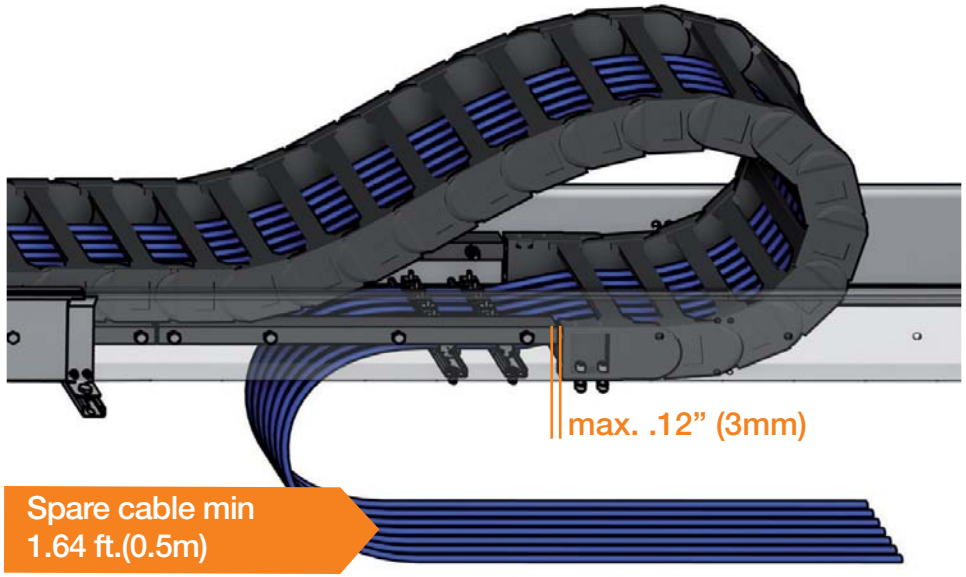


Wrong!

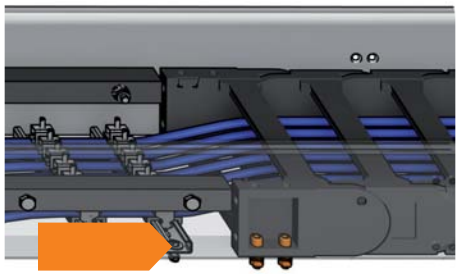


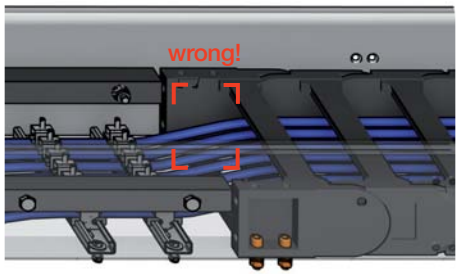
Attach Energy Chain®

Leave a spare cable loop for cable adjustment at fixed point and moving end.



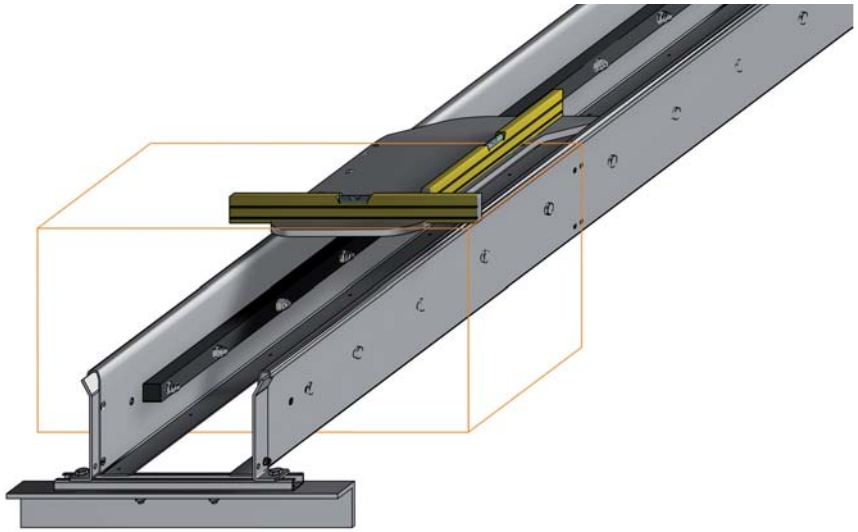
Make sure that the fixed point is in the correct position and affix it with Allen screws (DIN 912 / EN ISO 7462).





Level Moving End

Moving end has to be installed according to system drawing.
Support plate has to be level!
Mountingn height according to igusr drawing.

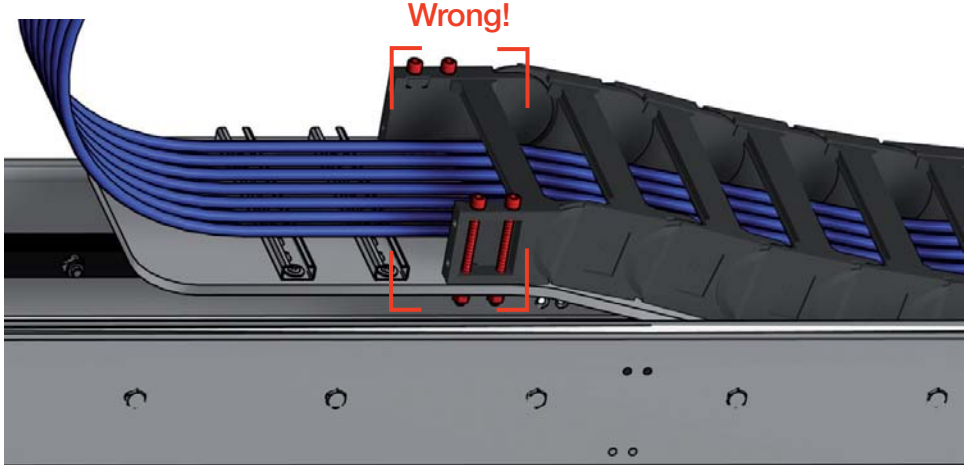


for E4-80/5050C h= 9.52” + .39” (242mm +10)

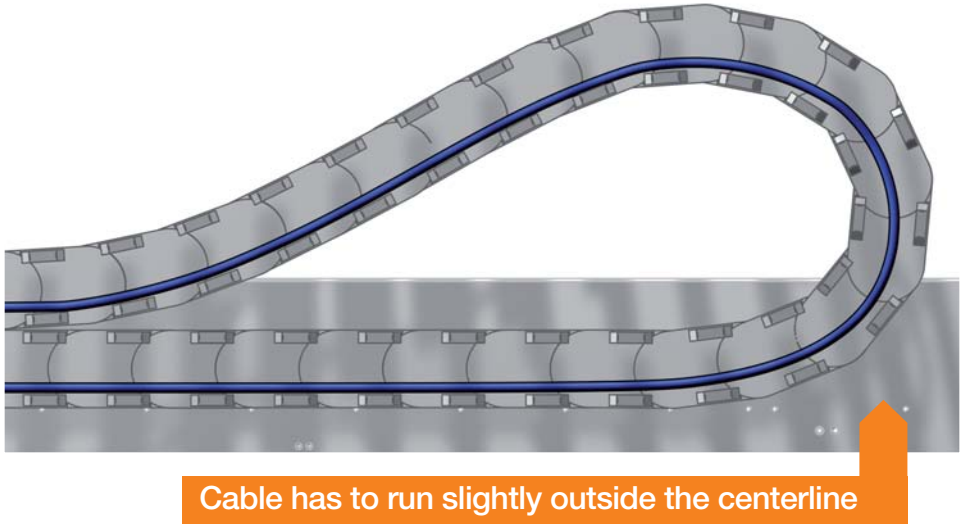
for E4-56/4040C/400 h= 10.47” + .39” (266mm +10)

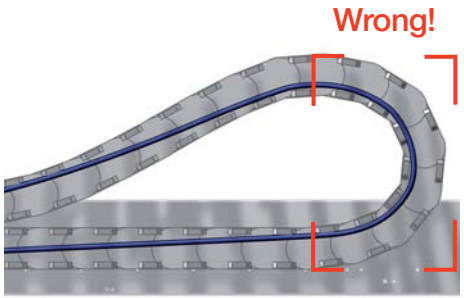
Flip chain radius, move it to the moving arm and fix it with Allen screws (DIN 912 / EN ISO 7462).



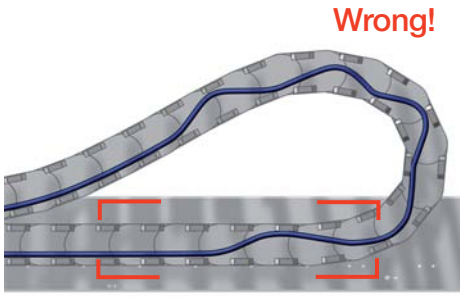


Correct cable adjustment





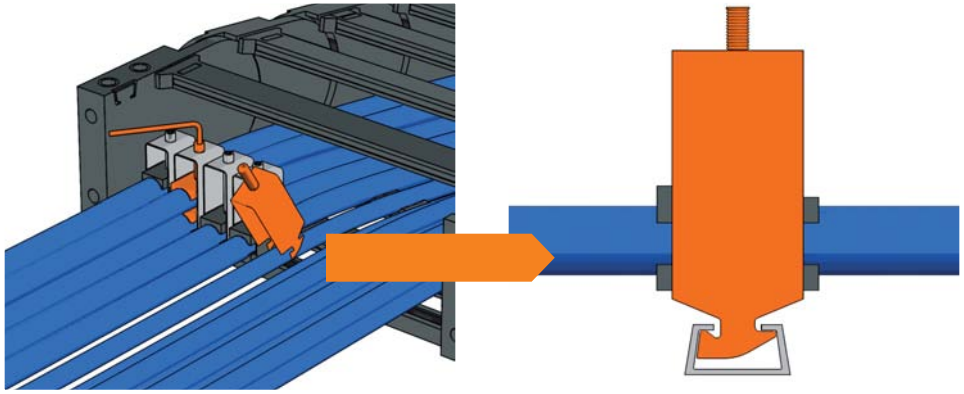
Cable too tight

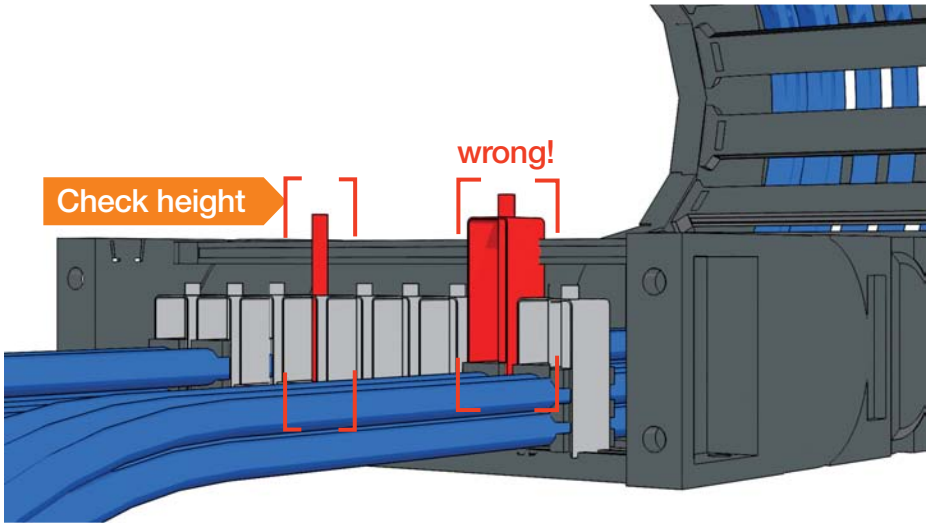


Cable too loose

Install strain relief clamps at moving end and fixed point.

Swing strain relief clamps in the profile-rail and tighten the screw.



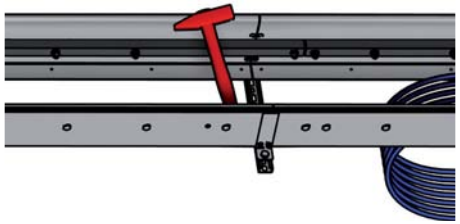


Move the Energy Chain® slowly and carefully to both end positions and check the cable arrangement/position. Double check after a few test cycles.

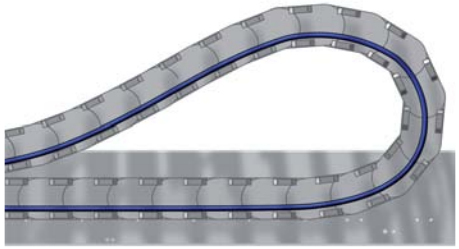
Are screws in place and fixed with torque wrench?



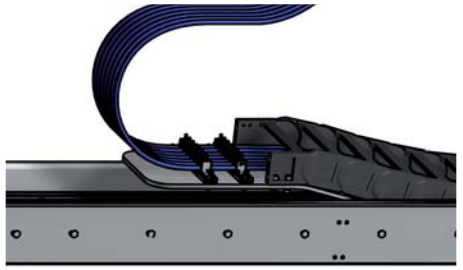
Are there any obstructions or tools in the guide trough?



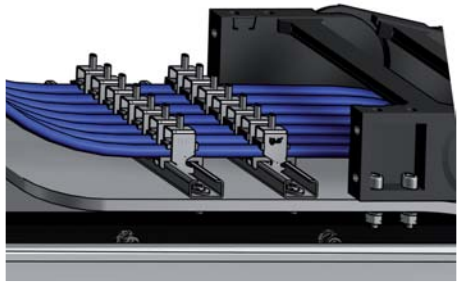
Is the cable arrangement correct?



Are moving-end height and Energy Chain® fixation correct?



Are all strain relief clamps installed at both ends?



PO Box 14349
East Providence, RI 02914
Tel.: 401-438-2200
Fax: 401-438-7270

Toll Free: 800-521-2747
E-mail: sales@igus.com
Website: www.igus.com

TAB 13
Bridge Crane and Structure
(Ovivo USA, LLC Part No. CSW1584-157)

american equipment llc.
451 WEST 3440 SOUTH
SALT LAKE CITY, UTAH 84115
(801) 269-0896 FAX (801) 269-0948
http://www.amquipinc.com

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am·quip®
ISO 9001:2015

OPERATION AND MAINTENANCE MANUAL

SOLD TO:
Ovivo USA
4246 Riverboat Road
Salt Lake City UT 84123

USER:
Valmont
1085 W 400 N
Lindon, UT 84042

7.5 TON

american equipment llc. job # 36481

american equipment, llc.

451 West 3440 South
SALT LAKE CITY, UT 84115
(801) 269-0896 FAX (801) 269-0948
http://www.amquipinc.com

ISO 9001:2015

CRANE S/N: 36481 **TYPE:** TRSG

SOLD TO: Ovivo
4246 Riverboat Road STE 300
Salt Lake City, UT 84123

USER: Custer Avenue CSO Facility
780 Custer Avenue
Atlanta, GA 30318

PURCHASER ORDER #: DSW0116304

CAPACITY: 7.5 tons **SPAN:** 20'-1-3/8"

TOTAL WEIGHT: 3600 lbs **CMAA CLASS/SERVICE:** Indoor / 3

HOIST MFG: Supplied by Others **HOIST S/N:**

END TRUCK MFG: DETROIT **END TRUCK S/N:** 171883

TROLLEY DATA:

	CAPACITY	LIFT	REEVING	TYPE OF HOIST
HOIST	**7.5 ton**	N/A	N/A	N/A

TROLLEY VFD PART #:

BRIDGE DATA:

TYPE OF DRIVE	TYPE OF CONDUCTOR	SIZE OF BEAM	WALKWAY
BY OTHERS	BY OTHERS	W16x89	NONE

BRIDGE VFD PART #:

ELECTRICAL DATA

POWER SUPPLY: 480/3/60

	SPEED FT. PER MIN	HP
HOIST	**BY OTHERS**	BY OTHERS
TROLLEY	**BY OTHERS**	BY OTHERS
BRIDGE	**120 FPM**	2 @ 3/4 HP

HOIST VFD PART #

RUNWAY DATA

RAIL SIZE	RUNWAY LENGTH	COLLECTORS	COND. TYPE
30# ASCE	45'-1"	BY OTHERS	BY OTHERS

CONTROLS

PENDANT MFG/TYPE	PENDANT LOCATION	RADIO MFG/TYPE	RADIO S/N
NONE	NONE	NONE	TRANS: NONE
			RCV: NONE

NOTES:

american equipment inc.
451 WEST 3440 SOUTH
SALT LAKE CITY, UTAH 84115
(801) 269-0896 FAX (801) 269-0948
http://www.amquipinc.com

Date: 06/13/23 UPDATE - B

CRANE SPECIFICATIONS

	MANUFACTURER	PART NO.	DESCRIPTION
CUSTOMER:			**OVIVO**
CUSTOMER P.O. NUMBER:			**DSW0116304**
CUSTOMER MARK NUMBER:			
PROJECT NAME:			**Custer AVE CSO Facility cranes**
AM-QUIP JOB NUMBER:	**amquip**	**36481**	Bridge crane for bosker
CRANE TYPE:			Top running single girder
CAPACITY IN TONS:			7.5 Tons
CRANE SPAN:			20'-1 3/8"
HOIST	**None - customer supplied bosker**		
BRIDGE BEAM:			W16x89
END TRUCKS	**Detroit**	**ET6-(59)-SXP**	Rotating axle end trucks
WHEELBASE:			4'-11"
RUNWAY RAIL:			30# ASCE crane rail (By Amquip)
WHEEL MATERIAL:			Graphite ducitle iron
WHEEL SIZE			6 1/4" Diameter
END TRUCK BUMPERS			Rubber bumpers
BRIDGE SPEED:			120 FPM max
BRIDGE MOTOR LOCATION:			One each end truck (A4 configuration)
RUNWAYS			By Amquip
RUNWAY LENGTH:			45'-1"
RUNWAY BEAM SIZE:			W24x131
GENERAL			
BRIDGE WEIGHT:			3,600 lbs
HOIST/TROLLEY WEIGHT:			N/A - Bosker weight is part of 7.5 ton load
TOTAL WEIGHT:			3,600 lbs
MAX WHEEL LOAD:			4,650 lbs w/o impact
DUTY CYCLE:			3
SERVICE:			Indoor
CRANE PAINT:			New Amquip Yellow Enamel
FREE STANDING SYSTEM COATING:			Hot dipped Galvanized
AMBIENT TEMPERATURE:			20 deg F - 104 deg F
ALTITUDE:			<4500 Feet

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Date: 06/13/23

UPDATE - B

	DESCRIPTION		DESCRIPTION
Job Number / Customer	36481OVIVO	**Flood Lights**	None
Voltage / Phase / Frequency	480-3-60	**Anti-Collision**	None
Ambient Temperature	20 deg F - 104 deg F	**Limit Switches**	None
Environment classification	Class I, Div II, Group D		
Bridge Control	By others		
variable frequency drive			
speed control			
branch circuit overcurrent device		**Load Cell & Display**	None
motor overload device		**Radio**	None
disconnect / overcurrent device		# of motions	
control transformer (size in VA)		hoist select	
vendor schematic #		vendor schematic #	
Hoist Control	N/A	**Pendant**	None
variable frequency drive		on/off (momentary or maintained)	
speed control		# of buttons	
branch circuit overcurrent device		hoist select	
motor overload device		horn	
control transformer (size in VA)		length	
vendor schematic #		traveling	
Trolley Control	N/A	vendor schematic #	
variable frequency drive		**Enclosures (NEMA Rating)**	By others
speed control		**Conduit (NEMA Rating)**	By others
branch circuit overcurrent device			
motor overload device		**Hoist / Trolley Festoon**	None
vendor schematic #		loop depth	
Bridge Motor(s) Type	TEFC	trolley construction	
hp	2 @ 3/4 HP	**Floor Disc. / OC Device**	By others
full load amps	2 x 2.1 Amps estimated @ 480 V	**Runway Conductors**	By others
Insulation	Class F		
brakes	Disc Brakes		
Hoist Motor(s) Type	N/A		
hp / kw			
full load amps			
RPM / insulation			
brakes (type & voltage)			
Trolley Motor(s) Type	N/A		
hp / kw			
full load amps			
RPM / insulation			
brakes (type & voltage)			
Contactors (Electrical Class)	IEC Rated		
Warning Light	None		
Warning Horn	None		

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451 WEST 3440 SOUTH
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Approved	By
6/15/2022	JD

Bill of materials

JOB NO. 36481
CUST: OVIVO
Paint NEW AMQUIP YELLOW ENAMEL

item no.	part or assembly description	mfg or supplier	SL	part no.	no. req'd	Ref.
1	End Trucks	Detroit		ET6-(59)-SXP	1 Pair	36481-1
2	Bridge Girder			W16x89 - 20'-5 3/8"	1	36481-F1
3	End Truck Connection Angle - Long	Amquip		L4"x4"x1/2" - 1'-0"	4	36481-F2
4	End Truck Connection Angle - Short	Amquip		L4"x4"x1/2" - 6 1/2"	4	36481-F2
5	Bosker Mounting Plate			7/8" A36	2	36481-F3A
6	Web Stiffeners	Amquip		1/4" A36	4	36481-F3A
7	Control Panel Mounting Angle	Amquip		3"x3"x5/16" - 1'-3 1/8"	2	36481-F3A
8	**Bumper Extension**	**Amquip**		**See Below**	**2**	**36481-F4**
9	Bumper Extension Tube	Amquip		3"x3/16" Sq. Tube - 1'-9"	2	36481-F4
10	Bumper Extension Plate	Amquip		1/2"x3" A36 - 4"	2	36481-F4

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ISO 9001:2015

CRANE S/N: 36482 **TYPE:** TRSG

SOLD TO: Ovivo
4246 Riverboat Road STE 300
Salt Lake City, UT 84123

USER: Custer Avenue CSO Facility
780 Custer Avenue
Atlanta, GA 30318

PURCHASER ORDER #: DSW0116304

CAPACITY: 7.5 tons **SPAN:** 20'-1-3/8"

TOTAL WEIGHT: 3600 lbs **CMAA CLASS/SERVICE:** Indoor / 3

HOIST MFG: Supplied by Others **HOIST S/N:**

END TRUCK MFG: DETROIT **END TRUCK S/N:** 171884

TROLLEY DATA:

	CAPACITY	LIFT	REEVING	TYPE OF HOIST
HOIST	**7.5 ton**	N/A	N/A	N/A

TROLLEY VFD PART #:

BRIDGE DATA:

TYPE OF DRIVE	TYPE OF CONDUCTOR	SIZE OF BEAM	WALKWAY
BY OTHERS	BY OTHERS	W16x89	NONE

BRIDGE VFD PART #:

ELECTRICAL DATA

POWER SUPPLY: 480/3/60

	SPEED FT. PER MIN	HP
HOIST	**BY OTHERS**	BY OTHERS
TROLLEY	**BY OTHERS**	BY OTHERS
BRIDGE	**120 FPM**	2 @ 3/4 HP

HOIST VFD PART #

RUNWAY DATA

RAIL SIZE	RUNWAY LENGTH	COLLECTORS	COND. TYPE
30# ASCE	45'-1"	BY OTHERS	BY OTHERS

CONTROLS

PENDANT MFG/TYPE	PENDANT LOCATION	RADIO MFG/TYPE	RADIO S/N
NONE	NONE	NONE	TRANS: NONE
			RCV: NONE

NOTES:

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CRANE SPECIFICATIONS

	MANUFACTURER	PART NO.	DESCRIPTION
CUSTOMER:			**OVIVO**
CUSTOMER P.O. NUMBER:			**DSW0116304**
CUSTOMER MARK NUMBER:			
PROJECT NAME:			**Custer AVE CSO Facility cranes**
AM-QUIP JOB NUMBER:	**amquip**	**36482**	Bridge crane for bosker
CRANE TYPE:			Top running single girder
CAPACITY IN TONS:			7.5 Tons
CRANE SPAN:			20'-1 3/8"
HOIST	**None - customer supplied bosker**		
BRIDGE BEAM:			W16x89
END TRUCKS	**Detroit**	**ET6-(59)-SXP**	Rotating axle end trucks
WHEELBASE:			4'-11"
RUNWAY RAIL:			30# ASCE crane rail (By Amquip)
WHEEL MATERIAL:			Graphite ducitle iron
WHEEL SIZE			6 1/4" Diameter
END TRUCK BUMPERS			Rubber bumpers
BRIDGE SPEED:			120 FPM max
BRIDGE MOTOR LOCATION:			One each end truck (A4 configuration)
RUNWAYS			By Amquip
RUNWAY LENGTH:			45'-1"
RUNWAY BEAM SIZE:			W24x131
GENERAL			
BRIDGE WEIGHT:			3,600 lbs
HOIST/TROLLEY WEIGHT:			N/A - Bosker weight is part of 7.5 ton load
TOTAL WEIGHT:			3,600 lbs
MAX WHEEL LOAD:			4,650 lbs w/o impact
DUTY CYCLE:			3
SERVICE:			Indoor
CRANE PAINT:			New Amquip Yellow Enamel
FREE STANDING SYSTEM COATING:			Hot dipped Galvanized
AMBIENT TEMPERATURE:			20 deg F - 104 deg F
ALTITUDE:			<4500 Feet

