Hart Engineering Corporation

SUBMITTAL:
11326-03

PROJECT: 9722. - Veolia/Taunton WWTP Solids Handling Improvements **DATE: 02/04/2022**

SUBMITTAL: 11326-03 - Gravity Thickener Equipment O&M Manual
REVISION: 0
STATUS: Eng
SPEC #: 11326

TO:
Carl Hendrickson
Veolia North America
125 S. 84th Street, Suite 175
Milwaukee, WI 53214
carl.hendrickson@veolia.com

FROM:
Ryan Murphy
Hart Engineering Corporation
800 Scenic View Drive
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Item	Revision	Description	Status	Date Sent	Date Returned
11326-03	0	Gravity Thickener Equipment O&M Manual	Eng	02/04/2022	
Notes:					

Additional Notes:

Status Codes
1-APP – No Exceptions Taken
2-ANR – Make Corrections Noted
3-R&R – Revise and Resubmit
4-REJ – Rejected
5-IPO – For Information Purposes Only
6-NRR – Not Required for Review
ENG – Submitted to Engineer

Sincerely,
Hart Engineering Corporation

_____ DATE: 02/04/2022

AMWELL®
A DIVISION OF McNISH CORPORATION

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NORTH AURORA, IL 60542
PHONE (630) 898-6900
FAX (630) 898-6901
E-MAIL amwell@amwell-inc.com

January 19, 2022

VIA E-mail: jramos@hartcompanies.com
info@totalmech.net
jdeluca@aquasolutionsinc.net

Total Mechanical Service Corporation
1 Park Place
Plymouth, Massachusetts 02360

Attention: Katryna Nilson

Subject: Taunton, Massachusetts
Wastewater Treatment Facility
Solids Handling Improvements
Model "HT" Gravity Sludge Thickener
P.O. No. 2021-16 & Dated 07/14/2021
AMWELL S.O. A22060
Information, Operation & Maintenance Manual

Dear Ms. Nilson:

In accordance with our proposal 21-0035, we are pleased to send a PDF copy of the Installation, Operation and Maintenance Manual for the Model "HT" Gravity Sludge Thickener Equipment we are furnishing on the subject project.

Feel free to call if you have any questions or if we can be of any further assistance.

Sincerely,

AMWELL®
A Division of McNish Corporation

Arthur L. Benner

Arthur L. Benner
Engineering Manager

ALB/jlb

AMWELL®
Aurora, Illinois

TAUNTON, MASSACHUSETTS

WASTEWATER TREATMENT FACILITY
SOLIDS HANDLING IMPROVEMENTS
SPEC. SECTION 11326 – SLUDGE THICKENER EQUIPMENT
MODEL “HT” CIRCULAR GRIT COLLECTOR MECHANISM

AMWELL S.O. A22060

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INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS

PROJECT ..... WASTEWATER TREATMENT FACILITY
SOLIDS HANDLING IMPROVEMENTS
TAUNTON, MASSACHUSETTS

ENGINEER ..... BETA ENGINEERING

CONTRACTOR/PURCHASER ..... TOTAL MECHANICAL SERIVCE CORP.
1 PARK PLACE
PLYMOUTH, MA 02360

ATTN: KATRYNA NILSON
PHONE: (508) 746-1183

P.O. NO.: 2021-16 & DATED 07/14/2021

AMWELL REPRESENTATIVE ..... AQUA SOLUTIONS, INC.
154 WEST GROVE STREET, UNIT D
MIDDLEBORO, MA 02346

CONTACT: JIM DELUCA
PHONE: (508) 947-5777
FAX: (508) 861-0733

SPECIFICATION REFERENCE ..... 11326 – SLUDGE THICKENER EQUIPMENT

AMWELL IDENTIFICATION NO. ..... S.O. A22060 – TWO (2) MODEL “HT” GRAVITY SLUDGE THICKENERS

SUBMITTED ..... JANUARY 19, 2022

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SECTION A

GENERAL INFORMATION

ALL EQUIPMENT

PARTS SUPPLIER

If a problem is encountered in installing or operating the equipment which cannot be solved by referring to the available material, please contact:

AMWELL
A Division of McNish Corporation
161 S. Lincolnway, Suite 310
North Aurora, Illinois 60542

Phone: (630) 898-6900
Fax: (630) 898-6901

Attention: Customer Service Department

PROCESS EQUIPMENT

GENERAL INFORMATION

All instructions are written as an aid to the erector and user. It is important to thoroughly read and study these instructions before erecting or operating the equipment. A few minutes spent reading these instructions might save unnecessary hours of re-doing some part of the erection of this equipment.

The procedures outlined are recommended by AMWELL and are a compilation of many years of experience. Should additional information not contained in this manual be needed, do not hesitate to contact our offices.

PROCESS EQUIPMENT

SPECIAL INSTRUCTIONS TO EQUIPMENT ERECTORS

A. RECEIVING SHIPMENT

All material has been thoroughly checked and inspected prior to shipment. We have taken precautions to protect the equipment against damage or losses during shipment. If the equipment is received in bad condition or the number of pieces are not as listed on the bill-of-lading or attached packing list, make sure you note this on the bill-of-lading and have the driver sign and acknowledge same. This enables you to place the proper claims against the freight company.

It is also strongly recommended that you give the itemized packing list to one person and have them verify upon receipt that all nuts, bolts, washers, etc. are received. This person should be held responsible for their storage and distribution as needed.

B. STORAGE

Proper storage of the equipment before and during installation is the responsibility of the erector. Specific storage instructions are covered elsewhere.

C. INSTRUCTIONS

Drawings and erection or installation instructions must be followed to assure proper sequences. In case of minor discrepancies, the drawings should govern. In the event of major discrepancies, notify AMWELL immediately.

D. FIELD INSTALLATION

As we do not anticipate problems with the installation of our equipment we assume the erector will follow the guidelines of the AISC "Code of Standard Practice". Specifically, Section 5-7.12. Because of the nature of an engineered fabricated product, a certain amount of fit-up and adapting must be done by the erector and is considered a normal part of installation, as well as any special tools needed for installation.

E. FIELD CHARGES

AMWELL will not accept any charge for modification, servicing, adjustment or for any other item without written authority in the form of a PURCHASE ORDER issued from the home office at Aurora, Illinois IN ADVANCE of doing the work. This authority will only be given when satisfactory proof is submitted and the authority will only then be issued providing the price is agreed upon and the authority is given as outlined above BY OUR CLAIMS MANAGER.

ANY BACKCHARGE SUBMITTED CONTRARY TO THIS AGREEMENT WILL BE REJECTED IN TOTAL WITHOUT CONSIDERATION.

PROCESS EQUIPMENT

STORAGE INSTRUCTIONS & PROTECTIVE PRECAUTIONS

If materials and equipment are to be stored or not used for 30 days, precautions should be taken to protect against corrosion and assure operating condition.

GENERAL STORAGE PRECAUTIONS

1. Be sure drive units are stored in normal operating position.

2. If possible, store drive units and all other parts in a dry, well ventilated building with a constant temperature.

3. When drive units are not installed, but must be stored outdoors:

    a. Place units on wooden blocks elevated above ground. Usually shipping crates or skids will often do. Be sure units are even and on firm supports. Do not store where water can collect.

    b. If shipping covers have been damaged or removed, cover with canvas or tarpaulin. Allow for adequate ventilation. Do not totally enclose with visqueen or plastic covers.

    c. Locate in an area out of the way of traffic. If possible store in a shaded area protected against the elements.

4. Apply a corrosion inhibitive agent to all unpainted metals such as drive shafts. For short periods, a coat of oil is sufficient.

SHORT TERM STORAGE - DRIVE

If equipment is to be installed upon receipt but will not operate for two months or less, leave power connected. Fill drive unit per the Lubrication Instructions in this manual. Operate equipment about twice a week for 5 minutes to lubricate moving parts. If motors are furnished with space heaters, leave connected throughout the non-operative period.

LONG TERM STORAGE - DRIVE

1. Store spur gear units in a sheltered location away from chemical vapors and moisture.

LONG TERM STORAGE - DRIVE (continued)

2. Avoid storage in direct sunlight. This will prevent ultra-violet damage to the seals, paint, and installation labels. This will also minimize the formation of condensation within the primary, intermediate and final gearboxes.

3. Primary drive reducers and gearmotors lubricant levels should be checked. Long term storage preparations should be completed in accordance with the motor and primary reducer manufacturer's recommendations, found in this manual. Remove breather plugs (if provided) and replace with breather vents to prevent leakage due to pressure build-up. Tag units "Service and fill to normal lubricant level before placing into service, see manufacturer's instructions."

4. Coat primary drive input shaft and seal (if applicable), output seal, output shaft with petrolateum (Cosmoline), a water resistant grease or commercial rust inhibiting coating such as Nox Rust X-110, Daubert Chemical Company, Inc. or RUST VETO 344, Houghton Fluid Technology & Service Worldwide, or equal, that can be readily removed with solvent.

5. Unpainted machined surfaces should be coated with petrolateum, a water resistant grease, or a commercial coating.

6. The drive unit is shipped without any lubricating oils. Fill the intermediate worm gear and final spur gear sumps with proper grades and types of lubricants to normal oil levels in accordance with Lubrication Instructions found in this manual, and add a vapor phase rust inhibitor such as Nox Rust Motorstor VCI-10 Oil, Daubert Chemical Company, Inc. or equal. Do not remove the worm gear breather vent. The worm gear requires functional breather vents to avoid pressure buildups caused by changes in ambient temperatures. The drive should then be resealed. Tag units "drain, flush & refill to normal oil levels before placing into service."

7. Temporary power should be connected and the drive run for eight (8) hours to warm and distribute the oil to the gears and allow the Nox Rust Motorstor VCI-10 to properly mix. After rotating drive, disconnect temporary power.

8. Remove chain guard and coat drive chain with grease. Coat sprockets and shear pin hubs (if provided) with petrolateum (Cosmoline), a water resistant grease or rust inhibiting coating such as Nox Rust X-110, Daubert Chemical Company, Inc. or RUST VETO 344, Houghton Fluid Technology & Service Worldwide. Reinstall chain guard.

LONG TERM STORAGE - DRIVE (continued)

9. The drive unit greaseable bearing has been filled at the factory, at the lubrication fitting – provide 2 or 3 shots of #2 soft bearing grease. Lubricate motor bearings in accordance with manufacturer's recommendations.

10. Connect temporary power and rotate drive through at least one (1) full revolution of the spur gear output to distribute lubrication every 4 weeks if stored indoors, and every 2 weeks if stored outdoors. Disconnect temporary power after drive has been rotated.

11. Visually inspect the motor and primary reducer/gearmotor, intermediate worm gear, and final spur gear weekly. Drain any condensate from the primary reducer, worm gear and spur gear oil sumps weekly. The amount of condensate drained will dictate increased or reduced frequency of this check. Top off oil levels with the appropriate lubricants as necessary.

12. Replenish vapor phase rust inhibitor in gear sumps at least every three (3) months of long term storage.

13. Recoat all machined surfaces previously coated with petrolateum (Cosmoline), a water resistant grease or commercial rust inhibiting coating such as Nox Rust X-110, Daubert Chemical Company, Inc. or RUST VETO 344, Houghton Fluid Technology & Service Worldwide, as necessary and at least every six (6) months of long term storage.

14. Refer to Lubrication and Maintenance Instructions found in this manual for winterizing procedures.

LONG TERM STORAGE - STRUCTURAL STEEL

Inspect painted surfaces for deterioration of primer paint. Remove corrosion and rust. Re-paint as necessary with identical type of primer. Shop primed surfaces should be finish-coated within the time specified by the paint manufacturer. When in doubt apply finish coats as soon as possible.

AMWELL cannot accept responsibility for shop primer coats that have deteriorated due to exposure and time.

PROCESS EQUIPMENT

STORAGE INSTRUCTIONS & PROTECTIVE PRECAUTIONS

SHOP PRIMER DURABILITY - STRUCTURAL STEEL

Shop primer paints are to serve as a minimal protective finish. AMWELL will not be responsible for condition of primed or finished painted surfaces after the equipment leaves its shop. Purchasers are invited to inspect painting in our shops for proper preparation and application prior to shipment. AMWELL assumes no responsibility for field surface preparation or touch-up of shipping damage to paint. Painting of fasteners and other touch-up to painted surfaces to be by purchaser's painting contractor after mechanism erection.

IMPORTANT NOTE: If, for any reason, AMWELL's paint job is rejected after installation, AMWELL will bear no costs associated with the removal or installation of the equipment to make modifications.

GALVANIZED COATINGS - STRUCTURAL STEEL

Galvanized coatings are designed to serve as a final protective finish. AMWELL will not be responsible for condition of coated surfaces after the equipment leaves its shop. AMWELL assumes no responsibility for field touch-up of shipping damage to coatings.

IMPORTANT NOTE: If, for any reason, AMWELL's galvanizing job is rejected after installation, AMWELL will bear no costs associated with the removal or installation of the equipment to make modifications.

PROCESS EQUIPMENT

HAZARDOUS MATERIAL WARNING

Effective May 25, 2015, the Federal Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (29 CRF 1910, 1200) requires all manufacturers and importers of hazardous chemicals to provide Safety Data Sheets (SDS) to all customers with initial shipment. Steel products, as supplied by AMWELL, in their usual physical form do not pose any health hazards. However, when subject to processing such as welding, burning, grinding, cutting, abrasive blasting, heat treatment, pickling or similar operations potentially hazardous fumes or dust may be emitted. Prolonged, repeated exposure to these processes may cause adverse health effects. When performing any processing, precautions should be taken including use of a dust-fume respirator and eye protection. Gloves are recommended for abrasion.

If you have any questions concerning the content of this letter, please contact us at any time.

PROCESS EQUIPMENT

TO ORDER SPARE OR REPAIR PARTS

To assure the correct parts are received it is most important that the following information is included in your correspondence.

A. SERIAL NUMBER

The serial number is also referred to as the “S.O.” number OR sales order number. This is a 5 or 6 digit number which appears on the equipment nameplate and all related written correspondence to this order. If this cannot be found, we will need to know the site location (project name), approximate years the equipment has been installed or the type of equipment for which parts are needed.

B. PART NUMBERS

Show the part name and number if at all possible. If taken from a drawing, include drawing number.

C. SIZES

Include sizes, if available, such as shaft lengths, diameters, thickness, etc.

D. MODIFIED EQUIPMENT

If the equipment has been modified or altered, please notify us as to what extent. We can only replace parts which were originally manufactured and supplied by **AMWELL**. We cannot accept responsibility if parts do not fit because of altered equipment.

E. ADDRESSES

Include "bill to" and "ship to" addresses. Also include a phone number and person to contact should further information be needed.

PROCESS EQUIPMENT

TO ORDER SPARE OR REPAIR PARTS

F. REQUEST FOR QUOTATION

As the majority of equipment are engineered products, please contact us with all pertinent information for current pricing and availability.

Send your inquiries and purchase order to:

AMWELL
A Division of McNish Corporation
600 N. Commons Drive, Suite 116
Aurora, Illinois 60504

Phone: (630) 898-6900

ATTENTION: PARTS DEPARTMENT

Your equipment is identified as follows:
Please include this number on all correspondence.

SERIAL NUMBER	TYPE OF EQUIPMENT
A22060-4	**Two (2) Model "HT" Gravity Thickener with Model "42H8T" Drive**
	Refer To Section "F" for Ordering Spare Parts

PROCESS EQUIPMENT

GENERAL INFORMATION

BACKCHARGES

AMWELL, A Division of McNish Corporation reserves the right to replace or repair in any manner or by any means, any part proven to be defective in material or workmanship provided buyer given prompt written notice of each defect to AMWELL.

If any equipment is received in bad or damaged condition or if any packages are broken, make a bad order notation to this effect on the shipping papers. This will enable you to place the proper claims against the carrier. Please notify AMWELL immediately, in writing, if any parts are found damaged or broken during shipment.

Correction of minor misfits such as hole misalignment that can be corrected in the field by reaming, cutting or trimming and any fit up as is customarily done in the field is considered a legitimate part of installation and charges therefore, will not be honored by AMWELL.

Any major discrepancies in fabrication or fit up that could affect the structural integrity of the equipment or prevent proper assembly must be reported immediately and in writing to AMWELL. AMWELL will not honor any invoice for corrective work performed by the buyer unless prior written approval has been obtained from AMWELL, before commencement of any work by the buyer. Such approval shall contain a description of the nature and extent of the work to be performed and a firm fixed price based upon a written quotation from the buyer. Invoices that exceed the price authorized will not be honored.

NO BACKCHARGES WILL BE ACCEPTED WITHOUT PRIOR WRITTEN APPROVAL BY AMWELL.

PROCESS EQUIPMENT

GENERAL INFORMATION

WARRANTY POLICY

All equipment furnished by AMWELL, A Division of McNish Corporation is warranted to be free from defects in material and workmanship.

Items not manufactured by AMWELL are warranted or guaranteed to the extent of the manufacturer's warranty.

All storage, assembly and/or installation must be followed explicitly as stated in this manual.

Removal of condensation and lubrication of gear boxes must be as prescribed in this manual.

Prior to being placed in operation, all equipment supplied by AMWELL must be inspected and certified to be in proper operational order. This must be done by an Authorized Field Service Representative of AMWELL after all equipment is completely installed.

Before the inspection can be done, all drive units must be operational with full permanent electrical power and all overload switches must be wired and functional.

The inspection will be limited to reasonably accessible items and does not relieve the installer's responsibility for proper assembly and adjustment.

Unless otherwise specifically authorized in writing, any deviations from the instructions given in this manual and/or operation of the equipment prior to inspection and certification by a Representative of AMWELL will render all equipment warranties, both specific and implied, null and void.

PROCESS EQUIPMENT

GENERAL INFORMATION

FIELD SERVICE

The erection aids material provided by AMWELL should enable you to install, operate and maintain the equipment. This instruction is provided to help you to help yourself and therefore to save you time and expense. If a problem is encountered in installing or operating the equipment which cannot be solved by referring to the available material, please feel free to contact us. Address your inquiry to our Customer Service Department, AMWELL, A Division of McNish Corporation, 161 S. Lincolnway, Suite 310, North Aurora, IL 60542, or call us at (630) 898-6900.

SECTION B

SAFETY INSTRUCTIONS AND PRECAUTIONS

CIRCULAR CLARIFIERS & THICKENERS

SAFETY INSTRUCTIONS AND PRECAUTIONS

SAFETY CONSIDERATIONS

Safety is the basic factor to consider at all times in operation of the collector equipment. Through, the use of proper clothing and tools, with proper applications and methods of handling, you can prevent serious accidents and injury to yourself and your fellow workers.

Drives are to be operated at proper speed, not any higher, or loaded any heavier than shown on nameplate data. Failure to comply could result in personal injury or machinery damage.

Do not work over tanks full of liquid without some form of throwable lifesaving device.

Always think safety first! Caution must be taken with any piece of equipment and especially with moving pieces of equipment and electrical devices.

Appropriate safety procedures and common sense must be used at all times by everyone involved during equipment installation, operation and maintenance.

The installation, operation and maintenance instructions provided in this manual are not a substitute for the installing contractor's or the equipment operator's safety procedures.

SAFETY EQUIPMENT:

- Limit Switch
- Lock-out Switch at Drive Location and Also Remote Location to Turn Off Power to Drive Motor.
- Guards - **DO NOT OPERATE EQUIPMENT WITHOUT SAFETY GUARDS!**

PRE-START SAFETY CHECK AND PRECAUTIONS:

Check to see that nothing is left in the tank, such as ladders, tools, hoses or other foreign objects. Also, make sure there are no workmen or any personnel in the tank before turning it on. Make sure all guards are in place. Make sure overload limit switches are in good condition and have not been bent or damaged.

If they have been damaged in any way, they should be replaced before trying to operate the machinery.

WARNING!: Be sure thickener operates in a clockwise direction. Do not allow drive to operate in a counter-clockwise direction for longer than a momentary period of time (2 seconds max.) or serious damage to the drive will result.

Make sure that all electrical lock-outs work properly both at the drive location and remote locations at the control panel.

Make sure that starting procedure is followed. When starting up new equipment, proceed cautiously, the possibility of errors always exists.

When performing work such as welding, burning, grinding, cutting, blasting or painting it is recommended that dust/fume respirators, safety eyeglasses and gloves be used.

CIRCULAR CLARIFIERS & THICKENERS

SAFETY INSTRUCTIONS AND PRECAUTIONS

PRE-START SAFETY CHECK AND PRECAUTIONS: (Continued)

Work in pairs and have ready a lifesaving preserver or ring when work is being done over a tank full of liquid.

SHUT DOWN PROCEDURE

If possible, turn off flow to the tank and run the thickener until all sludge has been removed. Then, drain the tank and turn the power off to the drive motor and lock out the drive at the drive location. Turn the power off and lock out the power at the main control panel and tag it "OUT OF SERVICE".

WHEN WORKING ON EQUIPMENT FOR MAINTENANCE

Make sure the unit is shut down and locked out, both at the location of the drive unit to be worked on and locked out at the main control panel and tagged "OUT OF SERVICE".

SHUT DOWN PROCEDURE IN CASE OF A BREAKDOWN

It is necessary to drain the tank to determine the problem, if it is continually going into an overload condition. The unit should be locked out electrically and tagged "Out Of Service". At that time, all the water should be pumped from the tank, so that the inspection can be made and find the cause of the problem for the binding or failure of the mechanism.

WARNING!: Never work on the drive unit or mechanism unless it is locked out and tagged **"OUT OF SERVICE".**

ELECTRICAL CONNECTIONS

Do not connect motor without making sure power supply is disconnected. Failure to comply can cause injury to personnel and/or damage to equipment. Do not connect motor without first determining that the power supply, voltage, frequency and phase correspond with the motor nameplate specifications. Wiring, controls and overload devices must comply with a National Electrical Code, local and OSHA requirements.

After determining the compatibility of a motor, connect motor as shown on diagram of nameplate.

Check direction of rotation.

Drives which are not lubricated may be operated only a few seconds without causing damage. To change rotation of 3 phase motors, interchange any two line leads. Refer to motor manufacturer's instructions for more detailed information.

Make sure proper loading is applied to drive, do not exceed the capacity as shown on the nameplate.

SECTION C

OPERATING INSTRUCTIONS

OPERATING INSTRUCTIONS

MODEL "HT" SLUDGE THICKENERS

OPERATING INSTRUCTIONS

PURPOSE

This machine has been designed as a thickening unit in the sludge treatment part of the wastewater treatment system. This thickener is used to separate more water from the sludge solids than can be accomplished in the primary and secondary clarifiers.

PRINCIPLE

This machine consists of rotating arms attached to a driving unit containing an integral bearing for supporting the mechanism with sludge rake arms for moving sludge to a center sludge hopper for discharge. The influent is introduced through the influent pipe. The influent, upon exiting from the influent pipe, has its entering velocity dissipated by means of a feedwell surrounding the center column and supporting cage for the mechanism. The influent then leaves the feedwell at its bottom in a uniform radial pattern.

The supernatant (or clarified effluent) overflows a V-notched weir extending around the outside of the tank into a collection launder and then flows to the supernatant discharge pipe.

Sufficient detention time has been designed into the sizing of the mechanism so that the solids in the influent well settle out to the tank bottom along a flow path from tank center to outer wall.

It is essential that the weirs be absolutely level in order that a steady and uniform liquid flow will discharge at all points. Irregularity in this level will cause more flow at the low points, and the consequent increase in velocity will likely carry fine suspended solids into the effluent. V-notched weirs are used to minimize the effect of wind across the liquid surface which might produce unequal weir loading.

The thickened sludge is raked inwardly to the center sludge hopper. This sludge is then discharged periodically to waste through the sludge draw-off pipe.

STARTING PROCEDURE

It is assumed that the machine is properly installed and thoroughly lubricated, that all parts are in alignment and proper clearance exists between the mechanism and concrete at all points, that the bottom of the tank has been screeded in, and that the arms have been adjusted so that there is proper clearance between squeegees and the tank bottom at all points throughout the complete revolution of the raking mechanism. There should be minimum clearance between each squeegee and the tank bottom at all times during a complete revolution of the raking mechanism. The clearance between the tank bottom and the squeegee should not exceed 1/2 inch over any appreciable area.

The mechanism should be run before allowing any feed to enter the tank and any discrepancies noted and corrected.

MODEL "HT" SLUDGE THICKENERS

OPERATING INSTRUCTIONS

STARTING PROCEDURE - (Continued)

After operating the mechanism in a dry tank for several hours, flow may be admitted while the mechanism continues to operate.

NORMAL OPERATION

The thickener mechanism and the sludge pumps should be operated as required in order that a sludge build-up will not occur to the point where it begins to overflow with the supernatant.

OPERATING PROBLEMS AND CORRECTIONS

Although provision has been made to minimize damage resulting from objects such as tools, rocks, rags and other foreign bodies being dropped into the tank, it is imperative that these objects be removed before continuing the mechanism operation.

1. Sludge Suction Lines Become Plugged

It is unlikely that the main sludge return line will become plugged, however, if it does, it will become evidenced by lack of sludge flow. It will be necessary to locate the problem and correct the situation.

2. Overload Alarm Sounds or Stops Motor (Ref. Dwg. D705-53988-171)

The purpose of the overload alarm is to warn the operator when the drive unit reaches a preset output torque. The most common cause of high torque is excessive depth of settled solids in the clarifier. The cause of any alarm or shutdown should be thoroughly investigated and eliminated as any attempt to operate the mechanism in this condition may seriously damage the machine.

The overload system is designed to cut power to the drive when a predetermined torque is reached by the gear. It has no ability to sense misalignment or damage occurring to the mechanism caused by continued rotation. If a misalignment occurs the gear will continue to rotate without regard to damage and will stop only if the torque sensed at the gear reaches the cut-out torque.

If an overload alarm sounds or cuts the power, there may be an accumulation of sludge in the tank which has been gradually building up due to the sludge being discharged at an average rate less than the rate of introduction of solids with the feed. It will be necessary to increase the rate of sludge draw-off in order to bring a sludge level to the appropriate elevation. Should the sludge load become so heavy that torque build-up occurs in the machine, the increased torque will force the worm shaft (Ref. 9) towards the spring housing (Ref. 21) depressing the spring (Ref. 20) and forcing the thrust rod (Ref. 19) to actuate the first limit switch sounding the alarm (Set at 28,500 ft. lbs.) and the operator will then know that something is causing an overload on the mechanism.

OPERATING PROBLEMS AND CORRECTIONS - (Continued)

2. Overload Alarm Sounds or Stops Motor - (Continued)

If the overload continues to increase, forcing the worm shaft (Ref. 9) to depress the spring (Ref. 20) still further until the cut-out torque of 31,800 ft. lbs. is reached, the drive control will cut electrical power to the drive unit thereby stopping the mechanism rotation. Should this occur, it will be necessary to somehow remove the sludge from the tank. This is possible by draining the sludge, or draining the tank and sluicing out the sludge. It is also possible that some foreign object may have dropped into the tank accidentally. If this occurs the mechanism may become overloaded and sound the alarm and stop. If this occurs, the object should be removed which is causing the obstruction and overload.

Additional protection is provided by means of a shear pin hub assembly which is designed to shear at approximately 37,100 ft. lbs.

It might be necessary to bypass the influent if the obstruction cannot be located rather quickly, as it may be necessary to drain the tank. Resetting of the overload device is not required. The spring automatically returns the shaft to its pre-overload position when the drive is stopped.

IMPORTANT NOTE: It is very important that once the cut-out limit switch has shut the drive down, it stays down until restarted manually. Design electrical system so that drive cannot restart by simply releasing pressure on cut-out limit switch.

Also, if a very gradual increase in the torque load is noted on the drive control indicator, it is possible that grit or silt is being introduced with the influent. Since there is no way for this material to be removed normally, it will gradually overload the mechanism until the alarm sounds. It will then be necessary to remove the cause of the overload.

Usually, provision is made to insure that grit and silt are removed from the influent to a thickener of this construction and it is very unlikely that this kind of load will occur. In the event that an overload does occur, due to any reason, it is necessary to observe the following guidelines:

DO NOT ATTEMPT TO KEEP ON RUNNING WHEN AN OVERLOAD IS INDICATED!

FIND THE TROUBLE AND CORRECT IT!

DO NOT START UP WITH A LOAD OF SLUDGE IN THE TANK!

DO NOT TAMPER WITH THE OVERLOAD ALARM SWITCH ADJUSTMENTS IN AN ATTEMPT TO KEEP THE MACHINE RUNNING UNDER OVERLOAD CONDITIONS!

MODEL "HT" SLUDGE THICKENERS

OPERATING INSTRUCTIONS

ATTENTION:

1. All bolts and nuts should be kept tight and original alignments and adjustments maintained. Inspection should be made at regular intervals.

2. Whenever possible, examine gear and all wearing parts periodically to determine whether excessive wear is taking place. Open all condensate drains on the drive unit bearings.

3. Test the overload alarm at least once per week to make certain that the mechanism is protected.

4. If the power is shut off, or if the mechanism is stopped for any reason longer than an hour, bypass the flow until the machine is started again.

5. Keep the machine and surroundings clean and touch up all rust spots or other paint damage frequently.

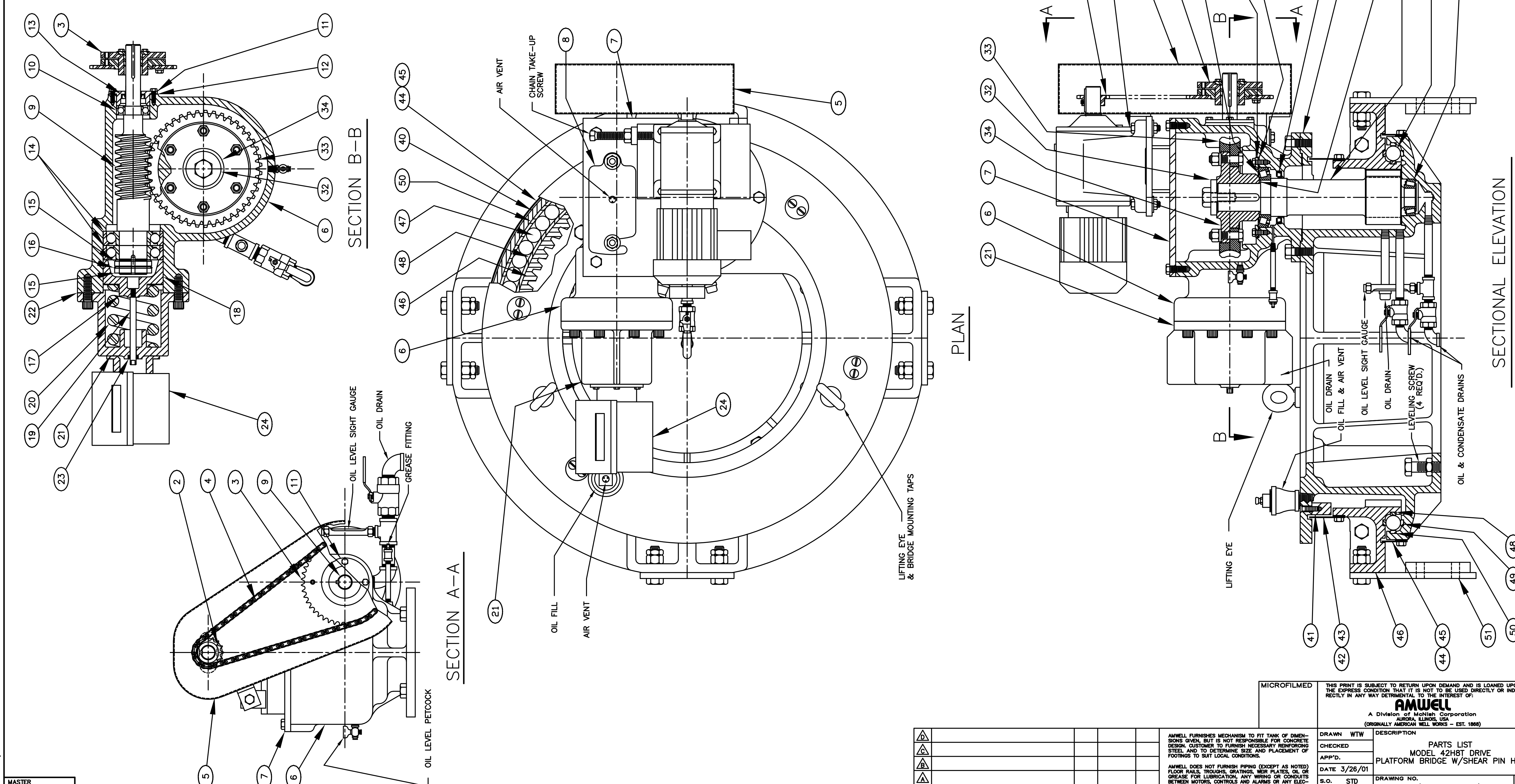
6. The entire mechanism above and below water line should be inspected once every year and painted as required.

LUBRICATION

Lubrication instructions and recommended lubricants are found in section "D" of this manual.

DRIVE ASSEMBLY
PARTS LIST DRAWING

REF	DESCRIPTION
1	GEARMOTOR
2	DRIVE SPROCKET – KEYED
3	DRIVEN SPROCKET – SHEAR PIN
4	ROLLER CHAIN
5	CHAIN GUARD
6	WORM GEAR HOUSING
7	WORM GEAR HOUSING COVER
8	INSPECTION & OIL FILL COVER
9	WORM SHAFT
10	BEARING
11	BEARING CAP
12	BEARING CAP GASKET
13	OIL SEAL – LIP IN
14	BEARING
15	LOCKNUT
16	LOCKWASHER
17	THRUST RING
18	SHIM
19	THRUST ROD
20	SPRING
21	SPRING HOUSING
22	SPRING HOUSING GASKET
23	OIL SEAL – LIP OUT
24	TORQUE OVERLOAD ASSEMBLY
32	WORM GEAR RETAINER
33	WORM GEAR
34	WORM GEAR HUB – KEYED
35	PINION SHAFT
36	BEARING
37	BEARING RETAINER
38	OIL SEAL – LIP IN
39	BEARING
40	SPUR GEAR HOUSING
41	SPUR GEAR HOLD-DOWN BLOCK
42	DUST SHIELD – SPLIT
43	DUST SHIELD SEAL
44	DUST SHIELD – SPLIT
45	DUST SHIELD SEAL
46	SPUR GEAR
47	BEARING BALL
48	REPLACEABLE BEARING RACE
49	REPLACEABLE BEARING RACE
50	REPLACEABLE BEARING RACE
51	DRIVE CAGE ATTACHMENT LUG
52	RETAINER SHIM SET
53	HUB SHIM SET



MICROFILMED

AMWELL
A Division of McNish Corporation
AURORA, ILLINOIS, USA
(ORIGINALLY AMERICAN WELL WORKS – EST. 1868)

AMWELL FURNISHES MECHANISM TO FIT TANK OF DIMENSIONS GIVEN, BUT IS NOT RESPONSIBLE FOR CONCRETE DESIGN. CUSTOMER TO FURNISH NECESSARY REINFORCING STEEL AND TO DETERMINE SIZE AND PLACEMENT OF FOOTINGS TO SUIT LOCAL CONDITIONS.

AMWELL DOES NOT FURNISH PIPING (EXCEPT AS NOTED) FLOOR RAILS, TROUGHS, GRATINGS, WEIR PLATES, OIL OR GREASE FOR LUBRICATION. ANY WIRING OR CONDUITS BETWEEN MOTORS, CONTROLS AND ALARMS OR ANY ELECTRICAL EQUIPMENT OF ANY KIND EXCEPT AS SPECIFICALLY STATED IN AMWELL SPECIFICATIONS.

SYM	REVISION	BY	DATE	CHKD
D				
C				
B				
A				

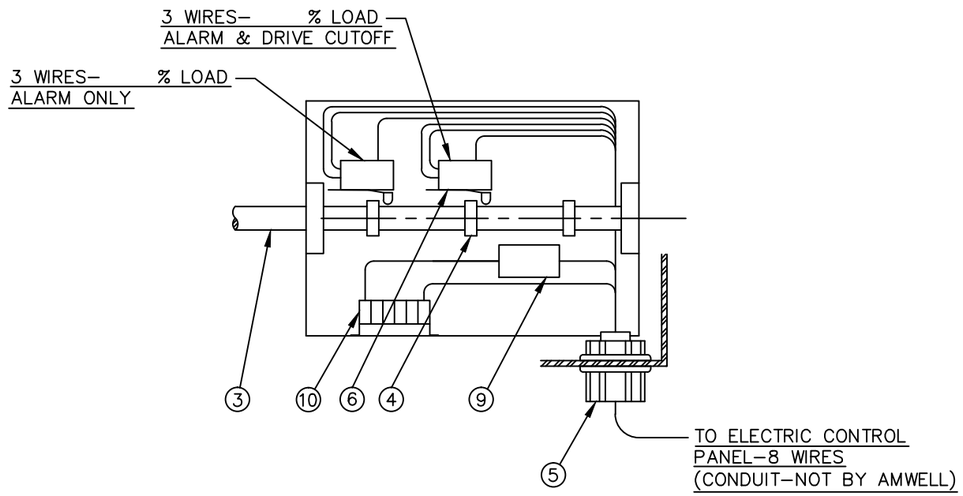
DRAWN WTW	DESCRIPTION: PARTS LIST MODEL 42H8T DRIVE PLATFORM BRIDGE W/SHEAR PIN HUB
CHECKED	
APP'D.	
DATE 3/26/01	
S.O. STD	DRAWING NO. D,7,0,5 5,3,9,8,8 1,7,1 — REV.
SCALE NONE	

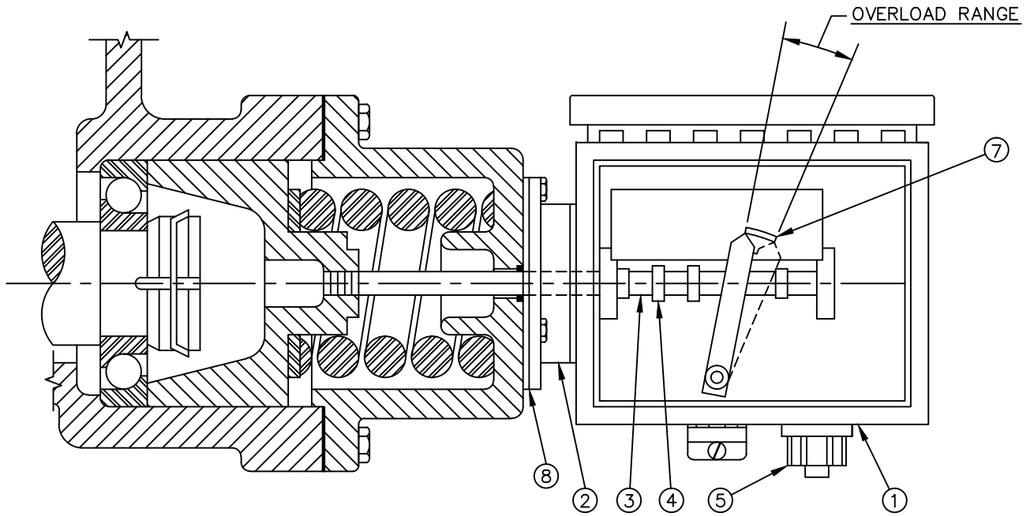
MASTER D-46888

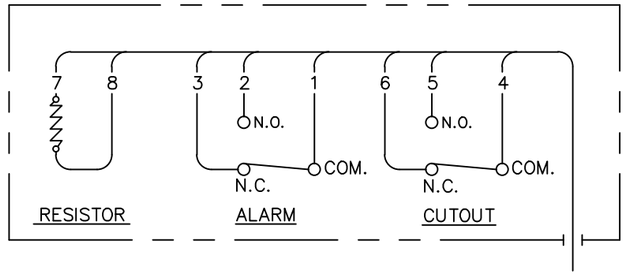
CAD FILE:F:\D53988 PLOT SCALE=0.25

TORQUE INDICATOR BOX ASSEMBLY

NO.	DESCRIPTION	MAT'L	QTY	PART NO.
1	ENCLOSURE NEMA 4X	S.S.	1	
2	ATTACHMENT RING	A–519	1	
3	THREADED ROD 1/4"–28 UNF	304 S.S.	1	
4	CLAMP COLLAR 1/4"–28 UNF	CAD PL	3	
5	CONDUIT HUB RIGID 1/2"	GALV.	1	
6	MICRO SWITCH		2	
7	RANGE MARKER	PAPER	1	
8	OVERLOAD DIAPHRAGM	NEOP.	1	
9	THERMOSTAT		1	
10	POWER RESISTOR (HEATER)		1	







1–REMOTE ALARM SYSTEM
A–NORMALLY OPEN ALARM CONTACT–TERMINALS 1 & 2
B–NORMALLY CLOSED ALARM CONTACT–TERMINALS 1 & 3

2–MOTOR OVERLOAD CUTOUT
A–NORMALLY OPEN CONTACT–TERMINALS 4 & 5
B–NORMALLY CLOSED CONTACT–TERMINALS 4 & 6

3–REFER TO CONTRACT DRAWINGS FOR OVERLOAD & ALARM CIRCUITRY.

4–FOR MAINTAINED CONTACT CONTROL SYSTEM, LOCKOUT DEVICE IS RECOMMENDED.

CAD FILE: C76003A PLOT SCALE=1

MASTER
C-41184

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(ORIGINALLY AMERICAN WELL WORKS – EST. 1868)

SYM	REVISION	BY	DATE	CHKD
D				
C				
B				
A				

AMWELL FURNISHES MECHANISM TO FIT TANK OF DIMENSIONS GIVEN, BUT IS NOT RESPONSIBLE FOR CONCRETE DESIGN. CUSTOMER TO FURNISH NECESSARY REINFORCING STEEL AND TO DETERMINE SIZE AND PLACEMENT OF FOOTINGS TO SUIT LOCAL CONDITIONS.

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DRAWN	WTW
CHECKED	
APP'D.	
DATE	7/10/14
S.O.	STD
SCALE	NONE

DESCRIPTION
PARTS LIST
TORQUE INDICATOR BOX ASSEMBLY

DRAWING NO. C,7,0,5|7,6,0,0,3|1,7,1 REV.

LIMIT SWITCH INFORMATION

Honeywell

MICRO SWITCH™ Hazardous Location Switches

EX Series

Datasheet

MICRO SWITCH™ Hazardous Location Limit Switches

Table 5. Replacement Catalog Listings

EX Series Part Number	Internal Switching Element/ Basic Switch	Actuator	Internal Springs
EXA-AR	BA-2R-P4	6PA5-EX	33PA6-EX
EXA-Q	BZ-2R-P4	8PA15-EX	–
EX-AR	BZ-2R-P4	6PA5-EX	33PA7-EX
EX- AR128	BZ-2R-P4	6PA130-EX	33PA7-EX
EX-AR16	BZ-2RW88-P5	6PA5-EX	–
EX-AR1613	BZ-2RW88-P5	6PA136-EX	–
EX-AR20*	BZ-2R-P4	*	33PA7-EX
EX-AR30	BZ-2R-P4	6PA5-EX	33PA5-EX
EX-AR50	BZ-2R-P4	6PA134-OP	33PA7-EX
EX-AR800	BZ-2R-P4	6PA5-EX	33PA7-EX
EXD-AR-3	DT-2R4-A7	6PA5-EX	33PA6-EX
EXD-AR30-3	DT-2R711-A7	6PA5-EX	33PA5-EX
EXD-Q-3	DT-2R-A7	8PA77-EX	–
EXH-AR3	4HS202	6PA5-EX	33PA6-EX
EXH-AR33	4HS203	6PA5-EX	33PA6-EX
EX-N15	BZ-2R15-P4	8PA12-EX	–
EX-Q	BZ-2R-P4	8PA15-EX	–
EX-Q800	BZ-2R-P4	8PA15-EX	–
Double Conduit			
1EX1	BZ-2R-P4	6PA5-EX	33PA6-EX
2EX1	BZ-2R-P4	6PA5-EX	33PA6-EX
4EX1-3	DT-2R4-A7	6PA5-EX	33PA6-EX

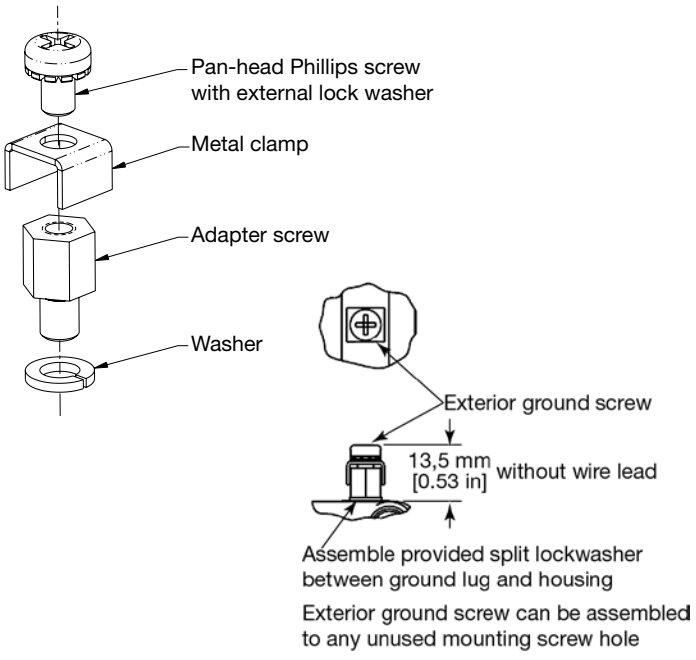
* Order levers separately

Table 6. Actuator Order Codes

	Type	Part Number
	One-way roller lever (for CW actuation)	6PA130-EX (bronze roller)
	One-way roller lever (for CCW actuation)	6PA142-EX (bronze roller)
	Adjustable length roller lever 43 mm to 76 mm [1.7 in to 3 in]	6PA138-EX (nylon roller)
	Rod lever 134 mm [5.28 in]	6PA136-EX (aluminum rod)
	Adjustable length 317,5 mm [12.5 in] max. rod lever with 25,4 mm [1 in] nylon roller	6PA204-EX
	Roller lever	6PA5-EX (bronze roller) 6PA127-EX (nylon roller)

GROUNDING SCREW ASSEMBLY

(for equipped models only)



MICRO SWITCH™ Hazardous Location Limit Switches

Table 8. Additional Available EX Lstings

Listing	CW	CCW	Plunger	SPDT	DPDT	2-CKT DB	1 A	10 A	15 A	20 A	Class 1 Group B	Pre-leaded
EXA-AR62	✓									✓		
EXA-N			✓	✓						✓		
EX-AR1620				✓					✓			
EX-AR-1621				✓					✓			
EX-AR182	✓			✓					✓			
EX-AR30		✓		✓					✓			
EX-AR400	✓			✓			5 A					
EX-AR420	✓			✓			5 A					
EX-AR471-15	✓					✓			✓			15 ft
EX-AR471-3	✓					✓			✓			3 ft
EX-AR68	✓			✓					✓			
EX-AR8	✓			✓					✓			
EX-AR800	✓			✓					✓		✓	
EX-AR830		✓		✓					✓			
EX-AR87	✓			✓					✓			
EXD-AR20-3	✓				✓			✓			✓	3 ft
EXD-AR-3	✓				✓			✓			✓	3 ft
EXD-AR30-3		✓			✓			✓			✓	3 ft
EXD-AR30-6		✓			✓			✓			✓	6 ft
EXD-AR62-3	✓				✓			✓			✓	3 ft
EXD-AR87-3	✓				✓			✓			✓	3 ft
EXD-N-3			✓		✓			✓			✓	3 ft
EXD-Q26-2			✓		✓			✓			✓	3 ft
EXD-Q-3			✓		✓			✓			✓	2 ft
EXD-Q62-3			✓		✓			✓			✓	3 ft
EXH-AR2	✓			✓			✓					✓
EXH-AR3	✓			✓			✓				✓	10.5 ft
EXH-AR33		✓		✓			✓				✓	10.5 ft
EXH-AR7	✓			✓			✓				✓	3 ft
EXH-AR7-R1	✓			✓			✓				✓	
EXH-N			✓	✓			✓				✓	
EXH-Q26-2			✓	✓			✓				✓	
EXHT-AR403	✓			✓			3 A					
EX-N15			✓	✓				✓				
EX-N152			✓	SPNO				✓				
EX-Q			✓	✓					✓			
EX-Q1			✓	SPNO				✓				
EX-Q171			✓	✓								
EX-Q173			✓	✓								
EX-Q19			✓	✓								
EX-Q22			✓	✓								
EX-Q62			✓	✓								
EX-Q800			✓	✓					✓		✓	
Double Conduit												
4EX1-3	✓				✓			✓				3 ft
4EX5-3	✓				✓			✓				3 ft

OPERATION & MAINTENANCE OF SHEAR PIN OVERLOAD

CIRCULAR CLARIFIERS

OPERATION & MAINTEANCE OF SHEAR PIN OVERLOAD

OPERATION

This device serves as a backup overload device to the normal limit switch overload system.

If the shear pin should break the cause of the overload should be determined and corrected also an investigation should be made as to why the alarm and shut-down limit switches did not function properly.

MAINTENANCE

Semi-Annually: Remove chain and sprocket and smear grease on the keyed hub to ensure freedom of operation in case of shear pin failure.

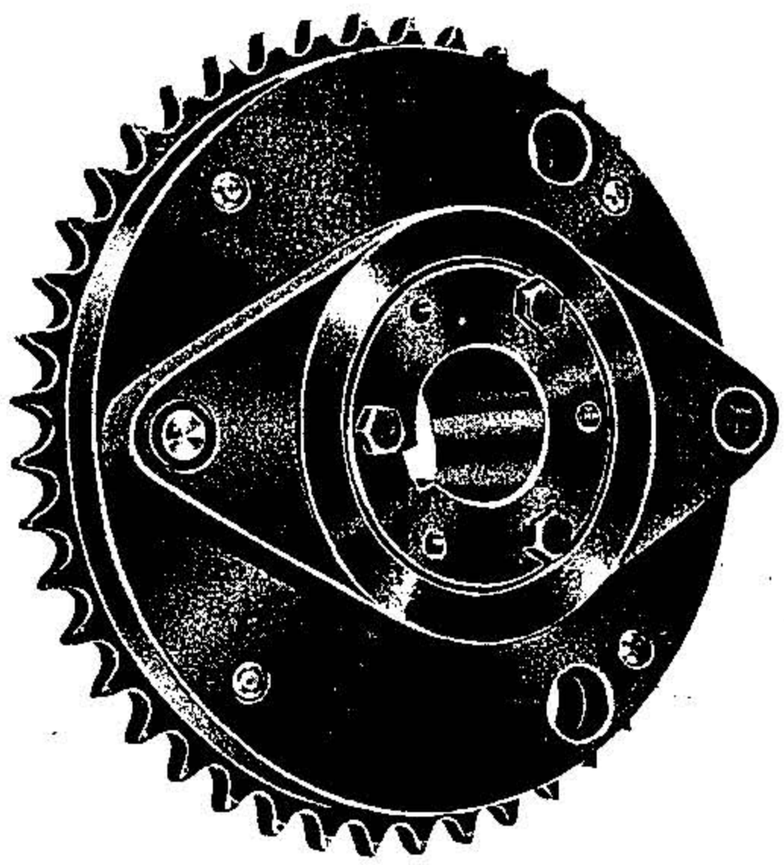
BROKEN SHEAR PIN REMOVAL

1. Remove chain guard.
2. Remove drive chain.
3. Loosen setscrews locking shear pin in place.
4. Manually rotate sprocket until the broken pin lines up with hole “C” (see drawing) so that the broken pin can be driven out. Continue to rotate sprocket until either hole “A” or “B” lines up with the broken pin in the keyed hub so it can also be driven out.
5. Inspect shear pin liners for damage or “rounding” of shear faces.

SHEAR PIN INSTALLATION

1. With drive chain removed, manually rotate sprocket until shear pin liners line up.
2. Install shear pin making sure neck of pin is centered between shear faces of shear pin liners.
3. Install and securely tighten setscrews locking pin in place.
4. Install drive chain.
5. Replace chain guard.

