Hart Engineering Corporation

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PROJECT: 9900. - Veolia/Taunton WWTF Phase 1 Improvements **DATE: 07/29/2022**

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Item	Revision	Description	Status	Date Sent	Date Returned
11317-03	1	Scum Concentrator O&M Manual	Eng	07/29/2022	
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Additional Notes:

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

Sincerely,
Hart Engineering Corporation

_____ DATE: 07/29/2022

D O C U M E N T T R A N S M I T T A L

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Date: July 28, 2022 **ECI Job No.:** 1194

Company: Hart Companies / Total Mechanical Services Corp.

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Project: City of Taunton, MA Wastewater Treatment Facility Phase 1 Improvements

Total Mechanical Services Corporation Project No.: 2021-26

	Document Name	Doc. No.	Sheet	Date	Rev	Code
1	Operation and Maintenance Manual for the 60-500 Saracco Scum Concentrator at City of Taunton MA, Wastewater Treatment Facility		596 pages	7.28.2022	1	FA
2	60-500 Saracco Scum Concentrator Startup Checklist		2 pages	7.28.2022	1	FA

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Comments: Two (2) electronic copies in .pdf submitted For Approval via email. Includes one (1) O&M Manual and one (1) Startup Checklist

Submitted by:

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Legend:

FYI For Your Information
FA For Customer Approval
FC Certified for Construction
AB As Built

EnviroCare International, Inc.

TAUNTON WASTEWATER TREATMENT PLANT
TAUNTON, MASSACHUSETTS

OPERATION AND MAINTENANCE MANUAL
FOR THE MODEL 60 – 500
SARACCO SCUM CONCENTRATOR

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Purchase Order No: 2021-26
Specification No: 11317

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EnviroCare International Job No.: 1194

Revision 0 – March, 2022
Revision 1 – July, 2022

Table of Contents

1.0 Introduction

EnviroCare International, Inc. located in American Canyon, California, manufactures the Saracco Scum Concentrator described within this Operation & Maintenance manual. It has been designed to meet the requirements detailed in specification section 11317. Detailed design information can be found on EnviroCare International customer drawings C100-1194 and C300-1194 found in Section 9 of this manual.

EnviroCare International (ECI) strives to provide a product of superior quality and workmanship. Saracco scum concentrators are completely shop assembled and operated prior to shipment. One (1) Model 60-500 Scum Concentrator system has been supplied to be installed at the Wastewater Treatment Plant Taunton, MA. To ensure continual product excellence, the equipment must be installed, operated and maintained properly. The contract may include some equipment items that are not an integral part of the scum concentrator and which may be shipped separately. These items, like all components of the scum concentrator, must be stored, installed, operated and maintained as specified by the manufacturer to qualify for full warranty coverage.

1.1 Limited Warranty and Claims Policy

Saracco Scum Concentrator Manufacturer's Warranty

EnviroCare International, Inc. (ECI) obligation with respect to any defect in accepted goods shall be limited to replacement of defective parts or to replacement of parts or of the entire product as herein provided and shall, in no event, exceed their purchase price. ECI shall bear no labor or installation expense arising out of such replacement of parts or of the entire product or any attempt to repair such parts or entire product. Any part or equipment supplied by EnviroCare International, Inc. which upon inspection by an ECI employee is proved defective in workmanship or material, will be replaced free of charge, F.O.B. point of manufacture. The defective part or equipment must be owned by the original purchaser and have been used in the ECI recommended service only. This warranty shall remain valid for a period of eighteen (18) months from shipment or twelve (12) months from initial operation, whichever occurs first. Applicable dates for the aforementioned events are recorded in the table below.

Date of Shipment	TBD, 2022
Date of Initial Operation	TBD, 2022

ECI retains no liability for commercial damage arising as a consequence of any defect in accepted equipment. Material cannot be returned without EnviroCare's prior authorization. The purchaser shall return such material, freight prepaid, to EnviroCare's fabrication facility.

All warranties and guarantees set forth are based upon the following conditions:

- The purchaser maintains the normal operating conditions as stated herein.
- The purchaser follows the O&M instructions as supplied by ECI.
- The obligations of this agreement have been fulfilled.

When contacting EnviroCare, customers should have the following information:

1. Customer name, location, purchase order number and date of purchase.
2. Scum concentrator model number.
3. Component serial number off nameplate. (If available)
4. Component model number off nameplate. (If available)
5. Equipment installation date.
6. Equipment failure date.
7. Details of Claim.

Claims may not be deducted from payments made to EnviroCare unless, EnviroCare has so agreed in writing in advance.

EnviroCare International, Inc.
507 Green Island Road
American Canyon, CA 94503
Telephone: 707.638.6800
Fax: 707.638.6898

1.2 Safety Rules and Practices

Summary: Prevention of accidents depends upon the safety-consciousness of all personnel. Therefore, the safe work rules and practices set forth in this section are intended to inform the operations and maintenance crew of the fundamentals of accident prevention when working with the scum concentration equipment.

It is not possible to cover all safety work rules and practices in this section. Personnel working on the scum concentrators or operating it should be guided by the basic principles specified herein. In case of doubt, ask a supervisor for information or clarification as to the correct procedure.

Safety Requirements

- Safety Hats: EnviroCare recommends that safety hats be worn when working on the equipment. A safety hat protects the head from falling objects and from "bumping" the head into low mounted equipment, piping, framework or other items.
- Safety Glasses: Safety glasses should be worn whenever work is done on the scum concentrators to protect the eyes from liquid splashes.
- Safety Devices: Permission of the area supervisor must be obtained before any action is taken that would render equipment inoperative. This includes removal and/or alteration of any control settings or any safety devices such as pump interlocks, overload relays, set points, etc.

- Housekeeping: Orderly arrangement of material and equipment are essential for safety. Each employee should strive to maintain a tidy work area.
- Clothing: It is imperative that personnel wear protective clothing when working around mechanical equipment. Tight clothing should be worn; neckties, rings, etc. should be removed.