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	DESCRIPTION		DESCRIPTION
Job Number / Customer	36482OVIVO	**Flood Lights**	None
Voltage / Phase / Frequency	480-3-60	**Anti-Collision**	None
Ambient Temperature	20 deg F - 104 deg F	**Limit Switches**	None
Environment classification	Class I, Div II, Group D		
Bridge Control	By others		
variable frequency drive			
speed control			
branch circuit overcurrent device		**Load Cell & Display**	None
motor overload device		**Radio**	None
disconnect / overcurrent device		# of motions	
control transformer (size in VA)		hoist select	
vendor schematic #		vendor schematic #	
Hoist Control	N/A	**Pendant**	None
variable frequency drive		on/off (momentary or maintained)	
speed control		# of buttons	
branch circuit overcurrent device		hoist select	
motor overload device		horn	
control transformer (size in VA)		length	
vendor schematic #		traveling	
Trolley Control	N/A	vendor schematic #	
variable frequency drive		**Enclosures (NEMA Rating)**	By others
speed control		**Conduit (NEMA Rating)**	By others
branch circuit overcurrent device			
motor overload device		**Hoist / Trolley Festoon**	None
vendor schematic #		loop depth	
Bridge Motor(s) Type	TEFC	trolley construction	
hp	2 @ 3/4 HP	**Floor Disc. / OC Device**	By others
full load amps	2 x 2.1 Amps estimated @ 480 V	**Runway Conductors**	By others
Insulation	Class F		
brakes	Disc Brakes		
Hoist Motor(s) Type	N/A		
hp / kw			
full load amps			
RPM / insulation			
brakes (type & voltage)			
Trolley Motor(s) Type	N/A		
hp / kw			
full load amps			
RPM / insulation			
brakes (type & voltage)			
Contactors (Electrical Class)	IEC Rated		
Warning Light	None		
Warning Horn	None		

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6/15/2022	JD

Bill of materials

JOB NO. 36482
CUST: OVIVO
Paint NEW AMQUIP YELLOW ENAMEL

item no.	part or assembly description	mfg or supplier	SL	part no.	no. req'd	Ref.
1	End Trucks	Detroit		ET6-(59)-SXP	1 Pair	36482-1
2	Bridge Girder			W16x89 - 20'-5 3/8"	1	36482-F1
3	End Truck Connection Angle - Long	Amquip		L4"x4"x1/2" - 1'-0"	4	36482-F2
4	End Truck Connection Angle - Short	Amquip		L4"x4"x1/2" - 6 1/2"	4	36482-F2
5	Bosker Mounting Plate			7/8" A36	2	36482-F3A
6	Web Stiffeners	Amquip		1/4" A36	4	36482-F3A
7	Control Panel Mounting Angle	Amquip		3"x3"x5/16" - 1'-3 1/8"	2	36482-F3A

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ISO 9001:2015

CRANE S/N: 36483 **TYPE:** TRSG

SOLD TO: Ovivo
4246 Riverboat Road STE 300
Salt Lake City, UT 84123

USER: Custer Avenue CSO Facility
780 Custer Avenue
Atlanta, GA 30318

PURCHASER ORDER #: DSW0116304

CAPACITY: 7.5 tons **SPAN:** 20'-1-3/8"

TOTAL WEIGHT: 3600 lbs **CMAA CLASS/SERVICE:** Indoor / 3

HOIST MFG: Supplied by Others **HOIST S/N:**

END TRUCK MFG: DETROIT **END TRUCK S/N:** 171885

TROLLEY DATA:

	CAPACITY	LIFT	REEVING	TYPE OF HOIST
HOIST	**7.5 ton**	N/A	N/A	N/A

TROLLEY VFD PART #:

BRIDGE DATA:

TYPE OF DRIVE	TYPE OF CONDUCTOR	SIZE OF BEAM	WALKWAY
BY OTHERS	BY OTHERS	W16x89	NONE

BRIDGE VFD PART #:

ELECTRICAL DATA

POWER SUPPLY: 480/3/60

	SPEED FT. PER MIN	HP
HOIST	**BY OTHERS**	BY OTHERS
TROLLEY	**BY OTHERS**	BY OTHERS
BRIDGE	**120 FPM**	2 @ 3/4 HP

HOIST VFD PART #

RUNWAY DATA

RAIL SIZE	RUNWAY LENGTH	COLLECTORS	COND. TYPE
30# ASCE	45'-1"	BY OTHERS	BY OTHERS

CONTROLS

PENDANT MFG/TYPE	PENDANT LOCATION	RADIO MFG/TYPE	RADIO S/N
NONE	NONE	NONE	TRANS: NONE
			RCV: NONE

NOTES:

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CRANE SPECIFICATIONS

	MANUFACTURER	PART NO.	DESCRIPTION
CUSTOMER:			**OVIVO**
CUSTOMER P.O. NUMBER:			**DSW0116304**
CUSTOMER MARK NUMBER:			
PROJECT NAME:			**Custer AVE CSO Facility cranes**
AM-QUIP JOB NUMBER:	**amquip**	**36483**	Bridge crane for bosker
CRANE TYPE:			Top running single girder
CAPACITY IN TONS:			7.5 Tons
CRANE SPAN:			20'-1 3/8"
HOIST	**None - customer supplied bosker**		
BRIDGE BEAM:			W16x89
END TRUCKS	**Detroit**	**ET6-(59)-SXP**	Rotating axle end trucks
WHEELBASE:			4'-11"
RUNWAY RAIL:			30# ASCE crane rail (By Amquip)
WHEEL MATERIAL:			Graphite ducitle iron
WHEEL SIZE			6 1/4" Diameter
END TRUCK BUMPERS			Rubber bumpers
BRIDGE SPEED:			120 FPM max
BRIDGE MOTOR LOCATION:			One each end truck (A4 configuration)
RUNWAYS			By Amquip
RUNWAY LENGTH:			45'-1"
RUNWAY BEAM SIZE:			W24x131
GENERAL			
BRIDGE WEIGHT:			3,600 lbs
HOIST/TROLLEY WEIGHT:			N/A - Bosker weight is part of 7.5 ton load
TOTAL WEIGHT:			3,600 lbs
MAX WHEEL LOAD:			4,650 lbs w/o impact
DUTY CYCLE:			3
SERVICE:			Indoor
CRANE PAINT:			New Amquip Yellow Enamel
FREE STANDING SYSTEM COATING:			Hot dipped Galvanized
AMBIENT TEMPERATURE:			20 deg F - 104 deg F
ALTITUDE:			<4500 Feet

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UPDATE - B

	DESCRIPTION		DESCRIPTION
Job Number / Customer	36483OVIVO	**Flood Lights**	None
Voltage / Phase / Frequency	480-3-60	**Anti-Collision**	None
Ambient Temperature	20 deg F - 104 deg F	**Limit Switches**	None
Environment classification	Class I, Div II, Group D		
Bridge Control	By others		
variable frequency drive			
speed control			
branch circuit overcurrent device		**Load Cell & Display**	None
motor overload device		**Radio**	None
disconnect / overcurrent device		# of motions	
control transformer (size in VA)		hoist select	
vendor schematic #		vendor schematic #	
Hoist Control	N/A	**Pendant**	None
variable frequency drive		on/off (momentary or maintained)	
speed control		# of buttons	
branch circuit overcurrent device		hoist select	
motor overload device		horn	
control transformer (size in VA)		length	
vendor schematic #		traveling	
Trolley Control	N/A	vendor schematic #	
variable frequency drive		**Enclosures (NEMA Rating)**	By others
speed control		**Conduit (NEMA Rating)**	By others
branch circuit overcurrent device			
motor overload device		**Hoist / Trolley Festoon**	None
vendor schematic #		loop depth	
Bridge Motor(s) Type	TEFC	trolley construction	
hp	2 @ 3/4 HP	**Floor Disc. / OC Device**	By others
full load amps	2 x 2.1 Amps estimated @ 480 V	**Runway Conductors**	By others
Insulation	Class F		
brakes	Disc Brakes		
Hoist Motor(s) Type	N/A		
hp / kw			
full load amps			
RPM / insulation			
brakes (type & voltage)			
Trolley Motor(s) Type	N/A		
hp / kw			
full load amps			
RPM / insulation			
brakes (type & voltage)			
Contactors (Electrical Class)	IEC Rated		
Warning Light	None		
Warning Horn	None		

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6/15/2022	JD

Bill of materials

JOB NO. 36483
CUST: OVIVO
Paint NEW AMQUIP YELLOW ENAMEL

item no.	part or assembly description	mfg or supplier	SL	part no.	no. req'd	Ref.
1	End Trucks	Detroit		ET6-(59)-SXP	1 Pair	36483-1
2	Bridge Girder			W16x89 - 20'-5 3/8"	1	36483-F1
3	End Truck Connection Angle - Long	Amquip		L4"x4"x1/2" - 1'-0"	4	36483-F2
4	End Truck Connection Angle - Short	Amquip		L4"x4"x1/2" - 6 1/2"	4	36483-F2
5	Bosker Mounting Plate			7/8" A36	2	36483-F3A
6	Web Stiffeners	Amquip		1/4" A36	4	36483-F3A
7	Control Panel Mounting Angle	Amquip		3"x3"x5/16" - 1'-3 1/8"	2	36483-F3A
8	**Bumper Extension**	**Amquip**		**See Below**	**2**	**36483-F4**
9	Bumper Extension Tube	Amquip		3"x3/16" Sq. Tube - 1'-9"	2	36483-F4
10	Bumper Extension Plate	Amquip		1/2"x3" A36 - 4"	2	36483-F4

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ISO 9001:2015

CRANE S/N: 36484 **TYPE:** TRSG

SOLD TO: Ovivo
4246 Riverboat Road STE 300
Salt Lake City, UT 84123

USER: Custer Avenue CSO Facility
780 Custer Avenue
Atlanta, GA 30318

PURCHASER ORDER #: DSW0116304

CAPACITY: 7.5 tons **SPAN:** 20'-1-3/8"

TOTAL WEIGHT: 3600 lbs **CMAA CLASS/SERVICE:** Indoor / 3

HOIST MFG: Supplied by Others **HOIST S/N:**

END TRUCK MFG: DETROIT **END TRUCK S/N:** 171886

TROLLEY DATA:

	CAPACITY	LIFT	REEVING	TYPE OF HOIST
HOIST	**7.5 ton**	N/A	N/A	N/A

TROLLEY VFD PART #:

BRIDGE DATA:

TYPE OF DRIVE	TYPE OF CONDUCTOR	SIZE OF BEAM	WALKWAY
BY OTHERS	BY OTHERS	W16x89	NONE

BRIDGE VFD PART #:

ELECTRICAL DATA

POWER SUPPLY: 480/3/60

	SPEED FT. PER MIN	HP
HOIST	**BY OTHERS**	BY OTHERS
TROLLEY	**BY OTHERS**	BY OTHERS
BRIDGE	**120 FPM**	2 @ 3/4 HP

HOIST VFD PART #

RUNWAY DATA

RAIL SIZE	RUNWAY LENGTH	COLLECTORS	COND. TYPE
30# ASCE	45'-1"	BY OTHERS	BY OTHERS

CONTROLS

PENDANT MFG/TYPE	PENDANT LOCATION	RADIO MFG/TYPE	RADIO S/N
NONE	NONE	NONE	TRANS: NONE
			RCV: NONE

NOTES:

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Date: 06/13/23 UPDATE - B

CRANE SPECIFICATIONS

	MANUFACTURER	PART NO.	DESCRIPTION
CUSTOMER:			**OVIVO**
CUSTOMER P.O. NUMBER:			**DSW0116304**
CUSTOMER MARK NUMBER:			
PROJECT NAME:			**Custer AVE CSO Facility cranes**
AM-QUIP JOB NUMBER:	**amquip**	**36484**	Bridge crane for bosker
CRANE TYPE:			Top running single girder
CAPACITY IN TONS:			7.5 Tons
CRANE SPAN:			20'-1 3/8"
HOIST	**None - customer supplied bosker**		
BRIDGE BEAM:			W16x89
END TRUCKS	**Detroit**	**ET6-(59)-SXP**	Rotating axle end trucks
WHEELBASE:			4'-11"
RUNWAY RAIL:			30# ASCE crane rail (By Amquip)
WHEEL MATERIAL:			Graphite ducitle iron
WHEEL SIZE			6 1/4" Diameter
END TRUCK BUMPERS			Rubber bumpers
BRIDGE SPEED:			120 FPM max
BRIDGE MOTOR LOCATION:			One each end truck (A4 configuration)
RUNWAYS			By Amquip
RUNWAY LENGTH:			45'-1"
RUNWAY BEAM SIZE:			W24x131
GENERAL			
BRIDGE WEIGHT:			3,600 lbs
HOIST/TROLLEY WEIGHT:			N/A - Bosker weight is part of 7.5 ton load
TOTAL WEIGHT:			3,600 lbs
MAX WHEEL LOAD:			4,650 lbs w/o impact
DUTY CYCLE:			3
SERVICE:			Indoor
CRANE PAINT:			New Amquip Yellow Enamel
FREE STANDING SYSTEM COATING:			Hot dipped Galvanized
AMBIENT TEMPERATURE:			20 deg F - 104 deg F
ALTITUDE:			<4500 Feet

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Date: 06/13/23

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	DESCRIPTION		DESCRIPTION
Job Number / Customer	36484OVIVO	**Flood Lights**	None
Voltage / Phase / Frequency	480-3-60	**Anti-Collision**	None
Ambient Temperature	20 deg F - 104 deg F	**Limit Switches**	None
Environment classification	Class I, Div II, Group D		
Bridge Control	By others		
variable frequency drive			
speed control			
branch circuit overcurrent device		**Load Cell & Display**	None
motor overload device		**Radio**	None
disconnect / overcurrent device		# of motions	
control transformer (size in VA)		hoist select	
vendor schematic #		vendor schematic #	
Hoist Control	N/A	**Pendant**	None
variable frequency drive		on/off (momentary or maintained)	
speed control		# of buttons	
branch circuit overcurrent device		hoist select	
motor overload device		horn	
control transformer (size in VA)		length	
vendor schematic #		traveling	
Trolley Control	N/A	vendor schematic #	
variable frequency drive		**Enclosures (NEMA Rating)**	By others
speed control		**Conduit (NEMA Rating)**	By others
branch circuit overcurrent device			
motor overload device		**Hoist / Trolley Festoon**	None
vendor schematic #		loop depth	
Bridge Motor(s) Type	TEFC	trolley construction	
hp	2 @ 3/4 HP	**Floor Disc. / OC Device**	By others
full load amps	2 x 2.1 Amps estimated @ 480 V	**Runway Conductors**	By others
Insulation	Class F		
brakes	Disc Brakes		
Hoist Motor(s) Type	N/A		
hp / kw			
full load amps			
RPM / insulation			
brakes (type & voltage)			
Trolley Motor(s) Type	N/A		
hp / kw			
full load amps			
RPM / insulation			
brakes (type & voltage)			
Contactors (Electrical Class)	IEC Rated		
Warning Light	None		
Warning Horn	None		

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Approved	By
6/15/2022	JD

Bill of materials

JOB NO. 36484
CUST: OVIVO
Paint NEW AMQUIP YELLOW ENAMEL

item no.	part or assembly description	mfg or supplier	SL	part no.	no. req'd	Ref.
1	End Trucks	Detroit		ET6-(59)-SXP	1 Pair	36484-1
2	Bridge Girder			W16x89 - 20'-5 3/8"	1	36484-F1
3	End Truck Connection Angle - Long	Amquip		L4"x4"x1/2" - 1'-0"	4	36484-F2
4	End Truck Connection Angle - Short	Amquip		L4"x4"x1/2" - 6 1/2"	4	36484-F2
5	Bosker Mounting Plate			7/8" A36	2	36484-F3A
6	Web Stiffeners	Amquip		1/4" A36	4	36484-F3A
7	Control Panel Mounting Angle	Amquip		3"x3"x5/16" - 1'-3 1/8"	2	36484-F3A

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Tab 1

Operational Manual, Warranty

Disclaimer of Warranty

NOTICE

Warranty is NOT active until a signed copy of the "Start-Up Quality Control Checklist" has been completed and returned to:

American Equipment LLC.
451 West 3440 South
Salt Lake City, Utah 84115
Fax: (801) 269-0948 / scotts@amquipinc.com

American Equipment LLC. hereafter referred to as Company, assumes no responsibility for improper final wire and start-up of a crane by untrained personnel. A crane should only be commissioned by a technician who has knowledge, experience, and training in this process. Improper commissioning of a crane can lead to unexpected, undesirable, or unsafe operation. This may result in damage to equipment or personal injury. Company shall not be liable for economic loss, property damage, or other consequential damages or physical injury sustained by the purchaser or by any third party as a result of such commissioning. Company neither assumes nor authorizes any other person to assume for Company any other liability in connection with the sale or use of this crane.

WARNING

Improper commissioning of a crane can lead to unexpected, undesirable, or unsafe operation or performance

START-UP QUALITY CONTROL CHECKLIST

JOB NAME: _____ **JOB NUMBER:** _____

MECHANICAL

Vent plugs installed on both bridge motors	Yes - No - N/A
Conduit properly installed and tightened	Yes - No - N/A
Open gears lubed	Yes - No - N/A
Checked all oil levels	Yes - No - N/A
All track hangers tight	Yes - No - N/A
All c-track joints tight	Yes - No - N/A
End-stops installed in track	Yes - No - N/A
Stop track hangers tightened into track	Yes - No - N/A
Festoons extend to end of track	Yes - No - N/A
Trolley festoon secured to tow-arm	Yes - No - N/A
Trolley festoon clears hoist	Yes - No - N/A
Trolley properly spaced for beam	Yes - No - N/A
All red-tags completed and removed	Yes - No - N/A
Tow-arms adjusted and secured	Yes - No - N/A
Trolley tow-arm connected to lead trolley	Yes - No - N/A
Runway straight and alligned - visually	Yes - No - N/A
All bolts on explosion-proof boxes installed	Yes - No - N/A

ELECTRICAL

Festoon wires marked and terminated per drawings	Yes - No - N/A
Strain chain & warning label installed on pendant	Yes - No - N/A
Pendant set to proper height	Yes - No - N/A
Pendant strain-relief in place	Yes - No - N/A
All sealoffs poured	Yes - No - N/A
Collector shoes installed and aligned	Yes - No - N/A
Tandem collector shoes installed (all VFC cranes)	Yes - No - N/A
Heat shrinks heated down	Yes - No - N/A
Conductor bar straight and alligned - visually	Yes - No - N/A

Air (Service)

Hose reel swivel installed	Yes - No - N/A
Air regulator pressure set	Yes - No - N/A
Checked for Air leaks	Yes - No - N/A
All Air Lines blown out (water)	Yes - No - N/A
Hose reel properly tensioned	Yes - No - N/A
Ensure cross shaft couplings secure (set screws)	Yes - No - N/A

OPERATION

Bridge motors rotate in same direction	Yes - No - N/A
All speeds present on hoist, trolley, & bridge	Yes - No - N/A
All hoist limit switches operational & adjusted	Yes - No - N/A
Trolley, & bridge limit switches operational	Yes - No - N/A
On/Off brings in and drops out mainline	Yes - No - N/A
All functions on pendant work	Yes - No - N/A
All radio functions operational	Yes - No - N/A
All horns and lights operational	Yes - No - N/A
All VFD's programmed to FLA of motors	Yes - No - N/A
Warning device functioning (if radio is installed)	Yes - No - N/A
Trolley clears all obstructions in all positions along entire length of runway	Yes - No - N/A
Festoons clear all obstructions in all positions along entire length of runway	Yes - No - N/A
Bridge clears all obstructions along entire length of runway	Yes - No - N/A
Crane wired to permanent power	Yes - No - N/A
Read, understood, & followed the "Overhead Crane and Hoist Operation Manual"	Yes - No - N/A
All overload heaters adjusted to FLA of motors	Yes - No - N/A

LOAD TEST

Load test performed	Yes - No - N/A
Load test at: 100% 125% other	
Load test weight:	

NOTES:

If Circled
See Notes
on Back

QC PERFORMED BY _____ **DATE:** _____

ACCEPTED BY _____ **DATE:** _____

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american equipment
A Division of American Equipment Holdings

NEW EQUIPMENT WARRANTY

1. American Equipment LLC (hereinafter, "Seller") warrants all parts, materials, and equipment it sells in accordance with, and to the extent of, the warranty provided by the manufacturer of such parts, materials or equipment.

2. Seller warrants that the parts, and equipment it manufactures will be free from defective workmanship and materials for a period of one (1) year from the date of shipping, or 2000 hours, whichever comes first. Seller shall, at its option, repair or replace any part, material, or equipment that fails to comply with this warranty. Replacement parts, materials and equipment shall be supplied F.O.B. the manufacturer's facility. Labor necessary to (1) repair parts, materials or equipment covered under this Warranty, or (2) replace parts materials, or equipment within thirty (30) days after equipment has been placed in service, shall be provided at no charge to buyer. All other labor is expressly excluded by this warranty. Buyer shall make all parts, materials, and equipment replaced under this warranty available to seller for testing and inspection and/or shall ship such parts and equipment to seller for inspection and/or testing at seller's expense when so requested by the seller.

3. This Warranty shall not apply to the following parts and materials:

   a. Brake Linings
   b. Wire ropes
   c. Rope/chain guide assemblies.

   Warranties for these products of any kind or nature are expressly excluded.

4. **This warranty shall be null and void if parts, materials, and/or equipment subject to this warranty are:**
   a. Subject to any of the following conditions:
      (1) Side-pulling of load,
      (2) Excessive jogging,
      (3) Electrical line surges,
      (4) Electrical line under voltages,
      (5) Environmental exposure not specified in original order,
      (6) Accidental or improper storage and/or handling,
      (7) Supplied by anything but hard wired/hard piped permanent power (that is the use of generators, portable/mobile air compressors, cords or hoses of any kind, etc. is strictly prohibited),
      (8) Operated in excess of rated capacity or duty classification, or are otherwise misused, altered, or repaired in any manner not authorized by American Equipment,
      (9) Damaged due to an act of God or accident, or
      (10) Not maintained in accordance with recommended practices and instructions.
      (11) Exposed to the elements by improper storage resulting in water damage.

This writing constitutes the final expression of American Equipment's warranty for the parts, equipment and services sold by Seller to Buyer, and is a complete and exclusive statement of the terms of this warranty. This warranty is the sole and exclusive remedy of Buyer with respect to such parts, equipment, and services.

DISCLAIMER OF WARRANTIES: THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ALL OTHER WARRANTIES EXPRESS OR IMPLIED NOT SET FORTH HEREIN ARE EXPRESSLY EXCLUDED.

Accepted by_____ Date_____

Overhead Crane and Hoist Operation Manual

Revised, Jul 2017



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1. CONNECTING HOIST & CRANE TO ELECTRICAL SERVICE.

Electrical service to the hoist may be power cable or a guarded system having sliding shoe or wheel type collectors.

WARNING

Be certain that electrical power is OFF and locked in the open position before attempting any electrical connections to the hoist and crane. This equipment must be effectively grounded according to the National Electric Code ANSI/NFPA 70, or other applicable codes. If the grounding method used is through the bridge or trolley wheels, then each section of track must be grounded by metal-to-metal connection to the building ground. Certain environments may prevent proper grounding by this means. In this case a separate grounding conductor should be provided.

a) Follow ANSI/NFPA 70, state, and local electrical codes including the grounding provisions thereof when providing electrical service to the hoist.

b) Make electrical connections using the appropriate wiring diagrams furnished with the hoist, trolley and crane. **ALL ELECTRICAL CONNECTIONS**, including connections to collectors or power cord **SHALL BE MADE ONLY BY QUALIFIED JOURNEYMAN ELECTRICIANS**.

CAUTION

Power supply to hoist and trolley must be the same voltage, frequency, and phase that are specified on the hoist, trolley and crane nameplate.

2. PRE-OPERATION CHECKS

a) CHECK OIL LEVEL. The gear case has been filled with oil to the proper level. However this should be re-checked before operating the hoist.

Check oil level by removing the plug as indicated in appropriate service manuals. Fill to the level with oil as specified in as indicated in the hoist, trolley & crane parts and maintenance manual.

b) CHECK PUSH BUTTON OPERATION AND PHASING. To properly check the phase of the hoist, follow these steps:

(1) **With POWER OFF** operate all the push buttons and determine that they do not bind or stick in any position.

WARNING

If any push button binds or sticks in any position - **DO NOT TURN POWER ON** -determine the cause and correct the malfunction before operating.

(2) Connect hoist and crane to power source.

WARNING

On three phase hoists it is possible to have Reverse Phasing causing the block to lower when the UP button is depressed. When this condition exists the automatic limit switch is inoperative and hoist operation will be dangerous.

(3) Operate UP button briefly to determine direction of hook travel.

(4) If hook raises when UP button is depressed, phasing is correct.

(5) If hook LOWERS when UP button is depressed, HOIST IS REVERSED PHASED - TURN AND LOCK POWER OFF and check the pushbutton wiring. If the pushbutton was wired properly, correct the problem by interchanging any two leads at POWER SOURCE connection. Do not change internal wiring of hoist.

c) CHECK LIMIT SWITCH OPERATION.

(1) When a block operated upper limit stop is furnished follow this procedure. This limit stop is factory set to stop the lower block at the safest high position, guarding against over travel and possible to damage to hoist. No adjustment can be made. However, the hoist should be tested by jogging the lower block against the limit weight to be sure the limit switch is functioning properly. When lower block lifts the limit weight, the hoist will automatically stop. If lower block coasts through the limit switch when lifting a reversing switch will automatically close and reverse direction of motion to lowering.

WARNING

Damage to the hoist, a dropped load, and injury may result if limit switches fail due to improper use.

TO AVOID INJURY

Under normal operating conditions, STOP hoist travel before engaging limit switches. Limit switches are safety devices and should not be used as normal operating control.

WARNING

Some hoists may be shipped with the electrical controls loose (disconnected) and will NOT have the upper and lower limit switches connected. DO NOT OPERATE HOIST UNTIL LIMIT SWITCHES ARE PROPERLY CONNECTED AND ADJUSTED. Failure to do so may allow hoist to be operated beyond proper travel limits, which can cause load to drop, resulting in damage to equipment or injury.