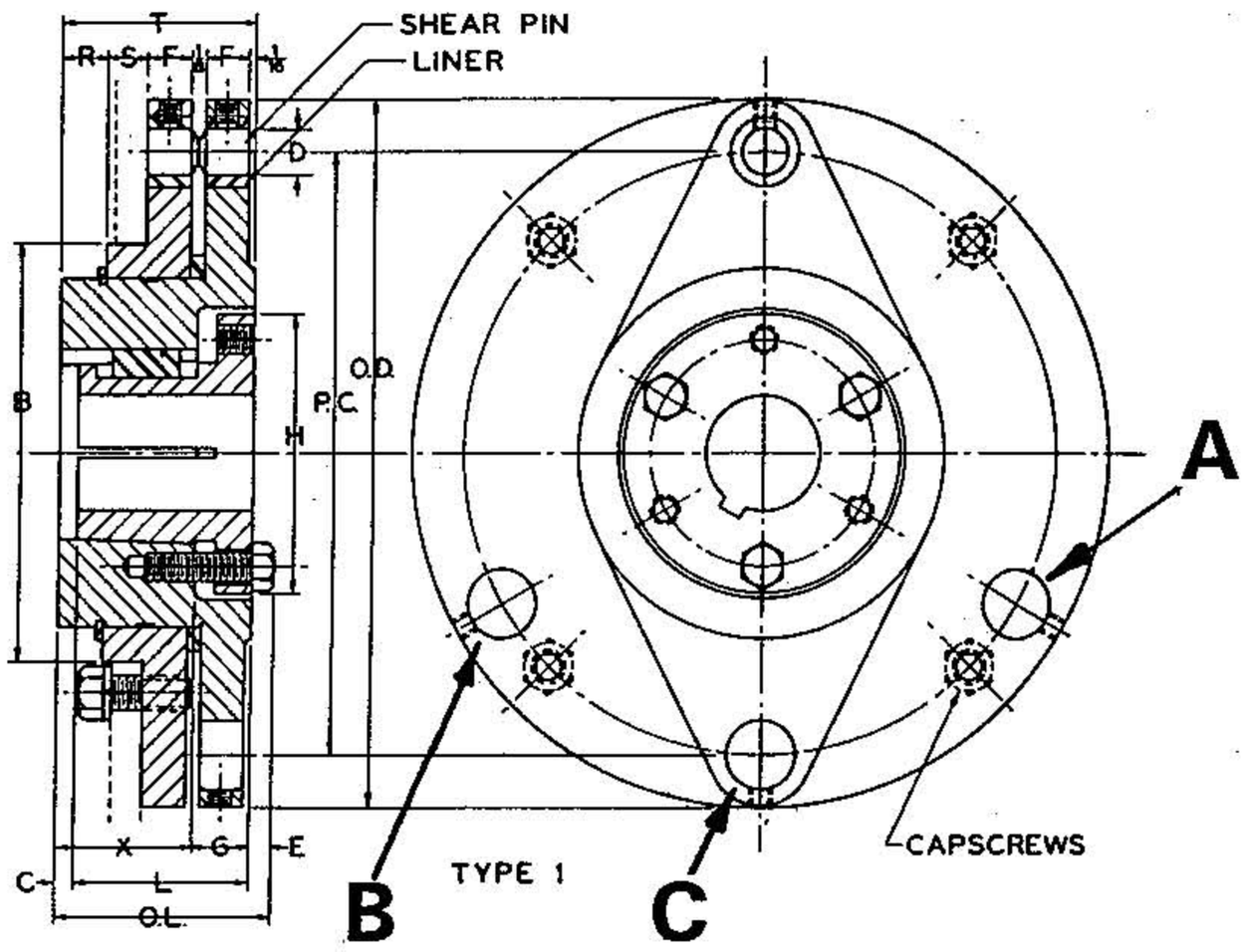
AMWELL A Division of McNish Corporation	INSTRUCTION / SERVICE MANUAL	SHEET NO. PAGE 2 OF 2
PRODUCT CODE CIRCULAR CLARIFIERS		ISSUED 3/27/90
SUBJECT OPERATION & MAINTENANCE OF SHEAR PIN OVERLOAD		SUPERSEDES 7/2/87



Shear Pin Hubs are designed to prevent damage to machinery due to sudden overload or jamming, by shearing the necked pin at a predetermined load. The inner part of the hub is keyed to the shaft and remains stationary while the outer part, to which the sprocket is bolted, rotates freely after pin breakage, allowing the drive to idle.

Shear Pin Hubs and Sprockets consist of three separate stock parts:

1. Steel Sprockets
2. Hub Assembly
3. Malleable Bushing



Stock Shear Pin Hubs—Specifications

Part No.	Type	Dimensions																Capscrews	
		O.D.	O.L.	P.C.	B	C	D	E	F	G	H	L	P	R	S	T	X	No.	Size
~~SHH1~~	1	5½"	2¼"	4.500"	3.250"	13/16"	¼"	3/16"	½"	7/16"	2½"	1¼"	—	½"	5/16"	2 1/16"	1 5/8"	3	3/8
SHP1	1	7⅝	2⅜	6.500	4.500	5/16	3/8	¼	½	5/8	3	1 15/16	—	½	7/16	2⅛	1½	3	½
~~SHQ1~~	1	10	3 3/32	8.625	6.000	½	½	9/32	¾	¾	4⅛	2½	—	1 1/16	⅝	3	2¼	4	½
SHR1	1	13	3 11/32	11.250	7.500	5/16	½	9/32	¾	⅞	5⅜	2⅞	—	⅝	¾	3 1/16	2 3/16	4	⅝

Stock Shear Pins

Shear Pin Neck Diameter	Shear Pin Hub Number															
	~~SHH1~~				SHP1				~~SHQ1~~				SHR1			
	Pin Part No.	In. Lbs. Torque	H.P.@ 100 R.P.M.	Minimum Recommended Shaft Dia.	Pin Part No.	In. Lbs. Torque	H.P.@ 100 R.P.M.	Minimum Recommended Shaft Dia.	Pin Part No.	In. Lbs. Torque	H.P.@ 100 R.P.M.	Minimum Recommended Shaft Dia.	Pin Part No.	In. Lbs. Torque	H.P.@ 100 R.P.M.	Minimum Recommended Shaft Dia.
3/32"	1H	930	1.4	¾"	1P	1340	2.1	⅞"								
⅛	2H	1660	2.6	⅞	~~2P~~	~~2390~~	~~3.8~~	1								
5/32	3H	2590	4.1	1	3P	3740	5.9	1⅛								
3/16	4H	3730	5.9	1⅛	~~4P~~	~~5380~~	~~8.5~~	1⅜	1Q	7140	11.3	1 7/16"	1Q	9310	14.7	1 9/16"
7/32					5P	7330	11.6	1 7/16	2Q	9720	15.4	1⅝	2Q	12690	20.1	1¾
¼					6P	9570	15.1	1 9/16	3Q	12700	20.1	1¾	3Q	16570	26.2	1 15/16
9/32					7P	12100	19.2	1¾	4Q	16060	25.4	1⅞	4Q	20950	33.2	2 1/16
5/16					8P	14950	23.7	*1¾	5Q	19840	31.4	2	5Q	25880	41.0	2¼
11/32									6Q	24010	38.0	2⅛	6Q	31320	49.6	2⅜
⅜									7Q	28590	45.3	2¼	7Q	37290	59.1	2½
13/32									8Q	33530	53.2	2 7/16	8Q	43740	69.4	2⅝
7/16									9Q	38890	61.7	2½	9Q	50720	80.4	2¾

SHUTDOWN & EMERGENCY SHUTDOWN PROCEDURES

CIRCULAR CLARIFIERS/THICKENERS (Without Skimmers)

SHUTDOWN PROCEDURES

SHUTDOWN PROCEDURES

Activate "OFF" selector switch.

Put in place all electrical lockouts and tag "OUT OF SERVICE - DO NOT START" at all control stations.

EMERGENCY SHUTDOWN PROCEDURES

1. Push "STOP" button.
2. Lock out unit electrically and tag "OUT OF SERVICE".
3. Stop flow to tank as soon as possible.
4. Correct reason for shutdown.
5. Do not start flow to tank again until equipment is capable of being run continuously.

WARNING!:

NEVER WORK ON DRIVE OR MECHANISM UNLESS IT IS LOCKED OUT ELECTRICALLY AND TAGGED "OUT OF SERVICE".

ENVIRONMENTAL AND LIMITING CONDITIONS AND SEASONAL OPERATIONS

CIRCULAR CLARIFIERS/THICKENERS

ENVIRONMENTAL AND LIMITING CONDITIONS AND SEASONAL OPERATIONS

ENVIRONMENTAL AND LIMITING CONDITIONS

This equipment is designed for continuous operation under all normal weather conditions.

We do not recommend operation of the equipment under the following conditions:

1) Flooding where parts of drive unit are submerged.

2) Icing where all moving parts and ventilation have been made inoperable.

3) Extremely dusty conditions where airborne dirt, sand or ash can plug ventilation openings.

4) Humidity is not a factor in the operation of this equipment.

4) Suggested temperature operating range: Maximum = 110°F

SEASONAL OPERATIONS

SUMMER MONTHS

There should be little or no operational change required between the winter and summer months from a mechanical standpoint.

1) It should be noted however, that a lengthy series of hot, sunny days will promote algae growth and may require additional operator clean-up in order to keep the effluent weirs free-flowing.

2) Areas of the country that are subject to heavy thunderstorms and flash flood conditions may, on occasion, experience excessive water intrusion that will result in peak flow rates that directly effect effluent quality.

WINTER MONTHS

1) Normally, operating the unit during the winter should be no different than during the other seasons. However, when the weather becomes extremely cold particular attention should be given to the effluent troughs.

SECTION D

LUBRICATION & MAINTENANCE

MAINTENANCE & LUBRICATION INSTRUCTIONS

CIRCULAR CLARIFIER DRIVES PIER MOUNTED, CAST IRON SPLIT SPUR GEAR TYPE

LUBRICATION AND MAINTENANCE INSTRUCTIONS (REFER TO DATA SHEET D905-64199-215)

A) GENERAL

AMWELL drive units are shipped with the worm gear housing filled to the proper level and the lower pinion bearing pocket of the spur gear housing with AGMA lubricant #4, ISO 150 oil. The worm and spur gear housings must be filled to the appropriate levels upon receipt. See drive long term storage instructions in Section A of this manual.

Prior to initial start-up, the oil reservoirs and sumps must be drained, flushed and refilled to the operating levels with the appropriate lubricants for the service conditions.

Lubricants recommended in these instructions are typical only and any lubricant of another manufacturer may be substituted provided it is of equal grade and composition.

The American National Standards Institute, ANSI, and the American Gear Manufacturers Association, AGMA, have issued ANSI/AGMA 9005, Industrial Gear Lubrication, which provides a reference criteria for the selection of gear lubricants.

B) GEAR REDUCERS

Refer to separate manufacturer's instructions.

C) SPUR GEAR DRIVE ASSEMBLY

Extreme pressure (EP) lubricants are petroleum-based oils with chemical additives to produce a protective film on the wearing surface.

Lower Split Spur Gear Housing

Fill thru oil fill (3) to the level pipe (1) with one of the following oils. Drain oil thru valves (7) & (8) .

APPROXIMATE LUBRICANT QUANTITIES

~~No. 28H Drive - 5 Qts.~~ No. 42H Drive - 10 Qts.~~ No. 42S Drive - 10 Qts.~~
~~No. 60H Drive - 4 Gals. No. 80H Drive - 6 Gals.~~

AGMA NUMBER	4EP	6EP	7EP	8EP
ISO GRADE	150	320	460	680
AMBIENT TEMP. ºF	-20 to 30	15 to 50	30 to 125	50 to 125+
OILS				
AMOCO	Permagear EP 150	Permagear EP 320	Permagear EP 460	Permagear EP 680
EXXON	Humble Gear Oil 150	Humble Gear Oil 320	Humble Gear Oil 460	Humble Gear Oil 680
MOBIL	Mobilgear 600 XP 150	Mobilgear 600 XP 320	Mobilgear 600 XP 460	Mobilgear 600 XP 680
SHELL	Omala 150	Omala 320	Omala 460	Omala 680
TEXACO	Meropa 150	Meropa 320	Meropa 460	Meropa 680
LUBRIPLATE	Lubriplate 163	APG80W-140	APG-140	APG-250

CIRCULAR CLARIFIER DRIVES PIER MOUNTED, CAST IRON SPLIT SPUR GEAR TYPE

LUBRICATION AND MAINTENANCE INSTRUCTIONS (REFER TO DATA SHEET D905-64199-215)

C) SPUR GEAR DRIVE ASSEMBLY (Continued)

****IMPORTANT:** It is recommended that a flexible long-necked funnel be used to add oil to the spur gear oil bath. The neck of the funnel should be bent so that the oil, to be added, is directed at the wall of the spur gear housing instead of allowing it to splash on top of the spur gear. This procedure will help prevent the oil from overflowing the dust shields.

Fill unit slowly using approximately 2/3 the required quantity of oil. Rotate drive to settle oil and add remainder of oil or until oil begins to emerge from the oil level pipe (1). When filled too fast, the viscosity of the oil will cause an overfill and spill out over the dust shield.

Check oil level monthly with oil level dipstick (2), drain off condensation with oil drain (7) and (8) and add equal amount of oil.

Drain and flush annually with lightweight oil such as, SAE 5, linseed oil or equal.

D) UPPER WORM GEAR ASSEMBLY

Lubricants recommended in these instructions are typical only and any lubricant of another manufacturer may be substituted provided it is of equal grade and composition. Rust and oxidating inhibited gear lubricants, typically called R & O oils, are petroleum based oils with chemical additives which provide rust protection and oil oxidation resistance. Steam cylinder oils and non-foaming circulating oils are normally found in this category. Rust and oxidation inhibited, compounded or synthetic oil is recommended for use in all worm gearing.

Fill thru inspection and oil fill cover (4) located on top of base plate until oil begins to emerge thru petcock (6). Drain oil thru oil drain pipe (9).

APPROXIMATE LUBRICANT QUANTITIES

~~6F Drive - 2 Qts~~.
→ 8F Drive - 4 Qts.←
~~10F Drive - 5 Qts.~~
~~12F Drive - 6 Qts.~~

AGMA NUMBER	4	6	7	8
ISO GRADE	150	320	460	680
AMBIENT TEMP. ºF	-20 to 30	15 to 50	30 to 125	50 to 125+
OILS				
AMOCO	Industrial Oil 150	Industrial Oil 320	Industrial Oil 460	Cylinder Oil No. 680
EXXON	Esstic Grade 150	Teresstic Grade 320	Teresstic Grade 460	Cylesstic TK 680
MOBIL	---	---	600W Super Cylinder	Extra Hecla Super Cylinder
SHELL	Morlina Oil 150	Morlina Oil 320	Morlina Oil 460	Valvata Oil 680
TEXACO	Regal Oil R & O 150	Regal Oil R & O 320	Regal Oil R & O 460	Pinnacle Cylinder Oil 680
LUBRIPLATE	SPO-224	SPO-266	SPO-277	SPO-288

CIRCULAR CLARIFIER DRIVES PIER MOUNTED, CAST IRON SPLIT SPUR GEAR TYPE

LUBRICATION AND MAINTENANCE INSTRUCTIONS (REFER TO DATA SHEET D905-64199-215)

E) PINION SHAFT BEARING

Lubricate once a month thru grease fitting (5) with one of the following greases:

Chevron - Rykon Premium #2	Arco - Litholine Hep 2
Mobil - Mobilgrease XHP222 Special	Lubriplate - 1200-2
Wolf's Head - Multi-Duty & Wheel Lube	Shell - Darina Grease 2
Gulf - Gulf High Temp. #1	Texaco - Molytex EP 2

Quantity Approx. 14 1/2 Oz. Initial Fill, 1 1/2 Oz. thereafter.

F) DRIVE CHAIN

Lubricate monthly with SAE 30 oil or equal.

G) ADJUSTING DRIVE CHAIN TENSION

(Reference drive parts list drawing in this brochure)

1) Remove chain guard.

2) Loosen gearmotor mounting bolts.

3) Loosen locknut on chain take-up screw.

4) Turning screw clockwise, adjust chain so that with moderate pressure to the slack side of the chain, the chain can be depressed approximately 1/2".

WARNING: Do not overtension as this will cause unnecessary wear on the chain and sprockets and put undue loads on the drive bearings.

5) Adjust locking nut on take-up screw so that screw is locked into position.

6) Retighten gearmotor mounting bolts.

7) Replace chain guard.

CIRCULAR CLARIFIER DRIVES PIER MOUNTED, CAST IRON SPLIT SPUR GEAR TYPE

LUBRICATION AND MAINTENANCE INSTRUCTIONS (REFER TO DATA SHEET D905-64199-215)

H) SUMMARY

Monthly:

1. Check oil levels, add as required.
2. Grease all fittings.
3. Check operation of overload switches, alarm and shut-off.
4. Open the drain valve (9) under the worm housing (upper reservoir) and open valves (7) & (8) (lower reservoir) and draw off a small quantity of oil to remove any accumulated water or foreign matter. This is especially important in cold climates where freezing of water can cause damage to the unit.
5. Lubricate drive chain.

Annually:

1. Change gear motor lubricant if recommended by manufacturer.
2. Drain and flush drive unit.
3. Adjust drive chain tension (if required).
4. Clean and paint equipment.

DRIVE UNIT PROTECTION FOR BLAST CLEANING DRAWING

CIRCULAR CLARIFIERS & THICKENERS

DRIVE UNIT PROTECTION FOR BLAST CLEANING

Refer to Sketch on Page 2 of 2

If it is necessary to blast clean the equipment in preparation for painting, the drive must be sealed against the entrance of grit. Grit in the drive will cause premature wear. Take the following steps before blast cleaning.

1. Remove the primary gear reducer, motor, chain, sprockets and chain guard.

2. Apply plumber's putty, followed by two layers of duct tape, at the worm shaft seal of the intermediate reduction unit. Also, protect the exposed worm shaft itself with two layers of duct tape. This sealing system will stand up under misdirected blasting and is relatively easy to remove.

3. Apply plumber's putty followed by two layers of duct tape at the thrust rod seal.

4. Protect all oil sight glasses, air vent, grease fittings, drive load indicator scale and overload switches with two layers of duct tape.

5. Plug the condensate drain in the lower housing.

6. The upper and lower edges of the dust shield must be sealed with plumber's putty and two layers of duct tape.

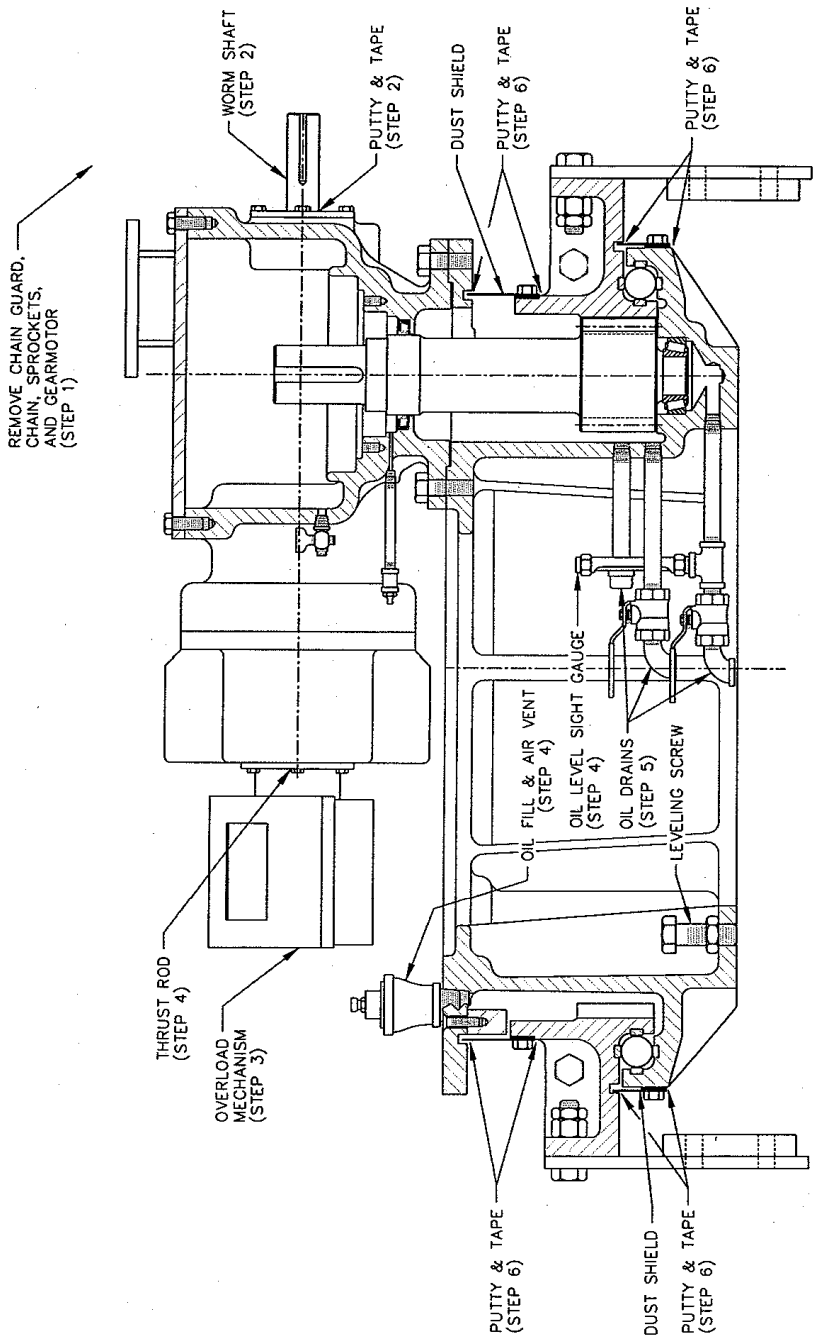
After blast cleaning, remove the tape and putty from the worm shaft, thrust rod and dust shields. Solvent clean the surfaces which have been puttied before painting the surface. Duct tape can remain on the other protected areas until painting has been completed.

Remove the condensate drain plug when blasting is complete. Condensate can freeze and damage drive components.

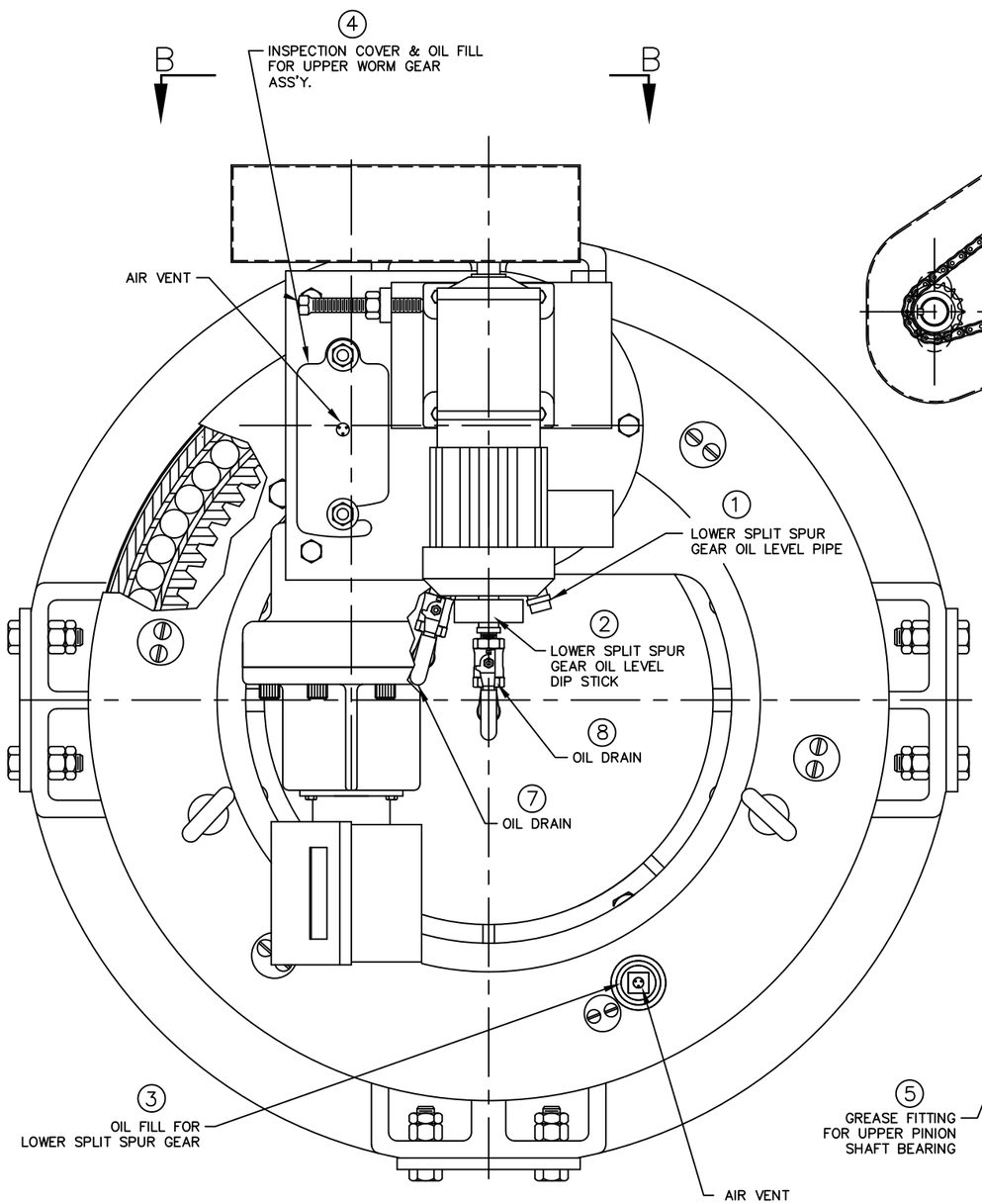
On some units a dual drive is furnished to drive both a flocculator and a bottom collector. The primary flocculator drive will be a variable speed unit and should be covered with heavy duty plastic rather than removed. The steps listed above should be followed with dual drives. There will be four dust shields, one worm shaft and one thrust rod to protect with plumber's putty and duct tape.

CIRCULAR CLARIFIERS & THICKENERS

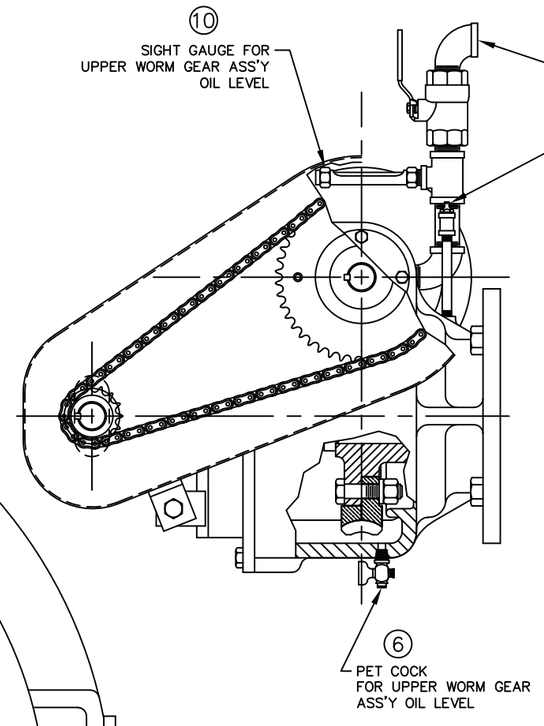
DRIVE UNIT PROTECTION FOR BLAST CLEANING



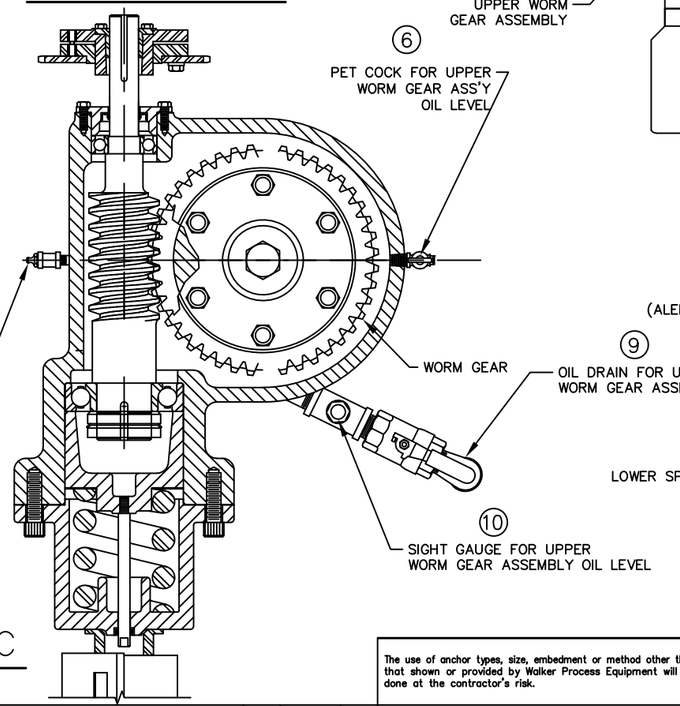
DATA SHEET FOR LUBRICATION DRAWING



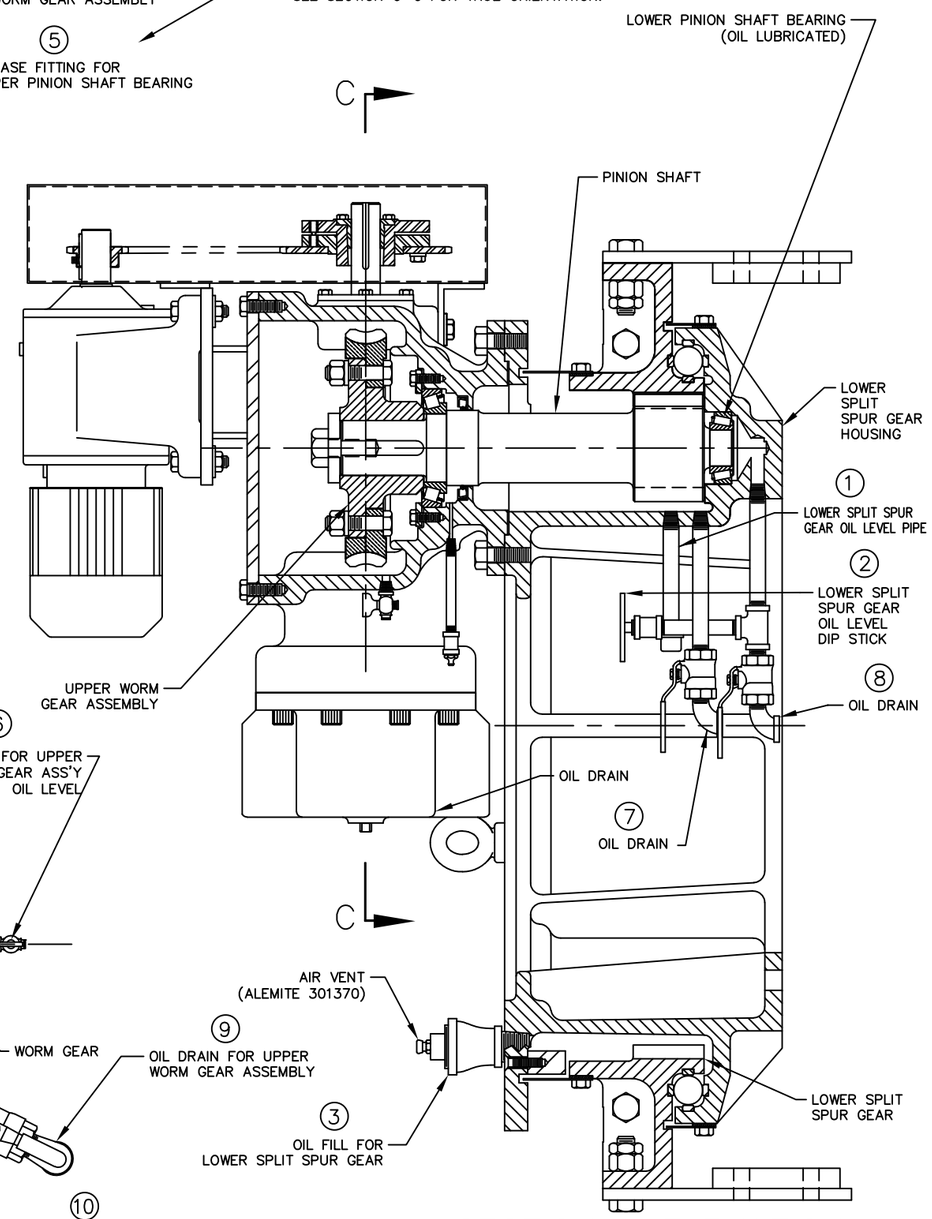
PLAN



SECTION B–B



SECTION C–C



SECTIONAL ELEVATION

SYM	REVISION	BY	DATE	CHKD
B				
A				

The use of anchor types, size, embedment or method other than that shown or provided by Walker Process Equipment will be done at the contractor's risk.

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	DATE	BY
DRAWN	12–26–07	Walt
CHECKED		
APPR.		
SCALE	NONE	
FILE REFERENCE		

Walker Process Equipment
Division of McNish Corporation
AURORA, ILLINOIS U.S.A.

DATA SHEET
FOR LUBRICATION
28" CLARIFIER DRIVES

CONTRACT | DRAWING NO. D,9,0,5|6,4,1,9,9|2,1,5 | REV.

MASTER D-62698

CAD FILE: D64199 PLOT SCALE = 0.25

MOTOR INFORMATION

BALDOR • RELIANCE

Product Information Packet

FLOLO CORP

05F472X122G1

1HP,1760RPM,3PH,60HZ,145TC,0518M,XPFC,F1

Part Detail

Revision:	-	**Status:**	PRD/A	**Change #:**		**Proprietary:**	No
Type:	AC	**Elec. Spec:**	05WGX122	**CD Diagram:**	CD0005	**Mfg Plant:**	
Mech. Spec:	05F472	**Layout:**	05LYF472	**Poles:**	04	**Created Date:**	07-13-2018
Base:	N	**Eff. Date:**	07-13-2018	**Leads:**	9#18		

Specs

Enclosure:	XPFC	**Inverter Code:**	Not Inverter
Frame:	145TC	**IP Rating:**	IP55
Frame Material:	Iron	**KVA Code:**	L
Output @ Frequency:	1.000 HP @ 60 HZ	**Lifting Lugs:**	Standard Lifting Lugs
Synchronous Speed @ Frequency:	1800 RPM @ 60 HZ	**Locked Bearing Indicator:**	Locked Bearing
Voltage @ Frequency:	460.0 V @ 60 HZ	**Motor Lead Quantity/Wire Size:**	9 @ 18 AWG
	230.0 V @ 60 HZ	**Motor Lead Termination:**	Flying Leads
XP Class and Group:	CLI GP D	**Motor Type:**	X0518M
XP Division:	Division I	**Mounting Arrangement:**	F1
Agency Approvals:	CSA	**Power Factor:**	71
	UL	**Product Family:**	Chemical Processing (Not DC)
Auxillary Box:	No Auxillary Box	**Pulley End Bearing Type:**	Ball
Auxillary Box Lead Termination:	Flying Leads	**Pulley Face Code:**	C-Face
Base Indicator:	No Mounting	**Pulley Shaft Indicator:**	Standard
Bearing Grease Type:	Polyrex EM (-20F +300F)	**Rodent Screen:**	None
Blower:	None	**RoHS Status:**	ROHS COMPLIANT
Current @ Voltage:	1.500 A @ 460.0 V	**Shaft Ground Indicator:**	No Shaft Grounding
	3.000 A @ 230.0 V	**Shaft Rotation:**	Reversible

	3.100 A @ 208.0 V	**Shaft Slinger Indicator:**	No Slinger
Design Code:	B	**Speed Code:**	Single Speed
Drip Cover:	No Drip Cover	**Motor Standards:**	NEMA
Duty Rating:	CONT	**Starting Method:**	Direct on line
Electrically Isolated Bearing:	Not Electrically Isolated	**Thermal Device - Bearing:**	None
Enclosure Modification:	Severe Duty Features	**Thermal Device - Winding:**	Normally Closed Thermostat
Feedback Device:	NO FEEDBACK	**Vibration Sensor Indicator:**	No Vibration Sensor
Front Shaft Indicator:	None	**Winding Thermal 1:**	None
Heater Indicator:	No Heater	**Winding Thermal 2:**	None
Insulation Class:	F	**XP Temp Code:**	T3C

Nameplate NP0015XPSL

NO.		CC	010A		
SER. #					
SPEC	05F472X122G1				
CAT.NO.					
H.P.	1	T. CODE	T3C		
VOLTS	230/460				
AMPS	3/1.5				
R.P.M.	1760				
HZ	60	PH	3	CLASS	F
SER.F.	1.15	DES	B	CODE	L
RATING	40C AMB-CONT				
FRAME	145TC	NEMA NOM. EFF	85.5		
USABLE AT 208V	3.1	PF	71		
BLANK					

AC Induction Motor Performance Data

Record # 45607 - Typical performance - not guaranteed values

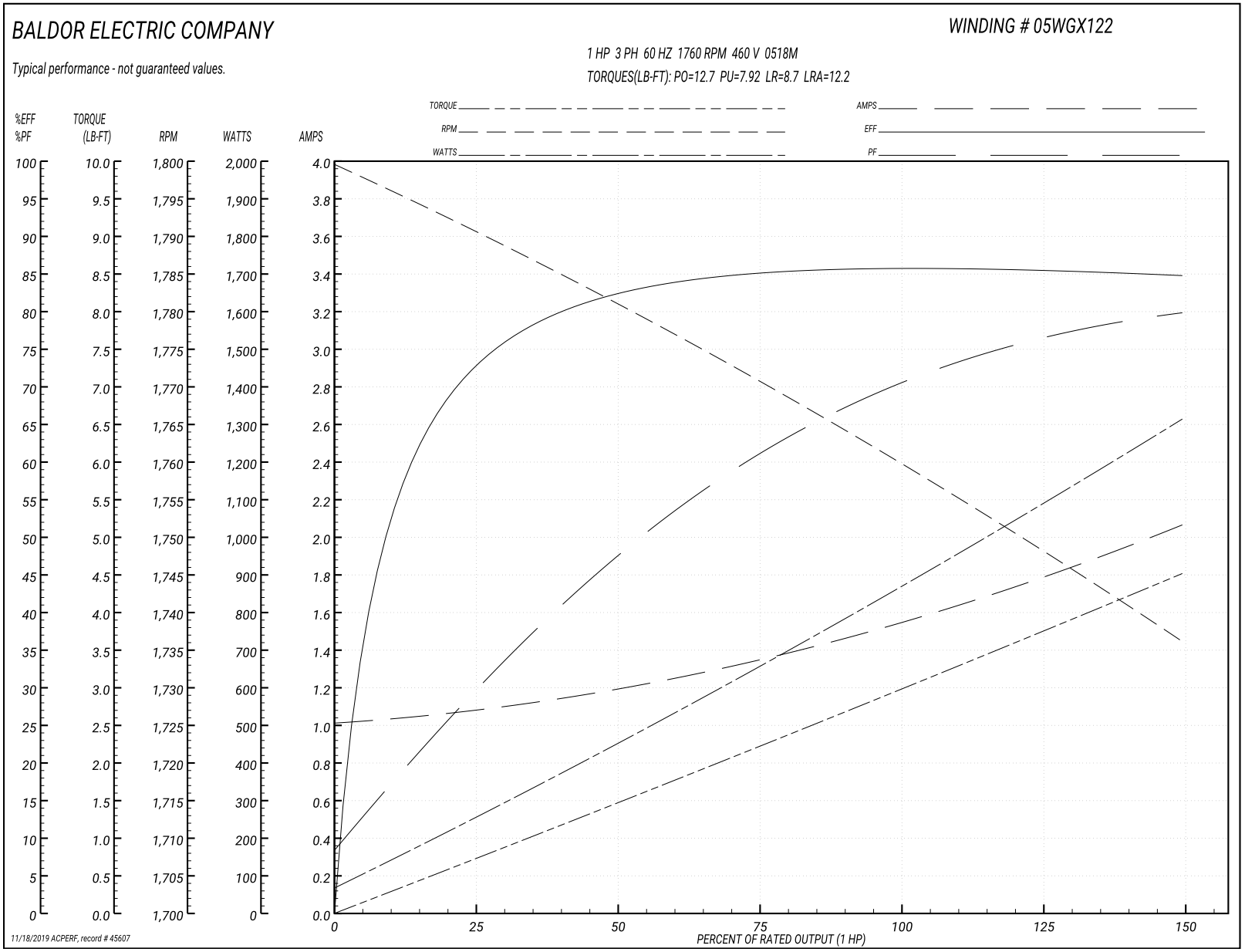
Winding: 05WGX122-R004	**Type:** 0518M	**Enclosure:** XPFC

Nameplate Data				460 V, 60 Hz: High Voltage Connection	
Rated Output (HP)	1			Full Load Torque	2.98 LB-FT
Volts	230/460			Start Configuration	direct on line
Full Load Amps	3/1.5			Breakdown Torque	12.7 LB-FT
R.P.M.	1760			Pull-up Torque	7.92 LB-FT
Hz	60	Phase	3	Locked-rotor Torque	8.7 LB-FT
NEMA Design Code	B	KVA Code	L	Starting Current	12.2 A
Service Factor (S.F.)	1.15			No-load Current	1.02 A
NEMA Nom. Eff.	85.5	Power Factor	71	Line-line Res. @ 25ºC	15.4 Ω
Rating - Duty	40C AMB-CONT			Temp. Rise @ Rated Load	29°C
S.F. Amps				Temp. Rise @ S.F. Load	34°C
				Locked-rotor Power Factor	54.1
				Rotor inertia	0.106 LB-FT2

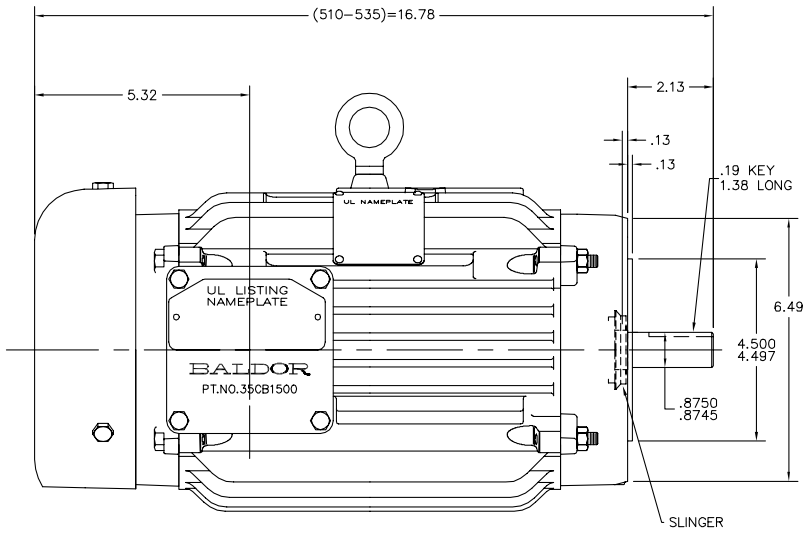
Load Characteristics 460 V, 60 Hz, 1 HP

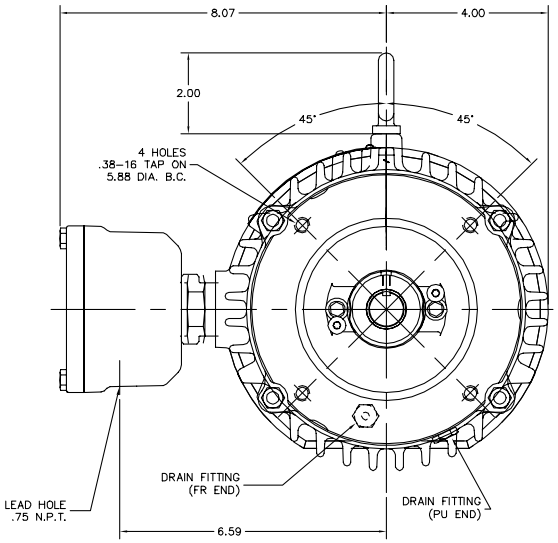
% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	30	48	61	70	76	80	74
Efficiency	72.2	82.2	85.2	86	85.6	84.7	85.6
Speed	1790	1781	1771	1760	1748	1736	1754
Line amperes	1.07	1.19	1.35	1.55	1.8	2.06	1.69

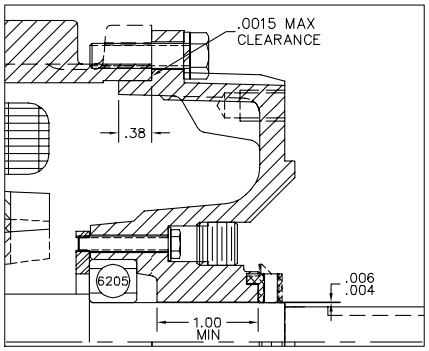
Performance Graph at 460V, 60Hz, 1.0HP Typical performance - Not guaranteed values



05LYF472





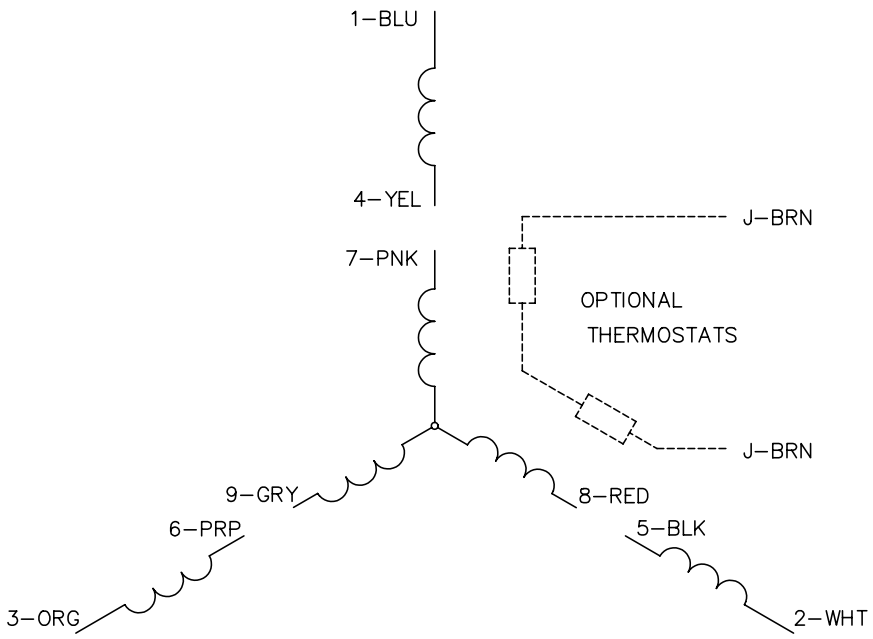


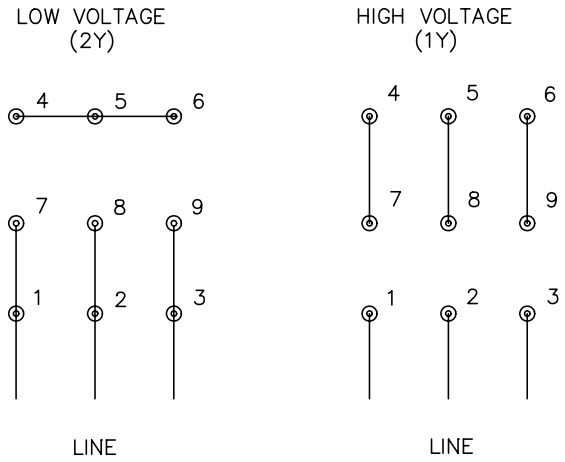
CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT BALDOR'S PRODUCT WILL PERFORM SUITABLY IN THE INTENDED APPLICATION.

REV. DESC: MOVE 1.00 MIN DIM OVER TO CORRECT LOCATION			BALDOR
REV. LTR: A	VERSION: 01	TDR: 000000759075	VER 143-5TC XPFC M CLI GP D W/SLINGER, CP FEATURES
FILE: \AAA\00170\423	REVISED: 11:22:26 08/03/2012	BY: ENALEM0	SH 1 of 1
MTL: -			

05LYF472

CD0005





NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0005

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			BALDOR ELECTRIC Co.
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435
CD0005		FILE: AAA00005140	MDL: –
		MTL: –	3PH, DV, 9 LEADS

REDUCER INFORMATION

Intelligent Drivesystems, Worldwide Services

INSTALLATION & OPERATING INSTRUCTIONS

NORD.COM/DOCS
DOCUMENT COLLECTION

Order Number: 203363807-100
NORD Model SK573.1 N140TC

NORD DRIVESYSTEMS

1. Safety & information symbols

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

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

2. Safety warnings

⚠ DANGER

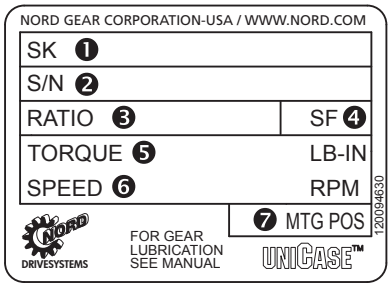
- All work involved in the transport, connection, commissioning and maintenance of any NORD product must be carried out by qualified and responsible technicians. All applicable national, regional, and local work regulations and safety requirements must also be complied with. **NORD assumes no liability for personal injury, accidental death, or equipment damage and malfunctions resulting from failure to comply with installation or operating instructions, safety notes, or any work regulations and laws!**
- Gear unit installation and maintenance work may only be performed when no power is available to the prime mover or motor. Electric motors, electrical brakes, and variable frequency drives, contain potentially dangerous high-voltage. Prior to installation or maintenance, shut down the power at the circuit breaker or power switch. **While working on the drive, make sure the power from the prime mover is isolated or secured on "lock-out" to prevent accidental start-up and to safeguard against injury!**
- Surfaces of motors and gear units may become hot during operation or shortly after start-up. In some instances additional protection against accidental contact may be necessary. **Use caution to avoid burns or serious injury!**

3. Observe published performance range & nameplate data

NOTICE

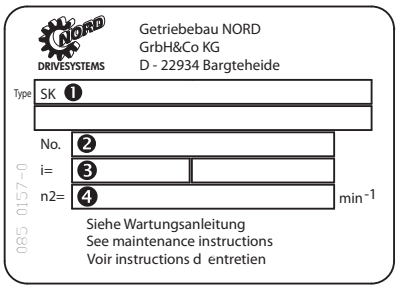
Observe the data on all reducer nameplates and verify published ratings for the NORD item/s in question. Do not operate any NORD equipment outside the published performance range. Failure to comply may result in damage to the drive unit, driven machine, or the environment.

U.S. Nameplate



❶ Model/Type
❷ Serial Number
❸ Gear Ratio
❹ Service Factor
❺ Torque Rating
❻ Output Speed RPM
❼ Mounting Position

European Nameplate



❶ Model/Type
❷ Serial Number
❸ Gear Ratio
❹ Speed

4. Transportation and handling

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

⚠ WARNING

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

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

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

5. DISPOSAL

MATERIAL DISPOSAL

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

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

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

1. Storage

IMPORTANT NOTE

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

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

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

2. Commissioning

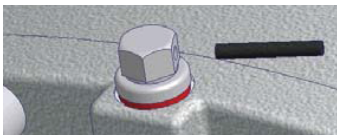
Prior to gear unit start-up, complete the following:

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

NOTICE

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

Sealed vent



Activated vent

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

IMPORTANT NOTE

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

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

3. Long-Term Storage

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

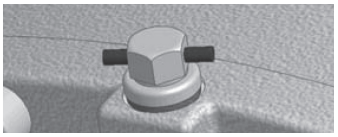
- Store the gear unit in its actual mounting position in accordance with the specified oil fill-level, in a clean and dry temperature controlled area. Avoid temperature fluctuations within the range of 0°C and 40°C (32°F to 104°F) and avoid relative humidity conditions in excess of 60%.
- Fill the reducer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

4. Commissioning After Long-Term Storage

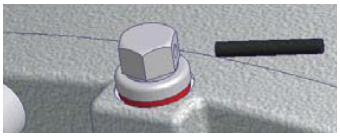
• Please check your gear unit for a vent and if applicable to your product, remove the sealing plug to activate.

NOTICE

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



Sealed vent



Activated vent

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

1. Installation site

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

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

2. Mounting position

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

NOTICE

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

3. Reducer mounting

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

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

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

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

Straightness: Based upon the length of the corresponding line.