Plant Safety

- Electrical: Only maintenance personnel assigned, or those authorized by the superintendent, are allowed to handle electrical equipment of any kind for the purpose of repairs or internal adjustment. It is recommended that all electric wires be treated as "hot". Personnel working on electrical equipment should wear safety hats made of non-conducting materials rather than metal hats. It is also recommended that wooden ladders be used for working on electrical equipment. Switches, relays or breakers should be locked or sealed in the 'OFF' position when electrical work involving shutdown is being performed. Such components should be red-tagged after they are locked and sealed. Main electrical drive switches shall be tagged and locked out when unintentional starting would create a hazard.
- Domestic Water: Connections to the domestic water system should be made only for drinking, utensil washing, shower facilities, etc. When domestic water is used for other purposes, it must be withdrawn from the system and transferred by means of open-ended hose or pipe. Solid connections should not be permitted.
- Compressed Air: Permanent connections from the compressed air system to pressurized equipment, which is operating, other than to control operators, should not be made. If temporary connections are made a check and block valve should be installed in the connecting line to prevent contamination of the air system.
- Detached Work Assignments: Employees from other departments, entering the scum concentrator area to obtain samples or perform other work, should contact and advise the shift operator of the duty to be performed. It is also mandatory that no valves or other equipment be manipulated or changed by unauthorized personnel.

- Equipment and Material for Emergencies: EnviroCare recommends that the following equipment be provided and maintained near the scum concentrator:
    a. (1) dry chemical fire extinguisher
    b. (1) plant approved first aid kit
    c. (1) eye wash station
    d. (1) device for communication with control room

2.0 Equipment Description

The Saracco Scum Concentrator system for this installation is comprised of three (3) major components, a concentrator tank, holding tank and scum pump. EnviroCare has supplied one (1) scum concentrator system to the Wastewater Treatment Plant. The system is installed on an outdoor foundation in place of the existing scum concentrator.

2.1 Concentrator Tank

The concentrator tank is a rectangular tank fabricated from 1/4" 304L-SS plate. It is approximately 4 feet wide and 15 feet long and capable of holding 2000 gallons of water or dilute scum. The main components of the concentrator tank and their function are listed below. In addition, refer to Figure 1 at the end of this section and ECI drawing C300-1194 in Section 9 of this manual.

- Concentrator Tank Inlet– The concentrator tank inlet is a 4" 150# flange on either side of the tank. The inlet flange that is not used will remain sealed with a blind flange. An inlet flow distribution pipe spans the width of the concentrator tank directing all of the influent towards the front beach of the tank.
- Distribution Baffles – Three distribution baffles made of 1/4" 304L-SS plate are strategically placed sequentially along the length of the concentrator tank. The diffuser baffle is the shortest of the three baffles and located towards the front of the tank. Its primary function is to direct the influent being reflected off the front wall in the upward direction (toward the surface). The second baffle is the separation baffle. The separation baffle is taller than the diffuser and positioned to concentrate the scum towards the front half of the tank while allowing the water to flow towards the rear of the tank to the weir. The third baffle is the weir or underflow baffle. This baffle penetrates the operating water surface in the tank isolating the floating scum from the weir compartment and drain.

- Adjustable weir – The adjustable weir is made from a 304L-SS slotted pipe and is capable of draining water from the tank via a 2"x26" opening into a 6" 150# flange on back end of the tank. The position of the opening on the adjustable weir dictates the water level in the tank. Generally, the water level is adjusted so that it is equal with the nose of the beach (ramp that slopes upward at front of tank to the scum chute).
- Collector Chain – The collector chain carries ten (8) flights that span the width of the tank skimming the water surface and conveying the scum up the beach to the scum chute. Four shafts support the collector chain. The shafts are mounted in take-up bearings allowing the chain tension and flight contact surface to be adjusted.
- SEW Drive / Drive Chain – The 1/2 HP SEW drives the head shaft at the front of the tank to operate the collector chain and flight assemblies. The SEW can manually be mechanically adjusted to operate at different speeds to adjust the wetness of the collected scum being discharged.
- Odor containment lids – The top of the concentrator tank is covered with removable fiber reinforced plastic (FRP) lids. The lids function to reduce the possibility of debris falling into the tank as well as to help contain foul odor. IMPORTANT: Do not walk or stand on the lids, as they are not designed to support personnel.
- Foul Air Connection - The concentrator tank foul air connection is a 6" 150# flange and located on the rear end of the tank near the adjustable weir above the operating water level.