(2) If a geared rotary type upper and lower limit switch is also provided. This switch is adjustable and although roughly preset by the factory, it should be adjusted at time of installation to the desired high and low limits of lower block travel. Refer to codes and standards HST-1 Electric Chain Hoists, HST-2 Hand Chain Manually Operated Hoists, HST-4 Overhead electric Wire rope Hoists, HST-5 Air Chain Hoists, HST-6 Air Wire Rope Hoists (These manuals may be purchased from AMSE.com).

d) CHECK LOWER BLOCK AND HOISTING CABLE. Depress DOWN push button and run lower block to its lowest position. NO LESS THAN TWO WRAPS SHALL REMAIN ON THE DRUM WITH THE LOADED HOOK IN ITS LOWEST POSITION. Also, check to see that the lower block and rope do not twist excessively. If it does twist to the extent that two ropes rub against each other, disengage the swaged rope end from the frame anchor and twist the rope four or five turns in a direction opposite to that which the block turns. Reconnect rope to the frame anchor, holding firmly to eliminate rope twisting back to its original position. Operate hoist up and down a few times. If lower block still rotates excessively repeat process until twisting is corrected.

e) LUBRICATE HOIST & OR CHAIN AND CABLE. For longer cable life, it is recommended that the cable and or chain be lubricated at time of installation by applying a heavy coating of lubricant as indicated.

f) When first using the hoist and trolley, operate with lighter loads through full travel before applying maximum load.

WARNING

For wire rope hoists with rope guides side pulling and excessive load swing will severely damage the rope and rope guide. Failure of these components may result in injury.

For wire rope hoists without rope guides side pulling and excessive load swing will severely damage the rope. Failure of these components may result in injury.

For chain hoist side pulling and excessive load swing may damage the chain and will damage the chain pocket. Failure of these components may result in injury.

3. OPERATIONAL CHECK

(a) New, reinstalled, altered, repaired, and modified cranes shall be tested by a designated person prior to initial use to ensure compliance with this volume.

(b) Tests shall include, as applicable, the following functions:

(1) lifting and lowering

(2) trolley travel

(3) bridge travel

(4) hoist-limit devices

(c) The trip setting of hoist-limit devices shall be determined by tests with an empty hook comprising aeries of runs, each at increasing hook speed up to the maximum speed, unless the hoist has only a single speed

(d) The actuating mechanism of the upper-limit device shall be located or adjusted so that it will trip the device in sufficient time to prevent contact of the load block or load with any part of the trolley or bridge

(1) travel-limiting devices

(2) locking and indicating devices, if provided

(e) Operational testing of altered, repaired, and modified cranes may be limited to the functions affected by the alteration, repair, or modification, as determined by a qualified person.

4. LOAD TEST

(a) New, reinstalled, altered, repaired, and modified cranes should be load tested prior to initial use, as determined by a qualified person.

(b) Load testing of altered, repaired, and modified cranes may be limited to the functions affected by the alteration, repair, or modification, as determined by a qualified person.

(c) The replacement of load chain and rope is specifically excluded from this load test; however, an operational test of the hoist shall be made in accordance with ANSI B30.2 para. 2-2.2.1(b) prior to putting the crane back in service.

(d) If a load test is conducted, the load shall be not less than 100% of the rated load of the crane or hoist(s), whichever governs; or more than 125% of the rated load of the crane or

hoist(s), whichever governs; unless otherwise recommended by the manufacturer or a qualified person.

(e) If a load test is conducted, the person conducting the load test shall prepare a written report of the load sustained during the test and the operations performed during the test. Reports shall be placed on file.

(f) If a load test is conducted, operations shall be performed as outlined below or as modified by a qualified person.

(1) Hoist the test load a distance to assure that the load is supported by the crane and held by the hoist brake(s).

(2) Transport the test load by means of the trolley for the full length of the bridge.

(3) Transport the test load by means of the bridge for the full length of the runway in one direction with the trolley as close to the extreme right-hand end of the crane as practical, and in the other direction with the trolley as close to the left-hand end of the crane as practical.

(4) Lower the test load, and stop and hold the test load with the brake(s).

5. OPERATION

General: Operation of hoist, trolley and bridge may be controlled by a convenient pendant push button station or radio control. With it, the hoist can be controlled to give fast lifting and lowering; or controlled to lift or lower the load in small increments, providing accurate spotting.

When first using the hoist, break it in by operating under lighter loads to full travel before applying maximum load.

(a) PUSH BUTTON OPERATION.

(1) Depress hoist push button marked UP to raise load.

(2) Depress hoist push button marked DOWN to lower load.

(3) Depress trolley push button marked RIGHT to traverse one direction.

(4) Depress trolley push button marked LEFT to traverse in the opposite direction.

(5) Depress bridge push button marked RIGHT to traverse one direction.

(6) Depress bridge push button marked LEFT to traverse in the opposite direction.

CAUTION

Excessive Jogging will cause premature burning of contact tips, motor overheating, and premature brake wear.

(b) On two-speed hoist, trolley, or bridge motions, partial depression of a button operates hoist, trolley, or at slow speed; depressing button completely operates hoist, trolley, or bridge at full speed.

6. Operating Precautions

Safe operation of an overhead hoist and crane are the operators responsibility.

Listed below are some basic rules that can make an operator aware of dangerous practices to avoid and precautions to take for his own safety and the safety of others. Observance of these rules in addition to frequent examinations and periodic inspection of the equipment may save injury to personnel and damage to equipment.

WARNING

Equipment covered herein is not designed or suitable as a power source for lifting or lowering persons.

DO'S

- DO read codes and standards B30.11 Monorails and Under hung Cranes, B30.16 overhead Hoists, B30.17 Overhead and Gantry Cranes (Top Running Bridge, single Girder, Under running Hoist, HST-1 Electric Chain Hoists, HST-2 Hand Chain Manually Operated Hoists, HST-4 Overhead electric Wire rope Hoists, HST-5 Air Chain Hoists, HST-6 Air Wire Rope Hoists (These manuals may be purchased from AMSE.com).
- DO be familiar with hoist, trolley and or bridge operating controls, procedures, and warnings.
- DO make sure hook travel is in the same direction as shown on the controls. If opposite direction occurs, see Pre-Operation Checks as indicated in the hoist and crane parts and maintenance manual.
- DO make sure hoist limit switches function properly.
- DO maintain firm footing when operating hoist.
- DO make sure that the load slings or other approved single attachments are properly sized and seated in the hook saddle.
- DO make sure that the hook latch is closed and not supporting the load.
- DO make sure that load is free to move and will clear all obstructions.
- DO take up slack carefully, check load balance, lift a few inches and check loads holding action before continuing.

- DO avoid swinging of load or load hook.
- DO make sure that all persons stay clear of the suspended load.
- DO warn personnel of an approaching load.
- DO protect wire rope or chain from weld splatter or other damaging contaminants.
- DO promptly report any malfunction, unusual performance, or damage of the hoist.
- DO inspect hoist, trolley and bridge regularly, replace damaged or worn parts, and keep appropriate records of maintenance.
- DO use the hoist, trolley and bridge manufacturers recommended parts when repairing a hoist.
- DO use hook latches.
- DO apply lubricant to the wire rope and or chain as recommended.
- DO operate hoist, trolley and bridge within recommended duty cycle and do not jog unnecessarily.
- DO conduct regular visual inspections for signs of damage and wear.
- DO provide supporting structure that has an appropriate design factor based on the load rating and dead weight of the hoist. If in doubt of the supporting structures strength, consult a structural engineer.
- DO, when starting to lift, move the load a few inches at which time the hoist should be checked for proper load holding action. The operation shall be continued only after the operator is assured that the hoist is operating properly and that the load is supported in the center of the base/bowl/saddle of the hook.
- DO observe recommended inspection and maintenance procedures.
- DO use good sense and best judgment whenever operating a hoist.

DO NOT'S

- DO NOT lift more than rated load.
- DO NOT use the hoist load-limiting device to measure the load.
- DO NOT use damaged hoist, trolley or bridge that is not working properly.
- DO NOT use the hoist with twisted, kinked, damaged, or worn wire rope or chain.
- DO NOT lift a load unless wire rope is properly seated in its groove(s) or the chain is in the chain pocket.
- DO NOT use wire rope or chain as a sling or wrap rope or chain around the load.
- DO NOT lift a load if any binding prevents equal loading on all supporting ropes.
- DO NOT apply the load to the tip of the hook.
- DO NOT operate unless load is centered under hoist.
- DO NOT allow your attention to be diverted from operating the hoist.
- DO NOT operate hoist with the hoisting rope out of the drum groove or the chain out of the chain pocket. Such operation may result in damage to the rope and or the chain breaking. This may result in dropping the load that can cause damage to the equipment and injury to operator or other personnel. Hoist rope or chain will remain in drum grooves or chain pocket during operation under normal operating conditions, however, slack or kinked rope or chain, excessive side pulls, swinging or jerking of load or similar abuse, may cause the rope to leave the grooves or the chain to leave the chain pocket.

7. OSHA Regulations (Standards - 29 CFR) Overhead and gantry cranes. - 1910.179

1910.179(j)(1)	Inspection

Inspection classification.

1910.179(j)(1)(i)

Initial inspection. Prior to initial use all new and altered cranes shall be inspected to insure compliance with the provisions of this section.

1910.179(j)(1)(ii)

Inspection procedure for cranes in regular service is divided into two general classifications based upon the intervals at which inspection should be performed. The intervals in turn are dependent upon the nature of the critical components of the crane and the degree of their exposure to wear, deterioration, or malfunction. The two general classifications are herein designated as "frequent" and "periodic" with respective intervals between inspections as defined below:

1910.179(j)(1)(ii)(a)

Frequent inspection - Daily to monthly intervals.

1910.179(j)(1)(ii)(b)

Periodic inspection - 1 to 12-month intervals.

1910.179(j)(2)

Frequent inspection. The following items shall be inspected for defects at intervals as defined in paragraph (j)(1)(ii) of this section or as specifically indicated, including observation during operation for any defects which might appear between regular inspections. All deficiencies such as listed shall be carefully examined and determination made as to whether they constitute a safety hazard:

1910.179(j)(2)(i)

All functional operating mechanisms for maladjustment interfering with proper operation. Daily.

1910.179(j)(2)(ii)

Deterioration or leakage in lines, tanks, valves, drain pumps, and other parts of air or hydraulic systems. Daily.

1910.179(j)(2)(iii)

Hooks with deformation or cracks. Visual inspection daily; monthly inspection with a certification record which includes the date of inspection, the signature of the person who performed the inspection and the serial number, or other identifier, of the hook inspected. For hooks with cracks or having more than 15 percent in excess of normal throat opening or more than 10< twist from the plane of the unbent hook refer to paragraph (l)(3)(iii)(a) of this section.

1910.179(j)(2)(iv)

Hoist chains, including end connections, for excessive wear, twist, distorted links interfering with proper function, or stretch beyond manufacturer's recommendations. Visual inspection daily; monthly inspection with a certification record which includes the date of inspection, the signature of the person who performed the inspection and an identifier of the chain which was inspected.

1910.179(j)(2)(vi)

All functional operating mechanisms for excessive wear of components.

1910.179(j)(2)(vii)

Rope reeving for noncompliance with manufacturer's recommendations.

1910.179(j)(3)

Periodic inspection. Complete inspections of the crane shall be performed at intervals as generally defined in paragraph (j)(1)(ii)(b) of this section, depending upon its activity, severity of service, and environment, or as specifically indicated below. These inspections shall include the requirements of paragraph (j)(2) of this section and in addition, the following items. Any deficiencies such as listed shall be carefully examined and determination made as to whether they constitute a safety hazard:

1910.179(j)(3)(i)

Deformed, cracked, or corroded members.

1910.179(j)(3)(ii)

Loose bolts or rivets.

1910.179(j)(3)(iii)

Cracked or worn sheaves and drums.

1910.179(j)(3)(iv)

Worn, cracked or distorted parts such as pins, bearings, shafts, gears, rollers, locking and clamping devices.

1910.179(j)(3)(v)

Excessive wear on brake system parts, linings, pawls, and ratchets.

1910.179(j)(3)(vi)

Load, wind, and other indicators over their full range, for any significant inaccuracies.

1910.179(j)(3)(vii)

Gasoline, diesel, electric, or other power plants for improper performance or noncompliance with applicable safety requirements.

1910.179(j)(3)(viii)

Excessive wear of chain drive sprockets and excessive chain stretch.

1910.179(j)(3)(x)

Electrical apparatus, for signs of pitting or any deterioration of controller contactors, limit switches and pushbutton stations.

1910.179(j)(4)

Cranes not in regular use.

1910.179(j)(4)(i)

A crane which has been idle for a period of 1 month or more, but less than 6 months, shall be given an inspection conforming with requirements of paragraph (j)(2) of this section and paragraph (m)(2) of this section before placing in service.

1910.179(j)(4)(ii)

A crane which has been idle for a period of over 6 months shall be given a complete inspection conforming with requirements of paragraphs (j)(2) and (3) of this section and paragraph (m)(2) of this section before placing in service.

1910.179(j)(4)(iii)

Standby cranes shall be inspected at least semi-annually in accordance with requirements of paragraph (j)(2) of this section and paragraph (m)(2) of this section.

1910.179(k) Testing

1910.179(k)(1)

1910.179(k)(1)(i) Operational tests.

Prior to initial use all new and altered cranes shall be tested to insure compliance with this section including the following functions:

1910.179(k)(1)(i)(a)

Hoisting and lowering.

1910.179(k)(1)(i)(b)

Trolley travel.

1910.179(k)(1)(i)(c)

Bridge travel.

1910.179(k)(1)(i)(d)

Limit switches, locking and safety devices.

1910.179(k)(1)(ii)

The trip setting of hoist limit switches shall be determined by tests with an empty hook traveling in increasing speeds up to the maximum speed. The actuating mechanism of the limit switch shall be located so that it will trip the switch, under all conditions, in sufficient time to prevent contact of the hook or hook block with any part of the trolley.

1910.179(k)(2)

Rated load test. Test loads shall not be more than 125 percent of the rated load unless otherwise recommended by the manufacturer. The test reports shall be placed on file where readily available to appointed personnel.

1910.179(l)	Maintenance

1910.179(l)(1)

Preventive maintenance. A preventive maintenance program based on the crane manufacturer's recommendations shall be established.

1910.179(l)(2)

Maintenance procedure.

1910.179(l)(2)(i)

Before adjustments and repairs are started on a crane the following precautions shall be taken:

1910.179(l)(2)(i)(a)

The crane to be repaired shall be run to a location where it will cause the least interference with other cranes and operations in the area.

1910.179(l)(2)(i)(b)

All controllers shall be at the off position.

1910.179(l)(2)(i)(c)

The main or emergency switch shall be open and locked in the open position.

1910.179(l)(2)(i)(d)

Warning or "out of order" signs shall be placed on the crane, also on the floor beneath or on the hook where visible from the floor.

1910.179(l)(2)(i)(e)

Where other cranes are in operation on the same runway, rail stops or other suitable means shall be provided to prevent interference with the idle crane.

1910.179(l)(2)(ii)

After adjustments and repairs have been made the crane shall not be operated until all guards have been reinstalled, safety devices reactivated and maintenance equipment removed.

1910.179(l)(3) Adjustments and Repairs.

1910.179(l)(3)(i)

Any unsafe conditions disclosed by the inspection requirements of paragraph (j) of this section shall be corrected before operation of the crane is resumed. Adjustments and repairs shall be done only by designated personnel.

1910.179(l)(3)(ii)

Adjustments shall be maintained to assure correct functioning of components. The following are examples:

1910.179(l)(3)(ii)(a)

All functional operating mechanisms.

1910.179(l)(3)(ii)(b)

Limit switches.

1910.179(l)(3)(ii)(c)

Control systems.

1910.179(l)(3)(ii)(d)

Brakes.

1910.179(l)(3)(ii)(e)

Power plants.

1910.179(l)(3)(iii)

Repairs or replacements shall be provided promptly as needed for safe operation. The following are examples:

1910.179(l)(3)(iii)(a)

Crane hooks showing defects described in paragraph (j)(2)(iii) of this section shall be discarded. Repairs by welding or reshaping are not generally recommended. If such repairs are attempted they shall only be done under competent supervision and the hook shall be tested to the load requirements of paragraph (k)(2) of this section before further use.

1910.179(l)(3)(iii)(b)

Load attachment chains and rope slings showing defects described in paragraph (j)(2) (iv) and (v) of this section respectively.

1910.179(l)(3)(iii)(c)

All critical parts which are cracked, broken, bent, or excessively worn.

1910.179(l)(3)(iii)(d)

Pendant control stations shall be kept clean and function labels kept legible.

1910.179(m)

Rope inspection. -

1910.179(m)(1)

Running ropes. A thorough inspection of all ropes shall be made at least once a month and a certification record which includes the date of inspection, the signature of the person who performed the inspection and an identifier for the ropes which were inspected shall be kept on file where readily available to appointed personnel. Any deterioration, resulting in appreciable loss of original strength, shall be carefully observed and determination made as to whether further use of the rope would constitute a safety hazard. Some of the conditions that could result in an appreciable loss of strength are the following:

1910.179(m)(1)(i)

Reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires.

1910.179(m)(1)(ii)

A number of broken outside wires and the degree of distribution or concentration of such broken wires.

1910.179(m)(1)(iii)

Worn outside wires.

1910.179(m)(1)(iv)

Corroded or broken wires at end connections.

1910.179(m)(1)(v)

Corroded, cracked, bent, worn, or improperly applied end connections.

1910.179(m)(1)(vi)

Severe kinking, crushing, cutting, or un-stranding.

1910.179(m)(2)

Other ropes. All rope which has been idle for a period of a month or more due to shutdown or storage of a crane on which it is installed shall be given a thorough inspection before it is used. This inspection shall be for all types of deterioration and shall be performed by an appointed person whose approval shall be required for further use of the rope. A certification record shall be available for inspection which includes the date of inspection, the signature of the person who performed the inspection and an identifier for the rope which was inspected.

1910.179(n)	**Handling the load**

1910.179(n)(1)

Size of load. The crane shall not be loaded beyond its rated load except for test purposes as provided in paragraph (k) of this section.

1910.179(n)(2)

Attaching the load.

1910.179(n)(2)(i)

The hoist chain or hoist rope shall be free from kinks or twists and shall not be wrapped around the load.

1910.179(n)(2)(ii)

The load shall be attached to the load block hook by means of slings or other approved devices.

1910.179(n)(2)(iii)

Care shall be taken to make certain that the sling clears all obstacles.

1910.179(n)(3)

Moving the load.

1910.179(n)(3)(i)

The load shall be well secured and properly balanced in the sling or lifting device before it is lifted more than a few inches.

1910.179(n)(3)(ii)

Before starting to hoist the following conditions shall be noted:

1910.179(n)(3)(ii)(a)

Hoist rope shall not be kinked.

1910.179(n)(3)(ii)(b)

Multiple part lines shall not be twisted around each other.

1910.179(n)(3)(ii)(c)

The hook shall be brought over the load in such a manner as to prevent swinging.

1910.179(n)(3)(iii)

During hoisting care shall be taken that:

1910.179(n)(3)(iii)(a)

There is no sudden acceleration or deceleration of the moving load.

1910.179(n)(3)(iii)(b)

The load does not contact any obstructions.

1910.179(n)(3)(iv)

Cranes shall not be used for side pulls except when specifically authorized by a responsible person who has determined that the stability of the crane is not thereby endangered and that various parts of the crane will not be overstressed.

1910.179(n)(3)(v)

While any employee is on the load or hook, there shall be no hoisting, lowering, or traveling.

1910.179(n)(3)(vi)

The employer shall require that the operator avoid carrying loads over people.

1910.179(n)(3)(vii)

The operator shall test the brakes each time a load approaching the rated load is handled. The brakes shall be tested by raising the load a few inches and applying the brakes.

1910.179(n)(3)(viii)

The load shall not be lowered below the point where less than two full wraps of rope remain on the hoisting drum.

1910.179(n)(3)(ix)

When two or more cranes are used to lift a load one qualified responsible person shall be in charge of the operation. He shall analyze the operation and instruct all personnel involved in the proper positioning, rigging of the load, and the movements to be made.

1910.179(n)(3)(x)

The employer shall insure that the operator does not leave his position at the controls while the load is suspended.

1910.179(n)(3)(xi)

When starting the bridge and when the load or hook approaches near or over personnel, the warning signal shall be sounded.

1910.179(n)(4)

Hoist limit switch.

1910.179(n)(4)(i)

At the beginning of each operator's shift, the upper limit switch of each hoist shall be tried out under no load. Extreme care shall be exercised; the block shall be "inched" into the limit or run in at slow speed. If the switch does not operate properly, the appointed person shall be immediately notified.

1910.179(n)(4)(ii)

The hoist limit switch which controls the upper limit of travel of the load block shall never be used as an operating control.

The employer shall insure that the operator does not leave his position at the controls while the load is suspended.

1910.179(n)(3)(xi)

When starting the bridge and when the load or hook approaches near or over personnel, the warning signal shall be sounded.

1910.179(n)(4)

Hoist limit switch.

1910.179(n)(4)(i)

At the beginning of each operator's shift, the upper limit switch of each hoist shall be tried out under no load. Extreme care shall be exercised; the block shall be "inched" into the limit or run in at slow speed. If the switch does not operate properly, the appointed person shall be immediately notified.

1910.179(n)(4)(ii)

The hoist limit switch which controls the upper limit of travel of the load block shall never be used as an operating control.

1910.179(o)

Other requirements, general -

1910.179(o)(1)

Ladders.

1910.179(o)(1)(i)

The employer shall insure that hands are free from encumbrances while personnel are using ladders.

1910.179(o)(1)(ii)

Articles which are too large to be carried in pockets or belts shall be lifted and lowered by hand line.

1910.179(o)(2)

Cabs.

1910.179(o)(2)(i)

Necessary clothing and personal belongings shall be stored in such a manner as not to interfere with access or operation.

1910.179(o)(2)(ii)

Tools, oil cans, waste, extra fuses, and other necessary articles shall be stored in the tool box, and shall not be permitted to lie loose in or about the cab.

1910.179(o)(3)

Fire extinguishers. The employer shall insure that operators are familiar with the operation and care of fire extinguishers provided

End of Manual.

american equipment, llc.
451 West 3440 South
Salt Lake City, Utah 84115
P: (801) 269-0896 F: (801) 269-0948

July 23, 2020

Re: Special Tools

To Whom It May Concern,

No special tools are required to perform any maintenance on the Overhead Bridge Crane supplied by American Equipment, Inc. All connections and parts can be removed with standard hand or power tools.

For questions on proper removal of any part or connection please refer to the appropriate section in the Crane Operation and Maintenance Manual.

Scott Shubin
Quality Control Manager

Tab 2

End Trucks

Detroit Hoist
Since 1905

PRODUCT

INFORMATION

SERIAL #171883

DETROIT HOIST AND CRANE LLC, CO.

6650 STERLING DRIVE NORTH
STERLING HEIGHTS MICHIGAN 48312

Detroit Hoist
Since 1905

WARRANTY

THE COMPANY WARRANTS THE EQUIPMENT AGAINST DEFECTS IN MATERIAL AND WORKMANSHIP FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF SHIPMENT, PROVIDED OPERATION IS MAINTAIN WITHIN CLASS D SERVICE CONDITIONS THE COMPANY WILL REPLACE FREE OF CHARGE, F.O.B. ITS MANUFACTURING PLANT, ANY PART OR PARTS (OTHER THAN WIRE ROPE OR ROPE GUIDE RINGS) FOUND TO BE DEFECTIVE PROVIDED THAT THE PURCHASER INFORMS THE COMPANY OF THE DEFECT IMMEDIATELY AND NO REPAIRS OR ALTERATIONS HAVE BEEN PERFORMED BY THE PURCHASER OR A THIRD PARTY WITHOUT WRITTEN APPROVAL BY THE COMPANY.

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Warning!
Read and review this manual for important instructions. Failure to do so can lead to safety risks, void of warranty and premature wear conditions.

