WEAVER CONSTRUCTION MANAGEMENT, INC.
3679 S. Huron St., Suite 404
Englewood, CO 80110
Phone: (303) 789-4111 FAX: (303) 789-4310

SUBMITTAL TRANSMITAL

August 17, 2011
WCM Submittal No: 11361-001.A

PROJECT: **Harold Thompson Regional WRF**
Birdsall Rd.
Fountain, CO 80817
Job No. 2908

ENGINEER: **GMS, Inc.**
611 No. Weber St., #300
Colorado Springs, CO 80903
719-475-2935 Roger Sams

OWNER: **Lower Fountain Metropolitan Sewage Disposal District**
901 S. Santa Fe Ave.
Fountain, CO 80817
719-382-5303 James Heckman

CONTRACTOR: **Walker Process Equipment**
840 N Russell Ave
Aurora, IL 60506-2853
630-892-7921 x 5401 Linda Woods

SUBJECT: Resubmittal Circular Clarifier - Sludge Collection Equipment - TAG CC-01 & CC-02

SPEC SECTION: 11361

PREVIOUS SUBMISSION DATES: 5/13/11

DEVIATIONS FROM SPEC: ___ YES _X_ NO

CONTRACTOR'S STAMP: This submittal has been reviewed by Weaver General Construction and approved with respect to the means, methods, techniques, & safety precautions & programs incidental thereto. Weaver General Construction also warrants that this submittal complies with contracted documents and comprises on deviations thereto:

Contractor's Stamp:	Engineer's Stamp:
Date: 8/17/11 Reviewed by: H.C. Myers (X) Reviewed Without Comments ( ) Reviewed With Comments	

ENGINEER'S COMMENTS:_____
_____

FOUNTAIN, COLORADO
HAROLD D. THOMPSON REGIONAL WATER RECLAMATION FACILITY

SPEC. SECTION 11361 - CIRCULAR CLARIFIER SLUDGE COLLECTION EQUIPMENT

MODEL "RSMTP" CIRCULAR CLARIFIERS

W.P.E. CONTRACT NO. Q10600A

WALKER PROCESS EQUIPMENT
Division McNish Corporation

840 North Russell Avenue
Aurora, Illinois
(630) 892-7921

Dedicated to the
Water and Wastewater
Industry

WALKER PROCESS EQUIPMENT
A DIVISION OF MCNISH CORPORATION
840 NORTH RUSSELL AVENUE
AURORA, ILLINOIS 60506
PHONE: (630) 892-7921

APPROVAL DETAILS

PROJECT ..... FOUNTAIN, COLORADO
HAROLD D. THOMPSON REGIONAL WATER RECLAMATION FACILITY

ENGINEER ..... GMS, INC.

CONTRACTOR/ PURCHASER ..... WEAVER GENERAL CONSTRUCTION CO.
3679 S. HURON STREET, SUITE 404
ENGLEWOOD, CO 80110

PHONE: (303) 789-4111
FAX: (303) 789-4310

P.O. #2908-11190 & DATED 3/14/11

AREA REPRESENTATIVE ..... WATER CONTROL CORP.
2460 W. 26TH AVENUE, SUITE 215-C
DENVER, CO 80211
CONTACT: BILL PERETTI

PHONE: (303) 477-1970
FAX: (303) 477-1981

SPECIFICATION REFERENCE ..... SECTION 11361 – CIRCULAR CLARIFIER SLUDGE COLLECTION EQUIPMENT

W.P.E. CONTRACT NO ..... ***Q10600A*** – TWO (2) MODEL "RSMTP" CIRCULAR CLARIFIER MECHANISMS

SUBMITTED ..... MAY 5, 2011

W.P.E.

May 5, 2011
Contract No. Q10600A

(*Revised 8/9/11)

TABLE OF CONTENTS

CERTIFICATE OF DESIGN

PROJECT NAME: Fountain, Colorado
Harold D. Thompson Regional Water Reclamation Facility

ENGINEER: GMS Inc.

CONTRACTOR: Weaver General Construction Co.
3679 S. Huron Street, Suite 404
Englewood, CO 80110

CONTRACT DOCUMENTS/ SPECIFICATION SECTION: Section 11361 – Circular Clarifier Sludge Collection Equipment

W.P.E. ORDER NUMBER: Q10600A – Two (2) Model "RSMTP" Circular Clarifiers

W.P.E., A Division of McNish Corporation, hereby certifies that the Circular Clarifier equipment and the material to be furnished by W.P.E. are designed in compliance and will meet the fit, form and function intent of the contract specifications and drawings. All exceptions are noted within the submittal comments contained in this submittal package. The equipment can be installed and will operate satisfactorily in the location shown on the contract drawings.

Walker Process Equipment
A Division of McNish Corporation

By: _____
Lloyd Cates
Vice President Engineering

Date: 8/10/2011

RESUBMITTAL COMMENTS

The following is in response to GMS Inc. returned submittal comments dated 6/29/11 on Submittal No. 11361-001:

A. Response to WPE submittal comments:

1) WPE acknowledges GMS' response that the short circuit current rating is acceptable.

2) WPE acknowledges GMS' response that the scum spray system is not furnished by WPE.

3) WPE has revised our submittal drawings to show top of weir wall at 5405.92', top of weir plate at 5406.43' and bottom of V-notch at 5406.18' per GMS' response.

4) WPE acknowledges GMS' response that the submitted 18" center column pipe is acceptable. As further explanation of the connection between the influent pipe and the WPE center column, the center column does not physically connect to the influent pipe. The center column is mounted to the anchor bolts and after final alignment, a 2" grout fill is placed between the center column bottom flange and the concrete flat surface at the tank center. Refer to DETAIL "B" on WPE Drawing D205-70550-167A for illustration of the connection.

5) WPE acknowledges GMS' approval response to WPE's submittal for hot-dipped galvanized steel components and shop painting of drive as detailed in WPE's original submittal specification.

6) WPE acknowledges GMS' response that the tank inside diameter is 60'.

B. General

1) Included in this resubmittal is WPE Drawing B205-71000-167 which shows the requested tank loading information.

2) As directed in the returned submittal, WPE has eliminated the 2" grout layer on the tank floor resulting in a new side water depth of 13'-0", with the concrete slab constructed to conform to the final requirements of the drawings. Please be aware that the purpose of the grout is to eliminate "high and low spots" in the poured concrete tank floor. Therefore, it is imperative that the contractor pour the tank to tight tolerances (1/4"±) since any excessively low and high spots will not be corrected with the grout layer. WPE cannot be held responsible if the tank floor is not properly poured.

C. Sludge Collection Equipment

1) WPE verifies that the brass squeegees project 1 ½" below the flights. Refer to Drawing A605-35022-292 included in this resubmittal for clarification.

2) Included in this resubmittal are three (3) pages of design calculations for the minimum, average, and maximum sludge draw-off rates. The calculations show the size and spacing of the header orifices, the size of the suction header, and the headloss and velocity throughout its length. Also included in this resubmittal is Drawing A605-40165-292 detailing the connection between the suction header and the sludge manifold.

3) See Comment #2 above for WPE response to this comment.

4) Included in this resubmittal is Drawing A605-38955-292 for the upper seal between the center column and the sludge manifold, Drawing A605-38956-292 for the lower seal between the sludge manifold and the seal plate, and Drawing A605-40168-292 for the connection of the center column wearing strip to the center column.

D. Access Bridge and Handrail

1) WPE confirms that the access bridge is designed for a total deflection (live load plus dead load) not exceeding 1/360 of the span. Our written specification has been revised accordingly.

2) Although WPE feels that an aluminum handrail system utilizing internal mechanical connectors is more aesthetically pleasing and seems to have been the handrail of choice for water treatment plants for the past 20 years, we have changed the handrail to external mechanical connectors as specified. WPE is submitting Hollaender Speed Rail with 1 ½" schedule 40 rails and posts, cast aluminum bases, ¼" x 4" bolted kick plates, and 304 stainless steel fasteners.

3) WPE has changed the vertical dimension between the centerline of the top rail and the centerline of the intermediate rail to 21" as requested.

4) WPE has changed the toe plate to ¼" thick as specified.

5) As stated in comment #2 above, WPE has changed to Hollaender Speed Rail which has bolted toe plates.

E. Weirs and Baffles

1) The concrete weir wall elevation has been changed to 5405.92' on MFG Drawing 5523-1 Revision 1. Please note that the elevation of the opposite wall (5405.80') is of no consequence to the WPE weirs so we have not shown that elevation.

2) Top of weir plate elevation has been changed to 5406.43' on MFG Drawing 5523-1 Revision 1.

3) The depth of the V-notch on the weir plate has been changed to 3" on MFG Drawing 5523-1 Revision 1.

4) The upper scum baffle support bracket has been changed to an "L" shaped bracket on MFG Drawing 5523-1 Revision 1 as requested to avoid interference with a future brush algae control system.

F. Scum Trough

1) WPE's standard design locates the crest of the scum trough ½" above the operating liquid level as we feel that provides the most efficient skimming operation, however to comply with the specification, we have revised our scum trough with the crest at the same elevation as the top of the scum baffle, which is 3" above the water level. A new scum trough Drawing C605-71001-200 and skimmer Drawing D205-62171-201 are included in this resubmittal as a result of this change. Please be aware that the scum baffle at the trough must now be raised above the elevation of the rest of the scum baffle as shown on Drawing D605-71001-200 to prevent scum from spilling over the baffle and flowing over the weir plate. This may require special design considerations for the future brush algae control system to avoid interference with this raised scum baffle section at the scum trough.

2) WPE verifies that the scum trough mounting and support arrangement provides sufficient support so that no objectionable deflection will occur at the inboard side of the scum trough when the clarifier is empty.

3) WPE normally does not supply detail drawings of our equipment as we feel it is proprietary information, however in an effort to secure approval of this job and move forward to production, included in this resubmittal package is WPE scum trough detail Drawing D405-70590-854.

G. Control System

1) WPE acknowledges that the specified shear pin torque setting is 170% of the design running torque or approximately 10,710 ft-lbs. However, in order to get that exact torque setting a "special" shear pin would be required. WPE utilizes commercially available shear pins in our design to provide readily available and affordable shear pins for replacement parts if required in the future. The closest commercially available standard shear pin will break at approximately 13,000 ft-lbs which is still well below the continuous torque rating of 14,700 ft-lbs for the 28H6T drive WPE is using on this job. Therefore, WPE is resubmitting with the shear pin value of 13,000 ft-lb as originally submitted. If the engineer requires that the specified shear pin rating of 10,710 ft-lbs be held, WPE can provide shear pins at that rating but be aware that replacement shear pins may not be as readily available in the event of an emergency breakdown.

2) WPE confirms the control panel main disconnect switch is capable of being locked in the "OFF" position. An additional catalog cut page (29-120F page 26) has been added with the padlocked information circled for your reference.

3) WPE confirms that all devices face-mounted through the control panel door are NEMA 4X rated. Two (2) catalog sheets for the elapsed time meter have been added with the NEMA 4X rating circled for your reference. The selector switches, pilot lights, and pushbuttons all carry a NEMA 4X rating as highlighted on page A-7 for IDEC switches and pilot devices.

W.P.E.

Contract Q10600A
(*Revised 8/9/11)

APPROVAL SPECIFICATIONS
FOR
SECONDARY CLARIFIERS NO. 1 & NO. 2

Project.....Harold D. Thompson Regional Water Reclamation Facility
Fountain, Colorado

* **Date**.....May 5, 2011 **(*Revised August 8, 2011)**

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

Type.....'RSMTP'

* **Submittal Drawings**.....

D205-70549-167	–	General Arrangement - PLAN
D205-70550-167A	–	General Arrangement - ELEV
D105-70551-166A	–	Anchor Location
D705-46884-171	–	Drive Assembly
C505-46818-171	–	Torque Indicator Box
D205-62171-201	–	Skimmer Assembly
C605-71001-200	–	Scum Trough Assembly
C605-70108-292	–	Scum Trough Flushing Gate
A605-35022-292	–	Flight and Squeegee
A605-40165-292	–	Suction Header/Manifold
A605-38955-292	–	Manifold Seal - Upper
A605-38956-292	–	Manifold Seal - Lower
A605-40168-292	–	Wearing Strip - Center Column
D405-70590-854	–	Scum Trough Detail Drawing
B205-71000-167	–	Tank Loads

* **Tank Size**.....60'-0" Dia. x 13'-0" S.W.D.

Clarifier Hydraulics (Per Basin)	**MINIMUM**	**DESIGN**	**MAXIMUM**
Sludge Return	0.42 MGD	0.69 MGD	1.89 MGD

MATERIAL SPECIFICATIONS:

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

Walkway.....Swaged locked I-Bar design aluminum grating with 1 1/2" bearing bars spaced on 1 3/16" centers and cross bars spaced on 4" centers. The panel ends and all openings shall be banded.

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

MATERIAL SPECIFICATIONS: (Continued)

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 except as noted.

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

Fasteners ..... All capscrew, 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 120 for compression members or 240 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 insure proper fit for field assembly.

SPARE PARTS ..... The following items shall be boxed or crated for long term storage and marked **"SPARE PARTS – S.O. Q10600A"**.

Four (4)	Oil level sight glasses
One (1)	Set of scraper arm squeegees overload.
One (1)	Set of suction header squeegees
Two (2)	Neoprene skimmer wipers
Two (2)	Sets of seals, gaskets and bearings for the drive mechanism
Ten (10)	Shear pins.

PAINTING SPECIFICATIONS .....Gearmotor to have manufacturer's standard paint.

Exterior surfaces of the drive to be solvent cleaned per SSPC specifications SP-1-63 and given one (1) shop coat of Tnemec Series N69-1211 Hi-Build Epoxoline II red primer, 2.0 to 10.0 mils dry film thickness.

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.

All steel products will be hot-dipped galvanized after fabrication in accordance with ASTM designation 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 W.P.E.

All finish coats are not by W.P.E. 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 W.P.E. on aluminum, stainless steel or other non-ferrous metals or on galvanized metal unless specifically designated.

Electrical Controls.....Each clarifier to be furnished with a control panel in a 304 stainless steel enclosure. Please reference the control panel tab for specific details.

EQUIPMENT SPECIFICATIONS:

EACH DRIVE UNIT SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS:

Model.....28H6T

Design Running Torque..... 6,300 ft. lbs.
Spur Gear Continuous Torque Rating .....14,700 ft. lbs. (approximately)
Momentary Peak Torque Rating.....43,400 ft. lbs. (approximately)
Alarm Torque Setting..... 7,560 ft. lbs. (120% of design running torque)
Motor Shut-off Torque Setting..... 8,820 ft. lbs. (140% of design running torque)
Shear Pin Torque Setting.....13,000 ft. lbs. (approximately)

DRIVE UNIT SPECIFICATIONS: (Continued)

Output Speed.....0.04 RPM (approximately)
Tip Speed.....8 FPM (approximately)

Rotation.....Clockwise

AGMA Design.....The drive unit has been designed and rated in accordance with ANSI/AGMA Sections 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.

All bearings are designed for a L-10 minimum life of 20 years based on the continuous torque.

Drive.....1/2 HP, Eurodrive frame size R37DRS71S4/DH, parallel-helical gearmotor; AGMA Class III, 38 RPM (ratio 44.81:1) output speed with 3 phase, 60 hertz., 230/460 volt, T.E.F.C., B.B., continuous duty, 40°C ambient, 1.15 Service Factor, NEMA Design 'B', Class 'F' insulation, 1800 RPM, severe duty motor for outdoor service. The gearmotor is mounted on a fabricated steel base with provision for taking up slack in the drive chain.

1/2" pitch steel sprocket with No. 40 self-lubricated steel roller chain enclosed in a weatherproof 12 gauge OSHA approved, removable, steel guard between gearmotor and the worm reduction unit. Chain S.F. at continuous torque is 16:1.

Intermediate worm reduction unit (6" centers) with centrifugally cast manganese bronze worm gear and hardened and ground AISI 8620 alloy steel worm driving a forged 4150 alloy, 12 tooth steel pinion 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 per ASTM A536 Grade 120-90-02 ductile iron, 84 tooth, 28" P.D. is driven by the steel pinion.

Spur gear and the entire clarifier mechanism is supported on a ball bearing assembly comprised of seventy-nine (79) SAE 52100 chrome alloy steel balls, 1 1/4" dia., running in an oil bath on replaceable heat treated (min. 43RC) alloy steel inserts in annular raceways.

Bearing race diameter is 31". The complete unit is encased in a cast iron gear case complete with neoprene seals and dust shields.

DRIVE UNIT SPECIFICATIONS: (Continued)

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

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) limit switches located in a NEMA 4X stainless steel enclosure and operated by a spring loaded actuator from the worm on the primary worm reduction unit. One (N.O. contact) switch will sound an alarm when the drive reaches the alarm torque of 7,560 ft. lbs. The other switch (N.C. contact) will stop the drive when it reaches the cut-out torque of 8,820 ft. lbs.

The protection system is also equipped with a graduated scale and operated by the spring loaded actuator. Indicator can be read from walkway. Enclosure is also furnished with a terminal block.

Additional protection has been provided by a shear pin sprocket which is designed to shear at approximately 13,000 ft. lbs.

CLARIFIER COMPONENTS SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS

* **Access Bridge** .....Two (2) W12 X 14 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 9'-0" wide x 10'-0" long platform shall be provided at the tank center. The platform shall provide a 36" clearance around the drive assembly. The walkway and platform area to have a 1/4" x 4" high aluminum kickplate.

The bridge will be designed for the dead load and a live load of 150 pounds per lineal foot accordance with AISC allowable stress. Total dead load plus live load deflection shall not exceed 1/360 of the span.

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.

CLARIFIER COMPONENTS: (Continued)

Center Column.....An 18" O.D. 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. Four (4) 4 1/2" wide x 14 1/2" deep openings are provided in the upper end to allow unrestricted passage of flow into the feedwell. The total area of the ports shall equal 100% of the cross sectional area of the center column. The velocity thru the openings shall be approximately 1.60 fps at average flow.

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 3'-0" square. The drive cage shall be designed to transmit twice the shear pin torque capacity of the drive assembly to the truss arms.

Influent Well.....A 12'-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) baffled scum outlet ports at water level.

Truss Arm.....The truss arm shall be of an all-welded construction made up of structural steel members having a minimum thickness of 1/4" and shall be a minimum of 3'-0" wide x 3'-6" high. The truss arm shall be rigidly connected to the drive cage and is designed to transmit twice the shear pin torque capacity of the drive mechanism. The truss arm shall be equipped with 1/4" steel flights so set and spaced to scrape the settled sludge from the tank bottom to a sludge pocket located near the tank center. Fixed to the flights are adjustable brass squeegees. The flights shall be arranged to provide a complete scraping of the floor once every revolution.

Sludge Manifold.....The sludge manifold shall be fabricated from 3/8" minimum thickness steel plate and rigidly mounted to the bottom of the drive cage. The sludge manifold shall have an upper replaceable neoprene seal which contacts the center column wearing ring and a lower replaceable neoprene seal which contacts the bottom seal plate.

The center column wearing ring material is Tivar-88 UHMW polyethylene.

The manifold directs the sludge from the suction header arm into the sludge draw-off sump located in the floor near the center of the tank. A bottom seal plate shall be securely anchored to the concrete floor and grouted in place after proper alignment.

CLARIFIER COMPONENTS: (Continued)

Inside Flight & Squeegee.....A 1/4" steel flight with a neoprene squeegee shall be provided to clean the tank bottom around the sludge manifold and direct the sludge to the first orifice.

Suction Header.....A rectangular shaped tapered suction header, varying in size from a maximum near the tank center to a minimum at the outer end and fabricated from 1/4" minimum thick steel plate, shall be rigidly mounted to the sludge manifold and supported with stainless steel tie rods and turnbuckles in both the horizontal and vertical plane. The longitudinal cross section axis of the header shall be mounted at an angle of 45° to the tank floor with the leading edge extended downward 2" to provide a fluidizing vane and direct the sludge into the area of influence of the orifices.

A neoprene squeegee with a steel backing plate is attached to the vane.

Inlet orifices shall be provided at regular intervals, not exceeding 30" C-C, varying in size from a minimum near the tank center to a maximum at the outer end, to provide a uniform sludge draw-off velocity throughout and to have each orifice size proportionate to the volume of sludge withdrawn. The minimum orifice size shall be 2" diameter. The design of the suction header and orifices shall be such as to insure hydraulic balance in the tank and a uniform sludge withdrawal from the entire tank bottom.

The suction header shall be designed for a sludge return of 480 gpm (0.69 MGD Average) and a maximum headloss of 1.25 feet for a sludge return of 1310 gpm (1.89 MGD Maximum). The minimum velocity through the suction header shall be 0.5 FPS at 290 gpm (0.42 MGD Minimum).

The suction header shall be hot dipped galvanized after fabrication.

Skimmer Assembly.....The surface skimmer shall consist of a rotating scum deflector bade of 1/4" steel plate, fastened to and supported by the influent well and the truss arm, to move the floating scum outward to the scum baffle and extending to the skimmer assembly. A 4'-0" skimmer assembly, fabricated from aluminum and non-corrosive material, shall be constructed to form a pocket for trapping the scum. The hinged skimmer blade, with an adjustable neoprene wiper, shall be the width of the scum trough.

CLARIFIER COMPONENTS: (Continued)

Scum Trough.....A 4'-0" wide scum trough, fabricated of 1/4" steel plate, shall have a 6" standard 125# pipe flange connection for the scum discharge pipe and shall be supported from the tank wall. The scum trough shall be self-flushing with an adjustable trip arm to activate a 3" flap gate.

* **Weir Plates**.....The effluent weirs shall consist of 1/4" by 12" fiberglass sections with 3" deep v-notches space on 6" centers. The effluent weir sections shall be furnished with round washers and splice plates for mounting to the tank wall.

Scum baffles.....The scum baffles shall consist of 1/4" by 12" fiberglass sections. The scum baffle sections shall be furnished with adjustable mounting brackets for mounting to the tank wall.

* **Anchorage**.....One (1) set of hook type anchor bolts set in a steel template for the center column, one (1) set of hook type anchor bolts for the seal plate and one (1) lot of expansion anchors for the bridge, scum trough, scum baffles and weir plates.

Note: Hook anchors for center column and seal plate were supplied by contractor per W.P.E. drawings.

THE FOLLOWING ITEMS ARE NOT FURNISHED BY W.P.E:

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.

Scum spray system.

PAINT SPECIFICATIONS

TNEMEC

PRODUCT DATA SHEET

HI-BUILD EPOXOLINE II N69 or V69

PRODUCT PROFILE

GENERIC DESCRIPTION Polyamidoamine Epoxy

COMMON USAGE An advanced generation epoxy for protection and finishing of steel and concrete. It has excellent resistance to abrasion and is suitable for immersion as well as chemical contact exposure. Contact your local Tnemec representative for a list of chemicals. This product can also be used for lining storage tanks that contain demineralized, deionized or distilled water. **Note:** Series V69 conforms with air pollution regulations limiting Volatile Organic Compounds (VOC) to a maximum of 250 grams/litre (2.08 lbs/gal) in areas requiring less than 100 grams/litre VOC, please refer to the Series L69 data sheet.

COLORS Refer to Tnemec Color Guide. **Note:** Epoxies chalk with extended exposure to sunlight. 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 cause yellowing to occur.

FINISH Satin

SPECIAL QUALIFICATIONS A two-coat system at 4.0-6.0 dry mills (100-150 dry microns) per coat passes the performance requirements of **MIL-PRF-4556F** for fuel storage.

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

COATING SYSTEM

PRIMERS **Steel:** Self-priming or Series 1, 27, 37H, 66, 90E-92, 90-97, 90-1K97, 91-H_2O, 94-H_2O, 135, 161, 394, 530
Galvanized Steel and Non-Ferrous Metal: Self-priming or Series 66, 161
Concrete: Self-priming or Series 130, 218
CMU: Self-priming or 54-562, 130, 215, 216, 218

TOPCOATS 46H-413, 66, L69, N69, 73, 84, 104, 113, 114, 161, 175, 1028, 1029, 1070, 1071, 1072, 1074, 1074U, 1075, 1075U, 1077, 1078. Refer to COLORS on applicable topcoat data sheets for additional information. **Note:** The following recoat times apply for Series N69/V69: Immersion Service—Surface must be scarified after 60 days. Atmospheric Service—After 60 days, scarification or an epoxy tie-coat is required. Contact your Tnemec representative for specific recommendations.

SURFACE PREPARATION

PRIMED STEEL **Immersion Service:** Scarify the Series 66, N69/V69 or 161 prime coat surface by abrasive blasting with fine abrasive before topcoating if it has been exterior exposed for 60 days or longer and N69/V69 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 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, ICRI CSP 2-4 Surface Preparation of Concrete and Tnemec's Surface Preparation and Application Guide.

CMU Allow mortar to cure for 28 days. Level protrusions and mortar spatter.

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

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

TECHNICAL DATA

VOLUME SOLIDS 67.0 ± 2.0% (mixed) †

RECOMMENDED DFT 2.0 to 10.0 mils (50 to 255 microns) per coat. **Note:** MIL-PRF-4556F applications require two coats at 4.0-6.0 mils (100-150 microns) per coat. Otherwise, the number of coats and thickness requirements will vary with substrate, application method and exposure. Contact your Tnemec representative.

CURING TIME AT 5 MILS DFT Without 44-700 Accelerator

Temperature	To Handle	To Recoat	Immersion
90°F (32°C)	4 hours	7 hours	6 days
80°F (27°C)	5 hours	8 hours	7 days
70°F (21°C)	7 hours	10 hours	7 days
60°F (16°C)	8 hours	12 hours	9 days
50°F (10°C)	12 hours	16 hours	12 days

Curing time varies with surface temperature, air movement, humidity and film thickness. **Note:** For faster curing and low-temperature applications, add No. 44-700 Epoxy Accelerator; see separate product data sheet.

VOLITILE ORGANIC COMPOUNDS
N69 - **Unthinned:** 2.40 lbs/gallon (285 grams/litre)
Thinned 10% (No. 4 Thinner): 2.80 lbs/gallon (334 grams/litre)
Thinned 10% (No. 60 Thinner): 2.80 lbs/gallon (335 grams/litre)
V69 - **Unthinned:** 1.95 lbs/gallon (234 grams/litre)
Thinned 2.5%: 2.08 lbs/gallon (250 grams/litre) †

HAPS
N69 - **Unthinned:** 2.40 lbs/gal solids
Thinned 10% (No. 4 Thinner): 3.25 lbs/gal solids
Thinned 10% (No. 60 Thinner): 2.40 lbs/gal solids
V69 - **Unthinned:** 2.05 lbs/gal solids
Thinned 2.5%: 2.30 lbs/gal solids)

THEORETICAL COVERAGE 1,074 mil sq ft/gal (26.4 m^2/L at 25 microns). See APPLICATION for coverage rates. †

HI-BUILD EPOXOLINE II | N69 or V69

NUMBER OF COMPONENTS Two: Part A (amine) and Part B (epoxy)

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

NET WEIGHT PER GALLON N69: 13.67 ± 0.25 lbs (6.10 ± .11 kg) (mixed) V69: 14.01 ± 0.25 lbs (6.36 ± .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 N69 & V69 Part A: 82°F (28°C) N69 Part B: 93°F (34°C) V69 Part B: 86°F (30°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.

APPLICATION

COVERAGE RATES

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m²/Gal)
Suggested (1)	6.0 (150)	9.0 (230)	179 (16.6)
Minimum	2.0 (50)	3.0 (75)	537 (49.9)
Maximum	10.0 (250)	15.0 (375)	107 (10.0)

Dense Concrete & Masonry: From 100 to 150 sq ft (9.3 to 13.9 m²) per gallon.
CMU: From 75 to 100 sq ft (7.0 to 9.3 m²) per gallon.
(1) Note for Steel: Roller or brush application requires two or more coats to obtain recommended film thickness. Also, Series N69 can be spray applied to an optional high-build film thickness range of 8.0 to 10.0 dry mils (205 to 255 dry microns) or 11.5 to 14.5 wet mils (209 to 370 wet microns). Allow for overspray and surface irregularities. 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
1. Start with equal amounts of both Parts A & B.
2. Using a power mixer, separately stir Parts A & B.
3. (For accelerated version. If not using 44-700, skip to No. 4.)
Add four (4) fluid ounces of 44-700 per gallon of Part A while Part A is under agitation.
4. Add Part A to Part B under agitation, stir until thoroughly mixed.
5. Both components must be above 50°F (10°C) prior to mixing. For application of the unaccelerated version to surfaces between 50°F to 60°F (10°C to 16°C) or the accelerated version to surfaces between 35°F to 50°F (2°C to 10°C), allow mixed material to stand 30 minutes and restir before using.
6. For optimum application properties, the material temperature should be above 60°F (16°C).
Note: The use of more than the recommended amount of 44-700 will adversely affect performance.

THINNING Use No. 4 or No. 60 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. **Note:** When using Series V69, a maximum of 2.5% of No. 4 Thinner may be used to comply with VOC regulations.

POT LIFE Without 44-700 15 hours at 50°F (10°C) 5 hours at 77°F (25°C) 3 hours at 100°F (38°C)
With 44-700 8 hours at 35°F (2°C) 4 hours at 77°F (25°C) 1 hour 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)	3000-4800 psi (207-330 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.
‡ Spray application of first coat on CMU should be followed by backrolling. **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: Use 3/8" or 1/2" (9.5 mm or 12.7 mm) synthetic woven nap roller cover. Use longer nap to obtain penetration on rough or porous surfaces.
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.

6800 Corporate Drive Kansas City, Missouri 64120-1372 1-800-TNEMEC1 Fax: 1-816-483-3969 www.tnemec.com

AGMA CALCULATIONS

(1)

PROJECT NAME: SECONDARY CLARIFIERS
FOUNTAIN, COLORADO
CONTRACT NUMBER: Q10600A

SPUR & WORM GEAR DRIVE CONTINUOUS TORQUE RATING SUMMARY

ANSI/AGMA 2001-D04 (12/28/04) - SPUR GEAR
ANSI/AGMA 6034-B92 (02/07/92) - WORM GEAR

CALCULATIONS BY: WTW
DATE: 03/28/11
WPE
"SPUR GEAR 2006" REV #0 - 4/17/2006

Spur Gear Drive Model:	28HI	1 Pinion
Worm Gear Drive Model:	A6	1 Worm Gear
Collector Diameter:	60.000	FEET
Operating Speed :	0.0420	RPM
Collector Tip Speed:	7.785	FEET / MINUTE
Spur Gear Operating Life:	20.000	YEARS
Spur Gear Cycles:	441,806	
Pinion Cycles:	3,092,645	

MATERIALS SPECIFICATIONS:

SPUR GEAR MATERIAL	120-90-02 DI
SPUR GEAR MIN HARDNESS	277 BHN
PINION MATERIAL	AISI 4150 GR 2 THS
PINION MIN HARDNESS	321 BHN
SPUR GEAR HOUSING	ASTM A-48 CL 40
BEARING BALLS	ABMA Gr 50 CAS @ 63/66 Rc
RACE INSERTS	AISI E4340, 43 Rc Min.
WORM GEAR MATERIAL	CENT CAST UNS 86300 BRONZE
WORM MATERIAL	AISI 8620 CARB 58 Rc

Where:

"IHS" - Induction Hardened Steel
"THS" - Thru Hardened Steel
"DI" - Ductile Iron
"BHN" - Brinnell Hardness
"Cl" - Class
"Rc" - Rockwell Hardness
"UNS" - Unified Numbering System

Required Spur Gear Torque:	75,600	IN LBS
(Continuous Torque)	6,300	FT LBS
Required Worm Gear Torque:	11,368	IN LBS
(For required spur gear torque)	947	FT LBS
Spur Gear Momentary Peak Torque:	521,784	IN LBS
	43,482	FT LBS
% Spur Gear Momentary Peak Torque To Required (Continuous) Torque:	690.2%	
Worm Gear Momentary Peak Torque:	114,526	IN LBS
	9,544	FT LBS
% Worm Gear Momentary Peak Torque To Required (Continuous) Torque:	1007.4%	
Required Motor Brake HP:	0.122	BHP

GEAR GEOMETRY SPECIFICATIONS

SPUR GEAR DIMENSIONAL DATA:		
Pitch Diameter	28.0000	IN
Tooth Count	84	
Tooth Face Width	3.0600	IN
Diametral Pitch	3.0000	
Operating Pressure Angle	20.0000	DEG
PINION DATA:		
Pitch Diameter	4.0000	IN
Tooth Count	12.0000	
Reduction Ratio	7.0000	:1
Aspect Ratio	0.7650	:1
MAIN BEARING DATA:		
Ball Race Diameter	31.0000	IN
Individual Ball Diameter	1.2500	IN
Ball Count	79	
WORM GEAR DIMENSIONAL DATA:		
Pitch Diameter	9.5908	IN
Ratio	43.0000	:1
SPROCKET RATIO:	3.0000	:1

SPUR GEAR MAIN DRIVE PITTING (DURABILITY) CONTINUOUS TORQUE RATING:

	FT LBS	IN LBS	
GEAR	14,732	176,779	233.8% OF REQUIRED TORQUE
PINION	15,949	191,391	253.2% OF REQUIRED TORQUE

SPUR GEAR MAIN DRIVE BENDING MOMENT (STRENGTH) CONTINUOUS TORQUE RATING:

	FT LBS	IN LBS	
GEAR	26,039	312,469	413.3% OF REQUIRED TORQUE
PINION	23,373	280,473	371.0% OF REQUIRED TORQUE

SPUR GEAR MAIN DRIVE CONTINUOUS TORQUE RATING:

FT LBS	IN LBS	GEAR DURABILITY LIMITS RATING:
14,732	176,779	233.8% OF REQUIRED TORQUE

WORM GEAR DRIVE CONTINUOUS TORQUE RATING:

FT LBS	IN LBS	
3,181	38,175	335.8% OF REQUIRED TORQUE

L-10 BEARING LIVES: SPUR GEAR ROTATION CLOCKWISE

SPECIFIED YEARS	RATED HOURS	RATED YEARS	
20.0	14,930,650	1,703.2	WORM SHAFT INPUT
20.0	7,011,436	799.8	WORM SHAFT THRUST
20.0	167,283,231	19,083.2	UPPER PINION/WORM GEAR
20.0	3,261,874	372.1	LOWER PINION
20.0	17,737,291	2,023.4	MAIN RACEWAY

PROJECT NAME: SECONDARY CLARIFIERS
FOUNTAIN, COLORADO
CONTRACT #: Q10600A

CALCULATION OF SPUR GEAR MAIN DRIVE BENDING MOMENT
ANSI/AGMA 2001-D04 (12/28/04)

CALCULATIONS BY: WTW
DATE: 03/28/11

WPE
"SPUR GEAR 2006" REV #0 - 4/17/2006

(2)

GIVEN:

Drive Model:	28HI	
Operating Speed :	0.0420	RPM
Operating Life:	20.000	Years

FORMULAE:

Combined Formulae for Allowable Transmitted Tangential Load (W_t), LBS

$$W_t = \frac{(F)(S_{at})(J)(Y_N)(n)}{(K_o)(K_v)(K_B)(K_m)(K_s)(K_T)(K_R)(P_d)(S_f)} \text{ LBS}$$

Allowable Output Torque, FT LBS

$$T = \frac{(W_t)(D)}{24} \text{ FT LBS}$$

WHERE:

W_t (LBS)	=	Allowable transmitted tangential load
T (FT LBS)	=	Allowable output torque
K_v	=	Dynamic Factor
F (IN)	=	Gear face width
J	=	Geometry Factor
K_s	=	Size Factor
K_m	=	Load Distribution Factor
K_o	=	Overload Factor
K_B	=	Rim Thickness Factor
S_{at} (PSI)	=	Allowable Bonding Stress
Y_N	=	Life Factor
K_t	=	Temperature Factor
K_r	=	Reliability Factor
D (IN)	=	Gear Pitch Diameter
P_d (IN)	=	Diametral Pitch
S_f	=	Factor of Safety
N	=	Number of Pinions Factor

FACTORS DICTATED BY GEAR DATA: VALUES:

D = Gear Pitch Diameter	=	28.0000	IN
F = Gear Face Width	=	3.0600	IN
S_{ay} = Gear Yield Strength	=	90,000	PSI
d = Pinion Pitch Diameter	=	4.0000	IN
F = Pinion Face Width	=	3.0600	IN
S_{ay} = Pinion Yield Strength	=	120,000	PSI
P_d = Diametral Pitch	=	3.0000	
m_G = Gear Set Ratio	=	7.0000	
O = Operating Press Angle	=	20.0000	DEG
n_p = Pinion Speed	=	0.2940	RPM
N = Number of Pinions Factor	=	1.0000	

FACTORS FROM AGMA STANDARD: VALUES:

K_s = Size Factor	=	1.0000	
K_m = Load Distribution Factor	=	1.2047	
K_o = Application Factor	=	1.0000	
K_T = Temperature Factor	=	1.0000	
K_R = Reliability Factor Bending	=	1.0000	
K_B = Rim Thickness Factor	=	1.0000	
J = Geometry Factor, Gear	=	0.4680	
S_{at} = Allowable Bending Stress, Gear	=	44,000	PSI
K_v = Dynamic Factor, Gear	=	1.0077	
Y_N = Life Factor, Gear	=	1.2900	
J = Geometry Factor, Pinion	=	0.4670	
S_{at} = Allowable Bending Stress, Pinion	=	49,000	PSI
K_v = Dynamic Factor, Pinion	=	1.0049	
Y_N = Life Factor, Pinion	=	1.0391	
S_F = Factor of Safety for Bending	=	1.0000	

ALLOWABLE OUTPUT TORQUE CALCULATIONS, LIMITED BY GEAR:

$$W_t = \frac{(\ 3.0600\ )(\ 44,000\ )(\ 0.4680\ )(\ 1.2900\ )(\ 1.0000\ )}{(\ 1.0000\ )(\ 1.0077\ )(\ 1.0000\ )(\ 1.2047\ )(\ 1.0000\ )(\ 1.0000\ )(\ 1.0000\ )(\ 3.0000\ )(\ 1.0000\ )}$$

W_t = 22,319 LBS

$$T = \frac{(\ 22,319\ )(\ 28\ )}{(\ 24\ )} = 26,039 \text{ FT LBS MAXIMUM CONTINUOUS TORQUE}$$

= 312,469 IN LBS MAXIMUM CONTINUOUS TORQUE

ALLOWABLE OUTPUT TORQUE CALCULATIONS, LIMITED BY PINION:

$$W_t = \frac{(\ 3.0600\ )(\ 49,000\ )(\ 0.4670\ )(\ 1.0391\ )(\ 1.0000\ )}{(\ 1.0000\ )(\ 1.0049\ )(\ 1.0000\ )(\ 1.2047\ )(\ 1.0000\ )(\ 1.0000\ )(\ 1.0000\ )(\ 3.0000\ )(\ 1.0000\ )}$$

W_t = 20,034 LBS

$$T = \frac{(\ 20,034\ )(\ 28\ )}{(\ 24\ )} = 23,373 \text{ FT LBS MAXIMUM CONTINUOUS TORQUE}$$

= 280,473 IN LBS MAXIMUM CONTINUOUS TORQUE

Bending Moment Allowable Torque = 23,373 FT LBS, MAX CONTINUOUS TORQUE
(Pinion Limits)
= 280,473 IN LBS, MAX CONTINUOUS TORQUE

PROJECT NAME: SECONDARY CLARIFIERS
FOUNTAIN, COLORADO
CONTRACT NUMBER: Q10600A

CALCULATION OF SPUR GEAR MAIN DRIVE PITTING RESISTANCE

ANSI/AGMA 2001-D04 (12/28/04)

CALCULATIONS BY: WTW

DATE: 03/28/11

WPE
"SPUR GEAR 2006" REV #0 - 4/17/2006

(3)

GIVEN:

Drive Model: 28HI
Operating Speed : 0.0420 RPM
Operating Life: 20.000 Years

FORMULAE:

Combined Formulae for Allowable Transmitted Tangential Load (W_t), LBS

$$W_t = \frac{(d)(F)(I)(n)}{(K_o)(K_v)(K_s)(K_m)(C_f)} \times \left| \frac{(Z_N)(s_{ac})(C_H)}{(C_p)(K_T)(K_R)(S_H)} \right|^2 \text{ LBS}$$

Allowable Output Torque, FT LBS

$$T = \frac{(W_t)(D)}{24} \text{ FT LBS}$$

WHERE:

W_t (LBS) = Allowable tangential load
T (FT LBS) = Allowable output torque
d (IN) = Pinion pitch diameter
F (IN) = Gear face width
I = Geometry Factor
K_v = Dynamic Factor
K_s = Size Factor
K_m = Load Distribution Factor
C_f = Surface Condition Factor
K_o = Overload Factor
S_{ac} (PSI) = Allowable Contact Stress
Z_N = Life Factor
C_H = Hardness Ratio Factor
C_p = Elastic Coefficient
K_T = Temperature Factor
K_R = Reliability Factor
S_H = Factor of Safety
N = Number of Pinions Factor

FACTORS DICTATED BY GEAR DATA: VALUES:

D = Gear Pitch Diameter	=	28.0000	IN
F = Gear Face Width	=	3.0600	IN
S_{ay} = Gear Yield Strength	=	90,000	PSI
d = Pinion Pitch Diameter	=	4.0000	IN
F = Pinion Face Width	=	3.0600	IN
S_{ay} = Pinion Yield Strength	=	120,000	PSI
P_d = Diametral Pitch	=	3.0000	
m_G = Gear Set Ratio	=	7.0000	
O = Operating Pressure Angle	=	20.0000	DEG
n_P = Pinion Speed	=	0.2940	RPM
N = Number of Pinions Factor	=	1.0000	

FACTORS FROM AGMA STANDARDS: VALUES:

K_s = Size Factor	=	1.0000	
K_m = Load Distribution Factor	=	1.2047	
C_f = Surface Condition Factor	=	1.0000	
K_o = Overload Factor	=	1.0000	
C_p = Elastic Coefficient	=	2,160	
K_T = Temperature Factor	=	1.0000	
K_r = Reliability Factor Pitting	=	0.8500	
I = Geometry Factor	=	0.1875	
S_{ac} = Allowable Contact Stress, Gear	=	126,000	PSI
C_H = Hardness Ratio Factor, Gear	=	1.0000	
Z_N = Life Factor, Gear	=	1.1909	
K_v = Dynamic Factor, Gear	=	1.0077	
S_{ac} = Allowable Contact Stress, Pinion	=	146,000	PSI
C_H = Hardness Ratio Factor, Pinion	=	1.0000	
Z_N = Life Factor, Pinion	=	1.0679	
K_v = Dynamic Factor, Pinion	=	1.0049	
S_H = Factor of Safety for Pitting	=	1.0000	

ALLOWABLE OUTPUT TORQUE CALCULATIONS, LIMITED BY GEAR:

$$W_t = \frac{(\ 4.0000\ )(\ 3.0600\ )(\ 0.1875\ )(\ 1.0000\ )}{(\ 1.0000\ )(\ 1.0077\ )(\ 1.0000\ )(\ 1.2047\ )(\ 1.0000\ )} \times \left| \frac{(\ 1.1909\ )(\ 126,000\ )(\ 1.0000\ )}{(\ 2,160\ )(\ 1.0000\ )(\ 0.8500\ )(\ 1.0000\ )} \right|^2$$

W_t = 12,627 LBS

$$T = \frac{(\ 12,627\ )(\ 28\ )}{(\ 24\ )} = 14,732 \text{ FT LBS, MAXIMUM CONTINUOUS TORQUE}$$

= 176,779 IN LBS, MAXIMUM CONTINUOUS TORQUE

ALLOWABLE OUTPUT TORQUE CALCULATIONS, LIMITED BY PINION:

$$W_t = \frac{(\ 4.0000\ )(\ 3.0600\ )(\ 0.1875\ )(\ 1.0000\ )}{(\ 1.0000\ )(\ 1.0049\ )(\ 1.0000\ )(\ 1.2047\ )(\ 1.0000\ )} \times \left| \frac{(\ 1.0679\ )(\ 146,000\ )(\ 1.0000\ )}{(\ 2,160\ )(\ 1.0000\ )(\ 0.8500\ )(\ 1.0000\ )} \right|^2$$

W_t = 13,671 LBS

$$T = \frac{(\ 13,671\ )(\ 28\ )}{(\ 24\ )} = 15,949 \text{ FT LBS, MAXIMUM CONTINUOUS TORQUE}$$

= 191,391 IN LBS, MAXIMUM CONTINUOUS TORQUE

Pitting Resistance Allowable Torque
(Gear Limits) = 14,732 FT LBS, MAXIMUM CONTINUOUS TORQUE

= 176,779 IN LBS, MAXIMUM CONTINUOUS TORQUE

PROJECT NAME: SECONDARY CLARIFIERS
FOUNTAIN, COLORADO
CONTRACT NUMBER: Q10600A

CALCULATION OF WORM GEAR TORQUE RATING

ANSI/AGMA 6034-B92 (02/07/92)

CALCULATIONS BY: WTW

DATE: 03/28/11

WPE
"SPUR GEAR 2006" REV #0 - 4/17/2006

(4)

INPUTED PROJECT REQUIREMENTS:

	REQUIRED OUTPUT TORQUE OF SPUR GEAR SET:	75,600	IN-LBS	
	ROTATIONAL SPEED OF SPUR GEAR:	0.0420	RPM	
	SPUR GEAR SET RATIO:	7.0000		
	NUMBER OF WORM GEAR SETS PER SPUR GEAR:	1		
T	REQUIRED OUTPUT TORQUE OF WORM GEAR SET:	11,368	IN-LBS	TO DEVELOP THE REQUIRED SPUR GEAR OUTPUT TORQUE (FACTOR OF SAFETY = 1.0)
n_G	ROTATIONAL SPEED OF WORM GEAR:	0.2940	RPM	
SF	REQUIRED WORM GEAR SAFETY FACTOR:	1.2500	: 1	

INPUTED WORM GEAR PARAMETERS:

	WORM GEAR SELECTION:	A6		
	WORM GEAR MATERIAL:	CENT CAST UNS 86300 BRONZE		
	WORM MATERIAL:	AISI 8620 CARB 58 Rc		
D_m	WORM GEAR PITCH DIAMETER:	9.5908	INCHES	
D_o	WORM GEAR OUTSIDE DIAMETER:	10.0000	INCHES	
D_t	WORM GEAR THROAT DIAMETER:	9.8440	INCHES	
D_r	WORM GEAR ROOT DIAMETER:	8.8860	INCHES	
F_e	WORM GEAR FACE WIDTH:	1.7500	INCHES	
N_G	NUMBER OF TEETH, WORM GEAR:	43.0000		
d_m	WORM MEAN/PITCH DIAMETER:	2.4092	INCHES	
d_o	WORM OUTSIDE DIAMETER:	3.0460	INCHES	
d_r	WORM ROOT DIAMETER:	2.0840	INCHES	
N_W	NUMBER OF THREADS, WORM:	1.0000		
C	CENTER DISTANCE:	6.0000	INCHES	
m_G	WORM GEAR SET REDUCTION RATIO:	43.0000	: 1	
λ	LEAD ANGLE OF WORM THREAD:	5.2891	DEGREES	
Φ_n	NORMAL PRESSURE ANGLE OF WORM THREAD:	20.0000	DEGREES	
C_s	MATERIALS FACTOR:	1,075		APPENDIX C, AGMA 6034-B92, BASED ON ABOVE Dm
		0.8081		

INITIAL CALCULATIONS:

n_W	ROTATIONAL SPEED OF WORM:	12.6420	RPM	(N * m_G)
F_e	EFFECTIVE FACE WIDTH OF WORM GEAR:	1.6061	INCHES	(2 / 3 * dm)
v	SLIDING VELOCITY AT WORM MEAN/PITCH DIAMETER:	8.0077	FPM	(π * n_w * d_m) / (12 * cos λ)
C_m	RATIO CORRECTION FACTOR:	0.9540		PRACTICAL GEAR DESIGN, DARLE W. DUDLEY, 1954, PAGE 139, Eq. (3-60)
C_v	VELOCITY FACTOR:	0.7920		APPENDIX C, AGMA 6034-B92, BASED ON ABOVE v
μ	FRICTIONAL COEFFICIENT:	0.0934		APPENDIX C, AGMA 6034-B92, BASED ON ABOVE v
f	FRICTION ANGLE:	5.3373	DEGREES	

FINAL CALCULATIONS:

W_t	ALLOWABLE TANGENTIAL LOAD ON WORM GEAR TEETH:	7,961	LBS	(C_s * (D_m $^{0.800}$) * F_e * C_m * C_v)
W_f	FRICTIONAL FORCE:	795	LBS	(μ * W_t) / (cosλ * cosΦ_n)
T_G	OUTPUT TORQUE DELIVERED BY WORM GEAR SET:	38,175	IN-LBS	(W_t * D_m / 2)
P_o	POWER DELIVERED BY WORM GEAR SET:	0.1782	HP	(W_t * D_m * n_W) / (126,000 * m_G)
P_i	POWER INPUT TO WORM GEARING MESH:	0.3710	HP	(W_t * D_m * n_W) / (126,000 * m_G) + (v * W_f / 33,000)
η	WORM GEAR SET EFFICIENCY:	48.016%		(P_o / P_i)
T_r	WORM GEAR SET TORQUE RATING:	38,175	IN-LBS	(T_G / T) ----> 3.36 :1 ACTUAL SAFETY FACTOR
		3,181	FT-LBS	

THE ACTUAL SAFETY FACTOR IS > THE REQUIRED SAFETY FACTOR.