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

IMPORTANT NOTE

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

4. Steel foundation

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

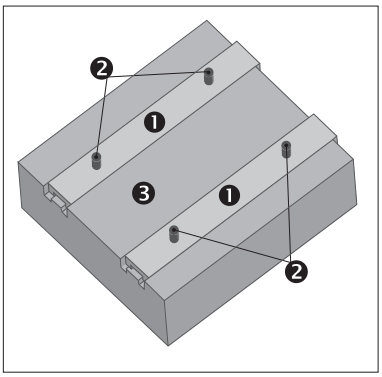
NOTICE

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

5. Concrete foundation

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

Figure 1: Concrete Foundation



❶ Grouted Structural Steel Mounting Pads
❷ Mounting Bolts
❸ Concrete Foundation

6. Bolt connections for footed & flange mounted units

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

Table 2A: Tightening Torque for Inch Reducer Mounting Bolts

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

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

Table 2B: Tightening Torque for Metric Reducer Mounting Bolts

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

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

7. Mounting the prime mover

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

A. After the main gear drive is properly aligned and bolted in place, align the prime mover with respect to the reducer input shaft.

B. Use shims under the feet of the prime mover as needed, and secure in place with the proper mounting bolts. Dowel pins may be field-installed to help prevent misalignment and ensure proper realignment if removed for service.

IMPORTANT NOTE

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

SOLID SHAFT CONNECTIONS

1. Solid shaft diameter tolerance

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

Table 1: Solid Shaft Diameter Tolerance

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

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

2. Fitting drive elements onto the reducer solid shaft

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

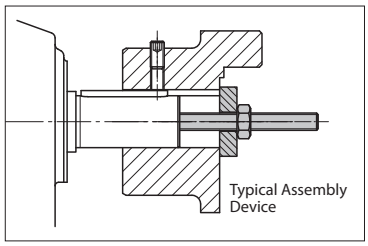


Table 2: Solid Shaft End - Threaded Holes

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

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

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

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

NOTICE

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

⚠ WARNING

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

3. Installing interference-fit hubs to the reducer shaft

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

⚠ WARNING

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

IMPORTANT NOTE

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

4. Coupling installation

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

Coupling gap and angular alignment

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

Parallel (or offset) alignment

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

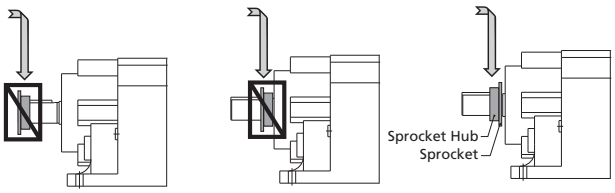
Check alignment

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

5. Installing sheaves (pulleys), sprockets and gears

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

Figure 2: Sprocket or Gear Mounting



Preferred Mounting of Sprocket or Gear

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

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

IMPORTANT NOTE

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

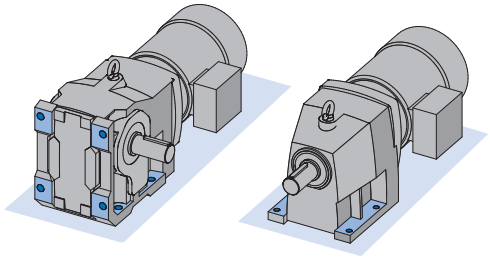
6. Outboard pinion gear alignment

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

REDUCER MOUNTING
FOOTED & FLANGE MOUNT GEAR UNITS

1. Foot-mounted reducers

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



IMPORTANT NOTE

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

2. Flange-mounted reducers (with B5 flange)

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

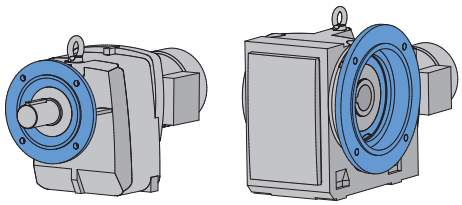


Table 1 : Flange Centering Shoulder Tolerance

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

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

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

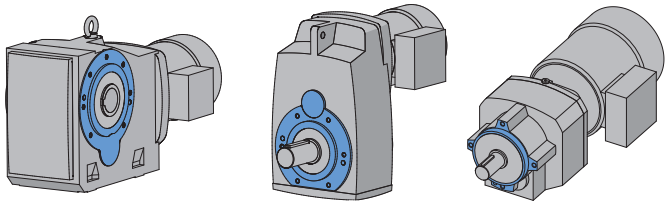
Set the gear unit into place and tighten the bolts until they are snug. Before final bolt-tightening check for any material gaps between the mating surfaces and if shimming is required, use "U" shaped shims at least 2 times the width of the bolt. Avoid over shimming a very irregular surface as this will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

IMPORTANT NOTE

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

3. Flange-mounted reducers (with B14 flange)

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



IMPORTANT NOTE

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

Table 2 : Flange Centering Shoulder Tolerance on NSD Tuph Units

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

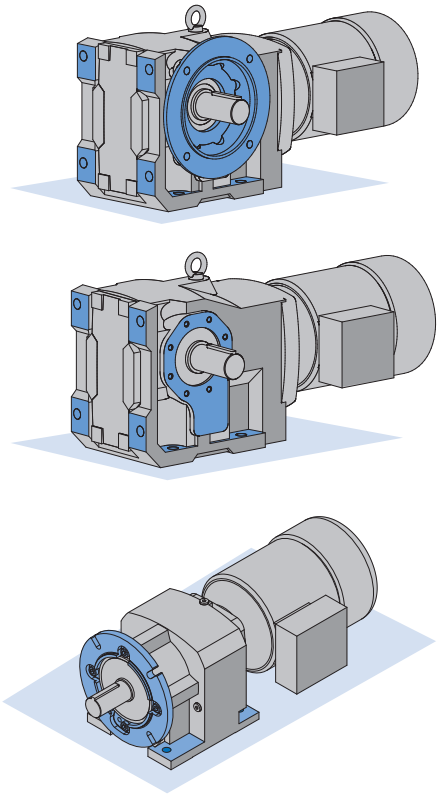
Above ø (mm)	To & Including ø (mm)	Tolerance (mm)
50	80	+0.052 / +0.033
80	120	+0.053 / +0.031
120	180	+0.054 / +0.029
180	230	+0.056 / +0.027

4. Foot & flange reducer housings

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

NOTICE

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



HELICAL & BEVEL REDUCER LUBRICATION

1. Importance of proper lubrication

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

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

2. Standard oil type

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

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

IMPORTANT NOTE

For shipping purposes, the following large Clincher™ gear units are supplied without oil:
- Clincher™ Sizes SK11282, SK11382, SK11382.1 and SK12382

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

IMPORTANT NOTE

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

IMPORTANT NOTE

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

3. Lubrication replacement

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

4. Oil viscosity

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

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

IMPORTANT NOTE

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

5. Maximum oil sump temperature limit

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

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

IMPORTANT NOTE

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

6. The importance of routine oil analysis

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

NOTICE

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

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

7. Mounting position and oil fill quantity

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

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

IMPORTANT NOTE

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

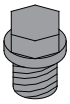
8. Oil plug locations

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

9. Drain and fill-level plugs

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

Drain Plug



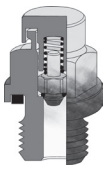
Fill Level Plug

10. Vent plug locations

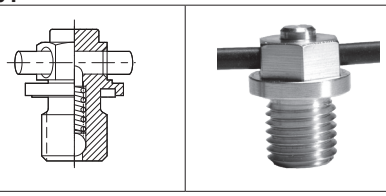
Reducer venting allows for air pressure differences that occur during operation, between the inner space of the reducer and the atmosphere, while ensuring leak-free operation. The AUTOVENT™ is standard for all vented gear units, unless otherwise noted.

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

Figure 1 AUTOVENT™ Types



Type 1

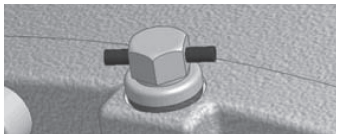


Type 2 with transportation plug

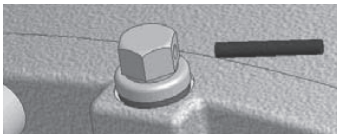
Open Vent - An optional open vent can be supplied by NORD. The open vent comes closed upon delivery with a transportation sealing plug (see Warning).

NOTICE

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



Sealed vent



Activated vent

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

HELICAL & BEVEL REDUCER LUBRICATION TYPES

Lubrication Tables – Helical and Bevel Gear Units

Standard Oil Lubricants

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

Optional Oil Lubricants

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

Grease Options (applied to greased bearings and seal cavities)

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

♦ Stocked Lubricants

❶ Standard product on serviceable gear units

❷ Standard product on maintenance free gear units

IMPORTANT NOTE

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

Oil Formulation Codes

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

Lubrication Notes

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

HELICAL & BEVEL REDUCER LUBRICATION TYPES

Oil Cross-reference Chart

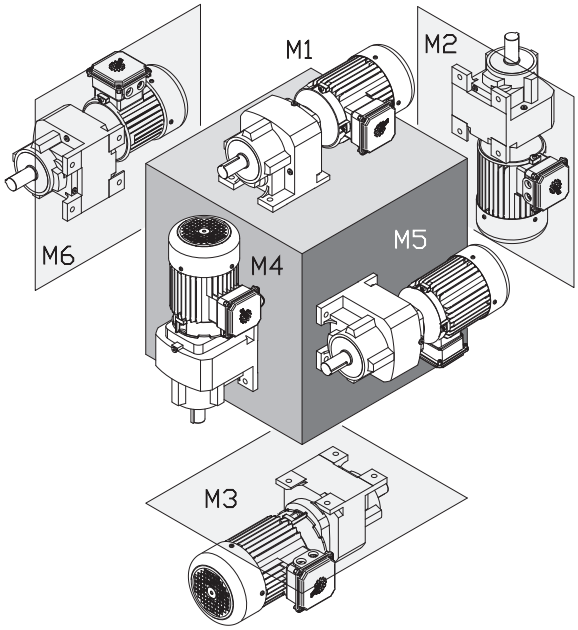
ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	FUCHS	KLÜBER LUBRICATION
VG150	MIN-EP	0 to 25°C (32 to 77°F)	Mobilgear 600XP150	Omala S2 G 150	Alpha SP150	Renolin EP150	Klüberoil GEM 1-150N
	PAO-EP	-30 to 25 °C (-22 to 77 °F)	Mobil SHC Gear 150	Omala S4 GX 150	Alphasyn EP150	Gearmaster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

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

NORDBLOC®.1 FOOTED OIL FILL QUANTITIES

NORDBLOC®.1 Fill Quantities (Footed)

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



IMPORTANT NOTE

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

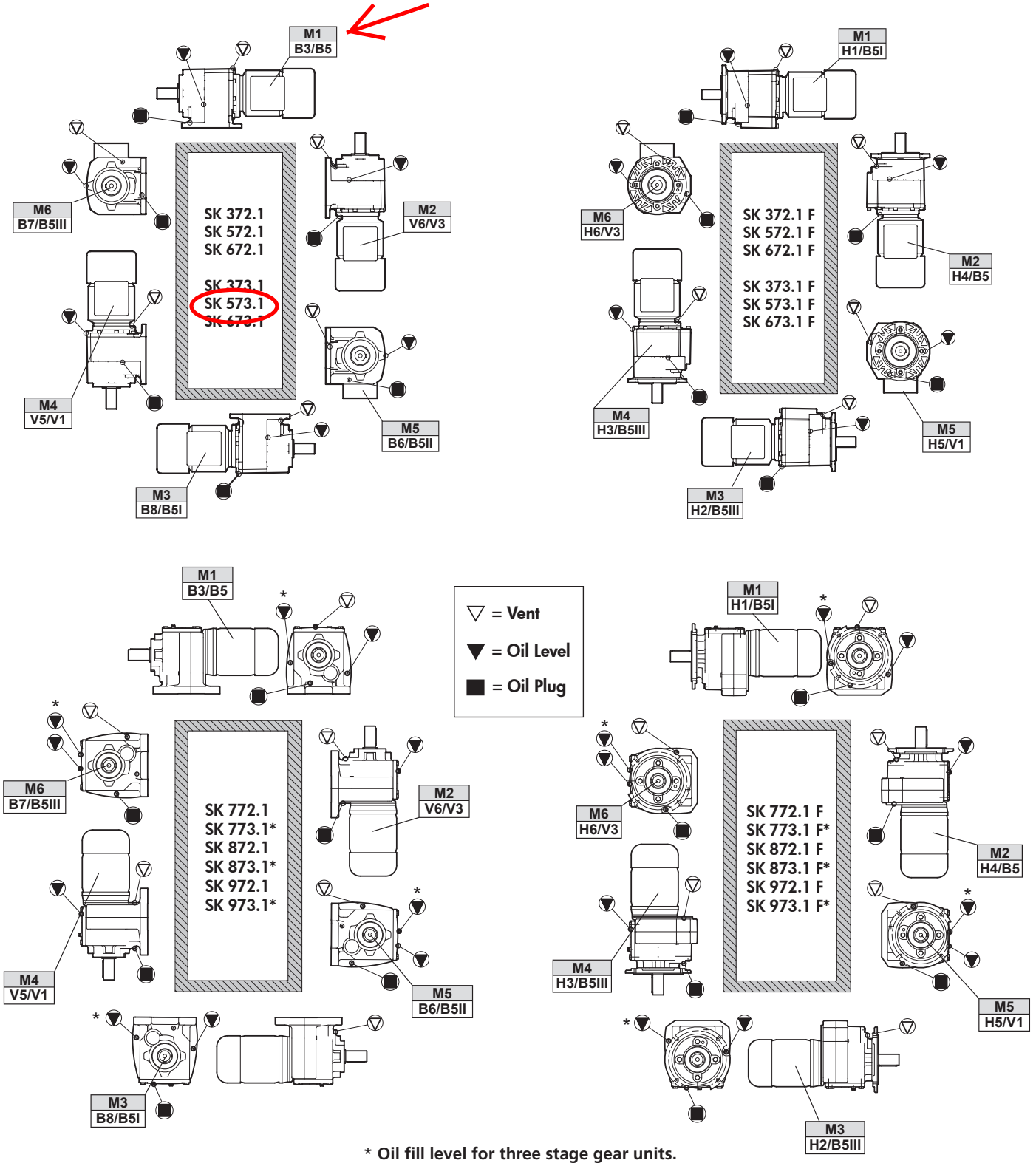
For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

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

NORDBLOC®.1
OIL PLUG & VENT LOCATIONS

Oil plug connections

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



*** Oil fill level for three stage gear units.**

NORD Gear Limited
Toll Free in Canada: 800.668.4378

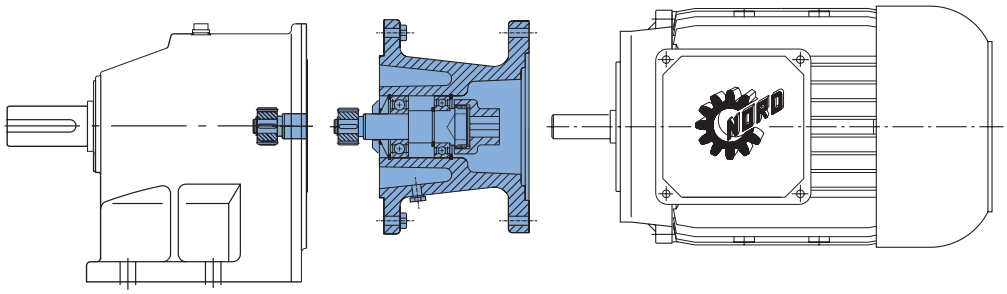
NORD Gear Corporation
Toll Free in the United States: 888.314.6673

Troubleshooting

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

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

NEMA/IEC/SERVO INPUT ADAPTERS & THEIR COUPLINGS



⚠ WARNING

While working on the gear drive system, make sure the power from the prime mover is isolated or secured on "lock-out" to prevent accidental start-up and to safeguard against injury!

NEMA/ IEC Motor Adapters

Motor adapters allow for easy installation and removal of industry standard motors. Motor adapters consist of a coupling and an adapter housing that connects the motor to the gear reducer.

NORD Gear supplies a coupling that is to be mounted on the motor shaft. It is important that the coupling is properly positioned.

- For NEMA Input Adapters, follow the Motor Installation Instructions on pages 3-5.
- For IEC Input Adapters, the supplied coupling will mount directly against the motor shaft shoulder. No locating measurements need to be taken.

IMPORTANT NOTE

Some of the larger IEC inputs will have a coupling spacer included to help locate the coupling. Slide the spacer against the motor shaft shoulder, slide the coupling against the spacer and tighten set screw(s).

IMPORTANT NOTE

For the larger motor adapters (IEC160 / N250TC and larger), an Automatic Lubricator may be supplied. This will need to be activated at the time of startup. For operation andactivation instructions, refer to user manual U45200. Motor adapter option AI and AN do not utilize an Automatic Lubricator and are lubricated for life.

NEMA/IEC Motor Weight Limits

When mounting a motor to a NORD NEMA C-face motor adapter it is important to consider the motor's weight. Following is a table that includes the maximum motor weight the NEMA adapter can support. If the motor exceeds the listed weight is must be externally supported. When a C-face mounted motor is externally supported care must be taken to ensure that the support system does not impose additional pre-loads on the NEMA motor adapter.

NEMA Motor Weight Limit

Motor FRAME	56C	140TC	180TC	210TC	250TC	280TC
Max Weight [lb]	66	110	176	221	441	551
Motor FRAME	**320TC**	**360TC**	**400TC**			
Max Weight [lb]	772	1544[4)]	1544			

IEC Motor Weight Limit

Motor FRAME	63	71	80	90	100	112	132
Max Weight [kg]	25	30	50[1)]	50	80[2)]	80	100
Motor FRAME	**160**	**180**	**200**	**225**	**250**	**280**	**315**
Max Weight [kg]	250[3)]	250	350	500	1000	1000	1500

1) ≤ 40 kg SK 920072.1, SK 92072.1, SK 071.1, SK 0182.1
2) ≤ 60 kg SK 1382.1, SK 92372.1, SK 12063, SK 372.1, SK 371.1
3) ≤ 200 kg SK 42, SK 4282, SK 9042.1, SK 42125
4) ≤ 1103 lb SK 62, SK 72, SK 73, SK 83, SK 93, SK 9072.1, SK 6282, SK 7282, SK 7382, SK 8382, SK 9392

Couplings

Couplings are made with tough abrasion resistant materials, which resist most chemicals and petroleum products. They are electrically isolated (prevent metal to metal contact) and require no lubrication or maintenance. Depending upon the size of the input, NORD provides either a gear or a jawtype coupling.

NORD supplies three different types of couplings depending on the size of input: "J" style, "M" style and "Jaw" style coupling. Following are instructions on how to properly mount each type of coupling onto the motor.

NEMA/IEC/SERVO INPUT ADAPTERS & THEIR COUPLINGS

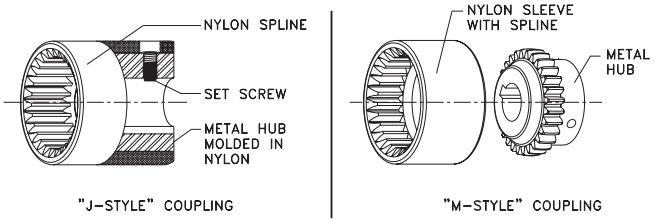
Couplings for the NEMA and IEC Adapters

Depending on the size of the input adapter to the gearbox, NORD Gear supplies two styles of couplings - BoWex® (gear tooth) and Rotex® (jaw) couplings.

BoWex® Couplings

NORD motor adapter input shafts have a machined spline on the end. NORD incorporates two styles of BoWex® couplings, the "J" and "M" styles. The "J" style is a one-piece coupling with a metal hub and nylon spline. The "M" style is a two-piece coupling – the metal hub and a nylon sleeve. Nylon and steel components allow them to operate in high ambient temperatures without lubrication or maintenance.

- Nylon sleeves resist dirt, moisture, most chemicals and petroleum products
- No lubrication required
- Operating Conditions: -22°F - 212°F (-30°C - 100°C)
- Higher temperature coupling sleeve available up to 250°F (120°C)
- Special bore available



BoWex® Couplings Mechanical Ratings "J" Style (NEMA & IEC)

Coupling Type	Rated Torque Cont.	Rated Torque Peak	Input Adapter Sizes	Bore Size
BoWex® J14	44.3 lb-in 5 N-m	88.5 lb-in 10 N-m	N56C IEC63, IEC71	5/8" 11mm, 14mm
BoWex® J24	106 lb-in 12 N-m	212 lb-in 24 N-m	N56C, N140TC IEC80, IEC90	5/8", 7/8" 19mm, 24mm
BoWex® J28	398 lb-in 45 N-m	1,195 lb-in 135 N-m	N180TC IEC100, IEC112	1-1/8" 28mm

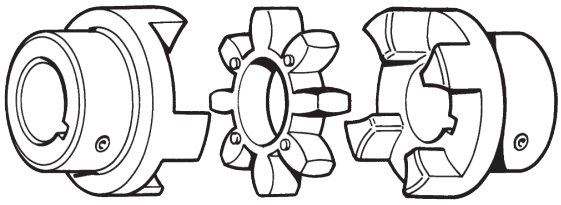
BoWex® Couplings Mechanical Ratings "M" Style (NEMA & IEC)

Coupling Type	Rated Torque Cont.	Rated Torque Peak	Input Adapter Sizes	Bore Size
BoWex® M38	708 lb-in 80 N-m	2,124 lb-in 240 N-m	N180TC, N210TC IEC132	1-1/8", 1-3/8" 38 mm
BoWex® M42	885 lb-in 100 N-m	2,655 lb-in 300 N-m	N250TC IEC160	1-5/8" 42 mm
BoWex® M48	1,239 lb-in 140 N-m	3,717 lb-in 420 N-m	N280TC IEC180	1-7/8" 48 mm

Rotex® Couplings

The cast iron jaw type couplings have an integral urethane "spider" that provides smooth transmission of the motor torque. A set screw on the coupling prohibits axial movement along the motor shaft.

- Excellent shock and vibration dampening
- Excellent resistance to oils and most chemicals
- No metal-to-metal contact
- Operating Conditions: -22°F - 195°F (-30°C - 90°C)
- Higher temperature material (Hytrel) spider available up to 230°F (110°C)
- Low temperature materials available upon request
- Special bores available



Rotex® Couplings Mechanical Ratings "R" Style (NEMA & IEC)

Coupling Type	Rated Torque Cont.	Rated Torque Peak	Input Adapter Sizes	Bore Size
Rotex® R42	3,983 lb-in 450 N-m	7,966 lb-in 900 N-m	AN250TC	1-5/8"
Rotex® R48	4,647 lb-in 525 N-m	9,294 lb-in 1,050 N-m	AN280TC AI160, AI180	1-7/8" 42, 42 mm
Rotex® R55	6,063 lb-in 685 N-m	12,126 lb-in 1,370 N-m	AN320TC AI200	2-1/8" 55 mm
Rotex® R65	8,319 lb-in 940 N-m	12,125 lb-in 1,880 N-m	N320TC, AN360TC[1] IEC200, AI200, IEC225	2-1/8", 2-3/8" 55, 55, 60mm
Rotex® R75	16,992 lb-in 1,920 N-m	33,954 lb-in 3,840 N-m	AN360TC[2], AN400TC AI250, AI280	2-3/8", 2-7/8" 70, 80 mm
Rotex® R90	31,860 lb-in 3,600 N-m	63,720 lb-in 7,200 N-m	N360TC IEC250, IEC280, IEC315, AI315	2-3/8" 70, 80, 85, 85 mm

1) AN360TC with R350 flange
2) AN360TC with R450 flange

Couplings for Servo Adapters

NORD Gear supplies Rotex® (jaw) couplings for SERVO adapter connections.

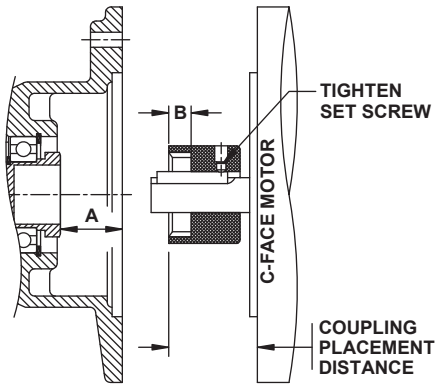
Rotex® Couplings Mechanical Ratings (Servo Adapter)

Coupling Type	Rated Torque Cont.	Rated Torque Peak	Input Adapter Sizes	Reducer Input Flange	Bore Size
Rotex® R19 GS	150 lb-in 17 Nm	301 lb-in 34 Nm	-SEP100, -SEK100	160S	19 mm
Rotex® R24 GS	531 lb-in 60 Nm	1062 lb-in 120 Nm	-SEP130, -SEK130	160S, 250S	24 mm
Rotex® R28 GS	1416 lb-in 160 Nm	2832 lb-in 320 Nm	-SEP165, -SEK165, -SEP215, -SEK215	160S, 250S 250S	32 mm 38 mm
Rotex® R48 GS	4647 lb-in 525 Nm	9293 lb-in 1050 Nm	-SEP215, -SEK215 -SEP300, -SEK300 -SEP300, -SEK300	300S 300S 350	38 mm 48 mm

SEP adapter couplings are for keyed motor shafts.
SEK adapter couplings are clamping style for shafts without key.
Alternate bores upon request.

"J" Style Coupling NEMA C-face Motor Installation

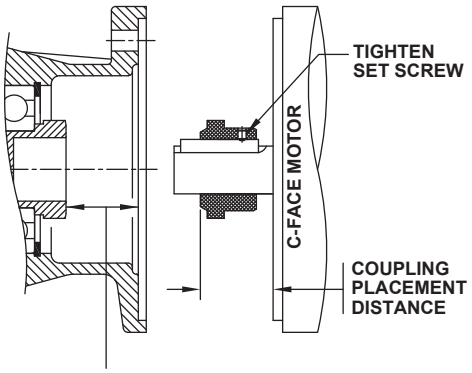
1. Measure the distance from the face of the input adapter to the face of the splined shaft and record that measurement as A in the equation below.
2. Measure depth of coupling engagement zone and record the measurement as "B" in the equation below.
3. Add "A" + "B" and subtract 0.08" (~2mm) from the distance. This needs to be done so that the coupling will not be preloaded after installation!
4. Use that measurement to locate the coupling from the face of the motor onto the shaft.
5. Once in place, tighten the set screw to lock the coupling in place. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.
6. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.



MEASURED DISTANCES A + B		SUBTRACT DISTANCE	COUPLING PLACEMENT DISTANCE
____ +	____	- 0.080" (2mm) =	____

"M" Style Coupling NEMA C-face Motor Installation

1 Measure the distance from the face of the input adapter to the face of the splined shaft & record that measurement.
2. Subtract 0.31" (~8mm) from the distance. This needs to be done so that the coupling will not be preloaded after installation!
3. Use that measurement to locate the coupling from the face of the motor onto the shaft.
4. Once in place, tighten the set screw to lock the coupling in place. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.
5. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.



MEASURED DISTANCE	SUBTRACT DISTANCE	COUPLING PLACEMENT DISTANCE
____	- 0.310" (8mm) =	____

"Jaw" Style Coupling NEMA C-face Installation for Type N Adapters and Servo Adapters

1. Measure the distance from the face of the input adapter to the face of the coupling as shown and record that measurement.

2. Subtract the "X" dimension from the measured distance. This needs to be done so that the coupling will not be preloaded after installation!

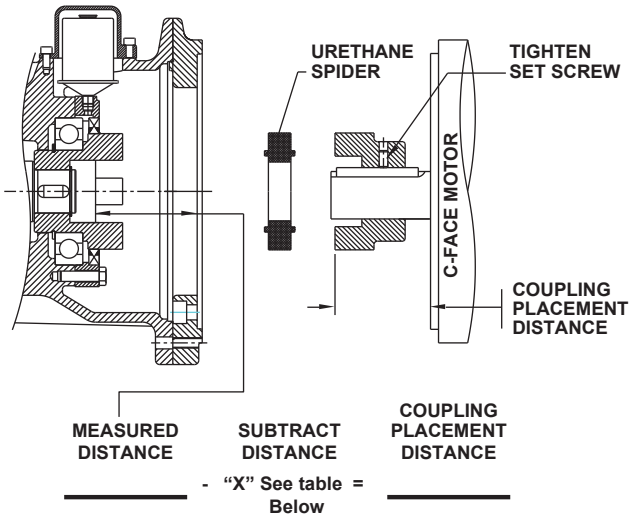
3. Use that measurement to locate the coupling from the face of the motor onto the shaft.

4. The metal portion of the coupling should be heated up prior to assembly, generally 250°F to 300°F (120°C to 150°C).

> ***IMPORTANT NOTE***
>
> DO NOT HEAT THE URETHANE SPIDER.

5. Once in place, tighten the setscrew to lock coupling in place. Let the coupling cool down before placing the spider into the jaws. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.

6. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.



Coupling Size	"X" (Subtract this value from measured distance)
R14	0.06" (1.5 mm)
R19 & R24	0.08" (2.0 mm)
R28	0.10" (2.5 mm)
R38 & 42	0.12" (3.0 mm)
R48	0.14" (3.5 mm)
R55	0.16" (4.0 mm)
R65	0.18" (4.5 mm)
R75	0.20" (5.0 mm)
R90	0.22" (5.5 mm)

NEMA/IEC/SERVO INPUT ADAPTERS & THEIR COUPLINGS

"Jaw" Style Coupling NEMA C-face Installation for Type AN Adapters

1. Remove the motor shaft's key and replace with the key supplied with the adapter. Reference Motor Parallel Keys table below.

IMPORTANT NOTE

NORD SUPPLIES A SPECIAL MOTOR SHAFT KEY
DO NOT USE THE KEY SUPPLIED WITH THE MOTOR!

2. For the attachment of the coupling half, heat up the coupling half to approx. 212°F (100°C). Position the coupling half as follows:
   - Push AI160, AI180 and AI225 on to the spacer bushing.
   - Push AI200, AI250, AI280 and AI315 on to the motor shaft collar.
   - AN250TC–AN400TC until dimension A has been reached (reference Position of the Coupling Half on the NEMA Motor Shaft table below)

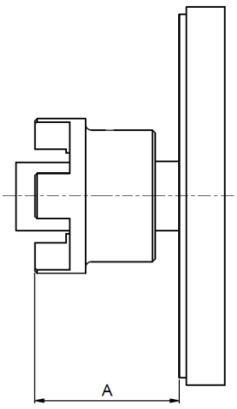
IMPORTANT NOTE

DO NOT HEAT THE URETHANE SPIDER.

2. Once in place, apply Loctite to the setscrew and tighten the setscrew to lock coupling in place. Let the coupling cool down before placing the spider into the jaws. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.

3. Attach the motor to the adapter. For the AN360TC and AN400TC adapters, attach the adapter flange to the motor first, then attach to the adapter.

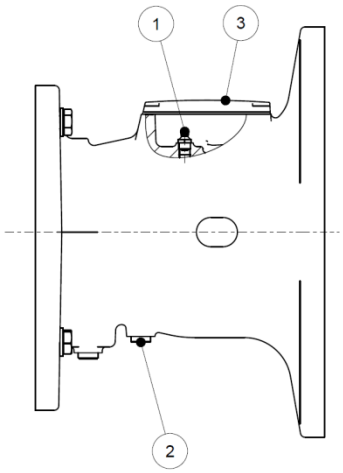
Motor Parallel Keys			
IEC/NEMA Type	**Coupling**	**Shaft ø**	**Motor Shaft's Key**
AI 160	R42	42 mm	12x8x45 mm
AI 180	R48	48 mm	14x9x45 mm
AN 250	R42	1.625 in	3/8x3/8x1 1/2 in
AN 280	R48	1.875 in	1/2x1/2x1 1/2 in
AI 200	R55	55 mm	16x10x50 mm
AN 320	R55	2.125 in	1/2x1/2x1 1/2 in
AI 225	R65	60 mm	18x11x70 mm
AN 360 R350	R65	2.375 in	5/8x5/8x2 1/4 in
AI 250	R75	65 mm	18x11x70 mm
AI 280	R75	75 mm	20x12x70 mm
AN 360 R450	R75	2.375 in	5/8x5/8x3 1/8 in
AN 400	R75	2.875 in	3/4x3/4x3 1/4 in



Coupling Half on the NEMA Motor Shaft		
NEMA type	**Coupling size**	**A [in]**
N250TC R350	R42	3.26
N250TC 300S	R42	3.38
N280TC R350	R48	3.44
N280TC 300S	R48	4.03
N320TC	R55	3.58
N360TC/350	R65	4.98
N360TC/450	R75	5.92
N400TC	R75	6.47

Re-greasing Option for AI...BRG1 and AN...BRG1

For the IEC/NEMA adapters AI and AN with option BRG1, grease the outer roller bearing with approx. 20–25 g of grease at the grease nipple. The grease nipple is located under a bolt-on inspection cover. Before re-greasing, unscrew the grease drain screw so that the excess grease can drain off. Remove the excess grease on the motor adapter.



1 Conical grease nipple
2 Grease drain screw
3 Inspection cover

Automatic Lubricator

Some NORD gear units with NEMA (or IEC) adapters ranging in size from N250TC-N400TC (or IEC160-IEC315) are supplied with a factory-installed, field-activated, PERMA® Classic Automatic Lubrication Cartridge. The automatic lubricator is used to dispense lubricant to the outer most roller bearing of the input NEMA (or IEC) input assembly. The lubrication cartridge must be activated prior to commissioning the gear unit. (Figures 1 & 2)

Some newer versions of the NEMA (or IEC) adapters also include a grease purge. The grease purge area is sealed for transportation; however, it is recommended that the G1/4 sealing screw be removed and that the grease collection container provided by NORD be installed just prior to activating the automatic lubricant dispenser. (Figure 3)

Principle of Operation

First the activation screw is threaded into the lubrication canister. Then the ring-eyelet on top of the activation screw is tightened until its breaking point. This causes a zinc-molybdenum gas generator to drop into a citric acid liquid electrolyte, which is contained within an elastic bladder. An electrochemical reaction slowly releases small amounts of hydrogen gas and gradually pressurizes the bladder, pushing the piston towards the lubrication chamber.

Grease is continuously injected into the lubrication point until the bearing cavity is full. Any back pressure from the bearing will cause the system to neutralize. The bladder inside the canister will continue to slowly build pressure so that once the equipment resumes normal operation; the lubricator will also resume its normal function.

The lubricator contains approximately 120 cm^3 or 120 ml (4.8 oz) of grease. For reference, a single stroke of a typical grease gun delivers approximately 1.0-1.2 cm^3 (0.03–0.04 oz) of grease. This means the canister contains approximately 100 strokes of grease. See Figure 1 for a detailed view of the PERMA® Lubricator.

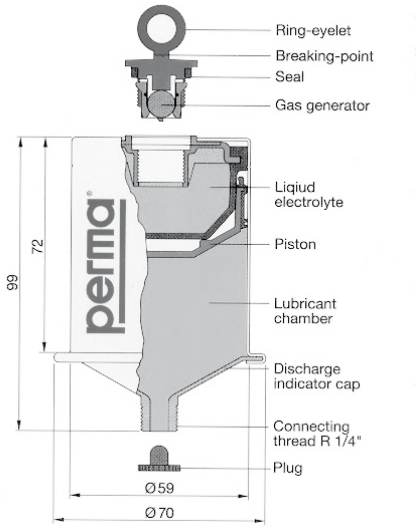


Figure 1 - PERMA® Automatic Lubrication Canister

NOTICE

- To prevent premature bearing failure, the lubrication dispenser must be activated prior to commissioning the gear reducer.
- The lubricator must only be used once and should never be opened or taken apart or permanent damage will result.
- Never unscrew the PERMA® canister from the lubrication point after activation or during the discharge period. This would cause a permanent pressure loss in the lubricator and would justify replacing the lubricator.

⚠ WARNING

- Avoid swallowing the gas generator, the liquid electrolyte, and the lubricant.
- Avoid contact of, the liquid electrolyte, and the lubricant with the eyes, skin or clothing.
- Observe all applicable MSDS sheets.
- Follow applicable local laws and regulations concerning waste disposal.

PERMA® Automatic Lubricator Options Supplied by NORD

NORD Part Number	28301000	28301010
Lubrication Option	Synthetic (standard)	Food Grade (optional)
PERMA® Classic Temperature Range ♦	0 to 40 °C (32 to 104 °F)	0 to 40 °C (32 to 104 °F)
Lubrication Volume	120 cm^3 or 120 ml (4.8 oz)	120 cm^3 or 120 ml (4.8 oz)
Grease Lubrication Mfg. / Type	Klüber / Petamo GHY 133	Lubriplate / FGL1
Lubrication Temperature Range ♦	-30 to 120 °C (-22 to 248 °F)	-18 to 120 °C (0 to 248 °F)

♦ The temperature range values shown do not apply to other components and/or lubricants within the gear reducer.

Lubricator Service Interval

The Automatic lubricator should be inspected approximately every 6 months. At the end of the lubrication period the piston becomes clearly visible through the clear nylon discharge indicator cap located at the bottom of the PERMA® canister (Figure 1); this helps indicate that the lubricant has been fully discharged at which time the lubricator should be replaced. When operating the gear unit 8 hours/day or less a replacement interval of 12 months or 1 year is possible. Ambient temperature will influence the discharge rate and may extend or shorten the replacement interval.

Ambient Considerations

The grease discharge rate is affected by the ambient temperature. PERMA® indicates that the lubricator contents will dispense for a 12 month period when the average temperature is 20 °C (68 °F). Grease dispensing rates depend primarily on average ambient conditions and not extreme highs and lows. Lower ambient temperatures will lead to slower dispensing rates and higher ambient temperatures will lead to faster dispensing rates.

Average Ambient Temperature	Discharge Period Months ♦
0 °C (32 °F)	>18
10 °C (50 °F)	18
20 °C (68 °F)	12
30 °C (86 °F)	6
40 °C (104 °F)	3

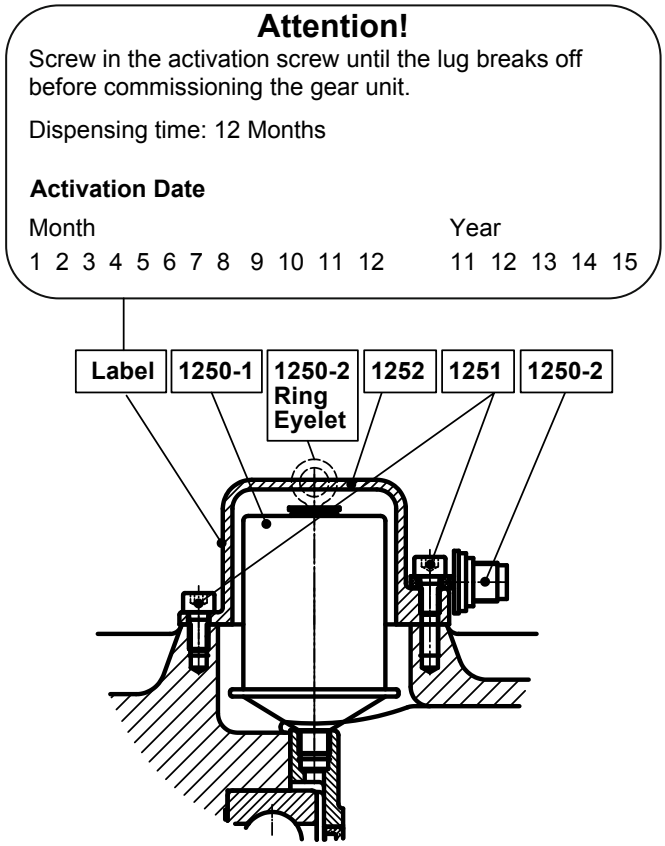
♦ Values are approximate.

Discharge can also be influenced by type of lubricant, vibration, and by the mating connecting parts in the lubrication system.

Activating the Automatic Lubricator

1. Loosen and remove the M8x16 assembly socket head cap screws (1251).
2. Carefully remove the protective cover (1252) installed over the automatic lubricator (1250-1).
3. Screw the activation screw (1250-2) into the automatic lubricator (1250-1) and twist the ring-eyelet until it reaches its breaking point.
4. Re-fit the cartridge cover (1252) and re-install and tighten the assembly screws (1251).
5. Mark the activation date on the adhesive label that is provided.

Figure 2 - Activating the Automatic Lubricator



1250-1 Automatic Lubricator
1250-2 Activation Screw
1251 Socket Head Cap Screws
1252 Protective Cover

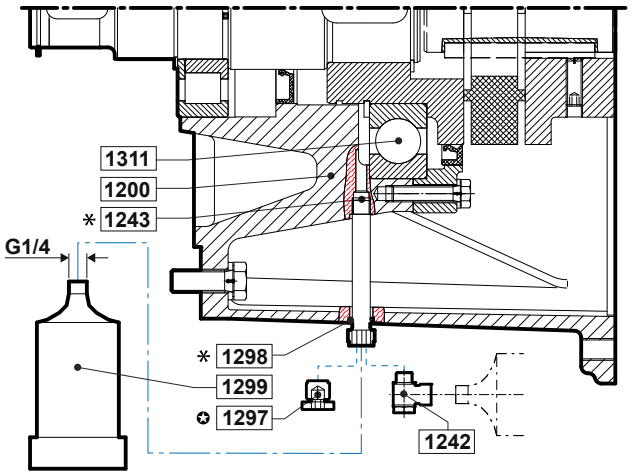
Grease Purge and Grease Drain Cup

Some versions of the NEMA (or IEC) adapters also include a grease purge and a grease drain cup (1299) for collecting old grease. The grease purge area is sealed for transportation.

It is recommended that the G1/4 sealing screw (1297) be removed and that the grease drain cup be installed after the automatic lubricant dispenser is activated.

The swivel fitting (1242) that NORD supplies allows the grease cup to be positioned at a 90° angle from its typical mounting. The swivel fitting allows the grease cup to be rotated so that it remains clear of any gear unit mounting obstructions.

Figure 3 – Grease Purge and Grease Cup Assembly



1200 NEMA or IEC Input Cylinder
1242 Swivel Fitting (P/N) 22006359)
1243 Extension*
1297 Screw Plug ✪
1298 Seal Ring*
1299 Grease Drain Cup (P/N 28301210)
1311 Bearing

* Supplied on certain input assembly sizes as needed.

✪ Remove the screw plug to install either the grease drain cup or the swivel fitting with the grease drain cup.

Grease Cup Servicing

NORD suggests that with every second replacement of the automatic lubricator, the grease collection cup (NORD Part No. 28301210) should be emptied or replaced with a new one. Follow the steps below to service the grease cup.

1. Unscrew the grease drain cup (1299) from either the outlet port of the NEMA or IEC input cylinder or from the extension (1243) that is secured to the NEMA or IEC input cylinder.
2. To empty the grease drain cup (1299) insert a stiff rod through the hole in the grey cap-end of the drain cup and push the internal plunger towards the thread-end of the drain cup. Please note that the dark gray end cap is bonded into place and cannot be removed.
3. Collect and properly dispose of the grease being pushed out of the drain cup. Due to the design of the container a residual amount of grease may remain in the container.
4. After emptying and cleaning the grease cup it can be fitted back onto the grease outlet port of the NEMA or IEC adaptor.
5. In the event the grease cup becomes damaged it should be replaced with a new container. Consider replacing the grease cup (P/N 28301210) with every second replacement of the automatic lubricator.

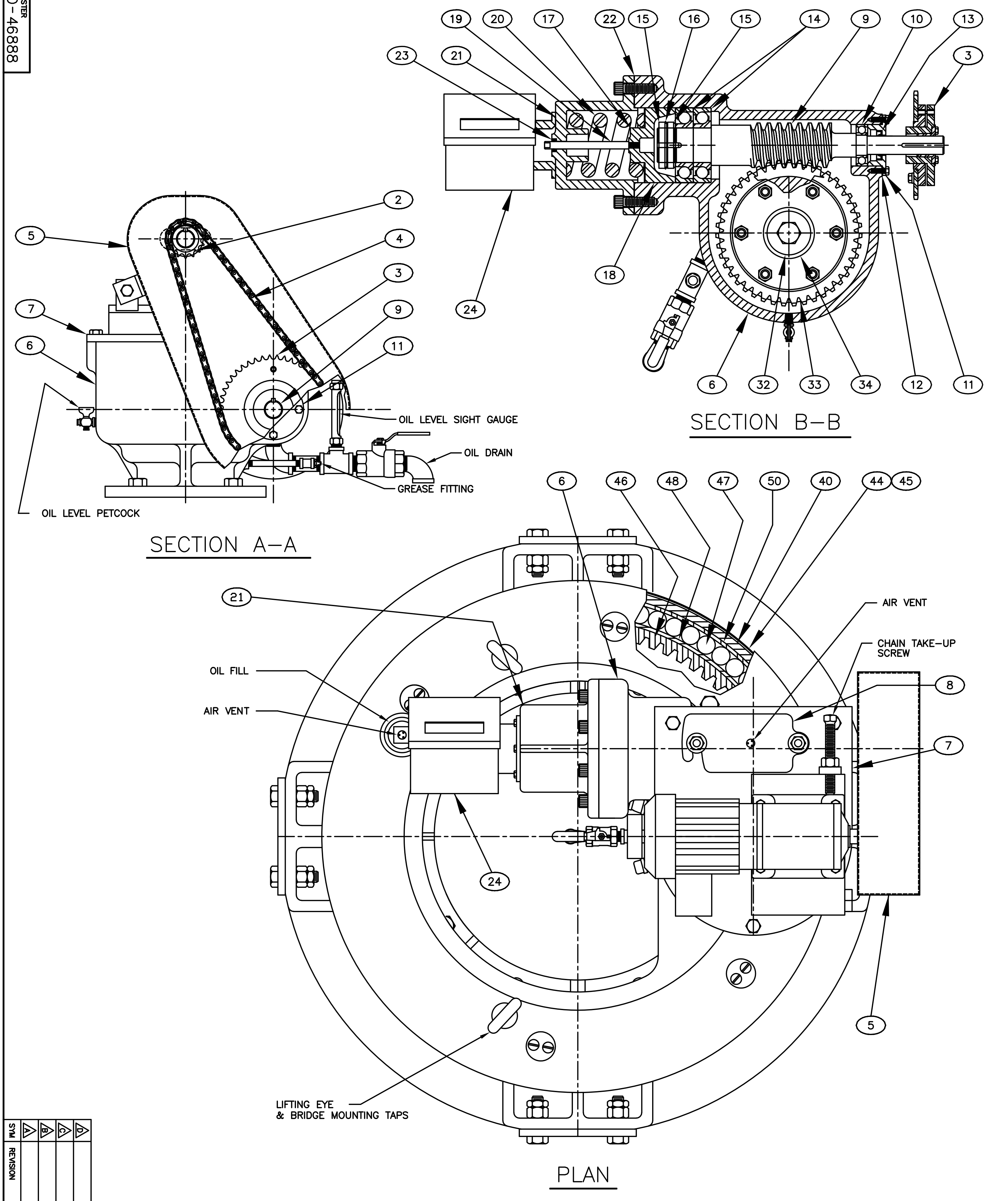
Replacing the Automatic Lubricator

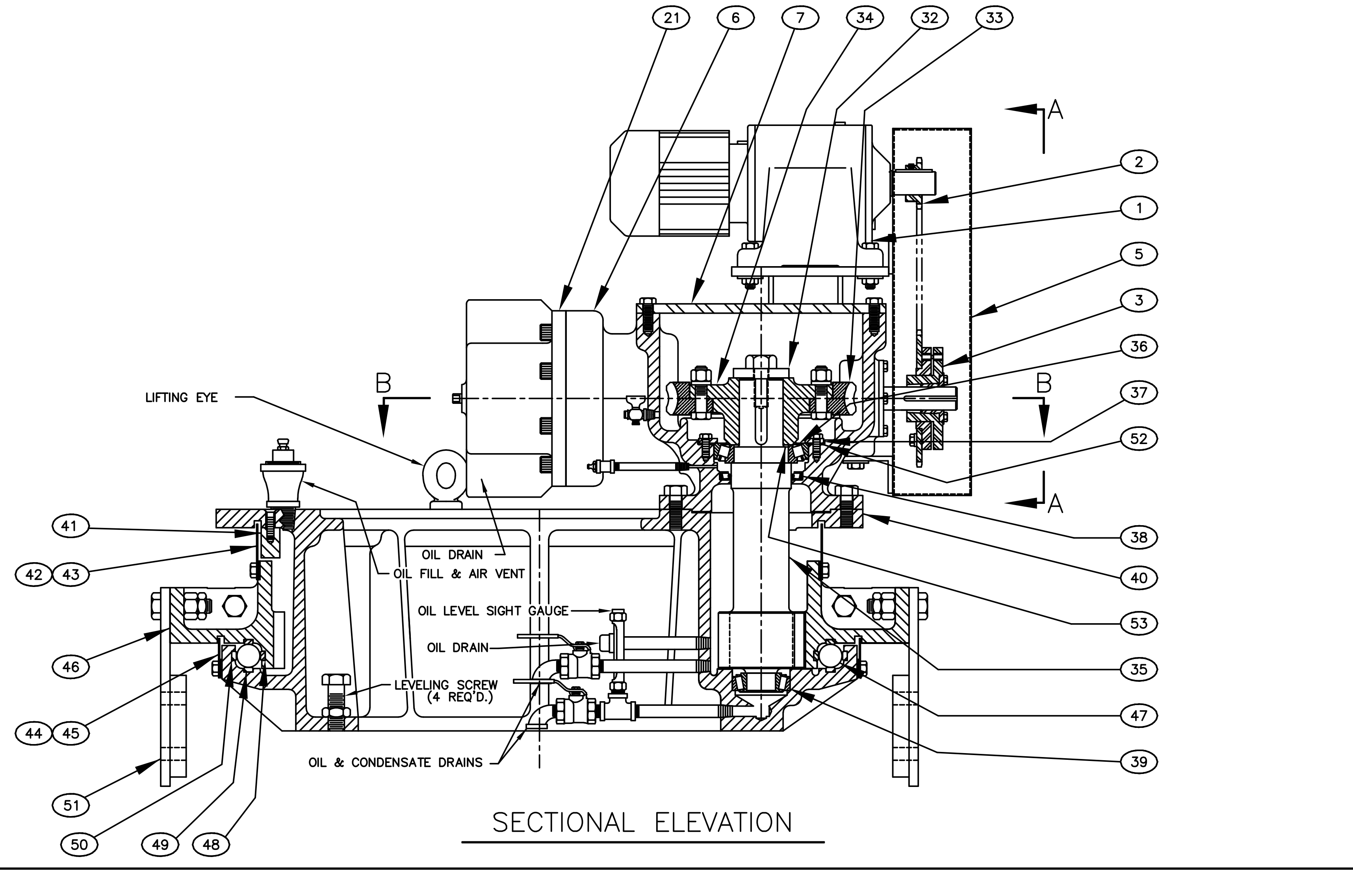
A new automatic lubricator can be ordered from NORD by specifying the appropriate Part Number from the table at the bottom of Page 1 of this manual. Reference Figure 2 and follow the steps below to replace the automatic lubricator.

1. Loosen and remove the M8x16 socket head cap screws (1251) holding the protective cover (1252) in place.
2. Unscrew the automatic lubricator (1250-1) from the bearing cover area of the NEMA or IEC input cylinder.
3. Install the new automatic lubricator and activate per the instructions on page 2.
4. Re-install the protective cover (1252) and the assembly screws (1251).
5. Note the activation date of the newly installed automatic lubricator

DRIVE ASSEMBLY
PARTS LIST DRAWING

MASTER D-46888





REF	DESCRIPTION
1	GEARMOTOR
2	DRIVE SPROCKET – KEYED
3	DRIVEN SPROCKET – SHEAR PIN
4	ROLLER CHAIN
5	CHAIN GUARD
6	WORM GEAR HOUSING
7	WORM GEAR HOUSING COVER
8	INSPECTION & OIL FILL COVER
9	WORM SHAFT
10	BEARING
11	BEARING CAP
12	BEARING CAP GASKET
13	OIL SEAL – LIP IN
14	BEARING
15	LOCKNUT
16	LOCKWASHER
17	THRUST RING
18	SHIM
19	THRUST ROD
20	SPRING
21	SPRING HOUSING
22	SPRING HOUSING GASKET
23	OIL SEAL – LIP OUT
24	TORQUE OVERLOAD ASSEMBLY
32	WORM GEAR RETAINER
33	WORM GEAR
34	WORM GEAR HUB – KEYED
35	PINION SHAFT
36	BEARING
37	BEARING RETAINER
38	OIL SEAL – LIP IN
39	BEARING
40	SPUR GEAR HOUSING
41	SPUR GEAR HOLD-DOWN BLOCK
42	DUST SHIELD – SPLIT
43	DUST SHIELD SEAL
44	DUST SHIELD – SPLIT
45	DUST SHIELD SEAL
46	SPUR GEAR
47	BEARING BALL
48	REPLACEABLE BEARING RACE
49	REPLACEABLE BEARING RACE
50	REPLACEABLE BEARING RACE
51	DRIVE CAGE ATTACHMENT LUG
52	RETAINER SHIM SET
53	HUB SHIM SET

SYM	REVISION	BY	DATE	CHKD
D				
C				
B				
A				

AMWELL FURNISHES MECHANISM TO FIT TANK OF DIMENSIONS GIVEN, BUT IS NOT RESPONSIBLE FOR CONCRETE DESIGN. CUSTOMER TO FURNISH NECESSARY REINFORCING STEEL AND TO DETERMINE SIZE AND PLACEMENT OF FOOTINGS TO SUIT LOCAL CONDITIONS.