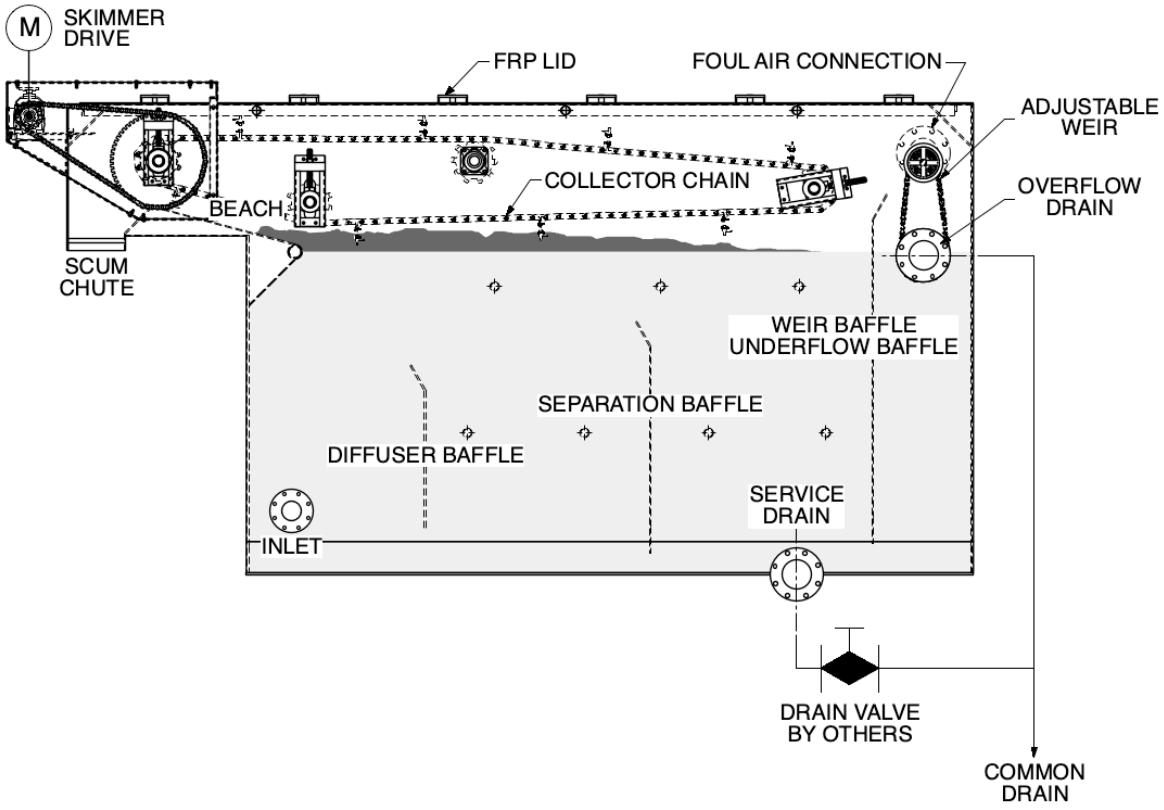


Figure 1 – Concentrator Tank

2.2 Holding Tank

The holding tank is a circular tank fabricated from 1/4" 304L-SS. It is approximately 5 feet in diameter at the top and transitions to a 12" diameter discharge at the bottom. The holding tank is capable of holding over 500 gallons of concentrated scum. The main components that makeup the holding tank and their function are listed below. In addition, refer to Figure 2 on the following page and ECI drawing C300-1194 in section 9 of this manual.

- Holding Tank Inlet – The holding tank inlet is a rectangular opening in the cover of the holding tank. The concentrator tank scum chute is designed to nest inside of the holding tank inlet. The concentrated scum being conveyed up the concentrator tank beach falls via gravity through the scum chute and into the holding tank.

- Heating Assembly – The holding tank conical section is equipped with resistance heaters on the exterior of the shell. The heaters maintain the concentrator scum temperature to improve its pumping ability. The heating elements are all factory wired to a junction box and enclosed in an insulated, protective heat shield. The heat shield is removable in the rare case that the heating elements need replacement or repair.
- Level – Four (4) point level switches are installed on the holding tank, a high high, high, low, and low low. The switches are used for alarm and interlock purposes.
- Mixer– This mixer is mounted vertically through the holding tank cover. It is equipped with an excluder seal where the shaft penetrates the cover and two (2) impellers.
- Knife gate - the 12" knife gate located at the bottom of the conical section allows the progressive cavity pump to be isolated for maintenance purposes.
- Netzsch Progressive Cavity Pump – This scum pump is mounted to the holding tank frame below the knife gate. The pump is equipped with an auger to help move the scum to the discharge end. It connects to the holding tank via a transition piece below the knife gate valve. A seal water assembly is required for this pump.

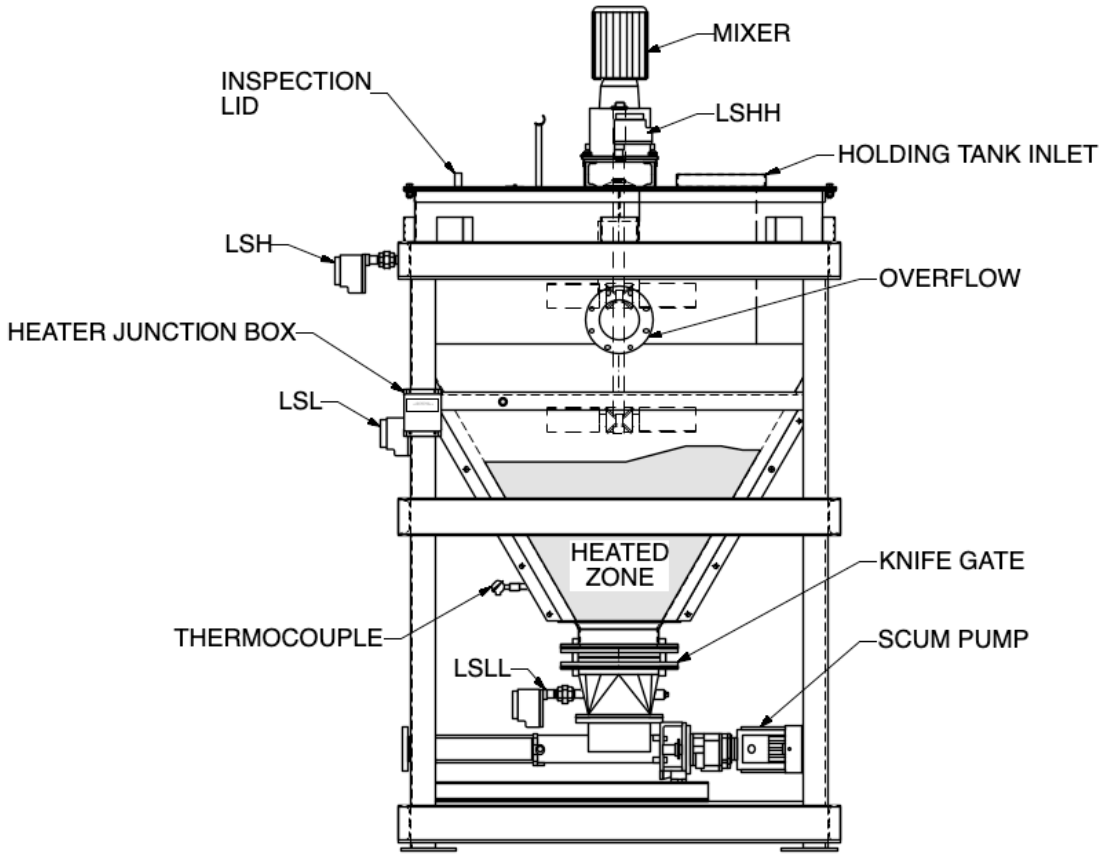


Figure 2 – Holding Tank

2.3 Control Panel

There is one (1) main panel for the control of the scum concentrator system. The Scum Concentrator Local Control Panel (LCP-7401) (ref drawing C700-1194). The LCP-7401 is the main control panel that houses all relays, timers, and main circuit breakers for the scum concentrator system. The concentrator tank and holding tank operate as a system and are controlled locally by the LCP-7401 panel. The control panel is a NEMA 4X stainless steel enclosure.