PROJECT NAME: SECONDARY CLARIFIERS
FOUNTAIN, COLORADO
CONTRACT NUMBER: Q10600A

L10 LIFE - REMOVABLE BEARING RACE CALCULATIONS

CALCULATIONS BY: WTW
DATE: 03/28/11

WPE
"SPUR GEAR 2006" REV #0 - 4/17/2006

SPUR GEAR MODEL:	28HI	
NUMBER OF PINION DRIVES:	1	
CONTINUOUS SPUR GEAR TORQUE:	75,600	IN LBS
THRUST LOAD ON SPUR GEAR (TOTAL DEAD & LIVE LOAD):	14,925	LBS
COLLECTOR OUTPUT SPEED:	0.0420	RPM
SPUR GEAR PITCH DIAMETER:	28	IN
SPUR GEAR TOOTH PRESSURE ANGLE:	20	DEGREES
BEARING RACE DIAMETER:	31.0000	IN
BEARING BALL DIAMETER:	1.2500	IN
BEARING BALL COUNT:	79	
RELIABILITY FACTOR:	1.0000	
MATERIAL FACTOR:	1.0000	
LUBRICATION FACTOR:	1.0000	
MOMENT LOAD ON MECHANSIM	0	LB FT
BEARING BALL CRUSHING STRENGTH	122,400	LBS

THRUST BEARING LIFE:

THRUST BEARING CAPACITY	57,313	LBS
LOAD IMPOSED ON BEARING THRUST	14,925	LBS
THRUST BEARING LIFE RATING	56,626,376	REVOLUTIONS
THRUST BEARING LIFE RATING	22,470,784	HOURS
THRUST BEARING LIFE RATING	2,563	YEARS

RADIAL BEARING LIFE:

SUM OF TANGENTIAL FORCES, TF	5,400	LBS
SUM OF RADIAL FORCES	1,965	LBS
MAXIMUM RADIAL FORCE	5,747	LBS
RADIAL BEARING CAPACITY	31,648	LBS
RADIAL BEARING LIFE	167,040,575	REVOLUTIONS
RATED HOURS OF LIFE	66,285,942	HOURS
RADIAL BEARING LIFE	7,562	YEARS

COMBINED THRUST AND RADIAL BEARING LIFE:

COMBINED STATISTICAL LIFE OF THRUST & RADIAL BEARINGS	44,697,974	REVOLUTIONS
COMBINED STATISTICAL HOURS OF LIFE OF THRUST & RADIAL BEARINGS	17,737,291	HOURS
COMBINED STATISTICAL YEARS OF LIFE OF THRUST & RADIAL BEARINGS	2,023	YEARS

(6)

PROJECT NAME: SECONDARY CLARIFIERS
FOUNTAIN, COLORADO
CONTRACT NUMBER: Q10600A

ABMA L10 BEARING LIFE CALCULATIONS
FOR BALL AND ROLLER BEARINGS
TIMKEN BEARING SYSTEMS ANALYSIS L10 LIFE CALCULATIONS
FOR TAPERED ROLLER BEARINGS

CALCULATIONS BY: WTW
DATE: 03/28/11

WPE
"SPUR GEAR 2006" REV #0 - 4/17/2006

SPUR GEAR ROTATION CLOCKWISE

SPUR GEAR MODEL: 28HI
WORM GEAR MODEL: A6

CONTINUOUS SPUR GEAR TORQUE:	75,600	IN LBS
CONTINUOUS WORM GEAR TORQUE:	11,368	IN LBS
COLLECTOR OUTPUT SPEED:	0.0420	RPM
PINION & WORM GEAR SPEED:	0.2940	RPM
WORM SPEED:	12.6420	RPM
AXIAL THRUST, Wa	2,371	LBS
SEPARATING FORCE BETWEEN WORM & GEAR, Wr	902	LBS
TANGENTIAL FORCE ON WORM, Wt	457	LBS
TANGENTIAL FORCE ON DRIVEN SPROCKET, St	154	LBS
TANGENTIAL FORCE ON PINION TOOTH, Pt	5,684	LBS
SEPARATING FORCE BETWEEN PINION & SPUR GEAR, Pr	2,069	LBS
DRIVEN SPROCKET WEIGHT, Ws	5	LBS
WORM SHAFT WEIGHT, Ww	17	LBS
WORM GEAR WEIGHT, Wg	18	LBS
PINION & RETAINER WEIGHT, Wp	32	LBS
OVERLOAD SPRING PRELOAD, Pl	0	LBS

REACTIVE LOADS ON BEARING #1 (LBS):
WORM SHAFT INPUT BEARING {VECTORS}

	Fx	Fy	Fz
Wa	0	(246)	
Wr		492	
Wt			249
Ws			7
Ww			11
St			(201)
TOTAL	0	246	66
SCALAR	0	246	66

RESULTANT RADIAL LOAD, Fr:	255 LBS
VALUE OF Fz/Co (Fa/Co):	0
VALUE OF Fx/Fr (Fa/Fr):	0
BEARING "e":	0.2200
EQUIVALENT DYNAMIC LOAD, P:	255
BEARING #1 L10 LIFE:	14,930,650 HRS

REACTIVE LOADS ON BEARING #3 (LBS):
UPPER PINION BEARING {VECTORS}

	Fx	Fy	Fz = Fea
Wa	3,146	0	
Wr	0	(1,197)	
Wt	0	200	(457)
Pt		771	
Pr	(281)		
Wg			18
Wp			32
TOTAL	2,866	(227)	(407)
SCALAR	2,866	227	407

RESULTANT RADIAL LOAD, Fr:	2,875 LBS
DYNAMIC EQUIVALENT RADIAL LOAD:	2,875 LBS
BEARING #3 L10 LIFE:	167,283,231 HRS

REACTIVE LOADS ON BEARING #2 (LBS):
WORM SHAFT THRUST BEARING {VECTORS}

	Fx	Fy	Fz
Wa	(2,371)	246	
Wr		410	
Wt			208
Ws			(2)
Ww			6
St			47
Pl	0		
TOTAL	(2,371)	656	259
SCALAR	2,371	656	259

RESULTANT RADIAL LOAD, Fr:	705 LBS
VALUE OF Fz/Co (Fa/Co):	0.0166
VALUE OF Fx/Fr (Fa/Fr):	3.3615
BEARING "e":	1.1400
EQUIVALENT DYNAMIC LOAD, P:	1,232 LBS
BEARING #2 L10 LIFE:	7,011,436 HRS

REACTIVE LOADS ON BEARING #4 (LBS):
LOWER PINION BEARING {VECTORS}

	Fx	Fy
Wa	(776)	0
Wr	0	295
Wt	0	(200)
Pt		4,913
Pr	(1,788)	
Wg		
Wp		
TOTAL	(2,564)	5,009
SCALAR	2,564	5,009

RESULTANT RADIAL LOAD, Fr:	5,627 LBS
DYNAMIC EQUIVALENT RADIAL LOAD:	5,627 LBS
BEARING #4 L10 LIFE:	3,261,874 HRS

TR

SUCTION HEADER HYDRAULIC CALCULATIONS

PROJECT: FOUNTAIN, COLORADO **S.O.** Q10600A **MINIMUM FLOW**

NOTE: ORIFICE C.C. = 2.25 FT, MIN FLOW/HEADER = 292.00 GPM

ORIFICE NUMBER	ORIFICE LOCATION TO CL (FT)	COVERAGE AREA (FT^2)	COVERAGE AREA (%)	HEADER SIZE (IN)			HEADER AREA (IN^2)	EQUAL PIPE DIA (IN)	SECTION LENGTH (FT)	ORIFICE DIA (IN)	ORIFICE AREA (IN^2)	ORIFICE AREA (%)
MANIFOLD	4.00	-	-	12.00	x	12.00	144.00	-	-	-	-	-
1	6.25	170.79	6.09	11.93	x	12.00	143.10	13.50	2.25	2.38	4.43	4.99
2	8.50	120.11	4.29	11.25	x	12.00	135.00	13.11	2.25	2.00	3.14	3.54
3	10.75	151.90	5.42	10.58	x	12.00	126.90	12.71	2.25	2.25	3.97	4.48
4	13.00	183.69	6.55	9.90	x	12.00	118.80	12.30	2.25	2.44	4.66	5.25
5	15.25	215.48	7.69	9.23	x	12.00	110.70	11.88	2.25	2.69	5.67	6.39
6	17.50	247.28	8.82	8.25	x	12.00	99.00	11.23	2.25	2.88	6.49	7.31
7	19.75	279.07	9.96	7.13	x	12.00	85.50	10.44	2.25	3.13	7.67	8.63
8	22.00	310.86	11.09	6.00	x	12.00	72.00	9.58	2.25	3.38	8.94	10.07
9	24.25	342.65	12.23	4.88	x	12.00	58.50	8.63	2.25	3.75	11.04	12.43
10	26.50	374.45	13.36	3.67	x	12.00	44.00	7.49	2.25	4.31	14.60	16.44
11	28.75	406.24	14.50	3.00	x	8.25	24.75	5.62	2.25	4.81	18.18	20.48
END OF HEADER	29.50											
TANK WALL	30.00											
TOTAL FLOOR AREA		2802.50	100.00								88.79	100.00

ORIFICE NUMBER	FLOW THUR ORIFICE (GPM)	CUMMULATIVE HEADER FLOW (GPM)	ORIFICE VELOCITY (FPS)	HEADER VELOCITY (FPS)	ORIFICE HEADLOSS (FT)	HEADER HEADLOSS (FT)	HEADER EXIT LOSS (FT)	HEADER ARMS PER CLARIFIER	TOTAL HEADER HEADLOSS (FT)	TOTAL MANIFOLD HEADLOSS (FT)	TOTAL HEADLOSS (FT)
MANIFOLD	-	292.00	-	0.65			0.001	1	0.059		
1	14.56	292.00	1.0551	0.65	0.005	0.000				0.000	0.060
2	10.33	277.44	1.0551	0.66	0.005	0.000					
3	13.07	267.11	1.0551	0.68	0.005	0.000					
4	15.34	254.04	1.0551	0.69	0.005	0.000					
5	18.65	238.70	1.0551	0.69	0.005	0.000					
6	21.34	220.06	1.0551	0.71	0.005	0.000					
7	25.21	198.72	1.0551	0.75	0.005	0.001					
8	29.41	173.51	1.0551	0.77	0.005	0.001					
9	36.30	144.10	1.0551	0.79	0.005	0.001					
10	48.01	107.80	1.0551	0.79	0.005	0.001					
11	59.79	59.79	1.0551	0.78	0.005	0.001					
	292.00				0.05	0.01					

PROJECT: FOUNTAIN, COLORADO **S.O.** Q10600A **AVERAGE FLOW**

NOTE: ORIFICE C.C. = 2.25 FT, AVE FLOW/HEADER = 480.00 GPM

ORIFICE NUMBER	ORIFICE LOCATION TO CL (FT)	COVERAGE AREA (FT^2)	COVERAGE AREA (%)	HEADER SIZE (IN)	HEADER AREA (IN^2)	EQUAL PIPE DIA (IN)	SECTION LENGTH (FT)	ORIFICE DIA (IN)	ORIFICE AREA (IN^2)	ORIFICE AREA (%)
MANIFOLD	4.00	-	-	12.00 x 12.00	144.00	-	-	-	-	-
1	6.25	170.79	6.09	11.93 x 12.00	143.10	13.50	2.25	2.38	4.43	4.99
2	8.50	120.11	4.29	11.25 x 12.00	135.00	13.11	2.25	2.00	3.14	3.54
3	10.75	151.90	5.42	10.58 x 12.00	126.90	12.71	2.25	2.25	3.97	4.48
4	13.00	183.69	6.55	9.90 x 12.00	118.80	12.30	2.25	2.44	4.66	5.25
5	15.25	215.48	7.69	9.23 x 12.00	110.70	11.88	2.25	2.69	5.67	6.39
6	17.50	247.28	8.82	8.25 x 12.00	99.00	11.23	2.25	2.88	6.49	7.31
7	19.75	279.07	9.96	7.13 x 12.00	85.50	10.44	2.25	3.13	7.67	8.63
8	22.00	310.86	11.09	6.00 x 12.00	72.00	9.58	2.25	3.38	8.94	10.07
9	24.25	342.65	12.23	4.88 x 12.00	58.50	8.63	2.25	3.75	11.04	12.43
10	26.50	374.45	13.36	3.67 x 12.00	44.00	7.49	2.25	4.31	14.60	16.44
11	28.75	406.24	14.50	3.00 x 8.25	24.75	5.62	2.25	4.81	18.18	20.48
END OF HEADER	29.50									
TANK WALL	30.00									
TOTAL FLOOR AREA		2802.50	100.00						88.79	100.00

ORIFICE NUMBER	FLOW THUR ORIFICE (GPM)	CUMMULATIVE HEADER FLOW (GPM)	ORIFICE VELOCITY (FPS)	HEADER VELOCITY (FPS)	ORIFICE HEADLOSS (FT)	HEADER HEADLOSS (FT)	HEADER EXIT LOSS (FT)	HEADER ARMS PER CLARIFIER	TOTAL HEADER HEADLOSS (FT)	TOTAL MANIFOLD HEADLOSS (FT)	TOTAL HEADLOSS (FT)
MANIFOLD	-	480.00	-	1.07			0.002	1	0.159		
1	23.94	480.00	1.7344	1.08	0.013	0.001				0.001	0.160
2	16.97	456.06	1.7344	1.08	0.013	0.001					
3	21.48	439.09	1.7344	1.11	0.013	0.001					
4	25.21	417.60	1.7344	1.13	0.013	0.001					
5	30.65	392.39	1.7344	1.14	0.013	0.001					
6	35.08	361.74	1.7344	1.17	0.013	0.001					
7	41.44	326.66	1.7344	1.23	0.013	0.001					
8	48.34	285.22	1.7344	1.27	0.013	0.001					
9	59.68	236.88	1.7344	1.30	0.013	0.002					
10	78.92	177.21	1.7344	1.29	0.013	0.002					
11	98.28	98.28	1.7344	1.27	0.013	0.003					
	480.00				0.14	0.01					

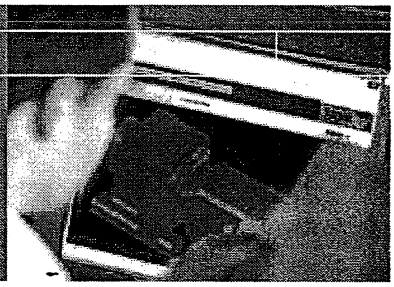
PROJECT: FOUNTAIN, COLORADO **S.O.** Q10600A **MAXIMUM FLOW**

NOTE: ORIFICE C.C. = 2.25 FT, MAX FLOW/HEADER = 1310.00 GPM

ORIFICE NUMBER	ORIFICE LOCATION TO CL (FT)	COVERAGE AREA (FT^2)	COVERAGE AREA (%)	HEADER SIZE (IN)			HEADER AREA (IN^2)	EQUAL PIPE DIA (IN)	SECTION LENGTH (FT)	ORIFICE DIA (IN)	ORIFICE AREA (IN^2)	ORIFICE AREA (%)
MANIFOLD	4.00	-	-	12.00	x	12.00	144.00	-	-	-	-	-
1	6.25	170.79	6.09	11.93	x	12.00	143.10	13.50	2.25	2.38	4.43	4.99
2	8.50	120.11	4.29	11.25	x	12.00	135.00	13.11	2.25	2.00	3.14	3.54
3	10.75	151.90	5.42	10.58	x	12.00	126.90	12.71	2.25	2.25	3.97	4.48
4	13.00	183.69	6.55	9.90	x	12.00	118.80	12.30	2.25	2.44	4.66	5.25
5	15.25	215.48	7.69	9.23	x	12.00	110.70	11.88	2.25	2.69	5.67	6.39
6	17.50	247.28	8.82	8.25	x	12.00	99.00	11.23	2.25	2.88	6.49	7.31
7	19.75	279.07	9.96	7.13	x	12.00	85.50	10.44	2.25	3.13	7.67	8.63
8	22.00	310.86	11.09	6.00	x	12.00	72.00	9.58	2.25	3.38	8.94	10.07
9	24.25	342.65	12.23	4.88	x	12.00	58.50	8.63	2.25	3.75	11.04	12.43
10	26.50	374.45	13.36	3.67	x	12.00	44.00	7.49	2.25	4.31	14.60	16.44
11	28.75	406.24	14.50	3.00	x	8.25	24.75	5.62	2.25	4.81	18.18	20.48
END OF HEADER	29.50											
TANK WALL	30.00											
TOTAL FLOOR AREA		2802.50	100.00								88.79	100.00

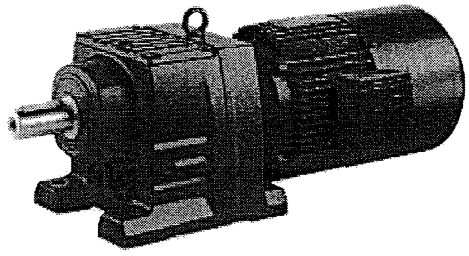
ORIFICE NUMBER	FLOW THUR ORIFICE (GPM)	CUMMULATIVE HEADER FLOW (GPM)	ORIFICE VELOCITY (FPS)	HEADER VELOCITY (FPS)	ORIFICE HEADLOSS (FT)	HEADER HEADLOSS (FT)	HEADER EXIT LOSS (FT)	HEADER ARMS PER CLARIFIER	TOTAL HEADER HEADLOSS (FT)	TOTAL MANIFOLD HEADLOSS (FT)	TOTAL HEADLOSS (FT)
MANIFOLD	-	1310.00	-	2.92			0.017	1	1.169		
1	65.33	1310.00	4.7335	2.94	0.096	0.005				0.005	1.174
2	46.33	1244.67	4.7335	2.96	0.096	0.005					
3	58.63	1198.35	4.7335	3.03	0.096	0.005					
4	68.81	1139.71	4.7335	3.08	0.096	0.006					
5	83.65	1070.90	4.7335	3.10	0.096	0.006					
6	95.73	987.25	4.7335	3.20	0.096	0.007					
7	113.10	891.52	4.7335	3.35	0.096	0.008					
8	131.92	778.42	4.7335	3.47	0.096	0.010					
9	162.87	646.49	4.7335	3.55	0.096	0.011					
10	215.39	483.63	4.7335	3.53	0.096	0.013					
11	268.23	268.23	4.7335	3.48	0.096	0.018					
	1310.00				1.06	0.09					

GEARMOTOR INFORMATION



PRODUCTFOCUS

R-Series
Parallel Gearmotors



OVERVIEW

SEW-Eurodrive's R-Series parallel gearmotors deliver exceptional performance and reliability combined with low maintenance. Available in many configurations, they continually distinguish themselves with their efficiency and durable gearing.

PRODUCT RANGE

- Power ratings from 0.05 to 433 HP
- Output speeds from 0.06 to 1346 rpm
- Output torques to 159,300 lb-in.

STANDARD FEATURES

Reducers

- Gears manufactured from certified steel, heat treated to a case hardness of 58-62 Rockwell C for long gear life
- Finished ground or shaved gear teeth to assure maximum mechanical efficiency (approximately 1.5% loss/gear stage), minimum noise and heat generation
- High capacity anti-friction bearings for optimum load carrying capacity and long life
- Captured keys on input and output shafts
- Gearcases made of high strength gray cast iron, SAE Class 30. R27 and smaller made of high strength pressure cast aluminum
- High cross-section modulus design, with center wall for maximum rigidity
- Center tapped holes on output shafts
- Double output seal design consisting of patented bi-helix inner seal made of Viton®, and double-lip Nitrile (Buna-N) outer seal*
- Available with inch dimension solid output shafts

Motors

- NEMA design B/C
- Inverter duty
- Connection terminals
- Extremely low motor rotor inertia
- CE Mark for shipment into Europe

Mounting Configurations

- Foot or flange mounts, foot/flange mounts available on selected sizes
- Suitable for mounting in any position
- Available as a gearmotor or a gear brakemotor

OPTIONAL FEATURES

- Solid output shafts available in metric sizes
- Severe duty protection
- Long-term storage protection
- Motors with high cycling capacity fail-safe brake
- 50 Hz motors for worldwide use
- Forced cooling for low frequency motor operation
- Thermostat or thermistor protection
- Plug connector terminal box for fast motor replacement

*Applicable 7-Series

Viton® is a registered trademark of DuPont Dow Elastomers

SEW EURODRIVE

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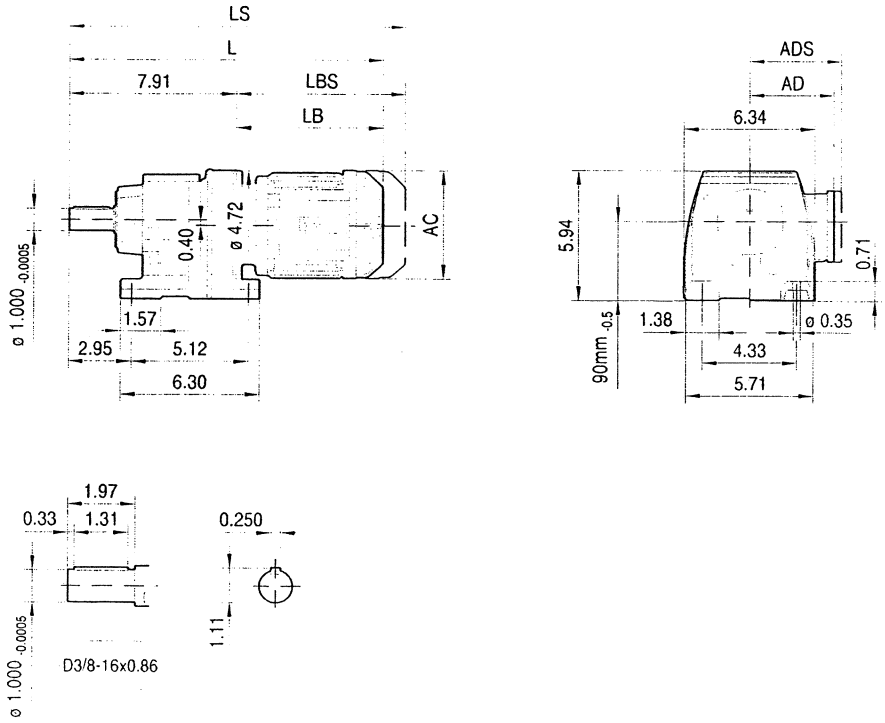

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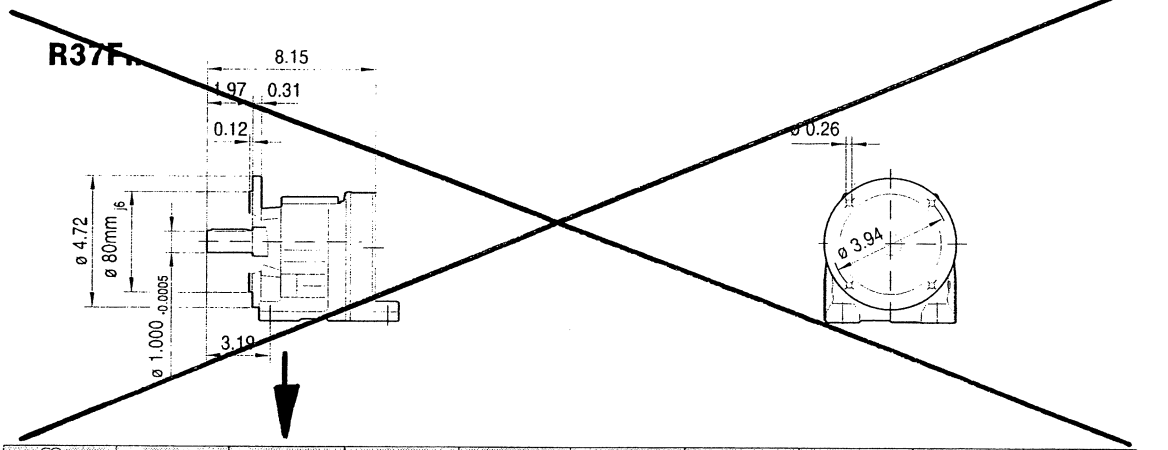
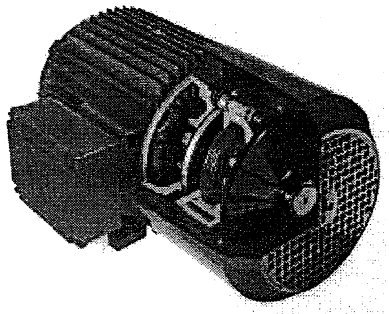


(→ 125)	DR63..	DR71S	DR71M	DR80S	DR80M	DR90M	DR90L	DR100M	DR100L/LC
AC	5.20	5.47	5.47	6.14	6.14	7.05	7.05	7.76	7.76
AD	4.13	4.69	4.69	5.04	5.04	5.51	5.51	6.18	6.18
ADS	4.13	5.08	5.08	5.47	5.47	5.91	5.91	6.22	6.22
L	15.43	15.91	16.89	17.24	18.46	18.62	19.41	20.59	21.77
LS	17.60	18.58	19.57	20.43	21.65	22.28	23.07	24.25	25.43
LB	7.52	7.99	8.98	9.33	10.55	10.71	11.50	12.68	13.86
LBS	9.69	10.67	11.65	12.52	13.74	14.37	15.16	16.34	17.52

PRODUCTFOCUS

AC Motors and Brakemotors



OVERVIEW

SEW-Eurodrive's squirrel-cage motors and brakemotors deliver exceptional performance and reliability combined with low maintenance. Designed for continuous duty under tough service conditions, these low-noise brakemotors are used wherever fast, safe braking is a major application requirement.

PRODUCT RANGE

- Power ratings from 0.25 to 100 HP
- 2-, 4-, 6-, 8-, 4/8-, 2/6-, 2/8-pole plus others
- Integral brakes to fit all frames

STANDARD FEATURES

- All motors designed for inverter duty
- Totally Enclosed Fan Cooled (TEFC)
- Continuous duty
- Standard 230/460V, 60 Hz per NEMA MG1
- Dimensional standards per IEC (metric)
- Oversized cast-iron conduit box
- Pressed-steel fan guard
- Molded plastic fan
- Connection terminals
- Extremely low rotor inertias
- High-cycle application
- CSA approved
- CE Mark for shipment into Europe

Insulation System

- Phase insulators
- Vertical dipping
- Optimized dipping for wire gauge
- Class H varnish
- Slot liners
- Top stick (wedge)
- Connecting wire sleeves
- Voltage spike resistant per NEMA MG1-31.40.4.2
- 1600 V peak at .1 µs or larger rise time

Mounting Configurations

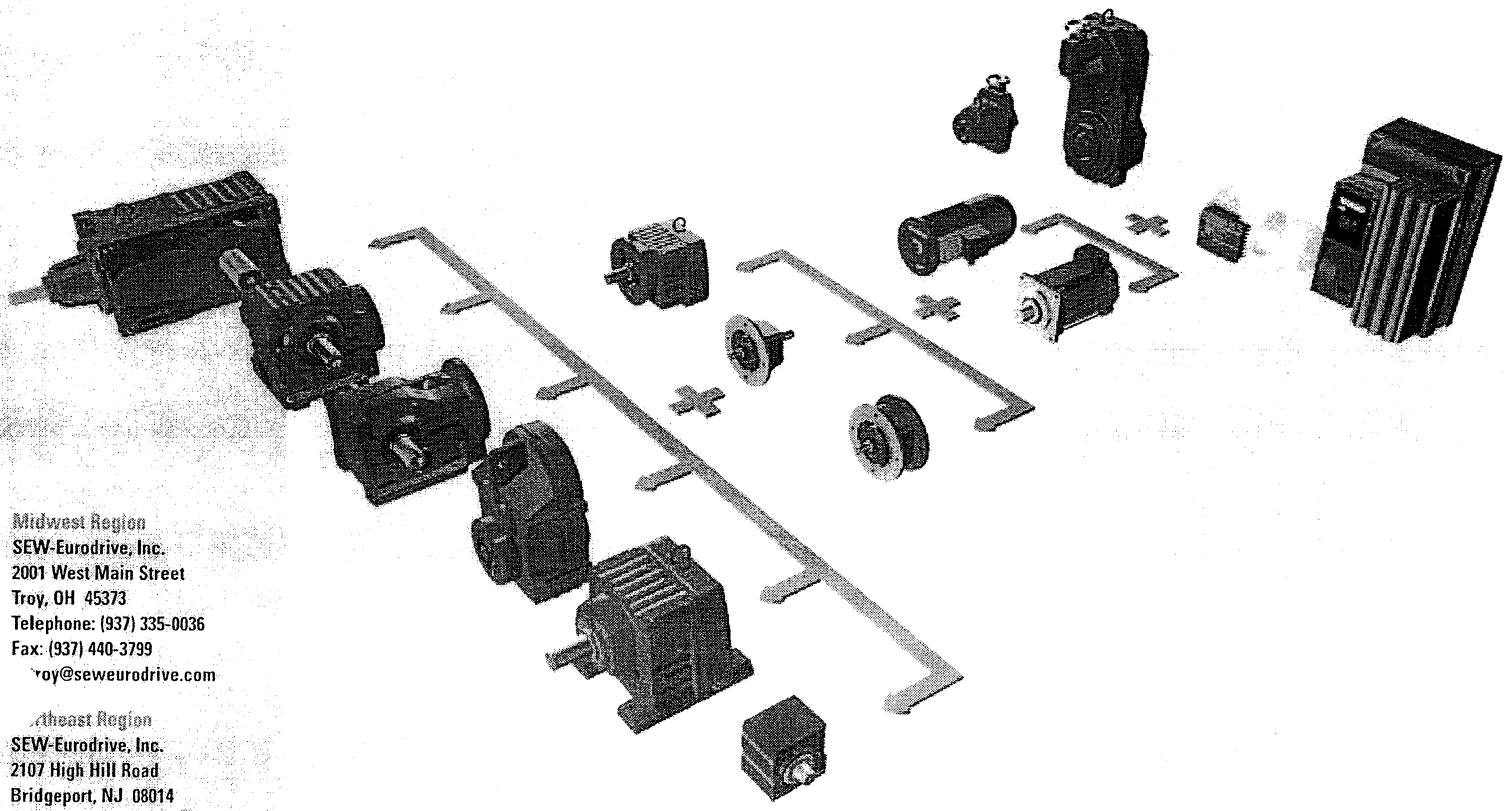
- IEC flange or foot mount
- NEMA C-face flange (size 56 - 184T) for 4 pole 0.75 to 5.0 HP
- Suitable for mounting in any position

OPTIONAL FEATURES

- High cycling fail-safe brake
- Severe duty protection
- Other voltage/frequency combinations for worldwide use
- Forced cooling for low frequency operation
- Thermostat or thermistors
- Classes F or H insulation
- Mounted encoder
- Food Industry Option Package (IOP) with 2yr. Warranty
- Movimot® Integrated Frequency Inverter
- Plug connectors

SEW EURODRIVE

PRODUCTFOCUS



Midwest Region
SEW-Eurodrive, Inc.
2001 West Main Street
Troy, OH 45373
Telephone: (937) 335-0036
Fax: (937) 440-3799
troy@seweurodrive.com

Northeast Region
SEW-Eurodrive, Inc.
2107 High Hill Road
Bridgeport, NJ 08014
Telephone: (856) 467-2277
Fax: (856) 845-3179
csbridgeport@seweurodrive.com

Southeast Region
SEW-Eurodrive, Inc.
1295 Old Spartanburg Hwy.
Lyman, SC 29365
Telephone: (864) 439-7537
Fax: (864) 439-7830
cslyman@seweurodrive.com

Southwest Region
SEW-Eurodrive, Inc.
3950 Platinum Way
Dallas, TX 75237
Telephone: (214) 330-4824
Fax: (214) 330-4724
csdallas@seweurodrive.com

Western Region
SEW-Eurodrive, Inc.
30599 San Antonio Street
Hayward, CA 94544
Telephone: (510) 487-3560
Fax: (510) 487-6381
cshayward@seweurodrive.com

www.seweurodrive.com

For more than 50 years, SEW-Eurodrive has been industry's global supplier of choice for innovative, reliable gearing and high-performance motors. We are also one of the world's leading suppliers of electronic drives. Wherever things need to be moved – that's where you'll find SEW-Eurodrive.

SEW gear units are legendary for their outstanding performance and uncompromising quality, and for the vast selection of modular options and power ratings available to meet the requirements of virtually any application. Installed in all major industrial sectors, our drive products continue to set new quality standards globally for meeting today's advanced power transmission challenges.

In our nine global manufacturing centers, we build SEW drive components and modules to exactly the same specifications and tolerances. However, final assembly and custom modifications are performed in our 56 regional assembly plants, located close to our customers in 40 countries around the world – so here in North America you can rest assured you're getting exactly the same drives, no matter where your equipment is going into operation.

What's more, being in close contact with our customers enables our sales engineers and technical specialists to provide knowledgeable applications and project planning assistance, as well as complete startup and training, at your site. And of course, all SEW-Eurodrive products are backed by our industry-leading 24/7 support program, should you ever require service.

SEW-Eurodrive. Driving the world – with innovative products, systems and support that deliver superior performance for your power transmission application.

SEW EURODRIVE

5 DR Series AC Motors/Brakemotors

5.1 *Notes on the data of energy-efficient motors*

The following table lists the short symbols used in the "Technical Data" tables.

P_N	Rated power
T_N	Rated torque
n_N	Rated speed
I_N	Rated current
cosφ	Power factor
$\eta_{100\%}$	Efficiency at 100% of the rated power
I_A/I_N	Starting current ratio
T_A/T_N	Starting torque ratio
T_H/T_N	Ramp-up torque ratio
Code Letter	NEMA code letter
J_{Mot}	Mass moment of inertia of the motor
J_{Mot_BE}	Mass moment of inertia of the brakemotor
BE..	Standard brake size
Z_0 BG	Switching frequency for operation with BG brake controller
Z_0 BGE	Switching frequency for operation with BGE brake controller
T_B	Standard brake torque
m	Mass of the motor
$m_{\_BE}$	Mass of the brakemotor

14.4 Technical data of 4-pole high efficiency motors

1800 rpm - S1

Motor type	P_N T_N [HP] [lb-in]	n_N [rpm]	I_N 230V [A]	I_N 460V [A]	I_N 575V [A]	cosφ	$\eta_{100\%}$ [%][1]	I_A/I_N	T_A/T_N T_H/T_N	Code Letter	J_{Mot} [10^{-3} lb-ft^2]	m [lb][2]
DRS71S4[3]	0.25 8.93	1700	0.9	0.45	0.36	0.69	72.0	4.2	1.9 1.9	G	11.6	17.2
~~DRS71S4[3]~~	~~0.33 12.3~~	~~1700~~	~~1.21~~	~~0.62~~	~~0.48~~	~~0.69~~	~~72.0~~	~~4.2~~	~~1.9 1.9~~	~~G~~	~~11.6~~	~~17.2~~
DRS71S4[3]	0.5 18.5	1700	1.84	0.92	0.74	0.69	72.0	4.2	1.9 1.9	G	11.6	17.2
~~DRS71M4[3]~~	~~0.75 27.4~~	~~1680~~	~~2.5~~	~~1.25~~	~~1.0~~	~~0.71~~	~~74.0~~	~~4.8~~	~~2.2 2.1~~	~~G~~	~~18.0~~	~~20.1~~
DRE80M4	1 36.2	1740	2.9	1.44	1.15	0.78	82.5	7.1	3 2.1	K	51	31.5
DRE90M4	1.5 53.1	1740	4.5	2.25	1.8	0.73	84.0	7.7	3.6 2.9	L	84.3	40.6
DRE90L4	2 72.5	1740	5.7	2.85	2.3	0.77	85.5	7.5	3.4 3.0	K	103	47.4
DRE100L4	3 107	1735	8.0	4.0	3.2	0.79	87.5	8.1	4 3.3	K	161	63.9
DRE100LC4	5 177	1750	12.9	6.5	5.2	0.83	87.5	7.6	2.5 2.3	J	213	68.4
DRE132S4	5.4 190	1765	13.8	6.9	5.5	0.81	88.5	8.7	2.9 2.5	K	451	102
DRE132M4	7.5 265	1755	18	9	7.2	0.85	89.5	8.1	2.5 1.6	J	605	132
DRE132MC4	10 358	1770	24.5	12.3	9.8	0.82	89.5	8.7	2.1 1.6	K	807	138
DRE160M4	12.5 438	1770	31	15.4	12.3	0.82	91.0	8	3 2.2	J	1068	196
DRE160MC4	15 522	1780	36.5	18.3	14.6	0.82	91.7	8.2	2.9 2	J	1401	207
DRE180M4	20 716	1775	47.5	24	19	0.86	91.7	7.4	2.6 1.9	H	2636	304
DRE180L4	25 885	1775	60	30	24	0.84	93.0	8.1	2.9 2.2	J	3087	335
DRE180LC4	30 1044	1780	71	35.5	28.5	0.84	93.0	7.6	2.4 1.8	J	3990	355
DRE200L4	40 1424	1780	99	49.5	39.5	0.82	93.0	7.4	2.6 2.1	J	5605	573
DRE225S4	50 1761	1775	119	59	47.5	0.84	93.0	7.2	2.7 2.0	H	6958	650
DRE225M4	60 2124	1780	142	71	57	0.85	93.6	7.3	2.8 1.9	H	8146	694

1) Efficiency levels according to IEC 60034-2-1 Ed. 1 (2007) / PLL from Residual Losses, NEMA MG1 and/or DoE

2) Applies for foot-mounted motor (DRS and DRE.../FL..)

3) Standard efficiency motor

US DoE CC056A applies to DRE, DRP and DVE motors

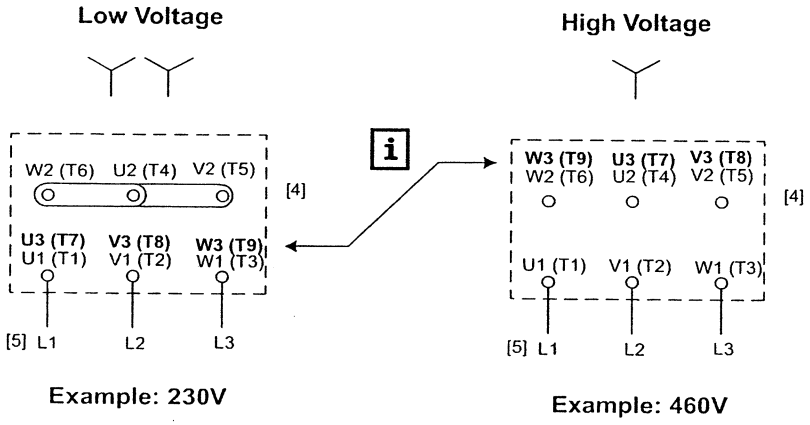
Motor type	P_N T_N [HP] [lb-in]	n_N [rpm]	BE..	T_B [lb-in][3]	Z_0 BG[1] BGE[2] [1/h]	J_{Mot_BE} [10^{-3} lb-ft^2]	m_{BE} [lb][4]
DRS71S4[5]	0.25 8.93	1700	BE05	22	4800 7600	14.7	22.5
~~DRS71S4[5]~~	~~0.33~~ 12.3	~~1700~~	~~BE05~~	~~31~~	4800 7600	~~14.7~~	~~22.5~~
DRS71S4[5]	0.5 18.5	1700	BE05	44	4800 7600	14.7	22.5
~~DRS71M4[5]~~	~~0.75~~ 27.4	~~1600~~	~~BE1~~	~~88~~	3300 8800	~~19.9~~	~~25.8~~
DRE80M4	1 36.2	1740	BE1	88	2800 7200	54.6	38.1
DRE90M4	1.5 53.1	1740	BE2	124	2400 6400	95	50.7
DRE90L4	2 72.5	1740	BE2	177	2400 6400	115	57.3
DRE100L4	3 107	1735	BE5	248	- 3000	175	77.2
DRE100LC4	5 177	1750	BE5	354	- 3000	228	81.6
DRE132S4	5.4 190	1765	BE5	487	- 2200	463	121
DRE132M4	7.5 265	1755	BE11	708	- 1600	629	165
DRE132MC4	10 358	1770	BE11	974	- 1200	843	172
DRE160M4	12.5 438	1770	BE20	1328	- 1000	1187	253
DRE160MC4	15 522	1780	BE20	1328	- 900	1520	264
DRE180M4	20 716	1775	BE20	1770	- 800	2778	374
DRE180L4	25 885	1775	BE30	2655	- 590	3420	423
DRE180LC4	30 1044	1780	BE30	2655	- 520	4322	441
DRE200L4	40 1424	1780	BE30 BE32	2655[6] 3540[7]	- 550	5938 6151	661 695
DRE225S4	50 1761	1775	BE30 BE32	2655[6] 4425[7]	- 320	7291 7505	738 771
DRE225M4	60 2124	1780	BE30 BE32	2655[6] 5310[7]	- 270	8479 8692	782 815

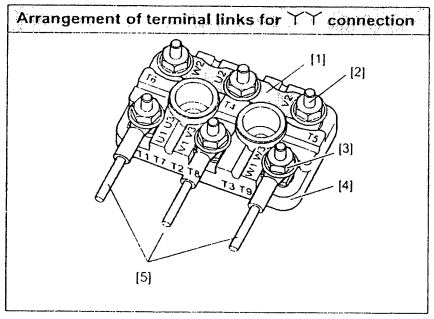
1) Operation with BG brake control system
2) Operation with BGE brake control system
3) Standard braking torque for IEC brakemotor
4) Applies for foot-mounted motor (DRS and DRE..BE../FI..)
5) Standard efficiency motor
6) Alternate reduced brake torque
7) Double-disc brake

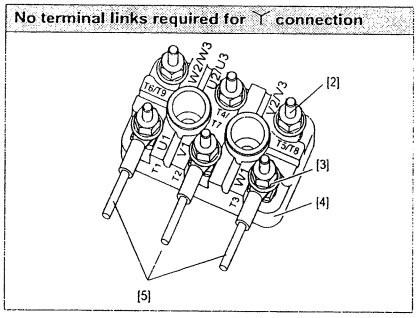
US DoE CC056A applies to DRE, DRP and DVE motors

3 R76 -

Connection Type R76
Single Speed, Dual Voltage
Example: 230V ⋎⋎ / 460V ⋎







[1] Terminal link
[2] Terminal stud
[3] Flange nut
[4] Terminal board
[5] Voltage supply (Customer connection)

VOLTAGE CHANGE

Three wires must be relocated and terminal links added to change from high to low voltage.

The wires designated U3 (T7), V3 (T8) and W3 (T9) must be reconnected and terminal links added as shown in the diagram.

Changing from low to high voltage is carried out in reverse order.

In both cases, the supply voltage is connected to U1 (T1), V1 (T2) and W1 (T3). The direction of rotation is changed by exchanging two wires.

2 Important notes

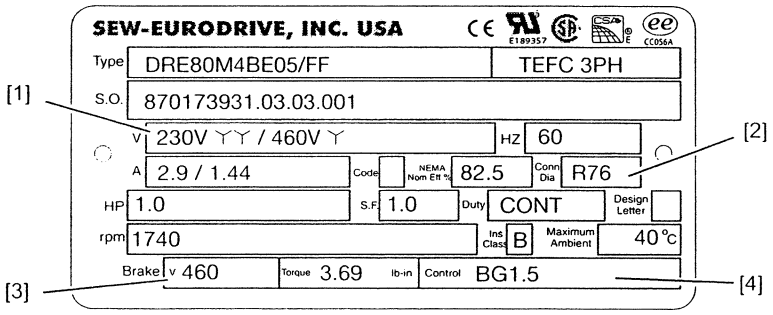
2.1 Safety notes

Refer to the Operating Instructions for safety and installation information. The latest version can be found at www.seweurodrive.com.

Installation, startup and service work may only be performed by trained personnel observing applicable accident prevention regulations and operating instructions.

2.2 Motor nameplate

Refer to the motor nameplate for information that describes the motor data. Some of the important fields related to the connection are listed below.



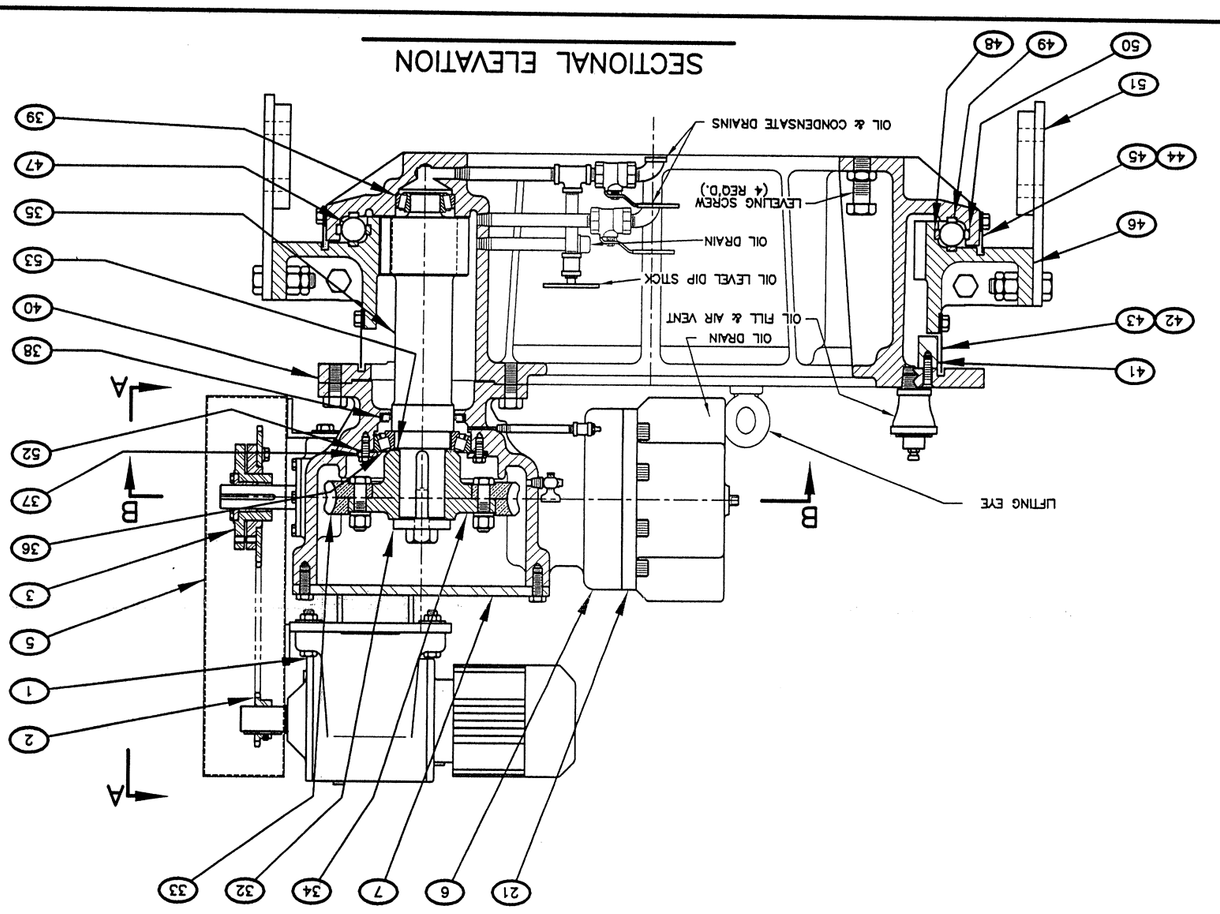
[1] Motor Voltage - Lists the motor voltage and configuration. Example: 230V ⋎⋎ / 460V ⋎.

[2] Connection Type - Lists the basic type of connection indicating the type of internal motor windings, ⋎⋎, ⋎, △, etc. Example: R76. This value may also be followed by a series of letters and/or numbers.

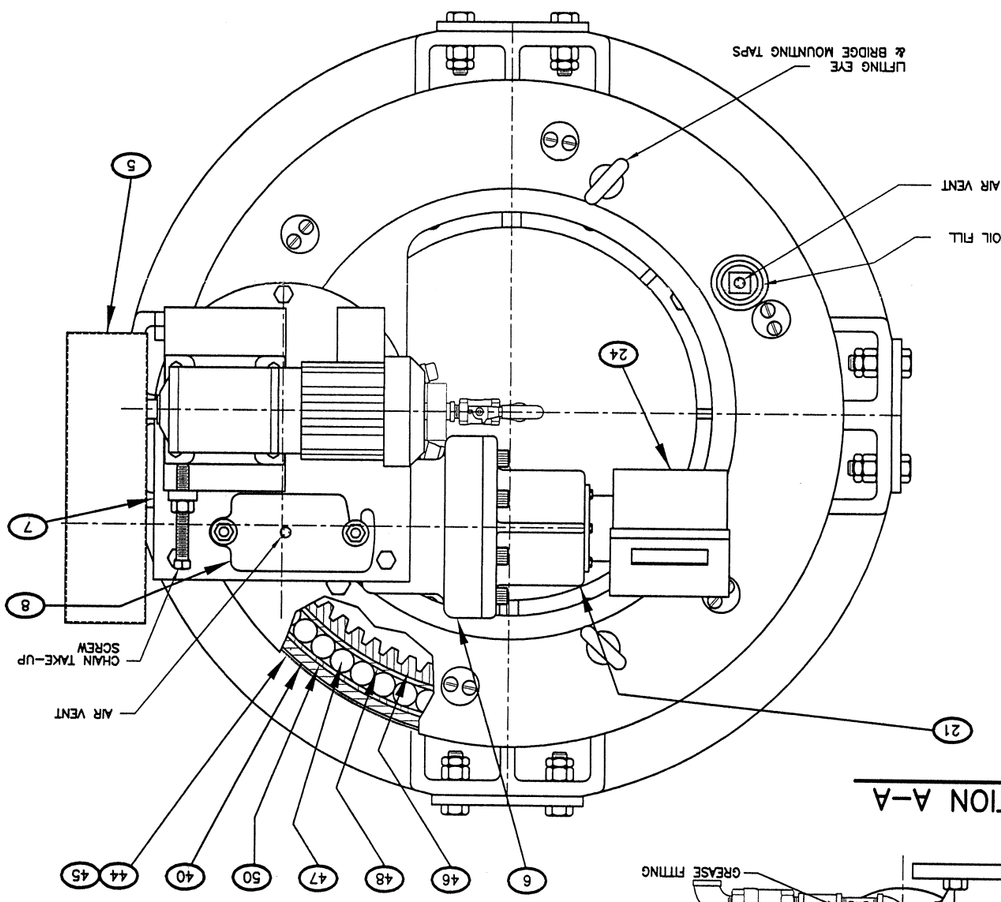
[3] Brake Voltage - Lists the brake voltage required to operate the brake. Example: 460V.

[4] Brake Control - Lists the brake control type. Example: BG, BGE, BSR, etc. These maybe followed by additional characters.