AMWELL DOES NOT FURNISH PIPING (EXCEPT AS NOTED) FLOOR RAILS, TROUGHS, GRATINGS, WEIR PLATES, OIL OR GREASE FOR LUBRICATION. ANY WIRING OR CONDUITS BETWEEN MOTORS, CONTROLS AND ALARMS OR ANY ELECTRICAL EQUIPMENT OF ANY KIND EXCEPT AS SPECIFICALLY STATED IN AMWELL SPECIFICATIONS.

MICROFILMED

AMWELL
A Division of McNish Corporation
AURORA, ILLINOIS, USA
(ORIGINALLY AMERICAN WELL WORKS – EST. 1868)

DRAWN	WTW
CHECKED	
APP'D.	
DATE	3/26/01
S.O.	STD
SCALE	NONE

DESCRIPTION
PARTS LIST
MODEL 42H8T DRIVE
PLATFORM BRIDGE W/SHEAR PIN HUB

DRAWING NO. D7055398817 1 REV.

SECTION E

TROUBLESHOOTING GUIDE

CIRCULAR CLARIFIERS

TROUBLESHOOTING GUIDE

1. Overload alarm sounds or drive operates at high torque for several days.	A. Torque build up on drive and mechanism.	A1. Stop feed to clarifier and check for operating problem. Refer to operating instructions. A2. Check for foreign object in tank. Stop drive if pointer is jumping.
	B. Heavy build up of solids due to shutdown.	B1. Increase sludge withdrawals and reduce sludge depth. B2. Agitate sludge in front of arms with rods or air. B3. Shutdown clarifier and drain tank. Check for grit.
2. Drive Stops.	A. Loss of electrical power.	A1. Check power source. A2. Check control fuse.
	B. Drive control cutout.	B1. If pointer on control is at maximum cut-out, drain tank to locate problem. Do Not by-pass control. B2. If pointer is not at maximum torque check control.
	C. Motor drive (s) cutout.	C1. Check for overheating. Refer to manufacturer's instructions. C2. Check for broken chain.
3. Sludge too thin.	A. Sludge withdrawal rate too high.	A1. Decrease removal of sludge.
	B. Overflow rate is too high.	B1. Decrease feed rate.
	C. Flow through tank has been short circuited.	C1. Adjust weirs for even overflow or convergent leakage.

CIRCULAR CLARIFIERS

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
4. Excessive floating scum.	A. Septic conditions on bottom of tank (pieces of floating sludge and objectionable odor)	A1. Check for clogged discharge line. See operating instructions. A2. Overflow rate is to low. Increase influent. A3. Sludge blanket depth too high. Increase sludge removal. A4. Check sludge removal schedule, may require more frequent intervals of removal. A5. Squeegees need replacement.
	B. Poor skimmer operation.	B1. Check Operation of skimmer.
5. Excessive suspended matter in effluent.	A. Excessive turbulence	A1. Reduce turbulence
	B. Too long sludge retention time.	B1. Increase sludge wasting.
	C. Short-circuiting of flow.	C1. Check weir level, adjust as required. C2. Check baffles in influent well. Adjust as required.
	D. Too high a sludge blanket.	D1. Increase sludge wasting to lower blanket.
6. Excessive growth on weirs.	A. Accumulation of solids causes algae.	A1. Increase frequency of cleaning.

SECTION F

SPARE PARTS INFORMATION

AMWELL®
A Division of McNish Corporation
Aurora, Illinois, USA

Issued 2/5/87
Supersedes NONE

ALL EQUIPMENT

PROCEDURE FOR ORDERING SPARE OR REPAIR PARTS

1. Identify your equipment using the AMWELL S.O. number shown below.

2. Identify the part by name and give the number of the drawing on which this part or assembly appears. If it is a part for a motor, pump, electrical control or any other part not manufactured by AMWELL, the information will be found in the manufacturer's reference data included in this manual, or on the manufacturer's nameplate.

3. Show the part number. (Information can be gained in the same manner).

4. Show the size and include all pertinent dimensions (such as diameter, length, thickness, bore, pitch, etc.) whenever possible.

5. If parts being ordered are electrical in nature, give all pertinent data; voltage, amperage, wattage, hertz, speed, power factor or other information given on a nameplate or in the brochure.

6. Submit your written purchase order or request for quotation, both signing and printing your full name so that we will know whom to contact should further clarification of the order be necessary. All verbal orders must be confirmed in writing.

7. Give return and shipping address.

8. Give preferred method of shipping: Parcel Post, Truck Freight, Rail Freight, Air Express, etc.

9. Show quantity desired.

10. Give instructions on where to send invoice.

11. All spare or repair part orders are subject to a minimum order charge.

12. Send all inquires to: AMWELL, A Division of McNish Corporation
161 S. Lincolnway, Suite 310, North Aurora, IL 60542
Phone: (630) 898-6900 / Fax: (630) 898-6901

YOUR EQUIPMENT IS IDENTIFIED AS FOLLOWS:

S.O. NUMBER: A22060

NAME OF EQUIPMENT: Two (2) Model "HT" Thickener Mechanism with Model “42H8T” Drive

CIRCULAR CLARIFIERS

RECOMMENDED SPARE PARTS

RECOMMENDED SPARE PARTS LIST		
QUANTITY	**ITEM**	**IDENTIFICATION NO.**
	NONE	

FURNISHED SPARE PARTS LIST		
QUANTITY	**ITEM**	**IDENTIFICATION NO.**
	NONE	

PRICES QUOTED UPON REQUEST.

SECTION G

INSTALLATION INSTRUCTIONS & DRAWINGS

PARTS LIST

IOM PARTS LIST		Contract: A22060 Job Name: TAUNTON, MA WWTP SOLIDS HANDLING IMPROVEMENTS		
A1100 (2) CIRCULAR CLARIFIER				
Total Ship Pcs	Mark	Description	Weight /EA	Material
		CIRCULAR CLARIFIER		
1		STRUCTURAL CALCULATIONS		
		DRIVE ASSEMBLY		
2	03	42H8T DRIVE ASSEMBLY		
		STAIRWAY ASSEMBLY		
2	814-292-12.01	STAIRWAY CHANNEL, RH	181	STL
2	814-292-12.02	STAIRWAY CHANNEL, LH	181	STL
16	814-292-12.03	STAIR TREAD 36" LG	7	ALUM
4	814-292-12.04	STAIRWAY LANDING FRAME	46	STL
4	814-292-12.05	BRACKET, BRIDGE SUPPORT	43	STL
4	814-292-12.06	SLIDE PLATE, 8W X 18 BEAM		NYLON
104	814-292-12.07	NUT HEX FINISHED 304 SS .375		304
104	814-292-12.08	CAPSCREW HEX HD 304 SS .375 X 1.25		304
104	814-292-12.09	LOCK WASHER 304 SS .375		304
64	814-292-12.10	WASHER STD PL 304 SS .375		304
12	814-292-12.11	CAPSCREW HEX HD 304 SS .5 X 1.75		304
12	814-292-12.12	NUT HEX FINISHED 304 SS .5		304
12	814-292-12.13	WASHER STD PL 304 SS .5		304
		ANCHORAGE - HB (BMAN02)		
16	814-292-04.01	THREADED ROD 304 SS 1.25 X 15 IN LG	5	304
32	814-292-04.02	NUT HEX FINISHED 304 SS 1.25		304
32	814-292-04.03	WASHER STD PL 304 SS 1.25		304
32	814-292-04.04	THREADED ROD 304 SS .75 X 7.5 IN LG		304
32	814-292-04.05	WASHER STD PL 304 SS .75		304
32	814-292-04.06	NUT HEX FINISHED 304 SS .75		304
2	814-292-04.07	TEMPLATE - 20" DIA CENTER COLUMN	24	STL
12	814-292-04.08	POWERS PE1000+ ANCHOR ADHESIVE		
		BRIDGE ASSEMBLY		
2	814-292-02.01	BRIDGE	2,250	STL
12	814-292-02.02	ANGLE - HANDRAIL MOUNTING	1	STL
4	814-292-02.03	BRACKET, BRIDGE SUPPORT	11	STL
4	814-292-02.04	SLIDE PAD		NYLON
24	814-292-02.05	CAPSCREW HEX HD 304 SS .5 X 1.25 FULL		304
24	814-292-02.06	NUT HEX FINISHED 304 SS .5		304
4	814-292-02.07	WASHER STD PL 304 SS .75		304
4	814-292-02.08	CAPSCREW HEX HD 304 SS .75 X 1.5 FULL		304
		HANDRAIL		
2	814-292-14.01A	HANDRAIL	168	ALUM
2	814-292-14.01B	KICKPLATE		ALUM
4	814-292-14.02A	HANDRAIL, LANDING	16	ALUM
4	814-292-14.02B	KICKPLATE, LANDING		ALUM
4	814-292-14.03	HANDRAIL, STAIRWAY	31	ALUM

IOM PARTS LIST	Contract: A22060 Job Name: TAUNTON, MA WWTP SOLIDS HANDLING IMPROVEMENTS			
A1100 (2) CIRCULAR CLARIFIER				
Total Ship Pcs	Mark	Description	Weight /EA	Material
96	814-292-14.04	NUT HEX FINISHED 304 SS .5		304
96	814-292-14.05	CAPSCREW HEX HD 304 SS .5 X 1.75		304
96	814-292-14.06	WASHER STD PL 304 SS .5		304
		GRATING		
2	814-292-9.01	GRATING, BRIDGE	118	ALUM
2	814-292-9.02	GRATING, LANDING	27	ALUM
		WALKWAY		
4	814-292-11.01	WALKWAY PLATE SECTION A	14	ALUM
4	814-292-11.02	WALKWAY PLATE SECTION B	40	ALUM
64	814-292-11.03	FLOOR FASTENERS GALV MI W/SS SCREWS		GALV
		DRIVE COVER		
2	814-292-10	DRIVE COVER	24	ALUM
		CENTER COLUMN		
2	814-292-03.01	CENTER COLUMN	1,424	STL
16	814-292-03.02	CAPSCREW HEX HD 304 SS 1 X 3.5		304
16	814-292-03.03	NUT HEX FINISHED 304 SS 1		304
		DRIVE CAGE		
2	814-292-05.01	DRIVE CAGE	1,220	STL
8	814-292-05.02	DRIVE CAGE HANGER	44	STL
32	814-292-05.03	CAPSCREW HEX HD 304 SS .625 X 1.5 FULL		304
32	814-292-05.04	CAPSCREW HEX HD 304 SS .625 X 3.5		304
64	814-292-05.05	NUT HEX FINISHED 304 SS .625		304
		INFLUENT WELL		
2	814-292-06.01	INFLUENT WELL	1,587	STL
4	814-292-06.02	INFLUENT WELL SUPPORT	90	STL
4	814-292-06.03	BAFFLE	14	STL
16	814-292-06.04	CAPSCREW HEX HD 304 SS .75 X 2 FULL		304
16	814-292-06.05	WASHER STD PL 304 SS .75		304
16	814-292-06.06	NUT HEX FINISHED 304 SS .75		304
40	814-292-06.07	CAPSCREW HEX HD 304 SS .5 X 1.25 FULL		304
8	814-292-06.07	CAPSCREW HEX HD 304 SS .5 X 1.25 FULL		304
8	814-292-06.08	WASHER STD PL 304 SS .5		304
40	814-292-06.09	NUT HEX FINISHED 304 SS .5		304
8	814-292-06.09	NUT HEX FINISHED 304 SS .5		304
		CLEVIS ROD ASSEMBLY ZPS 1.25 DIA		
8	841-292-08	CLEVIS ROD - 1.25" DIA X 2'-7.5" LG C-C - STL	20	STL
		TRUSS ARM		
4	814-292-07.01	TRUSS ARM	927	STL
8	814-292-07.02	NUT HEX FINISHED 304 SS 1.5		304
8	814-292-07.03	CAPSCREW HEX HD 304 SS 1.5 X 4.5		304
		FLIGHTS		
4	814-292-17.01	FLIGHT - INNER	25	STL

IOM PARTS LIST	Contract: A22060 Job Name: TAUNTON, MA WWTP SOLIDS HANDLING IMPROVEMENTS			
A1100 (2) CIRCULAR CLARIFIER				
Total Ship Pcs	Mark	Description	Weight /EA	Material
20	814-292-17.02	FLIGHT	70	STL
48	814-292-17.03	CAPSCREW HEX HD 304 SS .625 X 1.5 FULL		304
48	814-292-17.04	NUT HEX FINISHED 304 SS .625		304
48	814-292-17.05	WASHER SAE PL 304 SS .625		304
		SQUEEGEES		
4	814-292-18.01	SQUEEGEE - 16 GA X 3" X 2'-11" LG - 304SS	1	304
20	814-292-18.02	SQUEEGEE - 16 GA X 3" X 7'-0" LG - 304SS	4	304
148	814-292-18.03	CAPSCREW HEX HD 304 SS .375 X 1 FULL		304
148	814-292-18.04	WASHER STD PL 304 SS .375		304
148	814-292-18.05	NUT HEX FINISHED 304 SS .375		304
		PICKET		
18	814-292-13.01	PICKET - FIXED	37	STL
36	814-292-13.02	CAPSCREW HEX HD 304 SS .5 X 1.5 FULL		304
36	814-292-13.03	WASHER STD PL 304 SS .5		304
36	814-292-13.04	NUT HEX FINISHED 304 SS .5		304
4	814-292-16.01	PICKET, TRUSS ARM "A"	34	STL
4	814-292-16.02	PICKET, TRUSS ARM "B"	33	STL
4	814-292-16.03	PICKET, TRUSS ARM "C"	32	STL
4	814-292-16.04	PICKET, TRUSS ARM "D"	31	STL
4	814-292-16.05	PICKET, TRUSS ARM "E"	30	STL
4	814-292-16.06	PICKET, TRUSS ARM "F"	29	STL
4	814-292-16.07	PICKET, TRUSS ARM "G"	28	STL
4	814-292-16.08	PICKET, TRUSS ARM "H"	27	STL
4	814-292-16.09	PICKET, TRUSS ARM "J"	26	STL
4	814-292-16.10	PICKET, TRUSS ARM "K"	26	STL
80	814-292-16.11	CAPSCREW HEX HD 304 SS .5 X 1.5 FULL		304
120	814-292-16.12	WASHER STD PL 304 SS .5		304
40	814-292-16.13	NUT HEX FINISHED 304 SS .5		304
		NAMEPLATE - AMWELL		
2	814-292-15.01	AMWELL NAMEPLATE ALUMINUM WHITE ON BLUE		
4	814-292-15.02	PIPE RING MC-CARR #3225T31,2 FOR 1.5		
4	814-292-15.03	MACH SCREW RD HD 304 SS 10-24 X .5		304
4	814-292-15.04	NUT HEX FINISHED 304 SS 10-24		304

INSTALLATION INSTRUCTIONS

MODEL "HT" SLUDGE THICKENER

INSTALLATION INSTRUCTIONS

GENERAL

IMPORTANT - When unloading structural steel make sure slings are equally spaced and secured to the heavier members to prevent slippage. Heavier boxes and crates should be lowered by crane or other means and placed on timbers on high ground away from possible flooded areas.

Electrical equipment such as magnetic starters, push button stations etc. should be transferred immediately to a covered area.

The drive assembly should be kept above ground level and covered.

These instructions and all drawings furnished should be thoroughly examined before starting the installation. Installation time will be minimized with a clear understanding of these instructions.

Concrete work should be carefully checked to agree with the dimensions and arrangement shown on the concrete drawing, specifically, the location, elevation and projection of all anchor bolts. The concrete should be firmly set before an equipment is installed.

During installation of the machine correcting of minor misfits by reasonable amounts of reaming or cutting is considered a legitimate part of installation. Any error in steel work or hole location which prevents the proper assembling or fitting of parts should be reported immediately to the nearest **AMWELL** Representative. Approval and method of such correction work must be obtained from **AMWELL**.

SEQUENCE OF INSTALLATION

1. Center Column
2. Drive Cage
3. Drive Assembly
4. Influent Well
5. Truss Arms
6. Bridge
7. Checking the Machine for Level
8. Squeegees
9. Nameplate
10. Special Painting Note
11. Start-up Procedure

REFER TO MASTER ERECTION DIAGRAM 814-292

NOTE: It is a good idea to consult the lubrication and maintenance instructions at this point, determine the lubricants necessary for start-up and order them now so they will be available when required, particularly when the job site is in a remote area.

MODEL "HT" SLUDGE THICKENER

INSTALLATION INSTRUCTIONS

1. CENTER COLUMN - (Ref. Dwg. 814-292 SHEET 3)

Install center column anchors using template provided to locate.
Set the center column on the anchor bolts and place one washer and loosely screw one nut on each anchor bolt. Raise the center column to the proper elevation, plumb it accurately and secure, but do not place grout beneath the column at this step-in installation.

2. DRIVE CAGE (Ref. Dwg. 814-292 SHEET 3)

Place drive cage over center column and rest on tank floor.

3. DRIVE ASSEMBLY - (Ref. Dwg. 814-292 SHEET 3)

Place pre-assembled drive assembly on center column making certain that tapped holes in the gear housing are oriented properly to mount the bridge on the correct centerline. Bolt the drive assembly in place.

IMPORTANT - Exercise care in handling this assembly so as not to damage bearings and seals. Do not attach slings to the internal gear.

Bolt four (4) cage hangers to top of drive cage.

Raise the drive cage and bolt securely to the drive cage attachment lugs on the internal gear.

Check to make certain the drive assembly is level and the drive cage hangs plumb. Further adjustment may be required.

IMPORTANT NOTE: If unit is to be field sandblasted the drives are to be removed from the sandblast area to avoid contamination of the internal drive parts. Refer to Separate Instructions for “Drive Unit Protection for Blast Cleaning" found in this section.

4. INFLUENT WELL - (Ref. Dwg. 814-292 SHEET 4)

Bolt the influent well hangers to the drive cage.

Raise the influent well into position and bolt securely to the influent well supports.

Bolt the influent well scum port baffles in place

5. TRUSS ARMS - (Ref. Dwg. 814-292 SHEET 4)

Bolt truss arms to drive cage.

Attach clevis rod to cage and truss arm and adjust as required to put bottom of truss arm parallel to tank floor.

Bolt the flights to the truss arms.

Bolt pickets to truss arms.

IMPORTANT - At this point in installation make certain that the bottom of the truss arms are parallel with the floor throughout so that the squeegees will follow the floor properly.

6. BRIDGE - (Ref. Dwgs. 814-292 SHEET 6, 7, & 8, Grating Manufacturer's Erection Diagram & Handrail Manufacturer's Erection Diagrams).

Place bridge slide plates over anchor bolts at wall and shim to proper elevation.

Lower access bridge into position onto internal gear housing and slide plates and secure in place.

Assemble grating to bridge.

Assemble stair way to bridge.

Assemble grating to bridge.

Assemble pickets to bridge.

7. CHECKING THE MACHINE FOR LEVEL

IMPORTANT - The drive assembly must be level to insure that each arm will revolve in a horizontal plane. Bolts securing drive assembly to center column must be loosened before attempting to make adjustments with the leveling bolts.

SEE SEPARATE "LEVELING INSTRUCTIONS" PROVIDED IN THIS SECTION.

Level influent well.

Place grout under center column and tighten all bolts securely.

Level bridge and grout under bridge slide plates.

8. SQUEEGEES - (Ref. Dwg. 814-292 SHEET 5)

Clean the tank floor thoroughly and bolt the squeegees to the flights finger tight using the fasteners provided.

Rotate the arms to see that all squeegees clear the high spots in the tank floor. Adjust where necessary and tighten nuts firmly.

The recommended clearance between the squeegees and the finished tank bottom is 1/2".

9. NAMEPLATE - (Ref. Dwg. 814-292 SHEET 8)

Install nameplate on handrail as shown on above drawing.

10. SPECIAL PAINTING NOTE:

After all final alignments and adjustment procedures have been performed the exposed threads of all truss rods, sway braces and submerged adjusting screws should be painted with a minimum of 4.0 mils of finish paint to prevent rust through.

11. START-UP PROCEDURE - (Also Refer to "Starting Procedure" on page 2 of the "Operating Instructions" found in Section "C")

Make necessary electrical connections to the motor and overload devices. Connect the motor so that the thickener mechanism rotates clockwise looking down on it.

WARNING: **Be sure thickener operates in a clockwise direction. Do not allow drive to operate in a counter-clockwise direction for longer than a momentary period of time (2 seconds max.) or serious damage to the drive will result.**

Lubricate the drive assembly in accordance with separate lubrication instructions provided.

Refer to drive manufacturer's instruction sheets and check lubrication and oil level of all drive components.

The machine is now ready for operation. Fill the tank and adjust the weirs in order to provide proper operating liquid level and equal discharge along entire length of weir.

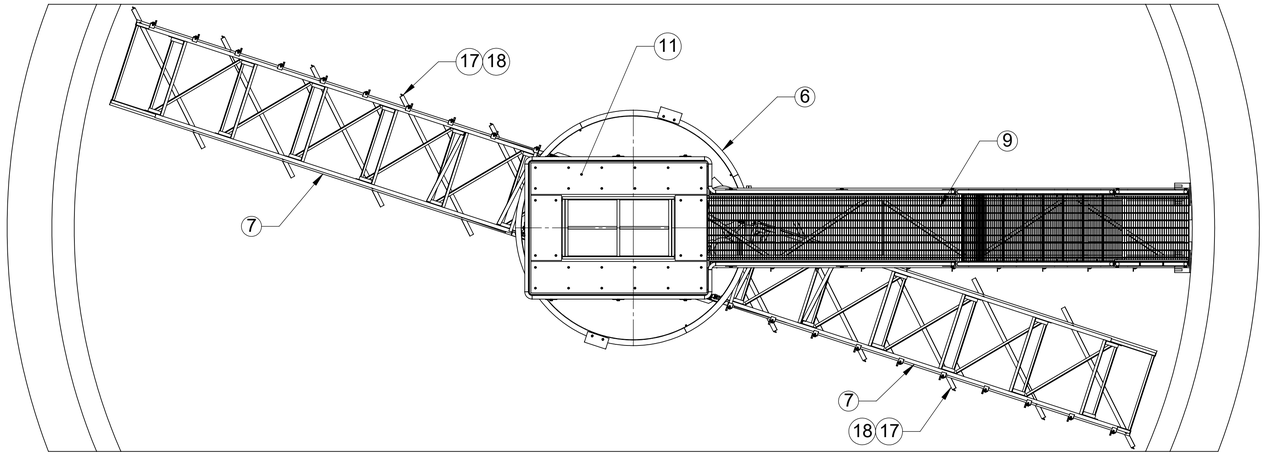
11. START-UP PROCEDURE - (Continued)

Any further information required may be obtained from:

AMWELL®
A Division of McNish Corporation
161 S. Lincolnway, Suite 310
North Aurora, Illinois 60542

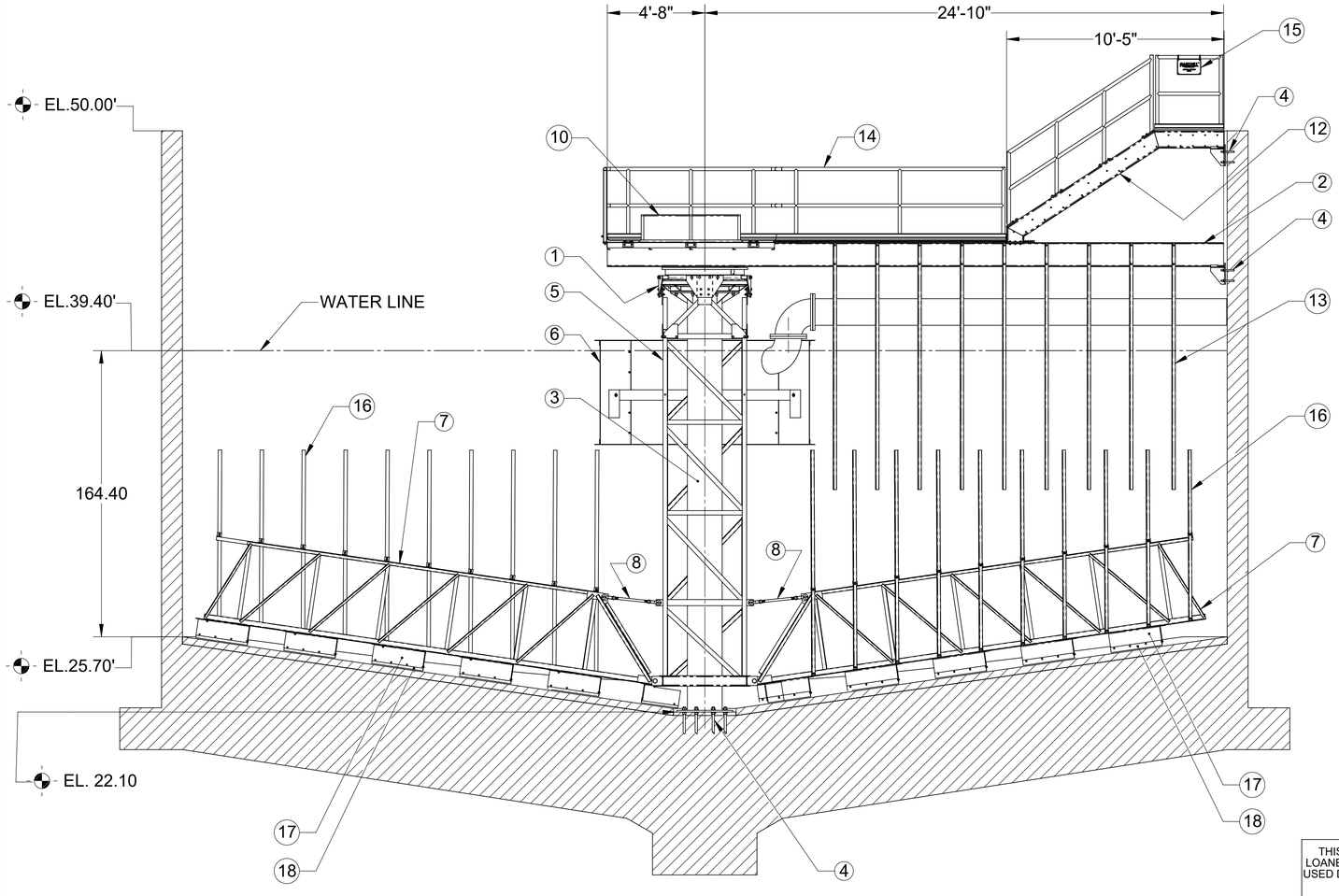
Phone: (630) 898-6900
Fax: (630) 898-6901
E-Mail: amwell@amwell-inc.com

GENERAL ASSEMBLY DRAWING (ERECTION DIAGRAM)

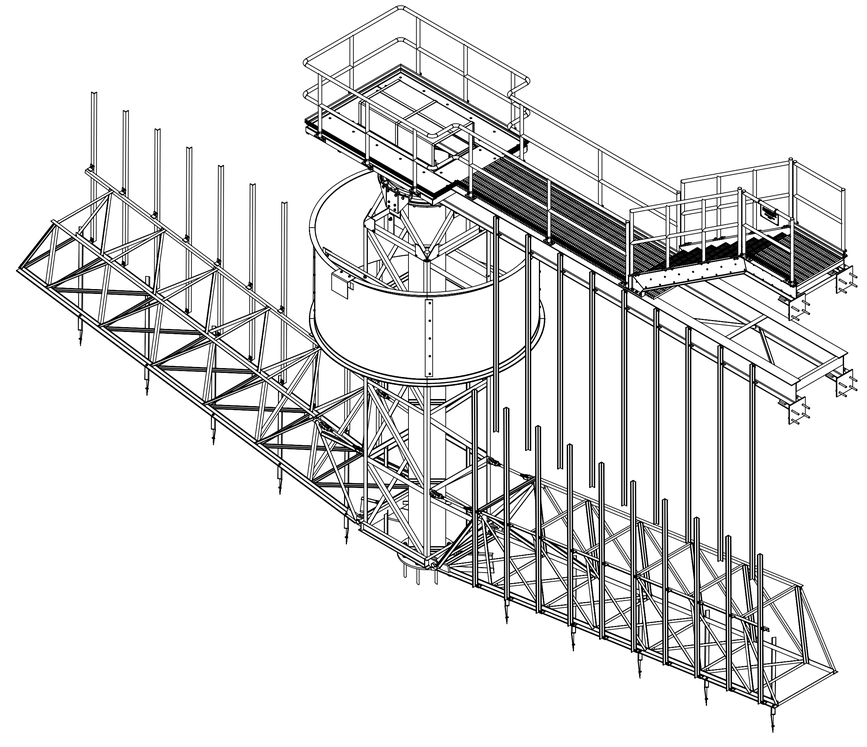


REF.	DESCRIPTION	QTY.
1	DRIVE ASSEMBLY, 42H8T	1
2	BRIDGE ASSEMBLY	1
3	CENTER COLUMN ASSEMBLY	1
4	ANCHORAGE ASSEMBLY	1
5	DRIVE CAGE ASSEMBLY	1
6	INFULENT WELL ASSEMBLY	1
7	TRUSS ARM ASSEMBLY	2
8	CLEVIS ROD 'A' 1-1/4 X 2'-7 1/2"	4
9	GRATING ASSEMBLY	1
10	COVER, DRIVE UNIT, 45" C-C	1
11	WALKWAY ASSEMBLY	1
12	STAIR ASSEMBLY	1
13	PICKETS, FIXED ASSEMBLY	1
14	HANDRAIL ASSEMBLY	1
15	AMWELL NAMEPLATE	1
16	PICKETS, TRUSS ARM, ASSEMBLY	2
17	FIGHT ASSEMBLY	2
18	SQUEEGEE ASSEMBLY	2

NOTE: QUANTITIES ARE FOR ONE UNIT



ELEVATION



REV.	DATE	BY	CH'KD	DESCRIPTION

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ANGULAR: ±1°	SCALE: 1:38.4
ALL DIMENSIONS ARE IN INCHES	S.O.: A22060-4
MASTER:	WEIGHT(LBS):435881.93
PATT. No.	MATERIAL:

AMWELL
A Division of McNish Corporation
AURORA, ILLINOIS, USA
(ORIGINALLY AMERICAN WELL WORKS - EST. 1868)

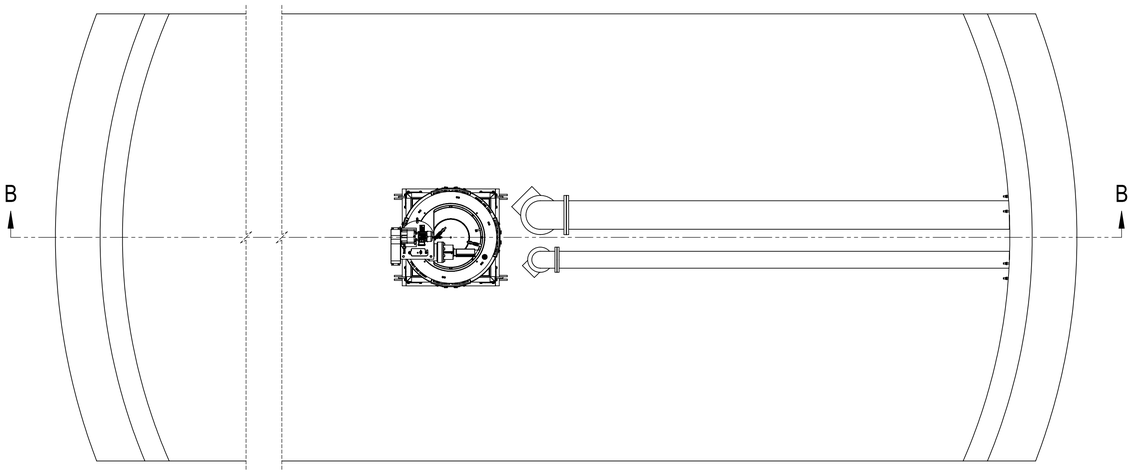
DESCRIPTION:
GENERAL ASSEMBLY, TAUNTON, MA

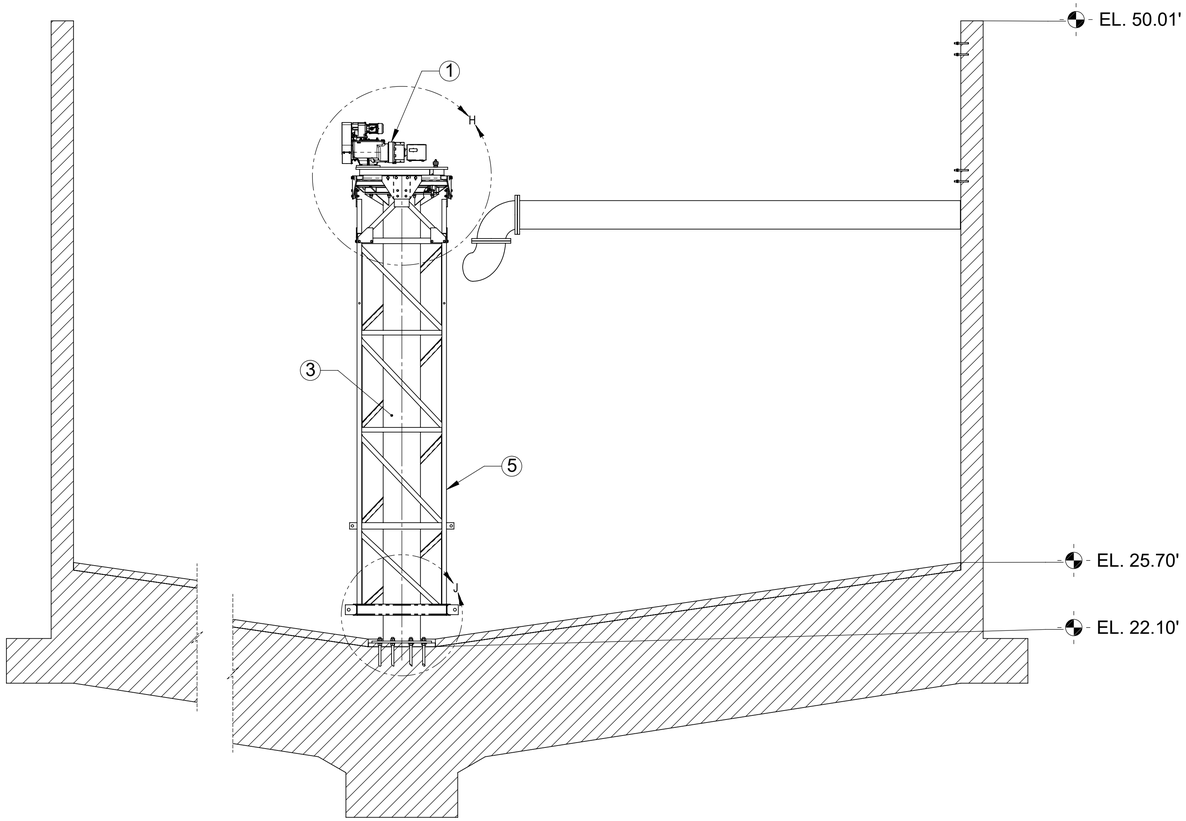
DRAWING NO.: 814-292

SHEET: 1 OF 8

REV.

CENTER COLUMN, DRIVE, DRIVE CAGE ASSEMBLY DRAWINGS





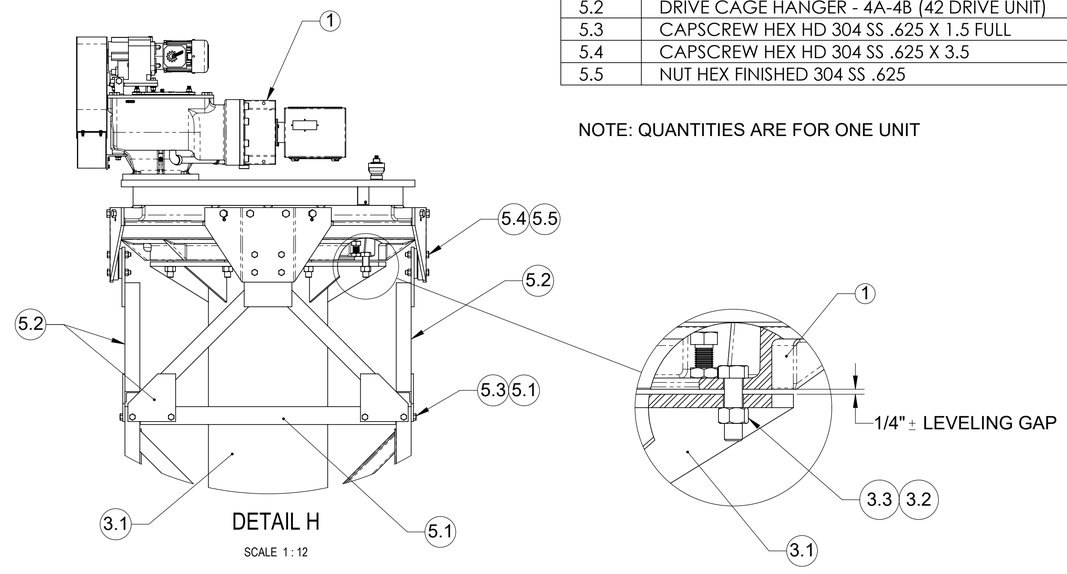
SECTION B-B

REF.	DESCRIPTION	QTY.
1	DRIVE ASSEMBLY, 42H8T	1

REF.	DESCRIPTION	QTY.
3	CENTER COLUMN ASSEMBLY	1
3.1	20" DIA CENTER COLUMN 42H	1
3.2	CAPSCREW HEX HD 304 SS 1 X 3.5	8
3.3	NUT HEX FINISHED 304 SS 1	8

REF.	DESCRIPTION	QTY.
5	DRIVE CAGE ASSEMBLY	1
5.1	DRIVE CAGE-4B	1
5.2	DRIVE CAGE HANGER - 4A-4B (42 DRIVE UNIT)	4
5.3	CAPSCREW HEX HD 304 SS .625 X 1.5 FULL	16
5.4	CAPSCREW HEX HD 304 SS .625 X 3.5	16
5.5	NUT HEX FINISHED 304 SS .625	32

NOTE: QUANTITIES ARE FOR ONE UNIT



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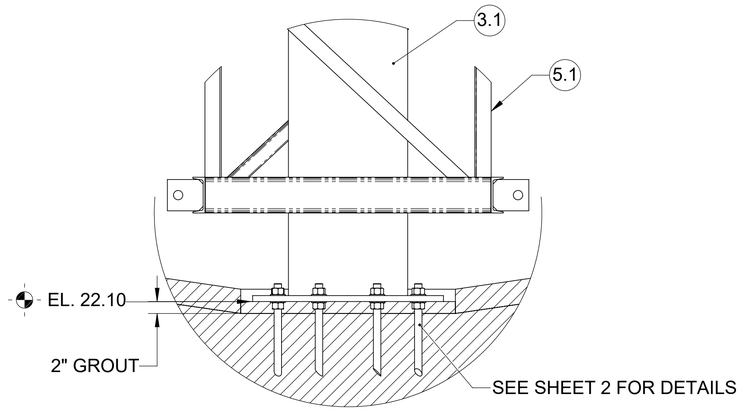

DETAIL J

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ALL DIMENSIONS ARE IN INCHES
MASTER:
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CHECKED:
DATE:10/28/2021
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WEIGHT(LBS):426857.97
MATERIAL:

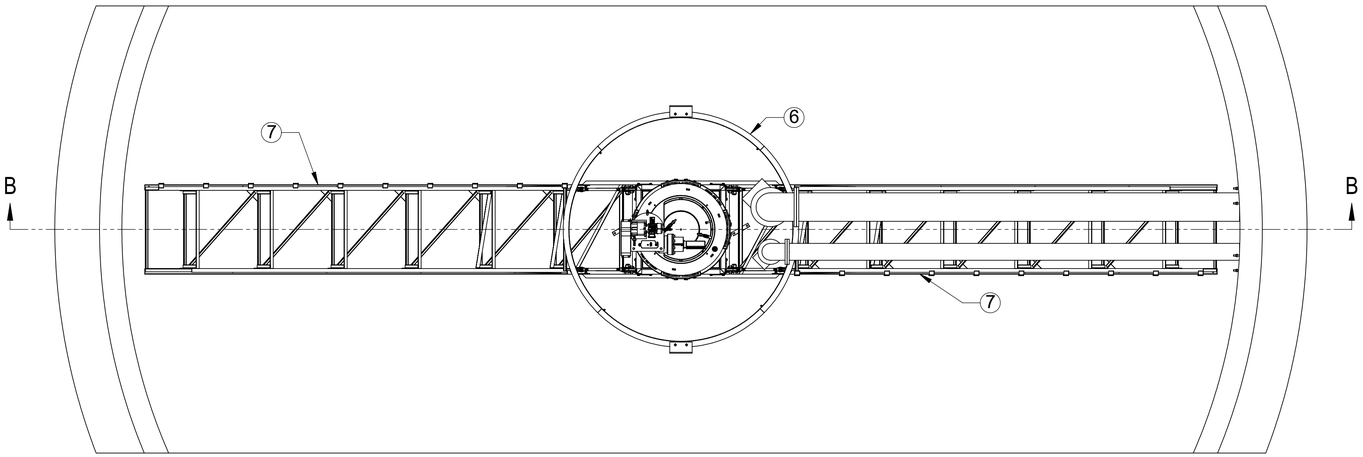
AMWELL
A Division of McNish Corporation
AURORA, ILLINOIS, USA
(ORIGINALLY AMERICAN WELL WORKS - EST. 1868)

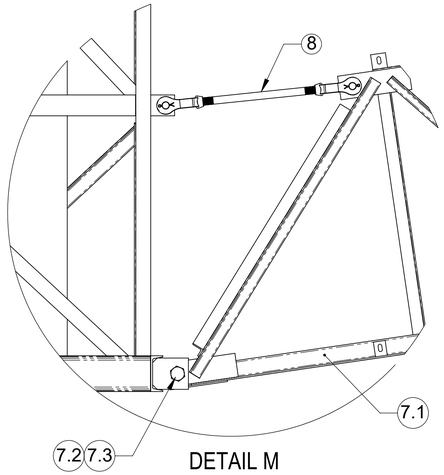
DESCRIPTION:
CENTER COLUMN, DRIVE, DRIVE CAGE ASSEMBLY

DRAWING NO.: 814-292
SHEET: 3 OF 8
REV.

REF.	DESCRIPTION	QTY.
6	INFULENT WELL ASSEMBLY	1
6.1	INFLUENT WELL 10'-0" X 5'-0" DIA	1
6.2	INFLUENT WELL SUPPORT CHANNEL	2
6.3	BAFFLE, INFLUENT WELL, BOLT ON`	2
6.4	CAPSCREW HEX HD 304 SS .75 X 2 FULL	8
6.5	WASHER STD PL 304 SS .75	8
6.6	NUT HEX FINISHED 304 SS .75	8
6.7	CAPSCREW HEX HD 304 SS .5 X 1.25 FULL	24
6.8	WASHER STD PL 304 SS .5	4
6.9	NUT HEX FINISHED 304 SS .5	24
7	TRUSS ARM ASSEMBLY	2
7.1	TRUSS ARM 4'-0", W/PICKETS	2
7.2	CAPSCREW HEX HD 304 SS 1.5 X 4.5	4
7.3	NUT HEX FINISHED 304 SS 1.5	4
8	CLEVIS ROD 'A' 1-1/4 X 2'-7 1/2"	4

NOTE: QUANTITIES ARE FOR ONE UNIT





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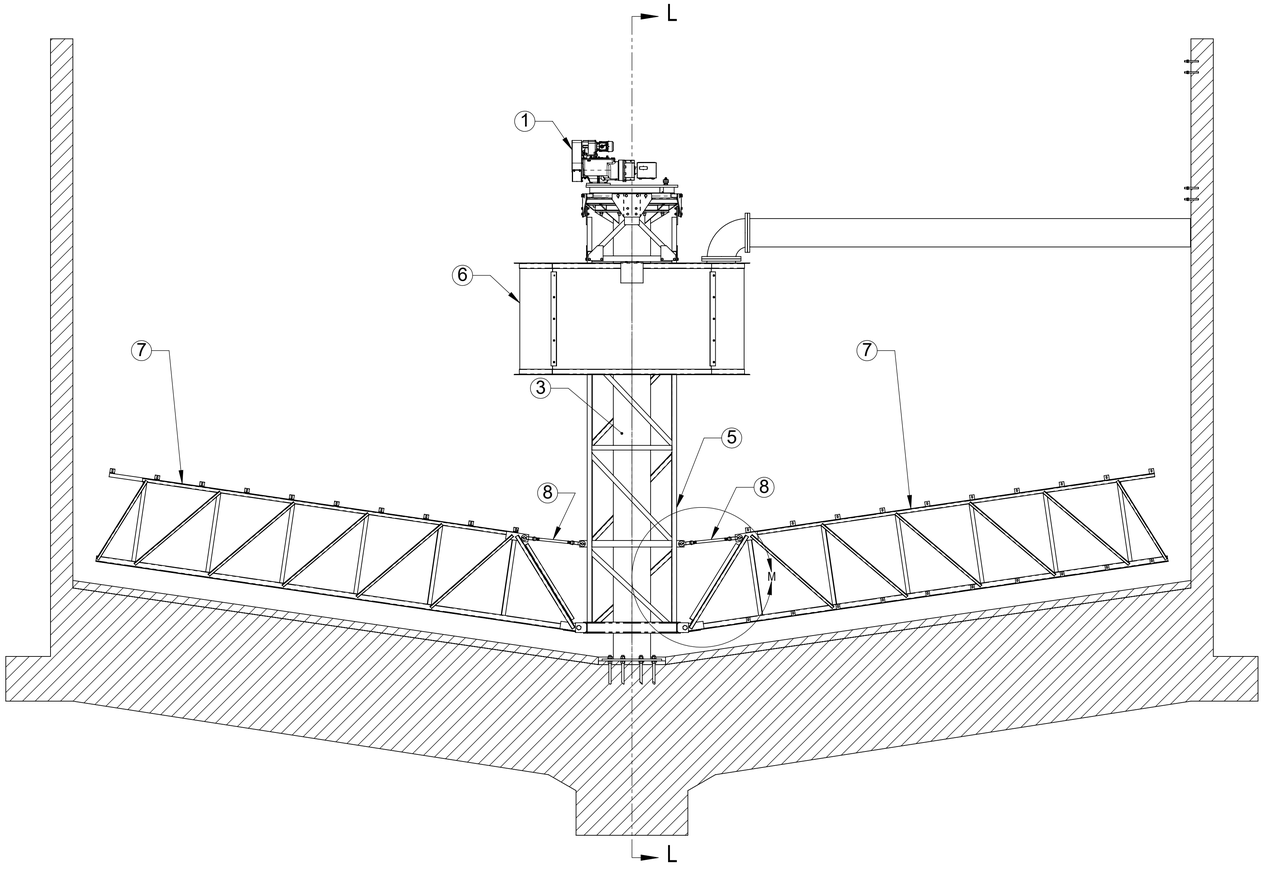
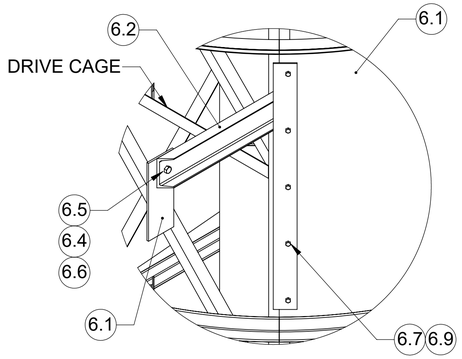


SECTION B-B



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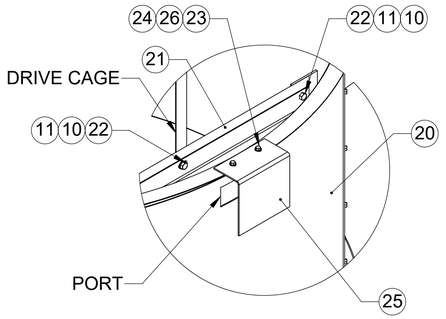

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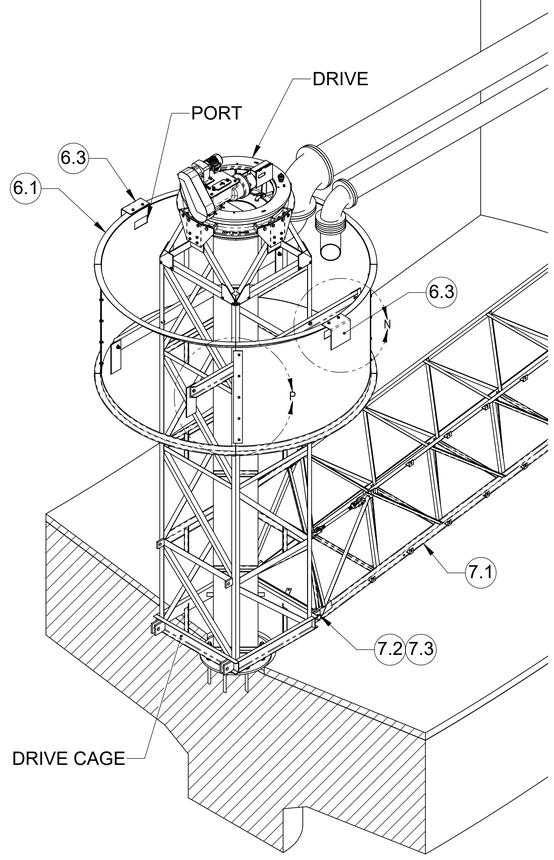

SECTION L-L

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DATE:10/28/2021

SCALE: 1:38.4

S.O.: A22060-4

WEIGHT(LBS):430618.33

MATERIAL:

AMWELL
A Division of McNish Corporation
AURORA, ILLINOIS, USA
(ORIGINALLY AMERICAN WELL WORKS - EST. 1868)

DESCRIPTION:

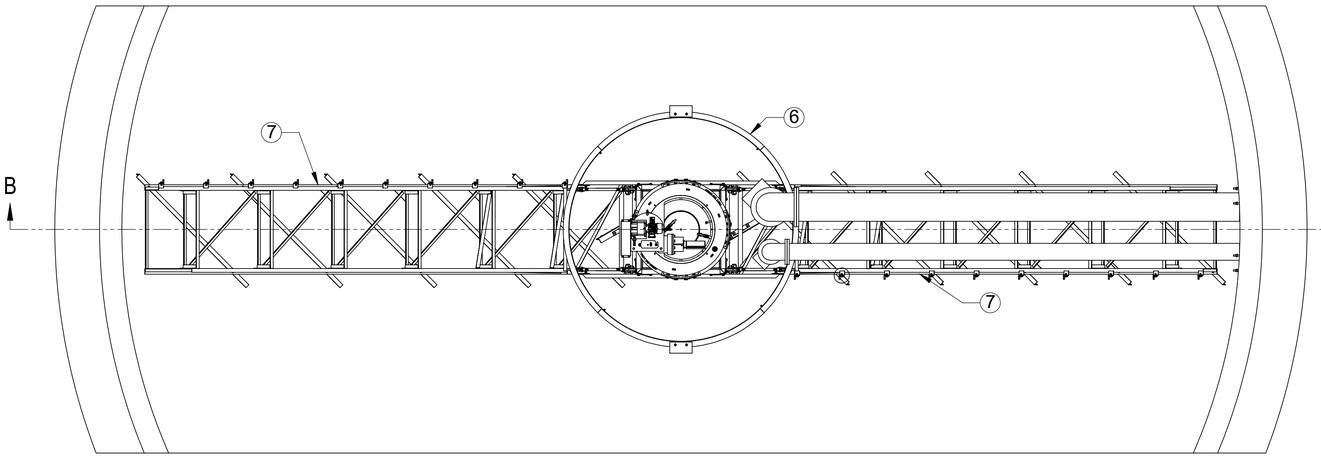
CENTER COLUMN, DRIVE, DRIVE CAGE ASSEMBLY

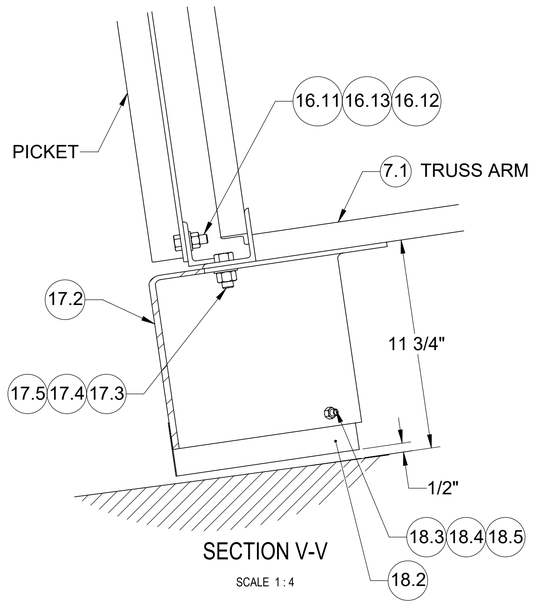
DRAWING NO.: 814-292

SHEET: 4 OF 8

REV.