The LCP-7401 panel doors include all the selector switches, push buttons, indicating pilot lights, and controllers to control the equipment on the scum concentrator system including the mixer, holding tank heaters, skimmer drive, and scum pump. The LCP-7401 control panel is powered with 480VAC, which is converted to 120VAC by an internal transformer. Equipment within the LCP-7401 control panel provides all the control logic and interlocks necessary to properly operate the concentrated scum system per the contract documents. To facilitate control of the scum concentrator system, the motor starters, heater contactors and overloads are installed in the LCP -7401.

3.0 Installation

The Saracco scum concentrator system is shipped as a partially pre-assembled unit. Due to shipping size constraints, the system ships broken down as follows; concentrator tank, concentrator support frame, FRP odor containment lids, scum storage tank with knife gate valve, control panel, scum pump, mixer, level switches, miscellaneous hardware and spare parts. An additional description of the major shipping sub-assemblies can be found on ECI drawing C300-1194. The shipment shall be installed on the second floor of the solids handling building by the designated contractor.

3.1 Mechanical / Electrical Instructions

Final installation of the scum concentrator shall be as illustrated on the EnviroCare customer drawings found in Section 9 of this manual. Individual component manufacturer's operation and maintenance manuals can be found in Section 8 of this manual. Please thoroughly familiarize yourself with all sections of this manual before installation and operation of the scum concentrator. The following list details a suggested, basic sequence for installing the scum concentrator system:

1. Layout and install concentrator tank and holding tank concrete anchor bolts in accordance with ECI drawing C350-1194 prior to moving new equipment into the area. The concrete anchors are supplied by others.

   IMPORTANT: If any of the concrete anchors will be in the way when moving equipment into the building, they may need to be installed after equipment has been moved into the building.
2. Ensure the leveling jamb nuts are installed on the anchors prior to positioning the equipment.
3. Position the concentrator tank frame only (without tank) on its anchors.
4. Position the holding tank and frame assembly on its corresponding four anchors per ECI drawing C350-1194. The transition piece under the knife gate can be removed to help facilitate placement of the holding tank.
5. Position the progressive cavity scum pump on the holding tank frame pump mounting platform.

6. Position the concentrator tank on the frame. When set properly the tank scum chute will nest in the opening of the scum holding tank lid. Fasten concentrator tank on mounting frame using the supplied 1/2" mounting hardware.

7. Level the concentrator tank using the leveling jam nuts.

8. Verify that all field installed and factory installed hardware is tight as some joints may have loosened during shipment.

9. Install and tighten all concrete anchors and grout between baseplate and finished foundation. Refer to drawing C350-1194 / specifications for anchoring / grouting requirements.

10. Level the holding tank prior to setting the concentrator tank using the leveling jam nuts.

11. If not factory mounted, mount knife gate to scum storage tank with supplied 7/8" mounting hardware, (C300-1194). IMPORTANT: There are two different lengths of 7/8" hex bolts to fasten the upstream side of the valve to the holding tank. The (4) short hex bolts are to be used in the knife gate blind holes and the (8) long hex bolts are to be used in the knife gate through holes. Orient the knife gate with the hand-wheel as shown in C300-1194 and flow arrow pointing down. Do not forget to install the knife gate / scum storage tank interface gasket.

12. If not factory mounted, mount knife gate / pump transition piece to discharge of knife gate using supplied 7/8" mounting hardware. There are two different lengths of 7/8" hex bolts to fasten the downstream side of the valve to the transition piece. The (4) short bolts are to be used in the knife gate blind holes and the (8) long bolts are to be used in the knife gate through holes. Do not forget transition piece / knife gate interface gasket.

13. Level the progressive scum pump using the adjustable mounting platform and bring the inlet to meet the transition with the provided neoprene gasket. Bolt the scum pump to the transition using the provided 1/2" hex bolts, washers and nuts.

14. Install Sharpe mixer on the holding tank per the supplied installation manual. The portion of the holding tank lid opposite of the concentrator tank is removable to facilitate the installation of the mixer blades. The mixer mounts to the structure that spans the holding tank cover. The shaft and impellers will

need to be installed from inside the tank with the impellers 20" apart on centerline and the bottom impeller at the bottom of the shaft. Install the shaft excluder seal to cover the area where the shaft penetrates the holding tank cover.

15. Connect concentrator tank piping and associated equipment to the concentrator tank inlet and outlet connections. All piping and associated equipment / hardware by others. Reference ECI drawing C100-1194 and project contract drawings.
16. Connect foul air duct to the holding tank foul air connection.
17. Place the odor containment covers on top of concentrator tank. (C550-1194)
18. Install scum concentrator access platform (if applicable).
19. Wire concentrator tank skimmer drive to the scum concentrator control panel (C703-1194 sheet 1).
20. Wire the concentrator tank temperature transmitter to the scum concentrator control panel LCP-7401. (C703-1194 sheet 4).
21. Wire the mixer motor to the scum concentrator control panel LCP-7401 (C703-1194 sheet 2).
22. Install and wire the concentrated scum pump motor to the scum concentrator control panel LCP-7401 (C703-1194 sheet 3).
23. Install the four (4) level switches; one (1) in holding tank lid, two (2) in the holding tank, and one (1) in the tank to pump transition, (C300-1194). Wire per EnviroCare wiring diagrams, (C704-1194 sheets 1-2).
24. Wire scum holding tank's heating elements from their junction box JB7401 factory mounted on the leg of the holding tank frame to the corresponding terminals in scum concentrator control panel LCP-7401. Reference C710-1194 and C711-1194 for junction box connections.
25. Wire the scum concentrator signals to the control room. Wire per EnviroCare wiring diagrams. (C703-1194-sheets 1-4)
26. Complete all piping connections as required.

Installation questions should be directed to the EnviroCare Engineering Department. Reference EnviroCare project 1194.

4.0 Operation

The primary functions of the system are to concentrate dilute scum influent (floating materials, fats, oils, grease) that is collected in the primary clarifiers and to store the concentrated scum until it is pumped to the digestors.

The concentrator tank utilizes a combination of variables to maximize the machine's efficiency. The variables are retention time, surface area, and scum depth. Typical outlet scum concentration is 30-50% solids.

4.1 Process Flow Description

Refer to Figure 3 on the following page for a Flow Diagram of the system.