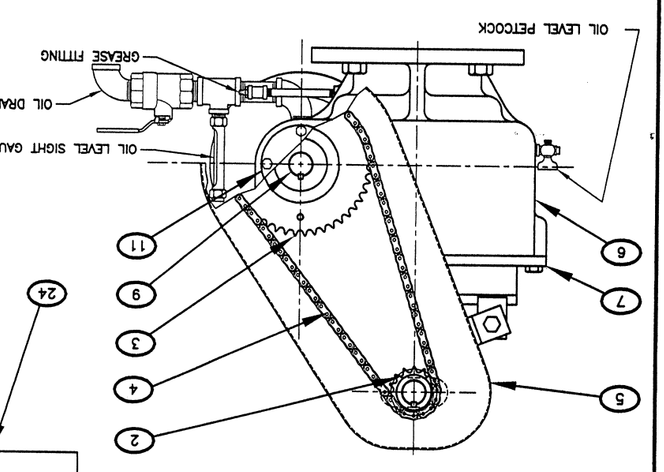
SECTIONAL ELEVATION



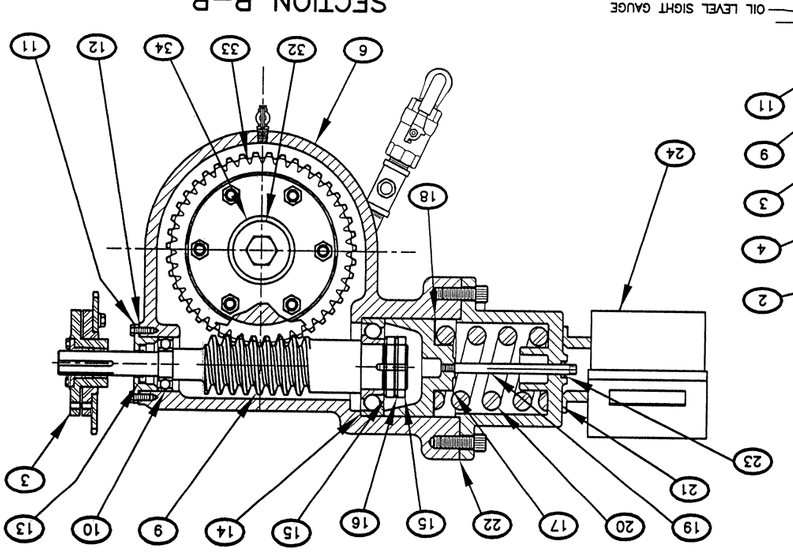
PLAN



SECTION A-A



SECTION B-B



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 - UP 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 - UP 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 - UP 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

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

PARTS LIST
MODEL 28H6T DRIVE
PLATFORM BRIDGE W/SHEAR PIN HUB

CONTRACT | DRAWING NO. | REV
STD. | D.7.0.5.14.6.8.8.4.1.1.7.1

	DATE	BY
DRAWN	5/7/97	WTW
CHECKED		
APPR.		
SCALE	NONE	
FILE REFERENCE		

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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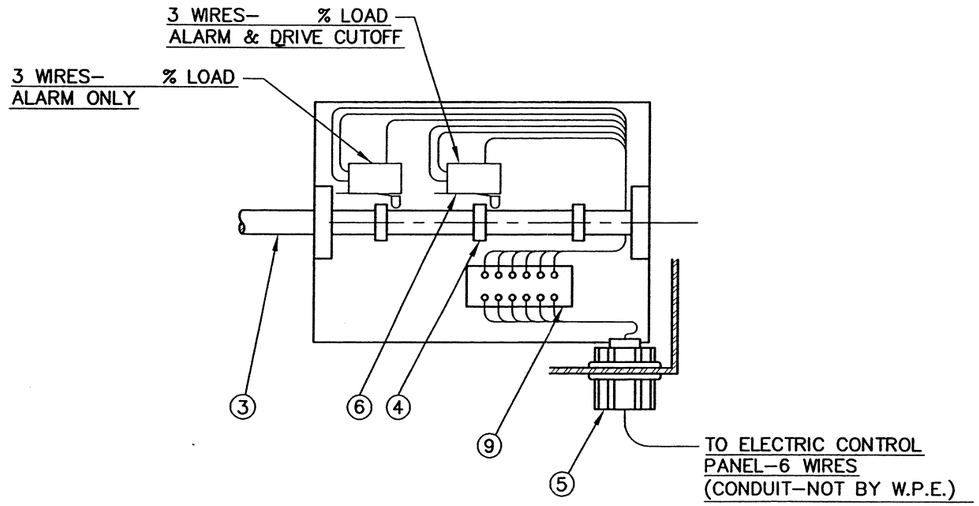
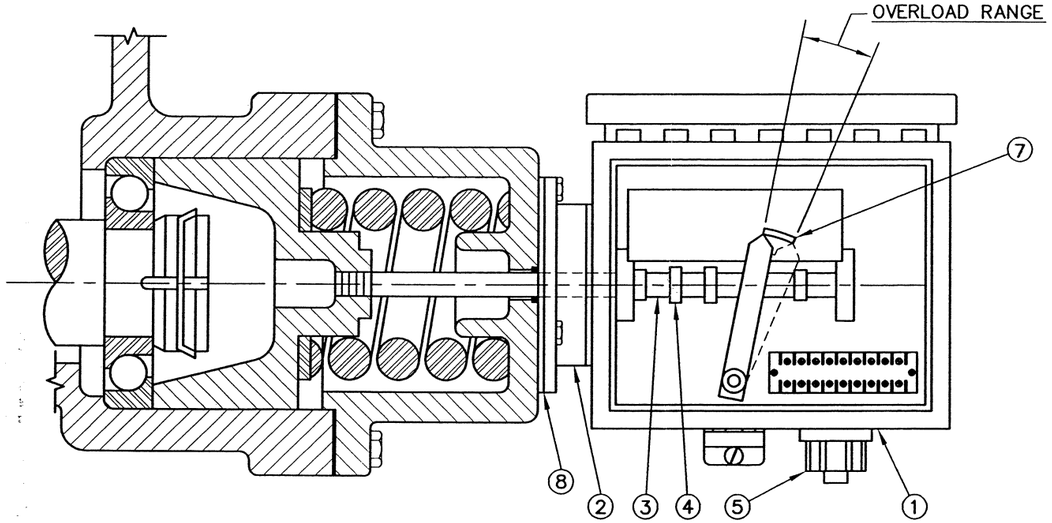
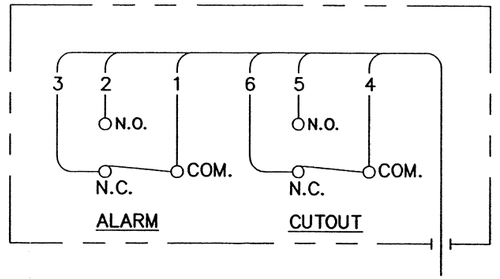
	BY	CHKD	DATE	REMARKS
REVISIONS				

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	TERMINAL BLOCK		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: F:\C46818W PLOT SCALE=1

SYM	REVISION	BY	DATE	CHKD
E				
D				
C				
B				
A				

MASTER
C-41184

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.

	DATE	BY
DRAWN	4/29/97	WTW
CHECKED		
APPR.		
SCALE	NONE	
FILE REFERENCE		

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

PARTS LIST
TORQUE INDICATOR BOX ASSEMBLY

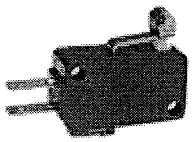
CONTRACT	DRAWING NO.	REV.
STD	C,5,0,5|4,6,8,1,8|1,7,1	

LIMIT SWITCH INFORMATION

Honeywell

Honeywell Sensing and Control

V7-7B17D8-201



V7 Series Miniature Basic Switch, Single Pole Double Throw Circuitry, 11 A at 277 Vac, Roller Lever Actuator, 2,78 N [10.0 oz] Maximum Operating Force, Silver Contacts, Quick Connect Termination

Actual product appearance may vary.

V7 Series Features

- World-wide package size acceptance
- Current rating ranges from 0.1 A to 25 A
- Wiping contact action
- Temperature range to 177 °C [350 ° F]
- Long mechanical life
- Elongated mounting holes for easier, more accurate mounting
- UL/CSA recognized, ENEC (European) approval available
- Choice of actuation, termination and operating characteristics

Potential Applications

- Appliances
- Vending machines
- Timing devices
- Office equipment
- Computer/business equipment
- Test instruments
- Medical/dental equipment
- Communications equipment
- HVAC equipment
- Manually operated devices
- Valves
- Gaming equipment
- Pressure switches

Description

MICRO SWITCH™ V5 and V7 Series basic switches are used for simple or precision on/off, end of limit, presence/absence, pressure, temperature and manual operator interface application needs.

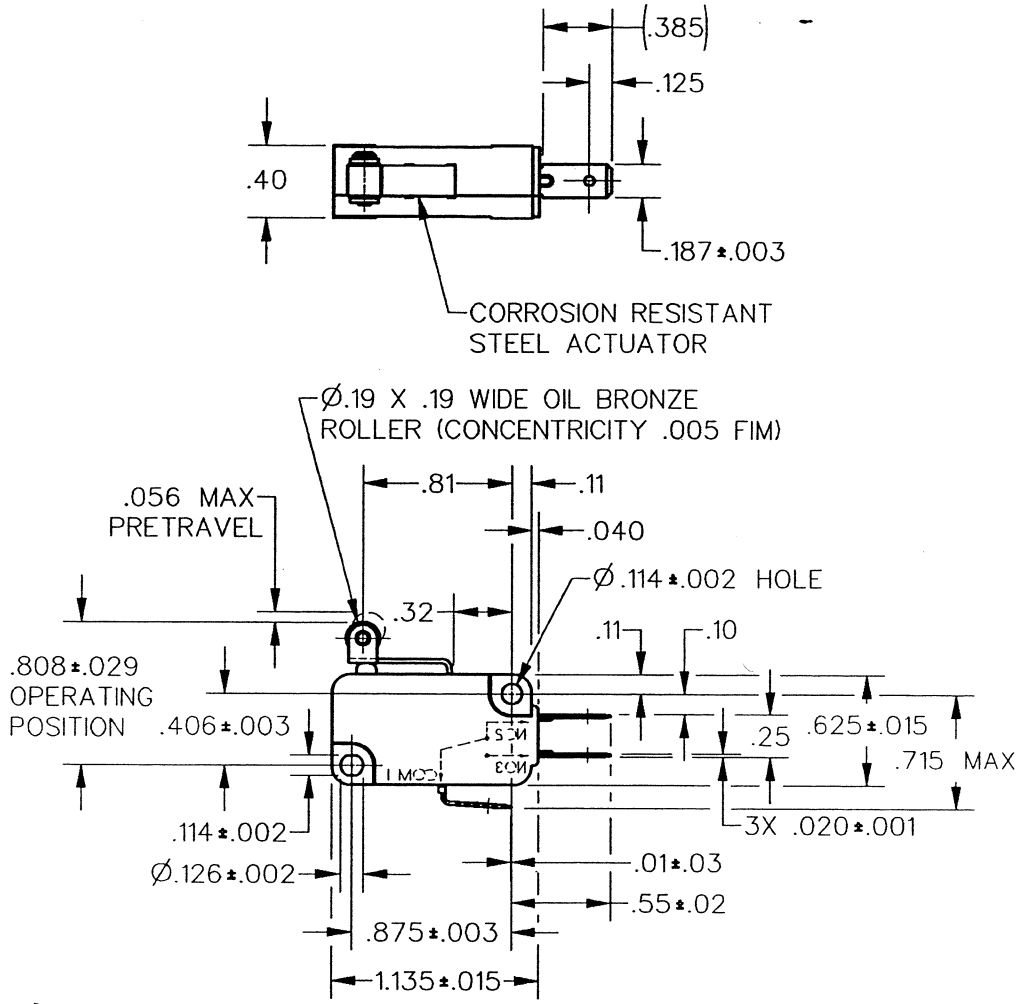
Product Specifications	
Switch Type	MICRO SWITCH™ Miniature 15,9 mm H x 10,2 mm W x 28,8 mm L [0.63 in H x 0.4 in W x 1.14 in L]
Sealed	No
Ampere Rating	11 A
Circuitry	Single Pole Double Throw (SPDT)
Actuator	Roller Lever
Termination	Quick Connect
Operating Temperature Range	-40 °C to 85 °C [-40 °F to 185 °F]
Voltage	277 Vac

Approvals	CSA,UL,ENEC
Actuator Length	20,6 mm [0.81 in]
Contact Type	Silver
Operating Force (O.F.)	2,78 N [10.0 oz] max.
Release Force (R.F.)	0,28 N [1.0 oz] min.
Pretravel (P.T.)	1,42 mm [0.056 in] max.
Overtravel (O.T.)	0,86 mm [0.034 in] min.
Differential Travel (D.T.)	0,33 mm [0.013] max.
Operating Position (O.P.)	20,5 ± 0,736 mm [0.808 ± 0.029 in]
Housing Material	PCT PolyesterThermoplastic
High Temperature	85 °C [185 °F]
CE mark	61058-1
UL File #	E12252
CSA File #	LR41370
Agency Approvals and Standards	1054
Mounting Centers	22,2 mm [0.88 in]
Maximum Tightening Torque	0,56 N m [5.0 in lb]
Weight	8 g [0.3 oz]
Package Height	16 mm [0.63 in]
Package Width	10,2 mm [0.40 in]
Package Length	27,7 mm [1.09 in]
Availability	Global
UNSPSC Code	30211905
UNSPSC Commodity	30211905 Snap switches
Series Name	V7

MICRO SWITCH
a Honeywell Division
FED.MFG.CODE 91929

SWITCH – BASIC

CATALOG LISTING
V7–7B17D8–201
CW–C6117



ANSI Y14.5M–1982 APPLIES

THIRD ANGLE PROJECTION

CHARACTERISTICS	ELECTRICAL DATA	SCALE FULL — DO NOT SCALE PRINT
OPERATING FORCE — — — — 10 OZ MAX	CONTACT ARRANGEMENT S P D T	UNLESS OTHERWISE SPECIFIED TOLERANCES ARE
RELEASE FORCE — — — — — 1 OZ MIN		ONE PLACE (.0) ±.030
DIFFERENTIAL TRAVEL — — — .013 MAX	L156 11A 1/3HP 125, 250 OR 277 VAC 1/2A 125 VDC, 1/4A 250 VDC 4A 125 VAC "L"	TWO PLACE (.00) ±.015
OVERTRAVEL — — — — — — .034 MIN		THREE PLACE (.000) ±.005
RELEASE TRAVEL — — — — .007 MIN		ANGLES ±
		WEIGHT

CATALOG LISTING V7–7B17D8–201 PAGE 1 OF 1
ISSUE 2 M
RELEASE NO. PR–23389 REPLACES X102350–V7

REVISIONS

A	PR23389						
TSM 17 APR 98							

DRAWN	TSM	7 APR 98	DDM/CAD				
CHECK		17 APR 98					
CHECK	JAF						
CHECK							
CHECK							

CONTROL PANEL INFORMATION

TLC CONTROLS INC. 553 W. CARBOY ROAD MT. PROSPECT, IL. 60056		
CUSTOMER:		8/8/11
Q-32714	TAG: FOUNTAIN, CO	DRAWING: AM40811TLC

TAG	QTY	DESCRIPTION	MANUFACTURER	CATALOG NUMBER
-	1	24 X 20 X 8 NEMA 4X STAINLESS STEEL CABINET	HOFFMAN	C-SD24208SS
-	1	CABINET SUB PANEL	HOFFMAN	C-P2420
CB	1	CIRCUIT BREAKER	EATON	HMCP003A0C
-	1	CIRCUIT BREAKER HANDLE	EATON	HM1R12X
M	1	MOTOR STARTER	ALLEN-BRADLEY	509-BOD
OL	1	OVERLOAD RELAY	ALLEN-BRADLEY	A2E
-	1	OVERLOAD RESET BUTTON	CONTROL CONCEPTS	RPB-B
CT	1	CONTROL TRANSFORMER	SOLA HEVI/DUTY	E150
TFU	2	TRANSFORMER FUSE	LITTELFUSE	CCMR-1/2
CFU	1	CONTROL FUSE	LITTELFUSE	FLM-1.6
CR	7	CONTROL RELAY	IDEC	RH2BUL-AC120V + SH2B-05
LR	1	HIGH TORQUE SHUTDOWN LATCHING RELAY	DIVERSIFIED	SPM-120-ADA
CM	1	CURRENT MONITOR	EMOTRON	EL-FI M20 + CTM010
E	1	ELAPSED TIME METER	ENM	T50
PL	7	PILOT LIGHT	IDEC	HW1P-1FQD-G,R & W-120
-	7	PILOT LIGHT BULB	IDEC	LSTD-H2 –G, R & W
SS	1	SELECTOR SWITCH	IDEC	HW1S-3TF20
PB1	1	PUSH BUTTON	IDEC	HW1B-M1F01-B
PB2	1	EMERGENCY PUSH BUTTON	IDEC	HW1B-V4F01-R
-	20	TERMINAL	ENTRELEC	011511607

NOTE: ALL PARTS SUBJECT TO CHANGE DEPENDING UPON AVAILABILITY.

ph

Hoffman®
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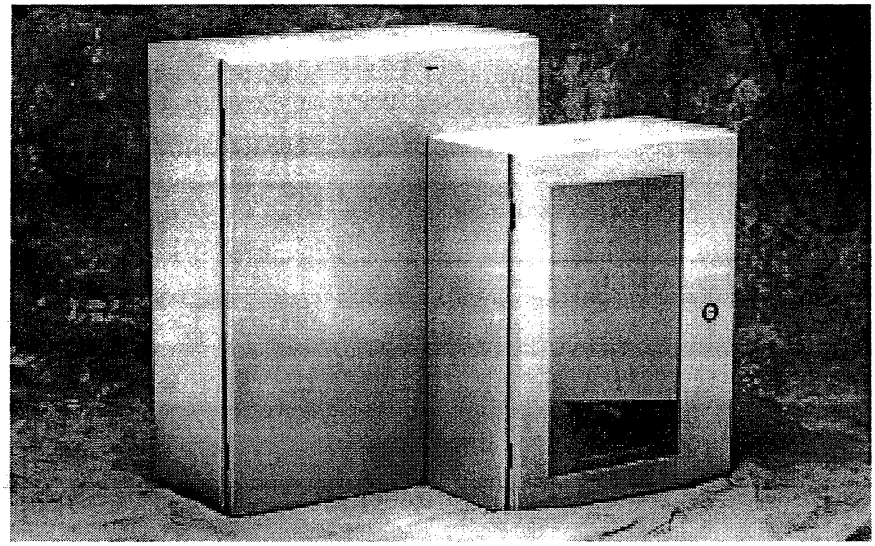
CONCEPT® Stainless Steel Wall-Mount Enclosures

Rev C January 2002



Application

The CONCEPT® stainless steel enclosure, with its streamlined design and UL Type 4X rating, is a perfect fit for mounting electrical or high-tech electronic equipment in a variety of indoor and outdoor settings. It is typically used in the following areas where corrosion-resistant protection is needed: food processing plants, pharmaceutical manufacturing facilities, petrochemical plants, pulp and paper processing, and waste water treatment facilities.

Patents:
Combined Handle and Lock Unit
360,345 (U.S.)
DEM 9405854.7 (Germany)
Enclosure Latch 5,509,703 (U.S.)
Hinge System 5,666,695 (U..S.)

Other patents pending.

Construction

- Manufactured from 16 or 14 gauge Type 304 or Type 316L stainless steel
- Seams continuously welded and ground smooth
- Minimum width body flange provides maximum door opening
- Body flange trough excludes liquids and contaminants
- Panel mounting studs fit optional CONCEPT panels and other accessories
- Mounting holes in back of body for direct mounting or for optional external mounting feet
- Type 304 stainless steel hidden hinges promote clean aesthetic appearance
- Standard full access 170° opening
- Doors are interchangeable and easily removable by pulling captive hinge pins
- For extra rigidity, door bars and center stiffener furnished on doors 36.00 x 36.00 and larger
- Provision on door (except window door style) for thermoplastic data pocket
- Provision on door (except window door style) for optional doorstop kit
- Quarterturn latches (or a 3-point latch system on larger enclosures) furnished with flush slotted insert. Optional handles or inserts are available.
- Window door enclosures have a clear polycarbonate window mounted flush with door surface
- Hinge mounting brackets for wire management or optional accessories
- Seamless foam-in-place one piece gasket provides oil-tight and dust-tight seal against contaminants
- Self-grounding latch system with double seal provides maximum protection against leakage
- Integral body grounding stud
- Furnished hardware kit consists of panel mounting nuts, grounding hardware, and sealing washers for wall mounting holes
- Installation instructions for enclosure and accessories are provided

Finish

Enclosures are unpainted. Cover and body have smooth brushed finish.

- Optional CONCEPT panels are white painted or zinc plated.
- Optional NEMA panels are white painted, zinc plated, aluminum or stainless steel.

Industry Standards

NOTE: Mounting feet required to maintain UL/CSA ratings. Some models also require internal panel; see order table.

UL508, File No. E61997: Type 4, Type 4X and Type 12
NEMA/EEMAC Type 4, Type 4X, Type 12, and Type 13
CSA File No. LR42186: Type 4, Type 4X and Type 12
VDE IP66
IEC 60529, IP66

Accessories

See General Accessories: CONCEPT® Enclosure Accessories, pages 11.66-11.71

Corrosion Inhibitors
Data pocket (except window door style)
Door Stop Kit (except window door style)
Lighting Kits
Panels (See table)
Panels, NEMA
Terminal Kit Assembly
Wiring Duct

Modification Services Program

You can customize this product to your unique requirements by specifying from these options:

- Enclosure height, width, depth
- Holes and cutouts in body, doors, subpanels
- Tapped holes, fasteners, mounting channel in enclosure and subpanel
- Mounting (adds and deletes)
- Doors
- Subpanels
- Thermal management (louvers, fans, filters)
- Windows
- Standard accessories
- Drip shield

For details, see Modification Services at hoffmanonline.com.
To order, contact your local Hoffman sales representative.

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CONCEPT® Stainless Steel Wall-Mount Enclosures

Rev B February 2001

Standard Sizes CONCEPT Stainless Steel Single-Door Wall-Mount Enclosures

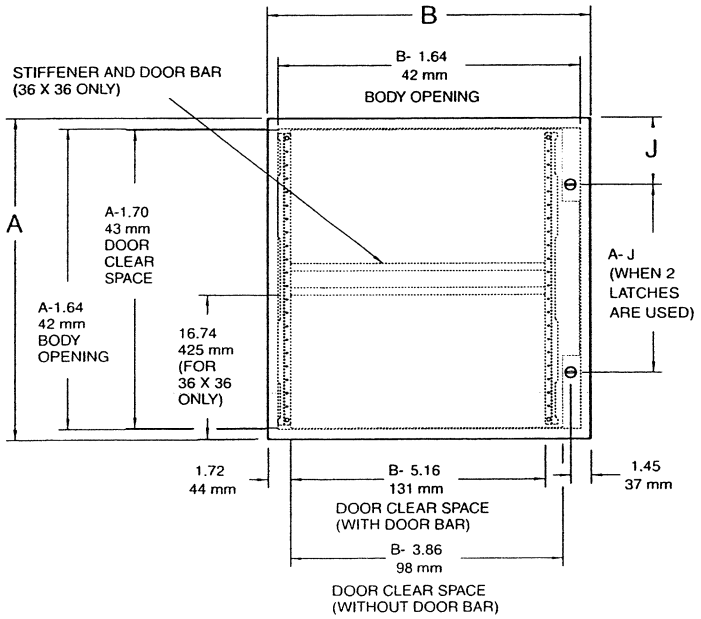
Type 304 Catalog Number	Type 316L Catalog Number	Door Gauge	Body Gauge	Enclosure Size A x B x C	* CONCEPT Panel Catalog Number	Panel Size D x E	Mounting G x H	Latches qty	style	J
C-SD12126SS	C-SD12126SS6	16	16	12.00 x 12.00 x 6.00 (305 x 305 x 152)	C-P1212	10.20 x 10.20 (259 x 259)	10.50 x 10.50 (267 x 267)	1	Quarterturn	6.00 (152)
C-SD16126SS	C-SD16126SS6	16	16	16.00 x 12.00 x 6.00 (406 x 305 x 152)	C-P1612	14.20 x 10.20 (361 x 259)	14.50 x 10.50 (368 x 267)	1	Quarterturn	8.00 (203)
C-SD16166SS	C-SD16166SS6	16	16	16.00 x 16.00 x 6.00 (406 x 406 x 152)	C-P1616	14.20 x 14.20 (361 x 361)	14.50 x 14.50 (368 x 368)	1	Quarterturn	8.00 (203)
C-SD20166SS	C-SD20166SS6	16	16	20.00 x 16.00 x 6.00 (508 x 406 x 152)	C-P2016	18.20 x 14.50 (462 x 361)	18.50 x 14.50 (470 x 368)	1	Quarterturn	10.00 (254)
C-SD20206SS	C-SD20206SS6	16	16	20.00 x 20.00 x 6.00 (508 x 508 x 152)	C-P2020	18.20 x 18.20 (462 x 462)	18.50 x 18.50 (470 x 470)	1	Quarterturn	10.00 (254)
C-SD16128SS	C-SD16128SS6	16	16	16.00 x 12.00 x 8.00 (406 x 305 x 203)	C-P1612	14.20 x 10.20 (361 x 259)	14.50 x 10.50 (368 x 267)	1	Quarterturn	8.00 (203)
C-SD16168SS	C-SD16168SS6	16	16	16.00 x 16.00 x 8.00 (406 x 406 x 203)	C-P1616	14.20 x 14.20 (361 x 361)	14.50 x 14.50 (368 x 368)	1	Quarterturn	8.00 (203)
C-SD16208SS	C-SD16208SS6	16	16	16.00 x 20.00 x 8.00 (406 x 508 x 203)	C-P2016	18.20 x 14.20 (462 x 361)	14.50 x 18.50 (368 x 470)	1	Quarterturn	8.00 (203)
C-SD20168SS	C-SD20168SS6	16	16	20.00 x 16.00 x 8.00 (508 x 406 x 203)	C-P2016	18.20 x 14.20 (462 x 361)	18.50 x 14.50 (470 x 368)	1	Quarterturn	10.00 (254)
C-SD20208SS	C-SD20208SS6	16	16	20.00 x 20.00 x 8.00 (508 x 508 x 203)	C-P2020	18.20 x 18.20 (462 x 462)	18.50 x 18.50 (470 x 470)	1	Quarterturn	10.00 (254)
C-SD24168SS	C-SD24168SS6	16	16	24.00 x 16.00 x 8.00 (610 x 406 x 203)	C-P2416	22.20 x 14.20 (564 x 361)	22.50 x 14.50 (572 x 368)	1	Quarterturn	12.00 (305)
C-SD24208SS	C-SD24208SS6	16	16	24.00 x 20.00 x 8.00 (610 x 508 x 203)	C-P2420	22.20 x 18.20 (564 x 462)	22.50 x 18.50 (572 x 470)	1	Quarterturn	12.00 (305)
† C-SD24248SS	† C-SD24248SS6	14	16	24.00 x 24.00 x 8.00 (610 x 610 x 203)	C-P2424	22.20 x 22.20 (564 x 564)	22.50 x 22.50 (572 x 572)	2	Quarterturn	5.00 (127)
† C-SD30248SS	† C-SD30248SS6	14	16	30.00 x 24.00 x 8.00 (762 x 610 x 8.00)	C-P3024	28.20 x 22.20 (716 x 564)	28.50 x 22.50 (724 x 572)	2	Quarterturn	5.00 (127)
† C-SD30308SS	† C-SD30308SS6	14	14	30.00 x 30.00 x 8.00 (762 x 762 x 203)	C-P3030	28.20 x 28.20 (716 x 716)	28.50 x 28.50 (724 x 724)	2	Quarterturn	5.00 (127)
† C-SD36248SS	† C-SD36248SS6	14	16	36.00 x 24.00 x 8.00 (914 x 610 x 203)	C-P3624	34.20 x 22.20 (869 x 564)	34.50 x 22.50 (876 x 572)	2	Quarterturn	5.00 (127)
† C-SD36308SS	† C-SD36308SS6	14	14	36.00 x 30.00 x 8.00 (914 x 762 x 203)	C-P3630	34.20 x 28.20 (869 x 716)	34.50 x 28.50 (876 x 724)	2	Quarterturn	5.00 (127)
C-SD202012SS	C-SD202012SS6	14	14	20.00 x 20.00 x 12.00 (508 x 508 x 305)	C-P2020	18.20 x 18.20 (462 x 462)	18.50 x 18.50 (470 x 470)	1	Quarterturn	10.00 (254)
† C-SD242412SS	† C-SD242412SS6	14	14	24.00 x 24.00 x 12.00 (610 x 610 x 305)	C-P2424	22.20 x 22.20 (564 x 564)	22.50 x 22.50 (572 x 572)	2	Quarterturn	5.00 (127)
† C-SD302412SS	† C-SD302412SS6	14	14	30.00 x 24.00 x 12.00 (762 x 610 x 305)	C-P3024	28.20 x 22.20 (716 x 564)	28.50 x 22.50 (724 x 572)	2	Quarterturn	5.00 (127)
† C-SD362412SS	† C-SD362412SS6	14	14	36.00 x 24.00 x 12.00 (914 x 610 x 305)	C-P3624	34.20 x 22.20 (869 x 564)	34.50 x 22.50 (876 x 572)	2	Quarterturn	5.00 (127)
† C-SD363012SS	† C-SD363012SS6	14	14	36.00 x 30.00 x 12.00 (914 x 762 x 305)	C-P3630	34.20 x 28.20 (869 x 716)	34.50 x 28.50 (876 x 724)	2	Quarterturn	5.00 (127)
† C-SD363612SS	† C-SD363612SS6	14	14	36.00 x 36.00 x 12.00 (914 x 914 x 305)	C-P3636	34.20 x 34.20 (869 x 869)	34.50 x 34.50 (876 x 876)	2	Quarterturn	5.00 (127)
† C-SD423612SS	† C-SD423612SS6	14	14	42.00 x 36.00 x 12.00 (1067 x 914 x 305)	C-P4236	40.20 x 34.20 (1021 x 869)	40.50 x 34.50 (1029 x 876)	1	3-point	21.00 (533)
† C-SD483612SS	† C-SD483612SS6	14	14	48.00 x 36.00 x 12.00 (1219 x 914 x 305)	C-P4836	46.20 x 34.20 (1173 x 869)	46.50 x 34.50 (1181 x 876)	1	3-point	24.00 (610)
† C-SD603612SS	† C-SD603612SS6	14	14	60.00 x 36.00 x 12.00 (1524 x 914 x 305)	C-P6036	58.20 x 34.20 (869 x 462)	58.50 x 34.50 (1486 x 876)	1	3-point	30.00 (762)

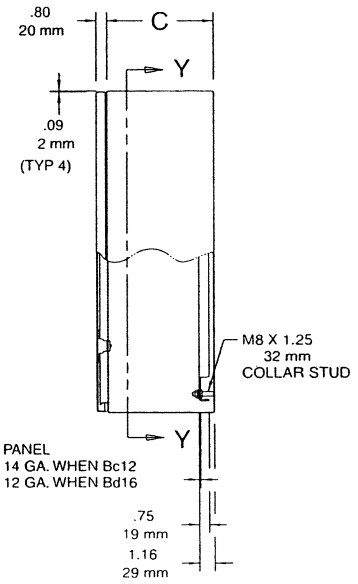
Millimeter dimensions ( ) are for reference only; do not convert metric dimensions to inch.

* Panels must be ordered separately. Optional zinc-plated CONCEPT panels available for most sizes. Optional NEMA size steel and stainless steel panels require conversion kit catalog number C-CPM4 (see section 11, General Accessories).

† Internal panel required to maintain UL/CSA ratings.

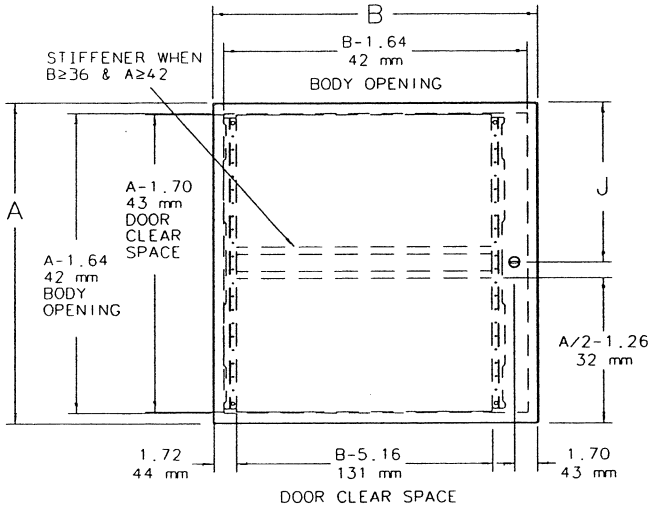
CONCEPT® Stainless Steel Single-Door Wall-Mount Enclosures

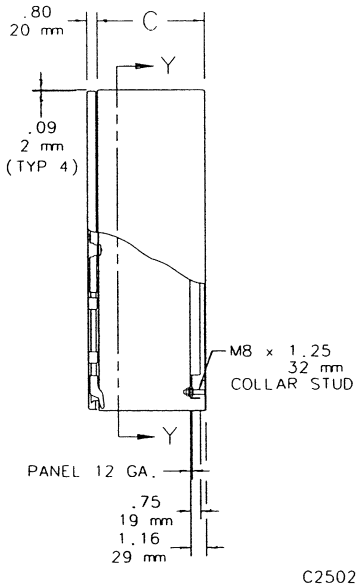




Single-Door Enclosure with Quarterturn Latching

NOTE: 1. Door has provision for data pocket. Use large data pocket provision when A = 30.00 (762) or more and B = 20.00 (508) or more. No data pocket provision when B = 12.00 (305).
2. Panels more than 22.0 inches (564) long have flanges along sides, except C-P2420 and C-P2424 which have flanges on two sides.





C2502

Inch
Millimeter

Single-Door Enclosure with 3-Point Latching

For Section Y-Y see following page.

F-Frame

Table 12-287. 600 Vac Maximum, 250 Vdc Maximum

NEMA Starter Size	Cont. Amps	Cam Setting	Motor Full Load Current Amperes (FLA) ①	MCP Trip Setting ②	MCP Catalog Number	Price U.S. $
0	3	A	.69 – .91	9	HMCP003A0C	
		B	.92 – 1.0	12		
		C	1.1 – 1.2	15		
		D	1.3 – 1.5	18		
		E	1.6 – 1.7	21		
		F	1.8 – 1.9	24		
		G	2.0 – 2.2	27		
		H	2.3 – 2.5	30		
0	7	A	1.5 – 2.0	21	HMCP007C0C	
		B	2.1 – 2.5	28		
		C	2.6 – 3.1	35		
		D	3.2 – 3.6	42		
		E	3.7 – 3.9	49		
		F	4.3 – 4.7	56		
		G	4.8 – 5.2	63		
		H	5.3 – 5.7	70		
0	15	A	3.4 – 4.5	45	HMCP015E0C	
		B	4.6 – 5.6	60		
		C	5.7 – 6.8	75		
		D	6.9 – 7.9	90		
		E	8.0 – 9.1	105		
		F	9.2 – 10.3	120		
		G	10.4 – 11.4	135		
		H	11.5 – 12.6	150		
1	30	A	6.9 – 9.1	90	HMCP030H1C	
		B	9.2 – 11.4	120		
		C	11.5 – 13.7	150		
		D	13.8 – 16.0	180		
		E	16.1 – 18.3	210		
		F	18.4 – 20.6	240		
		G	20.7 – 22.9	270		
		H	23.0 – 25.2	300		
2	50	A	11.5 – 15.2	150	HMCP050K2C	
		B	15.3 – 19.1	200		
		C	19.2 – 22.9	250		
		D	23.0 – 26.8	300		
		E	26.9 – 30.6	350		
		F	30.7 – 34.5	400		
		G	34.6 – 38.3	450		
		H	38.4 – 42.1	500		

Table 12-288. 600 Vac Maximum, 250 Vdc Maximum (Continued)

NEMA Starter Size	Cont. Amps	Cam Setting	Motor Full Load Current Amperes (FLA) ①	MCP Trip Setting ②	MCP Catalog Number	Price U.S. $
2	70	A	16.1 – 21.4	210	HMCP070M2C	
		B	21.5 – 26.8	280		
		C	26.9 – 32.2	350		
		D	32.3 – 37.5	420		
		E	37.6 – 42.9	490		
		F	43.0 – 48.3	560		
		G	48.4 – 53.7	630		
		H	53.8 – 59.1	700		
3	100	A	23.0 – 30.6	300	HMCP100R3C	
		B	30.7 – 38.3	400		
		C	38.4 – 46.0	500		
		D	46.1 – 53.7	600		
		E	53.8 – 61.4	700		
		F	61.5 – 69.1	800		
		G	69.2 – 76.8	900		
		H	76.9 – 84.5	1000		
4	150	A	34.6 – 46.0	450	HMCP150T4C	
		B	46.1 – 57.5	600		
		C	57.6 – 69.1	750		
		D	69.2 – 80.6	900		
		E	80.7 – 92.2	1050		
		F	92.3 – 103.7	1200		
		G	103.8 – 115.2	1350		
		H	115.3 – 126.7	1500		
4	150	A	57.0 – 75.0	750	HMCP150U4C	
		B	76.0 – 95.0	1000		
		C	96.0 – 114.0	1250		
		D	115.0 – 130.7	1500		
		E	③	1750		
		F	③	2000		
		G	③	2250		
		H	③	2500		

① Motor FLA ranges are typical. The corresponding trip setting is at 13 x the minimum FLA value shown. Where a 13 x setting is required for an intermediate FLA value, alternate Cam settings and/or MCP ratings should be used.

② For dc applications, actual trip levels are approximately 40% higher than values shown.

③ Settings above 130 amperes are for special applications. NEC Article 430-110(a) requires the ampere rating of the disconnecting means to be not less than 115% of the motor full load ampere rating.

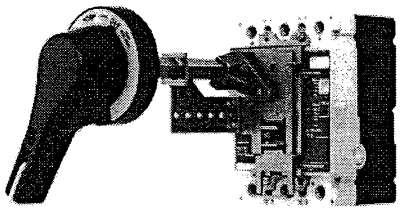
Note: HMCP 3 – 100 A come with line and load steel body terminals, 3T100FB. HMCP 150 A come with line and load steel body terminals, 3T150FB.

Through-the-Door Handle Mechanisms

Eaton's Cutler-Hammer through-the-door handle mechanisms mount on the front of an enclosure or cabinet door and externally operate the circuit breaker via a variable depth shaft or a linear operator (Type MC). Each rotary type handle mechanism includes a handle, base operating mechanism and shaft that can be cut to various lengths.

Series C Rotary and Universal Rotary handle mechanisms are for use with Molded Case Circuit Breakers (G, F, J, K, L, MDL), Molded Case Switches and Motor Circuit Protectors.

Series C Rotary and Universal Rotary, are UL listed and meet CSA requirements. Universal Rotary also meets IEC947-1/2 for international compliance. Rotary UL File Number is E64983.



Series C Rotary

Type 4/4X handles are similar to standard handles except they include an internal neoprene gasket. Type 4/4X handle style number is 6648C22G03. Due to gasketing effect between the handle and the housing, the handle may not indicate a tripped position.

Series C Rotary Accessories

As an option, an auxiliary switch is offered so that the control panel builder may electrically indicate the status of the breaker. This accessory would be mounted on the mechanism and comes with 24-inch (609.6 mm) pigtail leads.

Table 12-271. Series C Auxiliary Switch

Catalog Number	Price U.S. $
5108A61G01	

Table 12-272. Series C Rotary Ordering Information

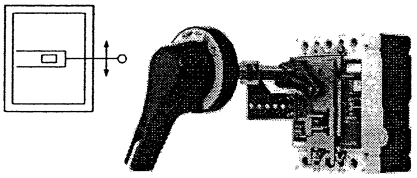
Shaft Length Inches (mm)	Complete Catalog Number ①	Price U.S. $	Separate Catalog Number						Catalog Number			
			Standard Handle ②	Price U.S. $	Breaker Mechanism ③	Price U.S. $	Shaft ④	Price U.S. $	IEC IP65 ⑤⑥	Price U.S. $	IEC IP66 ⑤⑥	Price U.S. $
F-Frame												
6 (152.4)	~~HM1R06~~		6648C22G01		6648C23G11		4217B37G04		WHM1R06		WHM1R06X	
12 (304.8)	HM1R12		6648C22G01		6648C23G11		4217B37G01		WHM1R12		WHM1R12X	
16 (406.4)	~~HM1R16~~		6648C22G01		6648C23G11		4217B37G02		WHM1R16		WHM1R16X	
24 (609.6)	HM1R24		6648C22G01		6648C23G11		4217B37G03		WHM1R24		WHM1R24X	
J-Frame												
6 (152.4)	HM2R06		6648C22G01		6648C23G21		4217B37G04		WHM2R06		WHM2R06X	
12 (304.8)	HM2R12		6648C22G01		6648C23G21		4217B37G01		WHM2R12		WHM2R12X	
16 (406.4)	HM2R16		6648C22G01		6648C23G21		4217B37G02		WHM2R16		WHM2R16X	
24 (609.6)	HM2R24		6648C22G01		6648C23G21		4217B37G03		WHM2R24		WHM2R24X	
K-Frame												
6 (152.4)	HM3R06		6648C22G01		6648C23G25		4217B37G04		WHM3R06		WHM3R06X	
12 (304.8)	HM3R12		6648C22G01		6648C23G25		4217B37G01		WHM3R12		WHM3R12X	
16 (406.4)	HM3R16		6648C22G01		6648C23G25		4217B37G02		WHM3R16		WHM3R16X	
24 (609.6)	HM3R24		6648C22G01		6648C23G25		4217B37G03		WHM3R24		WHM3R24X	
L- and MDL-Frame												
6 (152.4)	HM4R06		6648C22G11		6648C23G19		4217B37G04		WHM4R06		WHM4R06X	
12 (304.8)	HM4R12		6648C22G11		6648C23G19		4217B37G01		WHM4R12		WHM4R12X	
16 (406.4)	HM4R16		6648C22G11		6648C23G19		4217B37G02		WHM4R16		WHM4R16X	
24 (609.6)	HM4R24		6648C22G11		6648C23G19		4217B37G03		WHM4R24		WHM4R24X	
MD/MDS												
6 (152.4)	HM7R06		6648C22G21		6648C23G17		4217B37G04		—		—	
12 (304.8)	HM7R12		6648C22G21		6648C23G17		4217B37G01		—		—	
16 (406.4)	HM7R16		6648C22G21		6648C23G17		4217B37G02		—		—	
24 (609.6)	HM7R24		6648C22G21		6648C23G17		4217B37G03		—		—	
N-Frame												
6 (152.4)	HM5R06		6648C22G21		6648C23G08		4217B37G04		WHM5R06		WHM5R06X	
12 (304.8)	HM5R12		6648C22G21		6648C23G08		4217B37G01		WHM5R12		WHM5R12X	
16 (406.4)	HM5R16		6648C22G21		6648C23G08		4217B37G02		WHM5R16		WHM5R16X	
24 (609.6)	HM5R24		6648C22G21		6648C23G08		4217B37G03		WHM5R24		WHM5R24X	

① Complete catalog number includes the standard handle, mechanism, shaft and support brace/bracket.
② Handle is designed suitable for NEMA Types 1, 3R and 12 enclosures. Use style number **6648C22G03** for Type 4/4X handle or add **X** Suffix to complete catalog number. Handle is cast aluminum.
③ Breaker mechanism includes a shaft support bracket and its parts. Shaft is .50-inch (12.7 mm).
④ Longer shafts,16-inch (406.4 mm) and 24-inch (609.6 mm), include an adjustable support extension.
⑤ IEC Handle Mechanism supplied with Metric thread mounting hardware.
⑥ Complete catalog number includes a handle, mechanism and shaft.

Discount Symbol **CB-2**

Series C F-Frame External Accessories

SERIES C ROTARY HANDLE MECHANISM



Ordering Information

Breaker Frame	Shaft Length (inches)	COMPLETE CATALOG NUMBER①	SEPARATE STYLE NUMBERS		
			Standard Handle②	Breaker③ Mechanism	Shaft④
F	6	HM1R06	6648C22G01	6648C23G11	4217B37G04
	12	HM1R12	6648C22G01	6648C23G11	4217B37G01
	16	HM1R16	6648C22G01	6648C23G11	4217B37G02
	24	HM1R24	6648C22G01	6648C23G11	4217B37G03

The Westinghouse general purpose Rotary handle mechanisms are suitable for use with NEMA 1, 3R, 4, and 12 fabricated enclosures. They are designed for use with Series C F-Frame Circuit Breakers, Molded Case Switches, and Motor Circuit Protectors (HMCP).

Required for a standard application are the operating handle, shaft, and mechanism.

The operating handle has been designed to meet NFPA 79 requirements. It may be mounted in either the horizontal or the vertical direction. The handle was ergonomically designed with extra clearance for a "gloved hand" to operate. It may be padlocked in the OFF position utilizing 3 padlocks.

The standard label on the operating handle indicates ON/Tripped/OFF/Reset.

UL File E64893

To meet the various enclosure depths, four variable depth shafts are offered (6 inch, 12 inch, 16 inch, and 24 inch). Each shaft includes a support brace to ensure proper alignment. In addition, the 16 inch and 24 inch extra long shafts include an adjustable support bracket.

The standard mechanism located on the breaker does include means for internally locking the breaker in the "OFF" position with up to 3 padlocks each with a maximum diameter of .312 inch.

NEMA 4/4X handles are similar to standard handles except they include an internal neoprene gasket. NEMA 4/4X handle style number is 6648C22G03. Due to gasketing effect between the handle and the housing, the handle may not indicate a tripped position.

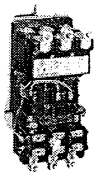
Accessories
As an option, an auxiliary switch is offered so that the control panel builder may electrically indicate the status of the breaker. This accessory would be mounted on the mechanism and comes with 24-inch pigtail leads.

Microswitch
(Includes 24-inch Pigtail leads)

STYLE NUMBER
5108A61G01

Refer to Technical Data 29-121 or Catalog 26-000 for replacement type Vari-depth and AMT handle mechanisms.

① Complete catalog number includes the standard handle, mechanism, shaft, and support brace/bracket.
② Handle is designed suitable for NEMA 1, 3R, and 12 enclosures.
③ Breaker mechanism includes a shaft support bracket and its parts.
④ Longer shafts (16 in. and 24 in.) include an adjustable support extension.



Bulletin 509, Size 3
with Eutectic Alloy
Overload Relay,
Open Type without Enclosure

Bulletin 509, Size 5
with Solid-State
Overload Relay,
Open Type without Enclosure

Heater Elements — Starters with eutectic alloy overload relay require 3 heater elements. See page 1-177 for heater element selection tables.

3-Phase • 600V AC Maximum • 60 Hz • With 3-Pole Overload Protection

NEMA Size	Continuous Ampere Rating [A]	Maximum Horsepower Rating Full Load Current Must Not Exceed "Continuous Ampere Rating" — Motor Voltage 200V	230V	50 Hz 380...415V	460...575V	Open Type Without Enclosure Cat. No.	Type 1 General Purpose Enclosure Surface Mounting Cat. No.	Type 3R/12 Rainproof, Dusttight Industrial Use Enclosure Cat. No.	Type 4/4X Watertight Corrosion-Resistant Enclosures Stainless Steel Cat. No.*	Type 4X Watertight Corrosion-Resistant Enclosure Fiberglass-Reinforced Polyester Cat. No.❄
00	9	1-1/2	1-1/2	2	2	509-TO⊗-✪	509-TA⊗-✪	Use Size 0 starter		
0	18	3	3	5	5	509-AO⊗-✪	509-AA⊗-✪	509-AJ⊗-✪	509-AC⊗-✪	509-AS⊗-✪
1	27	7-1/2	7-1/2	10	10	509-BO⊗-✪	509-BA⊗-✪	509-BJ⊗-✪	509-BC⊗-✪	509-BS⊗-✪
2	45	10	15	25	25	509-CO⊗-✪	509-CA⊗-✪	509-CJ⊗-✪	509-CC⊗-✪	509-CS⊗-✪
3	90	25	30	50	50	509-DO⊗-✪	509-DA⊗-✪	509-DJ⊗-✪	509-DC⊗-✪	
4	135	40	50	75	100	509-EO⊗-✪	509-EA⊗-✪	509-EJ⊗-✪	509-EC⊗-✪	
5	270	75	100	150	200	509-FO⊗-✪	509-FA⊗-✪	509-FJ⊗-✪	509-FC⊗-✪	
6‡	540	150	200	300	400	509-GO⊗-✪	§ 509-GA⊗-✪	§ 509-GJ⊗-✪	§ 509-GC⊗-✪	—
7‡	810	—	300	600	600	509-HO⊗-✪	509-HA⊗-✪	509-HJ⊗-✪	—	
8‡	1215	—	450	900	900	509-JO⊗-✪	509-JA⊗-✪	509-JJ⊗-✪	—	
9	2250	—	800	1600	1600	509-KO⊗-✪	509-KA⊗-✪	509-KJ⊗-✪	—	

⊗ Coil Voltage Code

The cat. no. as listed is incomplete. Select a coil voltage code from the table below to complete the cat. no. Example: **Cat. No. 509-BA⊗-✪** becomes **Cat. No. 509-BAD-✪**. For other voltages, please consult your local Rockwell Automation sales office or Allen-Bradley distributor.

[V]		24♣	110-115	115-120	200-208	220-230	230-240	240	277	380	380-400	415	440-460	460-480	500	550	575-600
Common Control➢	AC, 50 Hz	—	—	—	–	P⁘	—	T	—	N	KN	I	Q	—	M	R	—
	AC, 60 Hz	—	—	—	H	—	A♠	—	—	—	—	U	—	B	—	—	C
Transformer Control	AC, 60 Hz	—	—	—	H	—	A	—	—	—	—	—	—	B	—	—	C
Separate Control (without transformer)	AC, 50 Hz	K	S⌘	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	AC, 60 Hz	J	—	D+	—	—	—	—	F	—	—	—	—	—	—	—	—

✪ Overload Relay Code

Use to order solid-state overload relay. Do not use when ordering eutectic alloy overload relay. The cat. no. as listed is incomplete. Select an overload relay code from page 1-169 to complete the cat. no. Example: **Cat. No. 509-BAD-✪** becomes **Cat. No. 509-BAD-A2D**.