PICKETS (TRUSS ARM), FLIGHTS & SQUEEGEES ASSEMBLY



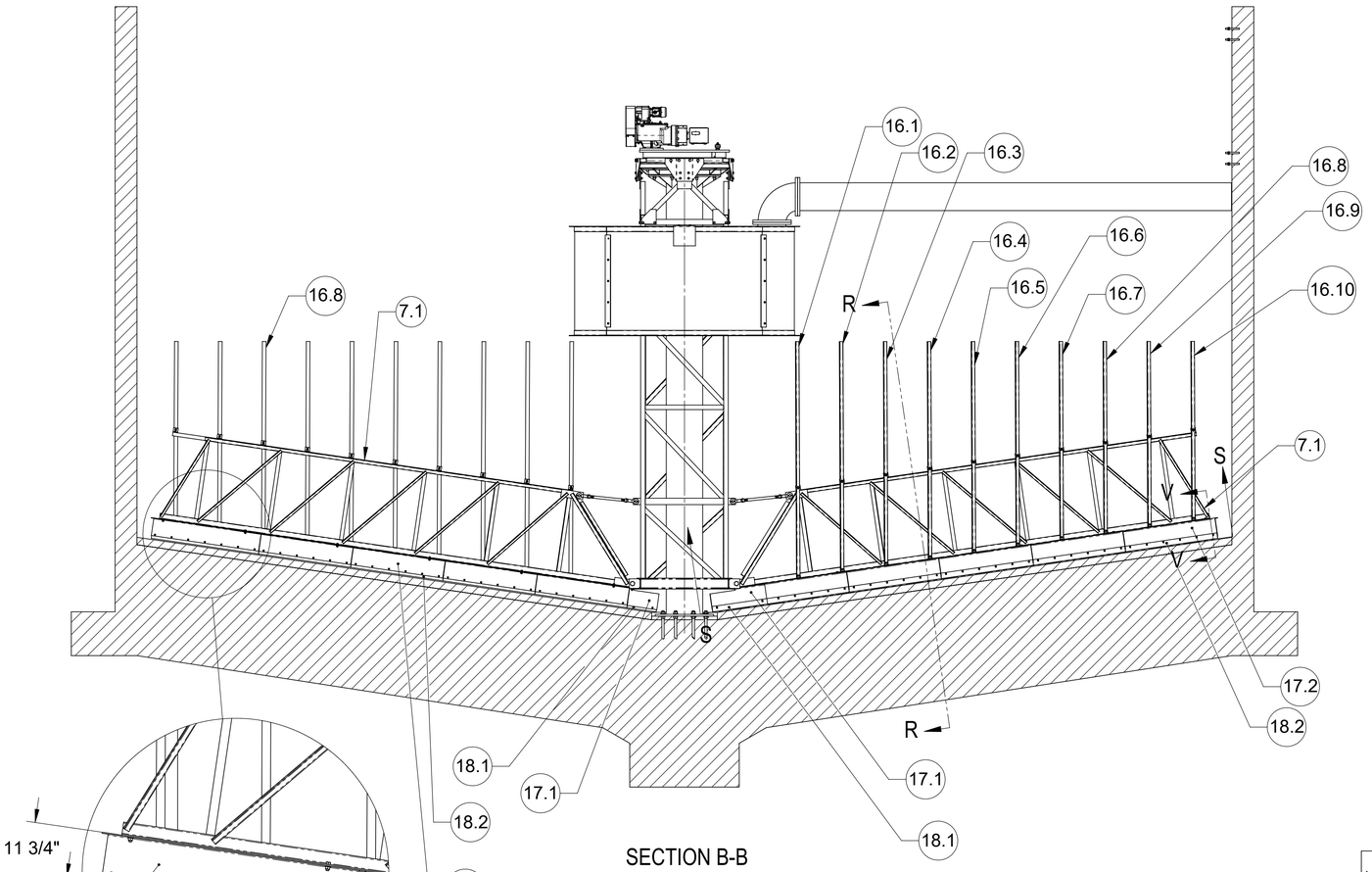


SECTION V-V

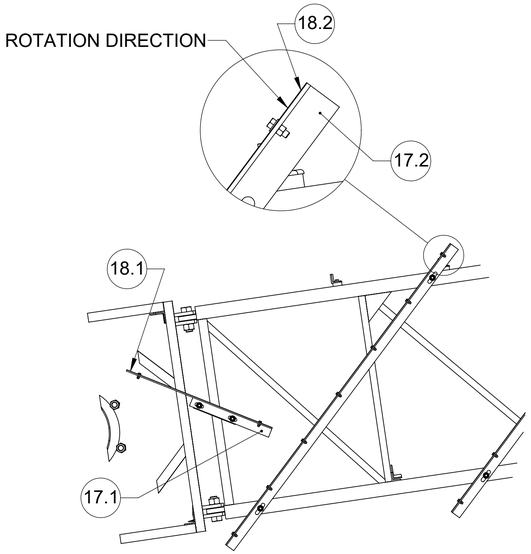
SCALE 1 : 4

REF.	DESCRIPTION	QTY.
16	PICKETS, TRUSS ARM, ASSEMBLY	2
16.1	PICKET, TRUSS ARM, "A"	2
16.2	PICKET, TRUSS ARM, "B"	2
16.3	PICKET, TRUSS ARM, "C"	2
16.4	PICKET, TRUSS ARM, D	2
16.5	PICKET, TRUSS ARM, "E"	2
16.6	PICKET, TRUSS ARM, "F"	2
16.7	PICKET, TRUSS ARM, "G"	2
16.8	PICKET, TRUSS ARM, "H"	2
16.9	PICKET, TRUSS ARM, "J"	2
16.10	PICKET, TRUSS ARM, "K"	2
16.11	CAPSCREW HEX HD 304 SS .5 X 1.5 FULL	40
16.12	WASHER STD PL 304 SS .5	60
16.13	NUT HEX FINISHED 304 SS .5	40
17	FIGHT ASSEMBLY	2
17.1	FLIGHT - INNER	2
17.2	FLIGHT, 9-3/4" X 7'-0" LG	10
17.3	CAPSCREW HEX HD 304 SS .625 X 1.5 FULL	24
17.4	NUT HEX FINISHED 304 SS .625	24
17.5	WASHER STD PL 304 SS .625	24
18	SQUEEGEE ASSEMBLY	2
18.1	SQUEEGE INNER	2
18.2	SQUEEGEE 3" X 7'-0" LG	10
18.3	CAPSCREW HEX HD 304 SS .375 X 1 FULL	74
18.4	WASHER STD PL 304 SS .375	74
18.5	NUT HEX FINISHED 304 SS .375	74

NOTE: QUANTITIES ARE FOR ONE UNIT

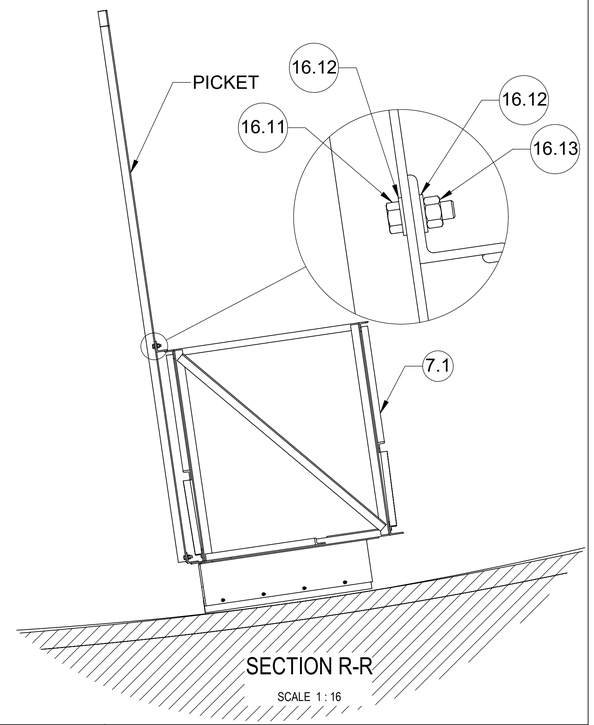


SECTION B-B



SECTION S-S

SCALE 1 : 16



SECTION R-R

SCALE 1 : 16

REV.	DATE	BY	CH'KD	DESCRIPTION

UNLESS OTHERWISE SPECIFIED:

DECIMAL: .xx ±.03 .xxx ±.015

ANGULAR: ±1°

ALL DIMENSIONS ARE IN INCHES

MASTER:

PATT. No.

DRAWN BY: EG

CHECKED:

DATE:10/28/2021

SCALE: 1:38.4

S.O.: A22060-4

WEIGHT(LBS):431997.34

MATERIAL:

AMWELL

A Division of McNish Corporation

AURORA, ILLINOIS, USA

(ORIGINALLY AMERICAN WELL WORKS - EST. 1868)

DESCRIPTION:

PICKETS (TRUSS ARM), FLIGHTS & SQUEEGEES ASSEMBLY

DRAWING NO.: 814-292

SHEET: 5 OF 8

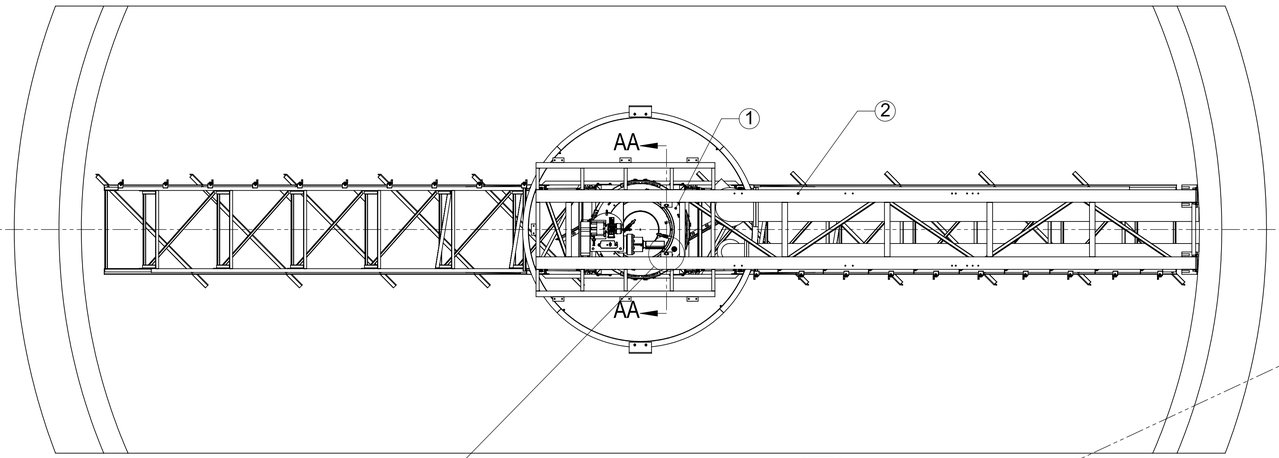
REV.

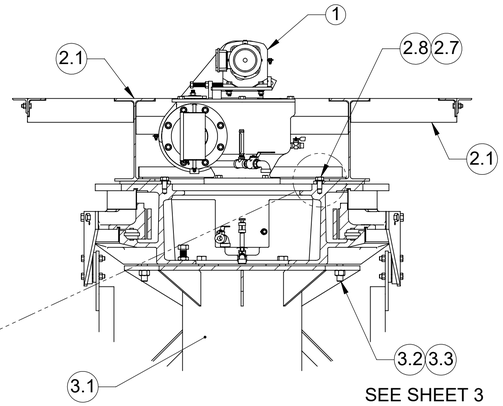
BRIDGE ASSEMBLY DRAWING

REF.	DESCRIPTION	QTY.
2	BRIDGE ASSEMBLY	1
2.1	BRIDGE, 42H8, 3'-0" C-C, 6' X 8' PLATFORM	1
2.2	ANGLE	6
2.3	BRACKET, BRIDGE SUPPORT	2
2.4	SLIDE PLATE, W8 X 18 BEAM	2
2.5	CAPSCREW HEX HD 304 SS .5 X 1.25 FULL	12
2.6	NUT HEX FINISHED 304 SS .5	12
2.7	WASHER STD PL 304 SS .75	2
2.8	CAPSCREW HEX HD 304 SS .75 X 1.5 FULL	2

REF.	DESCRIPTION	QTY.
13	PICKETS, FIXED ASSEMBLY	1
13.1	PICKET, FIXED	9
13.2	CAPSCREW HEX HD 304 SS .5 X 1.5 FULL	18
13.3	WASHER STD PL 304 SS .5	18
13.4	NUT HEX FINISHED 304 SS .5	18

NOTE: QUANTITIES ARE FOR ONE UNIT

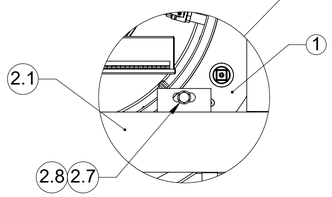


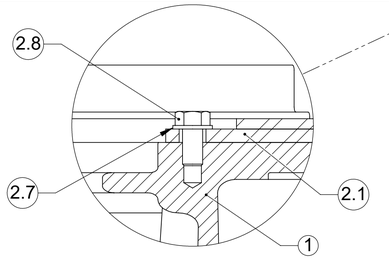


SEE SHEET 3

SECTION AA-AA

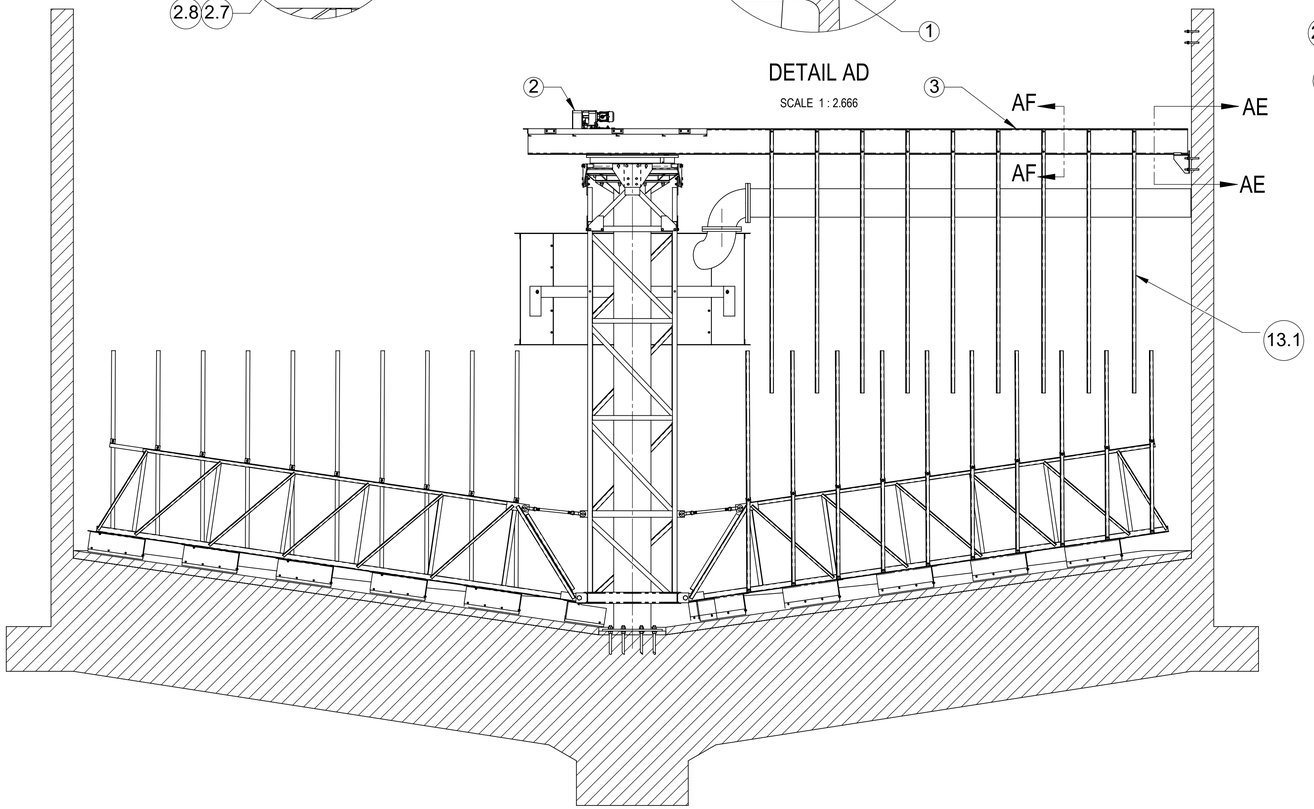
SCALE 1 : 12



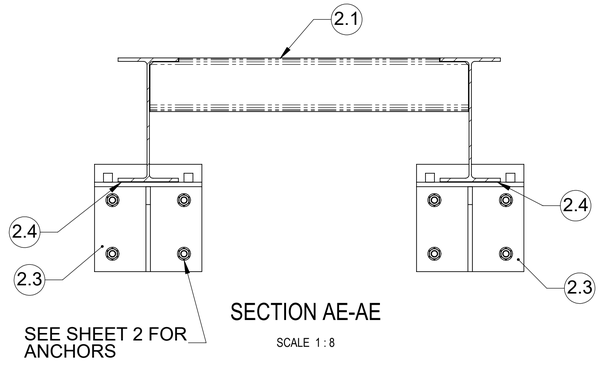


DETAIL AD

SCALE 1 : 2.666



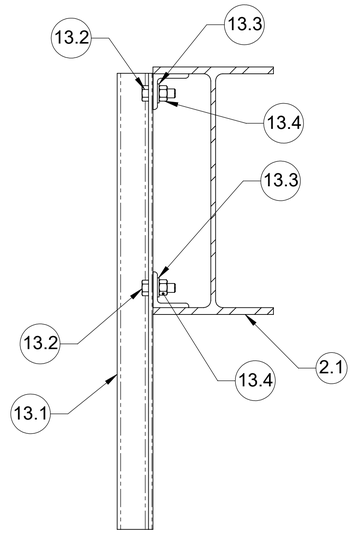
ELEVATION



SEE SHEET 2 FOR ANCHORS

SECTION AE-AE

SCALE 1 : 8



SECTION AF-AF

SCALE 1 : 4

REV.	DATE	BY	CH'KD	DESCRIPTION

UNLESS OTHERWISE SPECIFIED:	
DECIMAL: .xx ± .03 .xxx ± .015	
ANGULAR: ±1°	
ALL DIMENSIONS ARE IN INCHES	
MASTER:	
PATT. No.	
DRAWN BY: EG	
CHECKED:	
DATE:10/28/2021	
SCALE: 1:38.4	
S.O.: A22060-4	
WEIGHT(LBS):434685.82	
MATERIAL:	

AMWELL
A Division of McNish Corporation
AURORA, ILLINOIS, USA
(ORIGINALLY AMERICAN WELL WORKS - EST. 1868)

DESCRIPTION:
BRIDGE ASSEMBLY

DRAWING NO.: 814-292

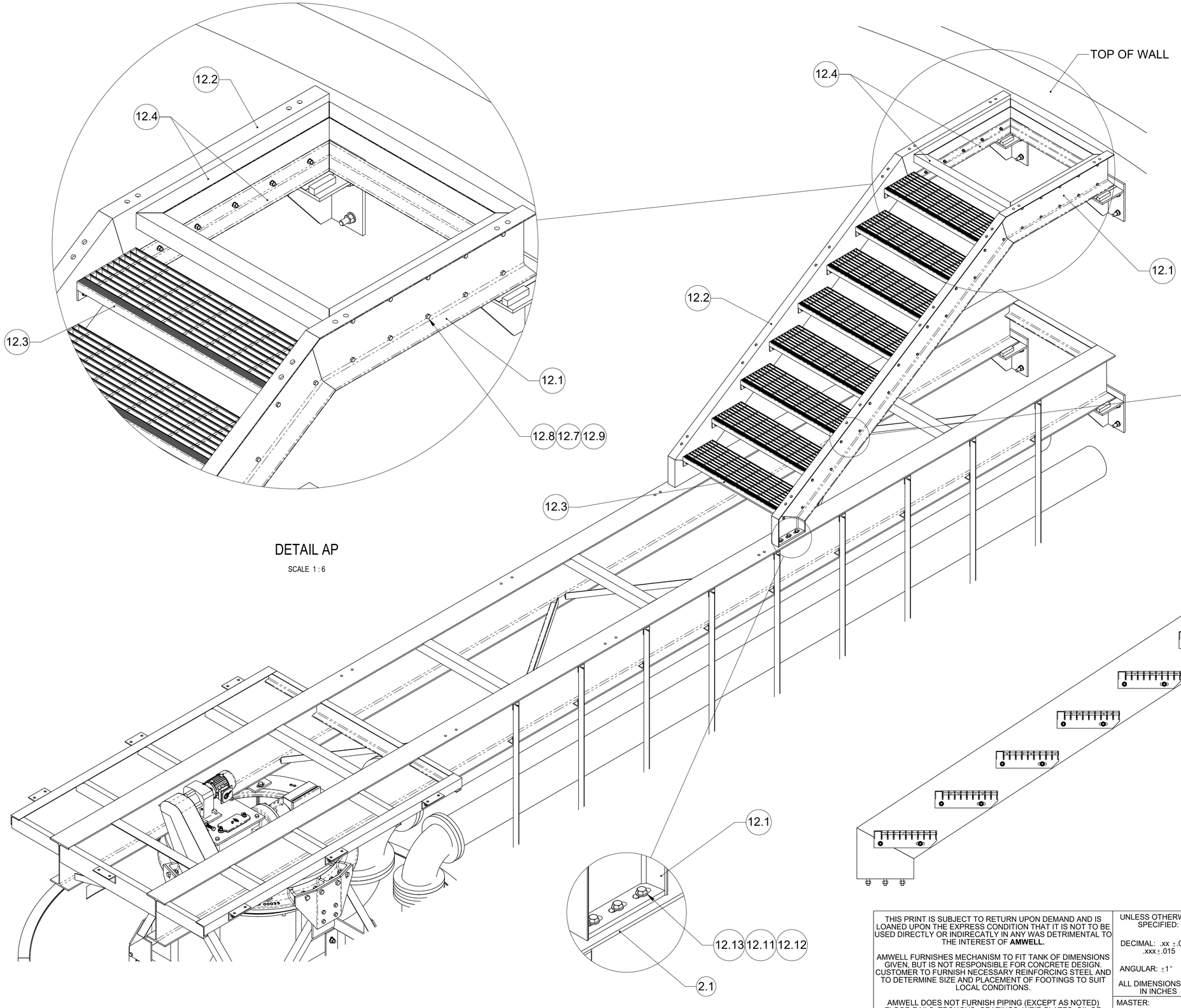
SHEET: 6 OF 8

REV.

STAIR ASSEMBLY DIAGRAM

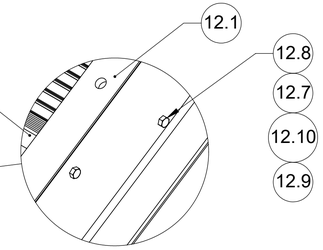
REF.	DESCRIPTION	QTY.
12	STAIR ASSEMBLY	1
12.1	STAIRWAY CHANNEL RH	1
12.2	STAIRWAY CHANNEL LH	1
12.3	STAIR TREAD 36" LG	8
12.4	STAIRWAY LANDING FRAME	2
12.5	BRACKET, BRIDGE SUPPORT	2
12.6	SLIDE PLATE, W8 X 18 BEAM	2
12.7	NUT HEX FINISHED 304 SS .375	52
12.8	CAPSCREW HEX HD 304 SS .375 X 1.25	52
12.9	LOCK WASHER 304 SS .375	52
12.10	WASHER STD PL 304 SS .375	32
12.11	CAPSCREW HEX HD 304 SS .5 X 1.75	6
12.12	NUT HEX FINISHED 304 SS .5	6
12.13	WASHER STD PL 304 SS .5	6

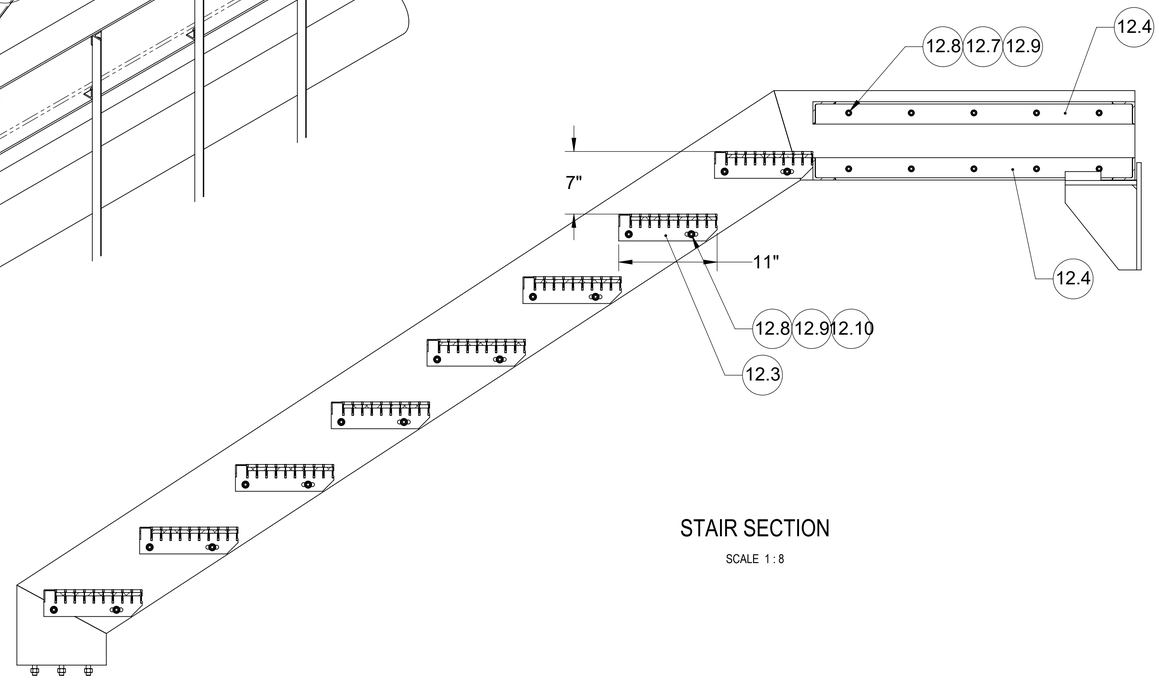
NOTE: QUANTITIES ARE FOR ONE UNIT



DETAIL AP

SCALE 1 : 6





STAIR SECTION

SCALE 1 : 8

REV.	DATE	BY	CH'KD	DESCRIPTION

THIS PRINT IS SUBJECT TO RETURN UPON DEMAND AND IS LOANED UPON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED DIRECTLY OR INDIRECATLY IN ANY WAS DETRIMENTAL TO THE INTEREST OF **AMWELL.**

AMWELL FURNISHES MECHANISM TO FIT TANK OF DIMENSIONS GIVEN, BUT IS NOT RESPONSIBLE FOR CONCRETE DESIGN. CUSTOMER TO FURNISH NECESSARY REINFORCING STEEL AND TO DETERMINE SIZE AND PLACEMENT OF FOOTINGS TO SUIT LOCAL CONDITIONS.

AMWELL DOES NOT FURNISH PIPING (EXCEPT AS NOTED) FLOOR RAILS, TROUGHS, GRATINGS, WEIR PLATES, OIL OR GREASE FOR LUBRICATION, ANY WIRING OR CONDUITS BETWEEN MOTORS, CONTROLS AND ALARMS OR ANY ELECTRICAL EQUIPMENT OF ANY KIND EXCEPT AS SPECIFICALLY STATED IN AMWELL SPECIFICATIONS.

UNLESS OTHERWISE SPECIFIED:	DRAWN BY: EG
DECIMAL: .xx ±.03 .xxx±.015	CHECKED:
ANGULAR: ±1°	DATE:10/28/2021
ALL DIMENSIONS ARE IN INCHES	SCALE: 1:38.4
MASTER:	S.O.: A22060-4
PATT. No.	WEIGHT(LBS):435295.19
	MATERIAL:

AMWELL
A Division of McNish Corporation
AURORA, ILLINOIS, USA
(ORIGINALLY AMERICAN WELL WORKS - EST. 1868)

DESCRIPTION:
STAIR ASSEMBLY

DRAWING NO.: 814-292

SHEET: 7 OF 8

REV.

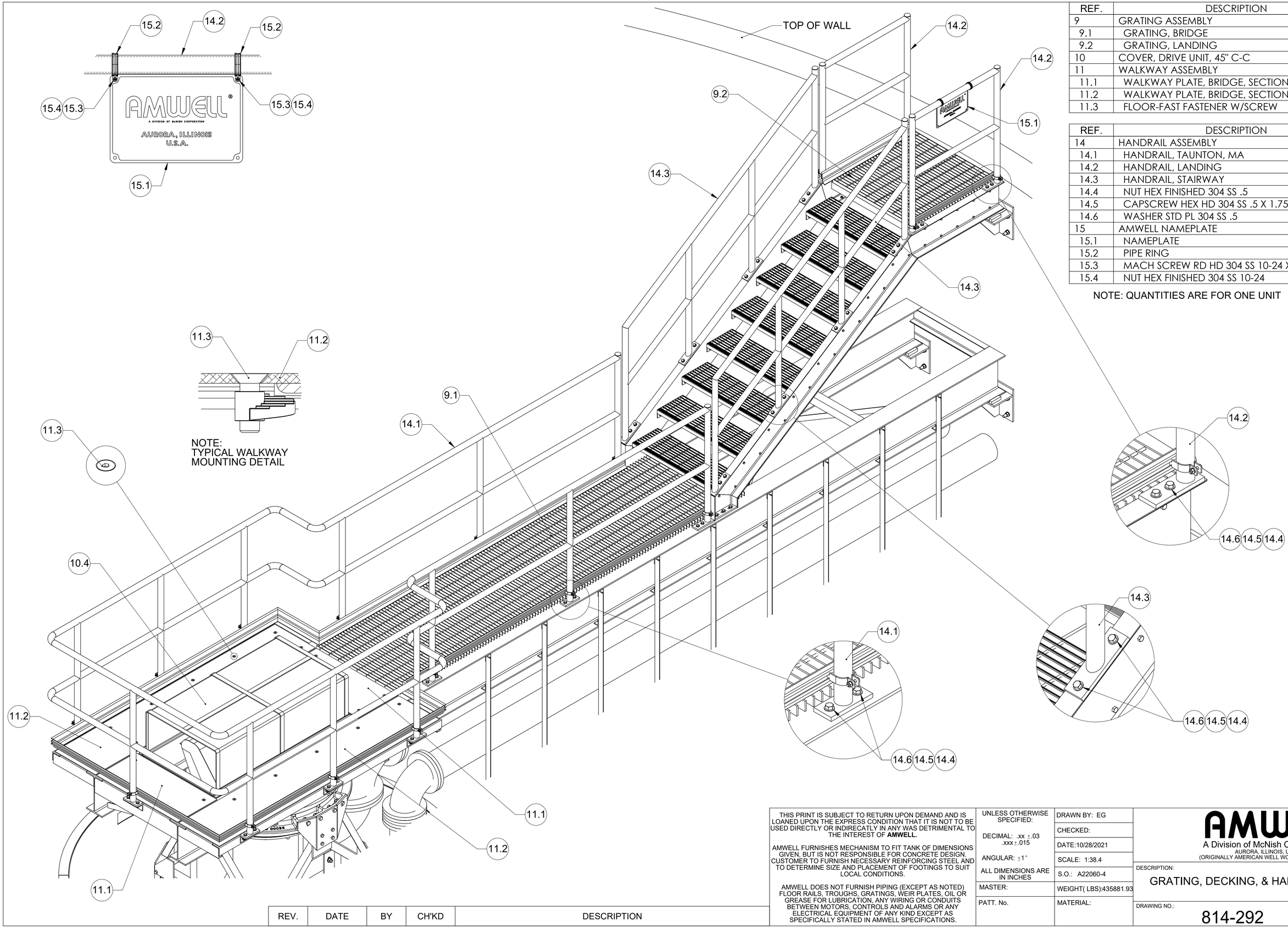
GRATING, DECKING & HANDRAIL ASSEMBLY DRAWING

REF.	DESCRIPTION	QTY.
9	GRATING ASSEMBLY	1
9.1	GRATING, BRIDGE	1
9.2	GRATING, LANDING	1
10	COVER, DRIVE UNIT, 45" C-C	1
11	WALKWAY ASSEMBLY	1
11.1	WALKWAY PLATE, BRIDGE, SECTION A, 1/4" THK	2
11.2	WALKWAY PLATE, BRIDGE, SECTION B, 1/4"	2
11.3	FLOOR-FAST FASTENER W/SCREW	32

REF.	DESCRIPTION	QTY.
14	HANDRAIL ASSEMBLY	1
14.1	HANDRAIL, TAUNTON, MA	1
14.2	HANDRAIL, LANDING	2
14.3	HANDRAIL, STAIRWAY	2
14.4	NUT HEX FINISHED 304 SS .5	48
14.5	CAPSCREW HEX HD 304 SS .5 X 1.75	48
14.6	WASHER STD PL 304 SS .5	48
15	AMWELL NAMEPLATE	1
15.1	NAMEPLATE	1
15.2	PIPE RING	2
15.3	MACH SCREW RD HD 304 SS 10-24 X .5	2
15.4	NUT HEX FINISHED 304 SS 10-24	2

NOTE: QUANTITIES ARE FOR ONE UNIT

NOTE:
TYPICAL WALKWAY
MOUNTING DETAIL



REV.	DATE	BY	CH'KD	DESCRIPTION

UNLESS OTHERWISE SPECIFIED:

DECIMAL: .xx ±.03
.xxx ±.015

ANGULAR: ±1°

ALL DIMENSIONS ARE IN INCHES

MASTER:

PATT. No.

DRAWN BY: EG

CHECKED:

DATE:10/28/2021

SCALE: 1:38.4

S.O.: A22060-4

WEIGHT(LBS):435881.93

MATERIAL:

AMWELL
A Division of McNish Corporation
AURORA, ILLINOIS, USA
(ORIGINALLY AMERICAN WELL WORKS - EST. 1868)

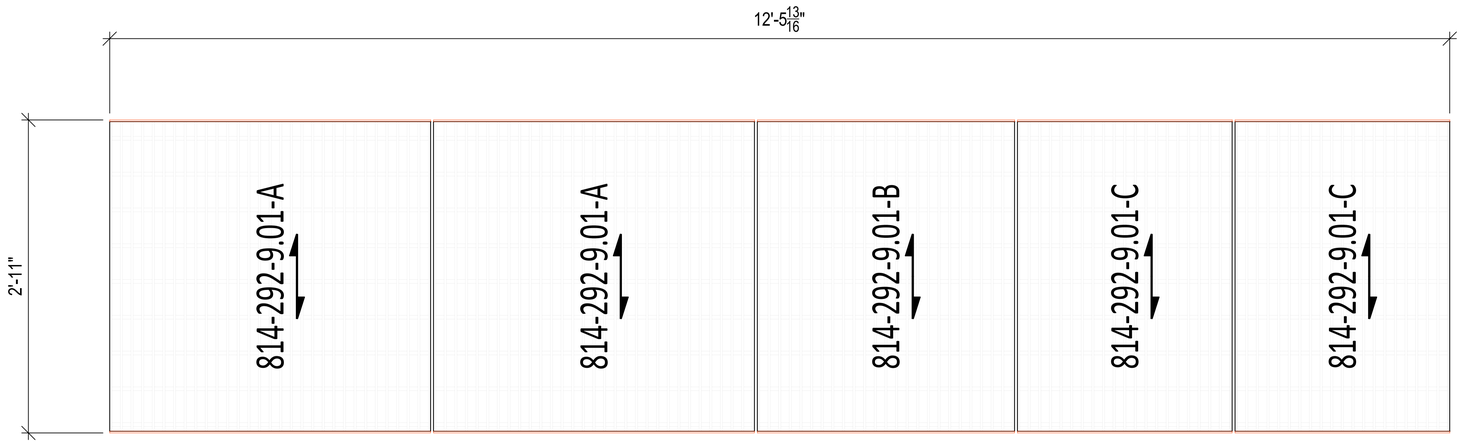
DESCRIPTION:
GRATING, DECKING, & HANDRAIL ASSEMBLY

DRAWING NO.: 814-292

SHEET: 8 OF 8

REV.

GRATING INFORMATION

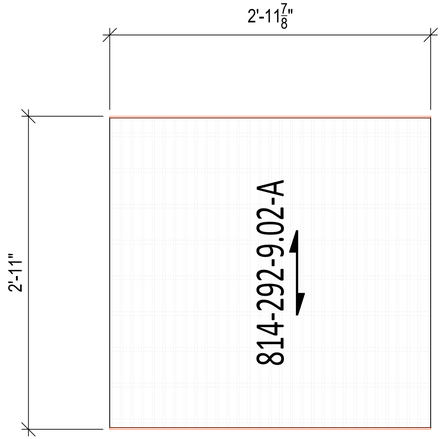


814-292-9.01

1-1/2"=1'-0"

Ref. Dwg #: 612-375 (10/11/2021)

(2 Req'd)



814-292-9.02

1-1/2"=1'-0"

Ref. Dwg #: 619-375 (8/2/2021)

(2 Req'd)

OHIO GRATINGS, INC.

Bill of Materials

19SGI4 (1 1/4") Striated

Mill, Swaged I-Bar Bar Grating, Aluminum

Qty	Mark	Finish Width	Finish Length	EG	Status
4	814-292-9.01-A	2'-11 7/8"	2'-11"	1 7/8"	Rel1 11/30/21
2	814-292-9.01-B	2'-4 3/4"	2'-11"	1 7/8"	Rel1 11/30/21
4	814-292-9.01-C	2'-0"	2'-11"	1 7/8"	Rel1 11/30/21
2	814-292-9.02-A	2'-11 7/8"	2'-11"	1 7/8"	Rel1 11/30/21

Extras Table

Band 1 1/4" x 3/16" Aluminum

Totals 12 pcs 212 lbs

Revisions Record

Rev	Date	By	Ckd	Description
A	11/24/2021	ZJP		Issued For Approval
0	11/30/2021	ZJP		Issued For Fabrication

General Notes

Lay all grating panels out in an entire area with a loose fit prior to fastening down in order to ensure a proper fit and uniform gaps between panels. Gaps between panels can range from a tight fit to a size equal to the space between two adjacent bearing bars in a panel. A typical gap is approximately 3/8".

Supporting steel with flanges greater than 1/4" in thickness may need to be pre-drilled in field prior to fastening down with a standard tek screw. Cutting cross bars in the field may be necessary in some locations for fastener clearance.

The ends of all bearing bars within a grating panel must be properly supported at ends of panels and within cutouts. Ohio Gratings recommends 1" of bearing surface for grating bearing bar depths up to 2¼" and 2" of bearing surface for grating bearing bar depths 2½" and over. Bearing bars should not be cantilevered beyond their supports.

Cutout sizes may be smaller or larger than the intended design due to the nature of grating and the standard locations of bearing bars.

Drawing Legend

- Indicates banding
- Indicates toeplate
- Indicates nosing
- (EG) Indicates the tagged end of panels for aligning cross rods
- Indicates the span direction of load carrying bars

OHIO GRATINGS, INC.

OGI Canton, OH:
5299 Southway St SW
Canton, OH 44706
Ph: 1-800-321-9800

OGI Houston, TX:
5500 Cedar Crest
Houston, TX 77087
Ph: 1-888-207-9392

OGI Ridgeland, SC:
5307 Cypress Ridge Dr
Ridgeland, SC 29936
Ph: 1-800-321-9800

www.ohiogratings.com

Project	Job A22060		
Customer	Amwell	OGi Q: 939441	
PO	P0056068	OGi SO: 4136	
Job #		Seq:	Rel:
Dwg: 4136		Sht: G1	

OHIO GRATINGS, INC.

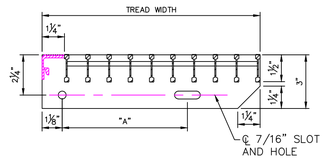
Bill of Materials

19SGI4 (1 1/2") Striated

Mill, Swaged I-Bar Bar Grating, Aluminum

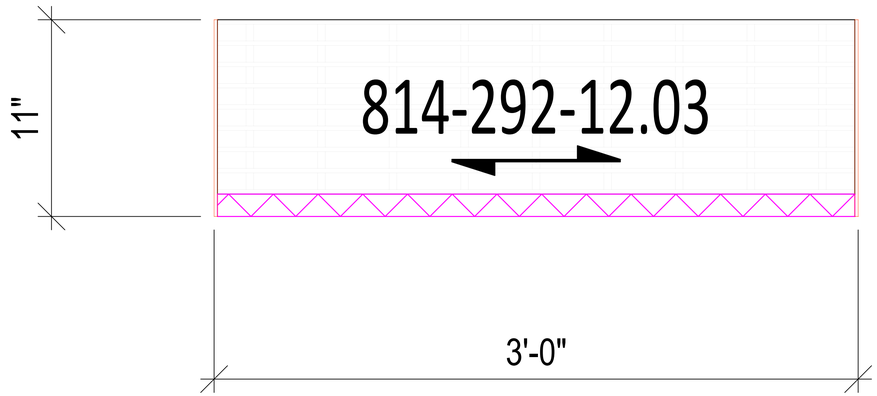
Qty	Mark	Finish Width	Finish Length	EG	Status
16	814-292-12.03	11"	3'-0"	1 13/16"	Rel1 11/30/21

Extras Table		
Band 3" x 3/16" Aluminum Standard Punch End Plate		
Grooved Nosing Aluminum		
Totals	16 pcs	136 lbs



CARRIER PLATE DETAIL

STAIR TREADS W/ GROOVED NOSING				
1-1/2" I-Bar (19SGI4) STRIATED ALUM				
QTY.	WIDTH x LENGTH	"A"	FINISH	MARK
16	11" x 3'-0"	7"	MILL	814-292-1203



Revisions Record

Rev	Date	By	Ckd	Description
A	11/24/2021	ZJP		Issued For Approval
0	11/30/2021	ZJP		Issued For Fabrication

General Notes

Lay all grating panels out in an entire area with a loose fit prior to fastening down in order to ensure a proper fit and uniform gaps between panels. Gaps between panels can range from a tight fit to a size equal to the space between two adjacent bearing bars in a panel. A typical gap is approximately 3/8".

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Drawing Legend

- Indicates banding
- Indicates toeplate
- Indicates nosing
- EG — Indicates the tagged end of panels for aligning cross rods
- Indicates the span direction of load carrying bars

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5299 Southway St SW
Canton, OH 44706
Ph: 1-800-321-9800

OGI Houston, TX:
5500 Cedar Crest
Houston, TX 77087
Ph: 1-888-207-9392

OGI Ridgeland, SC:
5307 Cypress Ridge Dr
Ridgeland, SC 29936
Ph: 1-800-321-9800

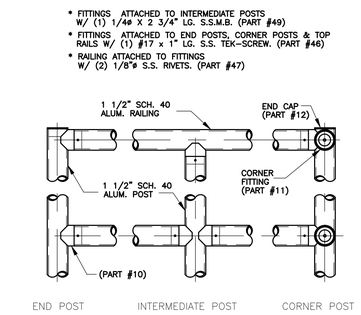
www.ohiogratings.com

Project	Job A22060		
Customer	Amwell	OGi Q: 939441	
PO	P0056068	OGi SO: 4136	
Job #		Seq:	Rel:
Dwg: 4136		Sht: G2	

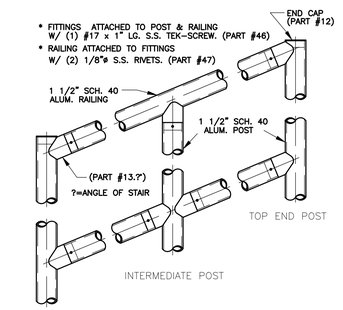
HANDRAIL INFORMATION

GENERAL NOTES
ALUM. MECH. SUB–ASSEMBLED
100

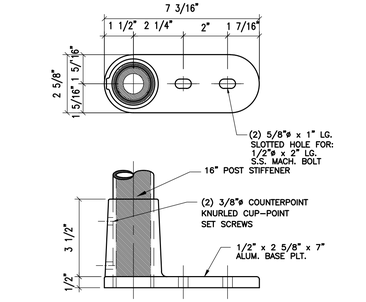
- ALL RAILS WHEN PROPERLY INSTALLED SHALL MEET OR EXCEED OSHA REQUIREMENTS.
- ALL RAIL IS TO BE OF MECHANICAL CONSTRUCTION. (U.N.O.)
- ALL RAIL, POSTS, & COMPONENTS ARE TO BE 6061–T6.
- ALL MOUNTING FASTENERS ARE TO BE STAINLESS STEEL T304.
- ALL RAILING SURFACES IN CONTACT WITH CONCRETE OR DISSIMILAR METALS SHALL RECEIVE ONE COAT OF ZINC CHROMATE.
- ALL RAILS ARE SHIPPED LOOSE IN 24'–0" STOCK LENGTHS FOR FIELD CUTTING & DRILLING AS REQUIRED.
- ALL POSTS ARE CUT TO LENGTH WITH FITTINGS ATTACHED. (EXCEPT FOR TOP FITTINGS AT INTERMEDIATE POSTS)
- CAST BASE PLATES TO BE FIELD ATTACHED.
- ALL RAILS & POSTS TO BE 1 1/2" SCH. 40 ALUM. PIPE.(1.90 O.D., 1.61 I.D.)
- FINISH TO BE CLEAR SATIN ANODIZED (.7 MIL.) AA–M10–C22–A41
- MAX. POST SPACING IS 6'–0" O.C.
- ALL BENDS TO BE FIELD CUT.



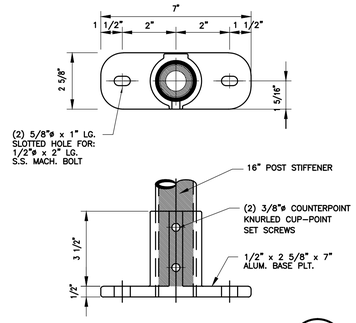
HORIZONTAL RAIL CONNECTIONS
102



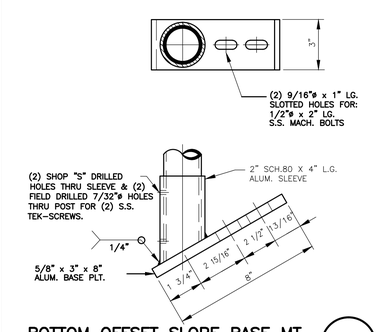
SLOPE RAIL CONNECTIONS
104



OFFSET HORIZ. BASE MT.
123



INTERM. HORIZ. CAST BASE MT.
124



BOTTOM OFFSET SLOPE BASE MT
(TO BE FIELD ATTACHED)
128

INTERMEDIATE SLOPE BASE MT.
(TO BE FIELD ATTACHED)
129

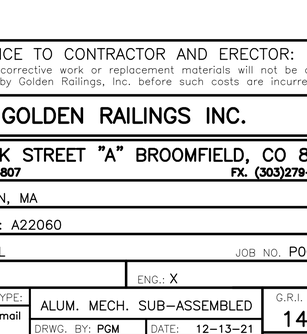
TOP OFFSET SLOPE BASE MT.
(TO BE FIELD ATTACHED)
130

FIELD JOINT
SPLICE SLEEVE
166

TYPICAL CORNER DETAIL U.N.O.
3" RAD. BEND
240

TYPICAL NOTES
"Z" TOE BOARD
250

- 4" EXTRUDED ALUM. "Z" SHAPE
- SHIPPED LOOSE, IN 24'–0" LENGTHS FOR FIELD CUTTING, DRILLING, MITERING, NOTCHING AND CURVING.
- INSTALL TOE BOARD ON WALKING SURFACE SIDE OF RAILING W/ 1/4" CLEARANCE FROM WALKING SURFACE.
- ALL FASTENERS TO BE STAINLESS STEEL.
- ALL HARDWARE TO BE FIELD DRILLED (U.N.O.)



"Z" TOE BOARD
HARDWARE
251

"Z" TOE BOARD
HARDWARE (DTL. B & C)
252

"Z" TOE BOARD
FIELD JOINT
254

"Z" TOE BOARD
TERM. DTL.–WALL & END POST
255

"Z" TOE BOARD
OUTSIDE CORNER
256 A

"Z" TOE BOARD
INSIDE CORNER
257 A

"Z" TOE BOARD
W/1/2"x2 5/8"x7" BASE MT.
258

NOTICE TO CONTRACTOR AND ERECTOR:
Back charges for corrective work or replacement materials will not be accepted unless authorized by Golden Railings, Inc. before such costs are incurred.

GOLDEN RAILINGS INC.

520 BURBANK STREET "A" BROOMFIELD, CO 80020
PH. (303)279–5807 FX. (303)279–6214

LOCATION: TAUNTON, MA

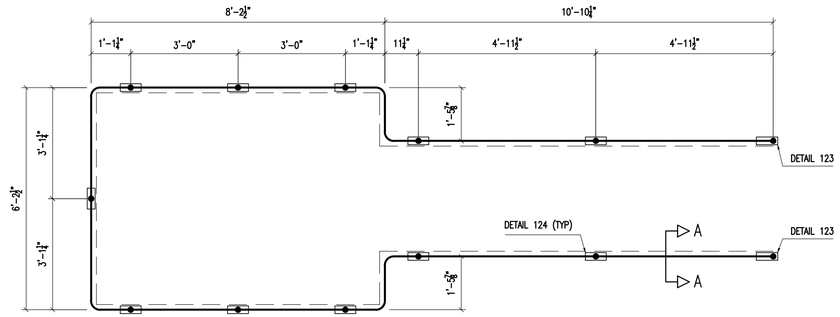
PROJECT: S.O. NO: A22060

CUSTOMER: AMWELL JOB NO. P0056069

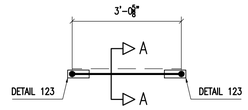
G.C.: X ENG.: X

NO.	FOR:	TYPE:			G.R.I. NO.
1	APPROVAL	Email	ALUM. MECH. SUB–ASSEMBLED		14350
			DRWG. BY: PGM	DATE: 12–13–21	
			CK. BY: X	DATE: X	DRWG. NO.
			NOT TO SCALE		D–1

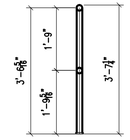
TOTAL POST ——— 50
BASE MT. ——— 50



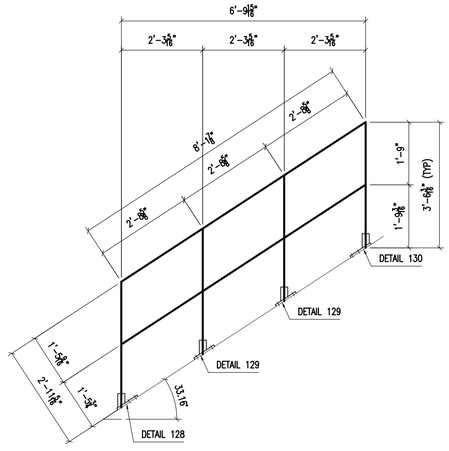
HANDRAIL: PLATFORM
SCALE: 1/2"=1'-0" REF: SHT. 611-412
(2 TOTAL)



HANDRAIL: LANDING
SCALE: 1/2"=1'-0" REF: SHT. 617-412
(4 TOTAL)



SECTION A-A
NOT TO SCALE
(34 POSTS)



HANDRAIL: STAIRWAY
SCALE: 1/2"=1'-0" REF: SHT. 616-412
(4 TOTAL)

LEGEND
TOE BOARD — — —
HANDRAIL ●——●——●

NOTICE TO CONTRACTOR AND ERECTOR:
Back charges for corrective work or replacement materials will not be accepted unless authorized by Golden Railings, Inc. before such costs are incurred.