Detroit Hoist Since 1905	**Product Information** **171883**	**Electric Endtruck**

SHIP TO

American Equipment, Inc.
451 West 3440 South
Salt Lake City UT 84115

Purchase Order: 0036481	Order Status: Order
Quote#: E-20642	Order Date: 4/5/2022
Unit Qty: 1 Pair	Est.Ship Date: 6/10/2022

ENDTRUCK SPECIFICATIONS

Model	ET6-(59)-SXP
Suspension	Top Running Single Girder
Capacity (Tons)	7.50 Ton
Estimated / Max Wheel Load (Per Wheel)	10,000 lbs / 10,000 lbs
Bridge Motor	0 @ 0
Control / Bridge Speed	No Controls / Variable (0 FPM Max)
CMAA Duty Class / Nema Type	Class D / Explosion Proof - Class 1 Division 2 Groups C, D
Power	Electric (460V-3PH-60HZ)
Wheel Diameter / Tread	6.50" / 2.50"
Max Rail Size	Reference Wheel Chart
Wheel Base	59.00"
Crane Span	39'-0"
Location	Indoor Service
Weight	650.00 lbs

MODEL FEATURES

Tube Type Single Girder Top Running End Trucks

Girder connections plates with hand access hole and cover

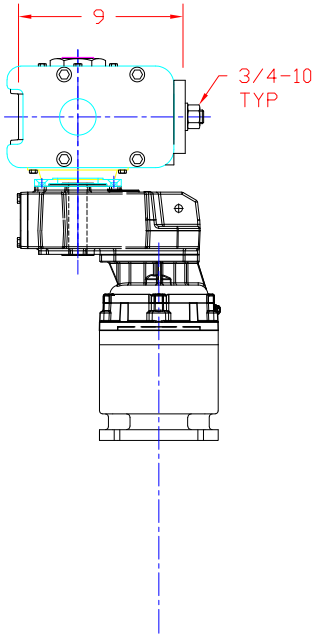
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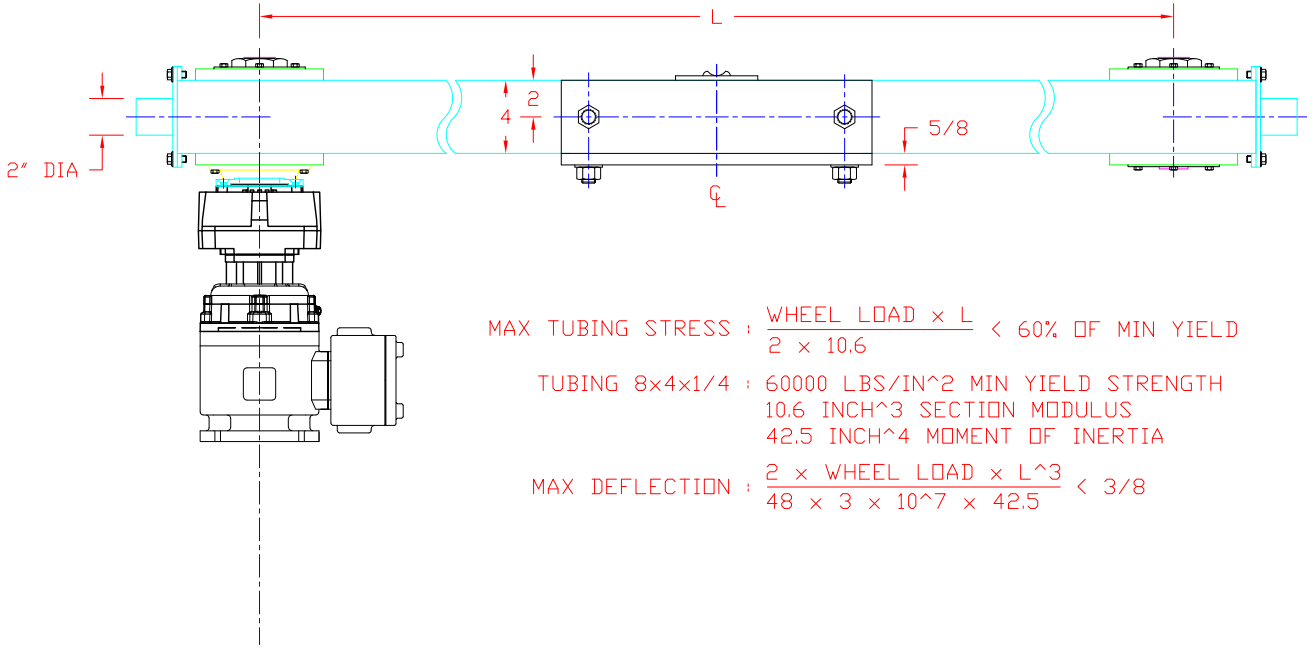
460V Class	460V input power
Non-Spark Resistant Features ET6	Non-spark resistant components
Deduct Motors	only supply gearbox and brake - customer to attach own motors

Download Manual

www.detroithoist.com/manuals

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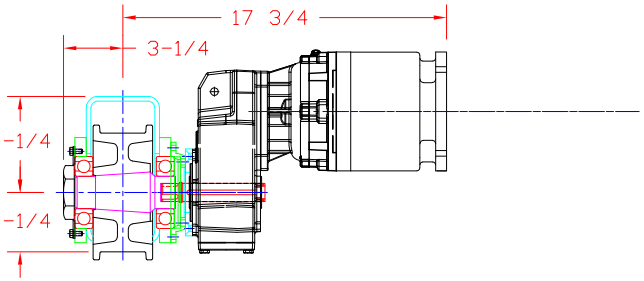


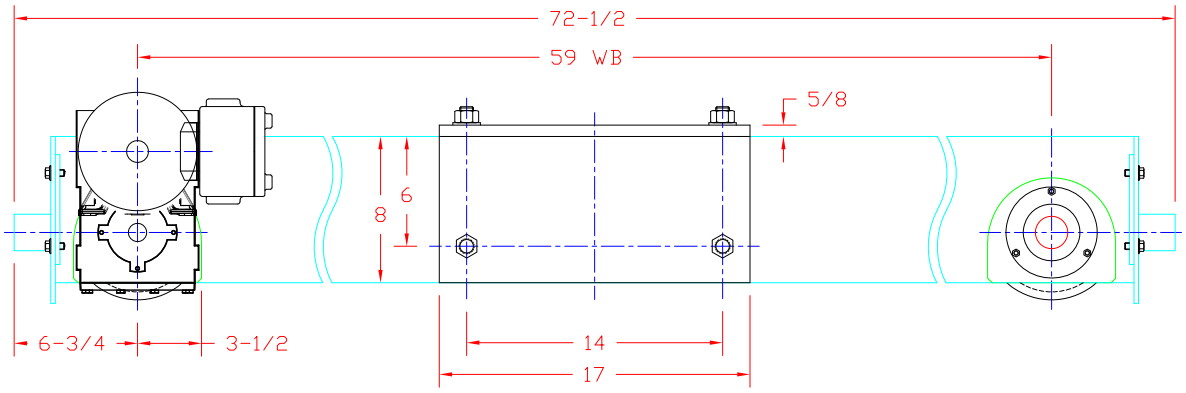


MAX TUBING STRESS : $\frac{\text{WHEEL LOAD} \times L}{2 \times 10.6} < 60\%$ OF MIN YIELD

TUBING 8x4x1/4 : 60000 LBS/IN^2 MIN YIELD STRENGTH
10.6 INCH^3 SECTION MODULUS
42.5 INCH^4 MOMENT OF INERTIA

MAX DEFLECTION : $\frac{2 \times \text{WHEEL LOAD} \times L^3}{48 \times 3 \times 10^7 \times 42.5} < 3/8$





American Equipment, Inc.
PO#0036481

MAIN FEATURES

- SEE CHARTS FOR MAX WHEEL LOAD
- ROTATING AXLES / TAPERED CONNECTION
- FLANGE MOUNTED PARALLEL HELICAL REDUCER
- HEAVY DUTY CONNECTION PLATES
- PRECISION LASER CUT TUBING

COMPONENT FEATURES

- CLASS 1, DIVISION 2, GROUPS C & D
- 100-70-03 GRAPHITE DUCTILE IRON WHEELS
- PREMIUM QUALITY SEALED BEARING
- MOTORS & BRAKES LABELED FOR EX-PROOF

MODEL ET6-(59)-SXP

SINGLE GIRDER TRUCK / 6-1/2" WHEEL
4'-11 WHEEL BASE

DWG NO.	DATE
171883(ET)	04/06/2022

DIM'S IN INCHES | SCALE 1:1 | LOCATION / T:SO-2022 /

Detroit Hoist
Since 1905

PRODUCT

INFORMATION

SERIAL #171884

DETROIT HOIST AND CRANE LLC, CO.

6650 STERLING DRIVE NORTH
STERLING HEIGHTS MICHIGAN 48312

Detroit Hoist
Since 1905

WARRANTY

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Detroit Hoist
Since 1905

Product Information
171884

Electric Endtruck

SHIP TO

American Equipment, Inc.
451 West 3440 South
Salt Lake City UT 84115

Purchase Order: 0036482	Order Status: Order
Quote#: E-21082	Order Date: 4/5/2022
Unit Qty: 1 Pair	Est.Ship Date: 6/10/2022

ENDTRUCK SPECIFICATIONS

Model	ET6-(59)-SXP
Suspension	Top Running Single Girder
Capacity (Tons)	7.50 Ton
Estimated / Max Wheel Load (Per Wheel)	10,000 lbs / 10,000 lbs
Bridge Motor	0 @ 0
Control / Bridge Speed	No Controls / Variable (0 FPM Max)
CMAA Duty Class / Nema Type	Class D / Explosion Proof - Class 1 Division 2 Groups C, D
Power	Electric (460V-3PH-60HZ)
Wheel Diameter / Tread	6.50" / 2.50"
Max Rail Size	Reference Wheel Chart
Wheel Base	59.00"
Crane Span	39'-0"
Location	Indoor Service
Weight	650.00 lbs

MODEL FEATURES

Tube Type Single Girder Top Running End Trucks

Girder connections plates with hand access hole and cover

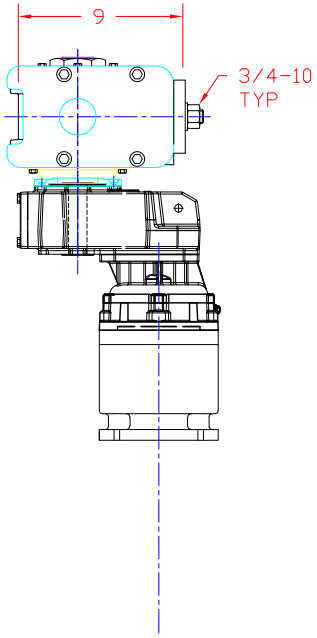
SELECTED OPTIONS

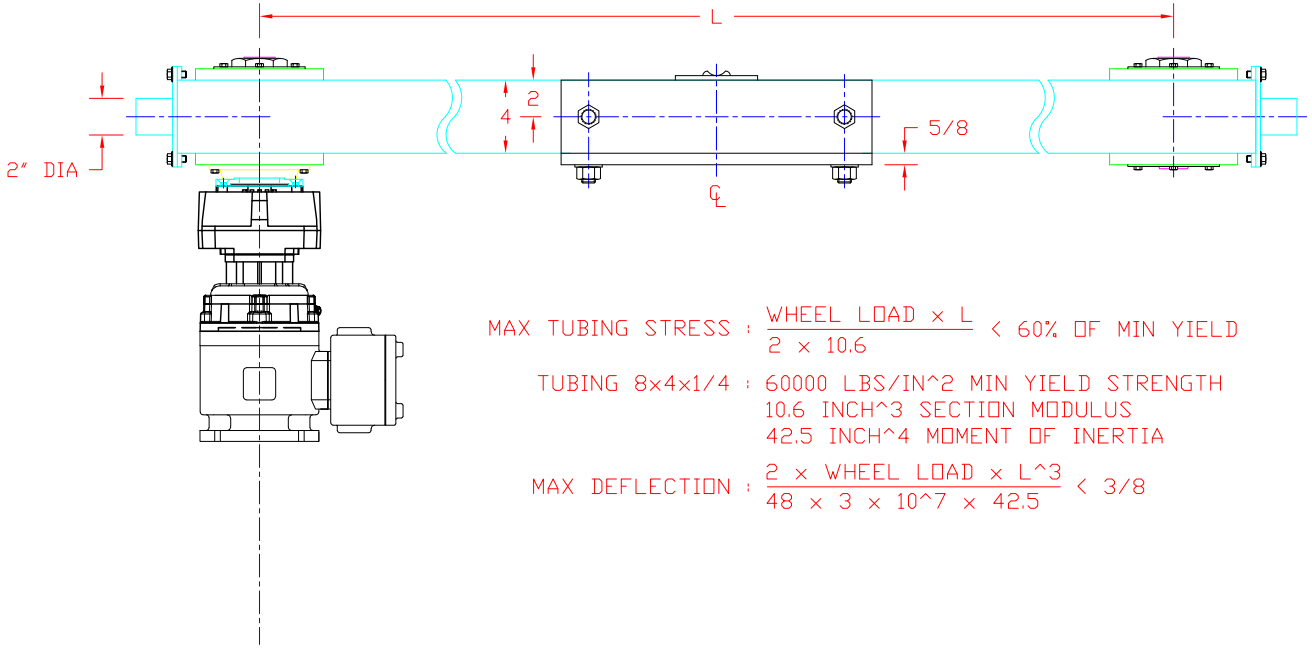
460V Class	460V input power
Non-Spark Resistant Features ET6	Non-spark resistant components
Deduct Motors	only supply gearbox and brake - customer to attach own motors

Download Manual

www.detroithoist.com/manuals

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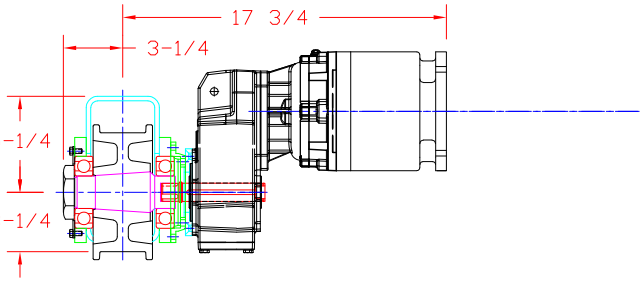


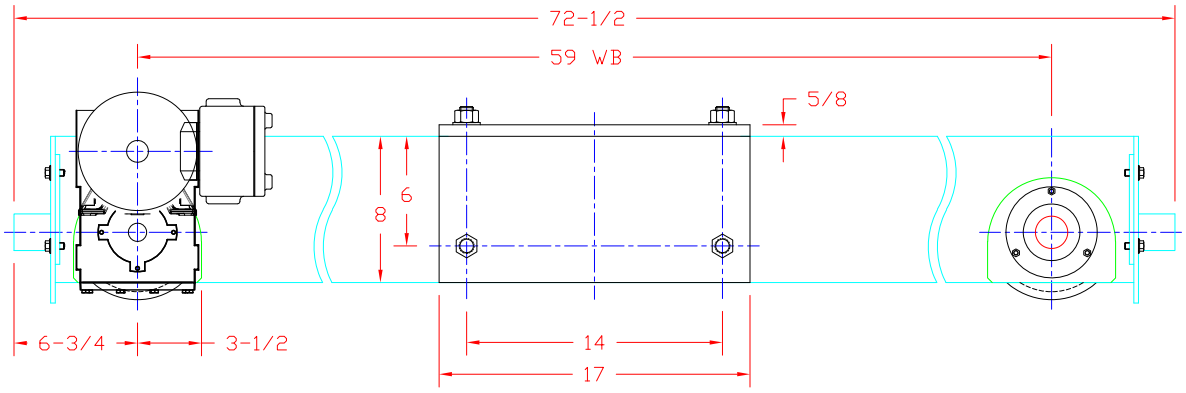


MAX TUBING STRESS : $\frac{\text{WHEEL LOAD} \times L}{2 \times 10.6}$ < 60% OF MIN YIELD

TUBING 8x4x1/4 : 60000 LBS/IN^2 MIN YIELD STRENGTH
10.6 INCH^3 SECTION MODULUS
42.5 INCH^4 MOMENT OF INERTIA

MAX DEFLECTION : $\frac{2 \times \text{WHEEL LOAD} \times L^3}{48 \times 3 \times 10^7 \times 42.5}$ < 3/8





American Equipment, Inc.
PO#0036482

MAIN FEATURES

- SEE CHARTS FOR MAX WHEEL LOAD
- ROTATING AXLES / TAPERED CONNECTION
- FLANGE MOUNTED PARALLEL HELICAL REDUCER
- HEAVY DUTY CONNECTION PLATES
- PRECISION LASER CUT TUBING

COMPONENT FEATURES

- CLASS 1, DIVISION 2, GROUPS C & D
- 100-70-03 GRAPHITE DUCTILE IRON WHEELS
- PREMIUM QUALITY SEALED BEARING
- MOTORS & BRAKES LABELED FOR EX-PROOF

MODEL ET6-(59)-SXP

SINGLE GIRDER TRUCK / 6-1/2" WHEEL
4'-11 WHEEL BASE

DWG NO.	DATE
171884(ET)	04/06/2022

DIM'S IN INCHES | SCALE 1:1 | LOCATION / T:SO-2022 /

Detroit Hoist
Since 1905

PRODUCT

INFORMATION

SERIAL #171885

DETROIT HOIST AND CRANE LLC, CO.

6650 STERLING DRIVE NORTH
STERLING HEIGHTS MICHIGAN 48312

Detroit Hoist
Since 1905

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Detroit Hoist
Since 1905

Product Information
171885

Electric Endtruck

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American Equipment, Inc.
451 West 3440 South
Salt Lake City UT 84115

Purchase Order: 0036483	Order Status: Order
Quote#: E-21083	Order Date: 4/5/2022
Unit Qty: 1 Pair	Est.Ship Date: 6/10/2022

ENDTRUCK SPECIFICATIONS

Model	ET6-(59)-SXP
Suspension	Top Running Single Girder
Capacity (Tons)	7.50 Ton
Estimated / Max Wheel Load (Per Wheel)	10,000 lbs / 10,000 lbs
Bridge Motor	0 @ 0
Control / Bridge Speed	No Controls / Variable (0 FPM Max)
CMAA Duty Class / Nema Type	Class D / Explosion Proof - Class 1 Division 2 Groups C, D
Power	Electric (460V-3PH-60HZ)
Wheel Diameter / Tread	6.50" / 2.50"
Max Rail Size	Reference Wheel Chart
Wheel Base	59.00"
Crane Span	39'-0"
Location	Indoor Service
Weight	650.00 lbs

MODEL FEATURES

Tube Type Single Girder Top Running End Trucks
Girder connections plates with hand access hole and cover

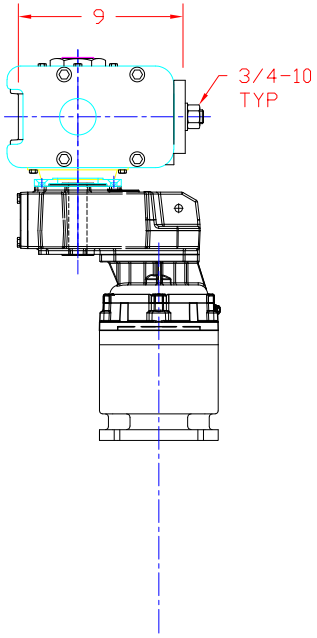
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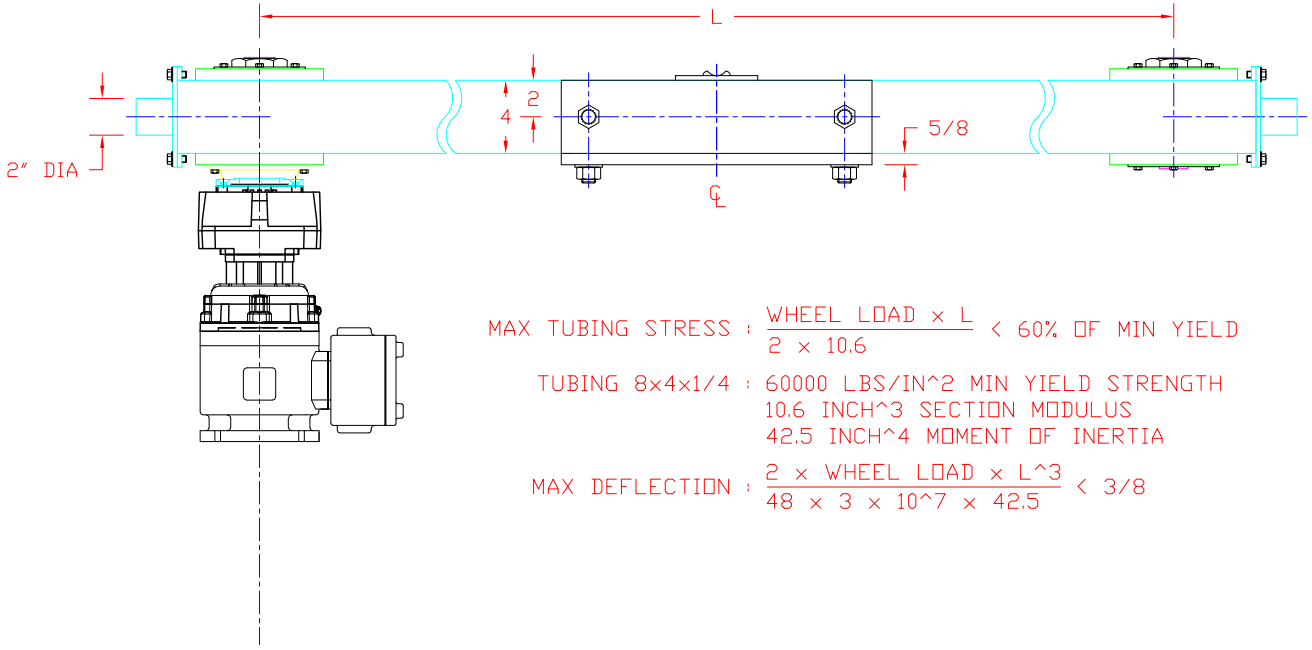
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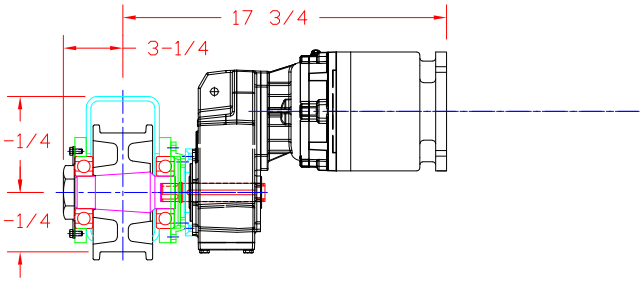


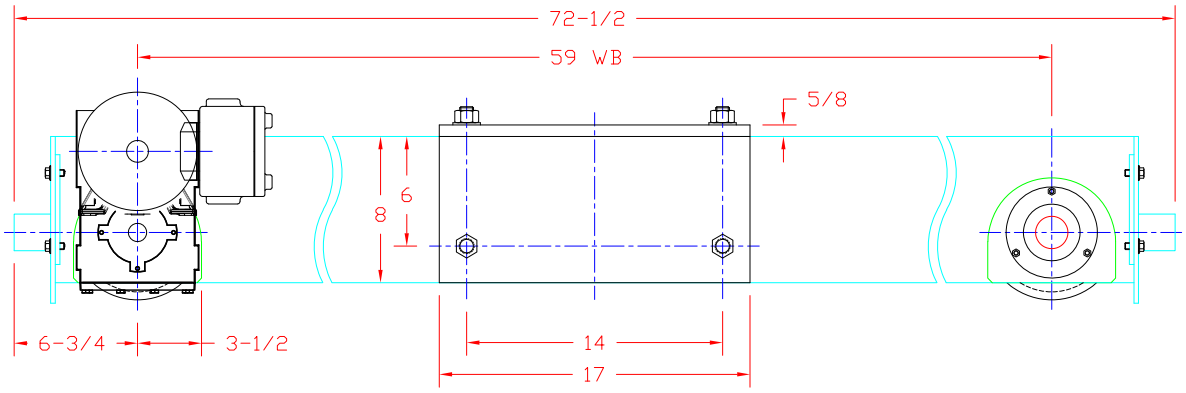


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American Equipment, Inc.
PO#0036483

MAIN FEATURES

- SEE CHARTS FOR MAX WHEEL LOAD
- ROTATING AXLES / TAPERED CONNECTION
- FLANGE MOUNTED PARALLEL HELICAL REDUCER
- HEAVY DUTY CONNECTION PLATES
- PRECISION LASER CUT TUBING

COMPONENT FEATURES

- CLASS 1, DIVISION 2, GROUPS C & D
- 100-70-03 GRAPHITE DUCTILE IRON WHEELS
- PREMIUM QUALITY SEALED BEARING
- MOTORS & BRAKES LABELED FOR EX-PROOF

MODEL ET6-(59)-SXP

SINGLE GIRDER TRUCK / 6-1/2" WHEEL
4'-11 WHEEL BASE

DWG NO.	DATE
171885(ET)	04/06/2022

DIM'S IN INCHES | SCALE 1:1 | LOCATION / T:SO-2022 /

Detroit Hoist
Since 1905

PRODUCT

INFORMATION

SERIAL #171886

DETROIT HOIST AND CRANE LLC, CO.

6650 STERLING DRIVE NORTH
STERLING HEIGHTS MICHIGAN 48312

Detroit Hoist
Since 1905

WARRANTY

THE COMPANY WARRANTS THE EQUIPMENT AGAINST DEFECTS IN MATERIAL AND WORKMANSHIP FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF SHIPMENT, PROVIDED OPERATION IS MAINTAIN WITHIN CLASS D SERVICE CONDITIONS THE COMPANY WILL REPLACE FREE OF CHARGE, F.O.B. ITS MANUFACTURING PLANT, ANY PART OR PARTS (OTHER THAN WIRE ROPE OR ROPE GUIDE RINGS) FOUND TO BE DEFECTIVE PROVIDED THAT THE PURCHASER INFORMS THE COMPANY OF THE DEFECT IMMEDIATELY AND NO REPAIRS OR ALTERATIONS HAVE BEEN PERFORMED BY THE PURCHASER OR A THIRD PARTY WITHOUT WRITTEN APPROVAL BY THE COMPANY.