* Sizes 6...8 are painted enclosures.
❄ Fiberglass reinforced polyester hubs are included with each starter.
‡ Does not include line and load lugs, see page 1-122 for kits.
§ Price includes control current transformer.
♣ Only available on sizes 00...5. When using 24V coils on size 4 or 5, an interposing relay may be required. See coil VA values on page 1-139.
➢ When selecting a factory-installed control circuit transformer (see Modifications page 1-116), use the common control coil voltage code to denote the transformer primary voltage. The starter coil and transformer secondary voltage will both be 120V by default. Example: **Cat. No. 509-BAB-6P** will have a transformer with a 480V primary/120V secondary voltage and a 120V starter coil. If a starter coil voltage other than 120V is desired, a second coil voltage code must be added to denote the coil/transformer secondary voltage. Example: **Cat. No. 509-BABJ-6P** will have a transformer with a 480V primary/24V secondary and a 24V starter coil.
⌘ This coil is optimized for 110...115V, 50 Hz applications, but can be used at 120V, 60 Hz nominal.
+ This coil is optimized for 115...120V, 60 Hz applications, but can be used at 110V, 50 Hz nominal.
⁘ This coil is optimized for 220...230V, 50 Hz applications, but can be used at 240V, 60 Hz nominal.
♠ This coil is optimized for 230...240V, 60 Hz applications, but can be used at 220V, 50 Hz nominal.

Accessories — page 1-121
Modifications — page 1-116
Specifications — page 1-136
Approximate Dimensions — page 1-146, page 1-147

Overload Relay Code Selection

For Application on Bulletin 500 Line Starters and NEMA Pump Panels

Starters Without Overload Relays for Field Assembly of Starters Using Bulletin 592 Overload Relays +❖♠[11]

These products are intended for field installation of Bulletin 592 Eutectic, or 592 solid-state overload relays. (Select Bulletin 592 overload relays from page 1-180...page 1-182.) They ship in a starter carton with provisions for mounting the overload relay (includes a starter mounting plate, screws/bolts and instructions).

Eutectic Alloy Overload Relays — Overload relay codes do not apply. Use Cat. No. as listed in product selection tables. Select heater elements from page 1-188. Starter Cat. Nos. marked in blue with eutectic alloy overload relays are part of the AB Express Program. Starters with solid-state overload relays are not presently part of the AB Express Program.

+ All Sizes — No overload relay.

❖ Bulletins 520, 522, and 523 require two overload relays.

♠ Bulletins 530, 1282, and 1283 require two overload relays. When selecting the proper solid-state overload relay or heater, divide motor nameplate full load amperes by 2.00. Use this value to select the proper overload relays.

[11]Bulletins 540, 1242, and 1243 have one overload relay. When selecting the proper solid-state overload relay or heater, divide motor nameplate full load amperes by 1.73. Use this value to select the proper overload relays.

E1 Plus Solid-State Overload Relay (Selectable Class 10, 20, or 30) (Automatic/Manual Reset)

For use with Bulletins 505, 505V, 506, 507, 509, 512, 512M, 513, 520, 522, 523, 530, 532, 533, 540, 542, 543, 570, 572, 573, 1232X, 1233X, 1242, 1243, 1272, 1273, 1282, and 1283.♣➢⌘

NEMA Size	Full Load Current Adjustment Range (A)	Overload Relay Code Class 20
00	0.1...0.5	A2A
	0.2...1.0	A2C
	1.0...5.0	A2D
	1.0...5.0	A2E
	3.2...16	A2F
0, 1 1PW 1YD	0.2...1.0	A2B
	0.2...1.0	A2C
	1.0...5.0	A2D
	1.0...5.0	A2E
	3.2...16	A2F
	5.4...27	A2G
1	9...45	A2H
2 2PW 2YD	5.4...27	A2G
	9...45	A2H
	9...45	A2J
3 3PW 3YD	9...45	A2J
	18...90	A2K
	18...90	A2L
4 4PW 4YD	30...150	A2K
	30...150	A2L
	30...150	A2M
5 5PW 5YD	60...300	A2N
6 6PW 6YD	120...600	A2R
7+	256...810	§
8+	384...1215	
9+	800...2250	

♣ Bulletins 520, 522, and 523 require two overload relay codes to complete the Cat. No. The first code will denote the high speed overload relay and the second code will denote the low speed overload relay.

➢ Bulletins 530, 532, 533, 1282, and 1283 have two overload relays and require two overload relay codes to complete the Cat. No. When selecting the proper SMP overload relay, divide motor nameplate full load amperes by 2.00. Use this value to select the proper overload relay codes.

⌘ Bulletins 540, 542, 543, 1242, and 1243 have one overload relay. When selecting the proper SMP overload relay, divide motor nameplate full load amperes by 1.73. Use this value to select the proper overload relay code.

+ These solid-state overload relays have an interposing relay with a 120V AC coil.

§ Order by description.

E3 Solid-State Overload Relay: 2 Inputs/1 Output

For use with Bulletins 505, 505V, 506, 507, 509, 512, 512M, 513, 520, 522, 523, 530, 532, 533, 540, 542, 543, 570, 572, 573, 1232X, 1233X, 1242, 1243, 1272, 1273, 1282, and 1283.*

NEMA Size	Full Load Current Adjustment Range (A)	Overload Relay Code*
00	1...5	EC1A
	3...15	EC1B
0...2	1...5	EC1A
	3...15	EC1B
	5...25	EC1C
	9...45	EC1D
3	9...45	EC1D
	18...90	EC1E
4	28...140	EC1F
5	60...302	EC1H
6	125...630	EC1K

E3 Plus Solid-State Overload Relay: 4 Inputs/2 Outputs, Built-In Ground Fault Sensor, PTC Thermistor Input

For use with Bulletins 505, 505V, 506, 507, 509, 512, 512M, 513, 520, 522, 523, 530, 532, 533, 540, 542, 543, 570, 572, 573, 1232X, 1233X, 1242, 1243, 1272, 1273, 1282, and 1283.*

NEMA Size	Full Load Current Adjustment Range (A)	Overload Relay Code*
00	1...5	EC2A
	3...15	EC2B
0...2	1...5	EC2A
	3...15	EC2B
	5...25	EC2C
	9...45	EC2D
3	9...45	EC2D
	18...90	EC2E
4	28...140	EC2F
5	60...302	EC2H

* Bulletin 520 requires two overload relay codes to complete the cat. no. The first code will denote the high speed overload relay and the second code will denote the low speed overload relay.

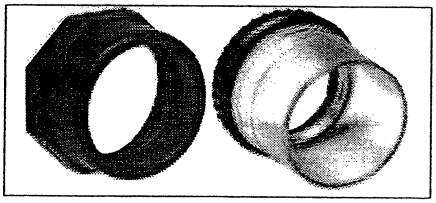
❊ Rockwell Automation recommends using 120 or 240V AC coils on all NEMA Starters with E3 solid-state overload relays. When using coil voltages other than 120 or 240V AC, consult your local Rockwell Automation distributor.

ACCESSORIES

FEATURES INCLUDE

- Alternate action block provides push-on push-off function
- EECR clamp ring provides guard on illuminated push buttons
- Lock off permits padlocking operators in depressed position

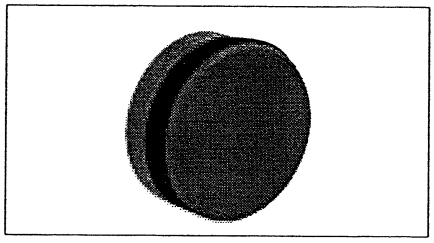
Extended Clamp Ring



Description	Catalog Number
Extended Clamp Ring	ECR
Guarded Clear Clamp Ring	EECR
Large Extended Clamp Ring	LECR

Use ECR with flush cap to offer additional protection. Use EECR with illuminated push buttons. Use LECR with flush or extended caps for easier access to button than ECR.

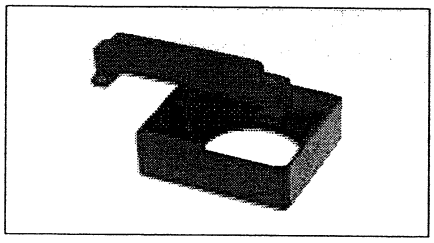
Hole Plug



Description	Catalog Number
Hole Plug	HP

Use to close unused panel holes. Supplied with sealing panel gaskets. Hole plug is NEMA 4X rated.

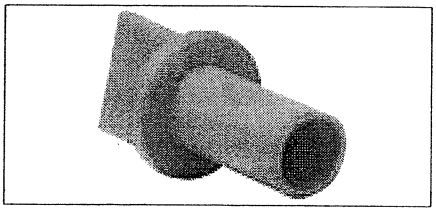
Mechanical Interlock



Description	Catalog Number
Mechanical Interlock	MI

Use to interlock two adjacent operators. May also be used to interlock a two unit maintained/momentary assembly.

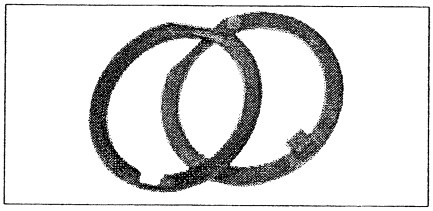
Lamp Removal Tool



Description	Catalog Number
Lamp Removal Tool	LRT

Used to facilitate the removal of lamps particularly in illuminated push button and push-to-test operators

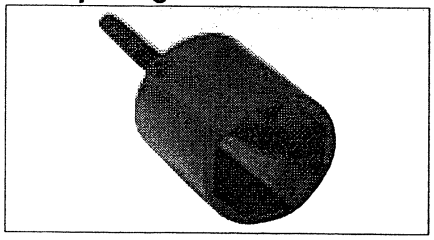
Thrust and Trim Washer



Description	Catalog Number
Anti-Rotation Washer for 30MM Product	TTW

Anti-rotation device for use with 30MM push-buttons, selector switches and pilot lights. Provides additional protection from rotation.

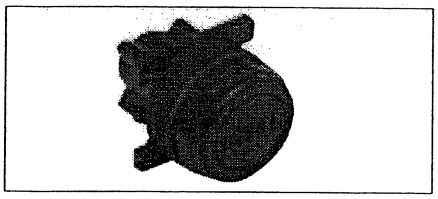
Clamp Ring Wrench



Description	Catalog Number
Clamp Ring Wrench	CRW

To simplify tightening and loosening of standard and aluminum 1 3/8" octagonal clamp ring.

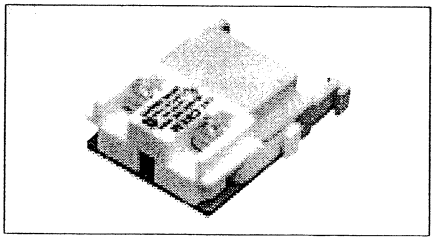
Reset Push Button



Description	Parts Included	Catalog Number
Reset Pushbutton	None	RPB
Reset Pushbutton	2 Bolts	RPB-B
Reset Pushbutton	Washer Set	RPB-W
Reset Pushbutton	1 3/4, 3	RPB-BW
Bolts only (1/4-20 x 1 3/4" & 3")		RPBB
Washer Set	None	RPBW

Unit mounts in standard 1 13/64" hole and accepts either 20 hex head bolts or 20 thread rod to provide adjustable extension. Universal styles include two bolts to cover 1" to 3" space from cover to overload reset rod. Other bolt lengths available upon request.

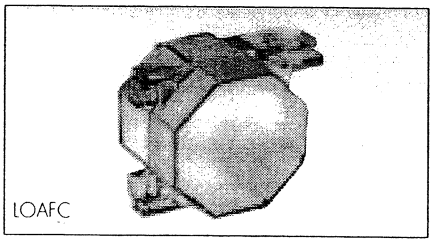
Alternate Action Block



Description	Catalog Number
Alternate Action Block	AABEM

Block mounts in position of a standard contact block to provide alternate contact action (push-on push-off). May be used with any push button or illuminated push button operator. Should be used with early make contact blocks (CBEM) only.

Lock Off Attachment

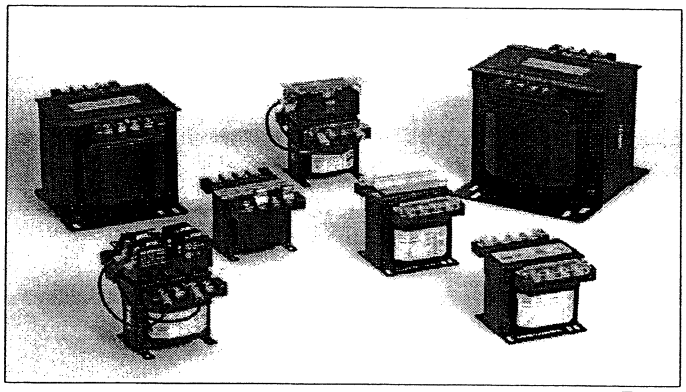


LOAFC

Use With	Catalog Number
Standard Extended Cap	LOAX
Standard Mushroom Cap	LOAM
PPMC or PXMC Cap	LOAP
Maintained Pushbuttons	PPGD
All Products	LOAFC

he SBE -- Encapsulated Series

The SBE Encapsulated industrial control transformers are epoxy encapsulated to seal the transformer windings against moisture, dirt and industrial contaminants. Extra deep, molded terminal barriers reduce the chance of electrical failure as the result of arcing or frayed lead wires. The rugged construction and proven reliability of the SBE design is uniquely suited for all industrial environments.



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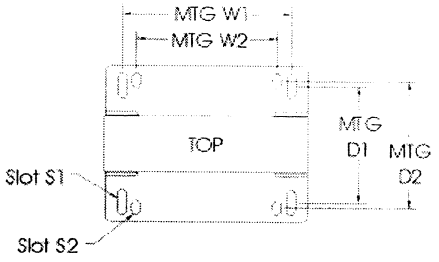
Features

- 50 - 1000 VA, 50/60 Hz – suitable for world wide applications.
- Interleaved copper windings reduce I^2R losses and maximize efficiency.
- 55°C Rise, 105°C insulation system to minimize heat.
- Epoxy encapsulated to protect cores and coils against moisture, dirt, and other contaminants.
- Meets or Exceeds NEMA Standard ST 1 and ANSI C89.1 for load inrush capability.
- Integrally molded, flame retardant (IEC 707 / ISO Class 1210) Terminal Blocks provide greater terminal contact area and improved conductivity.
- Heavy gauge steel mounting plate.
- Mounting dimensions are compatible with similar control transformers.
- ***Secondary fuse holders (FB2X) included for 13/32 x 1- 1/2 cartridges (fuses not included).***
- ***Factory-installed fuse holders are available (See WA & WB options).***
- 10 + 2 year warranty.

Related Products

- Linear Power Supplies
- DIN Rail DC Power Supplies
- Constant Voltage Transformers
- Line Reactors

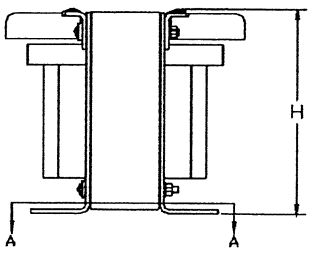
SBE Mounting Profiles



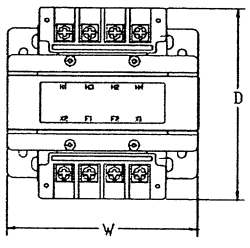
Mounting Dimensions

Accessories

Catalog Number	Description
FBP	Primary "CC" Rejection Type Fuse Holder (Finger Safe covers not available)
FB2	Secondary Fuse Holder only (Glass or Ceramic, ¼" x 1¼" fuse).
FB2X	Secondary Fuse Holder only (Midget Cartridge Type, 13/32" x 1½" fuse).
FBPC1	Primary "CC" Rejection Type Fuse Holder and Finger Safe Cover Kit
IP20	IEC Touchproof Cover Kit
SBEDIN	IEC Fuse Holder Adaptor Kit
WA & WB	Factory installed Fuse Holder



Profile



Top View

Visit our website at www.solaheviduty.com or contact **Technical Services** at **(800) 377-4384** with any questions.

BE Encapsulated Series Selection Tables

Group 2 – 220 x 440 Volt Primary, 110 Volt Secondary, 50/60 Hz
230 x 460 Volt Primary, 115 Volt Secondary, 50/60 Hz
240 x 480 Volt Primary, 120 Volt Secondary, 60 Hz

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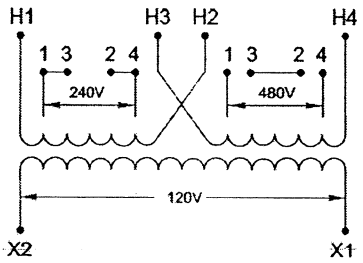
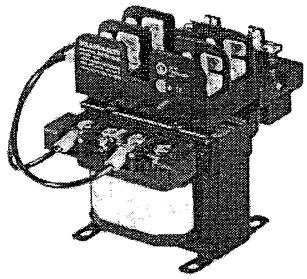
VA	Catalog Number	Height (inch)	Width (inch)	Depth (inch)	Mtg Width W1 / W2	Mtg Depth D1 / D2	Slot Size S1 / S2	Approx. Ship Weight (lbs)
50	E050	2.72	3.01	3.99	2.51 / NA	2.02 / NA	.20 x .33 / .20 x .33	3
75	E075	2.96	3.39	4.36	2.81 / 2.50	2.10 / NA	.20 x .50 / .20 x .50	3
100	E100	2.96	3.39	4.61	2.81 / 2.50	2.37 / NA	.20 x .50 / .20 x .50	4
150	E150	3.89	4.5	4.48	3.74 / 3.12	2.56 / 2.87	.20 x .65 / .20 x .33	6
200	E200	3.89	4.5	4.79	3.74 / 3.12	2.87 / 3.18	.20 x .65 / .20 x .33	8
250	E250	3.89	4.5	5.21	3.74 / 3.12	3.29 / 3.61	.20 x .65 / .20 x .33	9
300	E300	4.53	5.25	5.09	4.38 / 3.75	3.10 / NA	.31 x .71 / .31 x .71	10
350	E350	4.53	5.25	5.53	4.38 / 3.75	3.54 / NA	.31 x .71 / .31 x .71	13
500	E500	4.53	5.25	6.31	4.38 / 3.75	4.33 / NA	.31 x .85 / .31 x .85	17
750	E750	5.56	6.38	6.93	5.32 / 4.37	4.25 / 5.75	.31 x .85 / .31 x .85	25
1000	E1000	5.56	6.38	7.36	5.32 / 4.37	4.68 / 6.18	.31 x .85 / .31 x .85	32



Note: *Includes FB2X Secondary fuse holder.*

Group 2A – Factory installed Primary Fuse Holder Class "CC" and Secondary Fuse Holder (Glass or Ceramic, ¼" x 1¼" fuse type).

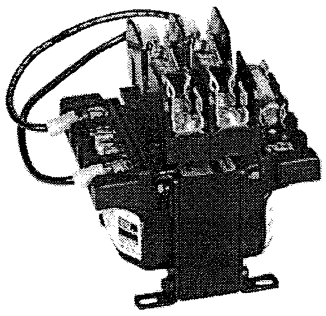
VA	Catalog Number	Height (inch)	Width (inch)	Depth (inch)	Mtg Width W1 / W2	Mtg Depth D1 / D2	Slot Size S1 / S2	Approx. Ship Weight (lbs)
50	E050WA	4.18	3.01	3.99	2.51 / NA	2.02 / NA	.20 x .33 / .20 x .33	3
75	E075WA	4.41	3.39	4.36	2.81 / 2.50	2.10 / NA	.20 x .50 / .20 x .50	4
00	E100WA	4.41	3.39	4.61	2.81 / 2.50	2.37 / NA	.20 x .50 / .20 x .50	8
150	E150WA	5.36	4.5	4.48	3.74 / 3.12	2.56 / 2.87	.20 x .65 / .20 x .33	11
200	E200WA	5.36	4.5	4.79	3.74 / 3.12	2.87 / 3.18	.20 x .65 / .20 x .33	10
250	E250WA	5.36	4.5	5.21	3.74 / 3.12	3.29 / 3.61	.20 x .65 / .20 x .33	15
300	E300WA	5.99	5.25	5.09	4.38 / 3.75	3.10 / NA	.31 x .71 / .31 x .71	13
350	E350WA	5.99	5.25	5.53	4.38 / 3.75	3.54 / NA	.31 x .71 / .31 x .71	15
500	E500WA	5.99	5.25	6.31	4.38 / 3.75	4.33 / NA	.31 x .85 / .31 x .85	30
750	E750WA	7.01	6.38	6.93	5.32 / 4.37	4.25 / 5.75	.31 x .85 / .31 x .85	30
1000	E1000WA	7.01	6.38	7.36	5.32 / 4.37	4.68 / 6.18	.31 x .85 / .31 x .85	34



Note: *Includes Finger Safe covers.*

Group 2B – Factory installed Primary Fuse Holder Class "CC" and Secondary Fuse Holder (Midget Cartridge, 13/32" x 1½" fuse type).

VA	Catalog Number	Height (inch)	Width (inch)	Depth (inch)	Mtg Width W1 / W2	Mtg Depth D1 / D2	Slot Size S1 / S2	Approx. Ship Weight (lbs)
50	E050WB	4.18	3.01	3.99	2.51 / NA	2.02 / NA	.20 x .33 / .20 x .33	3
75	E075WB	4.41	3.39	4.36	2.81 / 2.50	2.10 / NA	.20 x .50 / .20 x .50	4
100	E100WB	4.41	3.39	4.61	2.81 / 2.50	2.37 / NA	.20 x .50 / .20 x .50	8
150	E150WB	5.36	4.5	4.48	3.74 / 3.12	2.56 / 2.87	.20 x .65 / .20 x .33	11
200	E200WB	5.36	4.5	4.79	3.74 / 3.12	2.87 / 3.18	.20 x .65 / .20 x .33	10
250	E250WB	5.36	4.5	5.21	3.74 / 3.12	3.29 / 3.61	.20 x .65 / .20 x .33	15
300	E300WB	5.99	5.25	5.09	4.38 / 3.75	3.10 / NA	.31 x .71 / .31 x .71	13
350	E350WB	5.99	5.25	5.53	4.38 / 3.75	3.54 / NA	.31 x .71 / .31 x .71	15
500	E500WB	5.99	5.25	6.31	4.38 / 3.75	4.33 / NA	.31 x .85 / .31 x .85	30
750	E750WB	7.01	6.38	6.93	5.32 / 4.37	4.25 / 5.75	.31 x .85 / .31 x .85	30
000	E1000WB	7.01	6.38	7.36	5.32 / 4.37	4.68 / 6.18	.31 x .85 / .31 x .85	34



ote: Includes Finger Safe covers.

Visit our website at www.solaheviduty.com or
contact **Technical Services** at **(800) 377-4384** with any questions.

CCMR Series POWR-PRO® CC Fuses

600 VAC ▪ Dual-Element, Time-Delay ▪ 2/10 – 60 Amperes

Littelfuse
POWR-GARD™ Products

SPECIFICATIONS

Voltage Ratings: AC: 600 Volts
DC: 250 Volts (CCMR 2/10 — 2A)
(CCMR 4 1/2 — 10A)
(CCMR 35 — 60A)
300 Volts (CCMR 2 1/4 — 4A)
500 Volts (CCMR 12 — 30A)

Interrupting Ratings: AC: 200,000 amperes rms symmetrical
300,000 amperes rms symmetrical
(Littelfuse self-certified)
DC: 20,000 amperes

Ampere Range: 2/10 — 60 amperes

Approvals: AC: Standard 248-4, Class CC
UL Listed 2/10 – 30 amps (File No: E81895)
Standard 248, Class CD
UL Listed 35 – 60 amps (File No: E71611)
CSA Certified 2/10 – 60 amps
(File No: LR29862)
DC: Littelfuse self-certified

AMPERE RATINGS

3/10	1	2	3½	6¼	12	35
¼	1¼	2¼	4	7	15	40
3/8	1 4/10	2½	4½	7½	17½	45
½	1½	2 6/10	5	8	20	50
6/10	1 6/10	3	5 6/10	9	25	60
¾	1 8/10	3 3/10	6	10	30	

Example part number (series & amperage): CCMR 40

RECOMMENDED FUSE BLOCKS

L60030C series (CCMR 2/10 — 30A)
L60060C series (CCMR 35 — 60A)

Refer to Fuse Block section of this catalog for additional information.

For space-saving protection of motor circuits up to 40 HP*, we recommend Littelfuse POWR-PRO® CCMR series fuses. These fuses are the only true dual-element, time-delay fuses in a package this small that are specifically engineered for motor branch circuit protection. They provide Type 2 protection (no damage) to both NEMA-rated and the more sensitive IEC (International Electrotechnical Commission) type motor circuit components.

Because CCMR fuses are the most current limiting rating for rating, and because their time-delay characteristics permit the use of smaller fuse ratings in motor circuits than would be possible with fast-acting fuses, CCMR fuses provide superior short-circuit protection. Furthermore, they provide this superior protection in a fraction of the space required by other fuse classes. For example, when 600V three-pole, 30 ampere Class R fuse blocks are replaced by Littelfuse Class CC fuse blocks, mounting space requirements may be reduced 70% or more. This is especially important when a panel contains control devices for many motors.

In addition to the UL Listed smaller sizes, Littelfuse CCMR series fuses are now available in larger sizes — from 35 to 60 amperes! ***No other fuse is available with this current carrying capacity in a package this small. As a matter of fact, the 60 ampere CCMR fuse is the smallest 60A fuse available which is rated at 600 volts.***

*Consult the Motor Protection Tables in the Fuseology section for specific motor sizing information

APPLICATIONS

CCMR series fuses are specifically designed to withstand sustained starting currents of small motors

Provide short-circuit protection for motor branch circuits

Use with IEC- and NEMA-rated motor controllers and contactors

General purpose circuits up to 60 amps

FEATURES/BENEFITS

- **Space savings** — No other fuse class approved for branch-circuit protection has a 600 volt rating and 300,000 A.I.R. in a package this small.
- **Extremely current-limiting** — Reduces damage caused by heating and magnetic effects of short-circuit currents — stops damaging short-circuit currents faster than any mechanical protective device.
- **Excellent time delay** — Eliminates needless downtime caused by power surges or equipment demands . . . permits selection of fuse sizes closer to actual load conditions — provides better protection.
- **300kA Interrupting Rating** — Littelfuse self-certified to 300,000 amperes as standard. Meets future trend towards higher available short circuit currents.

250 Volt Slo-Blo® Type Fuse FLM Series

UL CSA QPL

ELECTRICAL CHARACTERISTICS:

% of Ampere Rating	Ampere Rating	Opening Time
135%	1/10-30	1 hour, Maximum
	32/10–30	12 seconds, Minimum
200%	0–3	5 seconds, Minimum

AGENCY APPROVALS: Listed by Underwriters Laboratories and Certified by CSA.

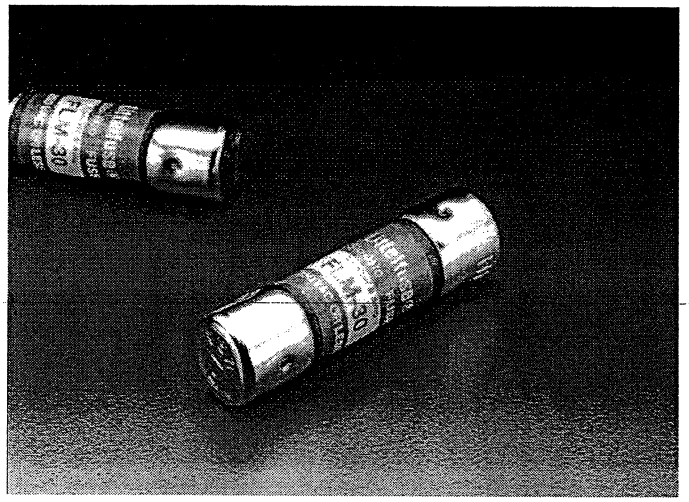
INTERRUPTING RATING: 10,000 amperes at 250 VAC.

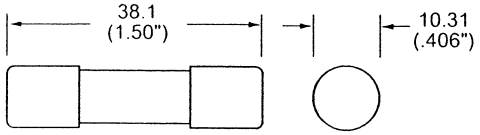
FUSES TO MIL SPEC: See F09B type in Military Section.

PATENTED

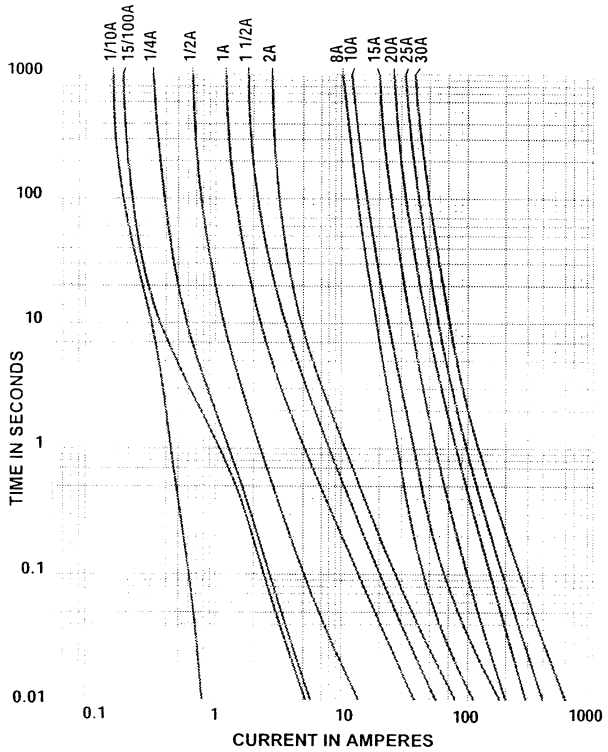
ORDERING INFORMATION:

Cartridge Catalog Number	Ampere Rating	AC Voltage Rating	Nominal Resistance Cold Ohms
FLM 1/10	.100	250	188.0
FLM 15/100	.150	250	87.0
FLM 2/10	.200	250	35.109
FLM 1/4	.250	250	5.413
FLM 3/10	.300	250	3.79
FLM 4/10	.400	250	2.10
FLM 1/2	.500	250	1.54
FLM 6/10	.600	250	1.024
FLM 8/10	.800	250	.623
FLM 1	1	250	.395
FLM 1 1/8	1.125	250	.356
FLM 1 1/4	1.25	250	.286
FLM 1 4/10	1.4	250	.253
FLM 1 1/2	1.5	250	.219
FLM 1 6/10	1.6	250	.184
FLM 1 8/10	1.8	250	.162
FLM 2	2	250	.125
FLM 2 1/4	2.25	250	.102
FLM 2 1/2	2.5	250	.0904
FLM 2 8/10	2.8	250	.0735
FLM 3	3	250	.0700
FLM 3 2/10	3.2	250	.0576
FLM 3 1/2	3.5	250	.0517
FLM 4	4	250	.0426
FLM 4 1/2	4.5	250	.0360
FLM 5	5	250	.0413
FLM 5 6/10	5.6	250	.0326
FLM 6	6	250	.0280
FLM 6 1/4	6.25	250	.0277
FLM 7	7	250	.02133
FLM 8	8	250	.01247
FLM 9	9	250	.01066
FLM 10	10	250	.00903
FLM 12	12	250	.00698
FLM 15	15	250	.00530
FLM 20	20	250	.00385
FLM 25	25	250	.00275
FLM 30	30	250	.00226





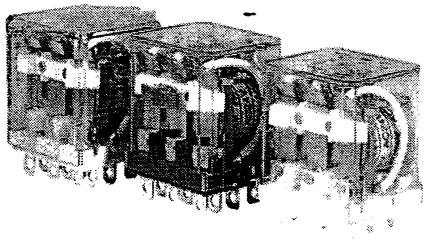
Average Time Current Curves



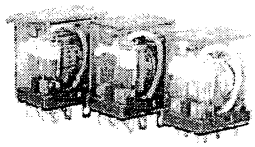
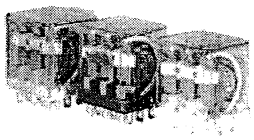
RH Series Compact Power Relays

SPDT through 4PDT, 10A contacts
Compact power type relays

The RH series are miniature power relays with a large capacity. The RH relays feature 10A contact capacity as large as the RR series but in a miniature package. The compact size saves space.



Part Number Selection

Contact	Model	Part Number: Blade Terminal	Part Number: PCB Terminal	Coil Voltage Code (Standard Stock in bold)
SPDT 	Basic	RH1B-U	RH1V2-U	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH1B-UL	—	
	With Check Button	RH1B-UC	—	
	With Indicator and Check Button	RH1B-ULC	—	
	Top Bracket Mounting	RH1B-UT	—	
	With Diode (DC coil only)	RH1B-UD	RH1V2-UD	DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH1B-ULD	—	**DC12V**, **DC24V**, DC48V, DC110V
DPDT 	Basic	RH2B-U	RH2V2-U	AC6V, AC12V, **AC24V**, **AC110-120V**, **AC220-240V** DC6V, **DC12V**, **DC24V**, DC48V, DC100-110V
	With Indicator	RH2B-UL	RH2V2-UL	
	With Check Button	RH2B-UC	—	
	With Indicator and Check Button	RH2B-ULC	—	
	Top Bracket Mounting	RH2B-UT	—	
	With Diode (DC coil only)	RH2B-UD	RH2V2-UD	DC6V, **DC12V**, **DC24V**, DC48V, DC100-110V
	With Indicator and Diode (DC coil only)	RH2B-ULD	—	
3PDT 	Basic	RH3B-U	RH3V2-U	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH3B-UL	RH3V2-UL	
	With Check Button	RH3B-UC	—	
	With Indicator and Check Button	RH3B-ULC	—	
	Top Bracket Mounting	RH3B-UT	—	
	With Diode (DC coil only)	RH3B-D*	RH3V2-D*	DC6V, DC12V, DC24V, DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH3B-LD*	—	
4PDT 	Basic	RH4B-U	RH4V2-U	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH4B-UL	RH4V2-UL	
	With Check Button	RH4B-UC	—	
	With Indicator and Check Button	RH4B-ULC	—	
	Top Bracket Mounting	RH4B-UT	—	
	With Diode (DC coil only)	RH4B-UD	RH4V2-UD	DC6V, DC12V, DC24V, DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH4B-LD*	—	

1. *Carries no UL recognition mark.
2. PCB terminal relays are designed to mount directly to a circuit board without any socket.

Ordering Information
When ordering, specify the Part No. and coil voltage code:
(example) **RH3B-U** **AC120V**
Part No. — Coil Voltage Code

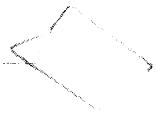
Sockets (for Blade Terminal Models)

Relays	Standard DIN Rail Mount [1]	Finger-safe DIN Rail Mount [1]	Through Panel Mount	PCB Mount
RH1B	SH1B-05	SH1B-05C	SH1B-51	SH1B-62
RH2B	SH2B-05	SH2B-05C	SH2B-51	SH2B-62
RH3B	SH3B-05	SH3B-05C	SH3B-51	SH3B-62
RH4B	SH4B-05	SH4B-05C	SH4B-51	SH4B-62




1. DIN Rail mount socket comes with two horseshoe clips. Do not use unless you plan to insert pullover wire spring. Replacement horseshoe clip part number is Y778-011.

Hold Down Springs & Clips

Appearance	Description	Relay	For DIN Mount Socket	For Through Panel & PCB Mount Socket	Min Order Qty
	Pullover Wire Spring	RH1B	SY2S-02F1 [2]	SY4S-51F1	10
		RH2B	SY4S-02F1 [2]		
		RH3B	SH3B-05F1 [2]		
		RH4B	SH4B-02F1 [2]		
	Leaf Spring (side latch)	RH1B, RH2B, RH3B, RH4B	SFA-202 [3]	SFA-302 [3]	20
	Leaf Spring (top latch)	RH1B, RH2B, RH3B, RH4B	SFA-101 [3]	SFA-301 [3]	

2. Must use horseshoe clip when mounting in DIN mount socket. Replacement horseshoe clip part number is Y778-011.
3. Two required per relay.

AC Coil Ratings

Voltage (V)	Rated Current (mA) ±15% at 20°C AC 50Hz SPDT	DPDT	3PDT	4PDT	AC 60Hz SPDT	DPDT	3PDT	4PDT	Coil Resistance (Ω) ±10% at 20°C SPDT	DPDT	3PDT	4PDT	Operation Characteristics (against rated values at 20°C) Max. Continuous Applied Voltage	Pickup Voltage	Dropout Voltage
6	170	240	330	387	150	200	280	330	330	9.4	6.4	5.4	110%	80% maximum	30% minimum
12	86	121	165	196	75	100	140	165	165	39.3	25.3	21.2			
24	42	60.5	81	98	37	50	70	83	83	153	103	84.5			
110	9.6	—	18.1	21.6	8.4	—	15.5	18.2	18.2	—	2,200	1,800			
110-120	—	9.4-10.8	—	—	—	8.0-9.2	—	—	—	—	—	—			
120	8.6	—	16.4	19.5	7.5	—	14.2	16.5	16.5	—	10,800	7,360			
220	4.7	—	8.8	10.7	4.1	—	7.7	9.1	9.1	—	10,800	7,360			
220-240	—	4.7-5.4	—	—	—	4.0-4.6	—		—	18,820	—	—			
240	4.9	—	8.2	9.8	4.3	—	7.1	8.3	8.3	—	12,100	9,120			

DC Coil Ratings

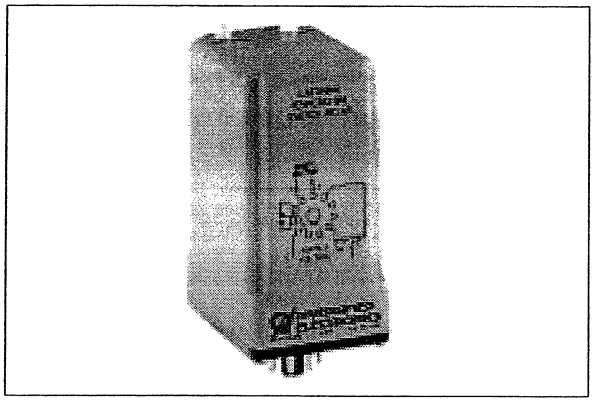
Voltage (V)	Rated Current (mA) ±15% at 20°C SPDT	DPDT	3PDT	4PDT	Coil Resistance (Ω) ±10% at 20°C SPDT	DPDT	3PDT	4PDT	Operation Characteristics (against rated values at 20°C) Max. Continuous Applied Voltage	Pickup Voltage	Dropout Voltage
6	128	150	240	250	47	40	25	24	110%	80% maximum	10% minimum
12	64	75	120	125	188	160	100	96			
24	32	36.9	60	62	750	650	400	388			
48	18	18.5	30	31	2,660	2,600	1,600	1,550			
100-110	—	8.2-9.0	—	—	—	12,250	—	—			
110	8	—	12.8	15	13,800	—	8,600	7,340			

Standard coil voltages are in **BOLD**.

SPM SERIES

DIVERSIFIED ELECTRONICS

Temperature Switch Relay
SPM-120-ACA/-ADA



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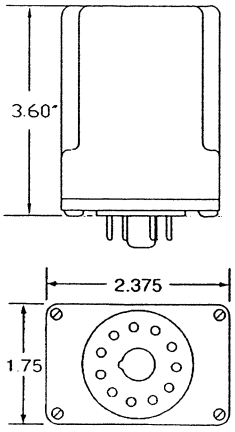
DIMENSIONS
INCHES

ACA and ADA



OPERATION
The non-volatile latching temperature switch relay monitors a normally-closed-low temperature switch. It incorporates a bistable relay that retains its state during power failures. LEDs indicate the status of the relay, and connections for an external reset button are provided for manual control. The reset inputs of multiple units may be connected to a single push button as long as proper polarity is observed when making the connections. Under normal conditions the temperature switch is closed and the relay is de-energized. When the temperature switch opens, the relay energizes and latches on until the temperature switch recloses and the reset button is pressed. The unit will function properly with zero to 2 k Ω of resistance in series with the temperature switch.

SPECIFICATIONS

SUPPLY VOLTAGE: 120 VAC, 50/60 Hz

TEMPERATURE SWITCH
- Voltage: 12 VDC
- Current: 2 mA max.

CONTACT RATING
- SPM-120-ACA: SPDT, 10 A @ 250 VAC, Resistive, 360 VA Ind.
- SPM-120-ADA: DPDT, 10 A @ 250 VAC, Resistive, 360 VA Ind.

POWER CONSUMPTION: 2 VA

TEMPERATURES
- Operate: -4° to 131°F (-20° to +55°C)
- Storage: -40° to 185°F (-40° to +85°C)

RESPONSE TIMES
- Operate: 10 ms (approximately)
- Release: 1 sec (approximately)

LIFE EXPECTANCY
- Mechanical: 30 Million Operations
- Electrical: 50,000 Operations @ Rated Load

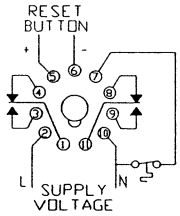
DUTY CYCLE: Continuous

INDICATORS
- SPM-120-ACA: Green LED illuminates under normal conditions; Red LED illuminates under fault conditions
- SPM-120-ADA: None

PACKAGE: 11-Pin Plug-In extended "A" style enclosure

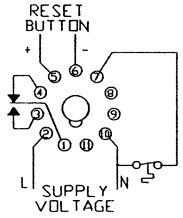
WIRING

ADA



RB-11/PF113A

ACA



RB-11/PF113A

ORDER INFORMATION

~~SPM-120-ACA~~

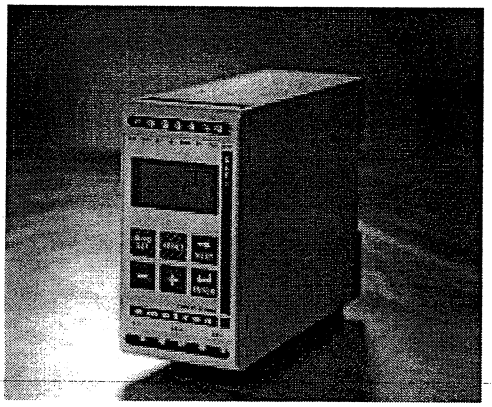
SPM-120-ADA

SPECIAL CONTROLS

NEW! Emotron EL-FI M20 Shaft Power Monitor

Protection for machines and processes.

EL-FI M20 prevents break downs by supervising the motor load (shaft power measurement). Over- and underload is detected before the motor is damaged.

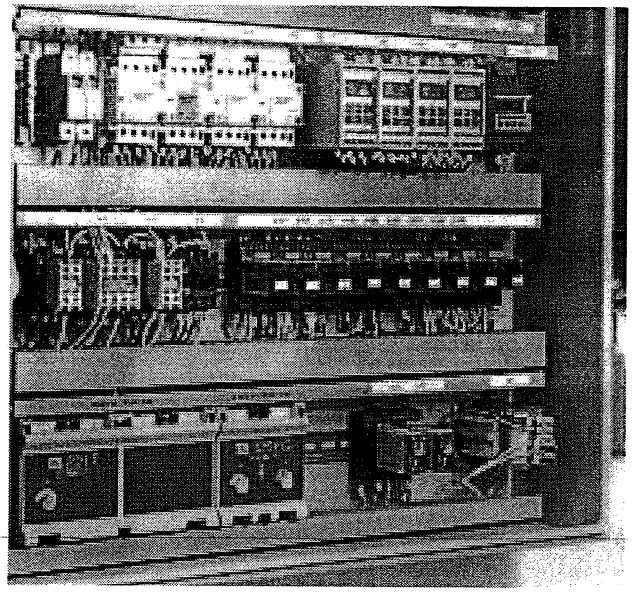


Improved Control and Protection
The EL-FI M20 replaces the EL-FI DLM with updated and improved possibilities to supervise and protect machines and pumps. As the EL-FI DLM, the EL-FI M20 uses the motor as a sensor. Over- and underload is detected as the instantaneous shaft power is supervised by measuring the input power and by calculating the motor power losses with an unique algorithm. The value of the real motor shaft power is indicated in the display in % of rated power, kW or HP.
The principle of measuring the instantaneous shaft power is calculated according to a unique method developed by Emotron.

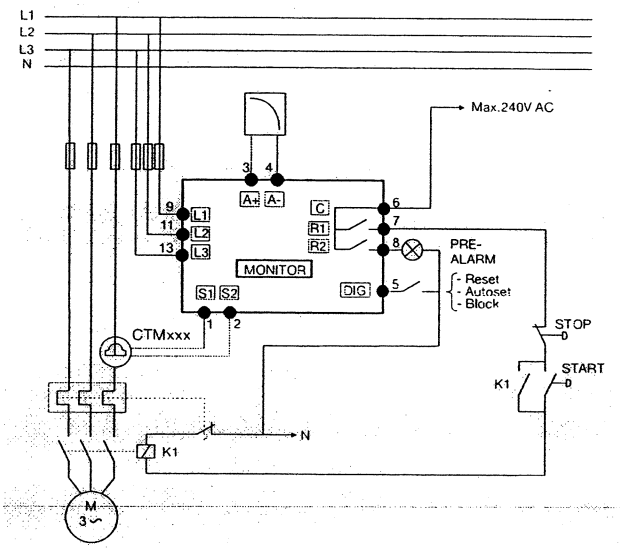
Preventive Measures
As other load monitors from Emotron is the EL-FI M20 used as a preventive measure. By supervising the equipment can expensive repairs be avoided and loss of valuable production time be prevented.

Easy Installation
The installationen is simple. The Auto Set function can automatically set the alarm levels. Press the Auto Set key during normal work load and in three seconds are the appropriate levels set. In addition to the fast and easy set of alarm levels is the need for mecanical safety devices, external transmitters and cabling minimized. The cost of installation and maintenance is hereby decreased.
The product can be installed on both new and older equipment.

Connection of the Emotron EL-FI M20



The Emotron EL-FI M20 is easily installed in the motor contactor cabinet.



Connection example.

Technical Data

Dimensions/Weight (WxHxD)	45x90x115mm (1.77"x3.54"x4.53")/0,3kg (10.5oz)
Protection class/Mounting	IP20/NEMA 1/35 mm DIN-rail 46277
Power consumption/Fuse	Max 6VA/max 10Amp
Supply Voltage	1x100-240 or 3x100-240 (optional) 3x380-500, 525-600, 600-690 VAC +/-10%
Frequency	50 or 60Hz
Relay output	Main Alarm Relay R1, Pre-Alarm Relay R2 5A/240VAC Resistive, 1,5A/240VAC Pilot duty/AC12
Analogue Output	0-20, 4-20, 20-0 or 20-4 mA, Scalable analogue signal Max load 500 ohm
Current Input	Up to 100Amp with current transformer CTM010, CTM025, CTM050 or CTM100 (over 100Amp CTM010 + additional standard current transformer)
Digital input	External Auto Set, Reset or Blocking Alarm (optional) Max 240VAC or 48VDC, High: >24VAC/DC, Low<1VAC/DC
Approved	CE (up to 690VAC) and cUL (up to 600VAC)

Emotron is developing and supplying equipment for control and protection of industrial processes and machines driven by electrical motors, featuring the following product groups:

- **Shaft power monitors**
- **Softstarters**
- **Frequency inverters**
- **Custom designed drives and power electronics**

emotron®

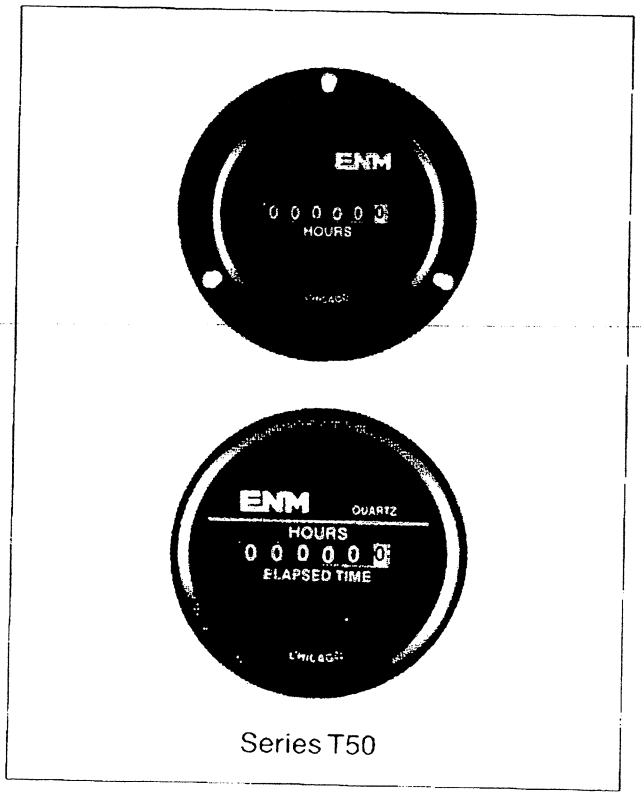
Head office: Emotron AB
Box 22225
SE-250 24 Helsingborg, Sweden
Phone +46 42 16 99 00, fax +46 42 16 99 49

www.emotron.com

01-2577-01 r2 EL-FI M20

Electronic Hour Meter Technical Data

AC Hour Meter, Series T50 211



Series T50

ENM's Series T50 electronic AC hour meter is a low cost reliable hour meter incorporating the latest state-of-the-art in electonics. It's quartz-crystal time base insures accurate long term time-keeping.

A reliable electromechanical wheel-type indicator is used to store accumulated hours.

This compact tamperproof meter is sealed against the environment to provide years of service.

The T50 elapsed time indicator was designed for use on test and recording equipment, for providing maintenance control, for establishing warranty programs, for measuring machine utilization and production time, or for any application where time-in-use is to be determined.