GOLDEN RAILINGS INC.
520 BURBANK STREET "A" BROOMFIELD, CO 80020
PH. (303)279-5807 FX. (303)279-6214

LOCATION: TAUNTON, MA
PROJECT: S.O. NO: A22060
CUSTOMER: AMWELL JOB NO. P0056069
G.C.: X ENG.: X

NO.	FOR:	TYPE:	ALUM. MECH. SUB-ASSEMBLED		G.R.I. NO.
1	APPROVAL	Email	DRWG. BY: PGM	DATE: 12-13-21	14350
			CK. BY: X	DATE: X	DRWG. NO.
			SCALE AS INDICATED		E-1

ADHESIVE ANCHOR INFORMATION

GENERAL INFORMATION

PE1000+®

Epoxy Injection Adhesive Anchoring System

PRODUCT DESCRIPTION

The PE1000+ is a two-component, high strength adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment. The PE1000+ is designed for bonding threaded rod and reinforcing bar hardware into drilled holes in concrete and solid masonry base materials.

GENERAL APPLICATIONS AND USES

- Bonding threaded rod and reinforcing bar into hardened concrete and grouted CMU
- Evaluated for use in dry and water-saturated concrete including water-filled holes
- Cracked and uncracked concrete
- Seismic and wind loading (see ESR-2583)
- Hammer-drill and diamond core drilled holes
- Can be installed in a wide range of base material temperatures

FEATURES AND BENEFITS

+ Designed for use with threaded rod and reinforcing bar hardware elements
+ Consistent performance in low and high strength concrete (2,500 to 8,500 psi)
+ Evaluated and recognized for freeze/thaw performance
+ Evaluated and recognized for long term and short term loading (see performance tables for applicable temperature ranges)
+ Evaluated and recognized for variable embedments (see installation specifications)
+ Cartridge design allows for multiple uses using extra mixing nozzles
+ Mixing nozzles proportion adhesive and provide simple delivery method into drilled holes
+ Easy dispensing reduces applicator fatigue

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES) ESR-2583
- Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, 2009 IRC, 2006 IBC, and 2006 IRC
- Tested in accordance with ACI 355.4 and AC308 for use in structural concrete according to ACI 318 Appendix D (Strength Design)
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading
- Compliant with NSF/ANSI Standard 61 for drinking water system components – health effects; minimum requirements for materials in contact with potable waterand water treatment
- Conforms to requirements of ASTM C 881, Types I, II, IV and V, Grade 3, Classes B & C (also meets type lll except for elongation)
- Department of Transportation listings – see www.powers.com or contact transportation agency

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Adhesive anchoring system shall be PE1000+ as supplied by Powers Fasteners, Inc., Brewster, NY. Anchors shall be installed in accordance with published instructions and requirements of the Authority Having Jurisdiction.

SECTION CONTENTS

PE1000+ DUAL CARTRIDGE AND MIXING NOZZLE

PACKAGING

Dual (side-by-side) Cartridge

- 13 fl. oz. (385 ml)
- 20 fl. oz. (585ml)
- 47 fl. oz. (1400ml)

STORAGE LIFE & CONDITIONS

Two years in a dry, dark environment with temperature ranging from 41°F to 95°F(5°C to 35°C)

ANCHOR SIZE RANGE (TYP.)

- 3/8" to 1-1/4" diameter threaded rod
- No. 3 to No. 10 reinforcing bar (rebar)

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Light-weight concrete
- Grouted concrete masonry

PERMISSIBLE INSTALLATION CONDITIONS

- Dry concrete
- Water-saturated concrete (wet)
- Water-filled holes (flooded)

TENSION ZONE CRACKED CONCRETE
SEISMIC REGION QUALIFICATION
CODE LISTED ICC-ES ESR-2583 CONCRETE

This Product Available In

PDA®

Powers Design Assist®
Real Time Anchor Design Software
www.powersdesignassist.com

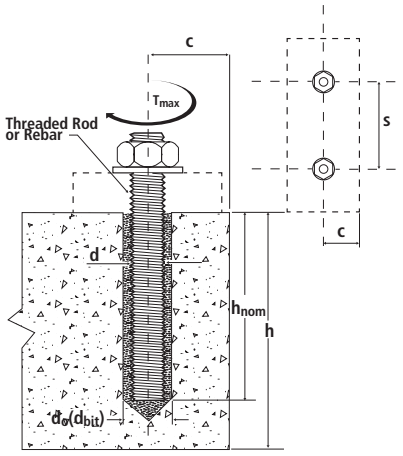
REFERENCE DATA (ASD)

Installation Table for PE1000+ (Solid Concrete Base Materials)

Dimension/Property		Notation	Units	Nominal Anchor Size									
Threaded Rod		-	-	**3/8"**	**1/2"**	**-**	**5/8"**	**3/4"**	**7/8"**	**1"**	**-**	**1-1/4"**	**-**
Reinforcing Bar		-	-	**#3**	**-**	**#4**	**#5**	**#6**	**#7**	**#8**	**#9**	**-**	**#10**
Nominal anchor diameter		d	in. (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.6)	1.250 (31.8)	1.250 (31.8)
Carbide drill bit nominal size		d_o [d_{bit}]	in.	7/16 ANSI	9/16 ANSI	5/8 ANSI	11/16 or 3/4 ANSI	7/8 ANSI	1 ANSI	1-1/8 ANSI	1-3/8 ANSI	1-3/8 ANSI	1-1/2 ANSI
Diamond core bit nominal size		d_o [d_{bit}]	in.	-	5/8		3/4	7/8	1	1-1/8	-	-	-
Minimum nominal embedment		h_{nom}	in. (mm)	2-3/8 (61)	2-3/4 (70)		3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5 (127)
Minimum spacing distance		s_{min}	in. (mm)	1-7/8 (48)	2-1/2 (62)		3-1/8 (80)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159)
Minimum edge distance		c_{min}	in. (mm)	1-3/4 (45)							2-3/4 (70)		
Maximum torque[1]	For c ≥ 5d	T_{inst}	ft.-lbf. (N-m)	15 (20)	33 (44)		60 (81)	105 (142)	125 (169)	165 (223)	-	280 (379)	-
	For c < 5d			7 (9)	15 (20)		27 (36)	47 (63)	56 (75)	74 (100)	-	126 (170)	-
Maximum torque[1,2]	For c ≥ 5d	T_{inst}	ft.-lbf. (N-m)	10 (13)	25 (33)		50 (67)	90 (122)	125 (169)	165 (223)	-	280 (379)	-
	For c < 5d			5 (6)	11 (14)		22 (29)	40 (54)	56 (75)	74 (100)	-	126 (170)	-
Effective cross sectional area of threaded rod		A_{se}	in.² (mm²)	0.078 (50)	0.142 (92)		0.226 (146)	0.335 (216)	0.462 (298)	0.606 (391)	-	0.969 (625)	-
Effective cross sectional area of reinforcing bar		A_{se}	in.² (mm²)	0.110 (71)	0.200 (129)		0.310 (200)	0.440 (284)	0.600 (387)	0.790 (510)	1.000 (645)	-	1.270 (819)

1. Torque may not be applied until the full cure time of the adhesive has been achieved.
2. Applies to ASTM A36/F 1554 Grade 36 threaded rods.

Detail of Steel Hardware Elements used with Injection Adhesive System



Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength f_y (ksi)	Minimum Ultimate Strength f_u (ksi)
Carbon Rod	A 36 or F 1554, Grade 36	3/8 through 1-1/4	36.0	58.0
	F 1554 Grade 55		55.0	75.0
	A 193, Grade B7 or F 1554, Grade 105		105.0	125.0
Stainless Rod (Alloy 304 / 316)	F 593 Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1-1/4	45.0	85.0
Grade 60 Reinforcing Bar	A 615, or A 767, A 996	3/8 through 1-1/4 (#3 through #10)	60.0	90.0
Grade 40 Reinforcing Bar	A 615	3/8 through 3/4 (#3 through #6)	40.0	60.0

Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drilled hole
h = Base material thickness
The minimum value of h should be $1.5h_{nom}$ or 3", whichever is greater.
h_{nom} = Minimum embedment depth

Allowable Load Capacities for PE1000+ Installed into Uncracked Normal-Weight Concrete with Threaded Rod and Reinforcing Bar (Based on Bond Strength/Concrete Capacity)[1,2,3,4,5,6]

Nominal Rod/Rebar Size (in. or #)	Minimum Embedment Depth (in.)	Minimum Concrete Compressive Strength, (f'c)			
		3,000 psi	4,000 psi	5,000 psi	6,000 psi
		Tension (lbs)			
3/8 or #3	2-3/8	1,195	1,235	1,270	1,300
	3-1/2	1,760	1,825	1,875	1,915
	4-1/2	2,265	2,345	2,410	2,460
1/2 or #4	2-3/4	1,770	1,835	1,885	1,925
	4-3/8	2,820	2,915	2,995	3,065
	6	3,865	4,000	4,110	4,200
5/8 or #5	3-1/8	2,420	2,505	2,575	2,630
	5-1/4	4,145	4,290	4,405	4,505
	7-1/2	5,970	6,180	6,345	6,485
3/4 or #6	3-1/2	2,870	2,970	3,050	3,120
	6-1/4	5,715	5,915	6,075	6,210
	9	8,560	8,860	9,100	9,300
7/8 or #7	3-1/2	2,870	2,970	3,050	3,120
	7	7,285	7,540	7,745	7,915
	10-1/2	11,700	12,110	12,440	12,715
1 or #8	4	3,505	3,630	3,725	3,810
	8	9,570	9,905	10,175	10,400
	12	15,635	16,185	16,625	16,990
1-1/8 or #9	4-1/2	4,185	4,330	4,445	4,545
	9	12,025	12,445	12,785	13,065
	13-1/2	19,865	20,560	21,120	21,585
1-1/4 or #10	5	4,900	5,070	5,210	5,325
	10	15,030	15,560	15,980	16,335
	15	25,165	26,045	26,755	27,345

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and at the minimum member thickness.
4. The tabulated load values are for applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in wet concrete or in water-filled holes may require a reduction in capacity. Contact Powers Fasteners for more information concerning these installation conditions.
5. Adhesives experience reductions in capacity at elevated temperatures. See the in-service temperature chart for allowable load capacity reduction factors.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load.

Allowable Load Capacities for PE1000+ Installed into Uncracked Normal-Weight Concrete with Threaded Rod and Reinforcing Bar (Based on Steel Strength)[1,2,3,4,5,6]

Nominal Rod Diameter or Rebar Size (in. or #)	Steel Elements - Threaded Rod and Reinforcing Bar											
	A36 or F1554, Grade 36		F1554, Grade 55		A 193, Grade B7 or F1554, Grade 105		F 593, CW (SS)		Grade 60 Rebar		Grade 40 Rebar	
	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
3/8 or #3	2,115 (9.4)	1,090 (4.8)	2,735 (12.2)	1,410 (6.3)	4,555 (20.3)	2,345 (10.4)	3,645 (16.2)	1,880 (8.4)	3,280 (14.6)	1,690 (7.5)	2,185 (9.7)	1,125 (5.0)
1/2 or #4	3,760 (16.7)	1,935 (8.6)	4,860 (21.6)	2,505 (11.1)	8,100 (36.0)	4,170 (18.5)	6,480 (28.8)	3,340 (14.9)	5,830 (25.9)	3,005 (13.4)	3,890 (17.3)	2,005 (8.9)
5/8 or #5	5,870 (26.1)	3,025 (13.5)	7,595 (33.8)	3,910 (17.4)	12,655 (56.3)	6,520 (29.0)	10,125 (45.0)	5,215 (23.2)	9,110 (40.5)	4,695 (20.9)	6,075 (27.0)	3,130 (13.9)
3/4 or #6	8,455 (37.6)	4,355 (19.4)	10,935 (48.6)	5,635 (25.1)	18,225 (81.1)	9,390 (41.8)	12,390 (55.1)	6,385 (28.4)	13,120 (58.4)	6,760 (30.1)	8,745 (38.9)	4,505 (20.0)
7/8 or #7	11,510 (51.2)	5,930 (26.4)	14,885 (66.2)	7,665 (34.1)	24,805 (110.3)	12,780 (56.8)	16,865 (75.0)	8,690 (38.7)	17,860 (79.4)	9,200 (40.9)	11,905 (53.0)	6,135 (27.3)
1 or #8	15,035 (66.9)	7,745 (34.5)	19,440 (86.5)	10,015 (44.5)	32,400 (144.1)	16,690 (74.2)	22,030 (98.0)	11,350 (50.5)	23,325 (103.8)	12,015 (53.4)	15,550 (69.2)	8,010 (35.6)
#9									29,680 (132.0)	15,290 (68.0)	19,785 (88.0)	10,195 (45.3)
1-1/4	23,490 (104.5)	12,100 (53.8)	30,375 (135.1)	15,645 (69.6)	50,620 (225.2)	26,080 (116.0)	34,425 (153.1)	17,735 (78.9)				
#10									37,625 (167.4)	19,380 (86.2)	25,080 (111.6)	12,920 (57.5)

1. AISC defined steel strength (ASD): Tensile = 0.33 • F_u • A_{nom}, Shear = 0.17 • F_u • A_{nom}
2. Allowable load capacities listed are calculated for the steel element type. Consideration of applying additional safety factors may be necessary depending on the application, such as life safety or overhead.
3. The tabulated load values are applicable to single anchors at critical edge and spacing distances and at the minimum member thickness.
4. The tabulated load values are for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installation in wet concrete or installations in water-filled holes may require a reduction in capacity. Contact Powers Fasteners for more information concerning these installation conditions.
5. Allowable shear capacity is controlled by steel strength for the given conditions.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load.

In-Service Temperature Chart for Allowable Load Capacities[1]

Base Material Temperature		Bond Strength Reduction Factor for Temperature
°F	°C	
41	5	1.00
50	10	1.00
68	20	1.00
75	14	1.00
104	40	0.85
110	43	0.82
122	50	0.76
140	60	0.69

1. Linear interpolation may be used to derive reduction factors between those listed.

Ultimate Load Capacities for Threaded Rod Installed with PE1000+ into the Block Face of Grout-Filled Concrete Masonry Walls[1,2]

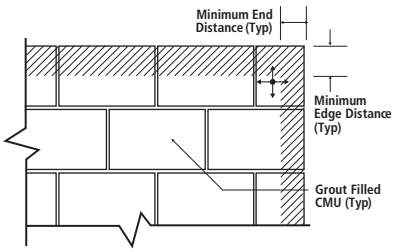
Nominal Rod Diameter d. in.	Drill Diameter d_{bit} in.	Minimum Embedment Depth in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Ultimate Load[3]		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/8	7/16	3 (76.2)	2-1/2 (63.5)	2-1/2 (63.5)	3,350 (14.9)	2,100 (9.3)	670 (2.9)	420 (1.9)
1/2	9/16	4 (101.6)	3 (76.2)	3 (76.2)	4,575 (20.3)	2,550 (11.3)	915 (4.1)	510 (2.3)
5/8	11/16	5 (127.0)	3-3/4 (95.3)	4 (101.6)	6,900 (30.7)	5,275 (23.5)	1,380 (6.1)	1,055 (4.7)

1. Tabulated load values are for anchors installed in minimum 8" wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90 that have reached a designated minimum compressive strength at the time of installation (f'm ≥1,500 psi). Mortar must be type N, S or M.
2. Anchor installations are limited to one per masonry cell. Shear loads may be applied in any direction.
3. The values listed are ultimate load capacities which should be reduced by a minimum safety factor of 5.0 or greater to determine the allowable working load. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.

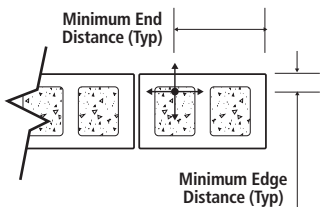
Load Capacities for Threaded Rod Installed with PE1000+ in the Top of Grout-Filled Concrete Masonry Walls[1,2]

Nominal Rod Diameter d. in.	Drill Diameter d_{bit} in.	Minimum Embedment Depth in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Ultimate Load[3]		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/2	9/16	6 (152.4)	1-3/4 (44.5)	3 (76.2)	5,950 (26.4)	1,450 (6.5)	1,190 (5.3)	290 (1.3)
5/8	11/16	8 (203.2)	1-3/4 (44.5)	4 (101.6)	9,450 (42.0)	1,700 (7.5)	1,890 (8.4)	340 (1.4)

1. Tabulated load values are for anchors installed in a minimum Grade N, Type II, lightweight, medium-weight or normal-weight masonry units conforming to ASTM C 90 that have reached a designated minimum compressive strength at the time of installation (f'm ≥1,500 psi). Mortar must be type N, S or M.
2. Anchor installations are limited to one per masonry cell. Shear loads may be applied in any direction.
3. The values listed are ultimate load capacities which should be reduced by a minimum safety factor of 5.0 or greater to determine the allowable working load. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.



Face Shell
Permissible Anchor Locations
(Un-hatched Area / Through Face Shell)



Top of Wall

STRENGTH DESIGN (SD)

Installation Specifications for Threaded Rod and Reinforcing Bar[1]

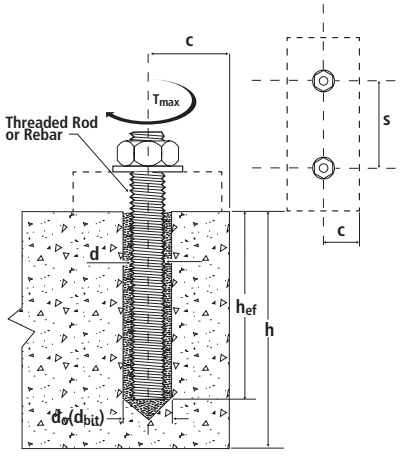
CODE LISTED
ICC-ES ESR-2583

Dimension/Property		Notation	Units	Nominal Anchor Size										
Threaded Rod		-	-	**3/8"**	**1/2"**	**-**	**5/8"**	**3/4"**	**7/8"**	**1"**	**-**	**1-1/4"**	**-**
Reinforcing Bar		-	-	**#3**	**-**	**#4**	**#5**	**#6**	**#7**	**#8**	**#9**	**-**	**#10**
Nominal anchor diameter		d	in. (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.6)	1.250 (31.8)	1.250 (31.8)
Carbide drill bit nominal size		d_o [d_{bit}]	in.	7/16 ANSI	9/16 ANSI	5/8 ANSI	11/16 or 3/4 ANSI	7/8 ANSI	1 ANSI	1-1/8 ANSI	1-3/8 ANSI	1-3/8 ANSI	1-1/2 ANSI
Diamond core bit nominal size		d_o [d_{bit}]	in.	-	5/8		3/4	7/8	1	1-1/8	-	-	-
Minimum embedment		$h_{ef,min}$	in. (mm)	2-3/8 (61)	2-3/4 (70)		3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5 (127)
Maximum embedment[4]		$h_{ef,max}$	in. (mm)	4-1/2 (114)	10 (254)		12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)	25 (635)
Minimum concrete member thickness		h_{min}	in. (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)			h_{ef} + $2d_o$						
Minimum spacing distance		s_{min}	in. (mm)	1-7/8 (48)	2-1/2 (62)		3-1/8 (80)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159)
Minimum edge distance		c_{min}	in. (mm)	1-3/4 (45)							2-3/4 (70)		
Maximum torque[2]	For c ≥ 5d	T_{inst}	ft.-lbf. (N-m)	15 (20)	33 (44)		60 (81)	105 (142)	125 (169)	165 (223)	-	280 (379)	-
	For c < 5d			7 (9)	15 (20)		27 (36)	47 (63)	56 (75)	74 (100)	-	126 (170)	-
Maximum torque[2,3]	For c ≥ 5d	T_{inst}	ft.-lbf. (N-m)	10 (13)	25 (33)		50 (67)	90 (122)	125 (169)	165 (223)	-	280 (379)	-
	For c < 5d			5 (6)	11 (14)		22 (29)	40 (54)	56 (75)	74 (100)	-	126 (170)	-
Effective cross sectional area of threaded rod		A_{se}	in.² (mm²)	0.078 (50)	0.142 (92)		0.226 (146)	0.335 (216)	0.462 (298)	0.606 (391)	-	0.969 (625)	-
Effective cross sectional area of reinforcing bar		A_{se}	in.² (mm²)	0.110 (71)	0.200 (129)		0.310 (200)	0.440 (284)	0.600 (387)	0.790 (510)	1.000 (645)	-	1.270 (819)

For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m. For pound-inch units: 1 mm = 0.03937 inch, 1 N-m = 0.7375 ft-lbf.

1. For use with the design provisions of ACI 318 Appendix D, ICC-ES AC308 Section 4.2 and ESR-2583
2. Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved
3. These torque values apply to ASTM A36/F 1554 Grade 36 threaded rods
4. The maximum embedment is limited to 12 diameters for the horizontal and upwardly inclined installations and for installations in water-filled (flooded) holes with a carbide drill bit.

Detail of Steel Hardware Elements used with Injection Adhesive System



Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength f_y (ksi)	Minimum Ultimate Strength f_u (ksi)
Carbon Rod	A 36 or F 1554, Grade 36	3/8 through 1-1/4	36.0	58.0
	F 1554 Grade 55		55.0	75.0
	A 193, Grade B7 or F 1554, Grade 105		105.0	125.0
Stainless Rod (Alloy 304 / 316)	F 593 Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1-1/4	45.0	85.0
Grade 60 Reinforcing Bar	A 615, or A 767, A 996	3/8 through 1-1/4 (#3 through #10)	60.0	90.0
	A 706		60.0	80.0
Grade 40 Reinforcing Bar	A 615	3/8 through 3/4 (#3 through #6)	40.0	60.0

Steel Tension and Shear Design for Threaded Rod in Normal Weight Concrete (For use with load combinations taken from ACI318 Section 9.2)

CODE LISTED ICC-ES ESR-2583

Design Information		Symbol	Units	Nominal Rod Diameter[1] (inch)						
				3/8	1/2	5/8	3/4	7/8	1	1-1/4
Threaded rod nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.250 (31.8)
Threaded rod effective cross-sectional area		A_{se}	inch² (mm²)	0.0775 (50)	0.1419 (92)	0.2260 (146)	0.3345 (216)	0.4617 (298)	0.6057 (391)	0.9691 (625)
ASTM A 36 and ASTM F 1554 Grade 36	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	4,495 (20.0)	8,230 (36.6)	13,110 (58.3)	19,400 (86.3)	26,780 (119.1)	35,130 (156.3)	56,210 (250.0)
		V_{sa}	lbf (kN)	2,695 (12.0)	4,940 (22.0)	7,860 (35.0)	11,640 (51.8)	16,070 (71.4)	21,080 (93.8)	33,725 (150.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F 1554 Grade 55	Nominal strength as governed by steel strength(for a single anchor)	N_{sa}	lbf (kN)	5,810 (25.9)	10,640 (47.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.0)	72,680 (323.3)
		v_{sa}	lbf (kN)	3,485 (15.5)	6,385 (28.4)	10,170 (45.2)	15,050 (67.0)	20,775 (92.4)	27,255 (121.2)	43,610 (194.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B7 and ASTM F 1554 Grade 105	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,685 (43.1)	17,735 (78.9)	28,250 (125.7)	41,810 (186.0)	57,710 (256.7)	75,710 (336.8)	121,135 (538.8)
		V_{sa}	lbf (kN)	5,815 (25.9)	10,640 (7.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.1)	72,680 (323.3)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F 593 CW Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,750 (34.5)	14,190 (63.1)	22,600 (100.5)	28,430 (126.5)	39,245 (174.6)	51,485 (229.0)	82,370 (366.4)
		V_{sa}	lbf (kN)	4,650 (20.7)	8,515 (37.9)	13,560 (60.3)	17,060 (75.9)	23,545 (104.7)	30,890 (137.4)	49,425 (219.8)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ASTM A 193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)[4]	N_{sa}	lbf (kN)	4,420 (19.7)	8,090 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
		V_{sa}	lbf (kN)	2,650 (11.8)	4,855 (21.6)	7,730 (34.4)	11,440 (50.9)	15,790 (70.2)	20,715 (92.1)	33,145 (147.4)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,365 (32.8)	13,480 (60.0)	21,470 (95.5)	31,775 (141.3)	43,860 (195.1)	57,545 (256.0)	92,065 (409.5)
		V_{sa}	lbf (kN)	4,420 (19.7)	8,085 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

1. Values provided for steel element material types are based on minimum specified strengths and calculated in accordance with ACI 318-11 Eq. (D-2) and Eq. (D-29) except where noted. Nuts and washers must be appropriate for the rod. Nuts must have specified proof load stresses equal to or greater than the minimum tensile strength of the specified threaded rod.
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used in accordance with ACI 318 D.4.3. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to ductile steel elements.
3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used in accordance with ACI 318-11 D.4.3. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to brittle steel elements
4. In accordance with ACI 318 D.5.1.2 and D.6.1.2 the calculated values for nominal tension and shear strength for ASTM A193 Grade B8/B8M Class 1 stainless steel threaded rods are based on limiting the specified tensile strength of the anchor steel to 1.9fy or 57,000 psi (393 MPa).

Concrete Breakout Design Information for Threaded Rod and Reinforcing Bars (For use with loads combinations taken from ACI 318 Section 9.2)[1]

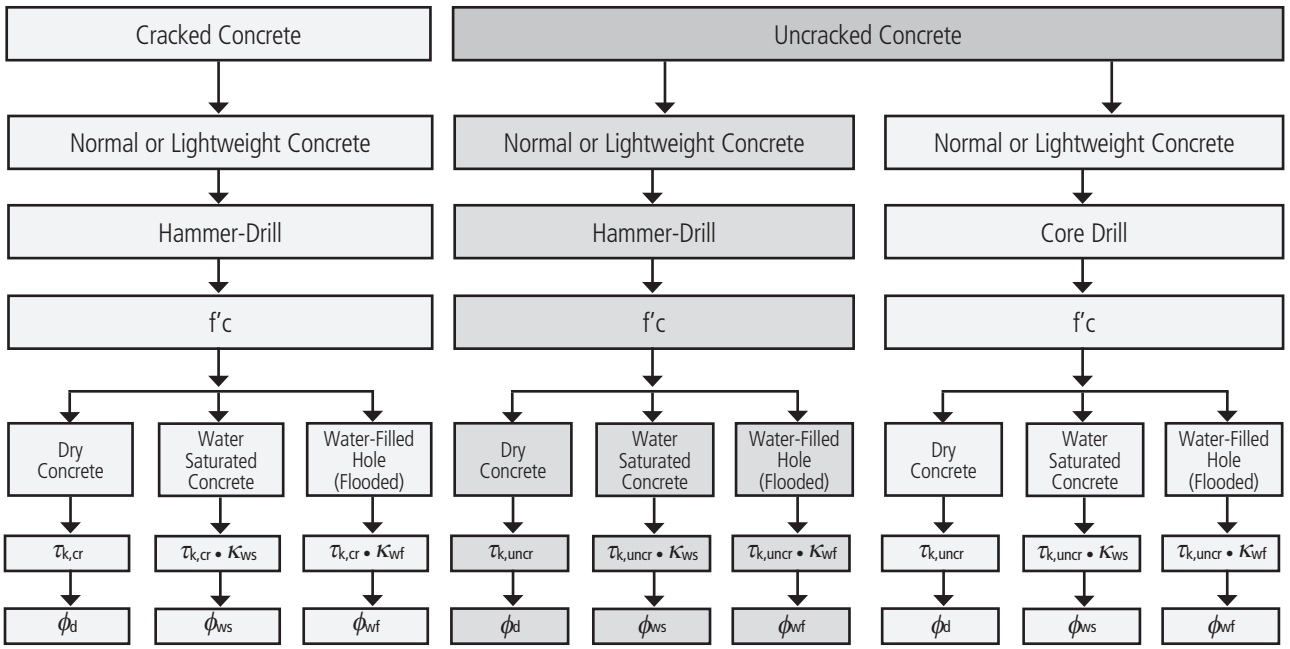
CODE LISTED ICC-ES ESR-2583

Design Information	Symbol	Units	Nominal Rod Diameter (inch) / Reinforcing Bar Size							
			3/8 or #3	1/2 or #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1-1/4 or #10
Effectiveness factor for cracked concrete	$k_{c,cr}$	- (SI)	Not Applicable	17 (7.1)						
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	- (SI)	24 (10.0)							
Minimum embedment	$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)
Minimum anchor spacing	s_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)
Minimum edge distance[2]	c_{min}	inch (mm)	5*d* where *d* is nominal outside diameter of the anchor							
Minimum edge distance,reduced[2]	$c_{min,red}$	inch (mm)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	2-3/4 (70)	2-3/4 (70)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)		h_{ef} + 2d_o where d_o is hole diameter;					
Critical edge distance—splitting (for uncracked concrete only)[3]	c_{ac}	inch	$c_{ac} = h_{ef} \cdot (\frac{\tau_{uncr}}{1160})^{0.4} \cdot [3.1\text{-}0.7 \frac{h}{h_{ef}}]$							
		(mm)	$c_{ac} = h_{ef} \cdot (\frac{\tau_{uncr}}{8})^{0.4} \cdot [3.1\text{-}0.7 \frac{h}{h_{ef}}]$							
Strength reduction factor for tension, concrete failure modes, Condition B[4]	ϕ	-	0.65							
Strength reduction factor for shear, concrete failure modes, Condition B[4]	ϕ	-	0.70							

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf.

1. Additional setting information is described in the installation instructions.
2. For installation between the minimum edge distance, c_{min}, and the reduced minimum edge distance, $c_{min,red}$, the maximum torque applied must be reduced (multiplied) by a factor of 0.45.
3. $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr} \cdot \sqrt{h_{ef} \cdot f'c}}{\pi \cdot d}$ and $\frac{h}{h_{ef}}$ need not be taken as larger than 2.4.
4. Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pryout governs, as set forth in ACI 318 D.4.3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used in accordance with ACI 318 D.4.4. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4.

FLOWCHART FOR THE ESTABLISHMENT OF DESIGN BOND STRENGTH



Bond Strength Design Information for Threaded Rods and Reinforcing Bars in Holes Drilled with a Hammer Drill and Carbide Bit (For use with load combinations taken from ACI 318 Section 9.2)[1]

Design Information		Symbol	Units	Nominal Rod Diameter (inch) / Reinforcing Bar Size							
				3/8 or #3	1/2 or #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	11/4 or #10
Minimum embedment		$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102	4-1/2 (114)	5 (127)
Maximum embedment	Dry concrete and saturated concrete[7]	$h_{ef,max}$	inch (mm)	4-1/2 (114)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)
	Water-filled hole (flooded)	$h_{ef,max}$	inch (mm)	4-1/2 (114)	6 (152)	7-1/2 (190)	9 (225)	10-1/2 (267)	12 (305)	13-1/2 (343)	15 (381)
75°F (24°C) Maximum Long-Term Service Temperature; 104°F (40°C) Maximum Short-Term Service Temperature[4,10]	Characteristic bond strength in cracked concrete[5,8]	$\tau_{k,cr}$	psi (N/mm²)	N/A	1,119 (7.7)	920 (6.3)	857 (5 .9)	807 (5.6)	807 (5.6)	807 (5.6)	807 (5.6)
	Characteristic bond strength in uncracked concrete[5,9]	$\tau_{k,uncr}$	psi (N/mm²)	2,375 (16.4)	2,244 (15.5)	2,148 (14.8)	2,073 (14.3)	2,013 (13.9)	1,960 (13.5)	1,916 (13.2)	1,876 (12.9)
110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[2,4]	Characteristic bond strength in cracked concrete[5,8]	$\tau_{k,cr}$	psi (N/mm²)	N/A	576 (4.0)	474 (3.3)	441 (3.0)	416 (2.9)	416 (2.9)	416 (2.9)	416 (2.9)
	Characteristic bond strength in uncracked concrete[5,9]	$\tau_{k,uncr}$	psi (N/mm²)	1,223 (8.4)	1,156 (8.0)	1,106 (7.6)	1,067 (7.4)	1,036 (7.1)	1,010 (7.0)	986 (6.8)	966 (6.7)
110°F (43°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[3,4]	Characteristic bond strength in cracked concrete[5,8]	$\tau_{k,cr}$	psi (N/mm²)	N/A	455 (3.1)	374 (2.6)	349 (2.4)	329 (2.3)	329 (2.3)	329 (2.3)	329 (2.3)
	Characteristic bond strength in uncracked concrete[5,9]	$\tau_{k,uncr}$	psi (N/mm²)	966 (6.7)	913 (6.3)	874 (6.0)	843 (5.8)	819 (5.6)	798 (5.5)	779 (5.4)	763 (5.3)
Permissible installation conditions[6]	Dry concrete	ϕ_d	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Water-saturated concrete	ϕ_{ws}	-	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
		κ_{ws}		0.93	0.9	0.96	1.0	1.0	1.0	1.0	0.99
	Water-filled hole (flooded)	ϕ_{wf}	-	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
		κ_{wf}		0.93	0.83	0.75	0.70	0.65	0.62	0.59	0.56
Reduction factor for seismic tension		$\alpha_{N,seis}$	-	1.0							

For SI: 1 inch = 25.4 mm, 1 psi = 0.006894 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

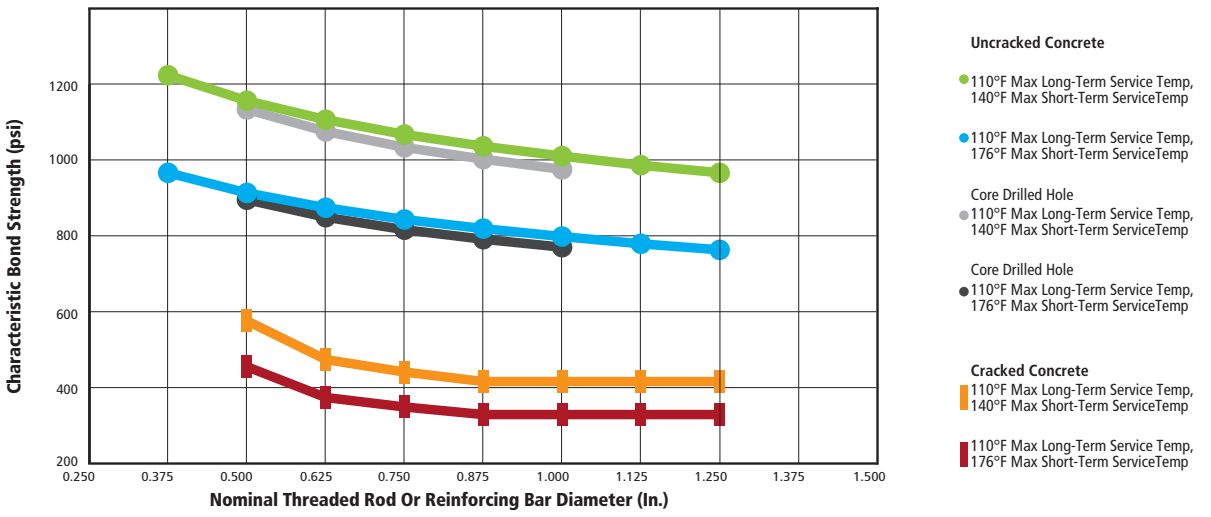
1. Bond strength values correspond to a normal-weight concrete compressive strength f'c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'c between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'c / 2{,}500)^{0.12}$ [For SI: $(f'c / 17.2)^{0.12}$].
2. The maximum short-term service temperature may be increased to 162°F (72°C) provided characteristic bond strengths are reduced by 10 percent. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category B.
3. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category A.
4. Short-term base material service temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term base material service temperatures are roughly constant over significant periods of time.
5. Characteristic bond strengths are for sustained loads including dead and live loads.
6. Permissible installation conditions include dry concrete, water-saturated concrete and water-filled holes. Water-filled holes include applications in dry or water-saturated concrete where the drilled holes contain standing water at the time of anchor installation.
7. Maximum embedment is limited to twelve anchor diameters for horizontal and upwardly inclined installations.
8. For structures assigned to Seismic Design Categories C, D, E or F, bond strength values for cracked concrete do not require an additional reduction factor applied for seismic tension ($\alpha_{N,seis}$ = 1.0), where seismic design is applicable.
9. Bond strength values for uncracked concrete are applicable for structures assigned to Seismic Design Categories A and B only.
10. **Room temperature range is not recognized by ACI 318-11 and does not meet the minimum temperature requirement of ACI 355.4, Table 8.1 and consequently is not applicable to design under ACI 318-11 or current and past editions of the International Building Code (IBC). The tabulated values are provided for analysis and evaluation of existing conditions only.**

Bond Strength Design Information for Threaded Rods and Reinforcing Bars in Holes Drilled with a Core Drill and Diamond Core Bit (For use with load combinations taken from ACI 318 Section 9.2)[1]

Design Characteristic		Notation	Units	Nominal Rod Diameter (inch) / Reforcing Bar Size				
				1/2" or #4	5/8" or #5	3/4" or #6	7/8" or #7	1" or #8
Minimum embedment		$h_{ef,min}$	in. (mm)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)
Maximum embedment[7]		$h_{ef,max}$	in. (mm)	10 (54)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)
75°F (24°C) Maximum Long-Term Service Temperature; 104°F (40°C) Maximum Short-Term Service Temperature[4,10]	Characteristic bond strength in uncracked concrete[5,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,419 (9.8)	1,351 (9.3)	1,298 (9.0)	1,257 (8.7)	1,221 (8.4)
110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[2,4]	Characteristic bond strength in uncracked concrete[5,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,133 (7.8)	1,075 (7.4)	1,033 (7.1)	1,022 (6.9)	975 (6.7)
110°F (43°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[3,4]	Characteristic bond strength in uncracked concrete[5,8]	$\tau_{k,uncr}$	psi (N/mm²)	895 (6.2)	849 (5.9)	816 (5.6)	791 (5.5)	770 (5.3)
Permissible Installation Conditions[6]	Dry concrete	ϕ_d	-	0.55	0.45	0.45	0.45	0.45
	Water-saturated concrete	ϕ_{ws}	-	0.45	0.45	0.45	0.45	0.45
		κ_{ws}	-	1.0	1.0	1.0	1.0	1.0
	Water-filled hole (flooded)	ϕ_{ws}	-	0.45	0.45	0.45	0.45	0.45
		κ_{wf}	-	0.94	0.95	0.95	0.95	0.96

For SI: 1 inch = 25.4 mm, 1 psi = 0.006894 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Bond strength values correspond to a normal-weight concrete compressive strength f'c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'c between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'c / 2{,}500)^{0.12}$ [For SI: $(f'c / 17.2)^{0.12}$].
2. The maximum short-term service temperature may be increased to 162°F (72°C) provided characteristic bond strengths are reduced by 10 percent. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category B.
3. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category A.
4. Short-term base material service temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term base material service temperatures are roughly constant over significant periods of time.
5. Characteristic bond strengths are for sustained loads including dead and live loads.
6. Permissible installation conditions include dry concrete, water-saturated concrete and water-filled holes. Water-filled holes include applications in dry or water-saturated concrete where the drilled holes contain standing water at the time of anchor installation.
7. Maximum embedment is limited to twelve anchor diameters for horizontal and upwardly inclined installations.
8. For structures assigned to Seismic Design Categories C, D, E or F, bond strength values for cracked concrete do not require an additional reduction factor applied for seismic tension ($\alpha_{N,seis}$ = 1.0), where seismic design is applicable.
9. Bond strength values for uncracked concrete are applicable for structures assigned to Seismic Design Categories A and B only.
10. **Room temperature range is not recognized by ACI 318-11 and does not meet the minimum temperature requirement of ACI 355.4, Table 8.1 and consequently is not applicable to design under ACI 318-11 or current and past editions of the International Building Code (IBC). The tabulated values are provided for analysis and evaluation of existing conditions only.**



Tension and Shear Design Strength Installed in Uncracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 75°F (24°C) Maximum Long-Term Service Temperature; 104°F (40°C) Maximum Short-Term Service Temperature [1,2,3,4,5,6,7,8]

STRENGTH DESIGN SD TABLES

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8 or #3	2-3/8	2,855	2,570	3,125	2,920	3,610	3,575	4,425	4,745	4,965	5,350
	3	4,055	4,010	4,440	4,555	5,125	5,570	6,060	7,295	6,275	8,540
	4-1/2	7,445	7,935	8,155	9,015	8,660	10,660	9,090	13,315	9,410	15,585
1/2 or #4	2-3/4	3,555	3,305	3,895	3,755	4,500	4,590	5,510	6,095	6,365	7,455
	4	6,240	6,700	6,835	7,610	7,895	9,310	9,665	12,365	10,535	14,780
	6	11,465	13,235	12,560	15,035	14,500	18,390	15,270	22,995	15,805	26,920
	10	22,910	30,315	23,420	33,500	24,240	39,220	25,450	48,975	26,345	56,740
5/8 or #5	3-1/8	4,310	4,120	4,720	4,680	5,450	5,720	6,675	7,600	7,710	9,295
	5	8,720	9,985	9,555	11,345	11,030	13,875	13,510	18,430	15,600	22,540
	7-1/2	16,020	19,725	17,550	22,410	20,265	27,410	22,840	35,210	23,640	41,225
	12-1/2	34,270	46,440	35,025	51,320	36,255	60,085	38,065	75,035	39,400	84,865
3/4 or #6	3-1/2	5,105	5,015	5,595	5,700	6,460	6,970	7,910	9,255	9,135	11,320
	6	11,465	13,595	12,560	15,445	14,500	18,895	17,760	25,095	20,505	30,695
	9	21,060	26,855	23,070	30,510	26,640	37,320	31,740	49,025	32,855	57,395
	15	45,315	63,370	48,675	71,435	50,385	83,635	52,900	104,445	54,755	117,935
7/8 or #7	3-1/2	5,105	4,930	5,595	5,605	6,460	6,855	7,910	9,100	9,135	11,130
	7	14,445	16,605	15,825	18,865	18,275	23,075	22,380	30,650	25,840	37,485
	10-1/2	26,540	32,800	29,070	37,265	33,570	45,580	41,115	60,540	43,425	71,450
	17-1/2	57,100	77,405	62,550	87,940	66,595	104,125	69,915	130,030	72,370	152,235
1 or #8	4	6,240	6,115	6,835	6,945	7,895	8,495	9,665	11,280	11,160	13,800
	8	17,650	19,750	19,335	22,435	22,325	27,440	27,340	36,450	31,570	44,580
	12	32,425	39,005	35,520	44,315	41,015	54,200	50,230	71,990	55,225	86,340
	20	69,765	92,055	76,425	104,585	84,690	125,830	88,915	157,140	92,040	183,970
#9	4-1/2	7,445	7,110	8,155	8,080	9,420	9,880	11,535	13,125	13,320	16,055
	9	21,060	23,055	23,070	26,190	26,640	32,035	32,625	42,550	37,675	52,040
	13-1/2	38,690	45,540	42,380	51,740	48,940	63,280	59,940	84,050	68,320	102,275
	22-1/2	83,245	107,440	91,190	122,065	104,780	149,000	110,005	186,075	113,870	217,845
1-1/4	5	8,720	8,170	9,555	9,285	11,030	11,355	13,510	15,085	15,600	18,450
	10	24,665	26,380	27,020	29,975	31,200	36,660	38,210	48,690	44,125	59,555
	15	45,315	52,110	49,640	59,200	57,320	72,410	70,200	96,175	81,060	117,630
	25	97,500	122,990	106,805	139,730	123,330	170,905	132,975	215,715	137,645	252,550
#10	5	8,720	8,160	9,555	9,270	11,030	11,335	13,510	15,060	15,600	18,420
	10	24,665	26,430	27,020	30,025	31,200	36,725	38,210	48,780	44,125	59,660
	15	45,315	52,205	49,640	59,310	57,320	72,545	70,200	96,350	81,060	117,845
	25	97,500	123,170	106,805	139,935	123,330	171,155	132,975	216,030	137,645	252,920

- Concrete Breakout Strength   - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed following methodology in ACI 318-11 Appendix D and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls. **This temperature range is not recognized by ACI 318-11 and does not meet the minimum temperature requirements from ACI 355.4 Table 8.1 and consequently is not applicable to design under ACI 318-11 or current and past editions of the international building code (IBC). The tabulated values are provided for analysis and evaluation of existing conditions only.**
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318 Section 9.2 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-2583.
5. Tabular values are permitted for short-term static loads only, seismic loading is not considered with these tables.
6. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-11 Appendix D.
7. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-11 Appendix D, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-11 Appendix D and ICC-ES AC308 and ESR-2583.
8. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength Installed in Uncracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

PDA STRENGTH DESIGN SD TABLES

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ΦN_{cb} or ΦN_a Tension (lbs.)	ΦV_{cb} or ΦV_{cp} Shear (lbs.)	ΦN_{cb} or ΦN_a Tension (lbs.)	ΦV_{cb} or ΦV_{cp} Shear (lbs.)	ΦN_{cb} or ΦN_a Tension (lbs.)	ΦV_{cb} or ΦV_{cp} Shear (lbs.)	ΦN_{cb} or ΦN_a Tension (lbs.)	ΦV_{cb} or ΦV_{cp} Shear (lbs.)	ΦN_{cb} or ΦN_a Tension (lbs.)	ΦV_{cb} or ΦV_{cp} Shear (lbs.)
3/8 or #3	2-3/8	2,225	2,330	2,275	2,450	2,355	2,535	2,470	2,660	2,555	2,755
	3	2,810	3,460	2,870	3,825	2,975	4,480	3,120	5,595	3,230	6,550
	4-1/2	4,215	6,320	4,310	6,985	4,460	8,175	4,680	10,085	4,845	10,435
1/2 or #4	2-3/4	3,245	3,185	3,320	3,520	3,435	4,120	3,605	5,145	3,730	6,025
	4	4,720	5,990	4,825	6,620	4,995	7,755	5,245	9,680	5,430	11,335
	6	7,080	10,915	7,240	12,065	7,495	14,125	7,865	16,945	8,145	17,540
	10	11,805	23,250	12,065	25,690	12,490	26,895	13,110	28,240	13,570	29,230
5/8 or #5	3-1/8	4,310	4,120	4,510	4,595	4,665	5,375	4,900	6,715	5,070	7,860
	5	7,060	9,175	7,215	10,140	7,465	11,870	7,840	14,825	8,115	17,355
	7-1/2	10,585	16,710	10,820	18,465	11,200	21,620	11,760	25,330	12,170	26,220
	12-1/2	17,645	35,610	18,035	38,845	18,670	40,210	19,600	42,215	20,285	43,695
3/4 or #6	3-1/2	5,105	5,015	5,480	5,700	5,735	6,790	6,000	8,480	6,195	9,925
	6	9,805	12,775	10,020	14,115	10,375	16,525	10,890	20,635	11,275	24,160
	9	14,705	23,265	15,035	25,710	15,560	30,100	16,335	35,185	16,910	36,420
	15	24,510	49,560	25,055	53,965	25,935	55,860	27,225	58,645	28,185	60,705
7/8 or #7	3-1/2	5,085	4,930	5,290	5,605	5,625	6,855	5,980	8,765	6,175	10,260
	7	12,960	15,900	13,245	17,570	13,710	20,570	14,395	25,690	14,900	30,075
	10-1/2	19,435	28,960	19,865	32,000	20,565	37,465	21,590	46,500	22,350	48,135
	17-1/2	32,395	61,700	33,110	68,185	34,275	73,820	35,985	77,500	37,245	80,225
1 or #8	4	6,240	6,115	6,685	6,945	7,110	8,495	7,645	11,045	7,895	12,930
	8	16,500	19,225	16,865	21,245	17,455	24,870	18,325	31,060	18,970	36,360
	12	24,750	35,010	25,295	38,690	26,185	45,295	27,490	56,570	28,455	61,290
	20	41,250	74,605	42,160	82,440	43,640	94,000	45,820	98,685	47,430	102,150
#9	4-1/2	7,445	7,110	8,105	8,080	8,615	9,880	9,350	13,025	9,655	15,250
	9	20,385	22,755	20,835	25,145	21,570	29,440	22,645	36,765	23,440	43,045
	13-1/2	30,580	41,450	31,255	45,805	32,355	53,630	33,965	66,970	35,160	75,730
	22-1/2	50,965	88,290	52,095	97,570	53,920	114,230	56,610	121,930	58,600	126,215
1-1/4	5	8,720	8,170	9,555	9,285	10,495	11,355	11,450	15,085	11,870	17,755
	10	24,660	26,380	25,205	29,150	26,090	34,130	27,390	42,620	28,350	49,895
	15	36,985	48,045	37,805	53,090	39,130	62,155	41,085	77,625	42,525	90,880
	25	61,645	102,380	63,005	113,140	65,220	132,460	68,470	147,480	70,875	152,660
#10	5	8,720	8,160	9,555	9,270	10,375	11,335	11,315	15,060	11,725	17,725
	10	24,660	26,425	25,205	29,200	26,090	34,190	27,390	42,695	28,350	49,985
	15	36,985	48,130	37,805	53,190	39,130	62,270	41,085	77,765	42,525	91,045
	25	61,645	102,530	63,005	113,305	65,220	132,655	68,470	147,480	70,875	152,660

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-11 Appendix D and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318 Section 9.2 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-2583.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-2583 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-11 D.4.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-11 Appendix D.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-11 Appendix D, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-11 Appendix D and ICC-ES AC308 and ESR-2583.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

EXPANSION ANCHOR INFORMATION

GENERAL INFORMATION

POWER-STUD®+ SD4/SD6

Stainless Steel Wedge Expansion Anchors

PRODUCT DESCRIPTION

The Power-Stud+ SD4 and Power-Stud+ SD6 anchors are fully threaded, torque-controlled, stainless steel wedge expansion anchors which are designed for consistent performance in cracked and uncracked concrete. Suitable base materials are normal-weight, sand-lightweight concrete, and grouted concrete masonry (CMU). The anchor is manufactured with a stainless steel body and expansion clip. Nut and washer are included.

GENERAL APPLICATIONS AND USES

- Structural connections, i.e., beam and column anchorage
- Safety-related and common attachments
- Interior and exterior applications
- Tension zone applications, i.e., cable trays and strut, pipe supports, fire sprinklers

FEATURES AND BENEFITS

+ Knurled mandrel design provides consistent performance in cracked concrete and helps prevent galling during service life.
+ Nominal drill bit size is the same as the anchor diameter
+ Anchor can be installed through standard clearance fixture holes
+ Length ID code and identifying marking stamped on head of each anchor
+ Anchor design allows for follow-up expansion after setting under tensile loading
+ Corrosion resistant stainless steel anchors
+ Domestically manufactured by request

APPROVALS AND LISTINGS

- International Code Council Evaluation Service (ICC-ES), ESR-2502 for cracked and uncracked concrete
- Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ACI 355.2/ASTM E 488 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 Appendix D
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading (Category 1 anchors)

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00-Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 Post-Installed Concrete Anchors. Expansion anchors shall be Power-Stud+ SD4 and Power-Stud+ SD6 as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

POWER-STUD+ STAINLESS STEEL ASSEMBLY

THREAD VERSION

- UNC threaded stud

ANCHOR MATERIALS

- Stainless steel body and expansion clip, nut and washer

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 3/4" diameter

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Sand-lightweight concrete
- Grouted Concrete Masonry (CMU)

TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

CODE LISTED
ICC-ES ESR-2502
CONCRETE

DDA
DEWALT DESIGN ASSIST

DUST X+
ANCHOR INSTALLATION SYSTEM

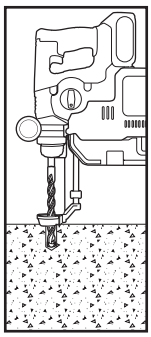
MATERIAL SPECIFICATIONS

Anchor component	Specification	
	SD4[1]	SD6[1]
Anchor body	Type 304 Stainless Steel	Type 316 Stainless Steel
Washer	300 Series Stainless Steel	Type 316 Stainless Steel
Hex Nut	Type 316 Stainless Steel	
Expansion wedge (clip)	Type 316 Stainless Steel	

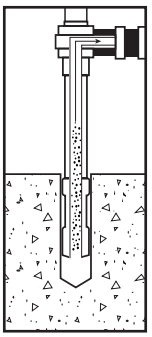
1. Domestically manufactured anchors are available upon request (made to order, see ordering information for details).