THIS WARRANTY SHALL NOT COVER NORMAL WEAR AND PARTS WHICH OWING TO THEIR INHERENT MATERIAL PROPETIES OR THE USE THEY ARE INTENDED FOR, ARE SUBJECT TO PREMATURE WEAR. THE COMPANY CANNOT BE HELD RESPONSIBLE FOR ANY REVERSAL OF PHASES ON THE POWER STATION NEWTWORK CONNECTED TO THE EQUIPMENT. THE COMPANY IS NOT LIABLE UNDER THIS WARRANTY FOR DAMAGES CAUSED BY IMPROPER INSTALLATION OR USE OF THE EQUIPMENT OR FOR LIFTING LOADS ABOVE RATED CAPACITY. THE COMPANY IS NOT LIABLE UNDER THIS WARRANTY FOR CONSEQUENTIAL DAMAGES, CLAIMS, EXPENDITURES OR LOSSES ARISING FROM OPERATIONAL DELAYS OR WORK STOPPAGES CAUSED BY DEFECTIVE EQUIPMENT. ALL REPAIRS ON THE EQUIPMENT DURING THE WARRANTY PERIOD MUST BE AUTHORIZED BY THE COMPANY. NO WARRANTY SHALL APPLY TO THE EQUIPMENT UNLESS THE PURCHASER PROVIDES A WRITTEN AND SIGNED CERTIFICATION TO THE COMPANY ("THE EQUIPMENT CERTIFICATION FORM") IN WHICH THE PURCHASER CERTIFIES THAT THE EQUIPMENT HAS BEEN PROPERLY INSTALLED AND TESTED BY PURCHASER, AND IN WHICH PURCHASER CERTIFIES THAT ALL SUCH EQUIPMENT IS IN SATISFACTORY WORKING ORDER. DAMAGE CAUSED BY IMPROPER STORAGE, IMPROPER INSTALLATION, UNAUTHORIZED REPAIRS, MISUSE, IMPROPER WIRING, IMPROPER ELECTRICAL SERVICE, IMPROPER HANDLING OR TREATMENT, OVERLOADING, THE USE OF UNSUITABLE FUELS AND OILS, IMPROPER MODIFICATIONS, IMPROPER MAINTENANCE, FAULTY CONSTRUCTION WORK AND/OR FOUNDATIONS, UNSUITABLE BUILDING GROUNDS, CHEMICAL, ELECTRO-CHEMICAL OR ELECTRICAL INFLUENCES, OR OTHER CIRCUMSTANCES WHICH MAY ARISE THROUGH NO FAULT OF THE COMPANY, SHALL BE EXCLUDED FROM THE WARRANTY.
ALL OF THE COMPANY'S WARRANTIES SHALL BE NULL AND VOID IN THE EVENT THAT PURCHASER OR ANY SUBSEQUENT USER ENGAGES IN ANY OF THE IMPROPER CONDUCT REFERENCED HEREIN, OR IF ANY OF THE FOREGOING EVENTS AND/OR CIRCUMSTANCES OCCUR. THE COMPANY SHALL BE FREE OF ANY AND ALL OBLIGATIONS, COSTS AND LIABILITIES UNDER THIS WARRANTY IN SUCH EVENT. ALL WARRANTIES SHALL EXTEND ONLY TO THE PURCHASER IN PRIVATE OF CONTRACT WITH THE COMPANY. PURCHASER, AND NOT THE COMPANY, SHALL BE SOLELY RESPONSIBLE FOR INFORMING USERS OF THE EQUIPMENT OF ALL LIMITATIONS OF WARRANTY AND LIABILITY. EXCEPT FOR THE FOREGOING, NO WARRANTY, EXPRESS, IMPLIED OR STATUTORY IS MADE BY THE COMPANY
THE COMPANY SHALL BE FREE OF ANY OBLIGATIONS UNDER THIS WARRANTY SHOULD THE PURCHASER DEFAULT ON PAYMENT TERMS AGREED UPON.

Warning!
Read and review this manual for important instructions. Failure to do so can lead to safety risks, void of warranty and premature wear conditions.

Detroit Hoist Since 1905	**Product Information** **171886**	**Electric Endtruck**

SHIP TO

American Equipment, Inc.
451 West 3440 South
Salt Lake City UT 84115

Purchase Order: 0036484	Order Status: Order
Quote#: E-21084	Order Date: 4/5/2022
Unit Qty: 1 Pair	Est.Ship Date: 6/10/2022

ENDTRUCK SPECIFICATIONS

Model	ET6-(59)-SXP
Suspension	Top Running Single Girder
Capacity (Tons)	7.50 Ton
Estimated / Max Wheel Load (Per Wheel)	10,000 lbs / 10,000 lbs
Bridge Motor	0 @ 0
Control / Bridge Speed	No Controls / Variable (0 FPM Max)
CMAA Duty Class / Nema Type	Class D / Explosion Proof - Class 1 Division 2 Groups C, D
Power	Electric (460V-3PH-60HZ)
Wheel Diameter / Tread	6.50" / 2.50"
Max Rail Size	Reference Wheel Chart
Wheel Base	59.00"
Crane Span	39'-0"
Location	Indoor Service
Weight	650.00 lbs

MODEL FEATURES

Tube Type Single Girder Top Running End Trucks
Girder connections plates with hand access hole and cover

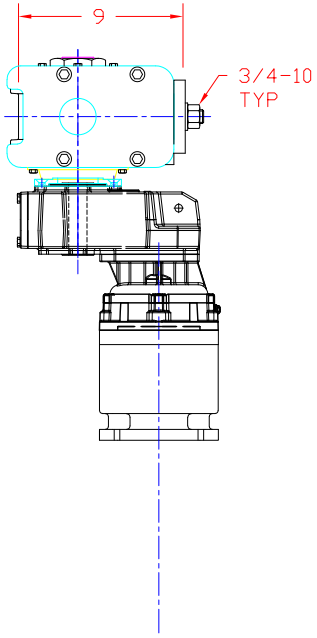
SELECTED OPTIONS

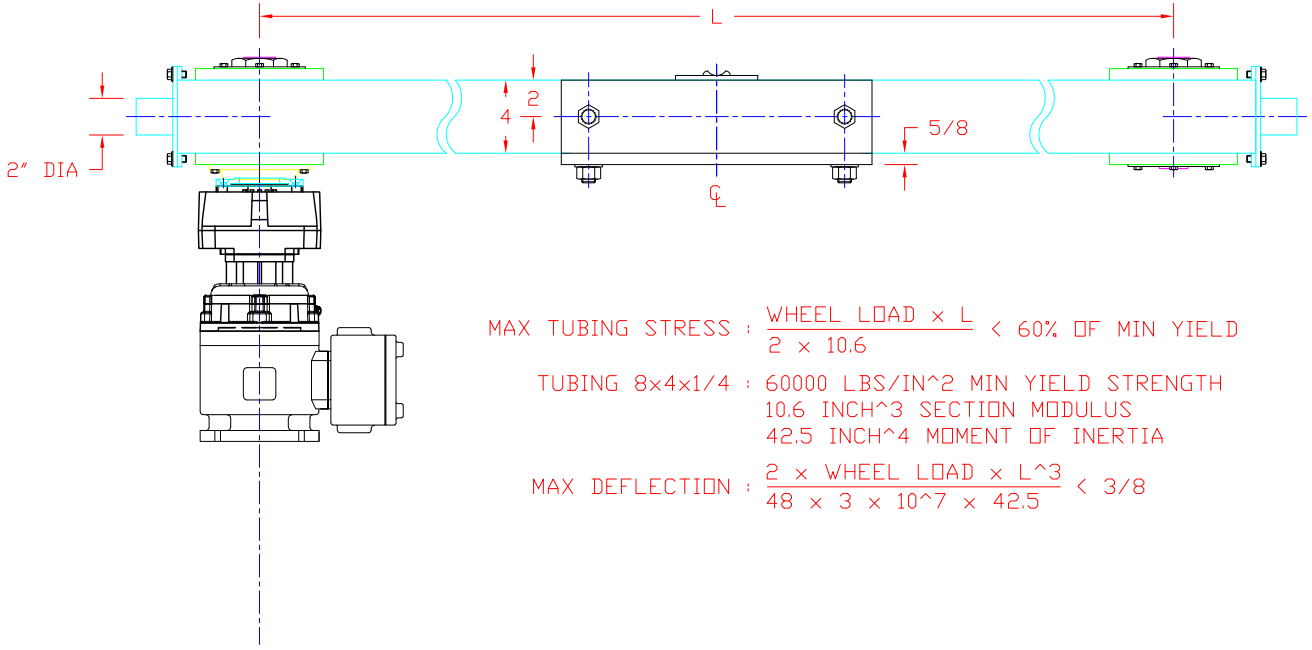
460V Class	460V input power
Non-Spark Resistant Features ET6	Non-spark resistant components
Deduct Motors	only supply gearbox and brake - customer to attach own motors

Download Manual

www.detroithoist.com/manuals

Special Notes: All price quotes, offers, acceptances, orders and acknowledgements by seller and/or buyer are subject to and governed by Detroit Hoist & Crane's General Terms and Conditions of Sale, a complete copy of which is deemed to be incorporated herein, and which is set forth in full on the Detroit Hoist & Crane website at www.detroithoist.com. In no event shall Detroit Hoist & Crane be deemed to have accepted, nor deemed to be bound by any contrary or conflicting terms and/or conditions if offered or presented by purchaser. All prices are F.O.B. our plant, Sterling Heights, Michigan USA withfreight collect or third party bill. Taxes are extra if applicable

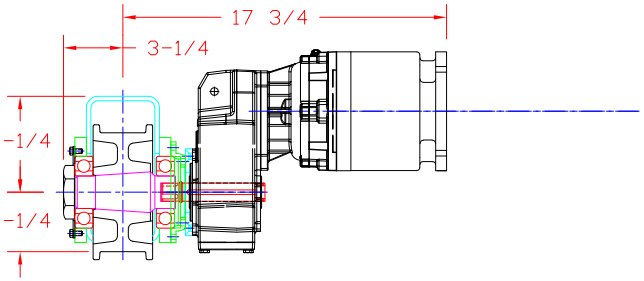


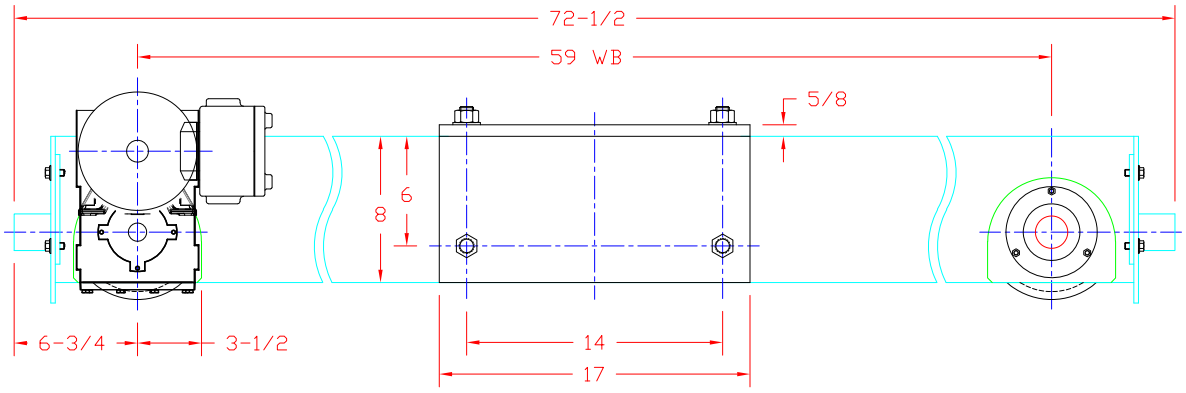


MAX TUBING STRESS : $\frac{\text{WHEEL LOAD} \times L}{2 \times 10.6} < 60\%$ OF MIN YIELD

TUBING 8x4x1/4 : 60000 LBS/IN^2 MIN YIELD STRENGTH
10.6 INCH^3 SECTION MODULUS
42.5 INCH^4 MOMENT OF INERTIA

MAX DEFLECTION : $\frac{2 \times \text{WHEEL LOAD} \times L^3}{48 \times 3 \times 10^7 \times 42.5} < 3/8$





American Equipment, Inc.
PO#0036484

MAIN FEATURES

- SEE CHARTS FOR MAX WHEEL LOAD
- ROTATING AXLES / TAPERED CONNECTION
- FLANGE MOUNTED PARALLEL HELICAL REDUCER
- HEAVY DUTY CONNECTION PLATES
- PRECISION LASER CUT TUBING

COMPONENT FEATURES

- CLASS 1, DIVISION 2, GROUPS C & D
- 100-70-03 GRAPHITE DUCTILE IRON WHEELS
- PREMIUM QUALITY SEALED BEARING
- MOTORS & BRAKES LABELED FOR EX-PROOF

MODEL ET6-(59)-SXP

SINGLE GIRDER TRUCK / 6-1/2" WHEEL
4'-11 WHEEL BASE

DWG NO.	DATE
171886(ET)	04/06/2022

DIM'S IN INCHES | SCALE 1:1 | LOCATION / T:SO-2022 /

		No.:
		Date: 11-APR-2013

Customer :

TECHNICAL PROPOSAL

Three-phase induction motor - Squirrel cage rotor

Product line : TEFC - General Purpose - NEMA 56

Catalog Number :
List Price : $

Notes:
.7518es3eb56c

Performed by:	Checked:

		No.:
		Date: 11-APR-2013

DATA SHEET
Three-phase induction motor - Squirrel cage rotor

Customer	:	
Product line	:	TEFC - General Purpose - NEMA 56

Frame	:	B56
Output	:	0.75 HP
Frequency	:	60 Hz
Poles	:	4
Full load speed	:	1730
Slip	:	3.89 %
Voltage	:	208-230/460 V
Rated current	:	2.37-2.24/1.12 A
Locked rotor current	:	15.5/7.73 A
Locked rotor current (Il/In)	:	6.9
No-load current	:	1.80/0.900 A
Full load torque	:	2.25 lb.ft
Locked rotor torque	:	290 %
Breakdown torque	:	320 %
Design	:	A
Insulation class	:	F
Temperature rise	:	80 K
Locked rotor time	:	15 s (hot)
Service factor	:	1.15 (1.00 at 208V)
Duty cycle	:	S1
Ambient temperature	:	-20°C - +40°C
Altitude	:	1000
Degree of Protection	:	IP55
Approximate weight	:	27 lb
Moment of inertia	:	0.08875 sq.ft.lb
Noise level	:	---

	D.E.	N.D.E.
Bearings	6203 ZZ	6202 ZZ
Regreasing interval	---	---
Grease amount	---	---

Load	Power factor	Efficiency (%)
100%	0.79	80.0
75%	0.70	78.0
50%	0.57	75.5

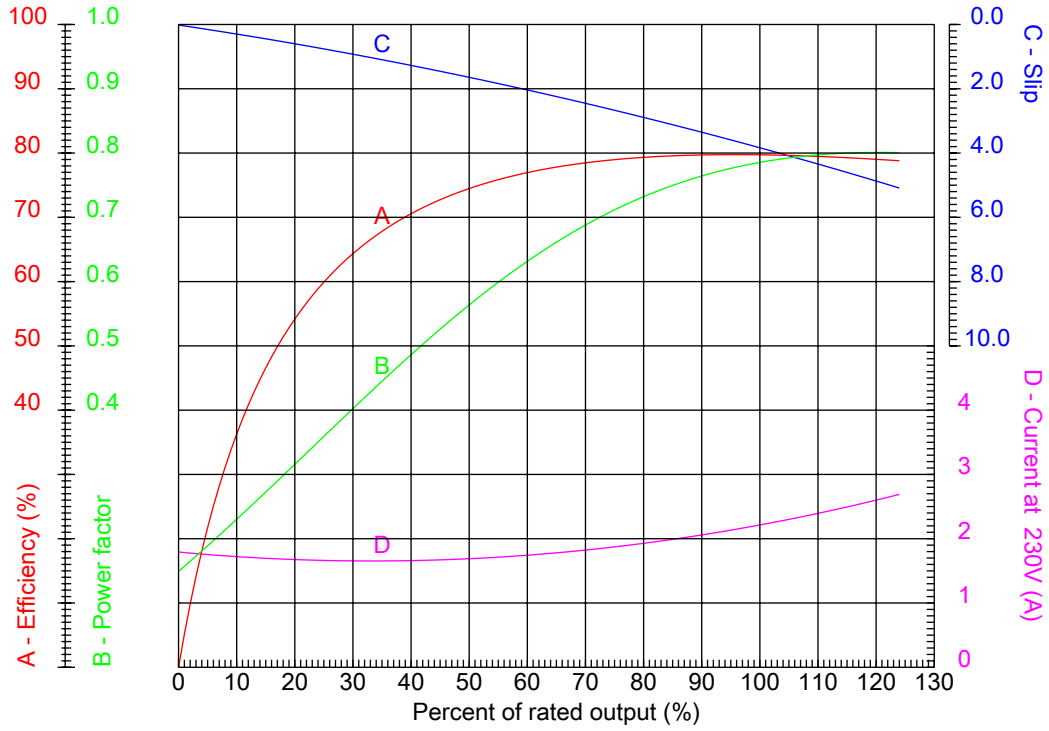
Notes:
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Performed by	Checked

	No.:
	Date: 11-APR-2013

PERFORMANCE CURVES RELATED TO RATED OUTPUT

Three-phase induction motor - Squirrel cage rotor



Customer	:
Product line	: TEFC - General Purpose - NEMA 56

Frame	: B56	Locked rotor current (Il/In)	: 6.9
Output	: 0.75 HP	Duty cycle	: S1
Frequency	: 60 Hz	Service factor	: 1.15 (1.00 at 208V)
Full load speed	: 1730	Design	: A
Voltage	: 208-230/460 V	Locked rotor torque	: 290 %
Rated current	: 2.37-2.24/1.12 A	Breakdown torque	: 320 %
Insulation class	: F		

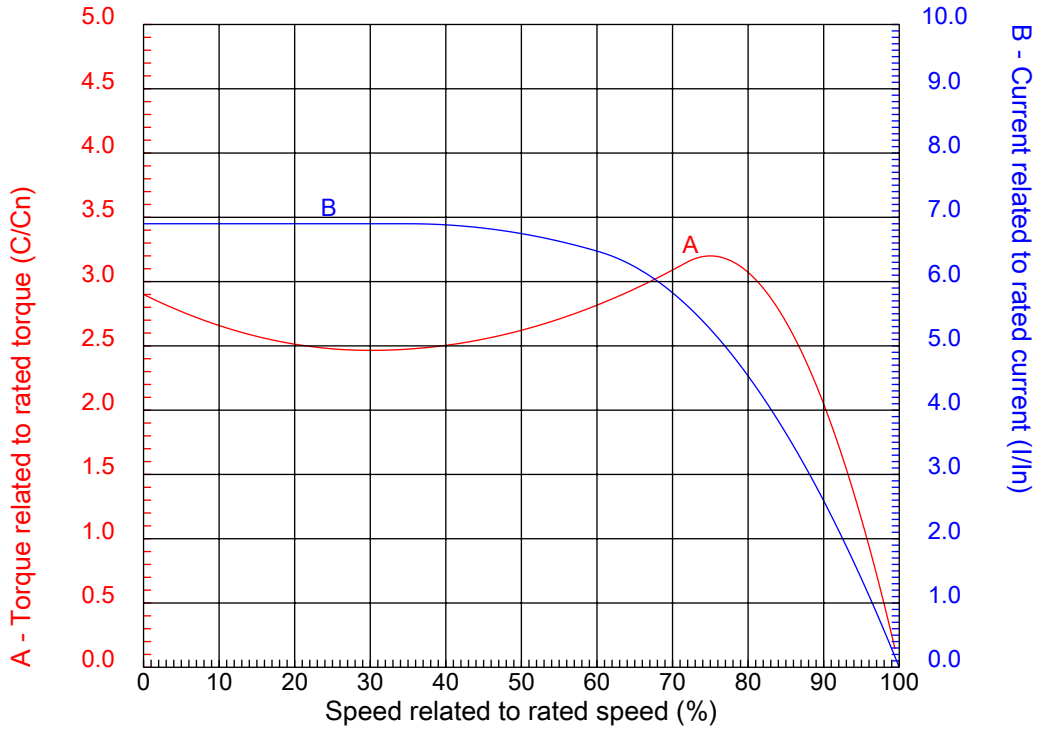
Notes:
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Performed by	Checked

	No.:
	Date: 11-APR-2013

CHARACTERISTIC CURVES RELATED TO SPEED

Three-phase induction motor - Squirrel cage rotor

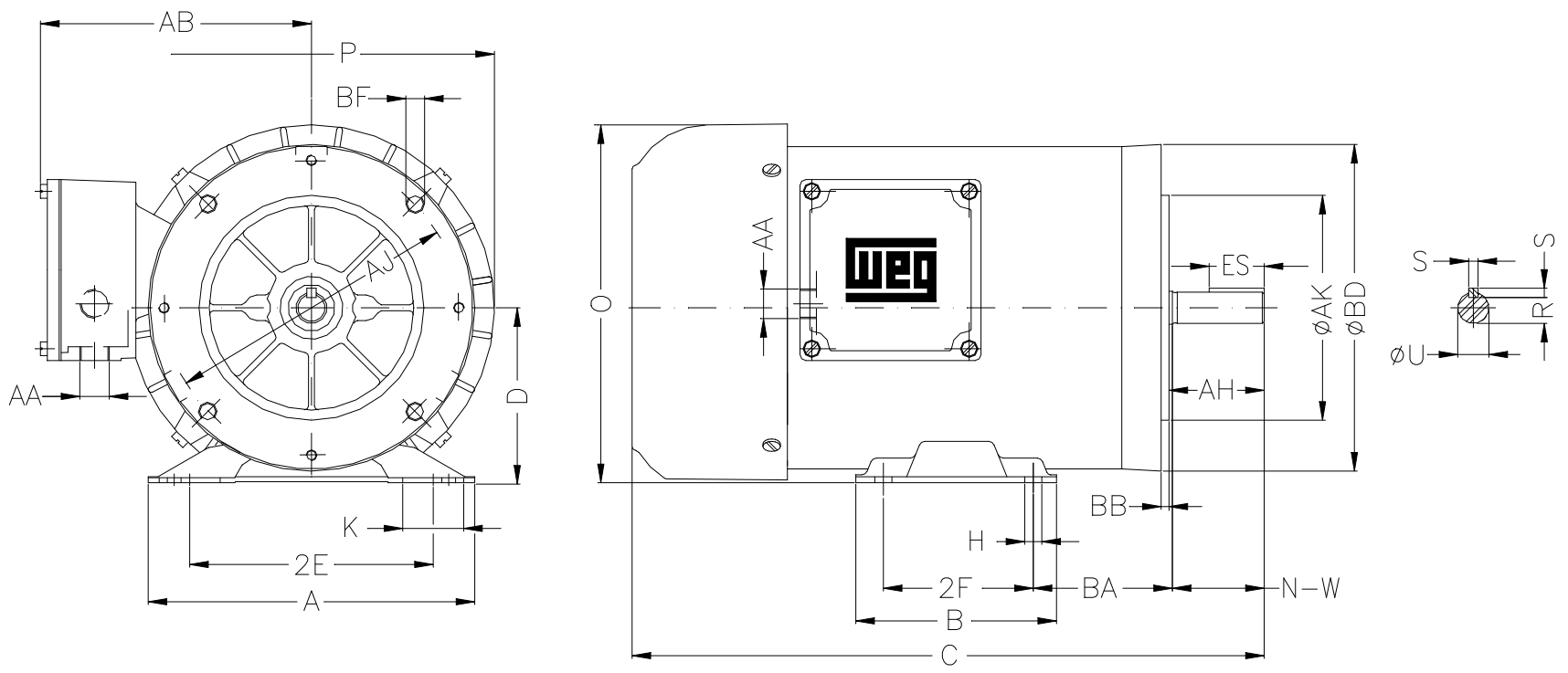


Customer	:
Product line	: TEFC - General Purpose - NEMA 56

Frame	: B56	Locked rotor current (Il/In)	: 6.9
Output	: 0.75 HP	Duty cycle	: S1
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Rated current	: 2.37-2.24/1.12 A	Breakdown torque	: 320 %
Insulation class	: F		

Notes:
.7518es3eb56c

Performed by	Checked



Notes: .7518es3eb56c

Performed by:

Checked:

Customer:

TEFC - General Purpose - NEMA 56

2E 4.874	2F 3.000	H 0.342	H1 1.220	BA 2.750
A 6.535	B 4.016	C 11.102	D 3.500	J 1.220
O 7.165	P 7.323	S 0.187	ES 1.102	R 0.517
N-W 1.874	U 0.6250	AB 5.433	AA 2XNPT 1/2"	Flange FC-149
AJ 5.874	AK 4.500	BD 6.535	BF UNC 3/8"x16-2B	BB 0.157
AH 2.063				

Three-phase induction motor

Frame B56 - IP55

11-APR-2013

Data sheet VISN 56 code 277-1000

ITEM TYPE	**VIS N 56L**	CERTIFICATE N.	**CSAus 2542839**		
REFERENCE NORMS	**FM 3600:2011 - FM3616:2011 - FM3615:2006 - ANSI/IEC 60529:2004 - FM 3810:2005**				
TYPE OF PROTECTION:	**Cl.I, DIV.1, Groups C,D, Cl.II, Div.1, Groups E, F, G, Cl.III**				
		PROTECTION DEGREE	**IP66**	Amb. Temperature °C	**-20 +55**
INS CLASS	**F**				
TYPE OF MAGNET	**DC**	Current VAC 370/480	**0,13 amps**	RATED VOLTAGE	**VAC 370/480**
DUTY	**S1**				
TYPE OF RECTIFIER	**WR2008/1-190**	Current VAC 210/277	**0,28 amps**	RATED VOLTAGE	**VAC 210/277**
POWER	**50 W**				
BRAKING TORQUE (Lb-Ft)	**11**	ENGAGEMENT TIME (ms)	**12**	BREAKING TIME DC SWITCHING (ms)	**20**
BODY MATERIAL	**CAST IRON GS400**	BEARING TYPE	**LIFE GREASE LUBRIFICATION**		
INPUT TYPE	**NEMA C-FACE 56**	OUTPUT FLANGE	**NEMA C-FACE 56**	OUTPUT SHAFT (diameter x lenght inches.)	5/8"x1-7/8"

Date June 25th 2015

Iussed by **MM**

1. INTRODUCTIONS

These safety instructions refer to the installation, operation and maintenance of the VIS N flameproof brake, certified for use in areas where there is a presence of potentially explosive atmospheres.
They are made up of a case and a terminal box in cast iron.The VIS N brakes are explosion proof made and they are manufactured in thirteen models:

VIS N 143(56 to 145)-182(182 to 215)-254(254 to 256)-284(284 to 286)-324(324 to 405)

The VIS N series brakes are designed following the CLASS 4228 81 – certified to U.S. standards.

Class I, Division 1, Groups C, D;
Class II, Division 1, Group E, F and G; Class III;
Component Type Electromagnetic Brakes, Insulation Class F, Models VIS N xxx-xxx, rated 24 to 600Vac, 50 / 60 Hz or 24 to 300 Vdc, 15 A max.