FEATURES:

- Solid State Electronic Circuit
- Quartz-Crystal for Accurate Timing
- Absolutely Will Not Lose Count
- High Impact, Tamperproof Plastic Case
- Sealed Against Moisture and Dirt
- UL and CSA Recognized
- Indicates Operating Time in Hours and Tenths
- Frequency Insensitive Design
- With Optional Gasket, complies to NEMA 4X and 12
- **MADE IN THE USA**

SPECIFICATIONS:

Time Scale:	6-digits 99,999.9 Hours Automatic recycle to zero
Figures:	Hours — White on black Tenths — Red on White Height — 0.140"
Operating Voltage:	230,115,24V AC+10% Other Voltage available
Frequency:	50 or 60 Hz
Power Consumption:	Less than 0.4 Watts
Accuracy:	Better than ±0.02% over entire range
Temperature:	From -30° C to 65°
Vibration Resistance:	Withstands 10 to 75 hz at 1 to 8 g's
Termination:	1/4" male blade terminals
Configuration:	Round 3-hole Bezel Round SAE Bezel with new push-on retaining ring

E-MAIL
ENM Co. @ AOL.COM
Toll Free (888) 372-0465

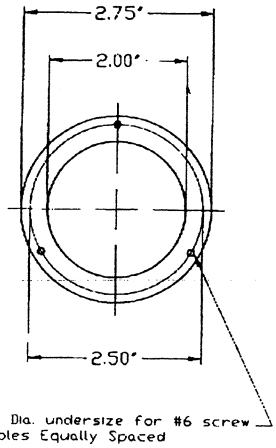
ENM Company
5617 Northwest Highway
Chicago, IL 60646-6135
(773) 775-8400 Fax: (773) 775-5968

Series T50 AC Dimensional Data

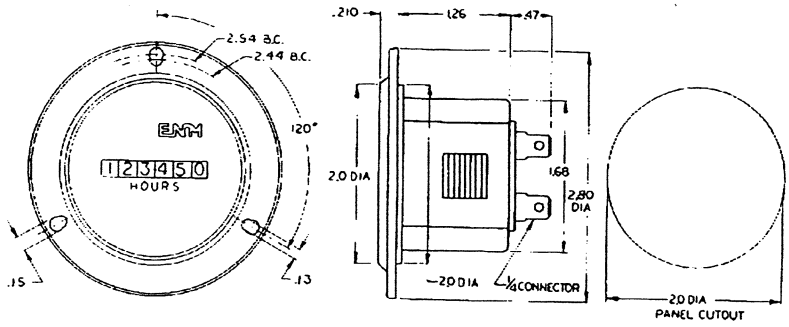
Panel Gasket
UL/NEMA 4X,12

Description	Part No.
NEMA Gasket	A40047-S

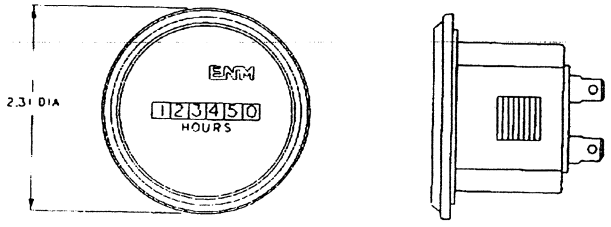
NEMA Gasket
w/ Mounting Hardware B20017



Round 3-Hole Bezel

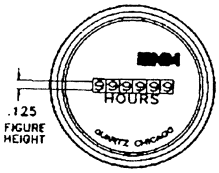


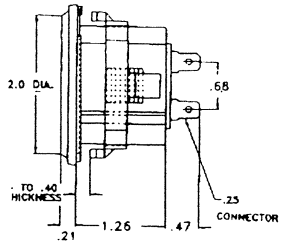
Round SAE Bezel

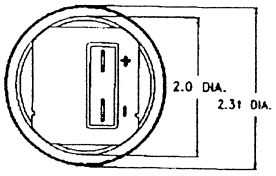


Power: Less than 0.4 Watts

Voltage	Part No.
230 AC	T50A1
115 AC	T50A2
24 AC	T50A4



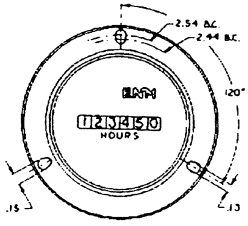


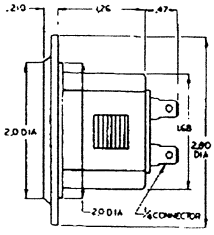


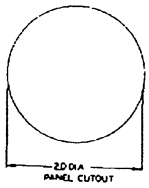
Technical Data Sheet #211

Power: Less than 0.4 Watts

Voltage	Part No.
230 AC	T50B1
115 AC	T50B2
24 AC	T50B4







Technical Data Sheet #211

Limited Warranty/Hour Meters

ENM Company hour meters are warranted to the consumer to be free from defects in material and workmanship for a period of 10,000 operating hours or for a period of 3 years, whichever first occurs.

All ENM products which fall within the warranty period due to defects in material or workmanship will be repaired or replaced, at ENM's option, without charge to the consumer when returned with proof of purchase to any authorized ENM dealer in the United States, transportation charges prepaid, provided there is no evidence of improper installation, tampering, or other abuse.

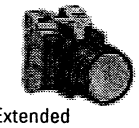
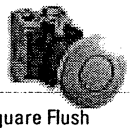
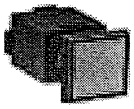
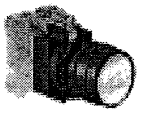
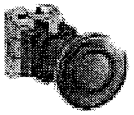
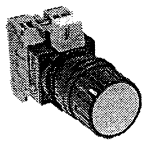
All implied warranties, including any implied warranty of merchantability or fitness for a particular purpose, shall be limited in duration to the express warranty period specified above.

ENM disclaims any liability for consequential damages due to breach of any written or implied warranty on its hour meters.

ENM Company
5617 Northwest Highway
Chicago, IL 60646-6135
(773) 775-8400 Fax: (773) 775-5968

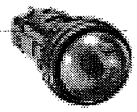
HW Series Oiltight Switches and Pilot Devices Ø 7/8" (22mm)

A

Series Model	HWΔB–	HWΔP–	HWΔL–	HW1B, HW1E	HW1S, HW1K, HW1F–	HW1R and HW1M-
Appearance	Flush  Extended  40mm Mushroom  Square Flush  Square Extended  Jumbo Mushroom 	Dome Lens  Flush Lens  Square Flush 	Flush  Extended  Extended/Shroud  40mm Mushroom  Square Extended 	Push–Pull  Pushlock Turn Reset  Pushlock Turn Reset  Pushlock Key Reset  Jumbo Pushlock Turn Reset  Unibody E-Stop  Illuminated Unibody E-Stop 	Knob Operator  Key Operator  Illuminated 	HW1M  HW1R 
See Page	*A-77*	*A-84*	*A-87*	*A-75*	*A-91, A-95, A-98*	*A-110 and A-108*
Operator Types	Non-illuminated: • Momentary • Maintained	Pilot Lights • LED/Incandescent	Illuminated Pushbuttons: • Momentary • Maintained • LED/Incandescent	• Modular or Unibody • Non-Illuminated • Illuminated (unibody only) (all units meet EN418)	Selector Switches • Non-Illuminated • Illuminated • LED/Incandescent • 2, 3, 4, 5- position (key & illum. 2 or 3-position only)	HW1R Selector Pushbutton • 2 position selector • Momentary HW1M Monolever • 2 or 4 position • Maintained or Spring return
Contact Configuration	Modular: (NO, NC, NO-EM, NC-LB (maximum 6 contacts)	—	Modular: NO, NC, NO-EM, NC-LB (maximum 6 contacts)	2NO, 1NO/1NC (Unibody)	Modular: NO, NC, NO-EM, NC-LB (maximum 6 contacts)	Modular: NO, NC, NO-EM, NC-LB (maximum 6 contacts)
Electrical Reliability	MTBF < 1 fault in 10 million operation cycles (3V DC, 5mA)					
Mechanical Life	Momentary Pushbuttons: 5,000,000 operations minimum (900 operations per hour) All other switches: 500,000					
Degree of Protection	IP65 (from front of the panel) ~~IP20 (type HW-F contact blocks)~~ (conforming to IEC60529) NEA Type 1, 2, 3, 3R, 3S, 4, **4X**, 5, 12, 13 (conforming to NEMA ICS-110)					HW1R: IP65, IP20 NEMA 1, 2, 3, 3R, 3S, 4, 4x, 5, 12, 13 HW1M: IP40, IP20
Termination	M3.5 screw terminals ~~(fingersafe/spring up/exposed screw)~~ with captive sems plate					
Approvals	UL File No. E68961 CSA File No. LR92374 CE TÜV Rheinland					Registration No. R9551089 (E-stops) Registration No. J9551458 (all other switches) Registration No. J9650511 (Pilot Lights)

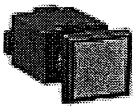
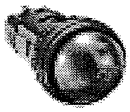
Pilot Lights (Assembled)

Part Numbers: LED Pilot Lights

Style			Part Number
Round Flush 	Full Voltage		HW1P-1FQD-②-③
	Transformer	120V 240V 480V	HW1P-1FH2D-② HW1P-1FM4D-② HW1P-1FT8D-②
Square Flush 	Full Voltage		HW2P-1FQD-②-③
	Transformer	120V 240V 480V	HW2P-1FH2D-② HW2P-1FM4D-② HW2P-1FT8D-②
Dome 	Full Voltage		HW1P-2FQD-②-③
	Transformer	120V 240V 480V	HW1P-2FH2D-② HW1P-2FM4D-② HW1P-2FT8D-②

1. In place of ②, specify the Lens/LED color code, in place of ③specify the full voltage code from table below.
2. Other voltages available, contact IDEC for details.
3. For nameplates and accessories,see page A-89.
4. For dimensions, see page A-92.

Part Numbers: Incandescent Pilot Lights

Style			Part Number
Round Flush 	Full Voltage		HW1P-1FQ-②-③
	Transformer	120V 240V 480V	HW1P-1FH2-② HW1P-1FM4-② HW1P-1FT8-②
Square Flush 	Full Voltage		HW2P-1FQ-②-③
	Transformer	120V 240V 480V	HW2P-1FH2-② HW2P-1FM4-② HW2P-1FT8-②
Dome 	Full Voltage		HW1P-2FQ-②-③
	Transformer	120V 240V 480V	HW1P-2FH2-② HW1P-2FM4-② HW1P-2FT8-②

1. In place of ②, specify the lens color code, in place of ③ specify the full voltage code. from tables below.
2. Other voltages available, contact IDEC for details.

② Lens/LED Color Code

Color	Code
Amber	A
Green	G
Red	R
Blue*	S
White	W
Yellow†	Y

* Blue LEDs are available in 24V only. Add $10.00 to list for blue.
† Yellow available in LED only.

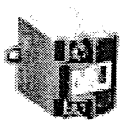
③ Full Voltage Code

LED	Incandescent
6 = 6V DC	6 = 6V AC/DC
12 =12V AC/DC	12 =12V AC/DC
24 = 24V AC/DC	24 = 24V AC/DC
120 = 120V AC*	—

* Add $1.50 to list price for 120V LED.

E-Stops (Sub-Assembled)

Transformer*	+	Operator	+	Lamp	+	Button/Lens	=	Complete Part





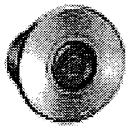
*Not required for full voltage units (full voltage clips used instead).

Part Numbers: Operators

	Style	Part Number
Ø 40mm Pushlock Turn Reset		AVD-300
Illuminated Ø 40mm Pushlock Turn Reset		AVLD3-0600N
Ø 40mm Push-Pull		AYD-3100
Illuminated Ø 40mm Push-Pull		2 pos AYLD-0600 3 pos AYLD22TK962-0B01*

1. *Includes red lens (40mm mushroom with red insert).

Part Numbers: Buttons and Lenses

	Style	Part No.
Ø 40mm Pushlock Turn Reset Button (available in red only)		AVN3B-R
Ø 40mm Pushlock Turn Reset Lens (available in red only)		AVLN3LU-R
Ø 40mm Push-Pull button		AYD3BN-①
Ø 40mm Push-Pull Lens (Incandescent or LED)		2 pos* AYLD3L-② 3 pos AYLD2L-②

1. *In place of ①, specify the Button Color Code. (See table below)*
2. *In place of ②, specify the LED Color Code.*
3. *Not available in blue.*

Part Numbers: Lamps

Type	Voltage	Part Number
LED 	6V AC/DC	LSTD-6②
	12V AC/DC	LSTD-1②
	24V AC/DC	LSTD-2②
	120V AC	LSTD-H2②
	240V AC	LSTD-M4②
Incandescent 	6V AC/DC	IS-6
	12V AC/DC	IS-12
	24V AC/DC	IS-24
	120VAC	L-120L

1. *In place of ②, specify the LED color code.*
2. *The LED contains a current-limiting resistor and a protection diode.*

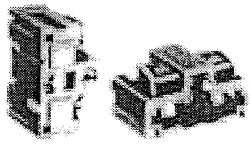
① Button Color Code

Color	Code
Black	B
Green	G
Red	R
Blue	S
Yellow	Y

② LED Color Codes

Color	Code
Amber	A
Green	G
Red	R
Blue	S
White	W

Part Numbers: Contact Blocks

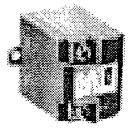
Description	Part Number	
	1NO	1NC
All Control Units 	BST-010	BST-001
	BST-010S (early make)	BST-001S (late break)
Dummy Blocks	BST-D	

1. *Dummy blocks (no contacts) are used with an odd number of contact blocks.*
2. *Combining BST-010S and BST-001S result in overlapping contacts (remain on, or closed, when switch is moved between two positions).*

Part Numbers: Full Voltage Clips

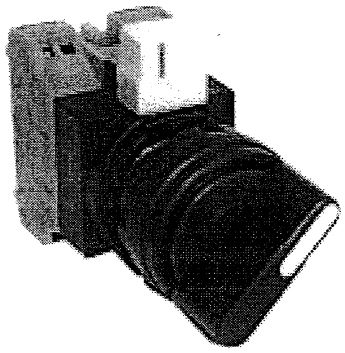
Primary Voltage (50/60Hz)	Part Number
Full Voltage Clips (2 req'd for each unit) 	APD-F

Part Numbers: Transformers

Description	Primary Voltage (50/60Hz)	Part Number
	120V AC	TWD-0126
	240V AC	TWD-0246
	480V AC	TWD-0486

6V secondary voltage (uses 6V lamp).

Selector Switches (Assembled)

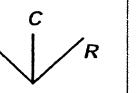
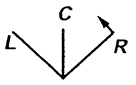
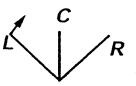
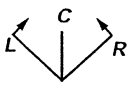


A

Part Numbers: 2–Position Selector Switches

Contact	Mounting	Operator Position L	Operator Position R	Maintained	Spring Return from Right
					
				Part Number	Part Number
1NO	1	0	X	HW1S-2TF10	HW1S-21TF10
	2	0	0		
1NO-1NC	1	0	X	HW1S-2TF11	HW1S-21TF11
	2	X	0		
2NO	1	0	X	HW1S-2TF20	HW1S-21TF20
	2	0	X		

Part Numbers: 3–Position Selector Switches

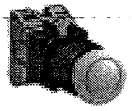
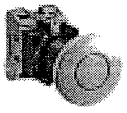
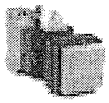
Contact	Mounting	Operator Position L	Operator Position C	Operator Position R	Maintained	Spring Return from Right	Spring Return from Left	Spring Return Two-Way
								
					Part Number	Part Number	Part Number	Part Number
2NO	1	X	0	0	HW1S-3TF20	HW1S-31TF20	HW1S-32TF20	HW1S-33TF20
	2	0	0	X				
2NO-1NC	1	X	0	0	HW1S-3JTF21N1	—	—	—
	2	0	0	X				
	3	0	X	0				

1. *Mounting refers to contact location on operator. See page A-83.*
2. *For nameplates, see page A-89.*
3. *Custom contact arrangements available. Contact IDEC for details.*

Non-Illuminated Pushbuttons (Assembled)

A

Part Numbers: Non-Illuminated Pushbuttons

Style	Contact	Momentary Part Number	Maintained (Latching) Part Number
Flush 	1NO	~~HW1B-M1F10-①~~	HW1B-A1F10-①
	1NC	HW1B-M1F01-①	HW1B-A1F01-①
	1NO-1NC	~~HW1B-M1F11-①~~	HW1B-A1F11-①
	2NO	HW1B-M1F20-①	HW1B-A1F20-①
	2NC	HW1B-M1F02-①	HW1B-A1F02-①
	2NO-2NC	HW1B-M1F22-①	HW1B-A1F22-①
Extended 	1NO	HW1B-M2F10-①	HW1B-A2F10-①
	1NC	HW1B-M2F01-①	HW1B-A2F01-①
	1NO-1NC	HW1B-M2F11-①	HW1B-A2F11-①
	2NO	HW1B-M2F20-①	HW1B-A2F20-①
	2NC	HW1B-M2F02-①	HW1B-A2F02-①
	2NO-2NC	HW1B-M2F22-①	HW1B-A2F22-①
Mushroom 1-5/32" (29mm) 	1NO	HW1B-M3F10-①	HW1B-A3F10-①
	1NC	HW1B-M3F01-①	HW1B-A3F01-①
	1NO-1NC	HW1B-M3F11-①	HW1B-A3F11-①
	2NO	HW1B-M3F20-①	HW1B-A3F20-①
	2NC	HW1B-M3F02-①	HW1B-A3F02-①
	2NO-2NC	HW1B-M3F22-①	HW1B-A3F22-①
Mushroom 1-9/16" (40mm) 	1NO	HW1B-M4F10-①	HW1B-A4F10-①
	1NC	HW1B-M4F01-①	HW1B-A4F01-①
	1NO-1NC	HW1B-M4F11-①	HW1B-A4F11-①
	2NO	HW1B-M4F20-①	HW1B-A4F20-①
	2NC	HW1B-M4F02-①	HW1B-A4F02-①
	2NO-2NC	HW1B-M4F22-①	HW1B-A4F22-①
Square Flush 	1NO	HW2B-M1F10-①	HW2B-A1F10-①
	1NC	HW2B-M1F01-①	HW2B-A1F01-①
	1NO-1NC	HW2B-M1F11-①	HW2B-A1F11-①
	2NO	HW2B-M1F20-①	HW2B-A1F20-①
	2NC	HW2B-M1F02-①	HW2B-A1F02-①
	2NO-2NC	HW2B-M1F22-①	HW2B-A1F22-①
Square Extended 	1NO	HW2B-M2F10-①	HW2B-A2F10-①
	1NC	HW2B-M2F01-①	HW2B-A2F01-①
	1NO-1NC	HW2B-M2F11-①	HW2B-A2F11-①
	2NO	HW2B-M2F20-①	HW2B-A2F20-①
	2NC	HW2B-M2F02-①	HW2B-A2F02-①
	2NO-2NC	HW2B-M2F22-①	HW2B-A2F22-①
Jumbo Mushroom 2-3/8"" (60mm) New 	1NO	HW1B-M5F10-①	
	1NC	HW1B-M5F01-①	
	1NO-1NC	HW1B-M5F11-①	
	2NO	HW1B-M5F20-①	—
	2NC	HW1B-M5F02-①	
	2NO-2NC	HW1B-M5F22-①	

① Button Color Code

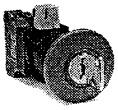
Color	Code
Black	B
Blue	S
Green	G
Red	R
Yellow	Y
White	W

1. In place of ①, specify the button color code.
2. Jumbo mushroom available only in red, green, and black.
3. For nameplates and accessories, see page A-89.
4. For dimensions, see page A-92.
5. For sub-assembly part numbers, see next page.

Emergency Stop Pushbuttons (Assembled)

A

Part Numbers: Special Function Non-Illuminated Pushbuttons

Style	Contact	Part Number
1-9/16" (40mm) Push–Pull 	1NO	HW1B-Y2F10-①†
	1NC	HW1B-Y2F01-①†
	1NO-1NC	HW1B-Y2F11-①†
	2NC	HW1B-Y2F02-①†
	2NO	HW1B-Y2F20-①†
1-5/32" (29mm) Pushlock Turn Reset 	1NO	HW1B-V3F10-R*
	1NC	HW1B-V3F01-R*
	1NO-1NC	HW1B-V3F11-R*
	2NO	HW1B-V3F20-R*
	2NC	HW1B-V3F02-R*
1-9/16" (40mm) Pushlock Turn Reset 	1NO	HW1B-V4F10-①†
	1NC	HW1B-V4F01-①†
	1NO-1NC	HW1B-V4F11-①†
	2NO	HW1B-V4F20-①†
	2NC	HW1B-V4F02-①†
1-9/16" (40mm) Pushlock Key Reset 	1NO	HW1B-X4F10-R*
	1NC	HW1B-X4F01-R*
	1NO-1NC	HW1B-X4F11-R*
	2NO	HW1B-X4F20-R*
	2NC	HW1B-X4F02-R*
2-3/8" (60mm) Pushlock Turn Reset 	1NO	HW1B-V5F10-R*
	1NC	HW1B-V5F01-R*
	1NO-1NC	HW1B-V5F11-R*
	2NO	HW1B-V5F20-R*
	2NC	HW1B-V5F02-R*
1-9/16" (40mm) Unibody Pushlock Turn Reset 	1NO-1NC	HW1E-BV4F11-R*
	2NC	HW1E-BV4F02-R*
	1NO-2NC	HW1E-BV412-R-TK2093

** Available only in Red.*
† Available in red or yellow (insert color code in place of ①)

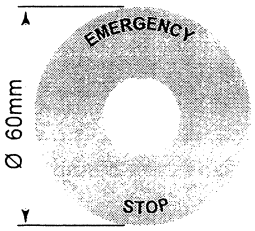
Part Numbers: Illuminated Unibody Emergency Stop

Style	Illumination Type	Contact	Part Number
	LED	1NO-1NC	HW1E-LV4F11QD-R*-③
		2NC	HW1E-LV4F02QD-R*-③
		2NC (with active lamp circuit)	HW1E-TV4F02QD-R-③
		1NO-1NC (with active lamp circuit)	HW1E-TV4F11QD-R*-③
	Incandescent	1NO-1NC	HW1E-LV4F11Q-R*-③
		2NC	HW1E-LV4F02Q-R*-③
		1NO-1NC (with active lamp circuit)	HW1E-TV4F11Q-R*-③
		2NO (with active lamp circuit)	HW1E-TV4F02Q-R*-③

*1. * Available in Red only.*
2. In place of ③, specify full voltage code.
3. With single unit construction, the positive action contacts are integrated in the body of the switch. This provides an extra degree of safety and reliability for critical emergency stop functions.
4. In the illuminated version, the light is independent of the switch action.
5 For nameplates and accessories, see page A-114.
6 For dimensions, see page A-117.
7. For sub-assembly part numbers, see next page.
8. All HW series E-stops comply with EN418, the IEC "E-Stop Addendum to the Low Voltage Directive," this includes "tamper proof" operation whereby a change of contact state is not possible by "teasing" or "floating" the operator.
9. "Active Lamp Circuit" consists of a built-in Normally Open contact in series with the lamp. This allows the lamp to illuminate only when the button is pressed and eliminates the need for external jumpering.

Part Numbers: Nameplates

HWAV–Yellow Plastic



	Part Number
60mm Diameter "Emergency Stop" Engraved	HWAV-27†
60mm Diameter Blank	HWAV-0Y
Engraved 80mm Diameter Emergency Stop (for jumbo mushroom use)	HWAV-527

† HWAV-27 comes engraved "Emergency Stop" as shown in drawing.

Part Number: E-Stop Shroud

Style	Part Number
	HW9Z-KG1-TK2120

Not applicable for 60mm mushroom.

③ Full Voltage Code

Voltage	Code
6VAC/DC	6
12VAC/DC	12
24VAC/DC	24

Standard terminal blocks

Compression clamp

DIN 1 - 3

Test connector : See Accessories section

End stop	th. 9 mm	BADL V0		0199 408.02
End stop	th. 9,1 mm	BAM		0103 002.26
Rail	35 x 7,5 x 1	PR30	prepunched	0173 220.05
Rail	35 x 15 x 2,3	PR4		0168 500.12
Rail	35 x 15 x 1,5	PR5	prepunched	0101 598.26
Rail	32 x 15 x 1,5	PR1Z2		0163 050.04

Other end stops and rails : See Accessories section

Characteristics

Wire size

		IEC NFC DIN	UL	CSA
Compression clamp	Solid wire	0,2-4 mm²	24-10 AWG	24-10 AWG
	Stranded wire	0,22-4 mm²	24-10 AWG	24-10 AWG

Voltage			
Rated	800 V	600 V	600 V
Pulse	8 kV		
Pollution degree	3		
Current			
Rated	32 A	30 A	25 A
Wire size			
Rated / Gauge	4 mm² / A4	10 AWG	10 AWG

Wire stripping length	Recomm. Screwdriver	Recomm. torque	Protection
9,5 mm	4 mm	0,5-0,8 Nm	IP 20
.37"	.157"	4.4-7 lb.in.	NEMA 1

Notes

The use of some accessories may decrease the block's voltage rating. For more information, consult us.

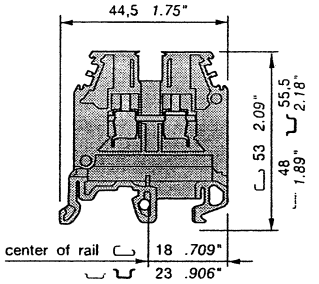
***BJDP1** permits the interconnection with a terminal block series "M" spacing 16 mm.*

***JDP3** permits the interconnection with a terminal block series "M" spacing 12 mm.*

***BJDP4** permits the interconnection with a terminal block series "D" spacing 8 mm or a terminal block series "M" spacing 8 or 10 mm.*

M 4/6...

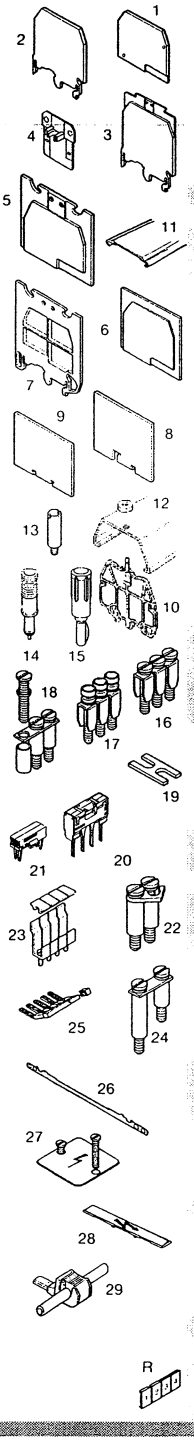
Spacing 6 mm + 0,05 *(.238")*



Standard 6 mm block **0115 116.07**

Color		Type	Part numbers
Standard blocks			
Grey		M 4/6	0115 116.07
Blue		M 4/6.N	0125 116.01
Orange		M 4/6	0105 002.20
Yellow		M 4/6	0105 116.16
Green		M 4/6	0105 001.27
Red		M 4/6	0105 032.15
Black		M 4/6	0105 031.14
White		M 4/6	0105 051.20
Brown		M 4/6	0105 209.14
Beige V0		M 4/6.V0	0195 116.00
Blue V0		M 4/6.N.V0	0199 002.26

Accessories



			Type		Part numbers
1	End section	grey	FEM6	th. 2,8 mm	0118 368.16
		blue	FEM6	th. 2,8 mm	0128 368.10
		orange	FEM6	th. 2,8 mm	0103 126.16
		yellow	FEM6	th. 2,8 mm	0103 062.21
		green	FEM6	th. 2,8 mm	0103 125.15
		white	FEM6	th. 2,8 mm	0103 312.20
		beige	FEM6 V0 V0	th. 2,8 mm	0198 368.17
		blue	FEM6 V0 V0	th. 2,8 mm	0199 302.07
		yellow	FEM6 V0 V0	th. 2,8 mm	0199 305.02
2	End section	grey	FEM61 (3)	th. 3,0 mm	0114 776.23
3	End section	grey	FEM6C (3)	th. 3,0 mm	0114 777.24
4	Circuit separator	grey	SCM6		0113 003.10
		blue	SCM6		0123 003.12
		beige	SCM6 V0 V0		0193 003.11
5	Separator end section	grey	SCF6	th. 3,0 mm	0118 707.03
		blue	SCF6	th. 3,0 mm	0128 707.05
		beige	SCF6 V0 V0	th. 3,0 mm	0198 707.04
6	Separator end section	grey	SCF61	th. 3,0 mm	0114 202.25
7	Separator end section	grey	SCFM6 (3)	th. 3,0 mm	0114 825.05
8	Separator end section	grey	SCFEX1 (3)	th. 2,4 mm	0103 619.04
9	Separator end section	grey	SCFEX3 (3)	th. 2,4 mm	0103 620.01
10	Separator end section (for cover CPV)	grey beige	SCFCV1-2 (3)	th. 3,0 mm	0116 795.11
			SCFCV1-2 V0(3)V0	th. 3,0 mm	0196 795.12
11	Protective cover		CPM	(for FEM6C, SCF6(V0) and SCFM6)	0187 312.14
12	Protective cover		CPV1-2	(for SCFCV1-2...)	0176 816.12
13	Test socket		AL2 (1)	DIA. 2 mm	0163 043.21
			AL3 (1)	DIA. 3 mm	0163 261.00
14	Test device		DCJ	yellow	0173 059.03
15	Test plug		FC2	DIA. 2 mm	0007 865.26
			FC4	DIA. 4 mm	0167 860.01
16	Assembled jumper bar	32 A	BJM6 (1)	2 poles	0168 516.25
	(without IP20 protection)	32 A	BJM6 (1)	3 poles	0168 517.26
		32 A	BJM6 (1)	4 poles	0168 518.07
		32 A	BJM6 (1)	5 poles	0168 519.00
		32 A	BJM6 (1)	10 poles	0168 973.07
17	Assembled jumper bar	32 A	BJMI6 (1)	2 poles	0176 663.00
	(with IP20 protection)	32 A	BJMI6 (1)	3 poles	0176 664.01
		32 A	BJMI6 (1)	4 poles	0176 665.02
		32 A	BJMI6 (1)	5 poles	0176 666.03
		32 A	BJMI6 (1)	10 poles	0176 667.04
18	Jumper bar not assembled	32 A	BJS6 (1)	20 poles	0174 784.20
	Post + screw + washer		EV6		0168 604.16
19	Connector plate	35 A	EL6		0173 627.21
20	Screwless jumper bar	32 A	BJE6.2 (4)	2 poles	0299 694.04
	orange IP 20	32 A	BJE6.3 (4)	3 poles	0299 695.05
		32 A	BJE6.4 (4)	4 poles	0299 696.06
		32 A	BJE6.5 (4)	5 poles	0299 697.07
		32 A	BJE6.10 (4)	10 poles	0299 702.14
21	Jumper		BJB		0199 466.23
22	Pivoting jumper bar	35 A	BJP6 (1)		0174 413.14
23	Alternated jumper bar	35 A	BJA6 (1)	10 poles	0116 541.12
24	Universal jumper bar	50 A	BJDP1 (1)(2)	spacing 6 <-> spacing 16	0179 623.03
		70 A	BJDP3 (1)(2)	spacing 6 <-> spacing 12	0179 625.05
		50 A	BJDP4 (1)(2)	spacing 6 <-> spacing 8 or 10	0174 781.25
25	Comb-type jumper bar	35 A	PC6 (4)	2 poles	0113 546.14
		35 A	PC6 (4)	10 poles	0113 548.26
	Insulating tip		EIP		0113 550.24
26	Shield connector		CBM5	th. 0,5 mm	0178 745.14
			CBM8	th. 0,8 mm	0178 746.15
27	Protection label		EP6	4 blocks	0163 427.17
	Screw for protection label		VSP6		0163 433.15
28	Protection label		EPU6		0107 038.25
29	IDC jumper		AD2,5		0114 205.20

R See section on markers method ⑪ ⑫

Note : (1) A circuit separator SC may be required with the use of these accessories.
(2) See "Notes". (3) End sections and separators snapped on rails.
(4) See section : "Accessories" for other configurations of poles.

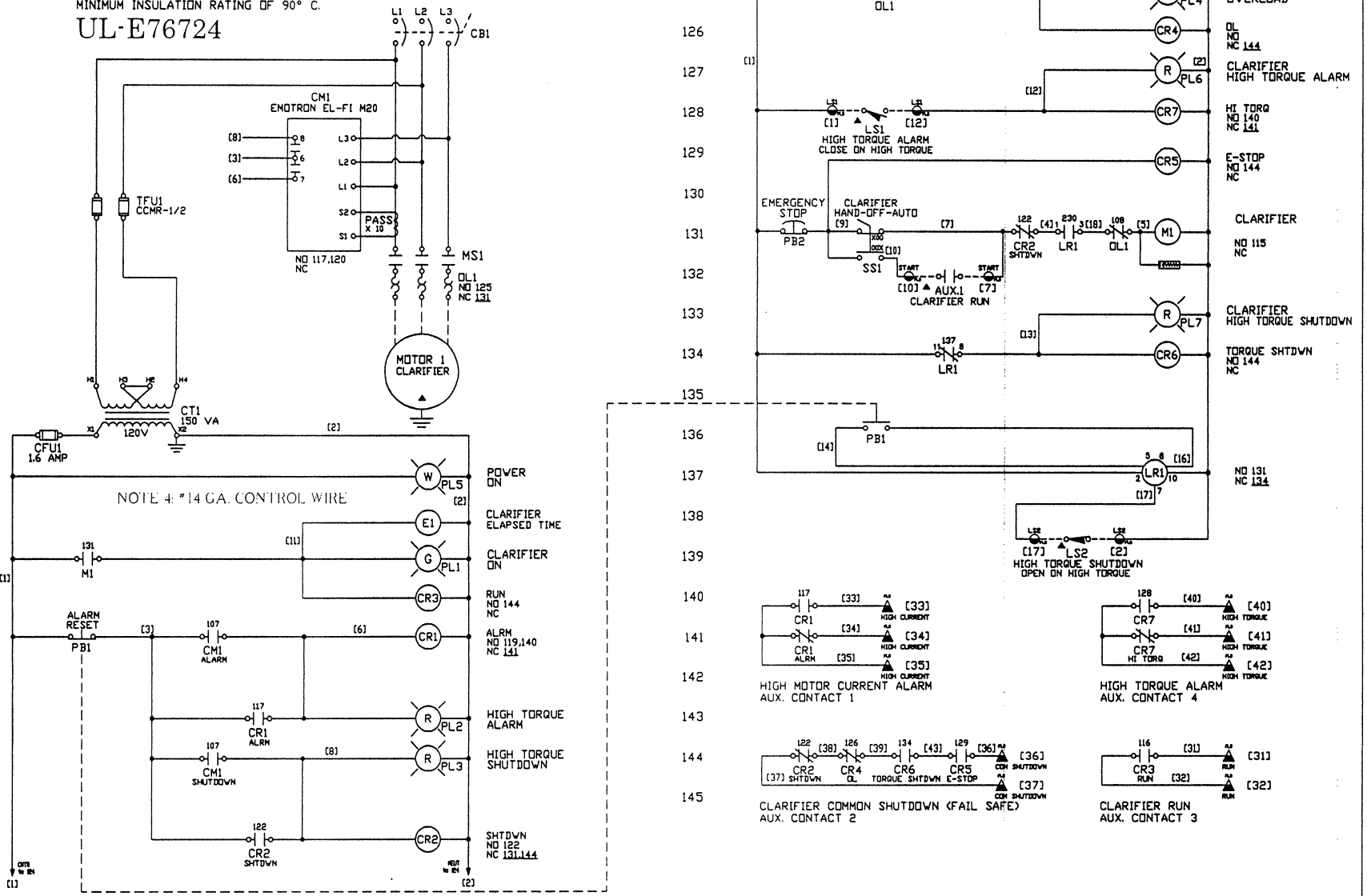
4€ /OLTS 3 PH 60 HZ 1/2 HP 1.0 FLA CLAR R MOTOR (QTY 2)

SHOR. CIRCUIT CURRENT 65 KA RMS SYMMETRICAL, 460V MAXIMUM

NOTE 1: SERVICE ENTRANCE DISCONNECT SWITCH MUST BE INSTALLED BETWEEN POWER SUPPLY AND THIS PANEL

NOTE 2: THIS PANEL SHALL BE INSTALLED OBSERVING ALL APPLICABLE STATE AND LOCAL CODES AND AS PER LATEST REVISION OF NEC. USE ONLY COPPER CONDUCTOR WITH A MINIMUM INSULATION RATING OF 90° C.

UL-E76724



SYM	REVISION	BY	DATE	CHKD
E				
D				
C				
B				
A				

	DATE	BY
DRAWN	4/8/11	PH
CHECKED		
APPR.		
SCALE	NONE	

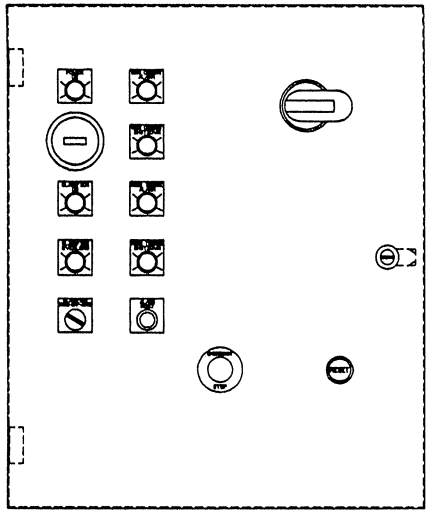
MASTER B -XXXX

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

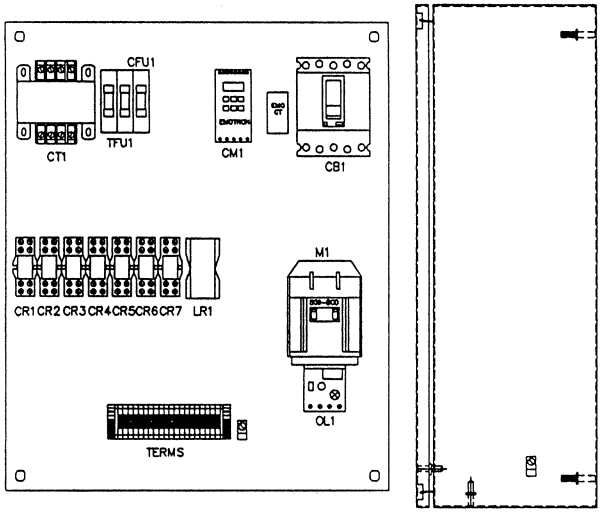
CLARIFIER CONTROL
FOUNTAIN, CO
P.O. #P0007982 Q-32714

CONTRACT	DRAWING NO.	REV.
SO Q10600A	B 9 0 | AM40811TLC 1 OF 2	X X X

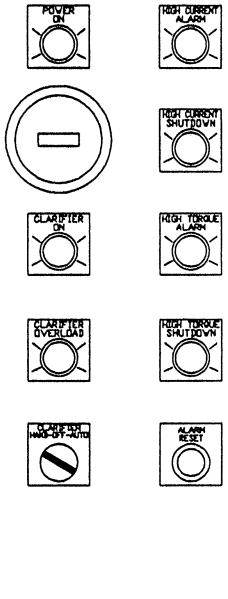
TAG	QTY	DESCRIPTION	MANUFACTURER	CATALOG NUMBER
-	1	24 X 20 X 8 NEMA 4X STAINLESS STEEL CABINET	HOFFMAN	C-SD24208SS
-	1	CABINET SUB PANEL	HOFFMAN	C-P2420
CB	1	CIRCUIT BREAKER	EATON	HMCP003A0C
-	1	CIRCUIT BREAKER HANDLE	EATON	HM1R12X
M	1	MOTOR STARTER	ALLEN-BRADLEY	509-BOD
OL	1	OVERLOAD RELAY	ALLEN-BRADLEY	A2E
-	1	OVERLOAD RESET BUTTON	CONTROL CONCEPTS	RPB-B
CT	1	CONTROL TRANSFORMER	SOLA HEVI/DUTY	E150
TFU	2	TRANSFORMER FUSE	LITTELFUSE	CCMR-1/2
CFU	1	CONTROL FUSE	LITTELFUSE	FLM-1.6
CR	7	CONTROL RELAY	IDEC	RH2BUL-AC120V + SH2B-05
LR	1	HIGH TORQUE SHUTDOWN LATCHING RELAY	DIVERSIFIED	SPM-120-ADA
CM	1	CURRENT MONITOR	EMOTRON	EL-FI M20 + CTM010
E	1	ELAPSED TIME METER	ENM	T50
PL	7	PILOT LIGHT	IDEC	HW1P-1FQD-G,R & W-120
-	7	PILOT LIGHT BULB	IDEC	LSTD-H2 -G, R & W
SS	1	SELECTOR SWITCH	IDEC	HW1S-3TF20
PB1	1	PUSH BUTTON	IDEC	HW1B-M1F01-B
PB2	1	EMERGENCY PUSH BUTTON	IDEC	HW1B-V4F01-R
-	20	TERMINAL	ENTRELEC	011511607



24 X 20 X 8 NEMA 4X STAINLESS STEEL CABINET



SUB PANEL



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[10]	START	FLD	132
[1]	LS1	FLD	128
[12]	LS1	FLD	128
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[17]	LS2	FLD	139
[31]	RUN	FLD	144
[32]	RUN	FLD	145
[33]	HIGH CURRENT	FLD	140
[34]	HIGH CURRENT	FLD	141
[35]	HIGH CURRENT	FLD	142
[36]	COM SHUTDOWN	FLD	144
[37]	COM SHUTDOWN	FLD	145
[40]	HIGH TORQUE	FLD	140
[41]	HIGH TORQUE	FLD	141
[42]	HIGH TORQUE	FLD	142

SEQUENCE OF OPERATION

HAND POSITION - CLARIFIER WILL RUN CONTINUOUSLY
OFF POSITION - CLARIFIER WILL BE OFF
AUTO POSITION - CLARIFIER WILL STOP AND START FROM REMOTE SOURCE

HIGH TORQUE SHUTDOWN, HIGH CURRENT SHUTDOWN AND OVERLOAD WILL STOP CLARIFIER IN ANY POSITION AND WILL REQUIRE MANUAL RESET.
CLARIFIER WILL STOP WHEN EMERGENCY STOP BUTTON IS PRESSED
CLARIFIER CAN BE RE-STARTED BY PULLING BACK EMERGENCY STOP BUTTON

[11] WIRE NUMBER
WIRE COLOR - BLK-POWER / RED-120V CONTROL / WHT-NEUTRAL / YEL-REMOTE / GRN-GROUND

- FIELD TERMINAL
- TERMINAL POWERED FROM REMOTE SOURCE
- REMOTE DEVICE

SYM	REVISION	BY	DATE	CHKD
E				
D				
C				
B				
A				

	DATE	BY
DRAWN	4/8/11	PH
CHECKED		
APPR.		

SCALE NONE

MASTER
B - XXXX

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

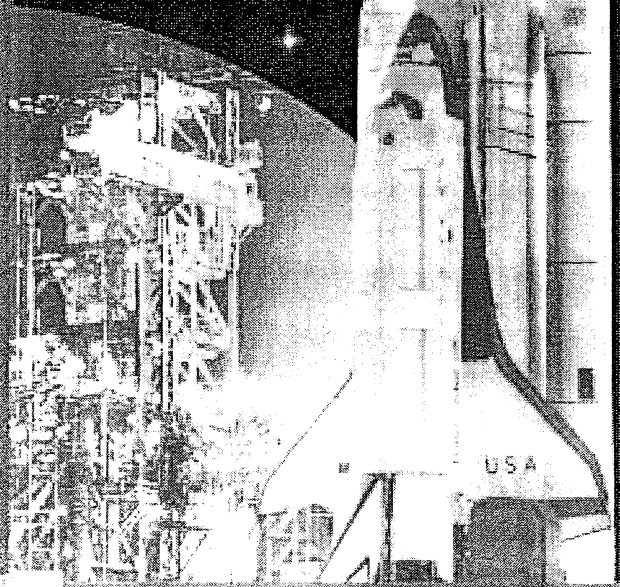
CLARIFIER CONTROL
FOUNTAIN, CO
P.O. #P0007982 Q-32714

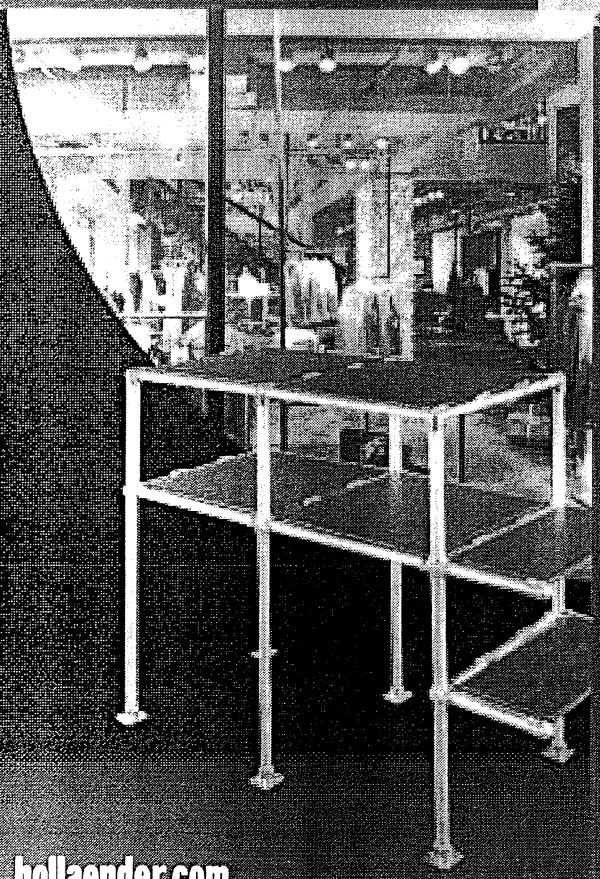
CONTRACT	DRAWING NO.	REV.
SO Q10600A	B90 AM40811TLC 2 OF 2	XXX

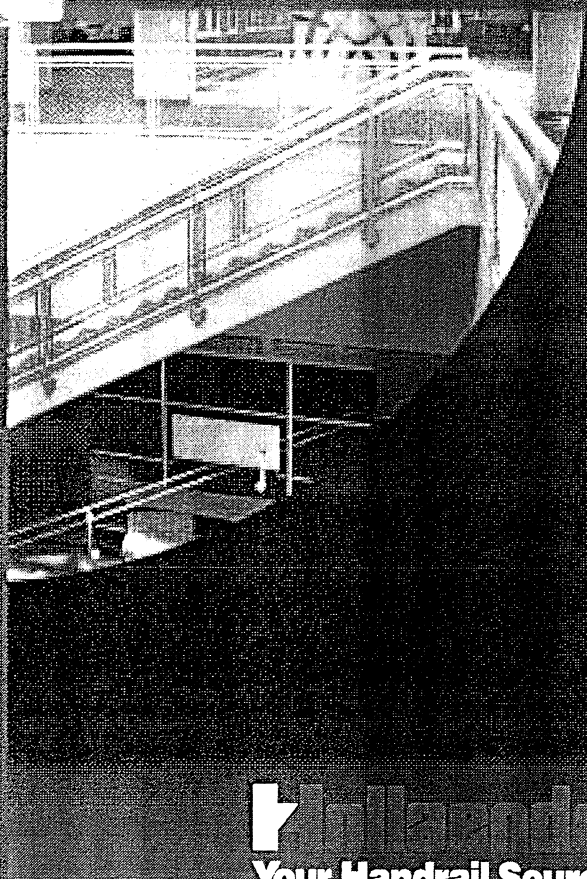
HANDRAIL INFORMATION

component catalog

Made With Pride in the USA







hollaender.com

Hollaender

Your Handrail Source.

Slip-On Fittings

Hollaender

The Hollaender® Advantage

- **Speed of Installation** – Studies have shown significant cost savings when compared to the cost of welded handrail and other structures
- **Ease of Installation** – Only tools required are a saw, hex key and tape measure
- **Flexibility** – Aluminum magnesium cast fittings can be used with aluminum, galvanized steel, stainless steel and black iron pipe
- **Reusability** – Structures fabricated with Hollaender® fittings can easily be disassembled and reconfigured
- **Strength** – Railing systems can be designed using standard Hollaender® products to meet any building code. Please refer to Technical Section of Catalog, www.hollaender.com, or call our engineers.
- **Time Tested** – Products are backed by over 60 years of experience

Applications are limited only by the imagination

Handrails & guardrails, playgrounds and carts, store fixtures, offshore petro/chemical, industrial plants, racking systems, warehouses, health & medical buildings, portable structures, recreational areas, amusement parks, film industry, government facilities & public works, displays, and much, much more.

Hollaender

Typical Hollaender® Slip-On Fittings

Hollaender® features the World's best known brands

Speed-Rail® – Inline design has become the benchmark for quality throughout the industry.

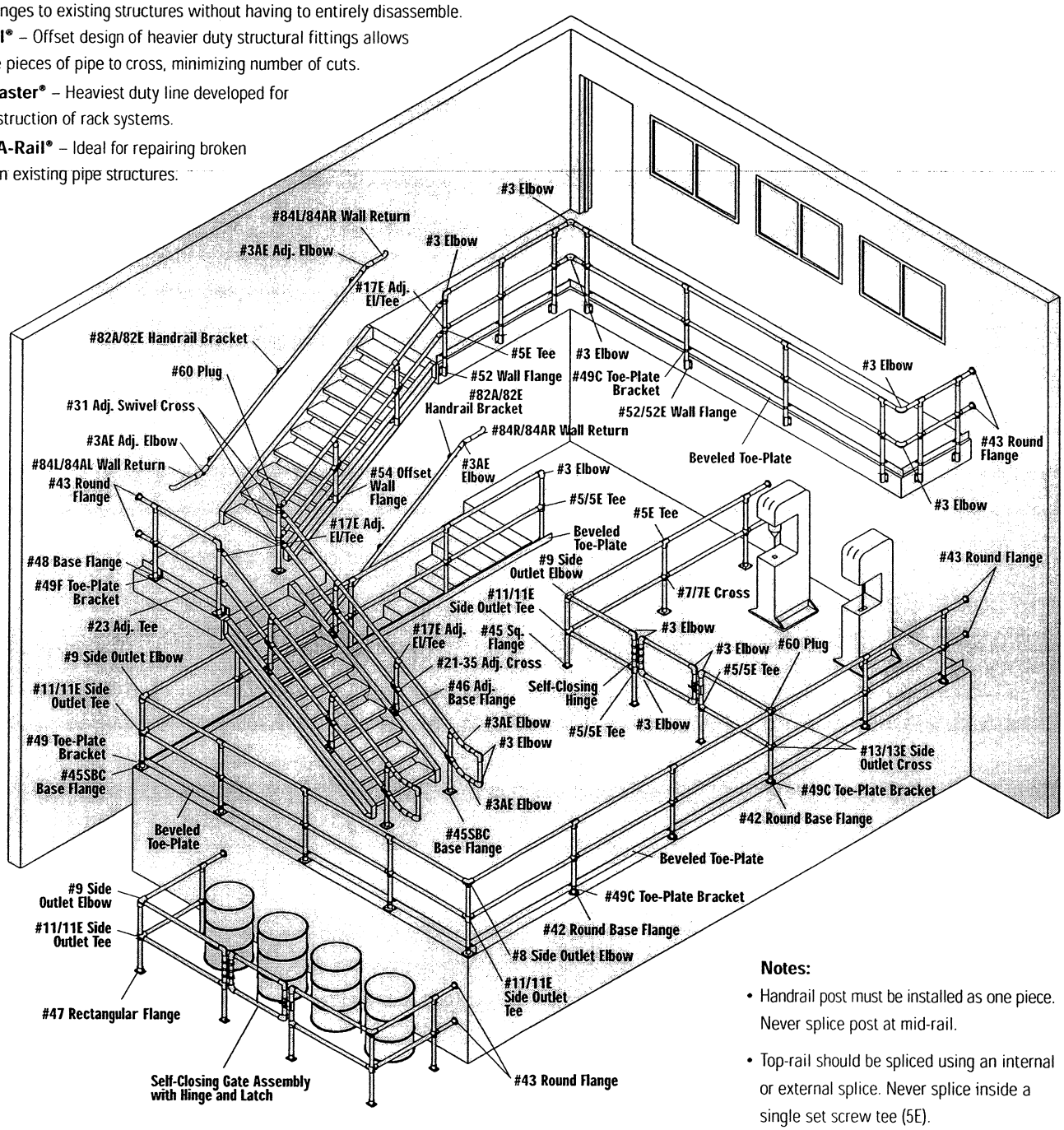
Speed-Rail® II – Patented modular fitting system which easily allows for additions and changes to existing structures without having to entirely disassemble.