INSTALLATION INSTRUCTIONS

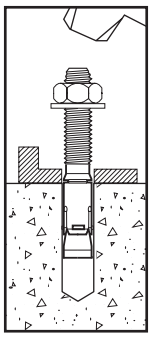
Installation Instructions for Power-Stud+ SD4 and Power-Stud+ SD6



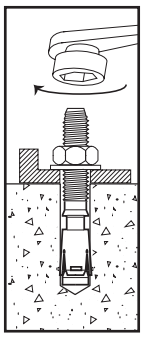
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove dust and debris from the hole during drilling, (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



Step 3
Position the supplied washer on the anchor and thread on the supplied nut. If installing through a fixture, drive the anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth.

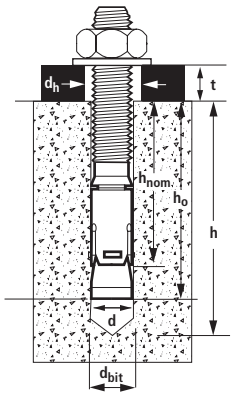


Step 4
Tighten the anchor with a torque wrench by applying the required installation torque, T_{inst}.

Length Identification

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
From	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"	6"	6-1/2"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"	10"
Up to but not including	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"	6"	6-1/2"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"	10"	11"
Length identification mark indicates overall length of anchor.																		

Anchor Detail



Nomenclature

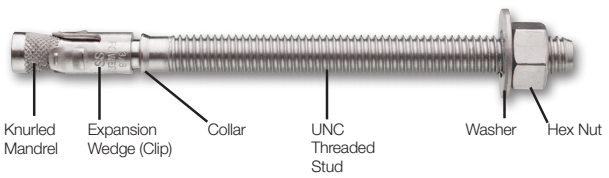
d = Diameter of anchor
d_{bit} = Diameter of drill bit
d_h = Diameter of fixture clearance hole
h = Base material thickness
The minimum value of h should be $1.5h_{nom}$ or 3" whichever is greater
h_{nom} = Minimum embedment depth

Head Marking

Legend

Letter Code = Length Identification Mark
'+' Symbol = Strength Design Compliant Anchor (see ordering information, symbol not on 1/4" diameter anchors)
Number Code = Stainless Steel Body Type (4 or 6)

Anchor Assembly



REFERENCE DATA (ASD)

Installation Specifications Table for Power-Stud+ SD4 and Power-Stud+ SD6 in Concrete

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter (inch)				
			1/4	3/8	1/2	5/8	3/4
Anchor outside diameter	d	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)
Thread Size (UNC)	-	in.	1/4-20	3/8-16	1/2-13	5/8-11	3/4-10
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI	3/8 ANSI	1/2 ANSI	5/8 ANSI	3/4 ANSI
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	5/16 (7.9)	7/16 (11.1)	9/16 (14.3)	11/16 (17.5)	13/16 (20.6)
Minimum embedment depth	h_{nom}	in. (mm)	1-1/8 (29)	1-3/8 (41)	1-7/8 (48)	2-1/2 (64)	3-3/8 (86)
Minimum hole depth	h_o	in. (mm)	1-1/4 (32)	1-1/2 (38)	2 (51)	2-5/8 (67)	3-1/2 (89)
Installation torque	T_{inst}	ft.-lbf. (N-m)	6 (8)	25 (34)	40 (54)	60 (81)	110 (149)
Torque wrench/socket size	-	in.	7/16	9/16	3/4	15/16	1-1/8
Nut height	-	in.	7/32	21/64	7/16	35/64	41/64
For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.							

Ultimate Load Capacities for Power-Stud+ SD4 and Power-Stud+ SD6 in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter in.	Minimum Embedment Depth h_{nom} in. (mm)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 MPa)	
		Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
1/4	1-1/8 (29)	1,095 (4.9)	2,135 (9.5)	1,200 (5.3)	2,135 (9.5)	1,390 (6.2)	2,135 (9.5)	1,455 (6.5)	2,135 (9.5)	1,680 (7.5)	2,135 (9.5)
	1-3/4 (44)	1,890 (8.4)	2,135 (9.5)	2,070 (9.2)	2,135 (9.5)	2,390 (10.6)	2,135 (9.5)	2,480 (11.0)	2,135 (9.5)	2,480 (11.0)	2,135 (9.5)
3/8	1-3/8 (41)	1,530 (6.8)	2,745 (12.2)	1,680 (7.5)	2,745 (12.2)	1,940 (8.6)	2,745 (12.2)	2,520 (11.2)	2,745 (12.2)	2,910 (12.9)	2,745 (12.2)
	1-7/8 (48)	2,790 (12.4)	2,745 (12.2)	3,060 (13.6)	2,745 (12.2)	3,530 (15.7)	2,745 (12.2)	4,195 (18.7)	2,745 (12.2)	4,840 (21.5)	2,745 (12.2)
	3 (76)	4,700 (20.9)	2,745 (12.2)	4,895 (21.8)	2,745 (12.2)	4,895 (21.8)	2,745 (12.2)	4,895 (21.8)	2,745 (12.2)	4,895 (21.8)	2,745 (12.2)
1/2	1-7/8 (48)	2,745 (12.2)	5,090 (22.6)	3,010 (13.4)	5,090 (22.6)	3,475 (15.5)	5,090 (22.6)	4,525 (20.1)	5,090 (22.6)	5,230 (23.3)	5,090 (22.6)
	2-3/8 (60)	5,370 (23.9)	5,090 (22.6)	5,880 (26.2)	5,090 (22.6)	6,790 (30.2)	5,090 (22.6)	6,790 (30.2)	5,090 (22.6)	7,845 (34.9)	5,090 (22.6)
	3-3/4 (95)	8,840 (39.3)	5,090 (22.6)	9,300 (41.4)	5,090 (22.6)	9,300 (41.4)	5,090 (22.6)	9,300 (41.4)	5,090 (22.6)	9,300 (41.4)	5,090 (22.6)
5/8	2-1/2 (64)	5,015 (22.3)	9,230 (41.1)	5,495 (24.4)	9,230 (41.1)	6,345 (28.2)	9,230 (41.1)	7,250 (32.2)	9,230 (41.1)	8,370 (37.2)	9,230 (41.1)
	3-1/4 (83)	6,760 (30.1)	9,230 (41.1)	7,405 (32.9)	9,230 (41.1)	8,560 (38.1)	9,230 (41.1)	9,615 (42.8)	9,230 (41.1)	11,105 (49.4)	9,230 (41.1)
	4-3/4 (121)	10,550 (46.9)	9,230 (41.1)	11,555 (51.4)	9,230 (41.1)	13,345 (59.4)	9,230 (41.1)	14,560 (64.8)	9,230 (41.1)	14,560 (64.8)	9,230 (41.1)
3/4	3-3/8 (86)	6,695 (29.8)	11,255 (50.1)	7,330 (32.6)	12,625 (56.2)	8,465 (37.7)	14,580 (64.9)	9,705 (43.2)	15,440 (68.7)	11,210 (49.9)	15,440 (68.7)
	4-1/2 (114)	10,800 (48.0)	15,440 (68.7)	11,830 (52.6)	15,440 (68.7)	13,575 (60.4)	15,440 (68.7)	17,110 (76.1)	15,440 (68.7)	19,760 (87.9)	15,440 (68.7)
	5-5/8 (143)	11,730 (52.2)	15,440 (68.7)	12,850 (57.2)	15,440 (68.7)	13,575 (60.4)	15,440 (68.7)	19,710 (87.7)	15,440 (68.7)	21,705 (96.5)	15,440 (68.7)

1. Tabulated load values are for anchors installed in uncracked concrete with no edge or spacing considerations. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working loads.

Allowable Load Capacities for Power-Stud+ SD4 and Power-Stud+ SD6 in Normal-Weight Concrete[1,2,3,4]

Nominal Anchor Diameter in.	Minimum Embedment Depth h_{nom} in. (mm)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 MPa)	
		Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
1/4	1-1/8 (28)	275 (1.2)	535 (2.4)	300 (1.3)	535 (2.4)	350 (1.6)	535 (2.4)	365 (1.6)	535 (2.4)	420 (1.9)	535 (2.4)
	1-3/4 (44)	475 (2.1)	535 (2.4)	520 (2.3)	535 (2.4)	600 (2.7)	535 (2.4)	620 (2.8)	535 (2.4)	620 (2.8)	535 (2.4)
3/8	1-3/8 (41)	385 (1.7)	685 (3.0)	420 (1.9)	685 (3.0)	485 (2.2)	685 (3.0)	630 (2.8)	685 (3.0)	730 (3.2)	685 (3.0)
	1-7/8 (60)	700 (3.1)	685 (3.0)	765 (3.4)	685 (3.0)	885 (3.9)	685 (3.0)	1,050 (4.7)	685 (3.0)	1,210 (5.4)	685 (3.0)
	3 (60)	1,175 (5.2)	685 (3.0)	1,225 (5.4)	685 (3.0)	1,225 (5.4)	685 (3.0)	1,225 (5.4)	685 (3.0)	1,225 (5.4)	685 (3.0)
1/2	1-7/8 (57)	685 (3.0)	1,275 (5.7)	755 (3.4)	1,275 (5.7)	870 (3.9)	1,275 (5.7)	1,130 (5.0)	1,275 (5.7)	1,310 (5.8)	1,275 (5.7)
	2-3/8 (64)	1,345 (6.0)	1,275 (5.7)	1,470 (6.5)	1,275 (5.7)	1,700 (7.6)	1,275 (5.7)	1,700 (7.6)	1,275 (5.7)	1,960 (8.7)	1,275 (5.7)
	3-3/4 (95)	2,210 (9.8)	1,275 (5.7)	2,325 (10.3)	1,275 (5.7)	2,325 (10.3)	1,275 (5.7)	2,325 (10.3)	1,275 (5.7)	2,325 (10.3)	1,275 (5.7)
5/8	2-1/2 (70)	1,255 (5.6)	2,310 (10.3)	1,375 (6.1)	2,310 (10.3)	1,585 (7.1)	2,310 (10.3)	1,815 (8.1)	2,310 (10.3)	2,095 (9.3)	2,310 (10.3)
	3-1/4 (86)	1,690 (7.5)	2,310 (10.3)	1,850 (8.2)	2,310 (10.3)	2,140 (9.5)	2,310 (10.3)	2,405 (10.7)	2,310 (10.3)	2,775 (12.3)	2,310 (10.3)
	4-3/4 (117)	2,640 (11.7)	2,310 (10.3)	2,890 (12.9)	2,310 (10.3)	3,335 (14.8)	2,310 (10.3)	3,640 (16.2)	2,310 (10.3)	3,640 (16.2)	2,310 (10.3)
3/4	3-3/8 (86)	1,675 (7.5)	2,815 (12.5)	1,835 (8.2)	3,155 (14.0)	2,115 (9.4)	3,645 (16.2)	2,425 (10.8)	3,860 (17.2)	2,805 (12.5)	3,860 (17.2)
	4-1/2 (114)	2,700 (12.0)	3,860 (17.2)	2,960 (13.2)	3,860 (17.2)	3,395 (15.1)	3,860 (17.2)	4,280 (19.0)	3,860 (17.2)	4,940 (22.0)	3,860 (17.2)
	5-5/8 (143)	2,935 (13.1)	3,860 (17.2)	3,215 (14.3)	3,860 (17.2)	3,395 (15.1)	3,860 (17.2)	4,930 (21.9)	3,860 (17.2)	5,425 (24.1)	3,860 (17.2)

1. Tabulated load values are for anchors installed in uncracked concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
3. Allowable load capacities must be multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
4. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

SPACING DISTANCE AND EDGE DISTANCE ADJUSTMENT FACTORS FOR NORMAL WEIGHT CONCRETE - TENSION (F_{NS}, F_{NC})

Spacing Reduction Factors - Tension (F_{NS})

Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embed. h_{nom} (in)		1-3/4	1-7/8	2-1/2	3-1/4	4-1/2
Minimum Spacing, s_{min} (in)		2	3	3	5	5
Spacing Distance (inches)	1-3/4	-	-	-	-	-
	2	0.79	-	-	-	-
	2-1/4	0.81	-	-	-	-
	2-1/2	0.83	-	-	-	-
	2-3/4	0.85	-	-	-	-
	3	0.87	0.87	0.82	-	-
	3-1/2	0.91	0.91	0.85	-	-
	4	0.96	0.96	0.88	-	-
	4-1/2	1.00	1.00	0.91	-	-
	5	1.00	1.00	0.94	0.85	0.76
	5-1/2	1.00	1.00	0.97	0.87	0.78
	6	1.00	1.00	1.00	0.90	0.80
	6-1/2	1.00	1.00	1.00	0.92	0.82
	7	1.00	1.00	1.00	0.94	0.84
	7-1/2	1.00	1.00	1.00	0.97	0.86
	8	1.00	1.00	1.00	0.99	0.87
	8-1/4	1.00	1.00	1.00	1.00	0.88
	8-1/2	1.00	1.00	1.00	1.00	0.89
	9	1.00	1.00	1.00	1.00	0.91
	9-1/2	1.00	1.00	1.00	1.00	0.93
	10	1.00	1.00	1.00	1.00	0.95
	10-1/2	1.00	1.00	1.00	1.00	0.97
	11	1.00	1.00	1.00	1.00	0.99
	11-1/4	1.00	1.00	1.00	1.00	1.00

Edge Distance Reduction Factors- Tension (F_{NC})

Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embed. h_{nom} (in)		1-3/4	1-7/8	2-1/2	3-1/4	4-1/2
Critical Edge Distance, c_{ac} (in)		5	5	7-1/2	9-1/2	9
Min. Edge Distance, c_{min} (in)		1-3/4	3	3	4-1/2	5
Edge Distance (inches)	1-1/2	-	-	-	-	-
	1-3/4	0.35	-	-	-	-
	2	0.40	-	-	-	-
	2-1/4	0.45	-	-	-	-
	2-1/2	0.50	-	-	-	-
	2-3/4	0.55	-	-	-	-
	3	0.60	0.60	0.40	-	-
	3-1/2	0.70	0.70	0.47	-	-
	4	0.80	0.80	0.53	-	-
	4-1/2	0.90	0.90	0.60	0.47	-
	5	1.00	1.00	0.67	0.53	0.56
	5-1/2	1.00	1.00	0.73	0.58	0.61
	6	1.00	1.00	0.80	0.63	0.67
	6-1/2	1.00	1.00	0.87	0.68	0.72
	7	1.00	1.00	0.93	0.74	0.78
	7-1/2	1.00	1.00	1.00	0.79	0.83
	8	1.00	1.00	1.00	0.84	0.89
	8-1/2	1.00	1.00	1.00	0.89	0.94
	9	1.00	1.00	1.00	0.95	1.00
	9-1/2	1.00	1.00	1.00	1.00	1.00

SPACING DISTANCE AND EDGE DISTANCE ADJUSTMENT FACTORS FOR NORMAL WEIGHT CONCRETE - SHEAR (F_{VS}, F_{VC})

Spacing Reduction Factors - Shear (F_{VS})

Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embed. h_{nom} (in)		1-3/4	1-7/8	2-1/2	3-1/4	4-1/2
Minimum Spacing, s_{min} (in)		2	3	3	5	5
Spacing Distance (inches)	1-3/4	-	-	-	-	-
	2	0.87	-	-	-	-
	2-1/4	0.88	-	-	-	-
	2-1/2	0.90	-	-	-	-
	2-3/4	0.91	-	-	-	-
	3	0.92	0.92	0.89	-	-
	3-1/2	0.95	0.95	0.91	-	-
	4	0.97	0.97	0.93	-	-
	4-1/2	1.00	1.00	0.95	-	-
	5	1.00	1.00	0.96	0.91	0.84
	5-1/2	1.00	1.00	0.98	0.93	0.85
	6	1.00	1.00	1.00	0.94	0.86
	6-1/2	1.00	1.00	1.00	0.95	0.88
	7	1.00	1.00	1.00	0.97	0.89
	7-1/2	1.00	1.00	1.00	0.98	0.90
	8	1.00	1.00	1.00	0.99	0.92
	8-1/4	1.00	1.00	1.00	1.00	0.92
	8-1/2	1.00	1.00	1.00	1.00	0.93
	9	1.00	1.00	1.00	1.00	0.94
	9-1/2	1.00	1.00	1.00	1.00	0.95
	10	1.00	1.00	1.00	1.00	0.97
	10-1/2	1.00	1.00	1.00	1.00	0.98
	11	1.00	1.00	1.00	1.00	0.99
	11-1/4	1.00	1.00	1.00	1.00	1.00

Edge Distance Reduction Factors - Shear (F_{VC})

Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embed. h_{nom} (in)		1-3/4	1-7/8	2-1/2	3-1/4	4-1/2
Min. Edge Distance, c_{min} (in)		1-3/4	3	3	4-1/2	5
Edge Distance (inches)	1-1/2	-	-	-	-	-
	1-3/4	0.39	-	-	-	-
	2	0.44	-	-	-	-
	2-1/4	0.50	-	-	-	-
	2-1/2	0.56	-	-	-	-
	2-3/4	0.61	-	-	-	-
	3	0.67	0.67	0.50	-	-
	3-1/2	0.78	0.78	0.58	-	-
	4	0.89	0.89	0.67	-	-
	4-1/2	1.00	1.00	0.75	0.55	-
	5	1.00	1.00	0.83	0.61	0.44
	5-1/2	1.00	1.00	0.92	0.67	0.49
	6	1.00	1.00	1.00	0.73	0.53
	6-1/2	1.00	1.00	1.00	0.79	0.58
	7	1.00	1.00	1.00	0.85	0.62
	7-1/2	1.00	1.00	1.00	0.91	0.67
	8	1.00	1.00	1.00	0.97	0.71
	8-1/4	1.00	1.00	1.00	1.00	0.73
	8-1/2	1.00	1.00	1.00	1.00	0.76
	9	1.00	1.00	1.00	1.00	0.80
	9-1/2	1.00	1.00	1.00	1.00	0.84
	10	1.00	1.00	1.00	1.00	0.89
	10-1/2	1.00	1.00	1.00	1.00	0.93
	11	1.00	1.00	1.00	1.00	0.98
	11-1/4	1.00	1.00	1.00	1.00	1.00

PERFORMANCE DATA

Ultimate Load Capacities for Power-Stud+ SD4 and Power-Stud+ SD6 installed into the Face of Grout Filled Concrete Masonry[1,2]

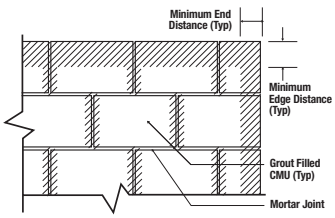
Nominal Anchor Diameter in.	Minimum Embedment h_{nom} in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Ultimate Tension Load lb (kN)	Direction of Shear Loading	Ultimate Shear Load lb (kN)
1/2	2-3/8 (60)	3 (76.2)	3 (76.2)	1,695 (7.5)	Any	2,080 (9.3)
		12 (304.8)	12 (304.8)	2,425 (10.8)	Any	4,905 (21.8)
5/8	3-1/4 (83)	12 (304.8)	12 (304.8)	5,565 (24.8)	Any	7,944 (35.3)

1. Tabulated load values are for anchors installed in minimum 8 inch wide, minimum Grade N, Type II, normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 5.0 or greater to determine allowable working loads.

Allowable Load Capacities for Power-Stud+ SD4 and Power-Stud+ SD6 installed into the Face of Grout Filled Concrete Masonry[1,2,3,4,5]

Nominal Anchor Diameter in.	Minimum Embedment h_{nom} in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Allowable Tension Load lb (kN)	Direction of Shear Loading	Allowable Shear Load lb (kN)
1/2	2-3/8 (60)	3 (76.2)	3 (76.2)	340 (1.5)	Any	415 (1.8)
		12 (304.8)	12 (304.8)	485 (2.2)	Any	980 (4.4)
5/8	3-1/4 (83)	12 (304.8)	12 (304.8)	1,115 (5.0)	Any	1,590 (7.1)

1. Tabulated load values are for anchors installed in minimum 8 inch wide, minimum Grade N, Type II, normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using an applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety.
3. The tabulated values are applicable for anchors installed in grouted masonry wall faces at a critical spacing distance, s_{cr}, between anchors of 16 times the anchor diameter. The spacing distance between two anchors may be reduced to a minimum distance, s_{min}, of 8 times the anchor diameter provided the allowable tension loads are multiplied a reduction factor of 0.80 and allowable shear loads are multiplied by a reduction factor of 0.90. Linear interpolation for calculation of allowable loads may be used for intermediate anchor spacing distances.
4. Anchors may be installed in the grouted cells and in cell webs and bed joints not closer than 1-3/8" from head joints. The minimum edge and end distances must also be maintained.
5. Allowable tension values for anchors installed into bed joints of grouted masonry wall faces with a minimum of 12" edge and end distance may be increased by 20 percent for the 1/2-inch diameter and 10 percent for the 5/8-inch diameter.



Wall Face
Permissible Anchor Locations
(Un-hatched Area)

STRENGTH DESIGN (SD)

Strength Design Installation Table for Power-Stud+ SD4 and Power-Stud+ SD6[1,4]

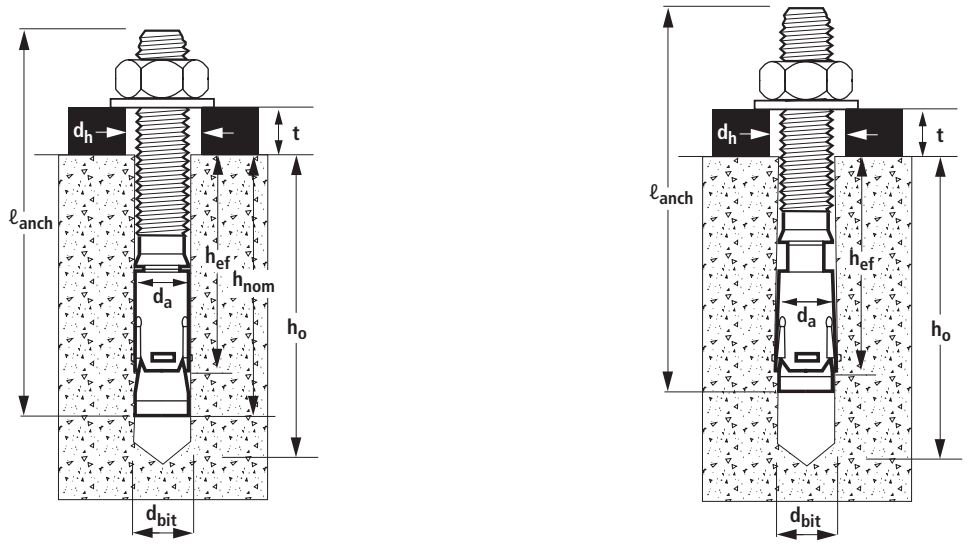
CODE LISTED
ICC-ES ESR-2502

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter									
			1/4	3/8		1/2		5/8		3/4		
Anchor outside diameter	d_a	in. (mm)	0.250 (6.4)	0.375 (9.5)		0.500 (12.7)		0.625 (15.9)		0.750 (19.1)		
Thread Size (UNC)	-	in.	1/4-20	3/8-16		1/2-13		5/8-11		3/4-10		
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	5/16 (7.9)	7/16 (11.1)		9/16 (14.3)		11/16 (17.5)		13/16 (20.6)		
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI	3/8 ANSI		1/2 ANSI		5/8 ANSI		3/4 ANSI		
Minimum nominal embedment depth[2]	h_{nom}	in. (mm)	1-3/4 (44)	1-7/8 (48)		2-1/2 (64)		3-1/4 (83)		4-1/2 (114)		
Effective embedment	h_{ef}	in. (mm)	1.50 (38)	1.50 (38)		2.00 (51)		2.75 (70)		3-3/4 (95)		
Minimum hole depth	h_o	in. (mm)	1-7/8 (48)	2 (51)		2-5/8 (67)		3-1/2 (89)		4-3/4 (121)		
Minimum member thickness	h_{min}	in. (mm)	3-1/4 (83)	3-1/4 (83)	4 (102)	4 (102)		5 (127)		6 (152)		
Minimum overall anchor length[3]	ℓ_{anch}	in. (mm)	2-1/4 (57)	2-3/4 (70)		3-3/4 (95)		4-1/2 (114)		5-1/2 (140)		
Minimum edge distance	c_{min}	in. (mm)	1-3/4 (44)	3 (76)	3-1/2 (89)	6 (152)	3 (76)	4-1/2 (114)	8-1/2 (216)	5 (127)	9 (229)	
Minimum spacing distance	s_{min}	in. (mm)	2 (51)	5-1/2 (140)	3 (76)	3 (76)	6 (152)	8-1/2 (216)	5 (127)	9 (229)	5 (127)	
Critical edge distance	c_{ac}	in. (mm)	5 (127)	5 (127)		7-1/2 (191)		9-1/2 (241)		9 (229)		
Installation torque	T_{inst}	ft.-lbf. (N-m)	6 (8)	25 (34)		40 (54)		60 (81)		110 (149)		
Torque wrench/socket size	-	in.	7/16	9/16		3/4		15/16		1-1/8		
Nut height	-	in.	7/32	21/64		7/16		35/64		41/64		

For SI: 1 inch = 25.4 mm; 1 ft-lbf = 1.356 N-m.

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor prior to tightening.
3. The listed minimum overall anchor length is based on anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth and possible fixture attachment.
4. The anchors may be installed in the topside of concrete-filled steel deck floor and roof assemblies in accordance with the following: the 1/4-inch diameter anchors must be installed in uncracked normal-weight or sand-lightweight concrete; 3/8-inch to 3/4-inch diameter anchors must be installed in cracked and uncracked normal-weight or sand-lightweight concrete over steel deck having a minimum specified compressive strength, f'c, of 3,000 psi (20.7 MPa) provided the concrete thickness above the upper flute meets the minimum thickness specified in this table.

Power-Stud+ SD4 and Power-Stud+ SD6 Anchor Detail



Application of Installation Torque

Tension Design Information for Power-Stud+ SD4 and Power-Stud+ SD6 Anchors in Concrete (For use with load combinations taken from ACI 318-14, Section 5.3 or ACI 318-11, Section 9.2)[1,8]

CODE LISTED
ICC-ES ESR-2502

Design Characteristic		Notation	Units	Nominal Anchor Diameter				
				1/4	3/8	1/2	5/8	3/4
Anchor category		1,2 or 3	-	1	1	1	1	1
Nominal embedment depth		h_{nom}	in.	1-3/4	1-7/8	2-3/8	3-1/4	4-1/2
STEEL STRENGTH IN TENSION (ACI 318-14 17.4.1 or ACI 318-11 D.5.1)								
Minimum specified yield strength (neck		f_y	ksi (N/mm^2)	60 (414)	60 (414)	60 (414)	60 (414)	60 (414)
Minimum specified ultimate tensile strength (neck)		f_{uta}	ksi (N/mm^2)	90 (621)	90 (621)	90 (621)	90 (621)	90 (621)
Effective tensile stress area (neck)		$A_{se,N}$	in^2 (mm^2)	0.0249 (16.1)	0.0530 (34.2)	0.1020 (65.8)	0.1630 (105.2)	0.2380 (151)
Steel strength in tension		N_{sa}	lb (kN)	2,240 (10.0)	4,780 (21.3)	9,160 (40.8)	14,635 (65.1)	21,380 (95.1)
Reduction factor for steel strength[2,3]		ϕ	-	0.75				
CONCRETE BREAKOUT STRENGTH IN TENSION (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)[8]								
Effective embedment		h_{ef}	in. (mm)	1.50 (38)	1.50 (38)	2.00 (51)	2.75 (70)	3.75 (95)
Effectiveness factor for uncracked concrete		k_{uncr}	-	24	24	24	24	24
Effectiveness factor for cracked concrete		k_{cr}	-	Not Applicable	17	21	21	21
Modification factor for cracked and uncracked concrete		$\psi_{c,N}$	-	1.0 See Note 5	1.0 See Note 5	1.0 See Note 5	1.0 See Note 5	1.0 See Note 5
Critical edge distance (uncracked concrete only)		c_{ac}	in. (mm)	5 (127)	5 (127)	7-1/2 (191)	9-1/2 (241)	9 (229)
Reduction factor for concrete breakout strength[4]		ϕ	-	0.65 (Condition B)				
PULLOUT STRENGTH IN TENSION (ACI 318-14 17.4.3 or ACI 318-11 D.5.3)[8]								
Characteristic pullout strength, uncracked concrete (2,500 psi)[5]		$N_{p,uncr}$	lb (kN)	1,510 (6.7)	See Note 7	See Note 7	See Note 7	8,520 (37.8)
Characteristic pullout strength, cracked concrete (2,500 psi)[5]		$N_{p,cr}$	lb (kN)	Not Applicable	See Note 7	See Note 7	See Note 7	See Note 7
Reduction factor for pullout strength[3]		ϕ	-	0.65 (Condition B)				
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)[8]								
Characteristic pullout strength, seismic (2,500 psi)[6,9]		$N_{p,eq}$	lb (kN)	Not Applicable	1,645 (7.3)	See Note 7	See Note 7	See Note 7
Reduction factor for pullout strength[4]		ϕ	-	0.65 (Condition B)				
Mean axial stiffnes values for service load range	Uncracked concrete	β	lbf/in (kN/mm)	171,400 (30,060)	490,000 (86,000)	459,000 (80,500)	234,000 (41,000)	395,000 (69,300)
	Cracked concrete	β	lbf/in (kN/mm)	Not Applicable	228,000 (40,000)	392,000 (68,800)	193,000 (33,800)	76,600 (13,400)

For SI: 1 inch = 25.4 mm; 1 ft-lbf = 1.356 N-m; 1 ksi = 6.894 N/mm^2; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. The tabulated value of ϕ for steel strength applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for steel strength must be determined in accordance with ACI 318-11 D.4.4.
3. The anchors are ductile steel elements as defined in ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
4. The tabulated value of ϕ for concrete breakout strength and pullout strength applies when both the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, for Condition B are satisfied. If the load combinations of Section 1605.2 of the IBC ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, for Condition A are satisfied, the appropriate value of ϕ for concrete breakout strength and pullout strength must be determined in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for concrete breakout strength and pullout strength must be determined in accordance with ACI 318-11 D.4.4.
5. For all design cases $\psi_{c,N}$ =1.0. The appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) must be used.
6. For all design cases $\psi_{c,P}$ =1.0. For concrete compressive strength greater than 2,500 psi, N_{pn} = (pullout strength value from table)*(specified concrete compressive strength/2,500)$^{0.5}$.
7. Pullout strength does not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
8. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
9. Tabulated values for characteristic pullout strength in tension are for seismic applications and are based on test results per ACI 355.2, Section 9.5.
10. Actual stiffness of the mean value varies depending on concrete strength, loading and geometry of application.

Shear Design Information for Power-Stud+ SD4 and Power-Stud+ SD6 Anchors in Concrete (For use with load combinations taken from ACI 318-14, Section 5.3 or ACI 318-11, Section 9.2)[1,7]

CODE LISTED
ICC-ES ESR-2502

Design Characteristic	Notation	Units	Nominal Anchor Diameter				
			1/4	3/8	1/2	5/8	3/4
Anchor category	1, 2 or 3	-	1	1	1	1	1
Nominal embedment depth	h_{nom}	in.	1-3/4	1-7/8	2-3/8	3-1/4	4-1/2
STEEL STRENGTH IN SHEAR (ACI 318-14 17.5.1 or ACI 318-11 D.6.1)[4]							
Minimum specified yield strength (threads)	f_y	ksi (N/mm²)	60 (414)	60 (414)	60 (414)	60 (414)	60 (414)
Minimum specified ultimate strength (threads)	f_{uta}	ksi (N/mm²)	90 (621)	90 (621)	90 (621)	90 (621)	90 (621)
Effective tensile stress area (threads)	$A_{se,V}$ [A_{se}][8]	in² (mm²)	0.0318 (20.5)	0.078 (50.3)	0.142 (91.6)	0.226 (145.8)	0.334 (212)
Steel strength in shear[6]	V_{sa}	lb (kN)	1,115 (5.0)	1,470 (6.6)	3,170 (14.3)	7,455 (33.6)	11,955 (53.2)
Reduction factor for steel strength[2,3]	ϕ	-	0.65				
CONCRETE BREAKOUT STRENGTH IN SHEAR (ACI 318-14 17.5.2 or ACI 318-11 D.6.2)							
Load bearing length of anchor (h_{ef} or $8d_a$, whichever is less)	ℓ_e	in. (mm)	1.50 (38.1)	1.50 (38.1)	2.00 (50.8)	2.75 (69.9)	3.75 (95)
Nominal anchor diameter	d_a	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)
Reduction factor for concrete breakout[4]	ϕ	-	0.70 (Condition B)				
CONCRETE PRYOUT STRENGTH IN SHEAR (ACI 318-14 17.2.3.3 or ACI 318-11 D.6.3)							
Coefficient for pryout strength (1.0 for $h_{ef} < 2.5$ in., 2.0 for $h_{ef} \geq 2.5$ in.)	k_{cp}	-	1.0	1.0	1.0	2.0	2.0
Effective embedment	h_{ef}	in. (mm)	1.50 (38.1)	1.50 (38.1)	2.00 (50.8)	2.75 (69.9)	3.75 (95)
Reduction factor for pryout strength[5]	ϕ	-	0.70 (Condition B)				
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)							
Steel strength in shear, seismic[8]	$V_{sa,eq}$	lb (kN)	Not Applicable	1,305 (5.9)	2,765 (12.3)	5,240 (23.3)	7,745 (34.5)
Reduction factor for steel strength in shear for seismic[2]	ϕ	-	0.65				

For SI: 1 inch = 25.4 mm; 1 ft-lbf = 1.356 N-m; 1 ksi = 6.894 N/mm²; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. The tabulated value of ϕ for steel strength applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11Section 9.2, as applicable, are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for steel strength must be determined in accordance with ACI 318-11 D.4.4.
3. The anchors are ductile steel elements as defined in ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
4. The tabulated value of ϕ for concrete breakout strength applies when both the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, for Condition B are satisfied. If the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 14.3.3 or ACI 318-11 D.4.3, for Condition A are satisfied, the appropriate value of ϕ for concrete breakout strength must be determined in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for concrete breakout strength must be determined in accordance with ACI 318-11 D.4.4.
5. The tabulated value of for pryout strength applies if the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for pryout strength must be determined in accordance with ACI 318-11 D.4.4, Condition B.
6. Tabulated values for steel strength in shear must be used for design.
7. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
8. Tabulated values for steel strength in shear are for seismic applications are based on test results per ACI 355.2, Section 9.6.

STRENGTH DESIGN PERFORMANCE DATA

Factored design strength ϕN_n and ϕV_n
Calculated in accordance with ACI 318-14 Chapter 17
Compliant with the International Building Code

STRENGTH DESIGN SD TABLES

Tension and Shear Design Strengths Installed in Cracked Concrete[1-6]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	f'c = 2,500 psi: ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	f'c = 2,500 psi: ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	f'c = 3,000 psi: ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	f'c = 3,000 psi: ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	f'c = 4,000 psi: ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	f'c = 4,000 psi: ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	f'c = 6,000 psi: ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	f'c = 6,000 psi: ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	f'c = 8,000 psi: ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	f'c = 8,000 psi: ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)
1/4	-	-	-	-	-	-	-	-	-	-	-
3/8	1-7/8	1,015	955	1,110	955	1,285	955	1,570	955	1,815	955
1/2	2-1/2	1,930	2,060	2,115	2,060	2,440	2,060	2,990	2,060	3,455	2,060
5/8	3-1/4	3,110	4,520	3,410	4,845	3,935	4,845	4,820	4,845	5,570	4,845
3/4	4-1/2	4,955	5,270	5,430	5,770	6,270	6,665	7,680	7,770	8,865	7,770

Minimum Concrete Compressive Strength

☐ - Anchor Pullout/Pryout Strength Controls ☐ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

Tension and Shear Design Strengths Installed in Uncracked Concrete[1-6]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	f'c = 2,500 psi: ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	f'c = 2,500 psi: ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	f'c = 3,000 psi: ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	f'c = 3,000 psi: ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	f'c = 4,000 psi: ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	f'c = 4,000 psi: ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	f'c = 6,000 psi: ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	f'c = 6,000 psi: ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	f'c = 8,000 psi: ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	f'c = 8,000 psi: ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)
1/4	1-3/4	980	725	1,075	725	1,240	725	1,520	725	1,680	725
3/8	1-7/8	1,435	955	1,570	955	1,815	955	2,220	955	2,565	955
1/2	2-1/2	2,205	2,060	2,415	2,060	2,790	2,060	3,420	2,060	3,945	2,060
5/8	3-1/4	3,555	4,845	3,895	4,845	4,500	4,845	5,510	4,845	6,365	4,845
3/4	4-1/2	5,540	7,375	6,065	7,770	7,005	7,770	8,580	7,770	9,905	7,770

Minimum Concrete Compressive Strength

☐ - Anchor Pullout/Pryout Strength Controls ☐ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
 - c_{a1} is greater than or equal to the critical edge distance, c_{ac} (table values based on $c_{a1} = c_{ac}$).
 - c_{a2} is greater than or equal to 1.5 times c_{a1}.

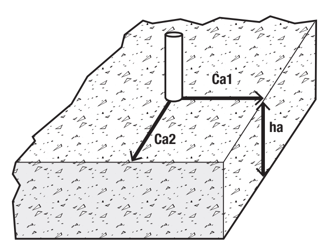
2- Calculations were performed according to ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, h_{ef}, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 for load combinations. Condition B is assumed.

4- Tabular values are permitted for static loads only, seismic loading is not considered with these tables.

5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



ORDERING INFORMATION

Power-Stud+ SD4 (Type 304 Stainless Steel Body) and Power-Stud+ SD6 (Type 316 Stainless Steel Body)

Cat. No.				Anchor Size	Thread Length	Box Qty.	Carton Qty.	Suggested ANSI Carbide Drill Bit Cat. No.				
Type 304 SS		Type 316 SS										
Standard	Domestic	Standard	Domestic					Full Head SDS-Plus	SDS-Plus	SDS-Max	Hollow Bit SDS-Plus	Hollow Bit SDS-Max
7300SD4	-	7600SD6	-	1/4" x 1-3/4"	3/4"	100	600	DW5517	DW5416	-	-	-
7302SD4	-	7602SD6	-	1/4" x 2-1/4"	1-1/4"	100	600	DW5517	DW5417	-	-	-
7304SD4	7304SD4USA	7604SD6	-	1/4" x 3-1/4"	2-1/4"	100	600	DW5517	DW5417	-	-	-
-	7310SD4USA	7610SD6	7610SD6USA	3/8" x 2-1/4"	7/8"	50	300	DW5527	DW5427	-	-	-
-	7312SD4USA	7612SD6	7612SD6USA	3/8" x 2-3/4"	1-3/8"	50	300	DW5527	DW5427	-	-	-
7313SD4	7313SD4USA	7613SD6	7613SD6USA	3/8" x 3"	1-5/8"	50	300	DW5527	DW5427	-		
-	7314SD4USA	7614SD6	7614SD6USA	3/8" x 3-1/2"	2-1/8"	50	300	DW5527	DW5427	-	-	-
7315SD4	7315SD4USA	7615SD6	7615SD6USA	3/8" x 3-3/4"	2-3/8"	50	300	DW5527	DW5427	-	-	-
7316SD4	7316SD4USA	7616SD6	7616SD6USA	3/8" x 5"	3-5/8"	50	300	DW55300	DW5429	-	-	-
-	7317SD4USA	7617SD6	7617SD6USA	3/8" x 7"	5-5/8"	50	200	DW55300	DW5429	-	-	-
-	7320SD4USA	7620SD6	7620SD6USA	1/2" x 2-3/4"	1"	50	200	DW5537	DW5437	DW5803	DWA54012	-
7322SD4	7322SD4USA	7622SD6	7622SD6USA	1/2" x 3-3/4"	2"	50	200	DW5537	DW5437	DW5803	DWA54012	-
7323SD4	7323SD4USA	7623SD6	7623SD6USA	1/2" x 4-1/2"	2-3/4"	50	200	DW5539	DW5438	DW5803	DWA54012	-
7324SD4	7324SD4USA	7624SD6	7624SD6USA	1/2" x 5-1/2"	3-3/4"	50	150	DW5539	DW5438	DW5803	DWA54012	-
7326SD4	7326SD4USA	7626SD6	7626SD6USA	1/2" x 7"	5-1/4"	25	100	DW5539	DW5438	DW5803	DWA54012	-
-	7330SD4USA	7630SD6	7630SD6USA	5/8" x 3-1/2"	1-1/2"	25	100	-	DW5446	DW5806	DWA54058	DWA58058
-	7332SD4USA	7632SD6	7632SD6USA	5/8" x 4-1/2"	2-1/2"	25	100	-	DW5446	DW5806	DWA54058	DWA58058
7333SD4	7333SD4USA	7633SD6	7633SD6USA	5/8" x 5"	3"	25	100	-	DW5446	DW5806	DWA54058	DWA58058
7334SD4	7334SD4USA	7634SD6	7634SD6USA	5/8" x 6"	4"	25	75	-	DW5446	DW5806	DWA54058	DWA58058
-	7336SD4USA	7636SD6	7636SD6USA	5/8" x 7"	5"	25	75	-	DW5447	DW5806	DWA54058	DWA58058
7338SD4	7338SD4USA	7638SD6	7638SD6USA	5/8" x 8-1/2"	6-1/2"	25	50	-	DW5447	DW5809	DWA54058	DWA58058
-	7340SD4USA	7640SD6	7640SD6USA	3/4" X 4-1/4"	1-7/8"	20	60	-	DW5453	DW5810	DWA54034	DWA58034
-	7341SD4USA	7641SD6	7641SD6USA	3/4" X 4-3/4"	2-3/8"	20	60	-	DW5453	DW5810	DWA54034	DWA58034
7342SD4	7342SD4USA	7642SD6	7642SD6USA	3/4" X 5-1/2"	3-1/8"	20	60	-	DW5453	DW5810	DWA54034	DWA58034
-	7344SD4USA	7644SD6	7644SD6USA	3/4" X 6-1/4"	3-7/8"	20	60	-	DW5455	DW5810	DWA54034	DWA58034
-	7346SD4USA	7646SD6	7646SD6USA	3/4" X 7"	4-5/8"	20	60	-	DW5455	DW5810	DWA54034	DWA58034
7348SD4	7348SD4USA	7648SD6	7648SD6USA	3/4" X 8-1/2"	6-1/8"	10	40	-	DW5455	DW5812	DWA54034	DWA58034
-	7349SD4USA	7649SD6	-	3/4" x 10"	7-5/8"	10	40	-	DW5455	DW5812	DWA54034	DWA58034

Domestically manufactured Power-Stud+ SD4 and Power-Stud+ SD6 anchors (assembled in the USA with foreign and domestic components) are made to order. Call for details.

Shaded catalog numbers denote sizes which are less than the minimum standard anchor length for strength design.

The published size includes the diameter and the overall length of the anchor.

All anchors are packaged with nuts and washers.

A manual hand pump is available (Cat. No. 08280).

Hollow drill bits must be used with a dust extraction vacuum (Cat. No. DW012).

SECTION H

SPECIFICATIONS & GENERAL ARRANGEMENT DRAWINGS

EQUIPMENT SPECIFICATIONS

APPROVAL SPECIFICATIONS FOR SLUDGE THICKENER

Project ..... Taunton Wastewater Treatment Plant – Solids Handling Improvements
Taunton, MA

Date ..... August 27, 2021

Number of Units ..... Two (2)

Type ..... 'HT'

Submittal Drawings .....

D205-82786-167	General Arrangement (pgs. 1 & 2) Anchor Location
D705-53988-171	Drive Assembly Parts List
C505-76003-171	Torque Indicator Box Assembly
B605-18828-870	Torque Test Arrangement

Tank Size ..... 50'-0" Diameter x 14' SWD

MATERIAL SPECIFICATIONS:

All items will conform to the requirements of the specifications listed below, except as noted on the equipment specifications.

Walkway ..... Bridge: Swaged locked I-Bar design aluminum grating with 1-1/4" bearing bars spaced on 1-3/16" centers and cross bars spaced on 4" centers. The panel ends and all openings shall be banded.

Ref: Ohio Grating 19-SGI-4

Platform: 1/4" aluminum diamond tread walkway plate.

Handrailing ..... The handrailing shall be mechanical joint system, 2-rail, anodized aluminum, 1-1/2" SCH. 40 rails and posts. The posts shall be at a maximum 6'-0" centers.

Ref: Golden Railings Riveted Railing System

Steelwork ..... All fabricated steel conforms to ASTM A36. All structural steel to be 1/4" minimum thickness and all plate to be 1/4" minimum thickness unless otherwise specified.

Anchorage ..... All anchor bolts shall conform to AISI 304 stainless steel.

Fasteners ..... All capscrews, nuts and washers shall conform to AISI 304 stainless steel.

Pipe..... All steel pipe to conform to ASTM A53.

Aluminum..... All aluminum plate shall be 6061-T651 and all aluminum structural members, bars and tubing shall be 6061-T6.

Stainless Steel..... All stainless steel shall be AISI 304.

Field Welding..... Not required.

GENERAL DESIGN, FABRICATION AND MANUFACTURING SPECIFICATIONS:

Design ..... The ratio of unbraced length to least radius of gyration shall not exceed 200 for compression members or 300 for tension members.

Fabrication..... Welding shall comply with the requirements of the specifications of the American Institute of Steel Construction and of the American Welding Society for the type of material to be welded.

All welds on submerged or partially submerged surfaces to be continuous.

Exposed sharp edges and sharp corners of sheared, burned, sawed, drilled, punched and/or cut material shall be dulled.

Assembly ..... Connections of major components to be shop assembled or checked or made with jig fixtures to ensure proper fit for field assembly.

***Painting Specifications**..... Gearmotor to have manufacturer's standard paint system.

Drive to have manufacturer’s standard paint system

All submerged ferrous metals will be sandblasted to a SP-10 and given one (1) shop prime coat of Tnemec 66 Epoxoline, 3 mils, d.f.t., red, followed by a 2nd and 3rd coat of Tnemec series 104 HS Epoxy, each coat 6.0-10.0 mil d.f.t. final color to be determined.

All non-submerged ferrous metal shall be sandblasted to SP-10 and given one (1) shop prime coat of Tnemec Hydro Zinc Series 94-H20, 2.5-3.5 mils.d.f.t., followed by a 2nd

Painting Specifications (continued)..... and 3rd coat of Tnemec Series 66 Epoxoline, 4.0-6.0 mils d.f.t. each coat. Final color to be determined.

Interior surfaces of castings, worm gear, worm shaft and spur gear to be given one (1) coat of rust preventative.

Regreaseable bearings to be packed with grease.

Where indicated on equipment specifications, steel products will be hot-dipped galvanized after fabrication in accordance with ASTM designations A-123, “Zinc (hot galvanized coatings on products fabricated from rolled, pressed and forged steel shapes, plates, bars and strips”.

Coatings and/or surface preparations shown above are in full compliance with the contract documents, or our interpretation of them. The contractor is responsible for the compatibility of the finish coatings with the primer coat.

All field touch-up of mars, scratches, bruises, etc., received by equipment during shipment, storage or erection and field prime coats on field weld seams are not by **AMWELL**.

All finish coats are not by **AMWELL**. It is recommended that finish coats be of same type and by same coatings manufacturer as prime coat to insure optimum compatibility.

No shop coatings are used by **AMWELL** on aluminum, stainless steel or other non-ferrous metals or on galvanized metal unless specifically designated.

DRIVE UNIT SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS:

Model..... 42H8T
Continuous Torque Rating..... 26,500 ft. lbs.
Alarm Torque Setting..... 26,500 ft. lbs.
Motor Shut-off Torque Setting ..... 31,800 ft. lbs.
Shear Pin Torque Setting ..... 37,100 ft. lbs. (approximately)
Output Speed..... 0.055 RPM (approximately)
Tip Speed ..... 8.5 FPM (approximately)
Rotation..... Clockwise

AGMA Design..... ..... The drive unit has been designed and rated in accordance with ANSI/AGMA Standards 2001-D04, "Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth"; and 6034-B92, "Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors" for 24-hour continuous duty loading and a 20 year design life.

AGMA Design (continued) ..... Bearings are designed for minimum L-10 life of 20 years, and the main support bearing raceways shall have a minimum L-10 life of 50 years based upon the design running torque rating of the drive mechanism.

Drive ..... One (1) Model 42H8T drive unit consisting of the following:

One (1) NORD Model SK573.1-140TC helical reducer, ratio: 38.02:1 with Baldor model 05F472X122G1, 1 HP, 3 phase, 60 hertz, 230/460 volt, ball bearings, continuous duty, 40°C ambient rating, 1.15 Service Factor, NEMA Design 'B', Class 'F' insulation, frame 140TC, c-face, explosion-proof, 1800 RPM motor, severe duty. Motor is rated for Class 1, Division 1, Group D environments, T3C temperature code. The reducer and motor are mounted on a fabricated steel base with provision for taking up slack in the drive chain.

5/8" pitch steel sprocket with No. 50SB side bow steel roller chain enclosed in a weatherproof 16 gauge 304 stainless steel removal guard between gearmotor and the worm reduction unit. Chain guard shall meet OSHA requirements and recommendations. Chain S.F. at continuous torque is 12:1.

Intermediate worm reduction unit (8" centers) with centrifugally cast manganese bronze worm gear (12.79" P.D.) and hardened, 58 RC, and ground AISI 8620H alloy steel worm driving a forged AISI 4150 alloy, 321 BHN, 12 tooth steel pinion (6" P.D.) 2.56" face width and keyed to the worm gear, with anti-friction bearings, enclosed in an ASTM A48 Class 40B cast iron housing.

Pinion design based on a 20 year life rating.

The main spur gear 120,000 PSI 120-90-02 ductile iron, 277 BHN, to ASTM A536 specifications, 84 tooth, 42" P.D. 2.56" face with and is driven by the steel pinion. Spur gear and the entire clarifier mechanism is supported on a ball bearing assembly comprised of ninety-seven (97) SAE 52100 chrome alloy steel balls, 1-1/2" dia., running in an oil bath on replaceable heat treated, 43 RC Min., alloy steel inserts in annular raceways. Bearing race diameter is 46". The complete unit is encased in an ASTM A48, Class 40B, cast iron gear case complete with neoprene seals and dust shields.

NOTE: Drive is designed to permit removal of two-piece spur gear, bearing balls and raceway liners without removing bridge or walkway.

Drive (continued) ..... Drive is equipped with an overload protection system to sound an alarm and shut off the gearmotor in the event of an overload. System consists of two (2) NEMA 7 & 9 limit switches provided in a NEMA 4X 304 stainless steel enclosure located on the worm gear housing and operated by a spring-loaded actuator from the worm on the primary worm reduction unit. One (1) (N.O. contact) switch will sound an alarm when the drive reaches the alarm torque of 26,500 ft. lbs. The other switch (N.C. contact) will stop the drive when it reaches the cut-out torque of 31,800 ft. lbs.

The protection system is also equipped with a graduated scale operated by the spring-loaded actuator. Indicator can be read from walkway.

Additional protection is provided by means of a shear pin hub assembly. Shear pin is designed to shear at approximately 37,100 ft. lbs. output torque.

CLARIFIER COMPONENTS SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS:

Access Bridge ..... Two (2) W8 x 18 structural steel beams on 3'-0" centers, interlaced with structural members for rigidity, extending across one half of the tank diameter, supported on the main spur gear housing and the tank wall. The bridge shall have a 3'-0" wide walkway with handrailing along both sides and around the platform. A 6'-0" wide x 8'-0" long platform shall be provided at the tank center. The platform shall provide a 24” clearance around the drive assembly. The walkway and platform area to have a 1/4" x 4" high aluminum kickplate.

The bridge shall be designed for the dead load and a live load of 50 pounds per square foot in accordance with AISC allowable stress. Total dead load plus live load deflection shall not exceed 1/360 of the span.

If shipping regulations prevent the bridge from being shipped in one (1) section, it will be fabricated and shipped in sections and provided with necessary splice connection plates which will be field assembled with bolts and nuts. After final alignment of bridge beams the splice connection will be field welded.

NOTE: The access end of the bridge must always be free to slide, due to thermal expansion and contraction of the bridge. Any conduit and/or piping that is attached to the bridge must end in a flexible connection at the access end of the bridge. Concrete walls and/or steps must be a minimum of 1" away from the bridge end.

Center Column..... A 20” diameter x 1/4" minimum wall thickness steel center column shall be provided for supporting the bridge, drive assembly and clarifier mechanism. The lower end is flanged for bolting to the foundation anchors and the upper end is flanged for the mounting of the drive assembly

Drive Cage ..... The drive cage shall be of an all-welded construction, made up of structural steel members having a minimum thickness of 1/4" and shall be 4'-0" square. The drive cage shall be designed to transmit twice the continuous torque capacity of the drive assembly to the truss arms.