2.MAIN CHARACTERISTICS

The electromagnetic brake VIS N is a negative disc brake type. Inside the brake group there is a braking disc in a position to sliding axially on the shaft and to be dragged by the same shaft, an electromagnet and a mobile anchor. When there is no current, the mobile anchor is pushed against the brake disc from the springs, this brake disc is pushed to another friction surface on the other side, in this way the shaft cannot rotate. In current presence, the electromagnet attracts to himself the mobile anchor freeing the disc and allowing of the rotation.

3. MARKING

The VIS brake's nameplate shows the following information :

MARKINGS

The following markings are applied on a metal nameplate, secured by rivets:
1. Manufacturers name, tradename or CSA Master Contract number "186833" adjacent to the CSA mark.
2. Complete electrical ratings in Volts (Vdc or Vac), frequency (Hz) and amperes (A).
3. Duty Service if different than 1
4. Model number
5. The CSA mark with adjacent indicator 'US'
6. Serial number.
7. Hazardous locations designation
8. "Warning: Explosion hazard, Do not disconnect power unless power has been switched off or the area is known to be non-hazardous"
9. "Warning: Seals shall be installed at enclosure wall"



The brakes are designed to work, with S1 duty (continuous) or S2, S3, S4 duty (intermittent).
All the VIS brake types are designed to work at the following starting and braking duty cycles:

Type	***start/h (max)***	***Nm (max)***
143-145	1600	25
182-184	1300	50
254-256	500	160
284-286	350	240
324-326	250	780

APPLICABLE REQUIREMENTS

FM 3600 : 2011 Approval Standard for Electrical Equipment for use in Hazardous (Classified) Locations General Requirements
FM 3616 : 2011 Dust-Ignitionproof Electrical Equipment General Requirements
FM 3615 : 2006 Explosionproof Electrical Equipment
ANSI/IEC 60529 : 2004 Degrees of Protection Provided by Enclosures (IP Code) (identical national adoption)
FM 3810 : 2005 Approval Standard for Electrical Equipment for Measurement, Control, and Laboratory Use
ANSI/ ISA-61010-1 (82.02.01) : 2004 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1 General Requirements

4. GENERAL SAFETY WARNINGS

Improper use, lack of inspection and maintenance can cause serious harm. The personnel must be informed of any danger caused by contact with live parts, rotating parts and hot surfaces. In normal working conditions the brake exceeds 50℃.
The VIS n brake must be moved, installed, put in service inspected, maintained and repaired only by qualified personnel.
The VIS brake is a component made to be mechanically connected to another machine. Consequently, it is the task of the person responsible for the installation to guarantee that during operation there is an adequate degree of protection for people or things against the danger of accidental contact with moving parts.

5. *STORAGE*

The brakes are shipped ready for installation. Upon receipt remove packaging and turn the shaft to check the brake has not been damaged, also check all physical aspects of the machine for damage. In the case where the brake is damaged an immediate notification must be given to Coel within 3 days.
In storing case, the brakes must be conserved in dry place, lacking in powders, vibrations, gas and corrosive smoke, with uniform temperature and held in normal position. The temperature of the brakes stocking place must be between 5℃ and 45℃, with relat ive humidity not over 60%. The storing time does not have to be longer than 18 months.

6. INSTALLATION

WARNING: Work on the VIS N brake must be carried out when the machine has stopped and been disconnected from the power supply (including auxiliary parts). Adequate precautions must be taken to avoid excess voltages or peak voltages. The cables must not be crushed or exposed to mechanical loading.
Use cables with sufficient section to bear the maximum current absorbed, avoiding overheating and/or drops in voltage. Connect the cables to terminals by following the instructions on the following diagrams. Check that terminal nuts are tightened.
Connections to the terminals must be made in order to guarantee safe distances between live uncovered parts. The area of contact of connections must be cleaned and protected against corrosion.
Earthing Connections:
Two earthing connections are provided, one inside the terminal box, the other one on the brake case. Both of them must be connected to the plant earth with at least one conductor with an adequate cross sectional area.
Reassembling the terminal box it is necessary to replace the ayer of grease. The terminal box cover must be tightened to ensure it is properly sealed.

7. PUTTING INTO OPERATION

It is the responsibility of the installer to establish the brake's fitness to be used in a certain plant, after analysing the characteristics of danger existing in the installation area with respect to current provisions of the law and to those issued for safety purposes.
Make sure that the brake is suited for use in the working conditions defined in order. Before starting the brake it is important to check that:

- installation has been carried out properly
- the bearings have not been damaged during installation
- the design data corresponds to those given on the plate and in the technical documentation.

8. MAINTENANCE

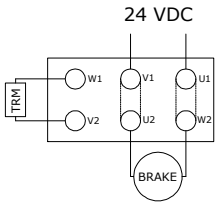
VIS brake are designed in order to avoid difficult maintenance operations.
MODIFICATIONS NOT AUTHORIZED FROM THE CONSTRUCTOR ARE NOT ADMITTED; IN CASE OF MODIFICATIONS THE GUARANTEE AND THE RESPONSIBILITY OF THE CONSTRUCTOR IS NOT VALID.
If repair work has to be performed on parts that influence the protection against explosions, the brake construction data must not be changed (for example: dimensions of joints, bearings characteristics, etc.) and if parts are replaced, this must be with original components.
The type of maintenance and frequency of checks depends on the ambient and working conditions. Especially wear on the brake disc depends on various factors: load inertia, brake rotation speed, and frequency of engaging.
Anyway, please find the following instructions:
Periodically clean the external surface of the brakes and remove dust
in particular around the terminal box.
b) Check that nominal current consumption is respected.
In case of non function of the brake, please supply to an authorized assistance workshop for repairing.

CONNECTIONS

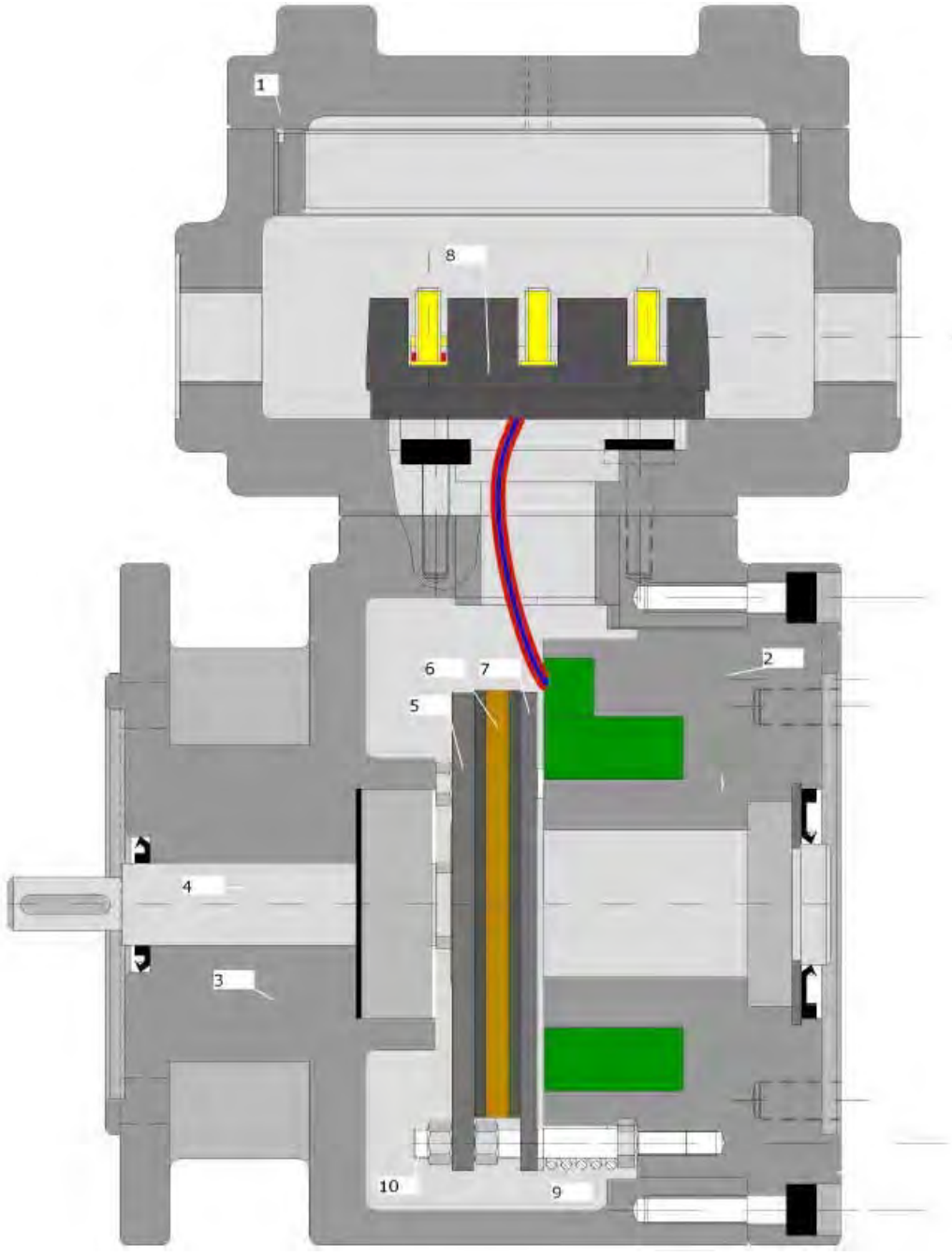
Connect the brake according to the following connection diagrams **[fig.2]**:

[fig.2]

FRENO DC - DC BRAKE



TRM : THERMISTORS-TERMICHE

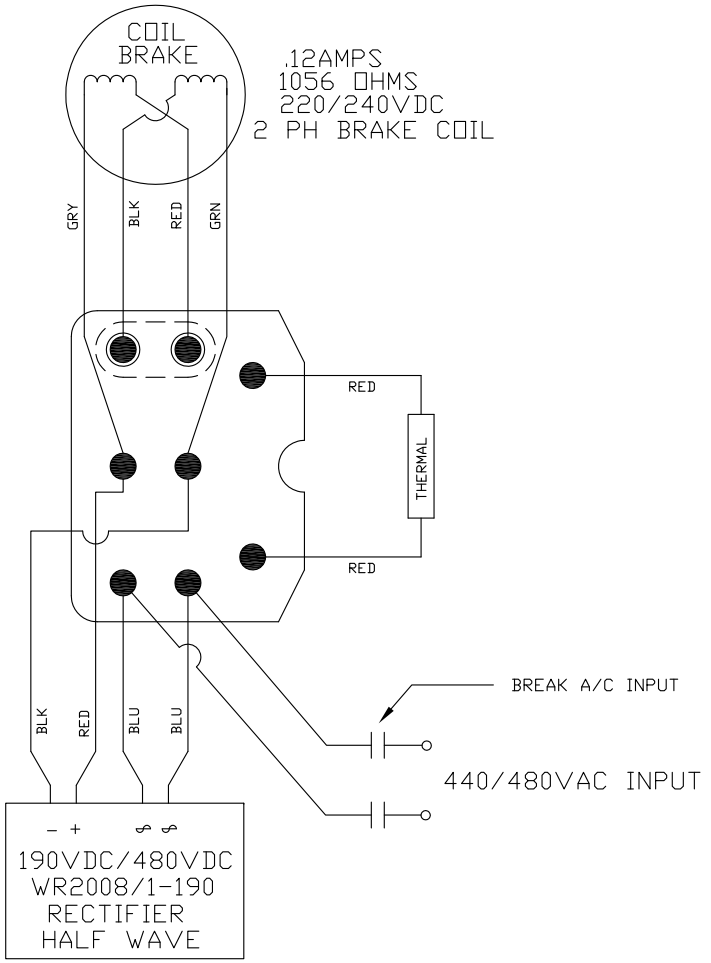


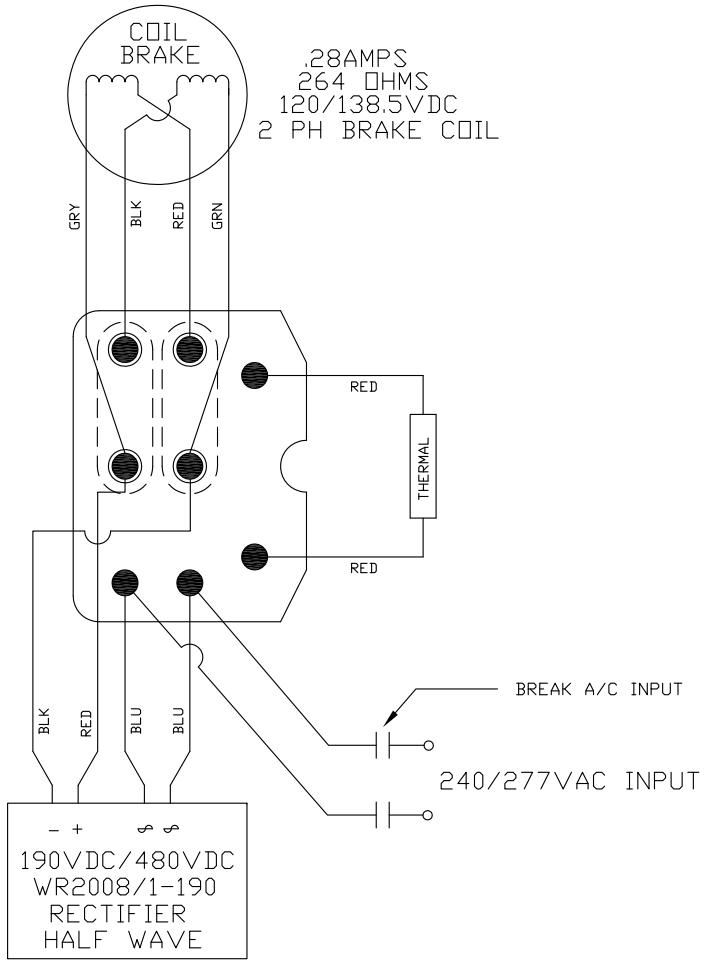
Componenti:

1 scatola morsettiera
2 elettromagnete
3 contenitore flangiato
4 albero freno
5 piastra d'attrito
6 disco freno
7 ancora mobile
8 morsettiera
9 molle
10 colonnette

Components:

1 - terminal box
2 - electromagnet
3 - flanged box
4 - brake shaft
5 - friction disk
6 - brake disk
7 - mobile anchor
8 - connection board
9 - springs
10 - guide stud bolt





VIS BRAKE

MOTOR/BRAKE WIRING

COEL / VIS BRIDGE BRAKE
WIRING DIAGRAM
INPUT 460VAC OR 230VAC

DWG / PART NO.	DRAWN BY / DATE
COEL-VIS-BRAKE-BRIDGE	MK XX/XX/XX

DETROIT HOIST & CRANE
REFERENCE DRAWING
END TRUCK SN. xxxxxx

PART # 277-1000 56TC
PART # 277-1005 143TC
PART # 277-1010 184TC

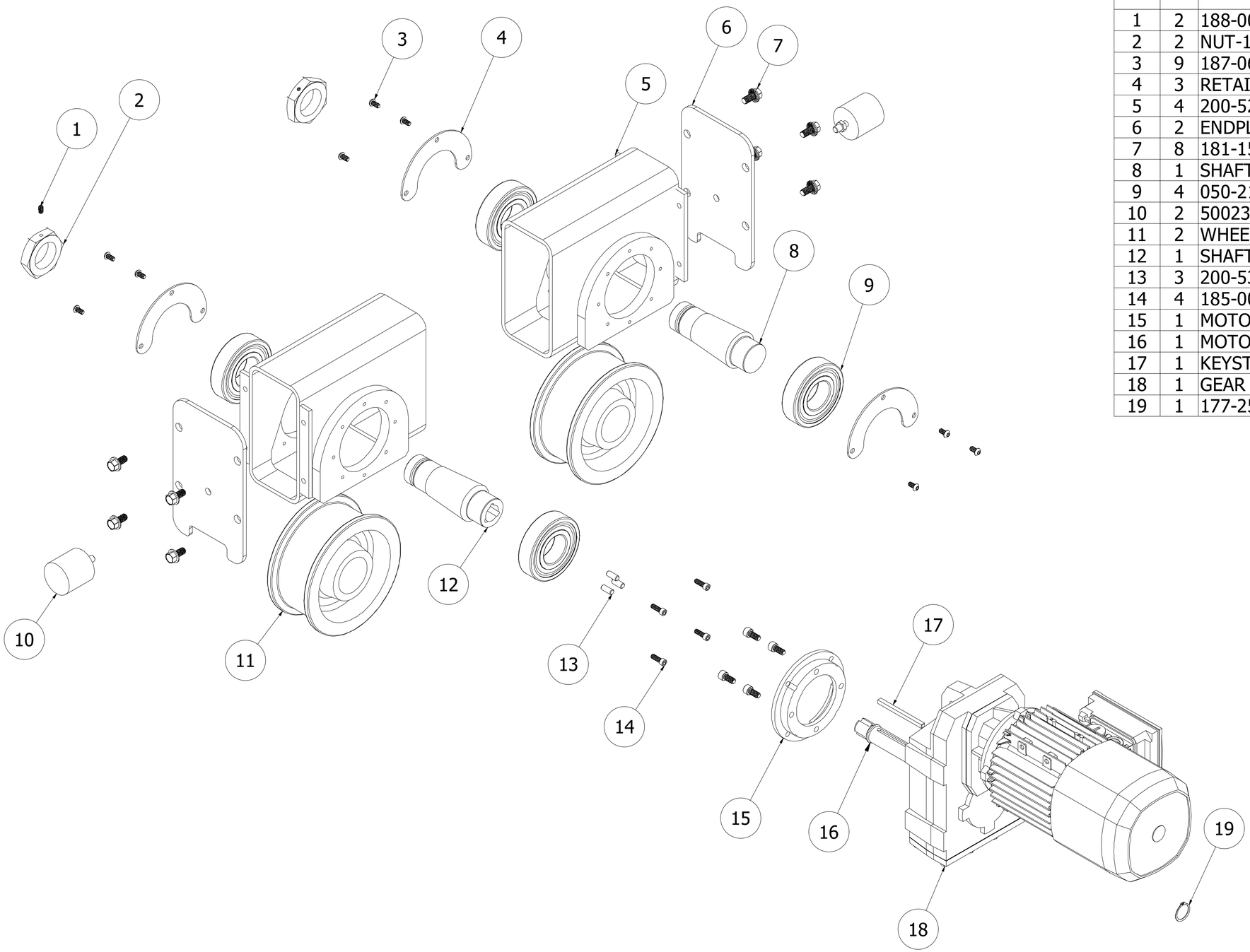
CLASS 1, DIV 1, C,&D - T3
CLASS 1, ZONE 2, IIC - T3
CLASS 2, DIV 1, E&F&G - T3

NOTE: X

NOTE: X

NOTE: X

SCALE N/A | DIRECTORY \



PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	188-0048	S/HD SET SCS, 1/4-20 X 1/2 CONE POINT
2	2	NUT-1.75-12	NUT 1-3/4-12 FINISHED
3	9	187-0685	BUTTON HEAD CAP SCR, 1/4-20 X 1/2
4	3	RETAINER-6	ET6 BEARING RETAINER
5	4	200-5290	FLAT BAR 1/4 X 3/4 X 5 1/2 TAPPED
6	2	ENDPLATE-6	ENDPLATE, ET6 / 8 X 4 X 1/4 TUBING
7	8	181-1505	H/H SERR FLG BOLT 3/8-16 X 3/4
8	1	SHAFT-I61	IDLER SHAFT ET6
9	4	050-2112	BEARING, #6309-2RS
10	2	50023757	BUMPER # AG-2 7/8
11	2	WHEEL-6.5	WHEEL, 6 1/2" MACH
12	1	SHAFT-D6-S	DRIVE SHAFT, WHEEL, ET6 / SHORT
13	3	200-5340	PIN, DOWEL 5/16" DIA X 3/4" LG
14	4	185-0015	SHCS 1/4-20 X 3/4" LG
15	1	MOTOR FLANGE	MOTOR FLANGE
16	1	MOTOR SHAFT	MOTOR DRIVE SHAFT
17	1	KEYSTOCK	DRIVE SHAFT KEY STOCK
18	1	GEAR MOTOR	GEAR MOTOR
19	1	177-2515	SNAP RING N5100-100

Detroit Hoist
Since 1905

TITLE
ET6 ASSEMBLY

DWG NO
ET6 ASSY-DWG

REV	SCALE	DRAWN BY	DATE
	1 / 3	KNR	1/10/2022

Tab 3

Hoist/Trolley

Hoist By Others

Tab 4

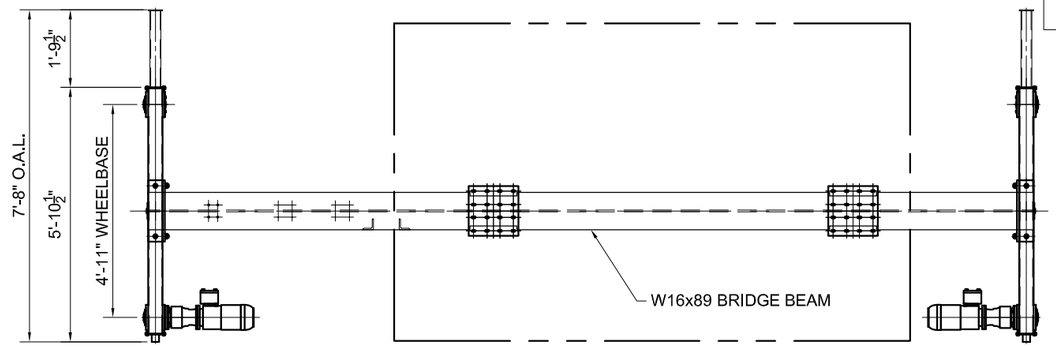
Electrical or Air Power

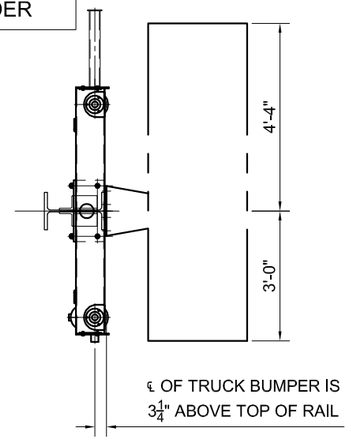
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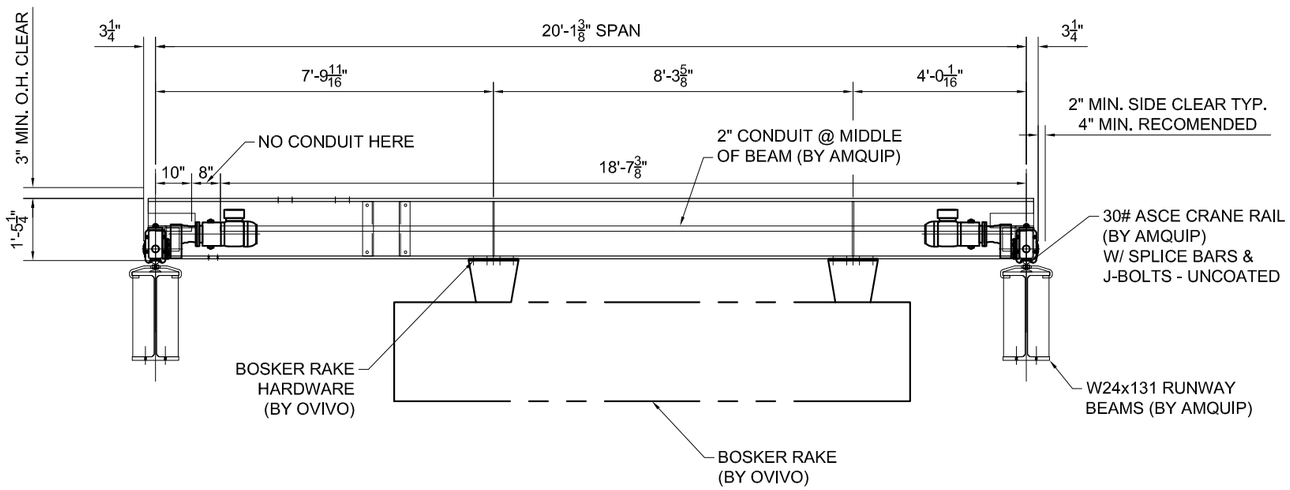
Tab 5

As Built Drawings

-POWER SUPPLY AND CONTROL (BY OTHERS)
-AMQUIP TO PROVIDE CONDUIT FROM MOTORS TO WEB OF BRIDGE GIRDER







ALLOWABLE RUNWAY TOLERANCES

MAXIMUM RATE OF CHANGE IN 20'-0" = ±¼" IN ALL CASES

RUNWAY STEEL BEAMS SPAN:
LESS THAN 50'-0" = ±3/16"
GREATER THAN 50'-0" BUT LESS THAN 100'-0" = ±¼"
GREATER THAN 100'-0" = ±⅜"

STRAIGHTNESS:
BETWEEN SUPPORTS = ±⅜"

ELEVATION:
BETWEEN SUPPORTS = ±⅜"

RAIL TO RAIL OR GIRDER TO GIRDER ELEVATION:
LESS THAN 50'-0" = ±3/16"
GREATER THAN 50'-0" BUT LESS THAN 100'-0" = ±¼"
GREATER THAN 100'-0" = ±⅜"

CENTERLINE OF RAIL OVER RUNWAY BEAM:
NO MORE THAN ¾ X THE THICKNESS OF THE RUNWAY BEAM WEB

RUNWAY CONDUCTOR BAR MUST BE STRAIGHT AND LEVEL PER INSTALLATION MANUAL

AS-BUILT

CRANE SPECIFICATIONS

BRIDGE WEIGHT:	3,600 LBS	OPERATING VOLTAGE:	480-3-60
TROLLEY WEIGHT:	6,625 LBS	CMAA CLASSIFICATION:	C
GRIPPER WEIGHT:	4,850 LBS	ELECTRICAL CLASS:	CLASS I, DIV II, GROUP D
TROLLEY & GRIPPER INCLUDED IN 7.5 TON CAP.		SERVICE:	INDOOR
MAX WHEEL LOAD:	4,650 LBS W/O IMPACT	AMBIENT TEMPERATURE:	20°F-104°F
BRIDGE SPEED:	120 FPM MAX.	ALTITUDE:	<4500 FEET
BRIDGE MOTOR:	2 @ ¾ HP		