Step 1. Dilute scum (influent) enters the concentrator tank through a 4" influent nozzle on the side of the tank. The scum influent is a continuous batch process. More specially, scum is intermittently pumped from the clarifier scum pits to the concentrator tank. After the pump cycle is complete, the dilute scum begins to separate in the tank.

Step 2. The influent then flows toward the rear of the tank allowing the scum to rise to the surface. Any scum which has not reached the skimming surface will be stopped by the underflow baffle and continue to rise to the surface

Step 3. The influent liquid, now separated from the scum, flows under the underflow baffle and rises to the discharge chamber.

Step 4. The liquid in the discharge chamber exits through an adjustable weir. The weir controls the water/scum interface in the concentrator tank, which in turn controls the scum blanket depth.

Step 5. The skimming flights push the scum up the beach until it falls free down the discharge chute. The skimming blades are designed to release any free water as they convey the scum up the beach, thereby achieving additional concentration.

The skimmer drive system includes a high torque overload switch as a safety against collector chain damage due to jamming of flights.

Step 6. Concentrated scum is discharged directly into the scum holding tank.

Step 7. The liquid in the discharge chamber, now scum free, becomes effluent and is discharged via the weir drain into the plant sewer and returned back to the headworks for further treatment.

Step 8. In the holding tank, the material hits the 60° angle conical tank walls, which direct the material to the discharge without allowing excessive buildup on the walls. Four point level sensors are utilized to alarm and eventually shutdown the skimmer system if the material levels get too high in the holding tank.

Step 9. Material discharges through the 12" discharge flange of the concentrated scum holding tank to a positive displacement scum pump.

Step 10. The scum pump connects to the existing 6" concentrated scum line to the digester.

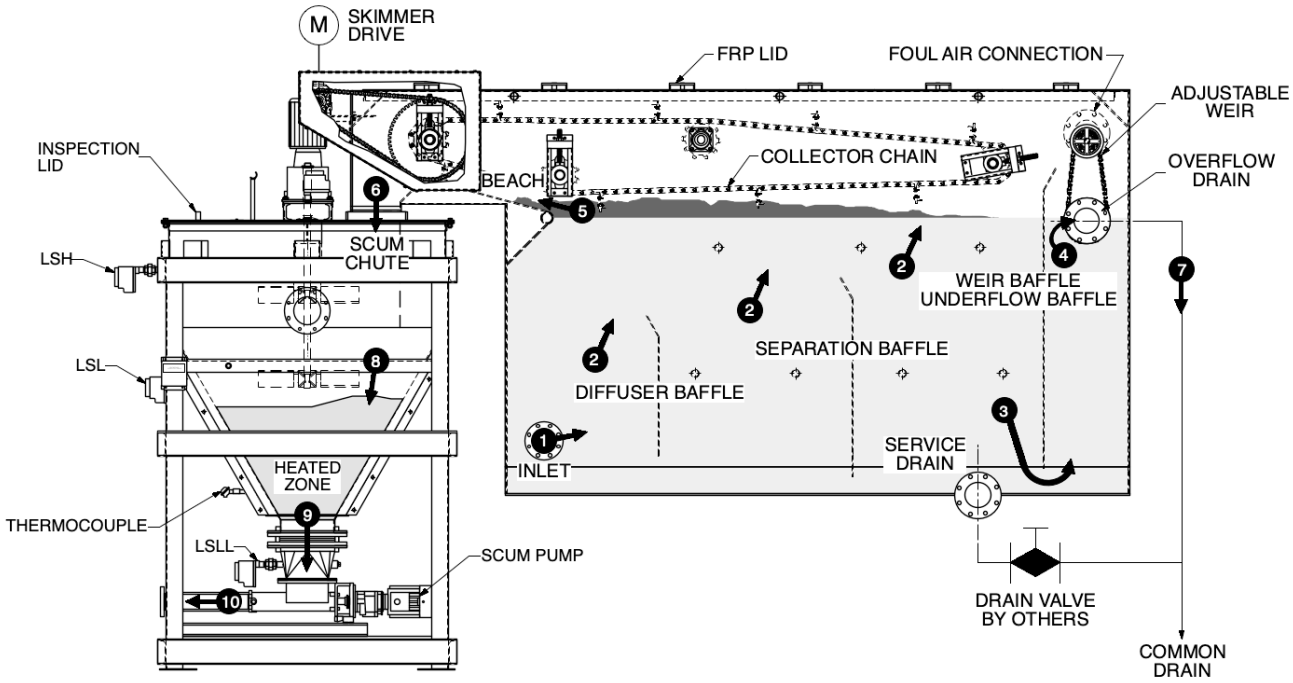


Figure 3 – Scum Concentrator Process Flow

4.2 Equipment Operation

The control panel power "OFF/ON" selector switch must be turned to the "on" position to power up the LCP-7401 control panel.

4.2.1 Skimmer Drive

On the local control panel, the skimmer drive has an "MANUAL/AUTO" (MA) selector switch, "RUNNING", "OVERLOAD" fault and "TORQUE" fault indicating lights, and "OL RESET" push button. In "MAN", the skimmer will start when the "START" push button is pressed and will stop when the "STOP" push button is pressed. "AUTO" runs the skimmer drive based on the holding tank not being HIGH/HIGH and the SCADA start command signal (factory jumpered) being present.

The skimmer is interlocked with TS1 (Tsubaki shock relay that measures motor current), CR13 (skimmer overload), CR14 (skimmer torque overload), and CR81A (holding tank HIGH/HIGH) in all of the above operating modes. Push "OL RESET" on the LCP-700 control panel button prior to starting the motor to reset all alarm conditions.

4.2.2 Scum Pump

The scum pump has a "MA" selector switch on the local control panel. "RUNNING", "OVERLOAD", and "SEAL FLOW" fault indicating lights, and "OL RESET" push button. While in "AUTO", the scum pump will start when the scum holding tank level reaches "HIGH" level and stop when the scum holding tank level reaches "LOW" level, while the "scum pump SCADA start command" signal (factory jumpered) is present. "MAN" allows the scum pump to be started manually using "START" push button is pressed on the scum concentrator control panel LCP-7401 provided none of the interlock faults are present and will stop when the "LOW/LOW" level is reached.