Nu-Rail® – Offset design of heavier duty structural fittings allows multiple pieces of pipe to cross, minimizing number of cuts.

Rackmaster® – Heaviest duty line developed for the construction of rack systems.

Mend-A-Rail® – Ideal for repairing broken welds on existing pipe structures.

Hollaender® products are produced from only the highest quality materials such as Aluminum Alloy 535, the most corrosive resistant alloy available today, and feature proprietary fasteners that have tremendous slip and loosening resistance.



Notes:

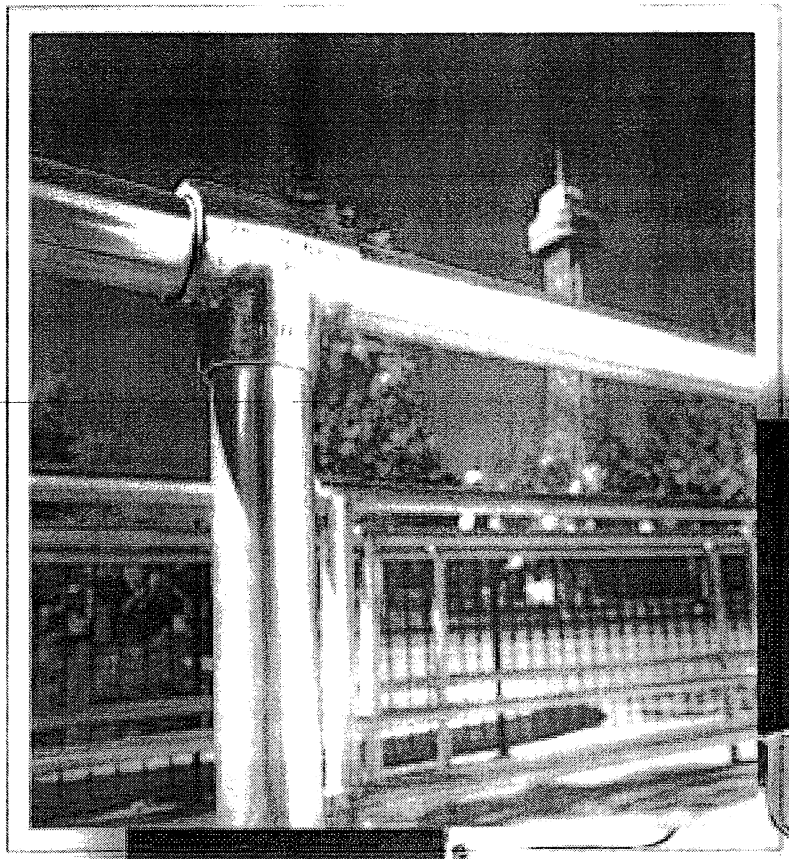
- Handrail post must be installed as one piece. Never splice post at mid-rail.
- Top-rail should be spliced using an internal or external splice. Never splice inside a single set screw tee (5E).

Constructed of aluminum/magnesium alloy, Speed-Rail* Systems are manufactured with maximum flexibility and strength in mind to provide you with years of structural integrity for a wide variety of demanding applications.

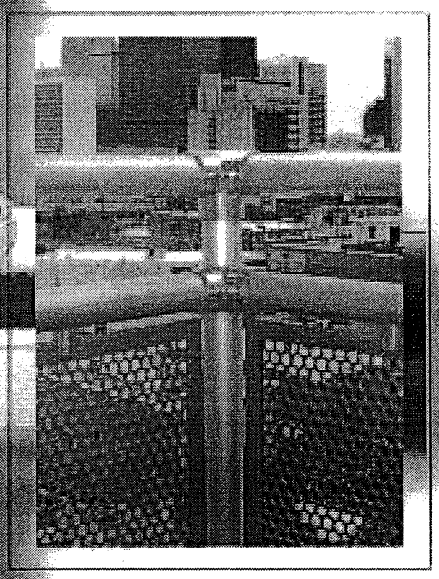
- Fittings and pipes are shipped to site, assembled at project location.
- Rapid installation, ease of repair and reconfiguration.

- Set screws have a proprietary internal-external knurl cup design that prevents screws from backing out in the heaviest vibration conditions.
- Available in 3/4", 1", 1 1/4", 1 1/2", 2" IPS systems.

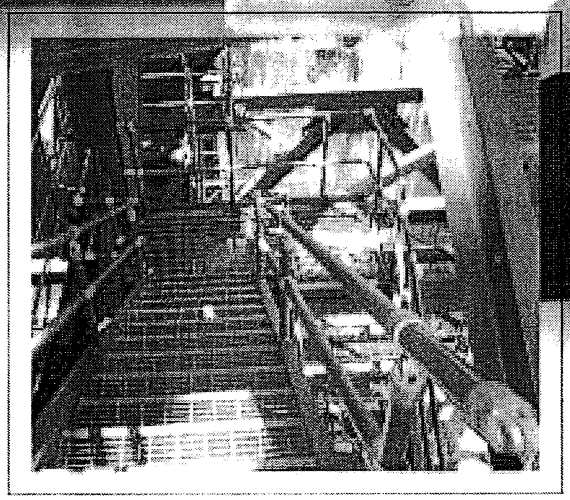
- Fittings are cast from ALMAG 535, aluminum - magnesium alloy - the most corrosion resistant casting alloy available today.
- Will work with any other metal, including steel, and will not suffer from "galvanic reaction corrosion".



Speed-Rail® queue line systems are used throughout the amusement industry in small to large parks.

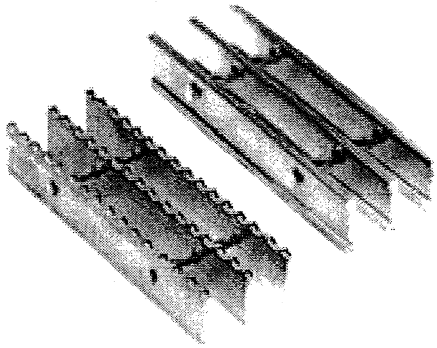


Speed-Rail® with infill panel systems that meet IBC or other codes provide an "industrial chic" look.



For OHSA regulated areas, Speed-Rail® is the most frequently used product, often in conjunction with galvanized steel pipe.

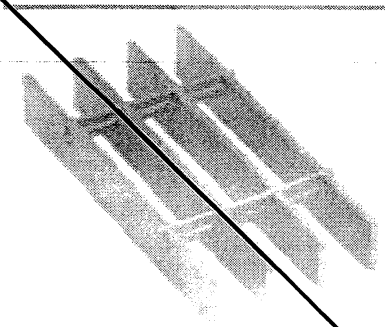
GRATING INFORMATION



Aluminum Rectangular, I Bar and LITEBAR.

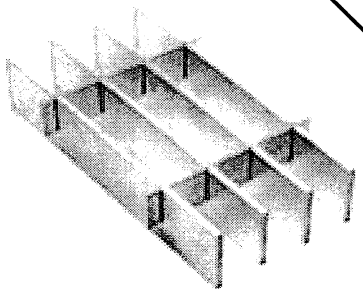
SG Series - SGI Series - SGLi Series

A type of pressure locked grating made by permanently attaching cross bars to bearing bars through a pressure applied swaging process. Bearing bars are either rectangular or "I" shaped and range in size from 1" through 2½". Both Rectangular Bar and I-Bar are offered in 1 3/16" and 1 5/16" spacings, as well as ADA (July 1991) compliant spacings. Cross bars are available on 4" and 2" centers. A serrated surface (rectangular bar) or striated surface(I-Bar) is available for skid resistance.



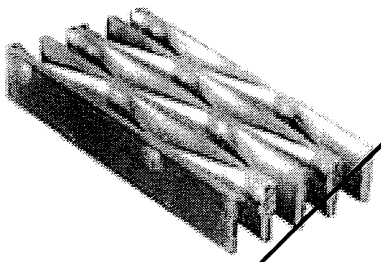
Aluminum Flush Top - SGF Series

A type of pressure locked grating in which the cross bars are in the same plane relative to the top surface of the grating. Bearing bar sizes range from 1" x ⅛" through 2½" x 3/16" in ¼" increments. Bearing bar spacing of 1 3/16", 1 5/16", 1 7/16" and 1 7/16" c.c. and cross bar spacing of 4" or 2" are available. Where skid resistance is desired, a serrated surface can be provided. ALUMINUM FLUSH TOP is available in spacings which provide a ¼" or ½" opening in conformance with provisions of the Americans With Disabilities Act (July 1991) for grating products.



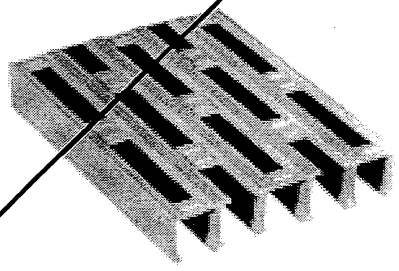
Aluminum Dove Tail - ADT Series

A type of pressure locked grating whereby bearing bars and cross bars are precision slotted, assembled in egg-crate fashion, and hydraulically pressed together to form a panel grid. Bearing bars range from 1" x 1/8" through 2½" x 3/16" in ¼" increments. Grating spacings for Aluminum Dove Tail include the standards, as well as the ADA (July 1991) compliant spacings. Many engineers prefer the bi-directional, rectilinear look and feel of Aluminum Dove Tail grating.



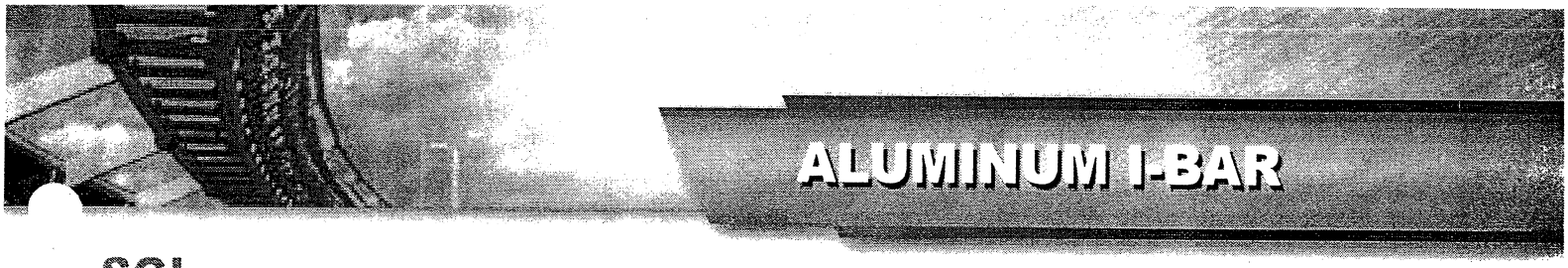
Aluminum Riveted - AR Series

A type of aluminum grating which combines straight bearing bars and bent connecting bars riveted together at their contact points. Riveted grating, although being the oldest style of industrial footwalk, is still the choice of many engineers due to its reliability and durability. All popular sizes and spacings of riveted grating are manufactured by Ohio Gratings with an emphasis on quality and service.



Aluminum Plank

A type of aluminum grating which is available in 6" wide sections, and either plain sided or interlocking. Plank can be provided in sections up to 20' 0" in length, or fabricated per plans and specs. Plank grating is available unpunched as an economical and structurally superior substitute for aluminum checkerplate, or with a variety of punch/patterns.

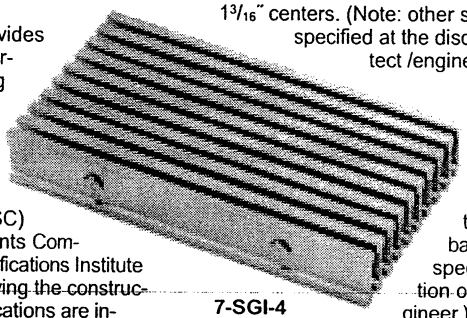


ALUMINUM I-BAR

SGI SERIES

PRODUCT SPECIFICATION GUIDE

How to Specify:
The information below provides a specification format for architectural and engineering specification sections that, when applied, will be consistent with the Three-Part Section Format for Construction Specifications Canada (CSC) and the Technical Documents Committee of Construction Specifications Institute (CSI) for specifications serving the construction industry. These specifications are intended for use as a guide spec for architects and engineers, and may need to be altered or modified to fit the specific conditions of the application in question.



7-SGI-4

PART 1: GENERAL...

1.1 Scope
The contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install grating, stair treads and frames.

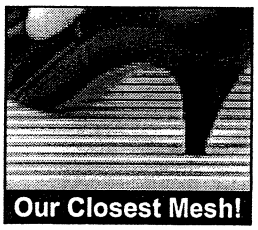
1.2 Quality Assurance
A.1. Comply with applicable provisions and recommendations of the following: NAAMM Metal Bar Grating Manual designated ANSI/NAAMM MBG 531 (Aluminum and Light Duty Steel and Stainless Steel Grating) and MBG 532 (Heavy Duty Steel Grating).
2. Aluminum: ASTM B221, Aluminum Alloy, Extruded Bars, Rods, Wire, Shapes and Tubing.

B.1. Take field measurements prior to preparation of shop drawings and fabrication where required, to ensure proper fitting of the work.

1.3 Submittals
A. The contractor shall submit for approval shop drawings for the fabrication and erection of all work. Include plans, elevations, and details of sections and connections. Show type and location of all fasteners.
B. The contractor shall submit the manufacturer's specifications, load tables, anchor details and standard installation details.

PART 2: PRODUCT...

1. Grating: Aluminum I-Bar SGI Series by Ohio Gratings, Inc., or approved equal.
2. Bearing Bars: I-Bar section with 1/4" flanges on a maximum of $1^{3}/_{16}$" centers. (Note: other spacings may be specified at the discretion of the architect /engineer.)
3. Cross Bars: Locked at right angles to bearing bars at a maximum of 4" on center. (Note: 2" cross bar centers may be specified at the discretion of the architect /engineer.)
4. Surface: Flanges to have a striated surface.
5. Loading: Grating to carry a pedestrian loading equal to a uniform load of 100# per square foot over the required clear span with deflection not to exceed 1/4". (Note: alternate loading requirements may be specified at the discretion of the architect /engineer.)
6. Finish: Mill finished.
7. Fabrication and Tolerances: in accordance with the NAAMM Metal Bar Grating Manual.



Where economy is a major consideration, the I-Bar SGI Series offers a popular and reasonably priced alternative to rectangular bar grating. Extruded I-Bar sections have the same load carrying capacity with less weight per square foot than rectangular bars. The striated top and bottom flanges provide a "built-in" skid resistance feature without the added cost of serrating.

***Note:** The .031" striations top and bottom are in addition to the standard grating depth. For example, a 1" I-Bar section has an overall depth of 1.062"*

PART 3: EXECUTION...

3.1 Installation
A. Prior to grating installation, contractor shall inspect supports for correct size, layout and alignment. Any inconsistencies between contract drawings and supporting structure deemed detrimental to grating placement shall be reported in writing to the architect or owner's agent prior to grating placement.

B. Install grating in accordance with shop drawings and standard installation clearances as recommended by the NAAMM Metal Bar Grating Manual.

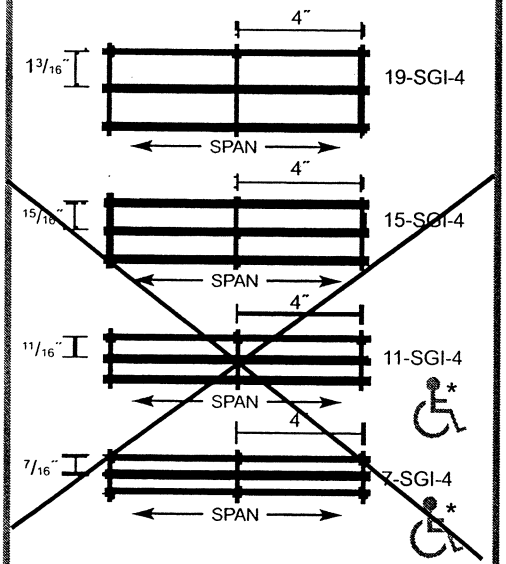
C. Cutting, Fitting and Placement.
1. Perform all cutting and fitting required for installation. Grating shall be placed such that cross bars align.
2. Wherever grating is pierced by pipes, ducts and structural members, cut openings neatly and accurately to size and weld a rectangular band bar of the same height and material as bearing bars.
3. Cutouts for circular obstructions are to be at least 2" larger in diameter than the obstruction. Cutouts for all piping 4" or less shall be made in the field.
4. All rectangular cutouts are to be made to the next bearing bar beyond the penetration with a clearance not to exceed bearing bar spacing.
5. Utilize standard panel widths wherever possible.

D. Protection of Aluminum from Dissimilar Materials:
1. Where aluminum surfaces come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with one coat of bituminous paint or other approved insulating material.
2. Where aluminum surfaces come into contact with dissimilar materials such as concrete, masonry or lime mortar, exposed aluminum surfaces shall be painted with one coat of bituminous paint or other approved insulating material.

3.2 Grating Attachment
Use anchorage devices (saddle clips) (grating clamps) (plank clips) (plank lugs) (countersunk lands) (Z clips) or (anchor blocks) and fasteners to secure grating to supporting members or prepared openings.

Grating Profiles Available...
SGI Series - Aluminum I-Bar

All profiles shown below are also available with 2" cross bar centers. Product numbers would be 19-SGI-2, 15-SGI-2, 11-SGI-2 and 7-SGI-2



*Note: Conforms with the spacing requirements of ADA (July 1991) when installed with the elongated opening perpendicular to the dominant direction of travel.
See ADA Guidelines

Bar Size (inches)	Ped Span, Inches	Wt.* Lbs. Sq. Ft.	Sec. Prop Sx*, in³ / Ix*, in⁴		Clear Span 2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"	6'-6"	7'-0"	8'-0"
1 x 1/8	39	1.71	0.211	U	421	269	187	137								
				D	0.144	0.225	0.324	0.439								
			0.105	C	421	337	281	241								
				D	0.115	0.180	0.259	0.353								
1 x 3/16	44	2.46	0.316	U	632	404	281	206	158							
				D	0.144	0.225	0.324	0.441	0.576							
I-Bar		1.99	0.158	C	632	505	421	361	316							
				D	0.115	0.180	0.259	0.353	0.461							
1 1/4 x 1/8	47	2.08	0.329	U	658	421	292	215	164							
				D	0.115	0.180	0.259	0.353	0.459							
			0.206	C	658	526	439	376	329							
				D	0.092	0.144	0.208	0.282	0.369							
1 1/4 x 3/16	52	3.01	0.493	U	987	632	439	322	247	195						
				D	0.115	0.180	0.259	0.353	0.461	0.583						
I-Bar		2.34	0.308	C	987	789	658	564	493	439						
				D	0.092	0.144	0.207	0.282	0.368	0.467						
			0.474	U	947	606	421	309	237	187						
[redacted]										0.486						
			0.355							421						
				D	0.077	0.120	0.173	0.235	0.307	0.389						
1 1/2 x 3/16	59	3.56	0.711	U	1421	909	632	464	355	281	227					
				D	0.096	0.150	0.216	0.294	0.384	0.487	0.599					
I-Bar		2.70	0.533	C	1421	1137	947	812	711	632	568					
				D	0.077	0.120	0.173	0.235	0.307	0.389	0.480					
[redacted]																
	66															
I-Bar		3.06	0.846	C	1934	1547	1289	1105	967	860	774	703	645			
				D	0.066	0.103	0.148	0.202	0.263	0.333	0.412	0.498	0.593			
2 x 3/16	73	4.68	1.263	U	2526	1617	1123	825	632	499	404	334	281	239		
				D	0.072	0.113	0.162	0.221	0.288	0.364	0.450	0.544	0.649	0.760		
I-Bar		3.43	1.263	C	2526	2021	1684	1444	1263	1123	1011	919	842	777		
				D	0.058	0.090	0.130	0.176	0.230	0.292	0.360	0.436	0.518	0.608		
2 1/4 x 3/16	80	5.24	1.599	U	3197	2046	1421	1044	799	632	512	423	355	303	261	
				D	0.064	0.100	0.144	0.196	0.256	0.324	0.400	0.484	0.576	0.677	0.784	
I-Bar		3.75	1.798	C	3197	2558	2132	1827	1599	1421	1279	1163	1066	984	914	
				D	0.051	0.080	0.115	0.157	0.205	0.259	0.320	0.387	0.461	0.541	0.628	
2 1/2 x 3/16	87	5.79	1.974	U	3947	2526	1754	1289	987	780	632	522	439	374	322	247
				D	0.058	0.090	0.130	0.176	0.230	0.292	0.360	0.436	0.519	0.609	0.705	0.923
I-Bar		4.15	2.467	C	3947	3158	2632	2256	1974	1754	1579	1435	1316	1215	1128	987
				D	0.046	0.072	0.104	0.141	0.184	0.233	0.288	0.348	0.415	0.487	0.565	0.737

U - Safe uniform load in pounds/sq. ft.

C - Safe concentrated load in pounds/ft. grating width

D - Deflection in inches

Loads and deflections given in this table are theoretical, and are based on a unit stress of 12,000 psi.

*Based on 10.105 bars/ft. of grating width. Bearing bars 1 3/16" c.c. Add .3 lbs./sq. ft. for 19-SG-2. Note: Grating for spans to the left of the heavy line have a deflection less than 1/4" for uniform loads of 100 lbs./sq. ft. This is the maximum deflection to afford pedestrian comfort and can be exceeded for other types of load at the discretion of the engineer. The actual Ped (pedestrian) Span under this condition is shown above for each size of grating. When serrated grating is specified, the depth of grating required for a specific load will be 1/4" greater than that shown in these tables.

Panel Width Chart (in.) - 19-SG-4 19-SG-2, 19-SGLi-4 19-SGLi-2, 19-SGF-4 19-SGF-2, 19-ADT-4 19-ADT-2

No. of Bars	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
3/16" Bars	1 3/8	2 9/16	3 3/4	4 15/16	6 1/8	7 5/16	8 1/2	9 11/16	10 7/8	12 1/16	13 1/4	14 7/16	15 5/8	16 13/16	18
No. of Bars	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
3/16" Bars	19 3/16	20 3/8	21 9/16	22 3/4	23 15/16	25 1/8	26 5/16	27 1/2	28 11/16	29 7/8	31 1/16	32 1/4	33 7/16	34 5/8	35 13/16

Add 1/4" for extended cross bars. Deduct 1/16" for 1/8" bearing bars. Standard panel widths indicated in **blue.

Panel Width Chart (in.) - 19-SGI-4 19-SGI-2

Dimensions Are Out-to-Out of Bearing Bars**

No. of Bars	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1/4" Flange	1 7/16	2 5/8	3 13/16	5	6 3/16	7 3/8	8 9/16	9 3/4	10 15/16	12 1/8	13 5/16	14 1/2	15 11/16	16 7/8	18 1/16
No. of Bars	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1/4" Flange	19 1/4	20 7/16	21 5/8	22 13/16	24	25 3/16	26 3/8	27 9/16	28 3/4	29 15/16	31 1/8	32 5/16	33 1/2	34 11/16	35 7/8

Bar thickness is 1/4" at top and bottom. Add 1/4" for extended cross bars. Standard panel widths indicated in **blue.

WEIR AND BAFFLE INFORMATION

MFG Water Treatment Products
P.O. Box 458
55 Fourth Avenue
Union City, PA 16438
free: 877-826-2509
ect: 814-438-3959
fax: 814-438-8538
mfgwtp.com

Water Treatment Products

MATERIAL OF CONSTRUCTION

COMPRESSION MOLDED FIBERGLASS LAMINATE

V-Notched Weirs, Flat-Crested Weirs, Flat Sheet, Baffle Plates, & Washers

Weir plates, baffle plates, flat sheet, and butt plates are matched metal die molded. Resin used shall be resistant to the corrosive effects of sewage and have a PH of approximately 7.

All Weir plates, baffle plates, butt plates and washers shall be fiberglass reinforced plastic pressure molded by the matched die method to produce uniform, smooth surfaces. All surfaces shall be smooth; resin rich; free of voids and porosity; without dry spots, crazes, or unreinforced areas; and shall provide for increased corrosion resistance and weathering.

lass content of the laminate shall be 30 percent +/- 2%, using Type "C" surfacing mat with silane finish on ooth sides of the laminate and Type "E" glass fiber reinforcement with chrome or silane finish. Inorganic fillers shall consist of no less than 40 percent of resin mixture. Final laminate thickness shall be within +/- 10 percent of the specified thickness.

Procedure to be used in determining the physical properties shall be in accordance with ASTM Standards and the following designations: Ultimate Tensile Strength – ASTM designation D 638; Flexural Strength – ASTM designation D 790; Modulus of Elasticity – ASTM designation D 790.

Test samples shall be full thickness of the item produced and shall not be machined on the surface.

Resin with sufficient thixotropic agent added to form a suitable resin seal mix shall be used to seal any machined edges.

All FRP components shall contain Cyasorb UV-9 light absorber and be BLUE – GREEN in color.

101194MC11

MFG Water Treatment Products
P.O. Box 458
55 Fourth Avenue
Union City, PA 16438
free: 877-826-2509
ct: 814-438-3959
fax: 814-438-8538
mfgwtp.com

Water Treatment Products

FIBERGLASS WEIRS, BAFFLES, BAFFLE SUPPORTS, & WASHERS

Subject: Mechanical Properties of Fiberglass Reinforced Thermoset Polyester Resin Material (Compression Molded Laminate). Ref: Sample Identification - #70685-241 Laminate

Scope

On 3 May, 2006 the following tests were conducted on the subject material by Molded Fiber Glass Company personnel at their facility in Ashtabula.

Results: (MFG) ASTM	Values, Units	Standard Deviation, Units
Thickness by ASTM D 638-97	0.28 inches	0.001 inches
Barcol Harness by ASTM D 2583-95	59	2.8
Tensile Strength by ASTM D 683-97	15,700 psi	900 psi
Flexural Strength by ASTM D 790-97	27,700 psi	1,700 psi
exural Modulus by ASTM D 790-97	1,470,000 psi	30,000 psi
Notch Izod Impact by ASTM D 256-A	15.5 ft-lbs/ inch	0.5 ft-lbs/inch
Water Absorption by ASTM D 570	0.04 percent	0.01 percent
Coefficient Thermal Expansion by ASTM D 831		10.1 X 10-6 in/in/°F----------

Preparation

All test specimens were prepared by Molded Fiber Glass Co. Personnel in accordance with the ASTM procedures.

Procedure

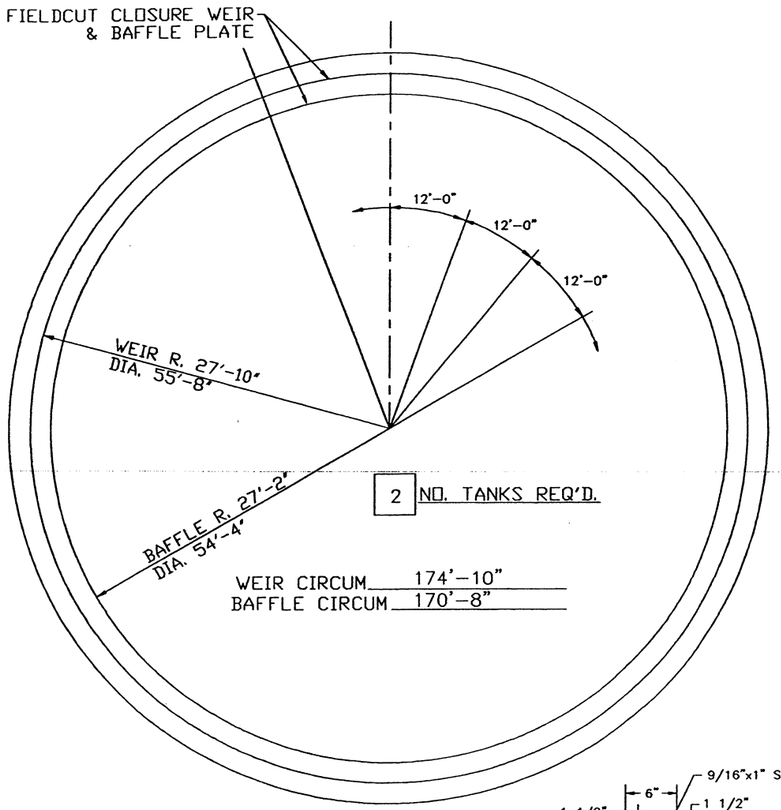
All tests were performed by Molded Fiber Glass Co. Personnel in accordance with the procedures specified by ASTM

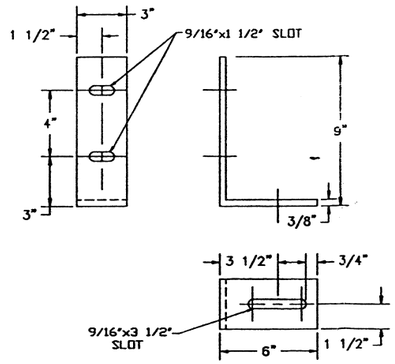
The tensile and flexural tests were conducted on a Sintech Universal Testing Machine 30,000 lb. Capability; the hardness tests were performed with a Barcol Hardness Tester, Model GYZJ 934; the Izod Impact Tests were performed on a TMI Impact Machine; and the CTE was performed on a Perkin-Elmer Thermomechanical Analyzer.

Conclusion

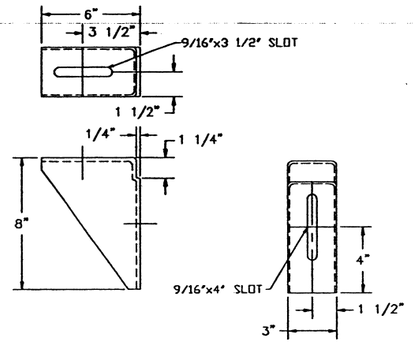
The above results are certified to have been properly obtained in accordance with the aforementioned ASTM est Methods.

ib Banerjee, Mechanical Engineer

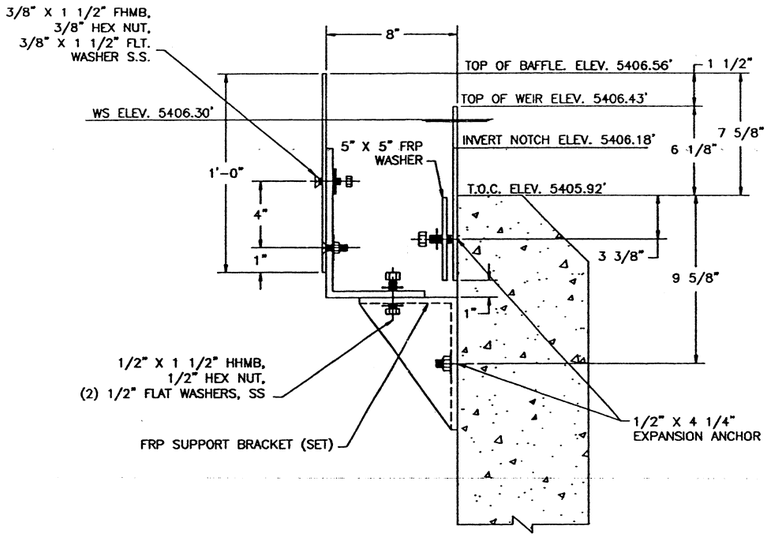




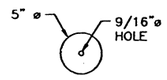
UPPER BAFFLE
SUPPORT BRACKET



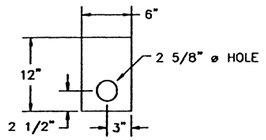
LOWER BAFFLE
SUPPORT BRACKET



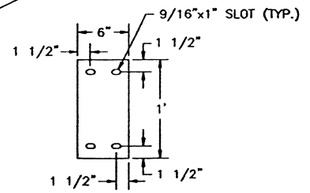
WALL MOUNTING DETAIL
SCALE – 2 : 1



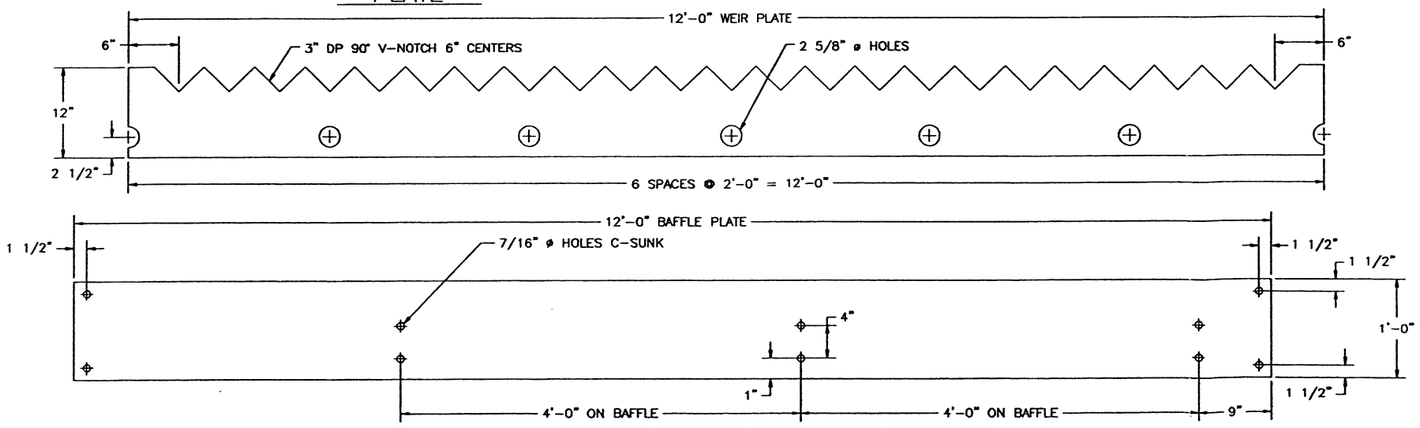
5" ø WASHER
9/16"ø HOLE



WEIR BUTT
PLATE



BAFFLE BUTT
PLATE



ANCHOR SPACING FOR BAFFLE SUPPORT
ON CONCRETE WALL TO BE 4'–1 1/8"

MATERIAL LIST – TWO TANKS

QTY.	MAT'L	DESCRIPTION	SIZE
30	FRP	WEIR PLATES	12" x 1/4" x 12'–0" (3" ON 6")
30	FRP	WEIR BUTT PLATES	12" x 1/4" x 6"
180	FRP	5"ø WASHERS	
30	FRP	BAFFLE PLATES	12" x 1/4" x 12'–0"
30	FRP	BAFFLE BUTT PLATES	12" x 1/4" x 6"
90	FRP	BAFFLE SUPPORT BRACKETS (UPPER)	3/8" THICK / L–SHAPED
90	FRP	BAFFLE SUPPORT BRACKETS (LOWER)	3/8" THICK / STANDARD
90	316 S.S.	HHMB	1/2" x 1 1/2"
90	316 S.S.	HEX NUTS	1/2"
180	316 S.S.	FLAT WASHERS	1/2"
300	316 S.S.	FHMB	3/8" x 1 1/2"
300	316 S.S.	HEX NUTS	3/8"
300	316 S.S.	FLAT WASHERS	7/16" ID x 1 1/2" OD
270	316 S.S.	EXPANSION ANCHORS	1/2" x 4 1/4"

FOUNTAIN, CO –

NO.	REVISIONS	DATE
1	REVISED PER COMMENTS	8-5-11

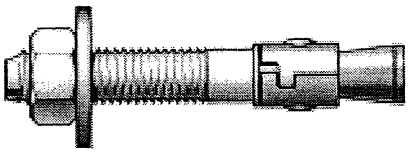
MFG WATER TREATMENT PRODUCTS COMPANY
55 4th AVENUE UNION CITY, PA 16438 PHONE: (814) 438-3558 FAX: (814) 438-8556

SCALE: REF.
TITLE: WEIR & BAFFLE DETAILS – TWO TANKS
FOUNTAIN, CO –

DIVISION : MFG/WTP
DRAWN BY : J. COLLINS
CHECKED BY :
APPROVED :
DATE : 4-14-11

SHEET NO.
5523–1

EXPANSION ANCHOR INFORMATION



Power-Stud™

WEDGE TYPE EXPANSION ANCHOR

BASE MATERIAL

Concrete, Stone

SIZE RANGE

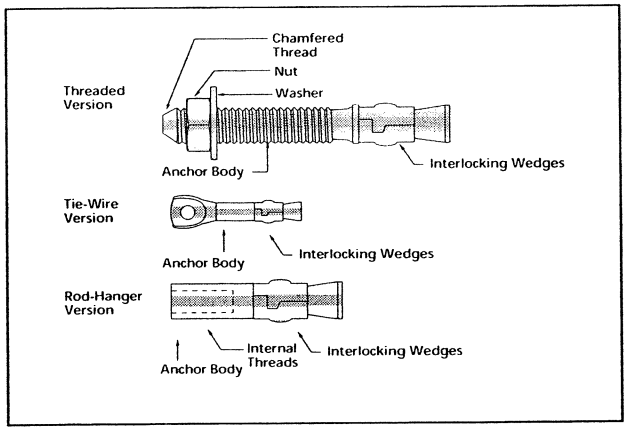
1/4" x 1-3/4" to 1-1/4" x 12"

ANCHOR MATERIAL

Carbon Steel & Type 304 or ~~316~~ Stainless Steel

PRODUCT DESCRIPTION

The Power-Stud anchor (formerly known as the Rawl-Stud) is a one piece, wedge type expansion anchor available in carbon steel and stainless steel. Threaded, Rod Hanger and Tie-Wire versions are designed for use in solid concrete. The drill bit diameter needed for proper installation is the same as the anchor diameter.



LENGTH IDENTIFICATION

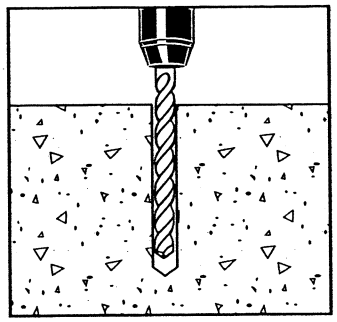
The threaded Power-Stud anchor has a length identification mark stamped on the head of the anchor as shown below.

MARK	A	B	C	D	E	F	G	H
From	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
Up to	2	2-1/2	3	3-1/2	4	4-1/2	5	5-1/2

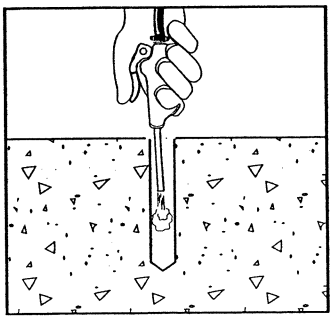
MARK	I	J	K	L	M	N	O	P
From	5-1/2	6	6-1/2	7	7-1/2	8	8-1/2	9
Up to	6	6-1/2	7	7-1/2	8	8-1/2	9	9-1/2

MARK	Q	R	S	T
From	9-1/2	10	11	12
Up to	10	11	12	13

INSTALLATION PROCEDURES

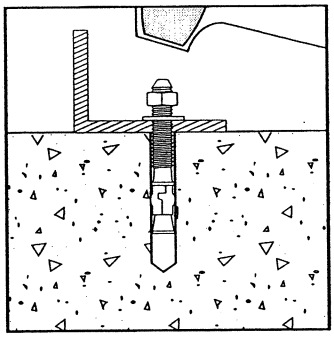


Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.

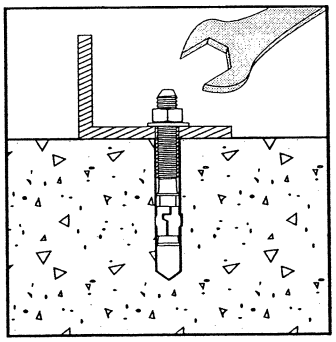


Blow the hole clean of dust and other material.

THREADED VERSION

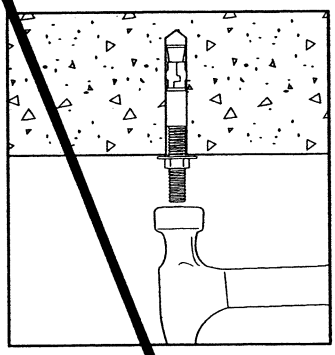


Position the washer on the anchor and thread on the nut.
Drive the anchor through the fixture into the anchor hole until the nut and washer are firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.

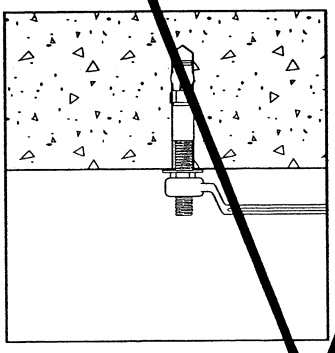


Tighten the anchor by turning the nut 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.

ROD HANGER VERSION

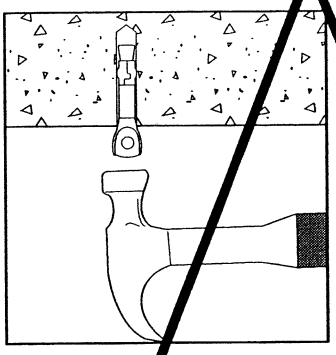


Thread the anchor onto the rod to be used along with a nut and washer. Drive the anchor into the hole until the anchor is at the required embedment depth. The anchor body should be recessed in the hole.

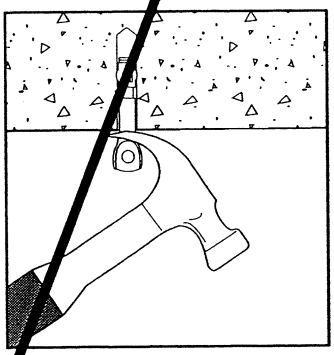


Run the nut and washer up to the concrete surface and tighten the anchor by turning the nut 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.

TIE-WIRE VERSION



Using the proper diameter bit, drive the anchor into the hole until the head is firmly seated against the base material. Be sure the anchor is driven to the required embedment depth.



Set the anchor with a prying action using a claw hammer.

ANCHOR SIZES AND STYLES

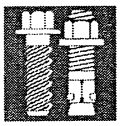
The following tables list the sizes and styles of standard Power-Stud anchors. To select the proper minimum anchor length for the threaded version, determine the embedment depth required to obtain the desired load capacity. Then add the thickness of the fixture, including any spacers or shims, to the embedment depth, along with the nut and washer thickness. The nut and washer thickness is equal to the nominal anchor diameter.

CARBON STEEL POWER-STUD

Carbon steel Power-Stud anchors are manufactured from carbon steel which is plated with commercial bright zinc and a supplementary chromate treatment in accordance with ASTM Specification B 633, SC1, Type III (Fe/Zn 5).

CAT. NO.	SIZE	MIN. EMBED.	THREAD LENGTH	STD. BOX	STD. CTN.	WT./ 100
7400	1/4" x 1-3/4"	1-1/8"	3/4"	100	500	3
7402	1/4" x 2-1/4"	1-1/8"	1-1/4"	100	500	3-1/2
7404	1/4" x 3-1/4"	1-1/8"	2-1/4"	100	500	4-3/4
7410	3/8" x 2-1/4"	1-5/8"	1-1/4"	50	250	8-3/4
7412	3/8" x 2-3/4"	1-5/8"	1-5/8"	50	250	9-1/2
7413	3/8" x 3"	1-5/8"	1-7/8"	50	250	10-3/4
7414	3/8" x 3-1/2"	1-5/8"	2-3/8"	50	250	12
7415	3/8" x 3-3/4"	1-5/8"	2-5/8"	50	250	12-3/4
7416	3/8" x 5"	1-5/8"	3-7/8"	50	250	15-1/2
7417	3/8" x 7"	1-5/8"	5-7/8"	50	200	21
7420	1/2" x 2-3/4"	2-1/4"	1-3/8"	50	200	18
7422	1/2" x 3-3/4"	2-1/4"	2-3/8"	50	200	23
7423	1/2" x 4-1/2"	2-1/4"	3-1/8"	50	200	28
7424	1/2" x 5-1/2"	2-1/4"	4-1/8"	50	150	32
7426	1/2" x 7"	2-1/4"	5-5/8"	25	100	44
7427	1/2" x 8-1/2"	2-1/4"	7-1/8"	25	100	46
7430	5/8" x 3-1/2"	2-3/4"	2"	25	100	40
7432	5/8" x 4-1/2"	2-3/4"	3"	25	100	54
7433	5/8" x 5"	2-3/4"	3-1/2"	25	100	57
7434	5/8" x 6"	2-3/4"	4-1/2"	25	75	64
7436	5/8" x 7"	2-3/4"	5-1/2"	25	75	72
7438	5/8" x 8-1/2"	2-3/4"	7"	25	75	84
7439	5/8" x 10"	2-3/4"	8-1/2"	25	75	100
7440	3/4" x 4-1/4"	3-3/8"	2-3/8"	20	60	70
7441	3/4" x 4-3/4"	3-3/8"	2-7/8"	20	60	76
7442	3/4" x 5-1/2"	3-3/8"	3-5/8"	20	60	85
7444	3/4" x 6-1/2"	3-3/8"	4-3/8"	20	60	95
7446	3/4" x 7"	3-3/8"	5-1/8"	20	60	105
7448	3/4" x 8-1/2"	3-3/8"	6-5/8"	10	40	120
7449	3/4" x 10"	3-3/8"	8-1/8"	10	30	135
7451	3/4" x 12"	3-3/8"	10-1/8"	10	30	155
7450	7/8" x 6"	3-7/8"	2-3/4"	10	40	120
7452	7/8" x 8"	3-7/8"	4-3/4"	10	40	160
7454	7/8" x 10"	3-7/8"	6-3/4"	10	30	200
7461	1" x 6"	4-1/2"	2-3/8"	10	30	170
7463	1" x 9"	4-1/2"	5-3/8"	10	30	240
7465	1" x 12"	4-1/2"	8-3/8"	5	15	300
7473	1-1/4" x 9"	5-5/8"	4-3/4"	5	15	360
7471	1-1/4" x 12"	5-5/8"	7-3/4"	5	15	480

The published length is the overall length of the anchor. Allow one anchor diameter for the nut and washer thickness when selecting a length.



MECHANICALLY GALVANIZED POWER-STUD

Mechanically Galvanized Power-Stud anchors are manufactured from steel which have a mechanically galvanized coating (zinc) in accordance with ASTM Specification B 695, Class 65, Type I.

CAT. NO.	SIZE	MIN. EMBED.	THREAD LENGTH	STD. BOX	STD. CTN.	WT./ 100
7720	1/2" x 2-3/4"	2-1/4"	1-3/8"	50	200	18
7723	1/2" x 4-1/2"	2-1/4"	3-1/8"	50	200	30
7724	1/2" x 5-1/2"	2-1/4"	4-1/8"	50	150	34
7726	1/2" x 7"	2-1/4"	5-5/8"	25	100	34
7730	5/8" x 3-1/2"	2-3/4"	2"	25	100	40
7734	5/8" x 6"	2-3/4"	4-1/2"	25	75	64
7741	3/4" x 4-3/4"	3-3/8"	2-7/8"	20	60	76
7742	3/4" x 5-1/2"	3-3/8"	3-5/8"	20	60	85
7748	3/4" x 8-1/2"	3-3/8"	6-5/8"	10	40	120
7750	7/8" x 6"	3-7/8"	2-3/4"	10	40	120
7752	7/8" x 8"	3-7/8"	4-3/4"	10	40	160
7763	1" x 9"	4-1/2"	5-3/8"	10	30	240

The published length is the overall length of the anchor. Allow one anchor diameter for the nut and washer thickness when selecting a length.

STAINLESS STEEL POWER-STUD

Stainless Steel Power-Stud anchors are manufactured from AISI Type 304 / 304 Cu and Type 316 steel which is passivated.