NOTES

1. ALL WELDING BY AWS D14.1 CERTIFIED WELDERS.
2. PAINT CRANE 1 COAT BUFF PRIMER
3. PAINT CRANE 1 COAT NEW AMQUIP YELLOW ENAMEL.
4. FREE STANDING STRUCTURE HOT DIPPED GALVANIZED.
5. STRUCTURAL BOLTS GRADE A325 GALVANIZED.
6. TOLERANCES PER CMAA 74.
7. CLEARANCE BETWEEN CRANE & OBSTRUCTIONS ARE THE RESPONSIBILITY OF THE OWNER USER.
8. ALL SIDE CLEARANCES 2" MINIMUM.
9. ALL OVERHEAD CLEARANCES 3" MINIMUM.
10. STANDARD CONSTRUCTION MATERIALS

REVISIONS

REV	DESCRIPTION	BY	DATE	APP'D	DATE
C	AS-BUILT	PO	12/20/2022	BW	01/06/2023
B	FOR FABRICATION	JAD	04/29/2022	TP	06/15/2022
A	SUBMITTAL	EDA	02/22/2022	AZ	02/23/2022

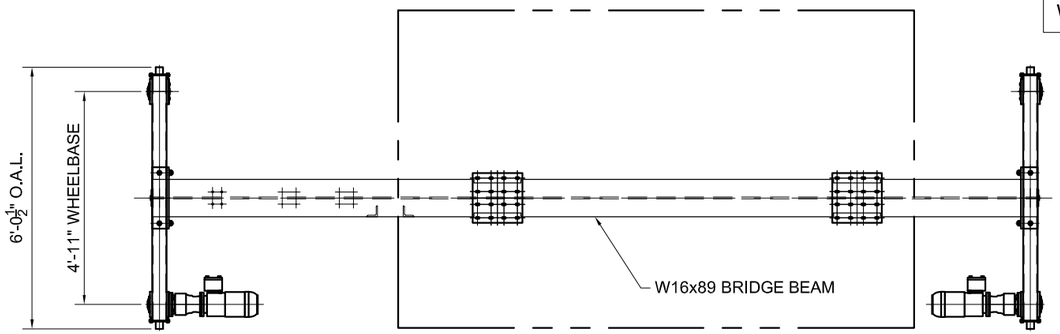
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451 WEST 3440 SOUTH, SALT LAKE CITY, UTAH 84115
PH: 801-269-0896 FAX: 801-269-0948
am-quip

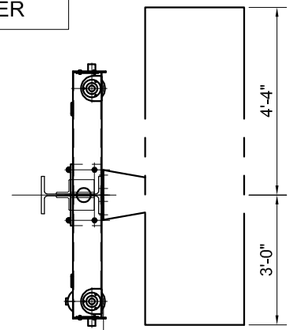
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7.5 TON TOP RUNNING SINGLE GIRDER

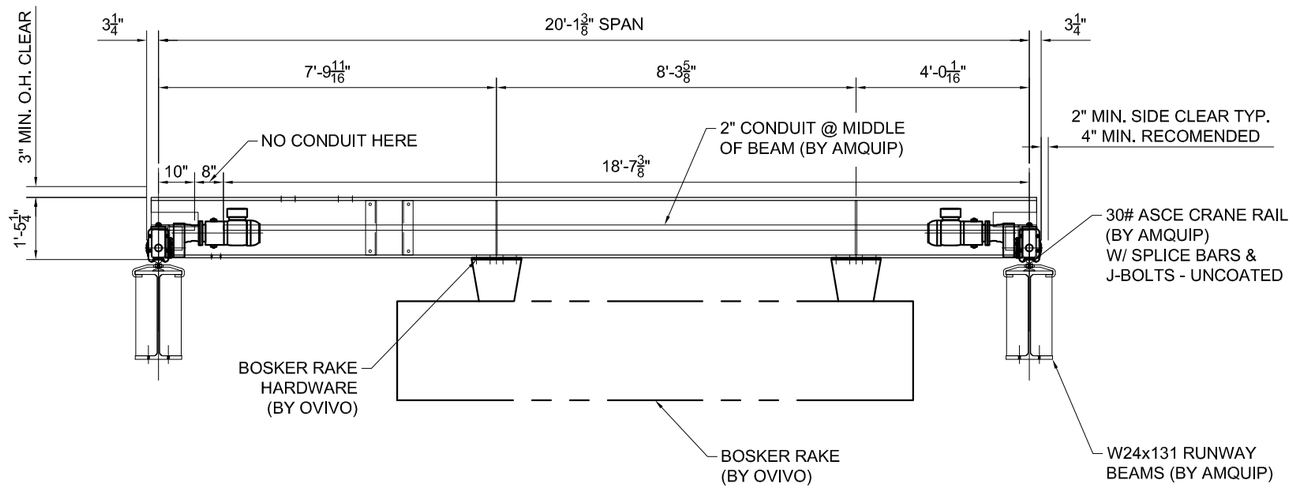
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OVIVO				
DWG. BY:	END USER:	SCALE:	CREATION DATE:	JOB:
EDA		NTS	02/22/2022	36481-1

-POWER SUPPLY AND CONTROL (BY OTHERS)
-AMQUIP TO PROVIDE CONDUIT FROM MOTORS TO WEB OF BRIDGE GIRDER





℄ OF TRUCK BUMPER IS 3¼" ABOVE TOP OF RAIL



ALLOWABLE RUNWAY TOLERANCES

MAXIMUM RATE OF CHANGE IN 20'-0" = ±¼" IN ALL CASES

RUNWAY STEEL BEAMS SPAN:
LESS THAN 50'-0" = ±3/16"
GREATER THAN 50'-0" BUT LESS THAN 100'-0" = ±¼"
GREATER THAN 100'-0" = ±⅜"

STRAIGHTNESS:
BETWEEN SUPPORTS = ±⅜"

ELEVATION:
BETWEEN SUPPORTS = ±⅜"

RAIL TO RAIL OR GIRDER TO GIRDER ELEVATION:
LESS THAN 50'-0" = ±3/16"
GREATER THAN 50'-0" BUT LESS THAN 100'-0" = ±¼"
GREATER THAN 100'-0" = ±⅜"

CENTERLINE OF RAIL OVER RUNWAY BEAM:
NO MORE THAN ¾ X THE THICKNESS OF THE RUNWAY BEAM WEB

RUNWAY CONDUCTOR BAR MUST BE STRAIGHT AND LEVEL PER INSTALLATION MANUAL

AS-BUILT

CRANE SPECIFICATIONS

BRIDGE WEIGHT:	3,600 LBS	OPERATING VOLTAGE:	480-3-60
TROLLEY WEIGHT:	6,625 LBS	CMAA CLASSIFICATION:	C
GRIPPER WEIGHT:	4,850 LBS	ELECTRICAL CLASS:	CLASS I, DIV II, GROUP D
TROLLEY & GRIPPER INCLUDED IN 7.5 TON CAP.		SERVICE:	INDOOR
MAX WHEEL LOAD:	4,650 LBS W/O IMPACT	AMBIENT TEMPERATURE:	20°F-104°F
BRIDGE SPEED:	120 FPM MAX.	ALTITUDE:	<4500 FEET
BRIDGE MOTOR:	2 @ ¾ HP		

NOTES

1. ALL WELDING BY AWS D14.1 CERTIFIED WELDERS.
2. PAINT CRANE 1 COAT BUFF PRIMER
3. PAINT CRANE 1 COAT NEW AMQUIP YELLOW ENAMEL.
4. FREE STANDING STRUCTURE HOT DIPPED GALVANIZED.
5. STRUCTURAL BOLTS GRADE A325 GALVANIZED.
6. TOLERANCES PER CMAA 74.
7. CLEARANCE BETWEEN CRANE & OBSTRUCTIONS ARE THE RESPONSIBILITY OF THE OWNER USER.
8. ALL SIDE CLEARANCES 2" MINIMUM.
9. ALL OVERHEAD CLEARANCES 3" MINIMUM.
10. STANDARD CONSTRUCTION MATERIALS

REVISIONS

REV	DESCRIPTION	BY	DATE	APP'D	DATE
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B	FOR FABRICATION	JAD	04/29/2022	TP	06/15/2022
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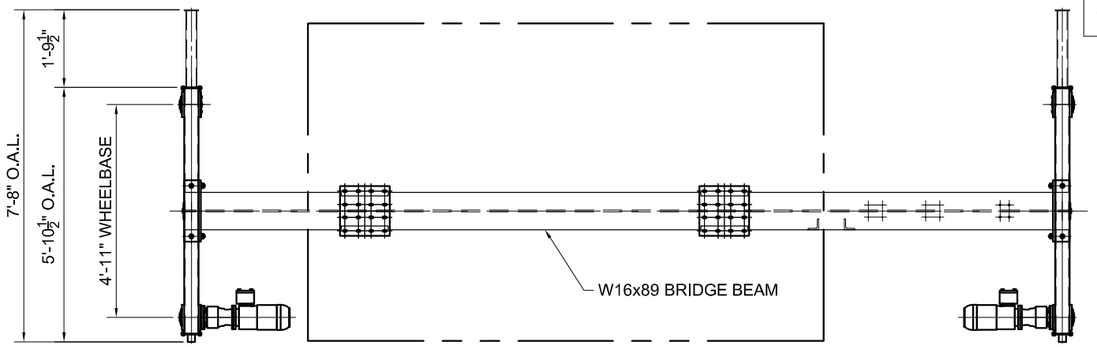
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451 WEST 3440 SOUTH, SALT LAKE CITY, UTAH 84115
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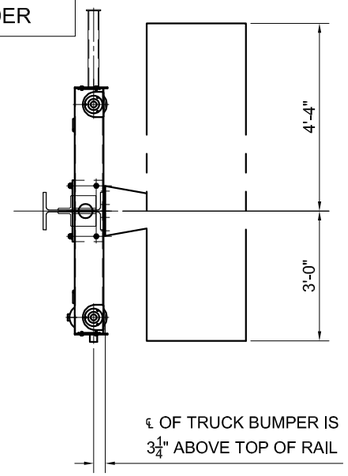
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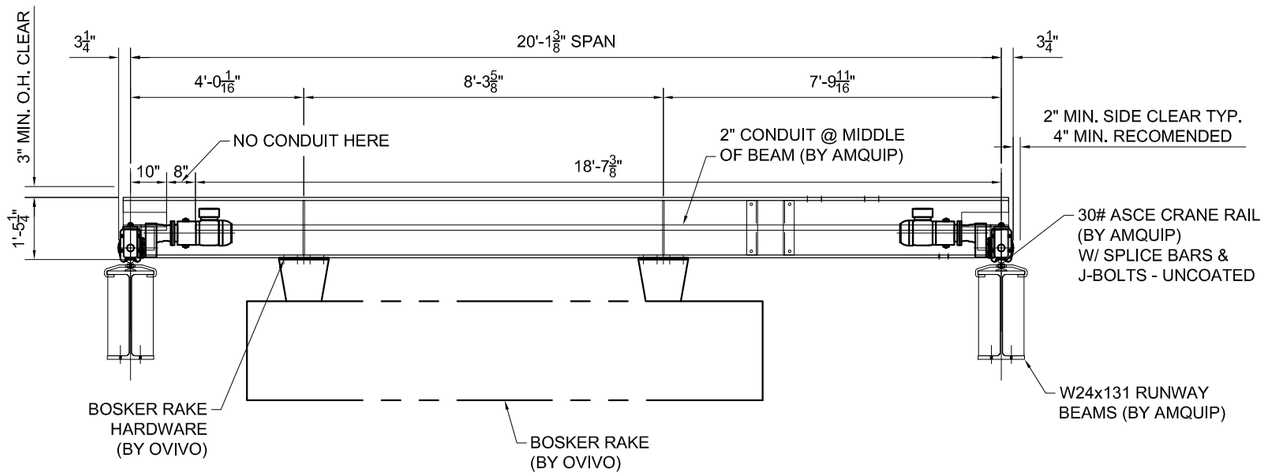
7.5 TON TOP RUNNING SINGLE GIRDER

CUSTOMER:	CUSTOMER PO OR JOB #:			
OVIVO				
DWG. BY:	END USER:	SCALE:	CREATION DATE:	JOB:
EDA		NTS	02/22/2022	36482-1

-POWER SUPPLY AND CONTROL (BY OTHERS)
-AMQUIP TO PROVIDE CONDUIT FROM MOTORS TO WEB OF BRIDGE GIRDER







ALLOWABLE RUNWAY TOLERANCES

MAXIMUM RATE OF CHANGE IN 20'-0" = ±¼" IN ALL CASES

RUNWAY STEEL BEAMS SPAN:
LESS THAN 50'-0" = ±3/16"
GREATER THAN 50'-0" BUT LESS THAN 100'-0" = ±¼"
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GREATER THAN 100'-0" = ±⅜"

CENTERLINE OF RAIL OVER RUNWAY BEAM:
NO MORE THAN ¾ X THE THICKNESS OF THE RUNWAY BEAM WEB

RUNWAY CONDUCTOR BAR MUST BE STRAIGHT AND LEVEL PER INSTALLATION MANUAL

AS-BUILT

CRANE SPECIFICATIONS

BRIDGE WEIGHT:	3,600 LBS	OPERATING VOLTAGE:	480-3-60
TROLLEY WEIGHT:	6,625 LBS	CMAA CLASSIFICATION:	C
GRIPPER WEIGHT:	4,850 LBS	ELECTRICAL CLASS:	CLASS I, DIV II, GROUP D
TROLLEY & GRIPPER INCLUDED IN 7.5 TON CAP.		SERVICE:	INDOOR
MAX WHEEL LOAD:	4,650 LBS W/O IMPACT	AMBIENT TEMPERATURE:	20°F-104°F
BRIDGE SPEED:	120 FPM MAX.	ALTITUDE:	<4500 FEET
BRIDGE MOTOR:	2 @ ¾ HP		

NOTES

1. ALL WELDING BY AWS D14.1 CERTIFIED WELDERS.
2. PAINT CRANE 1 COAT BUFF PRIMER
3. PAINT CRANE 1 COAT NEW AMQUIP YELLOW ENAMEL.
4. FREE STANDING STRUCTURE HOT DIPPED GALVANIZED.
5. STRUCTURAL BOLTS GRADE A325 GALVANIZED.
6. TOLERANCES PER CMAA 74.
7. CLEARANCE BETWEEN CRANE & OBSTRUCTIONS ARE THE RESPONSIBILITY OF THE OWNER USER.
8. ALL SIDE CLEARANCES 2" MINIMUM.
9. ALL OVERHEAD CLEARANCES 3" MINIMUM.
10. STANDARD CONSTRUCTION MATERIALS

REVISIONS

REV	DESCRIPTION	BY	DATE	APP'D	DATE
C	AS-BUILT	PO	12/20/2022	BW	01/06/2023
B	FOR FABRICATION	JAD	04/29/2022	TP	06/15/2022
A	SUBMITTAL	EDA	02/22/2022	AZ	02/23/2022

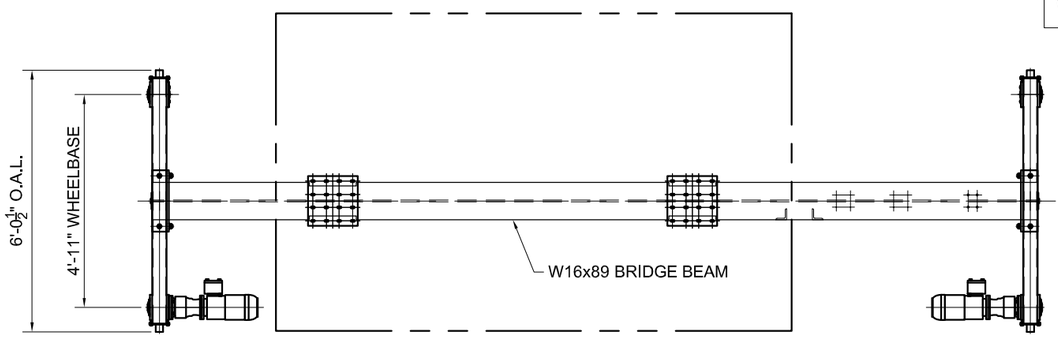
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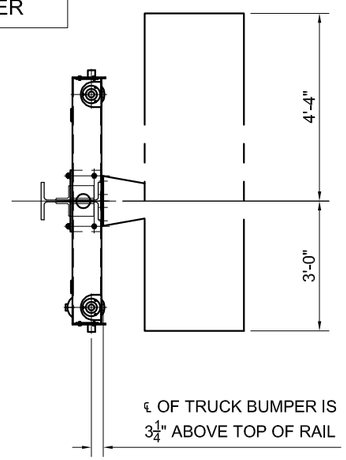
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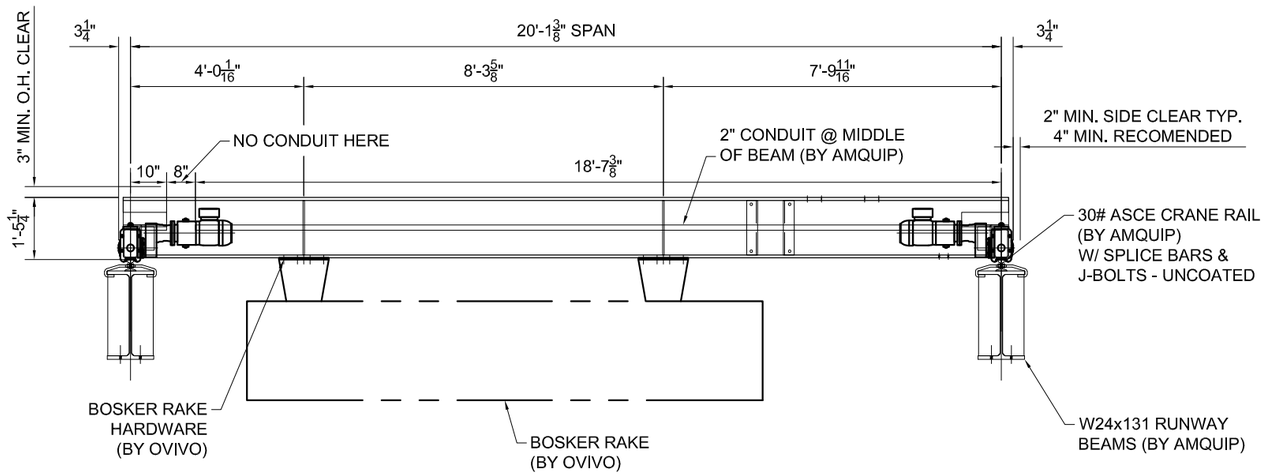
7.5 TON TOP RUNNING SINGLE GIRDER

CUSTOMER:	CUSTOMER PO OR JOB #:			
OVIVO				
DWG. BY:	END USER:	SCALE:	CREATION DATE:	JOB:
EDA		NTS	02/22/2022	36483-1

-POWER SUPPLY AND CONTROL (BY OTHERS)
-AMQUIP TO PROVIDE CONDUIT FROM MOTORS TO WEB OF BRIDGE GIRDER







ALLOWABLE RUNWAY TOLERANCES

MAXIMUM RATE OF CHANGE IN 20'-0" = ±¼" IN ALL CASES

RUNWAY STEEL BEAMS SPAN:
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CENTERLINE OF RAIL OVER RUNWAY BEAM:
NO MORE THAN ¾ X THE THICKNESS OF THE RUNWAY BEAM WEB

RUNWAY CONDUCTOR BAR MUST BE STRAIGHT AND LEVEL PER INSTALLATION MANUAL

AS-BUILT

CRANE SPECIFICATIONS

BRIDGE WEIGHT:	3,600 LBS	OPERATING VOLTAGE:	480-3-60
TROLLEY WEIGHT:	6,625 LBS	CMAA CLASSIFICATION:	C
GRIPPER WEIGHT:	4,850 LBS	ELECTRICAL CLASS:	CLASS I, DIV II, GROUP D
TROLLEY & GRIPPER INCLUDED IN 7.5 TON CAP.		SERVICE:	INDOOR
MAX WHEEL LOAD:	4,650 LBS W/O IMPACT	AMBIENT TEMPERATURE:	20°F-104°F
BRIDGE SPEED:	120 FPM MAX.	ALTITUDE:	<4500 FEET
BRIDGE MOTOR:	2 @ ¾ HP		

NOTES

1. ALL WELDING BY AWS D14.1 CERTIFIED WELDERS.
2. PAINT CRANE 1 COAT BUFF PRIMER
3. PAINT CRANE 1 COAT NEW AMQUIP YELLOW ENAMEL.
4. FREE STANDING STRUCTURE HOT DIPPED GALVANIZED.
5. STRUCTURAL BOLTS GRADE A325 GALVANIZED.
6. TOLERANCES PER CMAA 74.
7. CLEARANCE BETWEEN CRANE & OBSTRUCTIONS ARE THE RESPONSIBILITY OF THE OWNER USER.
8. ALL SIDE CLEARANCES 2" MINIMUM.
9. ALL OVERHEAD CLEARANCES 3" MINIMUM.
10. STANDARD CONSTRUCTION MATERIALS

REVISIONS

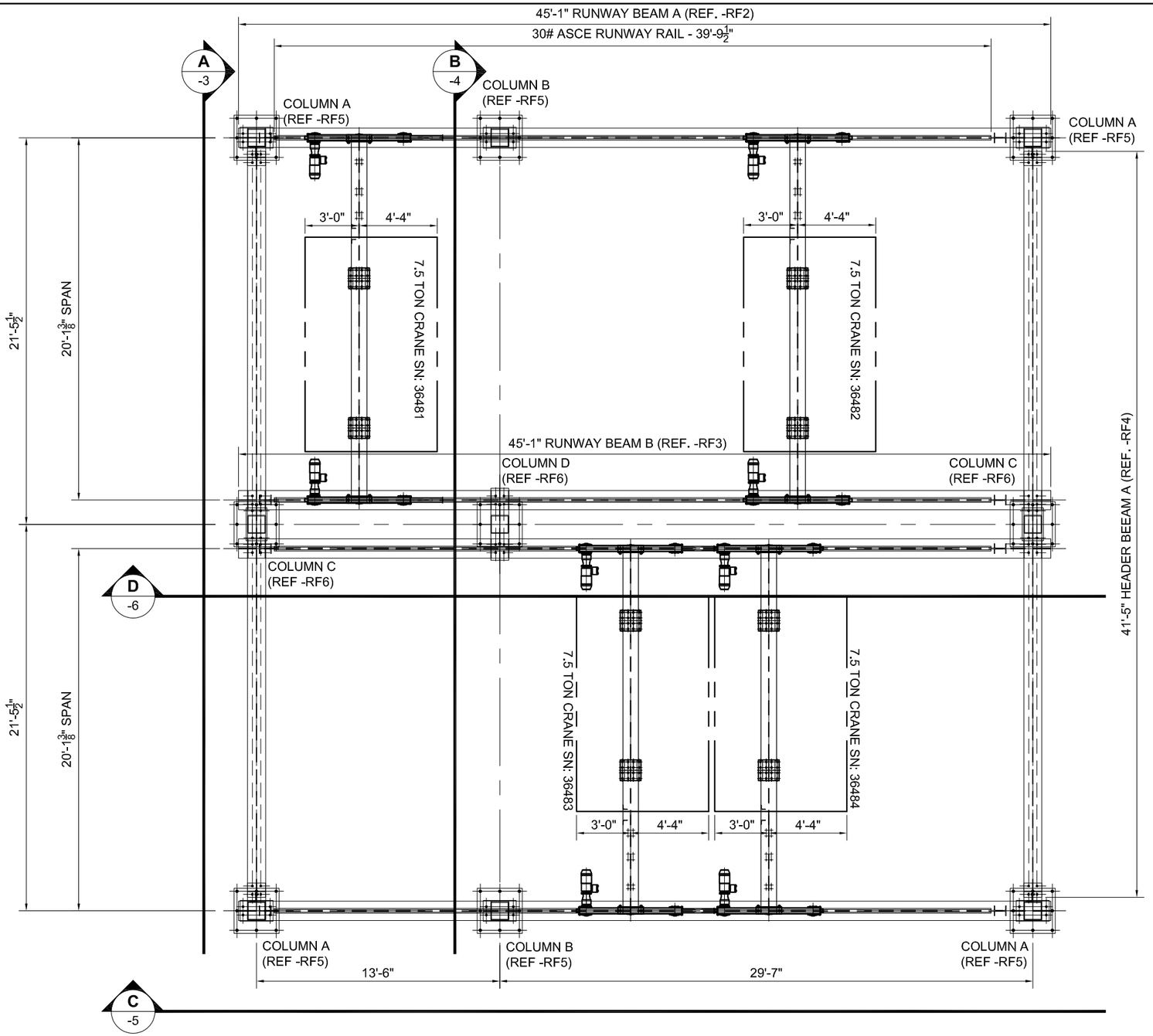
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B	FOR FABRICATION	JAD	04/29/2022	TP	06/15/2022
A	SUBMITTAL	EDA	02/22/2022	AZ	02/23/2022

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7.5 TON TOP RUNNING SINGLE GIRDER

CUSTOMER:	CUSTOMER PO OR JOB #:			
OVIVO				
DWG. BY:	END USER:	SCALE:	CREATION DATE:	JOB:
EDA		NTS	02/22/2022	36484-1



AS-BUILT

CRANE SPECIFICATIONS

REF 36481-1, 36482-1, 36483-1 & 36484-1

NOTES

1. ALL WELDING BY AWS D14.1 CERTIFIED WELDERS.
2. PAINT CRANE 1 COAT BUFF PRIMER
3. PAINT CRANE 1 COAT NEW AMQUIP YELLOW ENAMEL.
4. FREE STANDING STRUCTURE HOT DIPPED GALVANIZED.
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REVISIONS