The scum pump is interlocked with the capacitive-type CR82 (holding tank HIGH level switch), CR83 (holding tank LOW level switch), CR84 (holding tank LOW/LOW level

switch), CR33 (scum pump overload), and CR34 (scum pump seal water low flow). All of the interlocks function in the "AUTO" operating mode. However, in the "HAND" operating mode, CR82 (holding tank HIGH level) and CR83 (holding tank LOW level) faults are bypassed, the pump is started and stopped with the "START" and "STOP" push buttons on LCP-7401. Push the "OL RESET" button prior to starting the motor to reset all alarm conditions.

4.2.4 Mixer

On the local control panel, the mixer has a "MA" selector switch, "RUNNING" and "OVERLOAD" fault indicating lights, and a "OL RESET" push button. When the selector switch is positioned to "MAN" the mixer will start when the "RUN" push button is pressed on LCP-7401. "AUTO" allows the mixer drive to run based on the CR83 (holding tank LOW) level switch and the mixer SCADA start command (factory jumpered). The mixer is interlocked with CR83 (tank low level) and CR23 (mixer motor overload). Push the "OL RESET" button prior to re-starting the mixer motor to reset motor overload alarm conditions.

4.2.5 Holding Tank Heating System

On the local control panel, the heaters have a power 535 temperature controller in addition to "RUNNING", "OVER TEMP", and "OVERLOAD" fault indicating lights, and a "OL RESET" push button. Twelve heater elements are factory installed in a uniform arrangement around the holding tank cone and factory wired to a junction box JB 7401 attached to the holding tank frame. The scum temperature controller on the panel door controls the temperature by turning the heating elements on/off so that the process variable from the type K thermocouple sent via 4-20mA from the tmperature transmitter, located just above the knife gate, equals the controller temperature set point. The controller is interlocked with CR83 (holding tank LOW) level switch and CR44 (over temp) EnviroCare typically recommends that the scum temperature be maintained to a range 80-95°F. To clear a fault press "OL RESET" indicator light.

Caution: Overheating the tank can cause the scum to bake and harden in the tank.

4.2.6 Point Level Sensors

There are four point level sensors mounted on the scum storage tank. All four sensors require 120VAC control power to operate. Each circuit is fused with a 0.125 amp fuse in the panel.

The low/low level sensor is mounted in the pump / knife gate transition piece and is wired to CR84 and a panel alarm indicator. One contact from CR84 is utilized to provide a plant SCADA input. A second contact is used as an interlock with the concentrated scum pump operation. A third contact is used for scum pump control.

The low level sensor is mounted at the top of the holding tank cone and is wired to CR83 and a panel alarm indicator. One contact from CR83 is utilized to provide a plant SCADA input. A second contact is used to inhibit the scum heating system when the scum tank level is below low. A third contact is used for the mixer control.

The high-level sensor is mounted on the scum storage tank near the top of the holding tank cylinder section and is wired to CR82 and a panel alarm indicator. One contact from CR82 is utilized to provide a plant PCS input. A second contact is used for scum pump control.

The high/high level sensor is mounted on the scum storage tank cover and is wired to CR81 and a panel indicator. One contact from CR81 is utilized to provide a plant SCADA input. A second contact is wired as a permissive for the skimmer start circuit. Push the skimmer “OL RESET” button to reset the high/high sensor alarm.

4.3 Start-up

All manual valves directly related to the scum concentrator system as well as all associated permissives (mechanical or electrical) must be verified prior to starting equipment.
Generally, the equipment is initially operated with water before the introduction of scum.

4.3.1 Startup – Manual Mode

The following startup instructions will be described assuming all of the valves are closed and the power to the system is off. Valves allowing the circulation of heating water should be open. EnviroCare recommends commissioning the concentrator tank and then the holding tank.

1. Energize the scum concentrator panel 480V power supply.
2. Energize the control panel by turning on the main 1CB (50A) circuit breaker. Confirm that the "POWER ON" indicator light is illuminated. Check that the E-stop button is in the 'out' position. Press the "MOTOR CONTROL POWER RESET" and verify the "MOTOR CONTROL POWER ON" indicator light is illuminated. Verify operation of panel, field devices and all panel related control logic.
3. Ensure all valves upstream of the scum inlet are open. Work in conjunction with plant and / or contractor to position valves that are outside the supplied scope.
4. Prior to starting the skimmer drive, confirm that the gearbox oil level is adequate and all initial startup items are complete per the manufacturer's instructions in section 8. Start the skimmer drive. Place the skimmer drive selector switch in "MAN" and press the "START" button to run the skimmer continuously, as long as the holding tank is not HIGH/HIGH.

5. Adjust the Tsubaki shock relay to the lowest setting possible that will allow the skimmer motor to start. See manufacturer's instructions in Section 8.
6. Check skimmer flight blade movement over the beach. The skimmer blades should just touch the beach plate as they travel up it. If the blades require a height alteration, use the adjustable tail, turn and head shaft take-up bearings to raise and/or lower the blades.
7. Fill the concentrator tank with water.
8. Adjust weir assembly throughout height adjustment range to verify operation.
9. Insert all concentrator tank covers on top of the concentrator tank.
10. Fill the scum holding tank with water. As the water in the holding tank rises verify the functionality of the level transmitter and level indicator relay output setpoints for CR81 "HIGH/HIGH", CR82 "HIGH", CR83 "LOW" and CR84 "LOW/LOW" tank levels.
11. Check all piping and tank penetrations for leaks. Tighten and/or repair as necessary.
12. Manually close and open the 12" knife gate and verify operation of "LOW/LOW" level sensor.
13. Prior to starting the mixer, confirm that the gearbox oil level is adequate and all initial startup items are complete per the manufacturer's instructions in section 8. Once the holding tank level is above the mixer impeller blades, start the mixer by turning the selector switch to "MAN" and pressing the "START" button to run the mixer continuously, as long as the holding tank is above "LOW" level.
14. Prior to starting the scum pump, confirm that all initial startup items are complete per the manufacturer's instructions in section 8.
15. Leave the holding tank cover in the closed position. Once the holding tank level is above the "LOW/LOW" level, start the scum pump by turning the selector switch

to "MAN" and press "START" to run the scum pump continuously, as long as the holding tank is above "LOW/LOW" level.