TYPE 304 STAINLESS STEEL POWER-STUD

CAT. NO.	SIZE	MIN. EMBED.	THREAD LENGTH	STD. BOX	STD. CTN.	WT./ 100
7300	1/4" x 1-3/4"	1-1/8"	3/4"	100	500	3
7302	1/4" x 2-1/4"	1-1/8"	1-1/4"	100	500	3-1/2
7304	1/4" x 3-1/4"	1-1/8"	2-1/4"	100	500	4-3/4
7310	3/8" x 2-1/4"	1-5/8"	1-1/4"	50	250	8-3/4
7312	3/8" x 2-3/4"	1-5/8"	1-5/8"	50	250	9-1/2
7313	3/8" x 3"	1-5/8"	1-7/8"	50	250	10-3/4
7314	3/8" x 3-1/2"	1-5/8"	2-3/8"	50	250	12
7315	3/8" x 3-3/4"	1-5/8"	2-5/8"	50	250	12-3/4
7316	3/8" x 5"	1-5/8"	3-1/8"	50	250	15-1/2
7320	1/2" x 2-3/4"	2-1/4"	1-3/8"	50	200	18
7322	1/2" x 3-3/4"	2-1/4"	2-3/8"	50	200	23
7323	1/2" x 4-1/2"	2-1/4"	3-1/8"	50	200	30
7324	1/2" x 5-1/2"	2-1/4"	4-1/8"	50	150	34
7326	1/2" x 7"	2-1/4"	5-5/8"	25	100	44
7330	5/8" x 3-1/2"	2-3/4"	2"	25	100	40
7332	5/8" x 4-1/2"	2-3/4"	3"	25	100	54
7333	5/8" x 5"	2-3/4"	3-1/2"	25	100	57
7334	5/8" x 6"	2-3/4"	4-1/2"	25	75	64
7336	5/8" x 7"	2-3/4"	5-1/2"	25	75	72
7338	5/8" x 8-1/2"	2-3/4"	7"	25	75	84
7340	3/4" x 4-1/4"	3-3/8"	2-3/8"	20	60	70
7341	3/4" x 4-3/4"	3-3/8"	2-7/8"	20	60	76
7342	3/4" x 5-1/2"	3-3/8"	3-5/8"	20	60	85
7344	3/4" x 6-1/4"	3-3/8"	4-3/8"	20	60	95
7346	3/4" x 7"	3-3/8"	5-1/8"	20	60	105
7348	3/4" x 8-1/2"	3-3/8"	6-5/8"	10	40	120
7349	3/4" x 10"	3-3/8"	8-1/8"	10	30	135
7352	7/8" x 8"	3-7/8"	4-3/4"	10	40	160
7361	1" x 6"	4-1/2"	2-3/8"	10	30	170
7363	1" x 9"	4-1/2"	5-3/8"	10	30	240
7365	1" x 12"	4-1/2"	8-3/8"	5	15	300

The published length is the overall length of the anchor. Allow one anchor diameter for the nut and washer thickness when selecting a length.

TYPE 316 STAINLESS STEEL POWER-STUD

CAT. NO.	SIZE	MIN. EMBED.	THREAD LENGTH	STD. BOX	STD. CTN.	WT./ 100
7600	1/4" x 1-3/4"	1-1/8"	3/4"	100	500	3-1/4
7602	1/4" x 2-1/4"	1-1/8"	1-1/4"	100	500	4-3/4
7604	1/4" x 3-1/4"	1-1/8"	2-1/4"	100	500	5-1/4
7610	3/8" x 2-1/4"	1-5/8"	1-1/4"	50	250	8-3/4
7612	3/8" x 2-3/4"	1-5/8"	1-5/8"	50	250	10-1/2
7613	3/8" x 3"	1-5/8"	1-7/8"	50	250	11
7614	3/8" x 3-1/2"	1-5/8"	2-3/8"	50	250	12
7615	3/8" x 3-3/4"	1-5/8"	2-5/8"	50	250	13
7616	3/8" x 5"	1-5/8"	3-7/8"	50	250	17-1/4
7620	1/2" x 2-3/4"	2-1/4"	1-3/8"	50	200	18
7622	1/2" x 3-3/4"	2-1/4"	2-3/8"	50	200	24
7623	1/2" x 4-1/2"	2-1/4"	3-1/8"	50	200	30
7624	1/2" x 5-1/2"	2-1/4"	4-1/8"	50	150	34
7626	1/2" x 7"	2-1/4"	5-5/8"	25	100	44
7630	5/8" x 3-1/2"	2-3/4"	2"	25	100	40
7632	5/8" x 4-1/2"	2-3/4"	3"	25	100	54
7633	5/8" x 5"	2-3/4"	3-1/2"	25	100	57
7634	5/8" x 6"	2-3/4"	4-1/2"	25	75	64
7636	5/8" x 7"	2-3/4"	5-1/2"	25	75	72
7638	5/8" x 8-1/2"	2-3/4"	7"	25	75	84
7640	3/4" x 4-1/4"	3-3/8"	2-3/8"	20	60	70
7641	3/4" x 4-3/4"	3-3/8"	2-7/8"	20	60	76
7642	3/4" x 5-1/2"	3-3/8"	3-5/8"	20	60	85
7644	3/4" x 6-1/4"	3-3/8"	4-3/8"	20	60	95
7646	3/4" x 7"	3-3/8"	5-1/8"	20	60	105
7648	3/4" x 8-1/2"	3-3/8"	6-5/8"	10	40	120

The published length is the overall length of the anchor. Allow one anchor diameter for the nut and washer thickness when selecting a length.

ROD HANGER POWER-STUD

CAT. NO.	ROD SIZE	ANCHOR SIZE	DRILL DIA.	MIN. EMBED.	THREAD DEPTH	STD. BOX	STD. CTN.	WT./ 100
7806	3/8"	1/2" x 2-3/8"	1/2"	2-1/4"	9/16"	50	200	18
7808	1/2"	5/8" x 2-1/2"	5/8"	2-3/4"	3/4"	25	125	40
7810	5/8"	7/8" x 3-1/4"	7/8"	3-7/8"	15/16"	10	50	120

TIE-WIRE POWER-STUD

CAT. NO.	SIZE	TIE-WIRE HOLE SIZE	MIN. EMBED.	STD. BOX	STD. CTN.	WT./ 100
7409	1/4" x 2"	9/32"	1-1/8"	100	500	3-3/4

Powers FASTENERS

INSTALLATION SPECIFICATIONS

CARBON STEEL POWER-STUD

ANCHOR SIZE	1/4"	3/8"	1/2"	5/8"
ANSI Drill Bit Size	1/4"	3/8"	1/2"	5/8"
Fixture Clearance Hole	5/16"	7/16"	9/16"	11/16"
Thread Size	1/4-20	3/8-16	1/2-13	5/8-11
Nut Height	7/32"	21/64"	7/16"	35/64"
Washer O.D.	5/8"	1"	1-1/16"	1-3/4"
Wrench Size	7/16"	9/16"	3/4"	15/16"

ANCHOR SIZE	3/4"	7/8"	1"	1-1/4"
ANSI Drill Bit Size	3/4"	7/8"	1"	1-1/4"
Fixture Clearance Hole	13/16"	15/16"	1-1/8"	1-3/8"
Thread Size	3/4 - 10	7/8 - 9	1 - 8	1-1/4 - 7
Nut Height	41/64"	3/4"	55/64"	1-1/16"
Washer O.D.	2"	2-1/4"	2-1/2"	3"
Wrench Size	1-1/8"	1- 5/16"	1-1/2"	1-7/8"

STAINLESS STEEL POWER-STUD

ANCHOR SIZE	1/4"	3/8"	1/2"	5/8"
ANSI Drill Bit Size	1/4"	3/8"	1/2"	5/8"
Fixture Clearance Hole	5/16"	7/16"	9/16"	11/16"
Thread Size	1/4 - 20	3/8 - 16	1/2 -13	5/8 - 11
Nut Height	7/32"	21/64"	7/16"	35/64"
Washer O.D. (304 SS)	5/8"	13/16"	1-1/16"	1-3/4"
Washer O.D. (316 SS)	5/8"	7/8"	1-1/4"	1-1/2"
Wrench Size	7/16"	9/16"	3/4"	15/16"

ANCHOR SIZE	3/4"	7/8"	1"
ANSI Drill Bit Size	3/4"	7/8"	1"
Fixture Clearance Hole	13/16"	15/16"	1-1/8"
Thread Size	3/4 - 10	7/8 - 9	1 - 8
Nut Height	41/64"	3/4"	55/64"
Washer O.D. (304 SS)	2"	2-1/4"	2-1/2"
Washer O.D. (316 SS)	1-3/4"	2"	2"
Wrench Size	1-1/8"	1-5/16"	1-1/2"

ROD HANGER POWER-STUD

ROD SIZE	3/8"	1/2"	5/8"
Anchor Diameter	1/2"	5/8"	7/8"
ANSI Drill Bit Size	1/2"	5/8"	7/8"
Internal Thread Size	3/8-16	1/2-13	5/8-11

TIE-WIRE POWER-STUD

ANCHOR SIZE	1/4"
ANSI Drill Bit Size	1/4"
Tie-Wire Hole Size	9/32"
Head Height	3/4"

MATERIAL SPECIFICATIONS

CARBON STEEL POWER-STUD

ANCHOR COMPONENT	COMPONENT MATERIAL
Anchor Body	AISI 1018 (1/4"-3/4", lengths up to 7"), AISI 12L14 (7/8"-1-1/4" and all lengths over 7")
Nut	Carbon Steel, ASTM A 563, Grade A
Washer	Carbon Steel
Expansion Wedge	Tempered AISI 1010 Carbon Steel
Zinc Plating	ASTM B 633, SC1, Type III (Fe/Zn 5)

MECHANICALLY GALVANIZED POWER-STUD

ANCHOR COMPONENT	COMPONENT MATERIAL
Anchor Body	AISI 1018 (1/4"-3/4", lengths up to 7"), AISI 12L14 (7/8"-1-1/4" and all lengths over 7")
Nut	Carbon Steel, ASTM A 563, Grade A
Washer	Carbon Steel
Expansion Wedge	Type 304 Stainless Steel
Mechanically Galvanized Coating	ASTM B 695, Class 65, Type I

TYPE 304 STAINLESS STEEL POWER-STUD

ANCHOR COMPONENT	COMPONENT MATERIAL
Anchor Body	Type 304Cu (1/4" - 3/4", lengths up to 7"), Type 304 (7/8" - 1", lengths over to 7")
Nut	Type18-8 (300 Series) Stainless Steel
Washer	Type18-8 (300 Series) Stainless Steel
Expansion Wedge	Type 304 Stainless Steel

TYPE 316 STAINLESS STEEL POWER-STUD

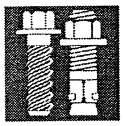
ANCHOR COMPONENT	COMPONENT MATERIAL
Anchor Body	Type 316L Stainless Steel
Nut	Type 316L Stainless Steel
Washer	Type 316L Stainless Steel
Expansion Wedge	Type 316 Stainless Steel

ROD HANGER POWER-STUD

ANCHOR COMPONENT	COMPONENT MATERIAL
Anchor Body	AISI 12L14 Carbon Steel
Expansion Wedge	Tempered AISI 1010 Carbon Steel
Zinc Plating	ASTM B 633 SC1, Type III (Fe / Zn 5)

TIE-WIRE POWER-STUD

ANCHOR COMPONENT	COMPONENT MATERIAL
Anchor Body	AISI 1018 Carbon Steel
Expansion Wedge	Tempered AISI 1010 Carbon Steel
Zinc Plating	ASTM B 633, SC1, Type III (Fe / Zn 5)



PERFORMANCE DATA

The following load capacities are based on testing conducted according to ASTM Standard E 488.

ULTIMATE LOAD CAPACITIES - CONCRETE

ANCHOR SIZE (IN)	EMBED. DEPTH (IN)	GUIDE TORQUE (FT-LBS)	2,000 PSI CONCRETE TENSION (LBS)	2,000 PSI CONCRETE SHEAR (LBS)	4,000 PSI CONCRETE TENSION (LBS)	4,000 PSI CONCRETE SHEAR (LBS)	6,000 PSI CONCRETE TENSION (LBS)	6,000 PSI CONCRETE SHEAR (LBS)
1/4	1-1/8	6 - 8	1,240	1,580	1,810	1,620	1,940	1,620
1/4	1-1/2	6 - 8	1,635	1,580	2,100	1,620	2,195	1,620
1/4	2	6 - 8	2,170	1,580	2,490	1,620	2,535	1,620
1/4	2-3/4	6 - 8	2,340	1,655	2,550	2,070	2,535	2,080
3/8	1-5/8	28 - 35	2,120	3,560	3,040	3,760	3,345	3,760
3/8	2	28 - 35	2,800	3,560	3,850	3,760	4,075	3,760
3/8	3	28 - 35	4,615	3,560	6,020	3,760	6,025	3,760
3/8	4-1/4	28 - 35	5,045	3,840	6,020	5,185	6,025	5,185
1/2	2-1/4	60 - 70	4,445	6,540	5,560	6,800	6,540	6,800
1/2	3	60 - 70	6,920	6,540	8,895	6,800	9,875	6,800
1/2	4	60 - 70	7,250	6,540	9,115	6,800	10,160	6,800
1/2	6	60 - 70	7,910	7,025	9,550	7,190	10,730	7,190
5/8	2-3/4	90 - 100	6,270	9,280	8,725	11,900	9,860	11,900
5/8	4	90 - 100	9,710	9,280	10,825	11,900	13,495	11,900
5/8	5	90 - 100	10,640	9,280	12,510	11,900	16,410	11,900
5/8	7	90 - 100	12,500	9,760	15,880	12,170	16,410	12,170
3/4	3-3/8	175 - 190	8,740	13,475	10,640	15,060	12,540	15,060
3/4	5	175 - 190	11,045	13,475	14,630	15,060	17,265	15,060
3/4	6	175 - 190	12,465	13,475	17,080	15,060	20,180	15,060
3/4	8	175 - 190	16,620	14,660	22,770	17,110	24,905	17,110
7/8	3-7/8	250 - 260	9,680	17,960	15,490	24,160	17,300	24,160
7/8	4-1/2	250 - 260	11,165	17,960	15,620	24,160	20,075	24,160
7/8	5-3/4	250 - 260	14,140	17,960	19,880	24,160	25,625	24,160
7/8	7	250 - 260	17,115	17,960	20,440	24,160	31,180	24,160
7/8	8	250 - 260	17,115	18,630	20,440	25,710	31,180	25,710
1	4-1/2	300 - 325	8,935	26,420	13,820	31,100	21,225	31,100
1	5-1/2	300 - 325	12,770	26,420	20,280	31,100	27,795	31,100
1	6-1/2	300 - 325	16,605	26,420	25,485	31,100	34,365	31,100
1	8	300 - 325	22,360	26,420	27,040	31,100	44,220	31,100
1	9	300 - 325	26,195	27,020	34,205	32,370	44,220	32,370
1-1/4	5-1/2	450 - 460	21,460	40,820	26,980	40,820	36,925	40,820
1-1/4	7	450 - 460	25,360	40,820	35,410	40,820	44,845	40,820
1-1/4	10	450 - 460	33,160	40,820	52,280	40,820	60,690	40,820

NOTE: The values listed above are ultimate load capacities in pounds for the carbon steel and stainless steel Power-Stud which should be reduced by a minimum safety factor of 4 to determine the allowable working load.

ULTIMATE LOAD CAPACITIES - GROUT FILLED HOLLOW BLOCK

ANCHOR SIZE	EMBED. DEPTH	GUIDE TORQUE (FT-LBS.)	GROUT FILLED BLOCK TENSION (LBS.)	GROUT FILLED BLOCK SHEAR (LBS.)
1/4"	1-1/8"	4	1,230	1,230
1/4"	2"	4	1,670	1,230
3/8"	1-5/8"	20	1,990	3,240
3/8"	3"	20	2,200	3,240
1/2"	2-1/4"	30	2,260	6,230
1/2"	4"	30	2,620	6,230
5/8"	2-3/4"	65	3,170	7,830
5/8"	5"	65	3,780	7,830
3/4"	3-3/8"	90	4,085	9,760
3/4"	5"	90	4,420	9,760

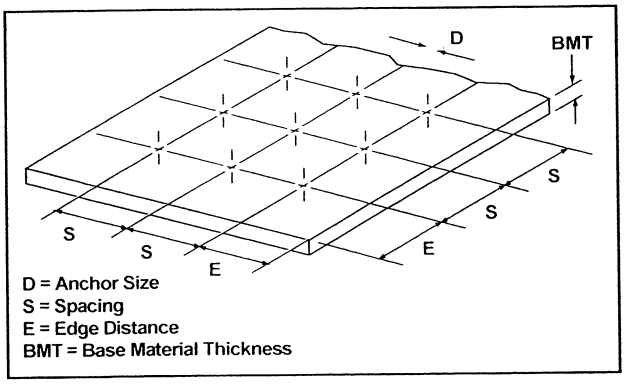
NOTE: Depending upon anchor application and governing building code, ultimate load capacities should be reduced by a minimum safety factor of 4 or greater to determine the allowable working load. The design professional familiar with the actual product installation should be consulted. Please refer to the general section entitled Evaluation of Test Data that appears earlier in this manual for current industry standards. The consistency of grout filled hollow block varies greatly. The load capacities listed above should be used as guidelines only. Job site tests should be conducted to verify base material consistency, proper installation, torque values, and actual anchor performance.

ULTIMATE LOAD CAPACITIES - LIGHTWEIGHT CONCRETE

ANCHOR SIZE	EMBED. DEPTH	GUIDE TORQUE (FT-LBS.)	2,000 PSI LIGHTWEIGHT CONCRETE TENSION (LBS.)	2,000 PSI LIGHTWEIGHT CONCRETE SHEAR (LBS.)
1/4"	1-1/8"	4	1,120	1,450
1/4"	2"	4	1,350	1,540
3/8"	1-5/8"	20	2,310	3,470
3/8"	2-1/2"	20	2,945	4,130
1/2"	2-1/4"	30	3,070	5,960
1/2"	4"	30	4,860	7,280
5/8"	2-3/4"	65	4,240	9,760
5/8"	5"	65	5,980	11,800
3/4"	3-3/8"	90	6,330	11,440
3/4"	5"	90	8,690	16,450

NOTE: The ultimate load capacities should be reduced by a minimum safety factor of 4 or greater to determine the allowable working load.

DESIGN CRITERIA



D = Anchor Size
S = Spacing
E = Edge Distance
BMT = Base Material Thickness

BASE MATERIAL THICKNESS

The minimum recommended thickness of base material, BMT, when using the Power-Stud is 125% of the embedment to be used. For example, when installing an anchor to a depth of 4", the base material thickness should be 5".

SPACING BETWEEN ANCHORS

To obtain the maximum load in tension or shear, a spacing, S, of 10 anchor diameters (10D) or greater should be used. The minimum recommended anchor spacing, S, is 5 anchor diameters (5D) at which point the load should be reduced by 50%. Anchor spacing closer or less than 5 diameters (5D) needs to be field tested. Actual base material conditions will determine any applicable reduction factor. The following table lists the load reduction factor, Rs, for each anchor diameter, D, based on the center to center anchor spacing.

ANCHOR SIZE D	ANCHOR SPACING, S (INCHES) TENSION AND SHEAR 10D	9D	8D	7D	6D	5D
1/4	2-1/2	2-1/4	2	1-3/4	1-1/2	1-1/4
3/8	3-3/4	3-3/8	3	2-5/8	2-1/4	1-7/8
1/2	5	4-1/2	4	3-1/2	3	2-1/2
5/8	6-1/4	5-5/8	5	4-3/8	3-3/4	3-1/8
3/4	7-1/2	6-3/4	6	5-1/4	4-1/2	3-3/4
7/8	8-3/4	7-7/8	7	6-1/8	5-1/4	4-3/8
1	10	9	8	7	6	5
1-1/4	12-1/2	11-1/4	9	8-3/4	7-1/2	6-1/4
Rs	**1.00**	**0.90**	**0.80**	**0.70**	**0.60**	**0.50**

EDGE DISTANCE - TENSION

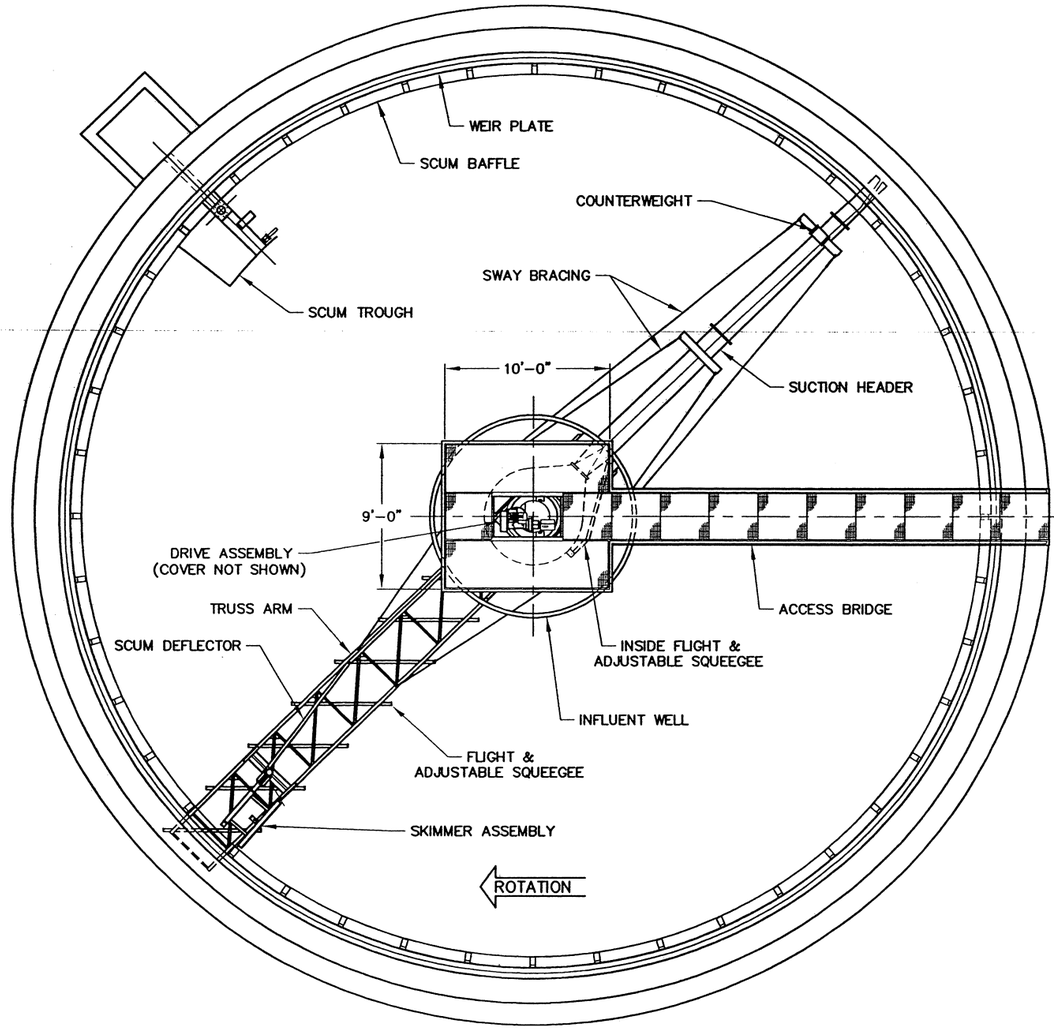
For tension loads, an edge distance, E, of 12 diameters (12D) or greater should be used to obtain the maximum tension load. The minimum recommended edge distance, E, is 5 diameters (5D) at which point the tension load should be reduced by 20%. Edge distances closer or less than 5 diameters (5D) need to be field tested. Actual base material conditions will determine any applicable reduction factor. The following table lists the load reduction factor, Re, for each anchor diameter, D, based on the anchor center to edge distance.

ANCHOR SIZE D	EDGE DISTANCE, E (INCHES) TENSION ONLY 12D	11D	10D	9D	8D	7D	6D	5D
1/4	3	2-3/4	2-1/2	2-1/4	2	1-3/4	1-1/2	1-1/4
3/8	4-1/2	4-1/8	3-3/4	3-3/8	3	2-5/8	2-1/4	1-7/8
1/2	6	5-1/2	5	4-1/2	4	3-1/2	3	2-1/2
5/8	7-1/2	6-7/8	6-1/4	5-5/8	5	4-3/8	3-3/4	3-1/8
3/4	9	8-1/4	7-1/2	6-3/4	6	5-1/4	4-1/2	3-3/4
7/8	10-1/2	9-5/8	8-3/4	7-7/8	7	6-1/8	5-1/4	4-3/8
1	12	11	10	9	8	7	6	5
1-1/4	15	13-1/4	12-1/2	11-1/4	9	8-3/4	7-1/2	6-1/4
Re	**1.00**	**0.97**	**0.94**	**0.91**	**0.89**	**0.86**	**0.83**	**0.80**

EDGE DISTANCE - SHEAR

For shear loads, an edge distance, E, of 12 anchor diameters (12D) or greater should be used to obtain the maximum load. The minimum recommended edge distance, E, is 5 anchor diameters (5D) at which point the shear load should be reduced by 50%. Edge distances closer or less than 5 diameters (5D) need to be field tested. Actual base material conditions will determine any applicable reduction factor. The following table lists the load reduction factor, Re, for each anchor diameter, D, based on the anchor center to edge distance.

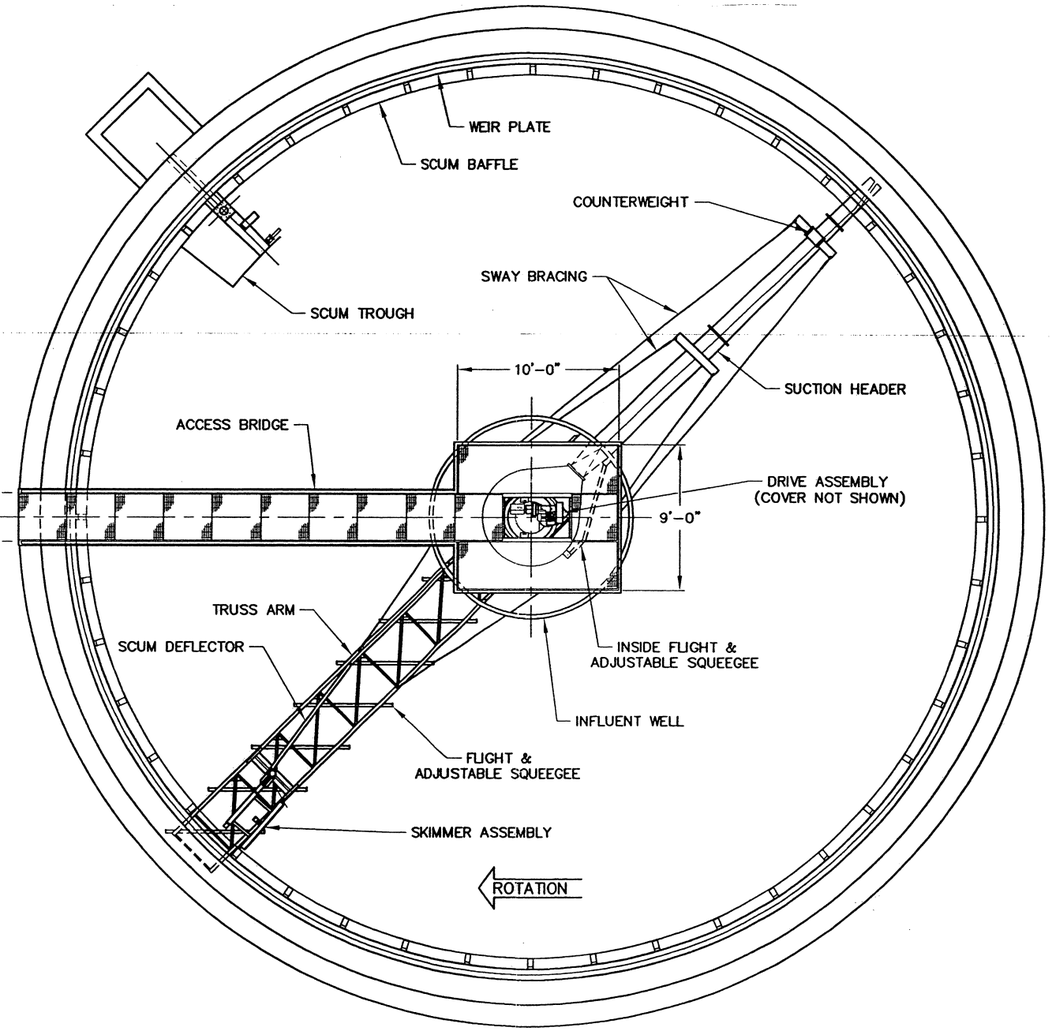
ANCHOR SIZE D	EDGE DISTANCE, E (INCHES) SHEAR ONLY 12D	11D	10D	9D	8D	7D	6D	5D
1/4	3	2-3/4	2-1/2	2-1/4	2	1-3/4	1-1/2	1-1/4
3/8	4-1/2	4-1/8	3-3/4	3-3/8	3	2-5/8	2-1/4	1-7/8
1/2	6	5-1/2	5	4-1/2	4	3-1/2	3	2-1/2
5/8	7-1/2	6-7/8	6-1/4	5-5/8	5	4-3/8	3-3/4	3-1/8
3/4	9	8-1/4	7-1/2	6-3/4	6	5-1/4	4-1/2	3-3/4



SECONDARY CLARIFIER No. 1

3'-0" C-C

3'-0" C-C



SECONDARY CLARIFIER No. 2

PLAN NORTH

CAD FILE: D70549

MASTER
D-70549

SYM	REVISION	BY	DATE	CHKD
2				
1				

	DATE	BY
DRAWN	4-4-11	RES
CHECKED		
APPR.		

SCALE NONE

FILE REFERENCE

WALKER PROCESS EQUIPMENT

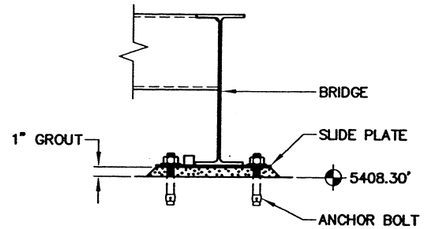
SECONDARY CLARIFIERS No. 1 & No. 2

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

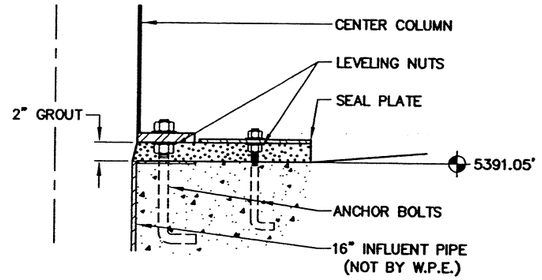
GENERAL ARRANGEMENT – PLAN
60'-0" DIA CLARIFIER – TYPE 'RSMTP'
FOUNTAIN, COLORADO

CONTRACT Q10600A

DRAWING NO. D,2,0,5|7,0,5,4,9|1,6,7 REV.



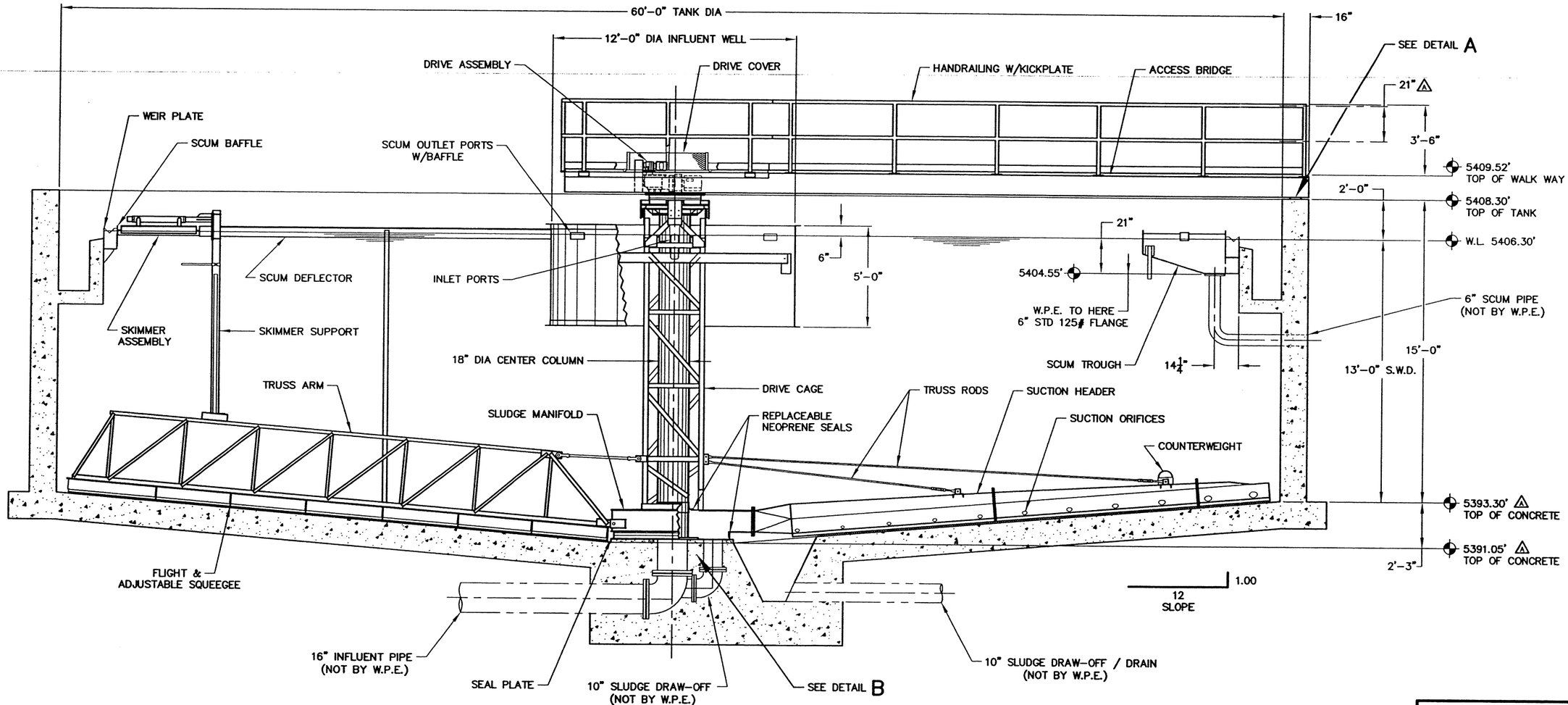
DETAIL A



DETAIL B ⚠

NOTES:

1. DO NOT USE THIS DRAWING FOR ERECTION PURPOSES.
2. FIELD WELDING – APPROX 50 LINEAL FEET OF 1/4" FILLET TYPE REQ'D.
3. FOR PLAN – SEE DRAWING D205–70549–167



SECTIONAL ELEVATION ⚠

SYM	REVISION	BY	DATE	CHKD
⚠B				
⚠A	GROUT REMOVED FROM TANK FLOOR. DETAIL 'B' REVISED & 21" WAS 18".	RES	7–26–11	

	DATE	BY
DRAWN	4–4–11	RES
CHECKED		
APPR.		

SCALE: NONE

FILE REFERENCE

WALKER PROCESS EQUIPMENT

SECONDARY CLARIFIERS No. 1 & No. 2

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

GENERAL ARRANGEMENT – ELEV
60'–0" DIA CLARIFIER – TYPE 'RSMTP'
FOUNTAIN, COLORADO

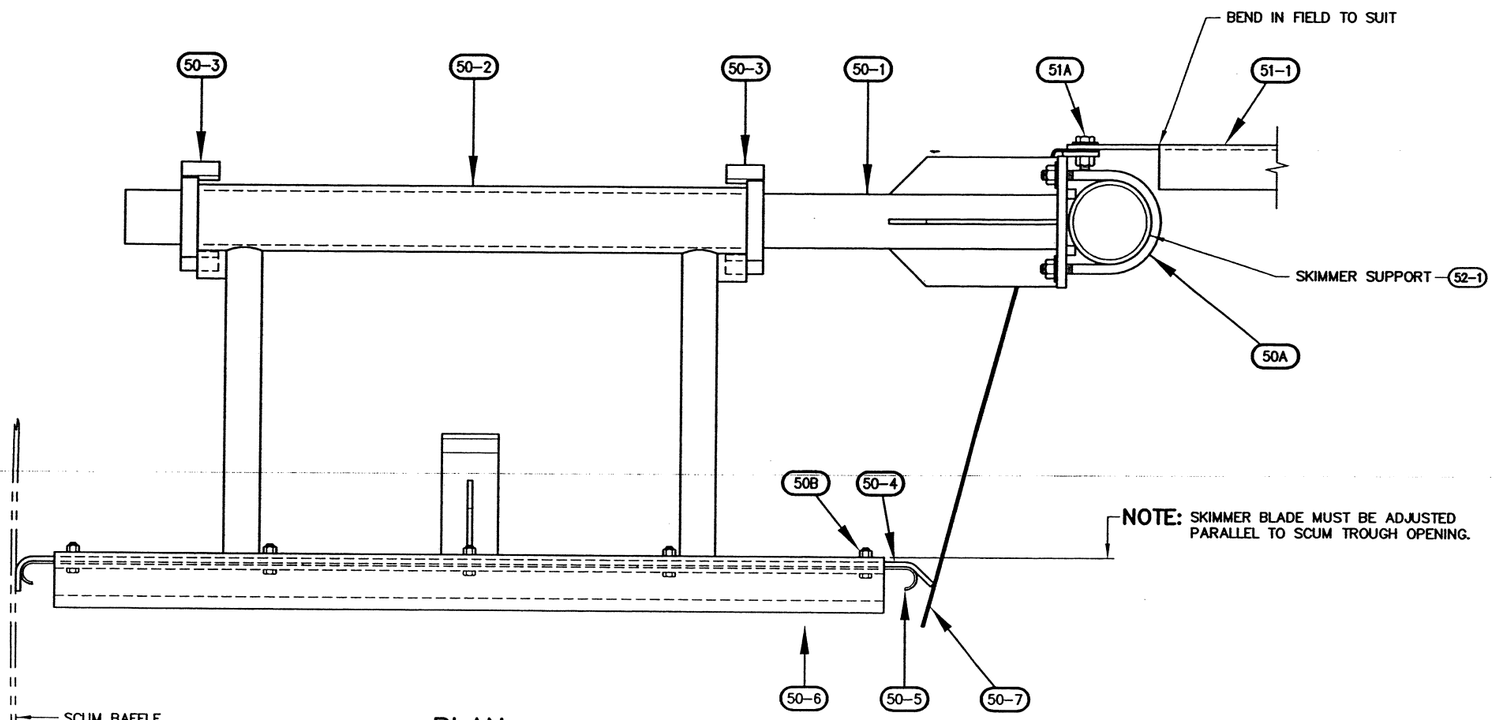
CONTRACT: Q10600A

DRAWING NO.: D,2,0,5,7,0,5,5,0,1,6,7 A

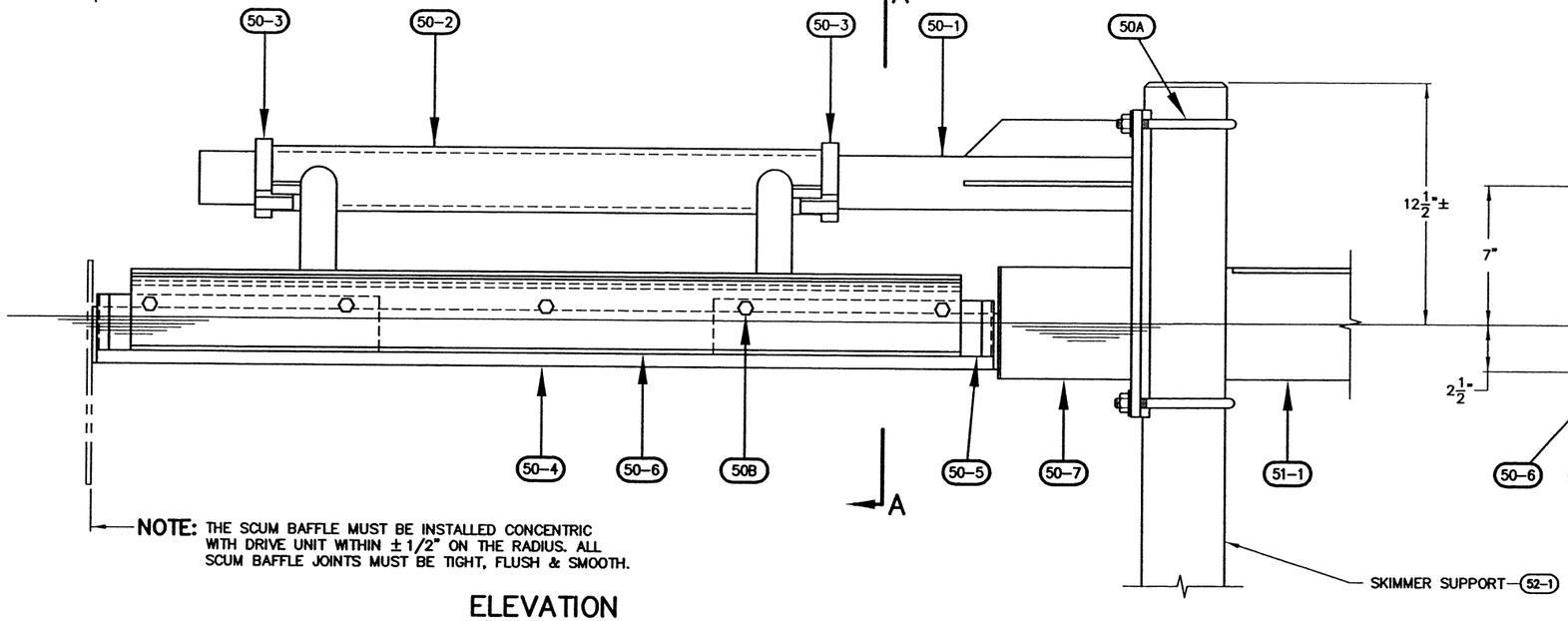
MASTER D-70550

CAD FILE: D705...

REF	DESCRIPTION		QTY
50–1	SKIMMER BOOM		1
50–2	SKIMMER ARM		1
50–3	STOP COLLAR		2
50–4	SQUEEGEE		1
50–5	SPRING BLADE		1RH&1LH
50–6	CLAMP CHANNEL		1
50–7	DEFLECTOR		1
51–1	SCUM DEFLECTOR		1
50A	U–BOLT		2
	HEX NUT 1/2"–13NC		4
	WASHER 1/2" STD		4
50B	CAPSCREW 3/8"–16NC X 1 1/4" LG		5
	HEX NUT 3/8"–16NC		5
51A	CAPSCREW 1/2"–13NC X 1 1/2" LG		2
	HEX NUT 1/2"–13NC		2
	WASHER 1/2" STD		2

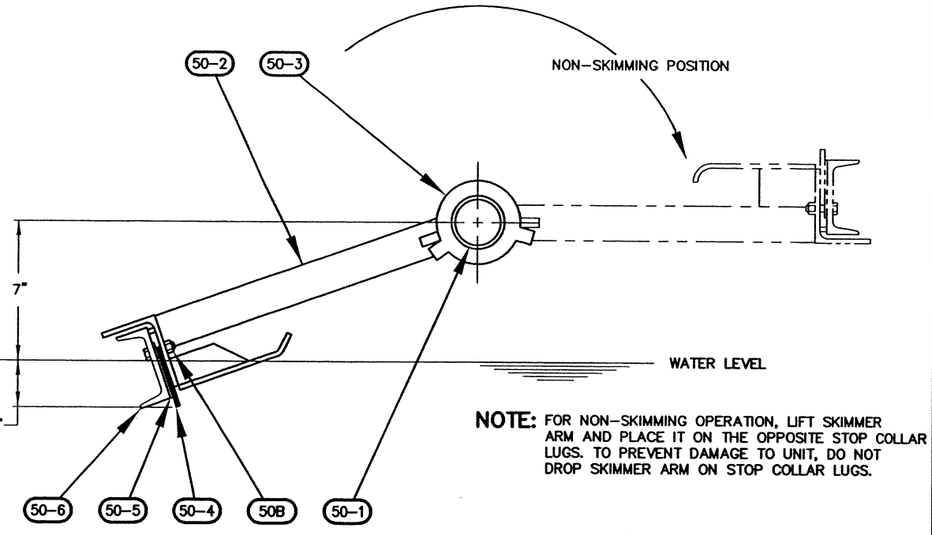


PLAN



NOTE: THE SCUM BAFFLE MUST BE INSTALLED CONCENTRIC WITH DRIVE UNIT WITHIN ±1/2" ON THE RADIUS. ALL SCUM BAFFLE JOINTS MUST BE TIGHT, FLUSH & SMOOTH.

ELEVATION



NOTE: FOR NON–SKIMMING OPERATION, LIFT SKIMMER ARM AND PLACE IT ON THE OPPOSITE STOP COLLAR LUGS. TO PREVENT DAMAGE TO UNIT, DO NOT DROP SKIMMER ARM ON STOP COLLAR LUGS.

SECTION A–A

SYM	REVISION	BY	DATE	CHKD
B				
A				

	DATE	BY
DRAWN	6–21–06	RES
CHECKED		
APPR.		
SCALE	NONE	
FILE REFERENCE		

WALKER PROCESS EQUIPMENT

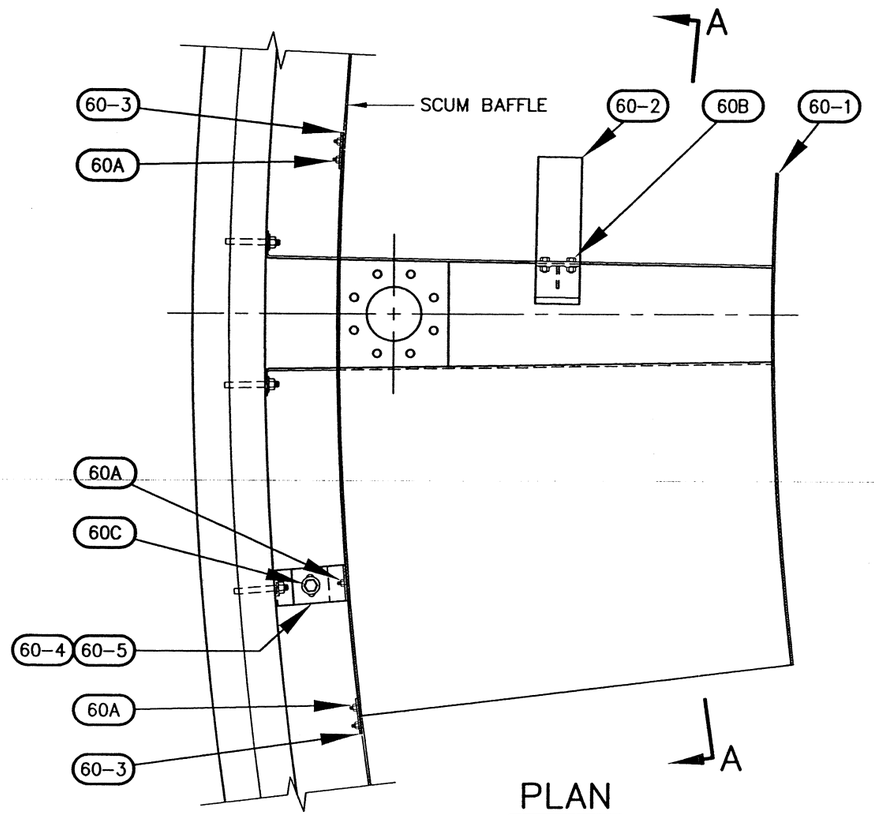
Walker Process Equipment
Division of McNish Corporation
AURORA, ILLINOIS U.S.A.

ERECTION DIAGRAM
HALF BRIDGE SKIMMER – 4'–0"

CONTRACT: STD
DRAWING NO.: D,2,0,5,6,2,1,7,1,2,0,1
REV.

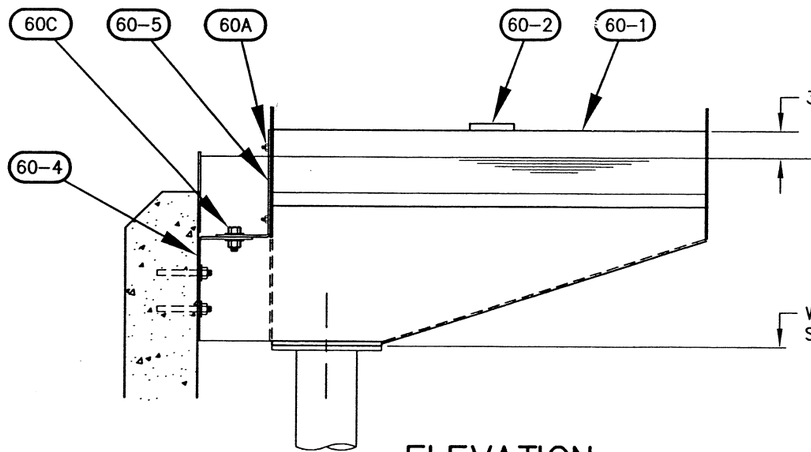
MASTER D-31914

CAD FILE: D6217)

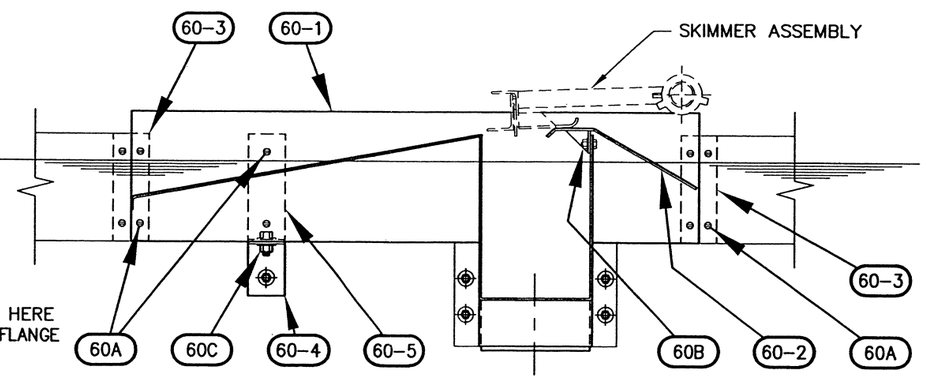


REF	DESCRIPTION		QTY
60-1	SCUM TROUGH		1
60-2	BACK STRAP		1
60-3	CONNECTION PLATE		2
60-4	BRACKET – LOWER		1
60-5	BRACKET – UPPER		1
60A	FLAT HD SCREW 3/8"–16NC X 1 1/4" LG		10
	HEX NUT 3/8"–16NC		10
60B	HEX NUT 1/2"–13NC		2
	WASHER 1/2" STD		2
60C	CAPSCREW 3/4"–10NC X 2" LG		1
	HEX NUT 3/4"–10NC		1
	WASHER 3/4" STD		2

NOTE: ADJUST BACK STRAP ELEVATION SO THAT THE SKIMMER ARM MOVES SMOOTHLY ACROSS THE SCUM TROUGH OPENING.



ELEVATION



SECTION A–A

CAD FILE: C71001

MASTER C-39742

SYM	REVISION	BY	DATE	CHKD
E				
D				
C				
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.