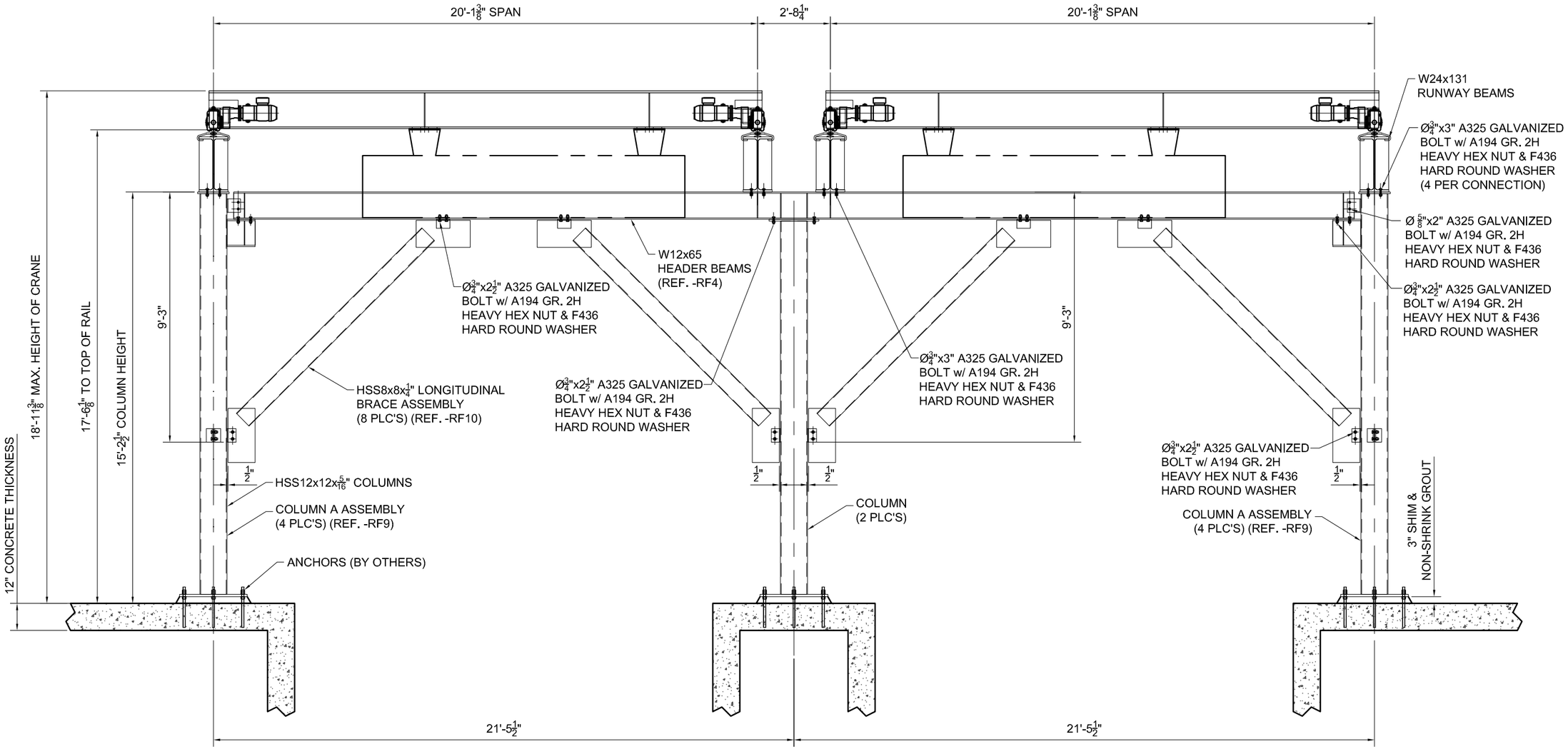
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B	FOR FABRICATION	JAD	04/29/2022	TP	06/15/2022
A	SUBMITTAL	EDA	02/22/2022	AZ	02/23/2022

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CRANE SYSTEM PLAN

CUSTOMER:	CUSTOMER PO OR JOB #:			
OVIVO				
DWG. BY:	END USER:	SCALE:	CREATION DATE:	JOB:
EDA		NTS	02/22/2022	36481-2



A -2 **SYSTEM END ELEVATION**

AS-BUILT

CRANE SPECIFICATIONS
REF 36481-1, 36482-1, 36483-1 & 36484-1

NOTES

1. ALL WELDING BY AWS D14.1 CERTIFIED WELDERS.
2. PAINT CRANE 1 COAT BUFF PRIMER
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4. FREE STANDING STRUCTURE HOT DIPPED GALVANIZED.
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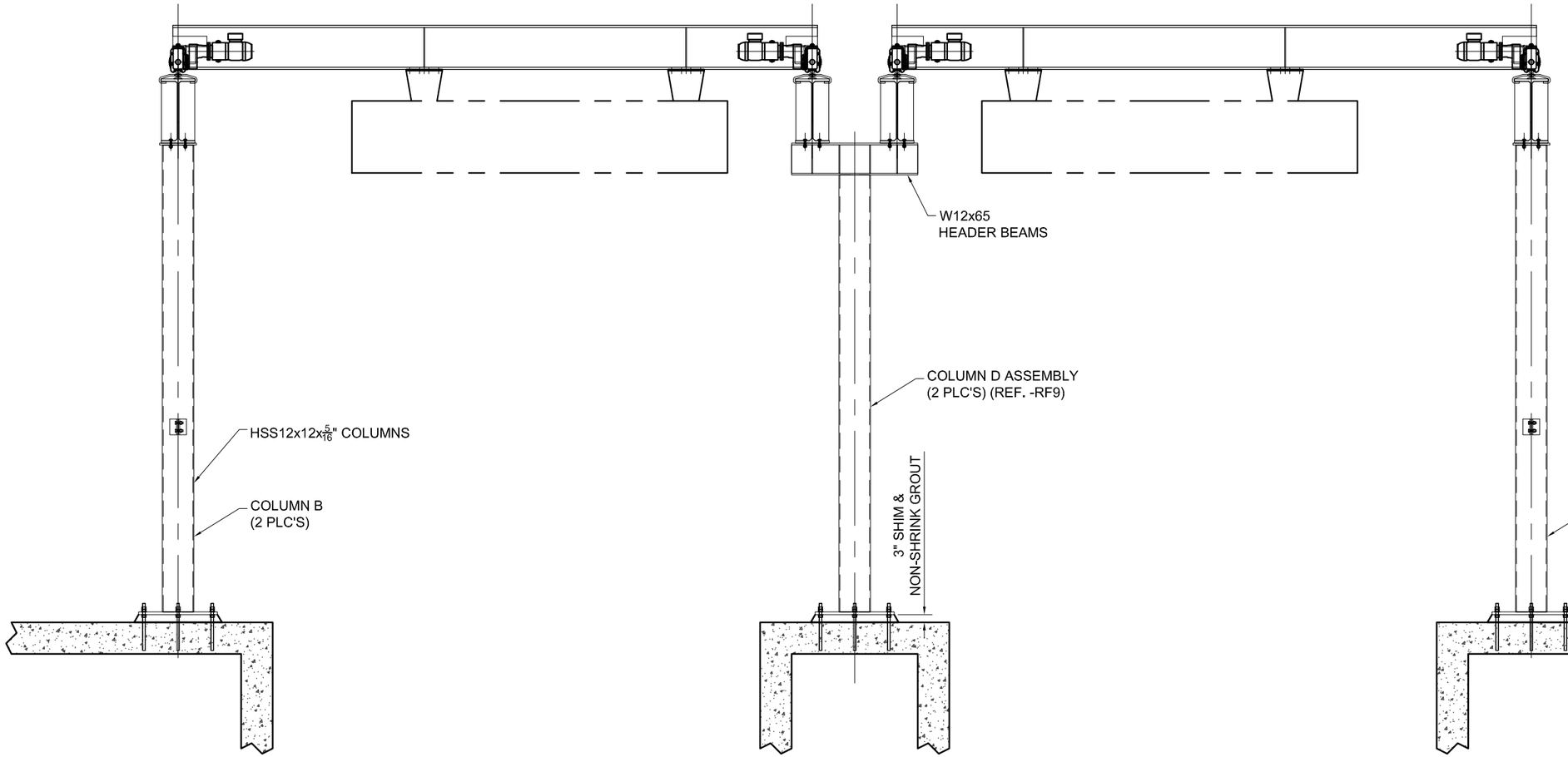
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B	FOR FABRICATION	JAD	04/29/2022	TP	06/15/2022
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CRANE SYSTEM END ELEVATION

CUSTOMER:	CUSTOMER PO OR JOB #:			
OVIVO				
DWG. BY:	**END USER:**	**SCALE:**	**CREATION DATE:**	**JOB:**
EDA		NTS	02/22/2022	36481-3



B -2 **SYSTEM END ELEVATION AT CENTER COLUMNS**

AS-BUILT

CRANE SPECIFICATIONS

REF 36481-1, 36482-1, 36483-1 & 36484-1

NOTES

1. ALL WELDING BY AWS D14.1 CERTIFIED WELDERS.
2. PAINT CRANE 1 COAT BUFF PRIMER
3. PAINT CRANE 1 COAT NEW AMQUIP YELLOW ENAMEL.
4. FREE STANDING STRUCTURE HOT DIPPED GALVANIZED.
5. STRUCTURAL BOLTS GRADE A325 GALVANIZED.
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REVISIONS

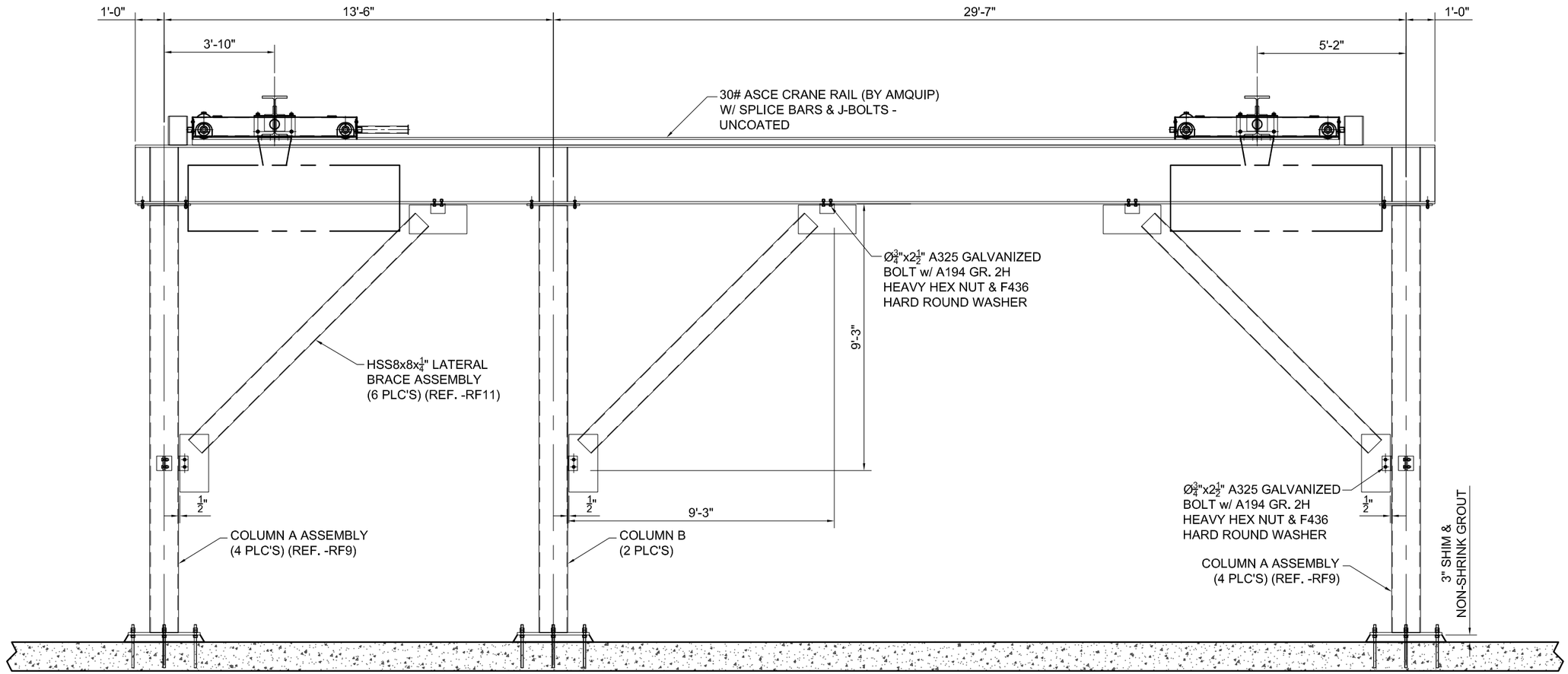
REV	DESCRIPTION	BY	DATE	APP'D	DATE
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B	FOR FABRICATION	JAD	04/29/2022	TP	06/15/2022
A	SUBMITTAL	EDA	02/22/2022	AZ	02/23/2022

american equipment, inc.
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CRANE SYSTEM END ELEVATION AT CENTER COLUMNS

CUSTOMER:	CUSTOMER PO OR JOB #:			
OVIVO				
DWG. BY:	END USER:	SCALE:	CREATION DATE:	JOB:
EDA		NTS	02/22/2022	36481-4



C -2 **SYSTEM SIDE ELEVATION**

AS-BUILT

CRANE SPECIFICATIONS
REF 36481-1, 36482-1, 36483-1 & 36484-1

NOTES

1. ALL WELDING BY AWS D14.1 CERTIFIED WELDERS.
2. PAINT CRANE 1 COAT BUFF PRIMER
3. PAINT CRANE 1 COAT NEW AMQUIP YELLOW ENAMEL.
4. FREE STANDING STRUCTURE HOT DIPPED GALVANIZED.
5. STRUCTURAL BOLTS GRADE A325 GALVANIZED.
6. TOLERANCES PER CMAA 74.
7. CLEARANCE BETWEEN CRANE & OBSTRUCTIONS ARE THE RESPONSIBILITY OF THE OWNER USER.
8. ALL SIDE CLEARANCES 2" MINIMUM.
9. ALL OVERHEAD CLEARANCES 3" MINIMUM.
10. STANDARD CONSTRUCTION MATERIALS

REVISIONS

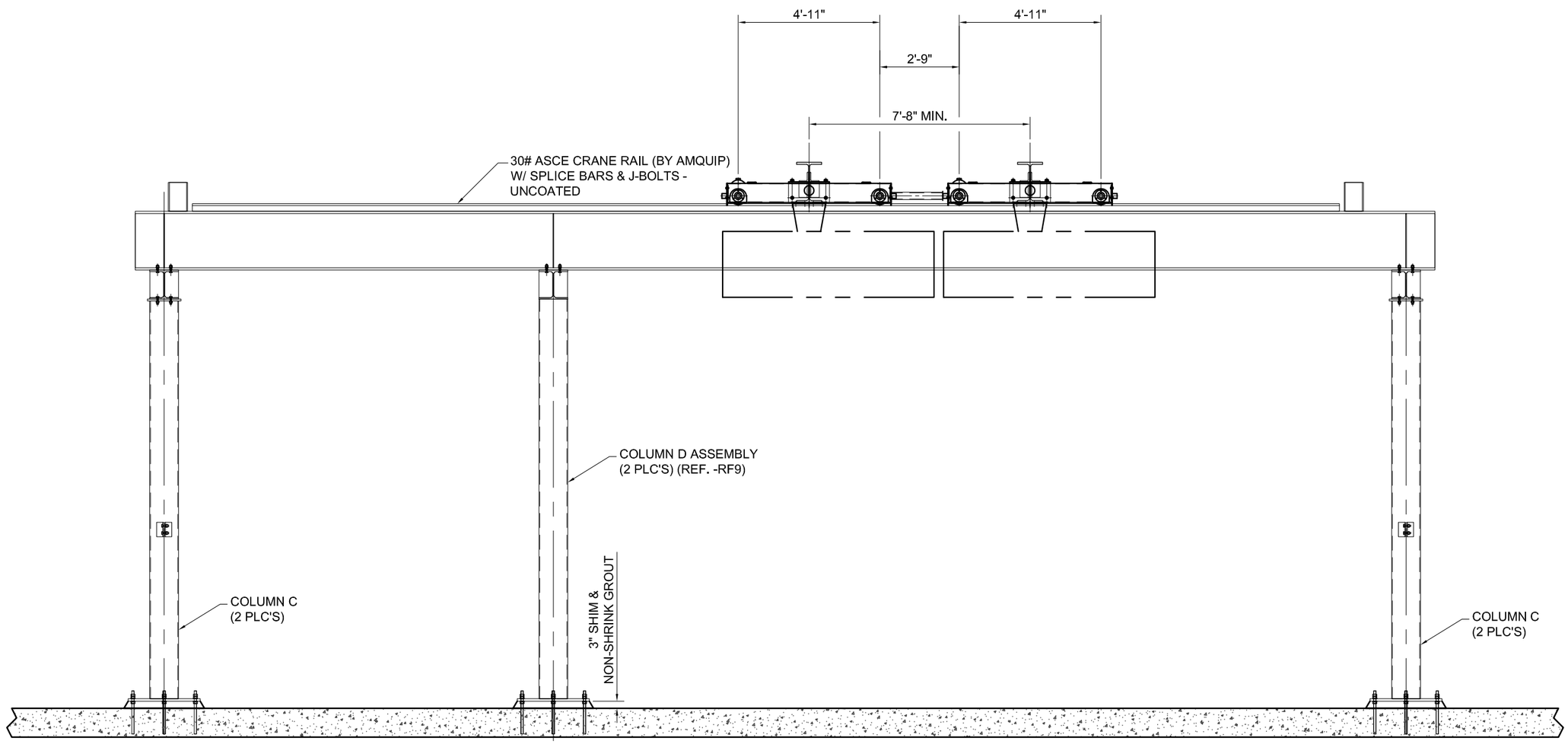
REV	DESCRIPTION	BY	DATE	APP'D	DATE
C	AS-BUILT	PO	12/20/2022	BW	01/06/2023
B	FOR FABRICATION	JAD	04/29/2022	TP	06/15/2022
A	SUBMITTAL	EDA	02/22/2022	AZ	02/23/2022

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CRANE SYSTEM SIDE ELEVATION

CUSTOMER:	CUSTOMER PO OR JOB #:			
OVIVO				
DWG. BY:	END USER:	SCALE:	CREATION DATE:	JOB:
EDA		NTS	02/22/2022	36481-5



D -2 **SYSTEM SIDE ELEVATION AT CENTER COLUMNS**

AS-BUILT

CRANE SPECIFICATIONS
REF 36481-1, 36482-1, 36483-1 & 36484-1

NOTES

1. ALL WELDING BY AWS D14.1 CERTIFIED WELDERS.
2. PAINT CRANE 1 COAT BUFF PRIMER
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REV	DESCRIPTION	BY	DATE	APP'D	DATE
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CRANE SYSTEM SIDE ELEVATION AT CENTER COLUMNS

CUSTOMER:	CUSTOMER PO OR JOB #:			
OVIVO				
DWG. BY:	END USER:	SCALE:	CREATION DATE:	JOB:
EDA		NTS	02/22/2022	36481-6

8.0 CHECKLIST

CHECKLIST

MECHANICAL/OPERATIONAL START-UP CHECK LIST
OVIVO® Deep Clean™ Brackett Bosker®

Ovivo Job #: CSW1584

Location: Custer Avenue WWTP, GA

Field Technician: _____

Proj. Mgr.: Michael Nunez

Equipment type: Bosker® Screen Raking System

Serial #: **CSW0001584-01 A**

General Assembly drawing #: CSW1584-151 YES NO

□	□	Is Bridge Crane oriented per the general arrangement drawing?
□	□	Has trolley been installed onto the Bridge Crane?
□	□	Is energy chain installed and wiring complete?
□	□	Does the energy chain appear to have the correct travel distance for the trolley?
□	□	Are E-stop(s) oriented correctly?
□	□	Is this unit being operated in an explosion proof environment?
□	□	Note any surface corrosion and photo document

General Assembly and Installation Inspection:

YES	NO	
□	□	Is field and control panel wiring complete?

Continue inspection from man lift:

YES	NO	
□	□	Remove all side covers for start-up access, match mark each for location

YES	NO	
□	□	Are gripper cables and hose reels installed so as windings are opposite each other?
□	□	Are all proximity switches are installed? (No mechanical switches used on this unit.)
□	□	Check hoist reducer oil level and vent
□	□	Check travel reducer oil level and vent

Hoist reducer type, size, and SO #: _____

Hoist reducer motor type/# _____ H.P. _____ F.L.A. _____

Brake type and model/serial # _____

Bridge Crane reducer type, size, and SO #: _____

Bridge Crane reducer motor type/# _____ H.P. _____ F.L.A. _____

Brake type and model/serial # _____

I/O check (NOTE carriage may not yet be positioned to access Bridge Crane gear reducer and motor).= Match proximity switch tag numbers to input numbers on the PLC. To flip the proximity switch, place a metal object (ruler, wrench, etc…) on top of the proximity switch face. This check out will take one person flipping switches on the trolley, and another person confirming the correct inputs are being received on the PLC. Limit switches and input are checked by flipping the limit switch lever. Note the function of each circuit breaker, temporary descriptive tags are useful. Each circuit breaker will be switched ON in numerical order.

Initial control panel start-up (main disconnect is OFF):

YES NO

□ □ Flip all circuit breakers to the OFF position
□ □ Confirm that LINE side of power to the disconnect is the proper voltage
Date: _____ Time: _____ Voltage: A – B _____ B – C _____ A – C _____
□ □ Energize the panel, no issues
□ □ Switch each circuit breaker, note any trip by circuit breaker # _____
□ □ All (necessary) circuit breakers are energized satisfactory
□ □ PLC is powered up
□ □ Misc items powered up i.e. 24V source, if applicable – current monitor/VFD

Continue start-up inspection from man lift:

□ □ Hoist upper limit proximity switch I/O check
□ □ Hoist lower limit proximity switch I/O check
□ □ Right side slack rope proximity switch I/O
□ □ Right side slack rope proximity switch 2 I/O
□ □ Left side slack rope proximity switch I/O
□ □ Left side slack rope proximity switch 2 I/O
□ □ Control panel door mounted E-Stop I/O
□ □ Local mounted E-Stop(s)

At this time, place control panel in HAND, and move trolley to pick/dump positions

□ □ Pick position actual matches the pick position theoretical based on encoders
□ □ Home/Dump actual matches the pick position theoretical based on encoders
□ □ Over-travel hard stop is mounted

YES NO
□ □ Trolley motor(s) direction of travel correct

At this time, let the hoist cables down, so as to check correct function and then connect the gripper.

□ □ Hoist motor direction of rotation is correct
□ □ Manually trip lower limit proximity switch while lowering for correct function

□ □ Manually trip upper limit proximity switch while raising for correct function

Lower cables to loop in the gripper rollers, rake does not need to be final level at this time (can be leveled after operation and cables have fully seated).

□ □ In HAND, raise rake @ 12” off the floor
□ □ Hoist brake is operational
□ □ In HAND, rake opens when OPEN is pressed
□ □ In HAND, rake closes when CLOSE is pressed
□ □ Raise rake in HAND and set upper limits
□ □ Check/adjust swing restrictors to seat with gripper rollers
□ □ In HAND, lower rake and manually check RH slack rope proximity & proximity switch 2
□ □ In HAND, lower rake and manually check LH slack rope proximity & proximity switch 2
□ □ Check that rake teeth are all tight, none bent
□ □ Check that hinged gripper side of rake has correct capturing mesh

YES NO N/A
□ □ □ Bar racks are vertical and plumb
□ □ □ Do the vertical bar racks have channel guides
□ □ □ Do the channel guides have wide, angled entry openings

YES NO
□ □ Verify rake teeth are centered between rack bars
□ □ Trolley stops in HAND at the HOME/DUMP/PARK positions
□ □ Adjust programmed pick position so rake enters channel guides smoothly
□ □ At pick location, lower open rake until teeth are 6” above the floor bottom
□ □ Close rake and insure no rubbing of teeth on concrete floor
□ □ Set lower limit and re-test lower limit position
□ □ Rake fully lowers at pick position, does not jam on wall or guides
□ □ Re-level rake (if necessary)
□ □ Upper limits adjusted correctly

Bar rack inspection: Channel guides

□ □ Top of channel guides are sloped out, and funnel shaped
□ □ Channel guide joint transitions are even
□ □ All channel guide anchors installed
□ □ If applicable, channel guides have been grouted
□ □ Rake descends full distance to invert without jamming in channel guides

Operational check: In HAND

YES NO
- □ □ Bridge Crane operates smooth in monorail through entire travel
- □ □ Bridge Crane stops at all pick targets
- □ □ Upper limit is set
- □ □ Lower limit is set
- □ □ Rake ascends properly at all pick positions
- □ □ Ready to continue Automatic start and control panel check out.?

NOTE: On the initial Auto operation, the operating amperage of each motor needs to be recorded.

HOIST RH: H.P. _____ FLA _____ Ascending amperage _____ - _____ - _____

HOIST LH: H.P. _____ FLA _____ Ascending amperage _____ - _____ - _____

TROLLEY: H.P. _____ FLA _____ Operating Amps _____ - _____ - _____

Continue with CONTROL PANEL Automatic check out.

List IP Address assigned with Systems Integrator:

_____
_____
_____
_____

If any settings have been made for this specific project, list them here:

_____
_____
_____
_____

COMMENTS:

_____
_____
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Completed by: _____

Date: _____