4.3.2 Startup – Auto Mode

This mode is the same as manual mode described in 4.3.1 except for selector switches: skimmer, scum pump, and mixer are set to "AUTO". The SCADA and its related control logic are not part of EnviroCare's scope of supply, but a run request is required (factory jumpered) for the automatic operation of the skimmer, mixer, scum pump, and heaters. The skimmer drive runs continuously. The skimmer drive will stop if the holding tank level reaches the "HIGH/HIGH" level sensor. The mixer starts when the scum level reaches the "LOW" level. The scum pump starts automatically when the "HIGH" level is reached and runs until the "LOW" level is reached. The heaters run based on the temperature set point and the holding tank level is above the "LOW" level.

After a scum blanket is established, check the position of the skimmer blade relative to the scum/water interface. Blades should be touching scum/water interface six to twelve inches (6"-12") in front of the beach. See Figure 4. The scum blanket depth is controlled by the adjustable weir, which is located at the weir end of the concentrator and adjusted by the hand wheel. The lower the water level is set, the deeper the scum blanket. In most applications, the ideal water level should be adjusted so that the scum blanket is one inch (1") deep.

Check skimmer flight blade movement over the beach. The skimmer blades should just touch the beach plate as they travel up it. If the blades require a height alteration, use the take-up bearings to raise and/or lower the blades. This step may be skipped if previously

adjusted. If the blades touch the beach too hard, the F2 attachments or skimmer chain may fail unexpectedly.

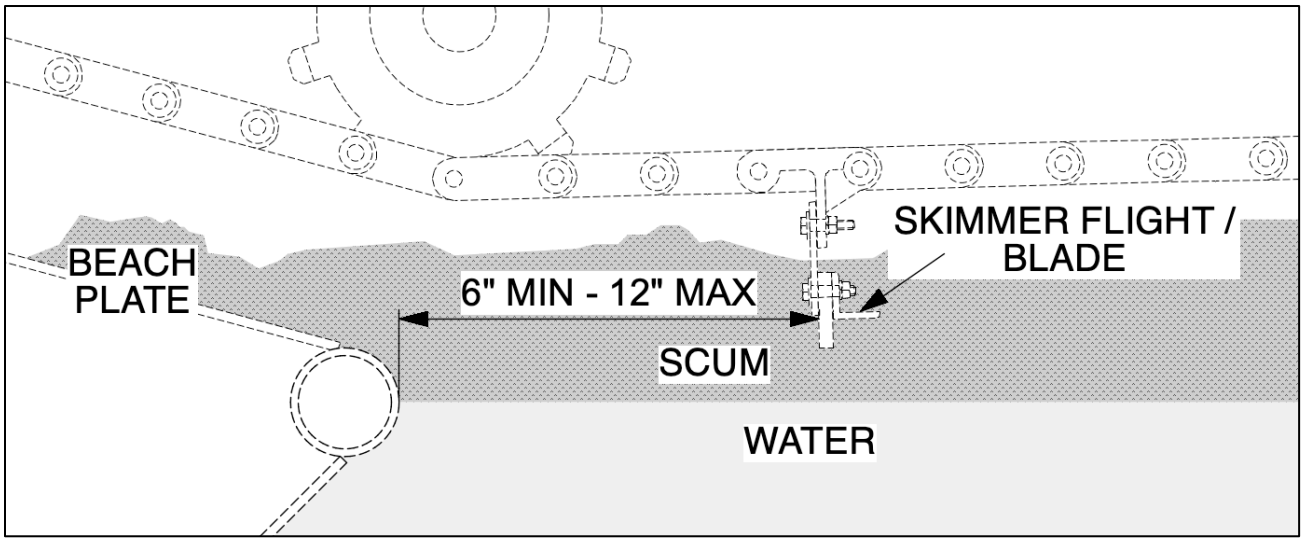


Figure 4 – Skimmer Flight / Blade Approach to Beach

4.4 Shutdown

4.4.1 Short Term

1. Stop flow to concentrator tank.
2. Stop the skimmer drive after a majority of the remaining scum has been conveyed from the concentrator tank into the scum storage tank.
3. Verify that holding tank has been pumped down to the "LOW/LOW" level sensor.
4. Press the "E-STOP" on LCP-7401.

4.4.2 Long Term

1. Stop flow to concentrator tank.
2. Set valve upstream of scum inlet in "closed" position.
3. Stop the skimmer drive after a majority of the remaining scum has been conveyed from the concentrator tank into the holding tank.
4. Drain the concentrator tank by opening the 6" drain valve.
5. Wash all excess scum off of the tank walls and internal components with hot water.
6. Set concentrator tank drain valves in the "closed" position after cleaning / draining.
7. Verify that the holding tank has been emptied to a disposal vehicle.
8. Wash all excess scum off of tank walls.
9. Do not allow concentrated scum to sit inside tank for periods of time greater than three days without heating or agitation. Concentrated scum left in the tank for extended periods of time without agitation or heating will harden to the consistency of concrete. This can become a maintenance headache and should be avoided whenever possible.

10. Flush concentrated scum out of discharge piping with water.

11. Power down entire system with the disconnect on the LPC-7401.

NOTE: Upstream valves are not included in EnviroCare's scope of supply. The concentrator tank and holding tank include 150# flanges for connection to process piping. The valves referred to in this section merely represent typical items included in the customer's piping design.

4.5 Troubleshooting

The EnviroCare Scum Concentrator has very few moving parts limiting the number of possible equipment related problems. The major moving parts are the scum pump, skimmer drive, collector chain/skimmer flight assembly, weir assembly, and mixer.

Scum Pump

Possible Problems:

1. Motor will not start.

Solutions:

1. No electrical power. Check source.
   Circuit breaker tripped. Reset.
   Overload relay tripped. Reset. Investigate cause of overload.
   Torque overload caused trip. Reset. Investigate cause of overload.
   Scum level below "LOW" level interlock condition. Allow scum to rise above "LOW" level setpoint.
   LOW/LOW level interlock tripped. Alarm condition. Eliminate cause of alarm.
   High temperature interlock tripped. Alarm condition. Eliminate cause of alarm.

Skimmer Drive Assembly

Possible Problems:

1. Motor will not start.
2. Excessive drive chain sag.

Solutions:

1. No electrical power. Check source.
   Circuit breaker tripped. Reset.
   Overload relay tripped. Reset. Investigate cause of overload.