Influent Well..... A 10’-0" diameter x 5'-0" deep influent well, fabricated from 3/16" steel plate with structural steel angle reinforcing, shall be supported from and rotate with the drive cage. The influent well shall diffuse the influent flow into the tank and be provided with two (2) scum outlet ports at water level.

Truss Arms ..... The truss arms shall be of an all-welded construction made up of structural steel members having a minimum thickness of 1/4" with structural steel vertical pickets, spaced 4’-0” centers. The truss arm shall be a minimum of 3-6” wide x 4’-0” high. The truss arms shall be rigidly connected to the drive cage and are designed to transmit twice the continuous torque capacity of the drive mechanism. The truss arms shall be equipped with 1/4" steel flights so set and spaced to scrape the settled sludge from the tank bottom to a sludge pockets located near the tank center. Fixed to the flights are adjustable 20 gauge stainless steel squeegees. The flights shall be arranged to provide a complete scraping of the floor twice every revolution.

If shipping regulations prevent the truss arms from being shipped in one (1) section, they will be fabricated and shipped in two (2) sections and provided with necessary splice connection plates and angles which will be field assembled with bolts and nuts. After final alignment of the truss arms, the splice connection will be field welded.

Anchorage ..... One (1) set of epoxy anchor bolts with a steel template for the center column and one (1) of expansion anchor bolts for the bridge. 304 stainless steel

THE FOLLOWING ITEMS ARE NOT FURNISHED BY AMWELL:

Piping, valves and wall fittings except as noted on equipment specifications and/or submittal drawings.

All wiring, conduits, electrical controls and alarm horn, light or bell except as noted on equipment specifications and/or submittal drawings.

Handrailing other than on the clarifier bridge and/or clarifier bridge platform.

Access stairs, ladders or platforms except as noted on equipment specifications and/or submittal drawings.

Grout, field paint and painting and lubricants.

Weirs, Baffles and Effluent Troughs.

PAINT SPECIFICATIONS

TNEMEC

HI-BUILD EPOXOLINE® SERIES 66

PRODUCT DATA SHEET

PRODUCT PROFILE

GENERIC DESCRIPTION Polyamide Epoxy

COMMON USAGE Industry standard for epoxy coatings for over 30 years. Known for its forgiving application characteristics in adverse and varied conditions, and for benchmark performance.

COLORS Refer to Tnemec Color Guide. **Note:** Epoxies chalk with extended exposure to sunlight and may yellow on aging. Lack of ventilation, incomplete mixing, miscatalyzation or the use of heaters that emit carbon dioxide and carbon monoxide during application and initial stages of curing may accelerate any potential yellowing.

FINISH Satin

SPECIAL QUALIFICATIONS Meets the performance requirements of **AWWA C 210** (not for potable water contact). Contact your Tnemec representative for system recommendations.

PERFORMANCE CRITERIA Extensive test data available. Contact your Tnemec representative for specific test results.

COATING SYSTEM

PRIMERS **Steel:** Self-priming or Series 1, 20, FC20, 37H, N69, 90, 91-H_2O, 94-H_2O, 161, 394, 530
Galvanized Steel and Non-Ferrous Metal: Self-priming
Concrete: Self-priming, 54-660, 201, 216, 218
CMU: 54-562, 54-660, 130, 216, 218
Drywall: 51-792 for dry interior environments
Note: A maximum recoat time may apply depending on the topcoat specified. Refer to the applicable topcoat product sheet for information on product specific maximum recoat times.

TOPCOATS 46H-413, 66, N69, 73, 84, 104, 113, 114, 161, 262, 265, 290, 291, 1070, 1071, 1072, 1074, 1074U, 1075, 1075U, 1077, 1078. Refer to COLORS on applicable topcoat data sheets for additional information. **Note:** A maximum recoat time may apply depending on the topcoat specified. Refer to the applicable topcoat product sheet for information on product specific maximum recoat times.

SURFACE PREPARATION

PRIMED STEEL **Immersion Service:** Scarify the Series 66 prime coat surface by abrasive-blasting with a fine abrasive before topcoating if: (a) the 66 prime coat has been in exterior exposure for 60 days or longer and 66, 46H-413, N69 or 161 is the specified topcoat; (b) the 66 prime coat has been in exterior exposure for 14 days or longer and Series 104 is the specified topcoat; (c) the 66 prime coat has been in exterior exposure for 7 days or longer and Series 262 or 265 is the specified topcoat.

STEEL **Immersion Service:** SSPC-SP10/NACE 2 Near-White Blast Cleaning
Non-Immersion Service: SSPC-SP6/NACE 3 Commercial Blast Cleaning

GALVANIZED STEEL & NON-FERROUS METAL Surface preparation recommendations will vary depending on the substrate and exposure conditions. Contact your Tnemec representative or Tnemec Technical Services.

CAST/DUCTILE IRON Contact your Tnemec representative or Tnemec Technical Services.

CONCRETE Allow new concrete to cure 28 days. For optimum results and/or immersion service, abrasive blast referencing SSPC-SP13/NACE 6 Surface Preparation of Concrete and Tnemec's Surface Preparation and Application Guide.

CMU Allow mortar to cure for 28 days. Prepare in accordance with SSPC-SP13/NACE 6 to level protrusions and mortar spatter, and remove other contaminants.

PAINTED SURFACES **Non-Immersion Service:** Ask your Tnemec representative for specific recommendations.

ALL SURFACES Must be clean, dry and free of oil, grease and other contaminants.

TECHNICAL DATA

VOLUME SOLIDS 56.0 ± 2.0% (mixed) †

RECOMMENDED DFT 2.0 to 6.0 mils (50 to 150 microns) per coat.
Note: Number of coats and thickness requirements will vary with substrate, application method and exposure. Contact your Tnemec representative.

CURING TIME

Temperature	To Touch	To Handle	To Recoat	Immersion
75°F (24°C)	2 hours	10 hours	12 hours	7 days

Curing time varies with surface temperature, air movement, humidity and film thickness.
Ventilation: When used as a tank lining or in enclosed areas, provide adequate ventilation during application and cure. Reference guidelines contained in the latest edition of AWWA D 102.

VOLATILE ORGANIC COMPOUNDS
Unthinned: 3.02 lbs/gallon (362 grams/litre)
Thinned 5%: 3.20 lbs/gallon (384 grams/litre)
Thinned 10%: 3.37 lbs/gallon (404 grams/litre) †

THEORETICAL COVERAGE 898 mil sq ft/gal (22.0 m²/L at 25 microns). See APPLICATION for coverage rates. †

NUMBER OF COMPONENTS Two: Part A and Part B

PACKAGING 5 gallon (18.9L) pails and 1 gallon (3.79L) cans — Order in multiples of 2.

NET WEIGHT PER GALLON 12.50 ± 0.25 lbs (5.67 ± .11 kg) (mixed) †

STORAGE TEMPERATURE Minimum 20°F (-7°C) Maximum 110°F (43°C)

TEMPERATURE RESISTANCE (Dry) Continuous 250°F (121°C) Intermittent 275°F (135°C)

SHELF LIFE Part A: 24 months; Part B: 12 months at recommended storage temperature.

FLASH POINT - SETA Part A: 82°F (28°C) Part B: 64°F (18°C)

HI-BUILD EPOXOLINE® | SERIES 66

HEALTH & SAFETY

Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product.
Keep out of the reach of children.

APPLICATION

COVERAGE RATES

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m²/Gal)
Suggested	4.0 (100)	7.0 (180)	225 (20.9)
Minimum	2.0 (50)	3.5 (90)	450 (41.8)
Maximum	6.0 (150)	10.5 (265)	150 (13.9)

Note: The above reflects the total range to which Series 66 can be applied for specific applications. To insure the proper thickness and number of coats is specified for certain substrates and exposures, consult the Tnemec Guide Specifications and/or contact your Tnemec representative. **Note:** Roller or brush application may require two or more coats to obtain recommended film thickness. Allow for overspray and surface irregularities. Wet film thickness is rounded to the nearest 0.5 mil or 5 microns. Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance. †

MIXING

Power mix contents of each container, making sure no pigment remains on the bottom. Pour a measured amount of Part B into a clean container large enough to hold both components. Add an equal volume of Part A to Part B while under agitation. Continue agitation until the two components are thoroughly mixed. Do not use mixed material beyond pot life limits. **Note:** Both components should be above 50°F (10°C) prior to mixing. For application to surfaces between 50°F to 60°F (10°C to 16°C), allow mixed material to stand thirty (30) minutes and restir before using. For optimum application properties, blended components should be above 60°F (16°C). Mixing ratio is one to one by volume.

THINNING

Use No. 4 Thinner. For air spray, thin up to 10% or 3/4 pint (380 mL) per gallon. For airless spray, roller or brush, thin up to 5% or 1/4 pint (190 mL) per gallon.

POT LIFE

20 hours at 50°F (10°C) 10 hours at 77°F (25°C) 4 hours at 100°F (38°C)

APPLICATION EQUIPMENT

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss JGA	E	765 or 704	5/16" or 3/8" (7.9 or 9.5 mm)	3/8" or 1/2" (9.5 or 12.7 mm)	75-100 psi (5.2-6.9 bar)	10-20 psi (0.7-1.4 bar)

Low temperatures or longer hoses require higher pot pressure.

Airless Spray

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.015"-0.019" (380-485 microns)	3000-4000 psi (207-276 bar)	1/4" or 3/8" (6.4 or 9.5 mm)	60 mesh (250 microns)

Use appropriate tip/atomizing pressure for equipment, applicator technique and weather conditions.
Note: Application over inorganic zinc-rich primers: Apply a wet mist coat and allow tiny bubbles to form. When bubbles disappear in 1 to 2 minutes, apply a full wet coat at specified mil thickness.
Roller: Roller application optional when environmental restrictions do not allow spraying. Use 3/8" or 1/2" (9.5 mm to 12.7 mm) synthetic woven nap covers.
Brush: Recommended for small areas only. Use high quality natural or synthetic bristle brushes.

SURFACE TEMPERATURE

Minimum 50°F (10°C) Maximum 135°F (57°C)
The surface should be dry and at least 5°F (3°C) above the dew point. Coating will not cure below minimum surface temperature.

CLEANUP

Flush and clean all equipment immediately after use with the recommended thinner or MEK.

† Values may vary with color.

Hydro-Zinc® 94-H_2O

PRODUCT PROFILE

GENERIC DESCRIPTION Aromatic Urethane, Zinc-Rich

COMMON USAGE A single-component, moisture-cured, zinc-rich primer for the interior and exterior of steel potable water tanks or other steel structures. Provides outstanding long-term corrosion resistance when used as a primer in conjunction with other Tnemec potable water tank coatings. It cures quickly and offers rapid recoat at surface temperatures down to 35°F. **Note:** When used in conjunction with cathodic protection, anodes or impressed current systems should **not** provide current demand more negative than –1.05 volts relative to a copper–copper sulfate reference electrode half-cell.

ZINC DUST CONTENT 83% by weight in dried film

COLOR Greenish-gray

SPECIAL QUALIFICATIONS Certified (with or without 44-710 Urethane Accelerator) in accordance with **ANSI/NSF Std. 61** for use on interior potable water tanks of 40,000 gallons or greater. Topcoating with Std. 61 certified Tnemec coatings is recommended. Contact your Tnemec representative for specific recommendations. Meets zinc-rich primer requirements of **AWWA D102-03** Standard for **Inside System No. 5** and **Outside System No. 4 & 6.** Series 94-H_2O uses a zinc dust which meets the requirements of **ASTM D 520 Type III** and contains less than .002% lead.

PERFORMANCE CRITERIA Extensive test data available. Contact your Tnemec representative for specific test results.

Certified to ANSI/NSF 61

COATING SYSTEM

TOPCOATS **Interior:** Series 20, FC20, L140, L140F, N140, N140F
Exterior: Series 25, 35, 66, L69, L69F, N69, N69F, 73, 156, 161, 700, 701, 1074, 1075, 1080, 1081, 1082. **Note:** Certain topcoat colors may not provide one-coat hiding depending on method of application. Contact your Tnemec representative. **Note:** Series 25 must be used as an intermediate coat if Series 35 is the specified topcoat.

SURFACE PREPARATION

Wet Interior: SSPC-SP10 Near-White Blast Cleaning
Exterior or Dry Interior: SSPC-SP6 Commercial Blast Cleaning.

TECHNICAL DATA

VOLUME SOLIDS 62.0 ± 2.0% (mixed)

RECOMMENDED DFT 2.5 to 3.5 mils (65 to 90 microns) per coat.

CURING TIME
Without 44-710

Temperature*	To Handle	To Recoat
75°F (24°C)	2 hours	8 hours
55°F (11°C)	4 hours	12 hours
35°F (2°C)	6 hours	16 hours

* 50% relative humidity. Curing time will vary with surface temperature, humidity and film thickness. **Ventilation:** When used in enclosed areas, provide adequate ventilation during application and cure.

With 44-710 Reference the 44-710 Urethane Accelerator product data sheet.
Note: For cure times to immersion service, reference the specified Tnemec interior topcoat product data sheet.

VOLATILE ORGANIC COMPOUNDS

Unthinned	Thinned 15% (No. 49 Thinner)	Thinned 10% (No. 3 Thinner)
0.8 lbs/gallon (96 grams/litre)	0.8 lbs/gallon (96 grams/litre)	1.6 lbs/gallon (194 grams/litre)

HAPS 0.8 lbs/gal solids | 0.8 lbs/gal solids | 0.86 lbs/gal solids

THEORETICAL COVERAGE 996 mil sq ft/gal (24.4 m^2/L at 25 microns). See APPLICATION for coverage rates.

NUMBER OF COMPONENTS One

PACKAGING 5 gallon (18.9L) pails (yielding 3 gallons) and 1 gallon (3.79L) cans.

NET WEIGHT PER GALLON 24.92 ± 0.60 lbs (11.30 ± .27 kg)

STORAGE TEMPERATURE Minimum 20°F (-7°C) Maximum 110°F (43°C)

TEMPERATURE RESISTANCE Dry (Continuous) 250°F (121°C) Intermittent 300°F (149°C)

SHELF LIFE 9 months at recommended storage temperature.

FLASH POINT - SETA 82°F (28°C)

HEALTH & SAFETY Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product. **Keep out of the reach of children.**

94-H_2O Hydro-Zinc®

APPLICATION

CAUTION! Series 94-H_2O, with one-component configuration, prevents the product's ability to offer "dry-fall" characteristics.

COVERAGE RATES

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m^2/Gal)
Suggested	3.0 (75)	5.0 (125)	331 (30.8)
Minimum	2.5 (65)	4.0 (100)	398 (37.0)
Maximum	3.5 (90)	5.5 (140)	284 (26.4)

Allow for overspray and surface irregularities. Wet film thickness is rounded to the nearest 0.5 mil or 5 microns. Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance.

MIXING Stir thoroughly making sure no pigment remains on the bottom of the can. Use an air-driven power mixer and keep material under constant agitation while mixing. Do not use material beyond pot life limits.

POT LIFE 8 hours at 77°F (25°C) and 50% R.H.
Caution: This product cures with moisture acting as a catalyst. Incorporation of moisture or moisture laden air (humidity) during use will shorten pot life. Avoid continual agitation at high RPM. When feasible keep containers of mixed material covered during use.

THINNING For air spray, thin up to 15% or 1¼ pints (570 mL) per gallon with No. 49 Thinner or thin up to 10% or ¾ pint (380 mL) per gallon with No. 3 Thinner. For brush or roller, thin up to 5% or ¼ pint (190 mL) per gallon with No. 49 Thinner or thin up to 10% or ¾ pint (380 mL) per gallon with No. 3 Thinner. Thinning is normally not required for airless spray. **Note:** No. 49 Thinner may be used where VOC restrictions apply. **Caution:** Series 94-H_2O certification is based on thinning with No. 49 or No. 3 Thinner. Use of any other thinner voids ANSI/NSF Std. 61 certification.

SURFACE TEMPERATURE Minimum 35°F (2°C) Maximum 120°F (49°C) Maximum for Brush & Roller 100°F (38°C)
The surface should be dry and at least 5°F (3°C) above the dew point.

APPLICATION EQUIPMENT **Note:** When intermediate and finish coats are white or light colors, best hiding of this dark color primer can be achieved by spray application; or when roller applied, by using ¼" nap covers.

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss * JGA	E	704 or 765	5/16" or 3/8" (7.9 or 9.5 mm)	3/8" or 1/2" (9.5 or 12.7 mm)	40-50 psi (2.8-3.4 bar)	10-20 psi (0.7-1.4 bar)

* (with heavy mastic spring) Low temperatures or longer hoses will require additional pressure. Use pressure pot equipped with an agitator and keep pressure pot at same level or higher than the spray gun. Compressed air must be dry.

Airless Spray

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.015"-0.019" (380-481 microns) Reversible Tip	3000-4000 psi (207-276 bar)	1/4" or 3/8" (6.4 or 9.5 mm)	60 mesh (250 microns)

Use appropriate tip/atomizing pressure for equipment, applicator technique and weather conditions.

Roller: Use a 1/4" or 3/8" (6.4 mm or 9.5 mm) synthetic woven nap roller cover. Stir material frequently or keep under agitation to prevent settling.

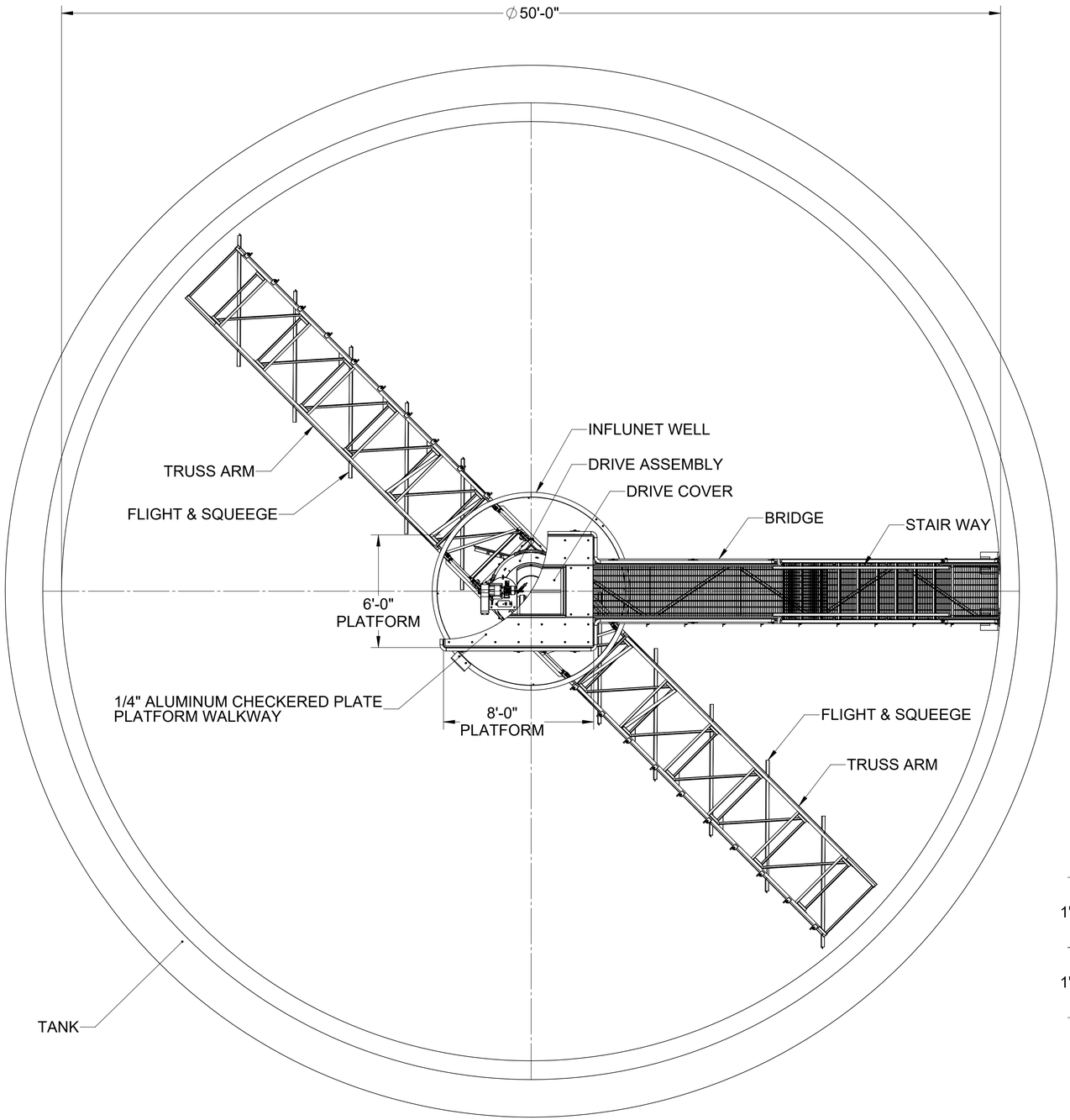
Brush: Use high quality natural or synthetic bristle brushes.

CLEANUP Flush and clean all equipment immediately after use with the recommended thinner or xylene.

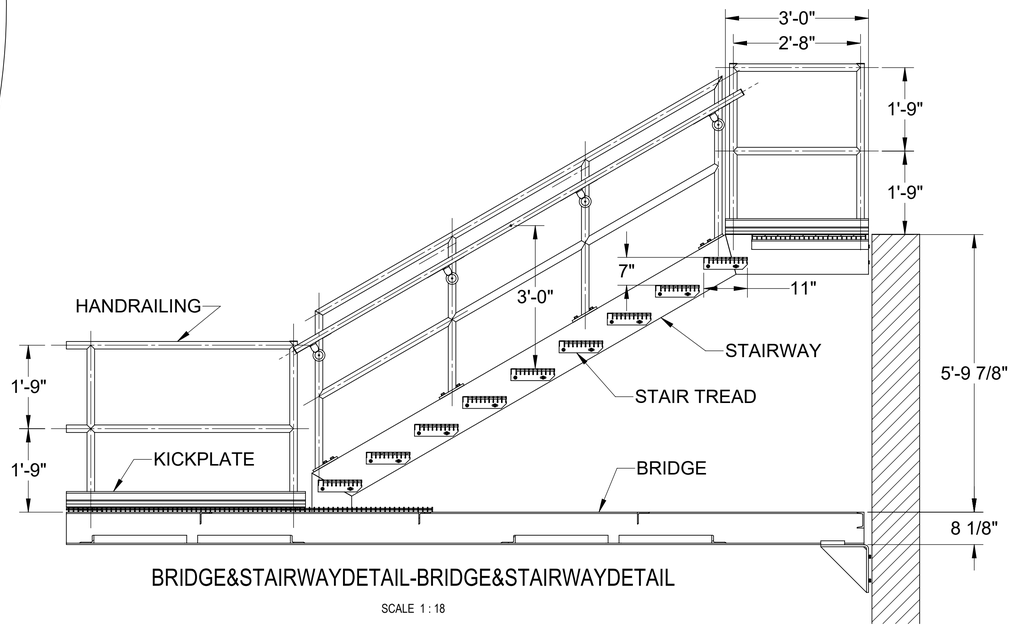
TNEMEC COMPANY INCORPORATED
6800 CORPORATE DRIVE, KANSAS CITY, MISSOURI 64120-1372 TEL: 1 800 TNEMEC 1 www.tnemec.com

PRINTED IN USA
(YDAT094) 94-H_2O

GENERAL ARRANGEMENT DRAWINGS



PLAN VIEW



BRIDGE&STAIRWAYDETAIL-BRIDGE&STAIRWAYDETAIL

SCALE 1 : 18

THIS PRINT IS SUBJECT TO RETURN UPON DEMAND AND IS LOANED UPON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED DIRECTLY OR INDIRECATLY IN ANY WAS DETRIMENTAL TO THE INTEREST OF **AMWELL.**

AMWELL FURNISHES MECHANISM TO FIT TANK OF DIMENSIONS GIVEN, BUT IS NOT RESPONSIBLE FOR CONCRETE DESIGN. CUSTOMER TO FURNISH NECESSARY REINFORCING STEEL AND TO DETERMINE SIZE AND PLACEMENT OF FOOTINGS TO SUIT LOCAL CONDITIONS.

AMWELL DOES NOT FURNISH PIPING (EXCEPT AS NOTED) FLOOR RAILS, TROUGHS, GRATINGS, WEIR PLATES, OIL OR GREASE FOR LUBRICATION, ANY WIRING OR CONDUITS BETWEEN MOTORS, CONTROLS AND ALARMS OR ANY ELECTRICAL EQUIPMENT OF ANY KIND EXCEPT AS SPECIFICALLY STATED IN AMWELL SPECIFICATIONS.

UNLESS OTHERWISE SPECIFIED:	DRAWN BY: EG
DECIMAL: .xx ±.03 .xxx ±.015	CHECKED:
ANGULAR: ±1°	DATE: 8/16/2021
ALL DIMENSIONS ARE IN INCHES	SCALE: 1:96
MASTER:	S.O.: A22060-4
PATT. No.	WEIGHT(LBS)1026424.48
	MATERIAL:

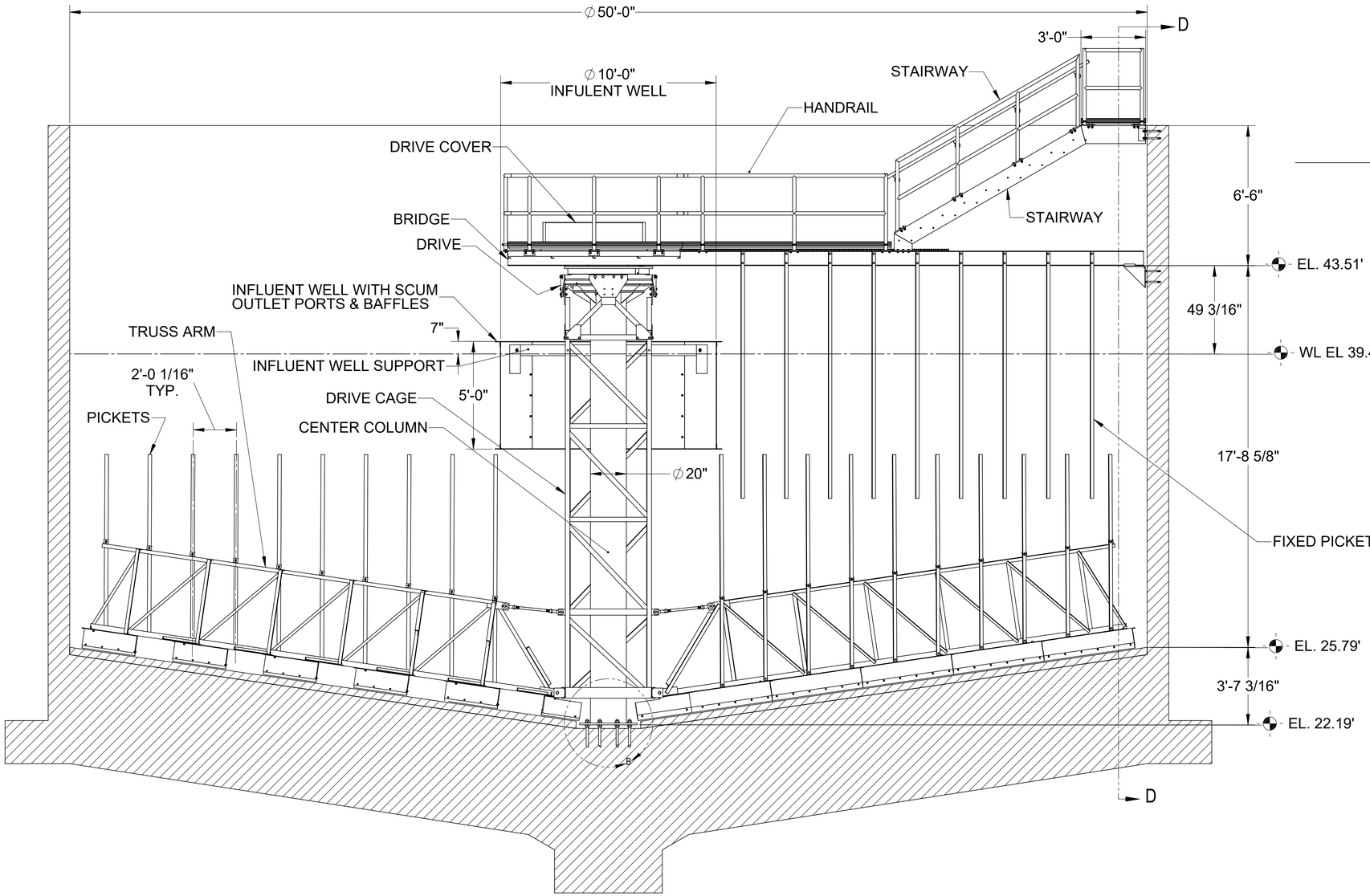
AMWELL
A Division of McNish Corporation
AURORA, ILLINOIS, USA
(ORIGINALLY AMERICAN WELL WORKS - EST. 1868)

DESCRIPTION:
GENERAL ARRANGMENT 50'-0" DIA. THINKER "HT", TAUNTON, MA

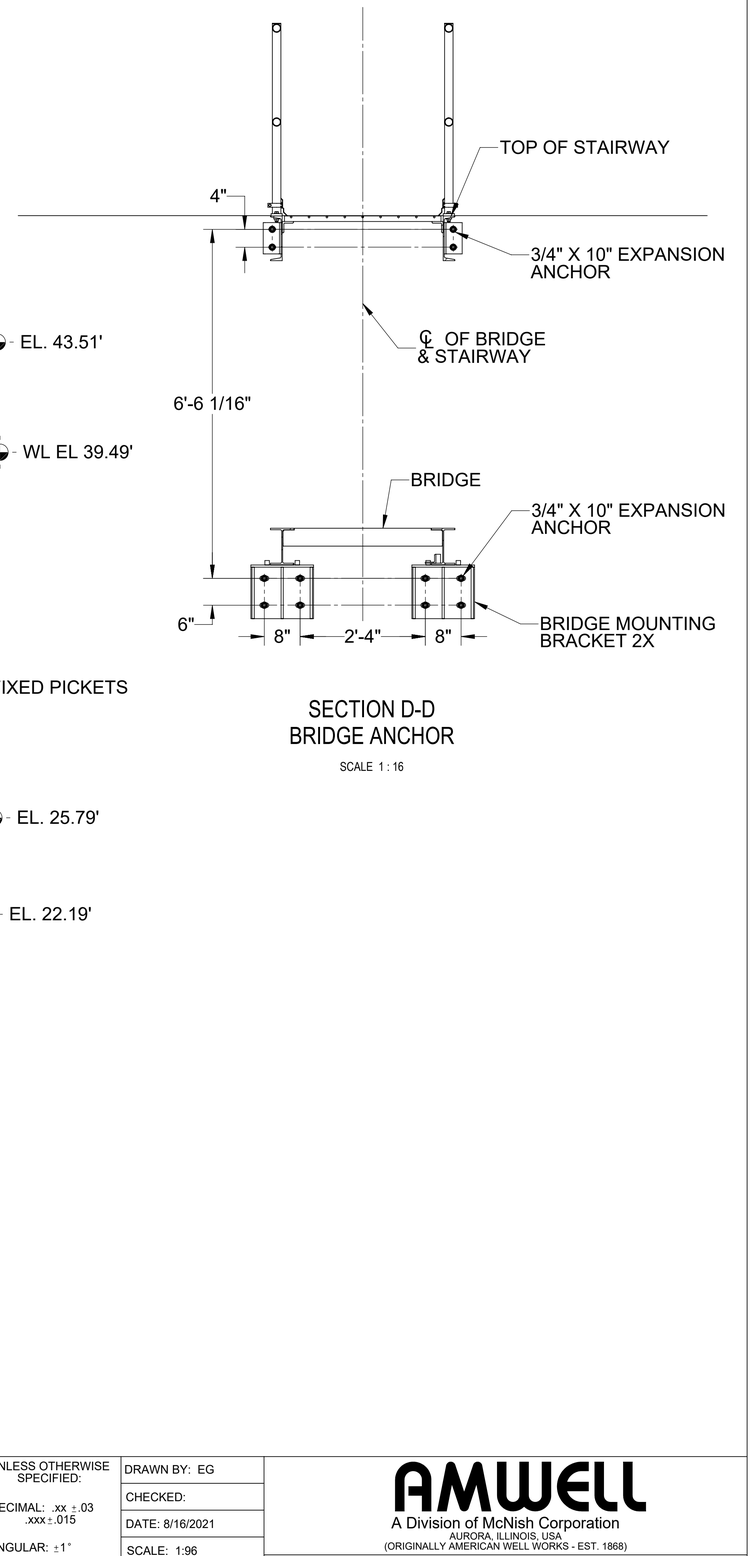
DRAWING NO.: D84722-167

SHEET: 1 OF 2

REV.

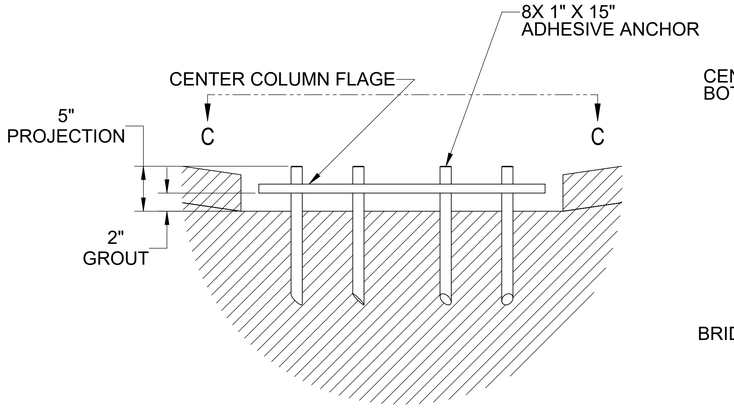


SECTION ELEVATION



SECTION D-D
BRIDGE ANCHOR

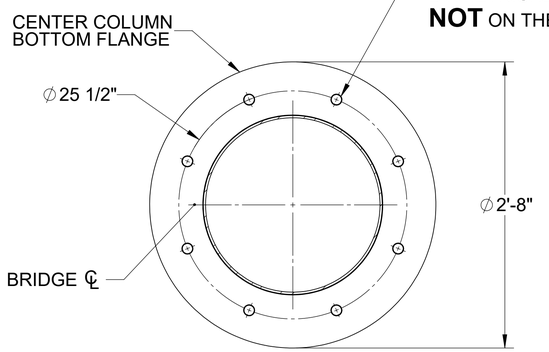
SCALE 1 : 16



DETAIL B
CENTER COLUMN ANCHOR

SCALE 1 : 8

IMPORTANT NOTE:
1" DIA X 15" LG ANCHOR BOLTS W/5" PROJECTION 8 TOTAL EQUALLY SPACED ON ∅25 1/2" D.B.C. SET ANCHORS SO THAT DIAMETRICALLY OPPOSITE ANCHORS ARE **NOT** ON THE BRIDGE ℄ .



SECTION C-C
CENTER COLUMN ANCHOR

SCALE 1 : 8

UNLESS OTHERWISE SPECIFIED:
DECIMAL: .xx ±.03 .xxx ±.015
ANGULAR: ±1°
ALL DIMENSIONS ARE IN INCHES
MASTER:
PATT. No.

DRAWN BY: EG
CHECKED:
DATE: 8/16/2021
SCALE: 1:96
S.O.: A22060-4
WEIGHT(LBS)1026424.48
MATERIAL:

AMWELL
A Division of McNish Corporation
AURORA, ILLINOIS, USA
(ORIGINALLY AMERICAN WELL WORKS - EST. 1868)

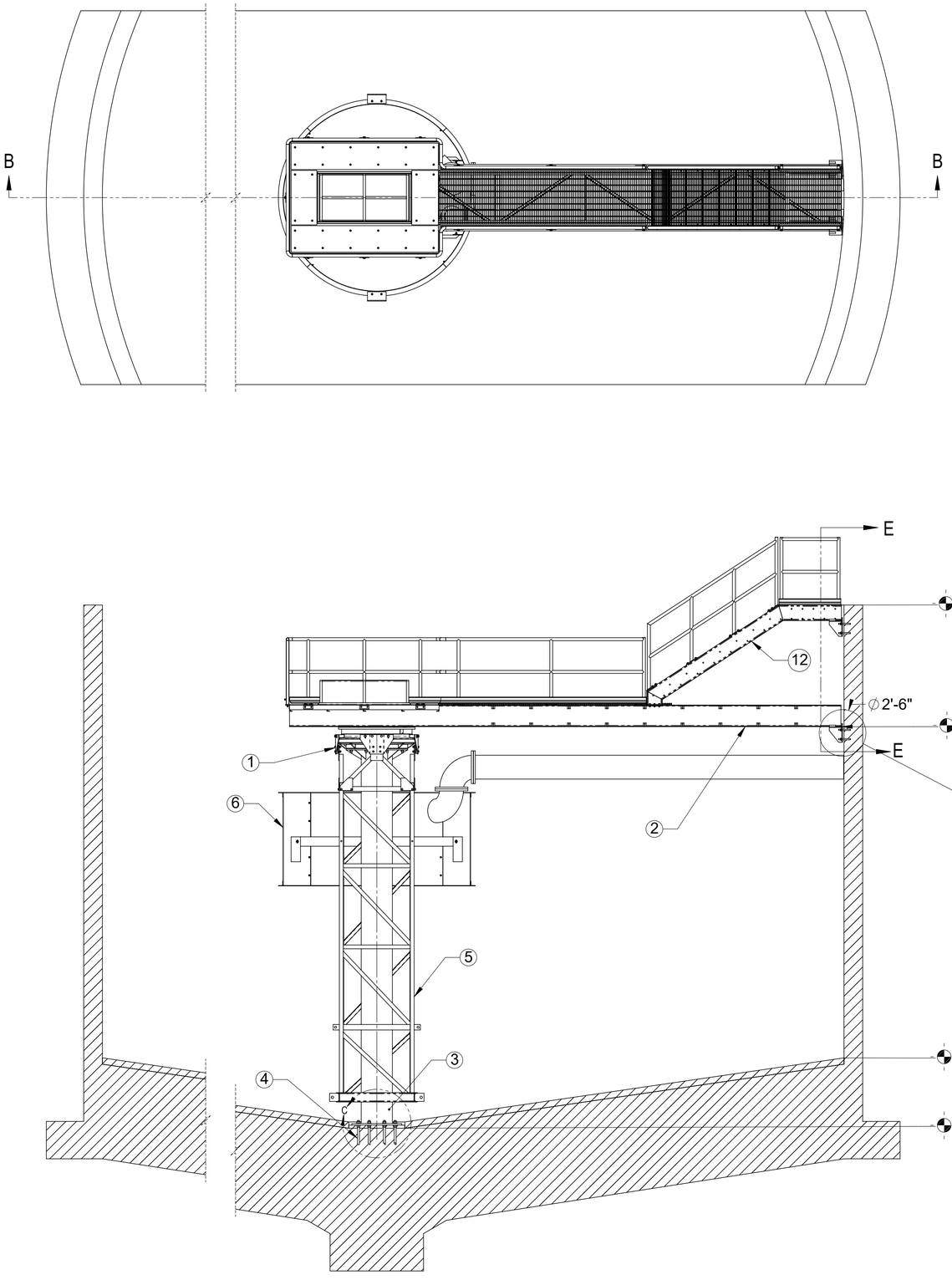
DESCRIPTION:
GENERAL ARRANGMENT 50'-0" DIA. THINKER "HT", TAUNTON, MA

DRAWING NO.: D84722-167
SHEET: 2 OF 2
REV.

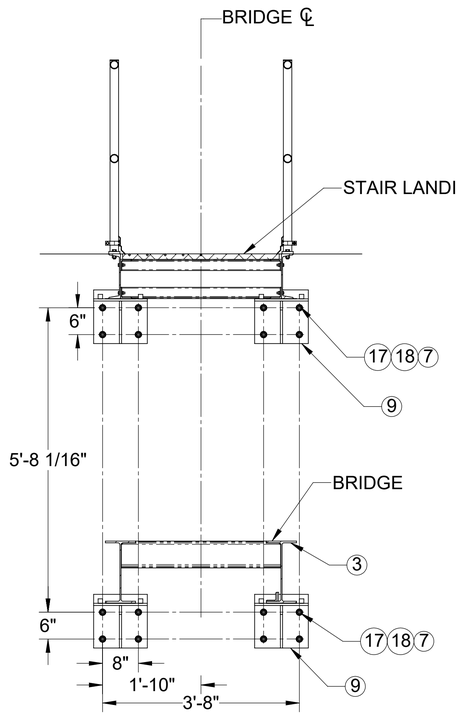
ANCHOR LOCATION DRAWING

REF.	DESCRIPTION	QTY.
4	ANCHORAGE ASSEMBLY	1
4.1	ANCHOR BOLT	8
4.2	NUT HEX FINISHED 304 SS 1.25	16
4.3	WASHER STD PL 304 SS 1.25	16
4.4	THREADED ROD 304 SS .75 X 7.5" LG	16
4.5	WASHER STD PL 304 SS .75	16
4.6	NUT HEX FINISHED 304 SS .75	16
4.7	TEMPLATE 20" CENTER COLUMN	1
4.8	POWERS PE1000+ ANCHOR ADHESIVE	3

NOTE:
QTY FOR ONE UNIT ONLY
PARTS 4.7 AND 4.8 NOT SHOWN

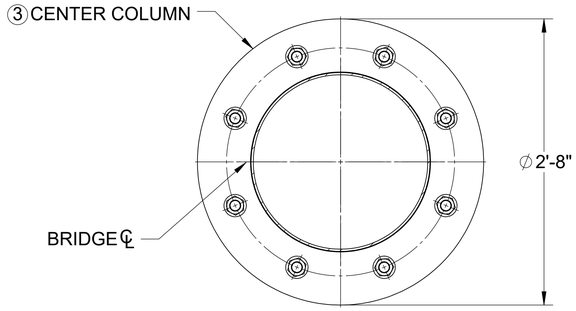


SECTION B-B



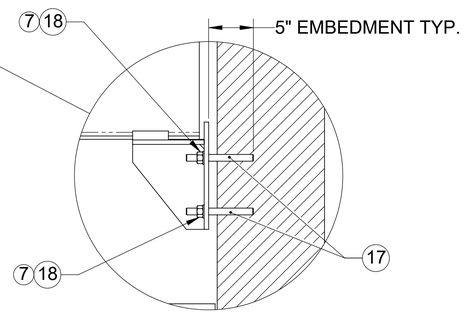
SECTION E-E

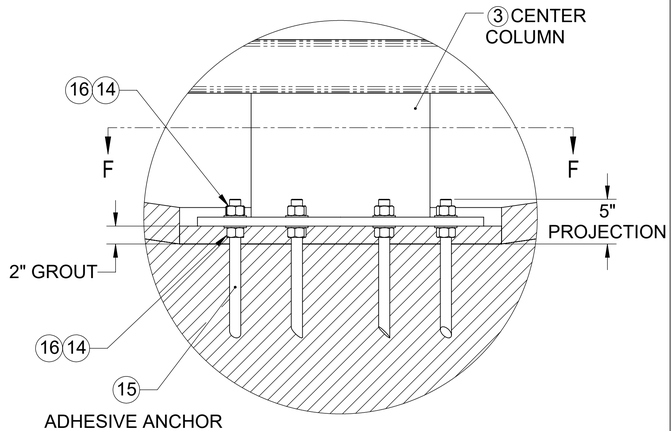
SCALE 1 : 16



SECTION F-F

SCALE 1 : 8





DETAIL C

SCALE 1 : 8

REV.	DATE	BY	CH'KD	DESCRIPTION

UNLESS OTHERWISE SPECIFIED:	
DECIMAL: .xx ±.03 .xxx ±.015	
ANGULAR: ±1°	
ALL DIMENSIONS ARE IN INCHES	
MASTER:	
PATT. No.	

DRAWN BY: EG	
CHECKED:	
DATE:10/28/2021	
SCALE: 1:38.4	
S.O.: A22060-4	
WEIGHT(LBS):432218.84	
MATERIAL:	

AMWELL
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(ORIGINALLY AMERICAN WELL WORKS - EST. 1868)

DESCRIPTION:
ANCHORAGE LAYOUT

DRAWING NO.: 814-292

SHEET: 2 OF 8

REV.

SECTION I

FIELD TORQUE TEST PROCEDURES

CIRCULAR CLARIFIERS/THICKENERS

FIELD TORQUE TEST PROCEDURES

REFERENCE DRAWING

B605-18828-870

EQUIPMENT REQUIRED

Two (2) Drill-in Anchors (Furnished by AMWELL)

Two (2) Dynamometers (Furnished by AMWELL)

Two (2) Come-a-longs (By Contractor)

Two (2) Sets Connecting Chains and Shackles (By Contractor)

1) Anchor bolts to be embedded in the tank wall at points 180° apart. Refer to drawing B605-18828-870 in submittals for size and location.

2) Connect chains, puller and scales.

3) Load scales evenly with come-a-longs to specified alarm torque, set switch, load to cut-out torque, set switch.

Gauge readings determined by the following formula:

$$P = \frac{T}{D \times 2}$$

P = Gauge reading in pounds

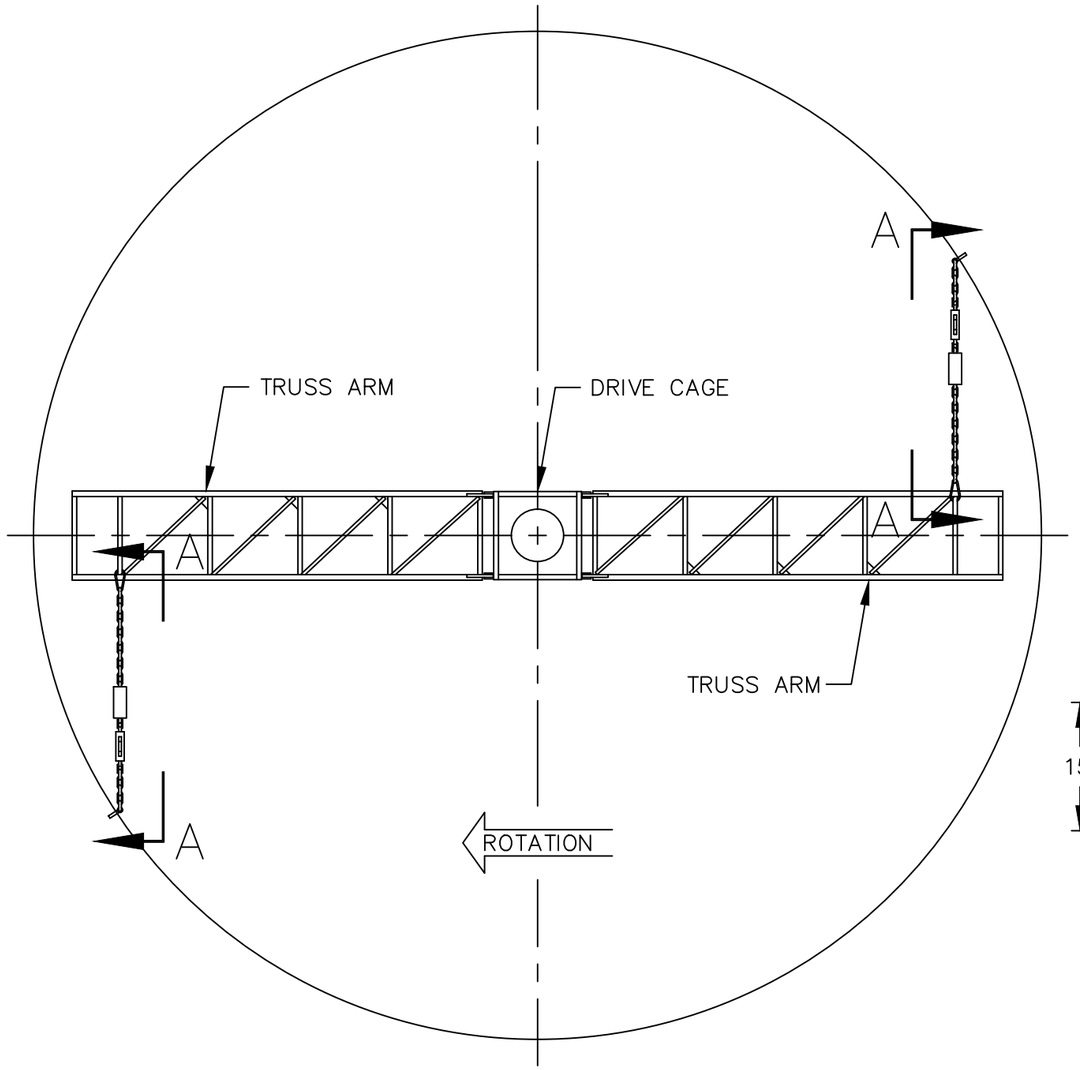
T = Torque in ft. lbs.

D = Distance from center line of tank to gauge connection on arm in feet.

NOTE:

Field torque test switch settings take precedence over factory set switch settings if different.

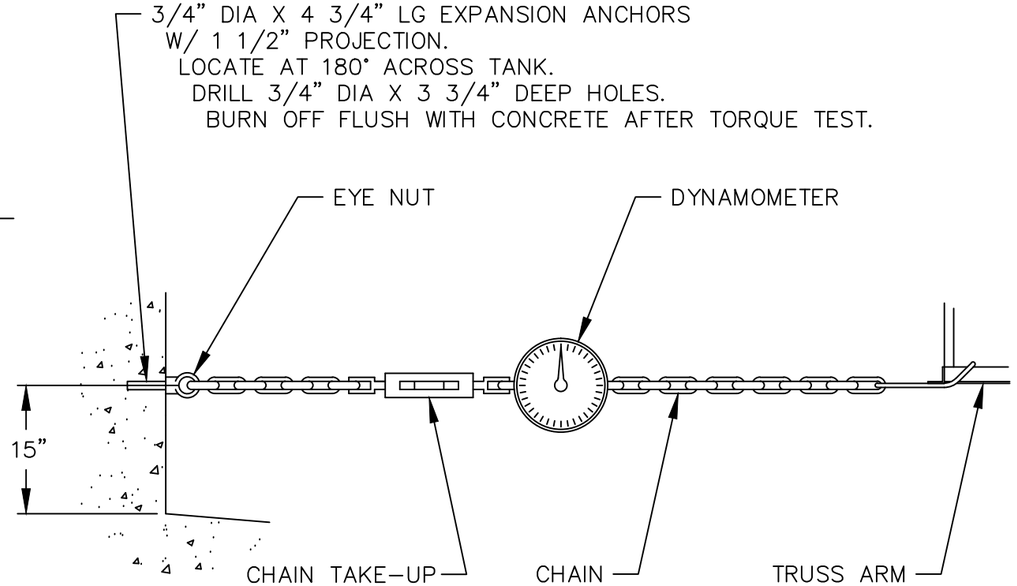
TORQUE TEST ARRANGEMENT



TANK FLOOR PLAN

NOTE:

CHAIN SHALL BE ATTACHED TO ANCHOR BOLT BY MEANS OF AN EYE NUT AND TO THE ARM BY WRAPPING CHAIN AROUND A VERTICAL MEMBER AND ATTACHING TO ITSELF AS SHOWN BELOW. TAKE–UP SHALL BE USED TO ELIMINATE ANY SLACK IN CHAIN. THE DYNAMOMETER SHALL THEN BE SET AT ZERO AND THE UNIT WILL BE READY TO TORQUE TEST.



VIEW A–A

AMWELL
A Division of McNish Corporation
AURORA, ILLINOIS, USA
(ORIGINALLY AMERICAN WELL WORKS – EST. 1868)

CAD FILE: B18828

MASTER
B-18828

SYM	REVISION	BY	DATE	CHKD
D				
C				
B				
A				

AMWELL FURNISHES MECHANISM TO FIT TANK OF DIMENSIONS GIVEN, BUT IS NOT RESPONSIBLE FOR CONCRETE DESIGN. CUSTOMER TO FURNISH NECESSARY REINFORCING STEEL AND TO DETERMINE SIZE AND PLACEMENT OF FOOTINGS TO SUIT LOCAL CONDITIONS.

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DRAWN	Walt
CHECKED	
APP'D.	
DATE	7–29–77
S.O.	STD
SCALE	NONE

DESCRIPTION

TORQUE TEST ARRANGEMENT

DRAWING NO. B 6 0 5 1 8 8 2 8 8 7 0

REV.