This is the property of the Walker Process Equipment and is to be used only in connection with the performance of work by Walker Process. Reproduction in whole or part for any other purpose is expressly forbidden.

	DATE	BY
DRAWN	7-27-11	RES
CHECKED		
APPR.		
SCALE	NONE	
FILE REFERENCE		

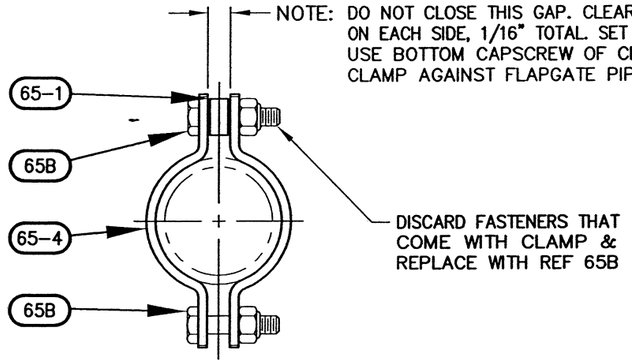
Walker Process Equipment
Division of McNish Corporation
AURORA, ILLINOIS U.S.A.

ERECTION DIAGRAM
SCUM TROUGH
2'–0", 3'–0" & 4'–0"

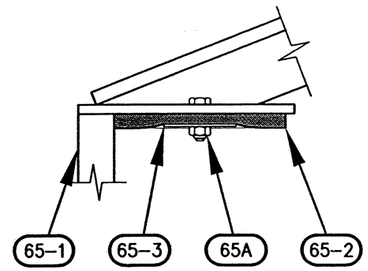
CONTRACT: STD

DRAWING NO.: C,6,0,5|7,1,0,0,1|2,0,0

REV.

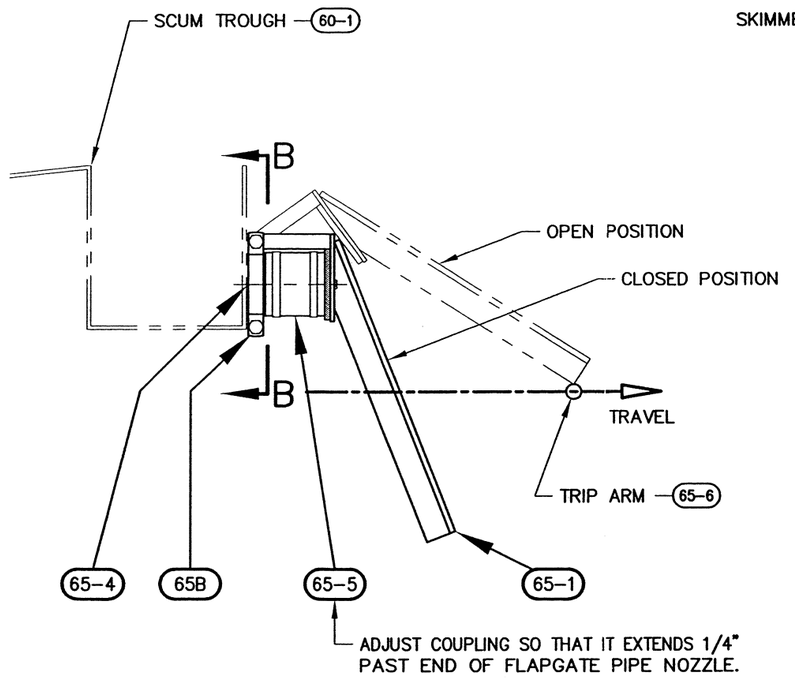


SECTION B–B

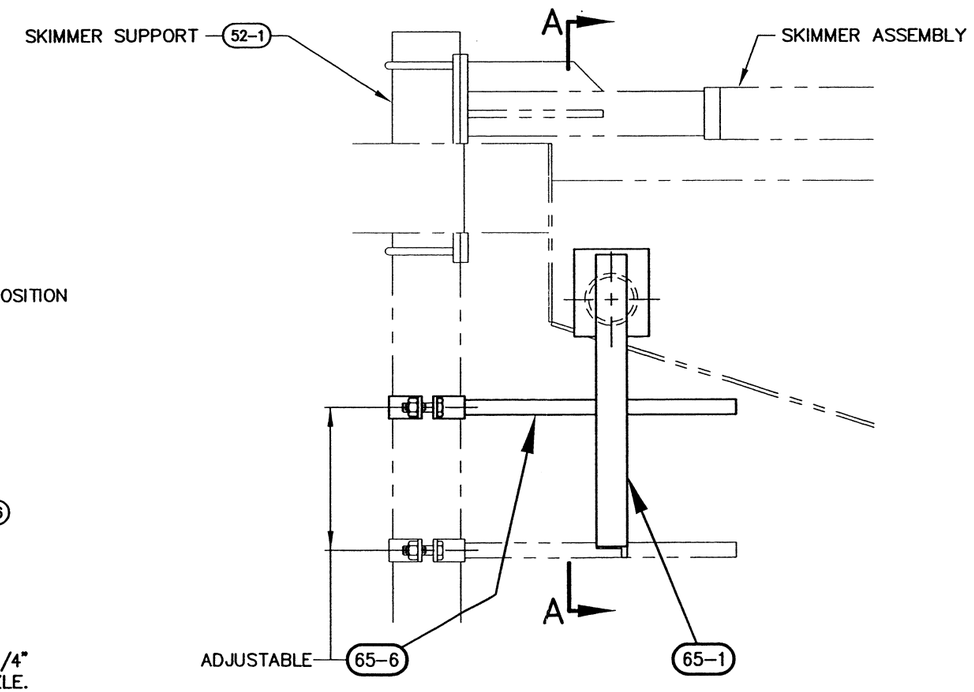


FLAP GATE ASSEMBLY

REF	DESCRIPTION		QTY
65–1	FLAP GATE		1
65–2	NEOPRENE SEAL		1
65–3	2" DIA WASHER		1
65–4	PIPE CLAMP		1
65–5	FLEXIBLE COUPLING		1
65–6	TRIP ARM		1
65A	HEX LOCK NUT 1/4"–20NC		1
65B	CAPSCREW 1/2"–13NC X 2 1/4" LG		2
	HEX LOCK NUT 1/2"–13NC		2



VIEW A–A



CAD FILE: C70108

SYM	REVISION	BY	DATE	CHKD
E				
D				
C				
B				
A				

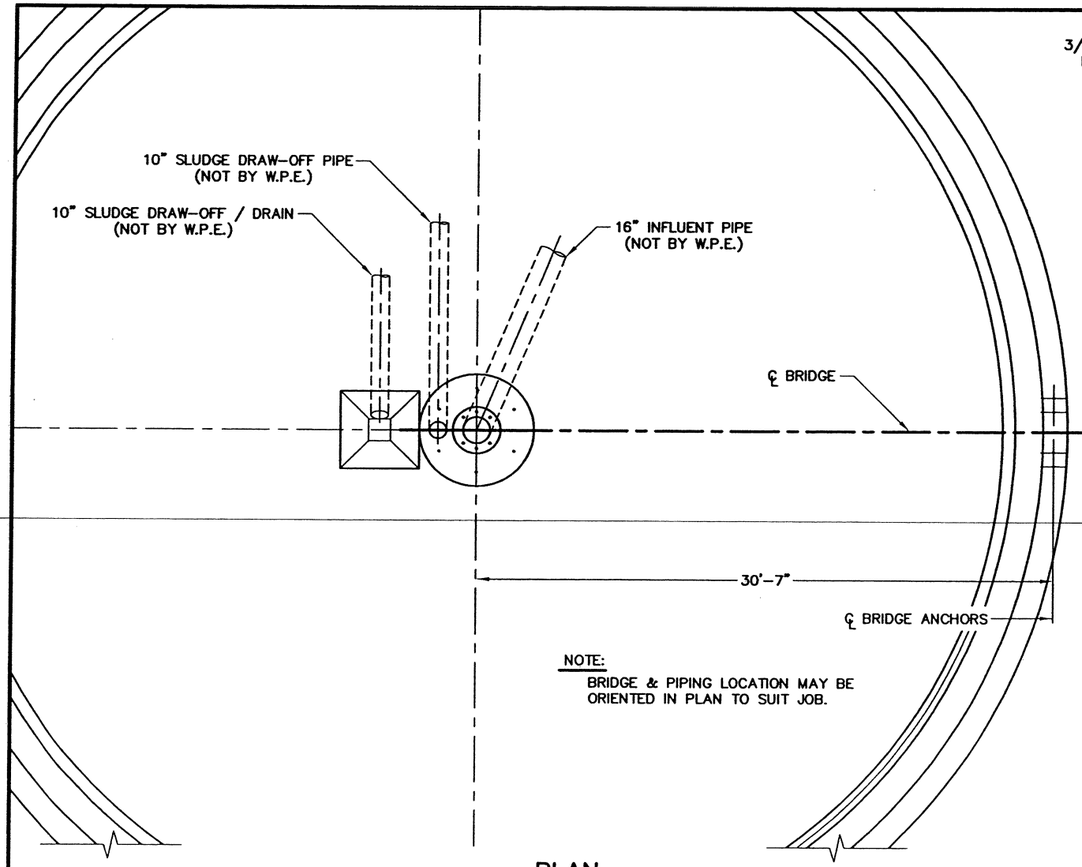
MASTER C-70108

	DATE	BY
DRAWN	1–11–11	RES
CHECKED		
APPR.		
SCALE	NONE	
FILE REFERENCE		

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

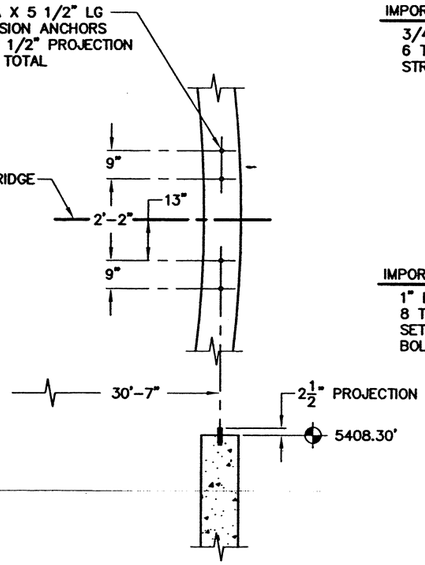
ERECTION DIAGRAM
SCUM TROUGH FLUSHING GATE

CONTRACT	DRAWING NO.	REV.
STD	C,6,0,5|7,0,1,0,8|2,9,2	

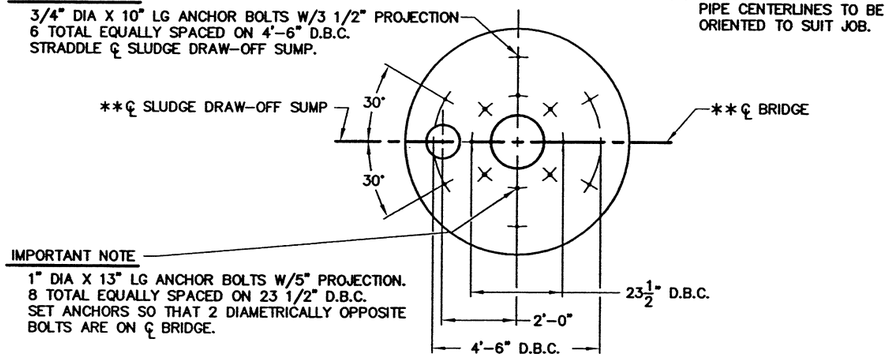


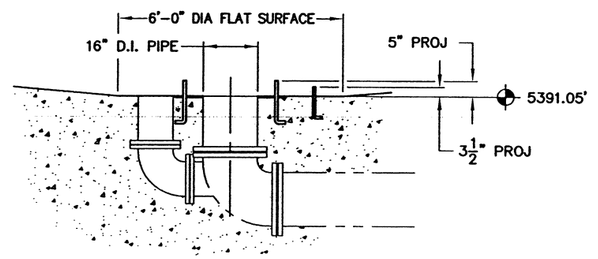
NOTE:
BRIDGE & PIPING LOCATION MAY BE ORIENTED IN PLAN TO SUIT JOB.

PLAN

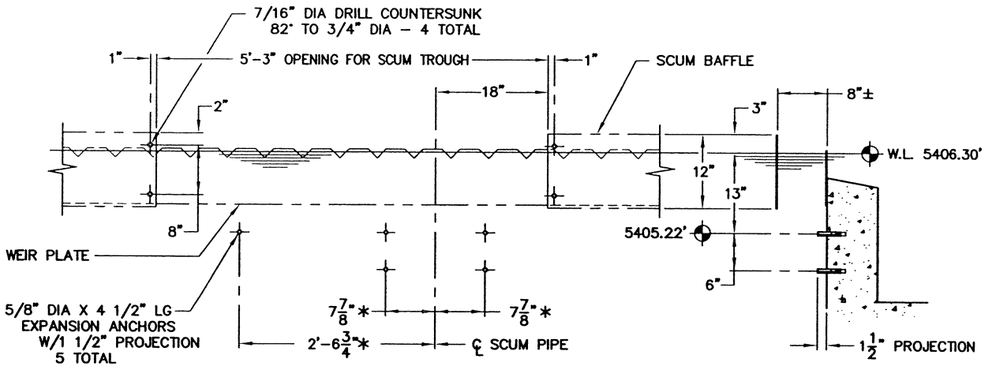


BRIDGE ANCHOR DETAIL



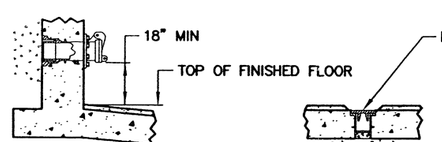


CENTER COLUMN & SEAL PLATE ANCHOR DETAIL

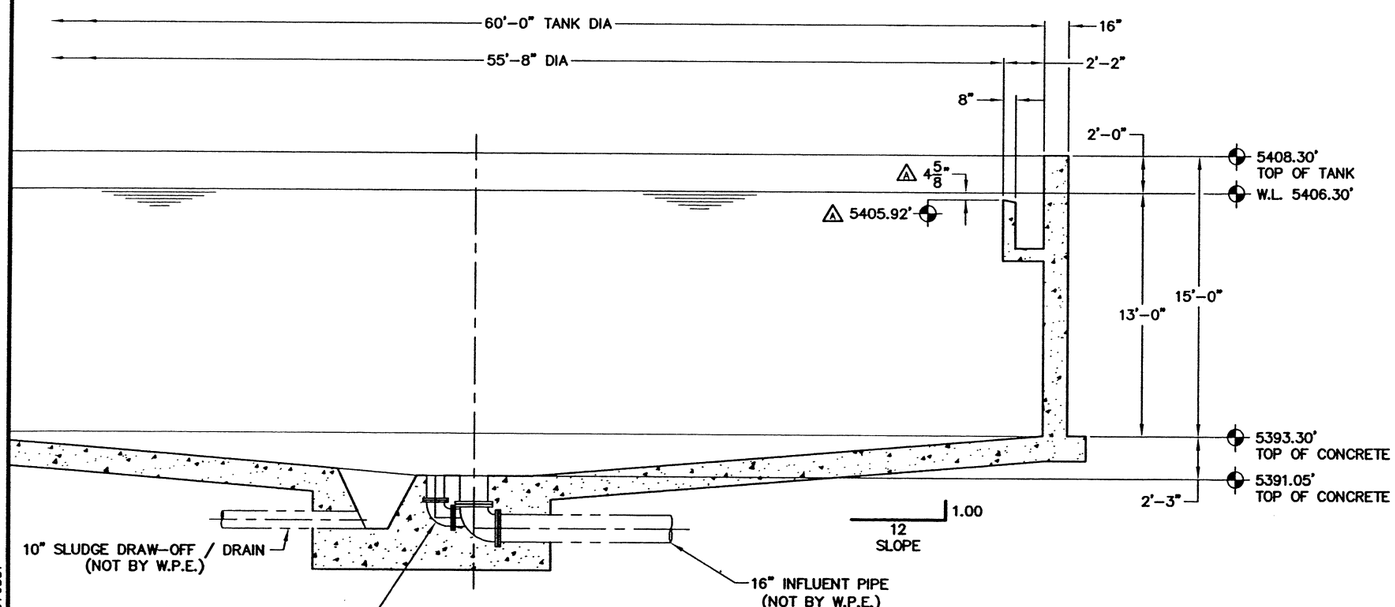


* MEASURED ON INSIDE CIRCUMFERENCE OF EFFLUENT TROUGH.

SCUM TROUGH ANCHOR DETAIL



INSTALLATION OF PRESSURE RELIEF VALVES - IF REQ'D
(NOT BY W.P.E.)



SECTIONAL ELEVATION ⚠

SYM	REVISION	BY	DATE	CHKD
⚠	EL 5405.92' WAS 5405.80' & 4 5/8" WAS 6".	RES	7-26-11	

	DATE	BY
DRAWN	4-1-11	RES
CHECKED		
APPR.		

SCALE NONE
FILE REFERENCE

SECONDARY CLARIFIERS
No. 1 & No. 2

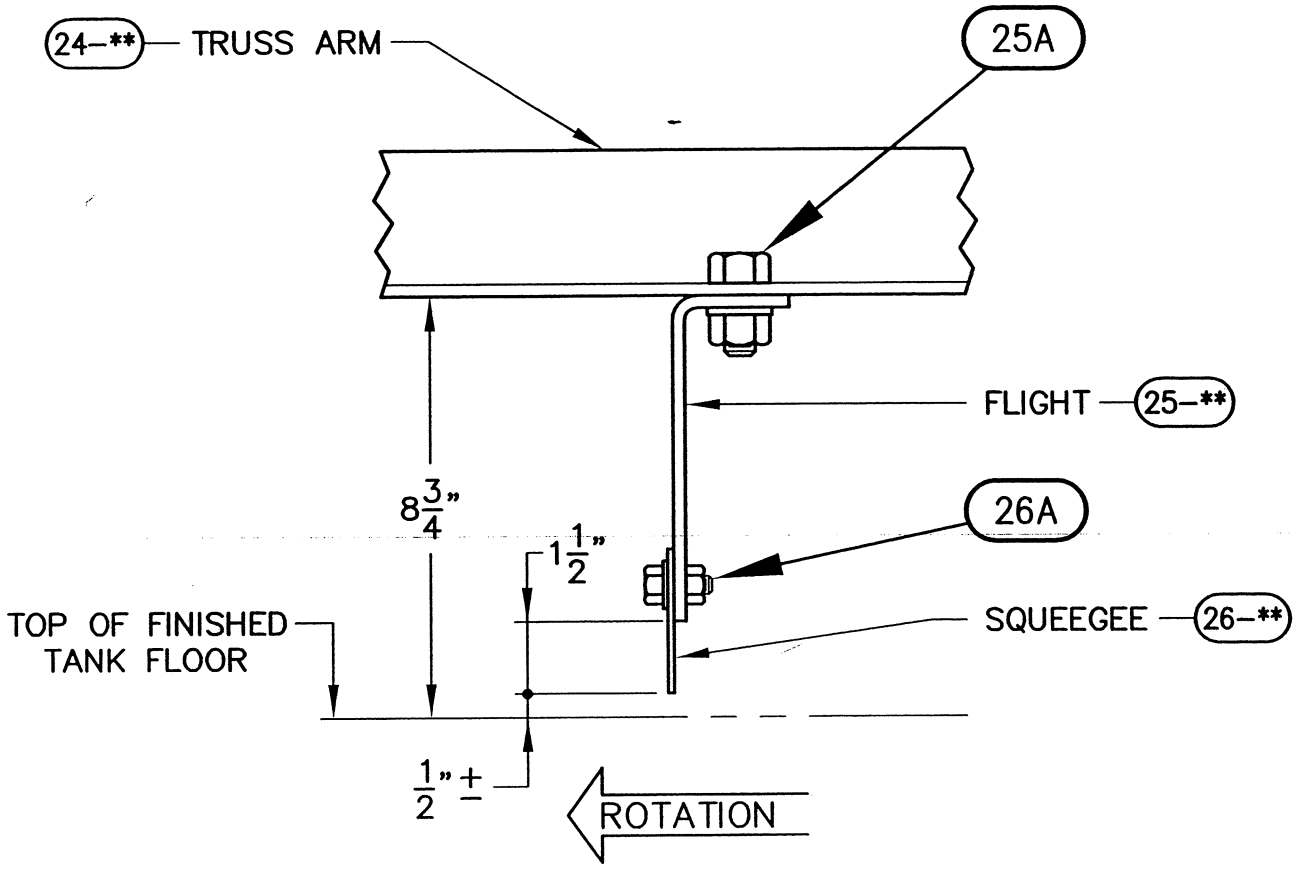
Walker Process Equipment
Division of McNish Corporation
AURORA, ILLINOIS U.S.A.

ANCHOR LOCATION
60'-0" DIA CLARIFIER - TYPE 'RSMTP'
FOUNTAIN, COLORADO

CONTRACT Q10600A
DRAWING NO. D.1.0.5.7.0.5.5.1.1.6.6 REV. A

MASTER D-0782
CAD FILE: D7055I

SYM	REVISION	BY	DATE	CHKD
A				



* QUANTITY PER FLIGHT

REF	DESCRIPTION		* QTY
26A	WASHER 3/8" STD		AS REQD
	HEX NUT 3/8"-16NC		AS REQD
	CAPSCREW 3/8"-16NC X 1" LG		AS REQD
25A	WASHER 5/8" (S.A.E.)		2
	HEX NUT 5/8"-11NC		2
	CAPSCREW 5/8"-11NC X 1 1/2" LG		2

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

MASTER
A-35022

WALKER PROCESS EQUIPMENT

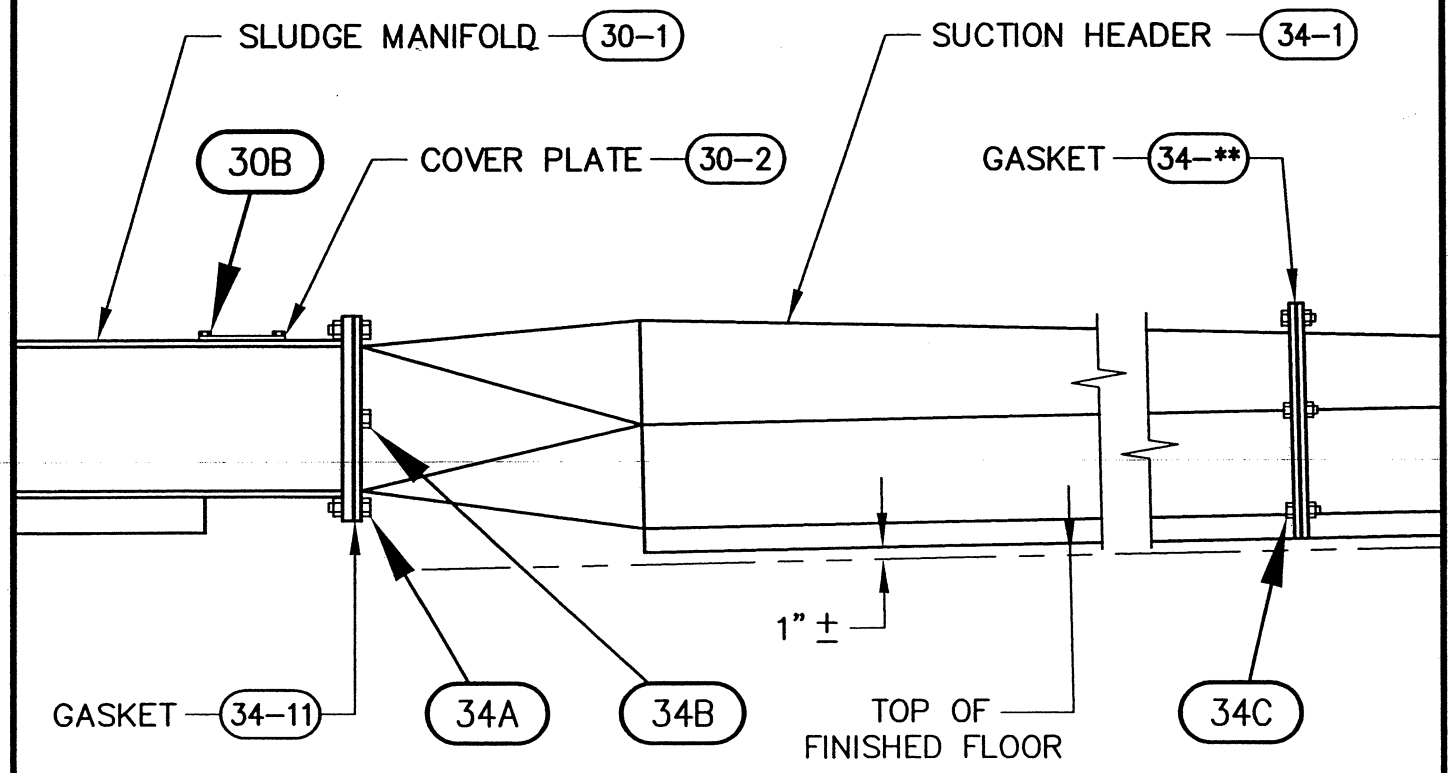
DRAWN	RES
CHECKED	
APP'D.	
DATE	12-5-91
S.O.	STD
SCALE	NONE

DESCRIPTION
ERECTION DIAGRAM
FLIGHT & SQUEEGEE

DRAWING NO. A,6,0,5|3,5,0,2,2|2,9,2
REV.

CAD FILE: A35022

SYM	REVISION	BY	DATE	CHKD
A				



REF	DESCRIPTION		QTY
34C	HEX NUT 5/8"-11NC		AS REQD
	CAPSCREW 5/8"-11NC X 2" LG		AS REQD
34B	CAPSCREW 3/4"-10NC X 1 1/2" LG		2
34A	HEX NUT 3/4"-10NC		6
	CAPSCREW 3/4"-10NC X 2 1/2" LG		6
30B	CAPSCREW 3/8"-16NC X 1" LG		6

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

MASTER
A-40165

DRAWN	RES
CHECKED	
APP'D.	
DATE	2-9-84
S.O.	STD
SCALE	NONE

DESCRIPTION

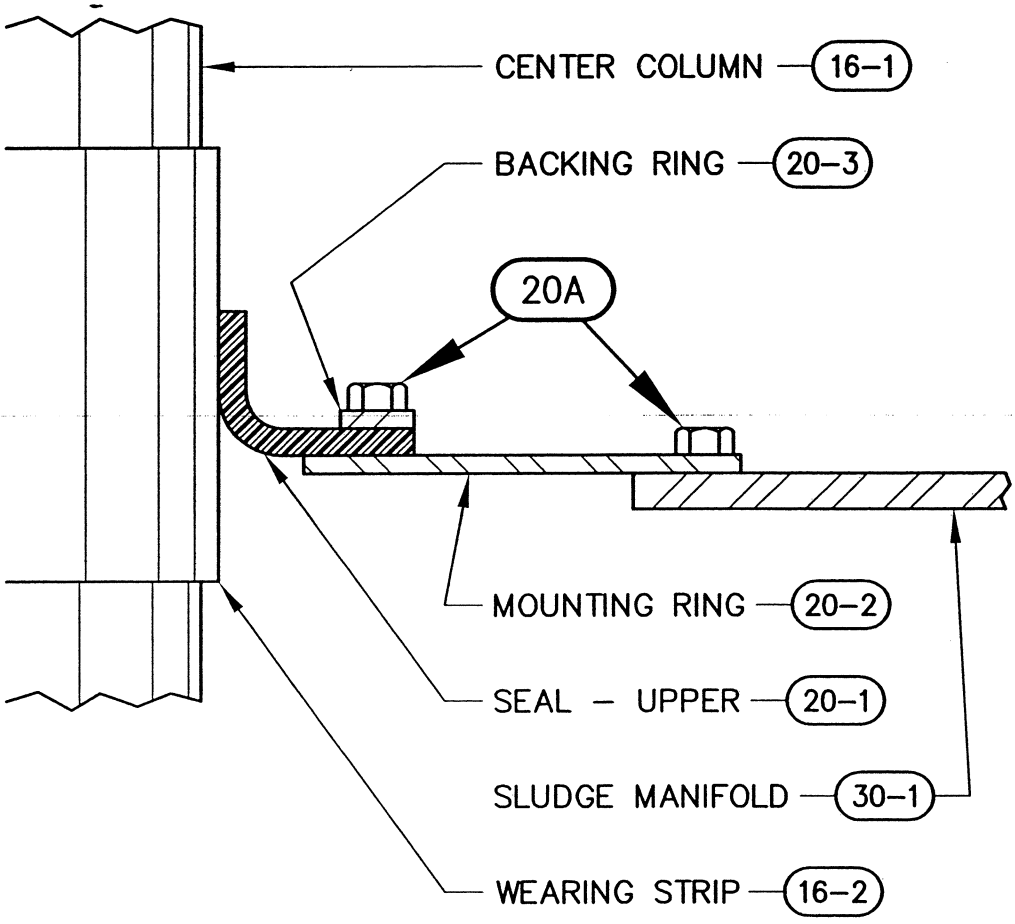
ERECTION DIAGRAM
SUCTION HEADER

DRAWING NO. A,6,0,5 | 4,0,1,6,5 | 2,9,2

REV.

CAD FILE: A40165

SYM	REVISION	BY	DATE	CHKD
A				



REF	DESCRIPTION		QTY
20A	CAPSCREW 3/8"–16NC X 1" LG		16

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

MASTER
A-38955

CAD FILE: A38955

DRAWN	RES
CHECKED	
APP'D.	
DATE	4–27–92
S.O.	STD
SCALE	NONE

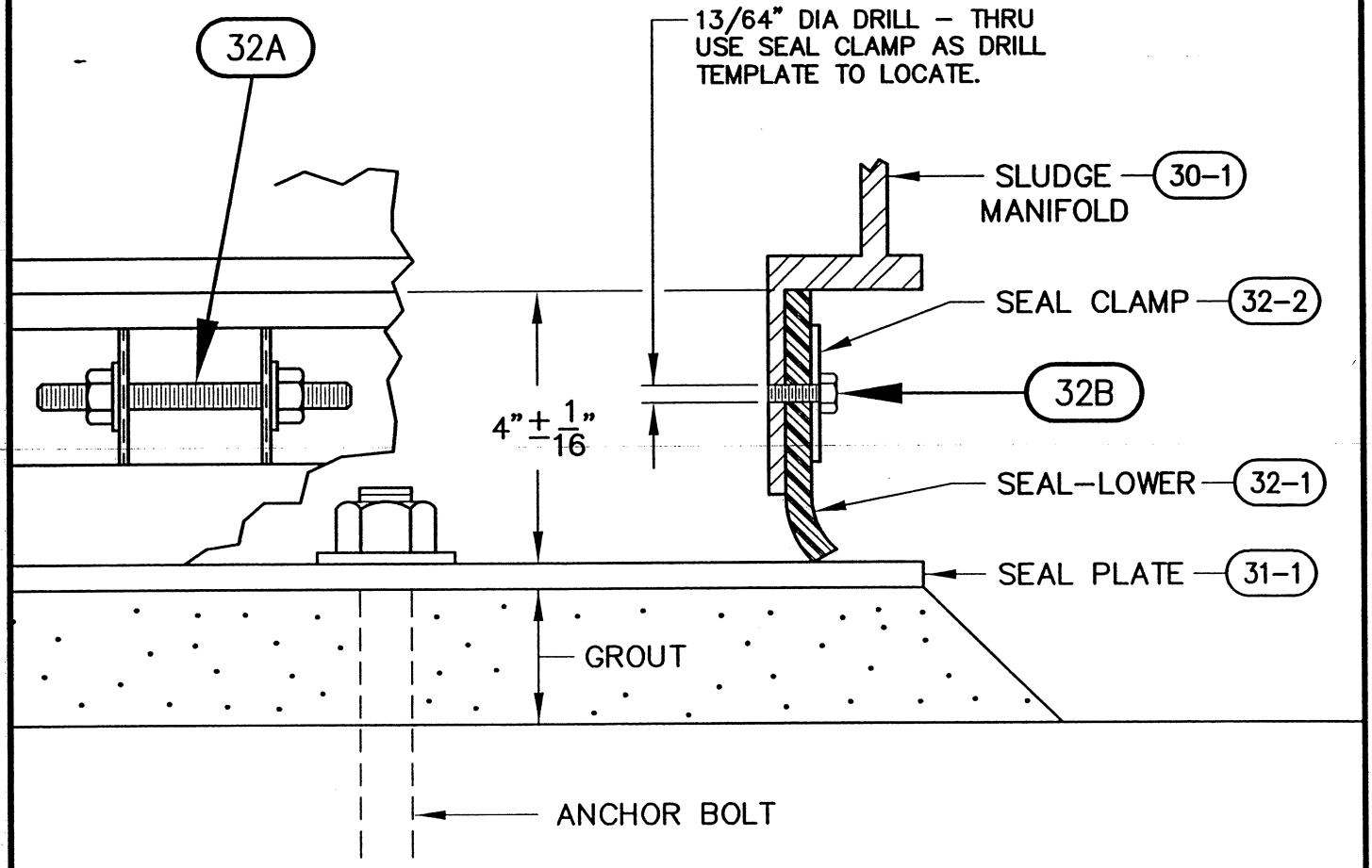
DESCRIPTION

ERECTION DIAGRAM
SLUDGE MANIFOLD SEAL – UPPER

DRAWING NO. A,6,0,5|3,8,9,5,5|2,9,2

REV.

SYM	REVISION	BY	DATE	CHKD
A				



REF	DESCRIPTION		QTY
32B	SELF TAPPING CAPSCREW 1/4" X 1 1/4" LG		34
32A	WASHER 3/8" STD		4
	HEX NUT 3/8"–16NC		4
	THREADED ROD 3/8"–16NC X 4 1/2" LG		2

MANIFOLD: 6'–0"

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

MASTER
A-38956

WALKER PROCESS EQUIPMENT

DRAWN	RES
CHECKED	
APP'D.	
DATE	4–28–92
S.O.	STD
SCALE	NONE

DESCRIPTION

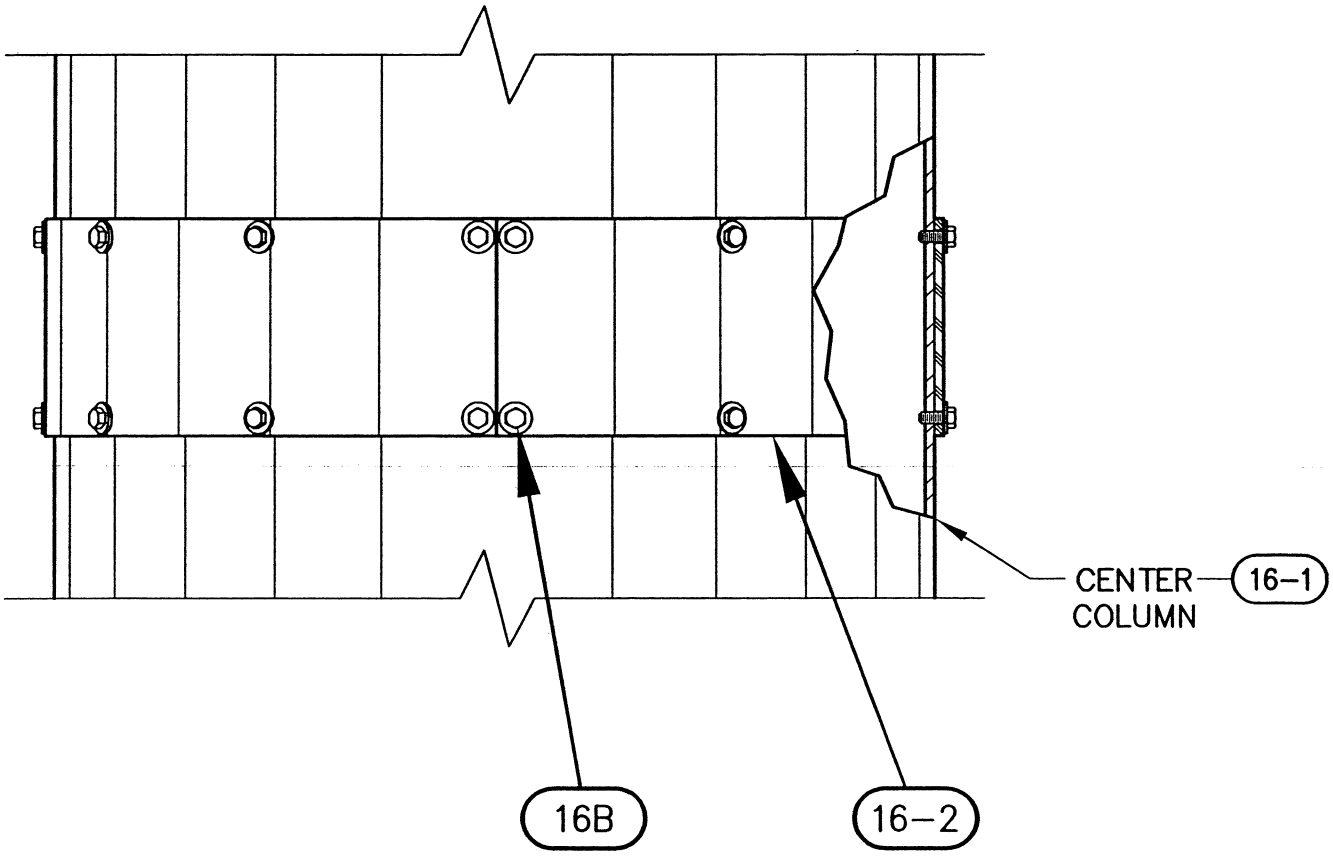
ERECTION DIAGRAM
SLUDGE MANIFOLD SEAL – LOWER

DRAWING NO. A,6,0,5|3,8,9,5,6|2,9,2

REV.

CAD FILE: A38956

SYM	REVISION	BY	DATE	CHKD
A				



16B	WASHER 5/16" STD		AS REQD
	CAPSCREW 5/16"-18NC X 5/8" LG		AS REQD
16-2	WEARING STRIP		1
REF	DESCRIPTION		QTY

CENTER COLUMN DIA:
UP TO 3'-0"

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

MASTER
A-40168

DRAWN	RES
CHECKED	
APP'D.	
DATE	9-3-92
S.O.	STD
SCALE	NONE

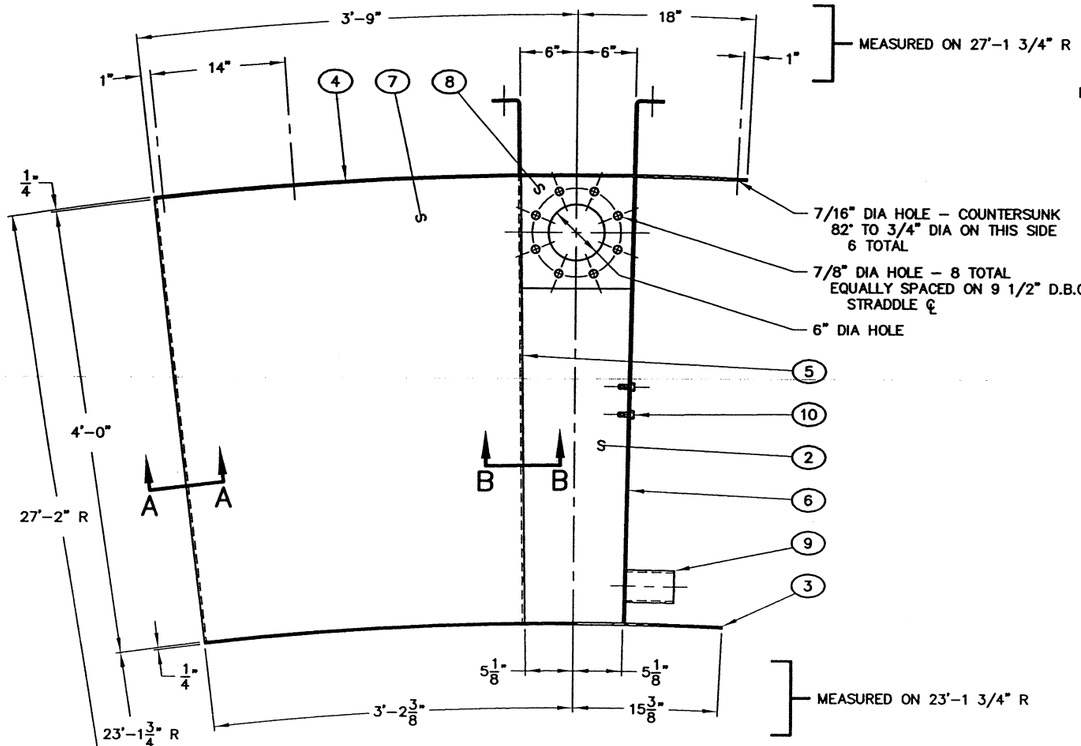
DESCRIPTION

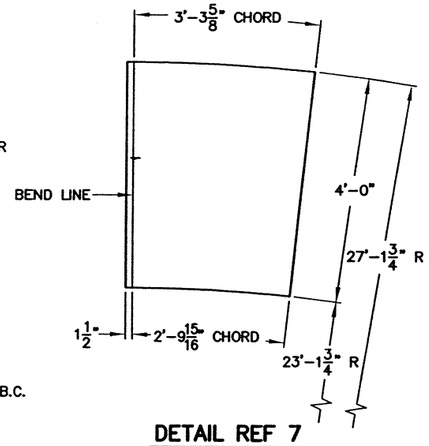
ERECTION DIAGRAM
WEARING STRIP - CENTER COLUMN

DRAWING NO. A,5,0,5|4,0,1,6,8|2,9,2

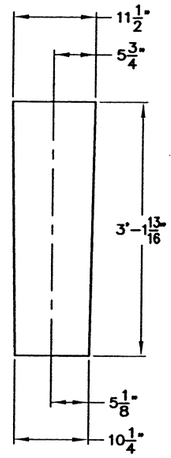
REV.

CAD FILE: A40168



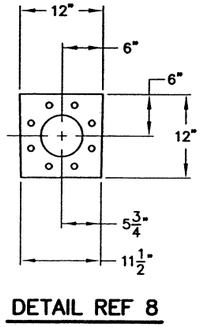


DETAIL REF 7

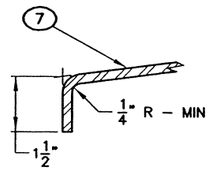


DETAIL REF 2

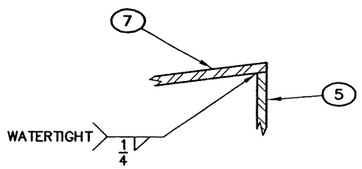
REF	DESCRIPTION	MATERIAL	QTY	WGT
1	PL 1/4" X 11 1/2" X 12" LG	STL	1	10
2	PL 1/4" X 11 1/2" X 3'-1 13/16" LG	STL	1	29
3	PL 1/4" X 14" X 4'-5 3/4" LG	STL	1	53
4	PL 1/4" X 14" X 5'-3" LG	STL	1	62
5	PL 1/4" X 23 1/4" X 4'-10 7/8" LG	STL	1	71
6	PL 1/4" X 23 1/2" X 4'-10 7/8" LG	STL	1	72
7	PL 1/4" (SEE DETAIL)	STL	1	130
8	PL 1/2" X 12" X 12" LG	STL	1	16
9	PIPE 3" SCH 40 X 5" LG	STL	1	3
10	CAPSCREW 1/2"–13NC X 1 1/4" LG	304 ST STL	2	–



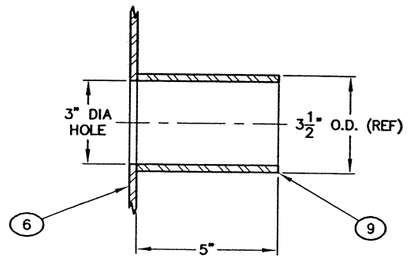
DETAIL REF 8



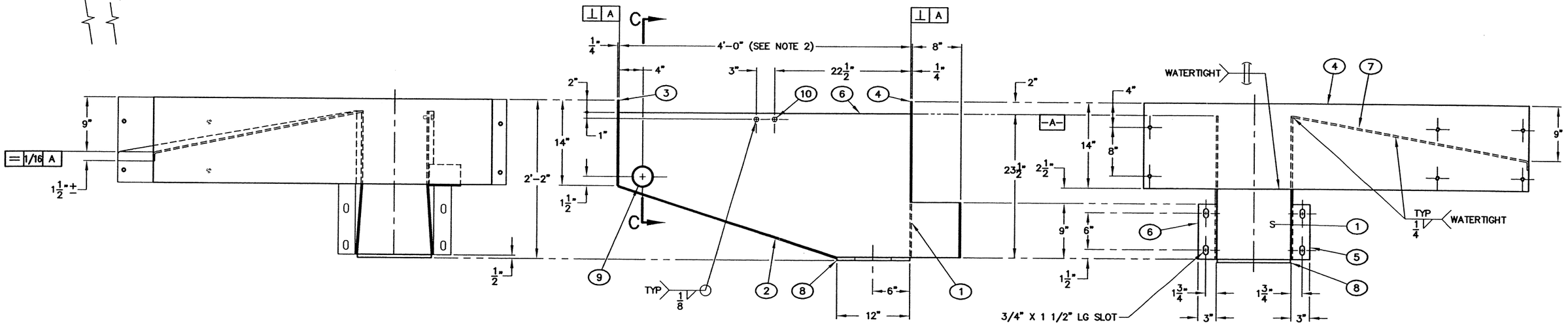
SECTION A–A



SECTION B–B



SECTION C–C



NOTES:

1. ALL WELDS TO BE 1/4" FILLET TYPE – CONTINUOUS & WATERTIGHT EXCEPT AS NOTED.
2. WIDTH OF SCUM BOX MUST BE HELD TO 4'-0" ±1/16" THROUGHOUT LENGTH.

SYM	REVISION	BY	DATE	CHKD
2				
1				

	DATE	BY
DRAWN	8–5–11	RES
CHECKED		
APPR.		
SCALE	NONE	
FILE REFERENCE		

WALKER PROCESS EQUIPMENT

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

SCUM TROUGH – 4'-0"

CONTRACT Q10600A

DRAWING NO. D.4.0.5|7.0.5.9.0|8.5.4 REV.

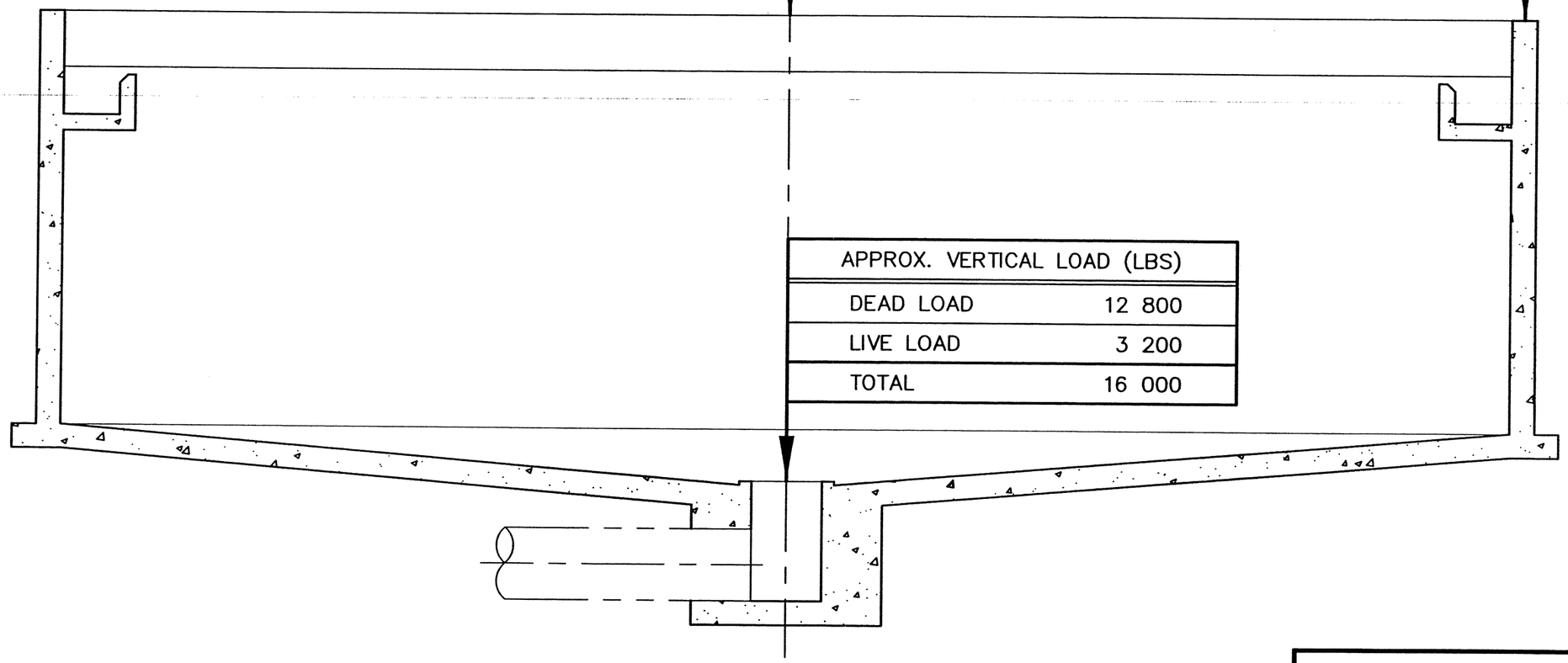
MASTER D-1074

CAD FILE: D7059

MAXIMUM ALLOWABLE OVER TURNING MOMENT
38 100 LB–FT

APPROX. VERTICAL LOAD (LBS)	
DEAD LOAD	1 100
LIVE LOAD	2 350
TOTAL	3 450

APPROX. VERTICAL LOAD (LBS)	
DEAD LOAD	12 800
LIVE LOAD	3 200
TOTAL	16 000



SECONDARY CLARIFIERS No. 1 & No. 2

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

TANK LOADS
60'–0" DIA CLARIFIER – TYPE 'RSMTP'
FOUNTAIN, COLORADO

CONTRACT	DRAWING NO.	REV.
Q10600A	B,2,0,5,7,1,0,0,0,1,6,7	

SYM	REVISION	BY	DATE	CHKD
E				
D				
C				
B				
A				

	DATE	BY
DRAWN	7–27–11	RES
CHECKED		
APPR.		
SCALE	NONE	

MASTER B-0615

CAD FILE: ⊎71000