Torque overload caused trip. Reset. Investigate cause of overload. Reset the Tsubaki in LPC-7401

HIGH/HIGH scum level in holding tank interlock tripped. Alarm condition. Eliminate cause of alarm.

2. Eliminate excessive sag by adjusting drive position.

Skimmer Mechanism

Possible problems:

1. Chain sag.
2. Gap between blade and beach.
3. Skimmer blade & water/scum interface is not 6" to 12" ahead of the beach.

Solutions:

1. Adjust tail shaft take-up bearing elevations to eliminate chain sag.
2. Adjust head shaft take-up bearing elevations to maintain constant contact between blade and beach.
3. Adjust turn shaft take-up bearing elevations maintain a 6" to 12" clearance between the skimmer blade contact with the water/scum interface and the beach.

Mixer Assembly

Possible Problems:

1. Motor will not start.

Solutions:

1. No electrical power. Check source.

   Circuit breaker tripped. Reset.

   Overload relay tripped. Reset. Investigate cause of overload.

   Low tank level interlock tripped. Alarm condition. Eliminate cause of alarm.

Adjustable Weir Assembly

Possible Problems:

1. Scum blanket is too thick or too thin.
2. Cannot adjust weir.
3. Water not draining.

Solutions:

1. Adjust the weir level to change the scum blanket depth and density:
   (a) To thin blanket, raise water level by raising the weir setting.
   (b) To thicken blanket, lower water level by lowering the weir setting.
2. Possible Weir Adjustment Solutions:
   (a) Possible corrosion in mechanism is preventing system from functioning. Inspect mechanism and determine if parts can be reconditioned or new parts need to be obtained.
   (b) Possible debris stuck in overflow weir. Clean mechanism.
3. Possible Insufficient Drainage Solutions:
   (a) Possible debris stuck in overflow weir. Clean mechanism.
   (b) Possible debris stuck in downstream piping. Clean piping.
   (c) Open all downstream valves.

Panel and Field Instrumentation & Valves

See manufacturer's Operation & Maintenance manuals for each specific piece of equipment. Refer to Section 8 – For Panel and Field Device manufacturer's O&M's.

4.6 Alarm List

The EnviroCare Scum Concentrator has several alarm conditions. The following descriptions identify the causes of each alarm and the recommended action:

Skimmer Over-Torque Fault

Cause:

1. Skimmer drive amperage draw is above set limit.

Recommended Action:

1. Check and clear skimmer drive system of obstructions or binding.
2. Press the Tsubaki Fault Reset button in LCP-7401 (reset requires holding the button for 2-3 seconds).
3. Re-start the skimmer drive system and verify correct operation.

Skimmer Motor Overload Fault

Cause:

1. Skimmer drive motor tripped the overload setting.

Recommended Action:

1. Inspect the skimmer drive motor and wiring for damage or shorting.
2. Press the skimmer OL RESET button.
3. Re-start the skimmer drive system and verify correct operation.

Scum Pump Motor Overload Fault

Cause:

1. Scum Pump motor tripped the overload setting.

Recommended Action:

1. Inspect the Scum Pump motor and wiring for damage or shorting.
2. Press the Scum Pump OL RESET button.
3. Re-start the Scum Pump and verify correct operation.

Scum Pump Seal Flow Fault

Cause:

1. Scum Pump ran for more than 15 seconds (adjustable) without seal water flow.

Recommended Action:

1. Inspect the seal water system for correct operation and flow rate.
2. Press the Scum Pump OL RESET button.
3. Re-start the Scum Pump and verify correct operation

Mixer Motor Overload Fault

Cause:

1. Mixer motor tripped the overload setting.

Recommended Action:

1. Inspect the Mixer motor and wiring for damage or shorting.
2. Press the Mixer OL RESET button.
3. Re-start the Mixer and verify correct operation.

Holding Tank High/High Fault

Cause:

1. The Holding Tank has reached HIGH/HIGH level.

Recommended Action:

1. Investigate the cause of the pump not beginning to pump down and correct.
2. Pump the Holding Tank level down to the “HIGH” level.

Holding Tank Over Temp Fault

Cause:

1. The Holding Tank has reached the High Temperature setpoint
   (factory setpoint 120ºF).

Recommended Action:

1. Investigate the cause of the high temperature and correct.
2. Allow the temperature to cool and the fault should reset (not latched).

Panel and Field Instrumentation & Valves

See manufacturer's Operation & Maintenance manuals for each specific piece of equipment. Refer to Section 8 – For Panel and Field Device manufacturer's O&M's.

5.0 Maintenance

5.1 Lubrication Schedule

Item	Device	Frequency	Lubricant
Skimmer Drive	Gear Box	6 months	Mobilgear 630 (1) Shell Omala 220 (1) Texaco Meropa 220 (1)
Skimmer Drive	Motor	N/A	N/A (2)
Skimmer Drive	ASA 80 Drive Chain	Monthly	Open Chain Lube
Skimmer Assy.	Flange Bearing	3 months	N/A: inspect for binding
Skimmer Assy.	Take-up Bearing	3 months	#2 lithium grease (1)
Skimmer Assy.	PC78 Acetal Chain	Monthly	SAE 30 –NO GREASE
Mixer	Motor Bearings	Yearly	#2 lithium grease (1)
Mixer	Gear Box	2 Years	Mobilgear 630 (1) Shell Omala 220 (1) Texaco Meropa 220 (1)
Scum Pump			See note 4
Weir Adjuster	1/4 Turn Worm Gear	Yearly	Alpha Green 2000
Weir Shaft	Pillow Block Bearing	Yearly	Polyurea base grease

Lubrication Schedule Notes:

(1) Refer to Section 8 for specific manufacturer's instructions for additional details.
(2) Motor bearings sealed & greased for life of bearing
(3) Do not over lubricate. Excess lubricant can damage seals.
(4) Refer to specific manufacturer's instructions in Section 8.0.

5.2 General Maintenance

Item	Device	Frequency	Maintenance Req'd
Skimmer Drive	ASA 80 Drive Chain	Monthly	Chain Tension (1)
Skimmer Assembly	PC78 Acetal Chain	Monthly	Chain Tension (1)
Skimmer Assembly	Collector Blades, Concentrator Tank Walls, & Beach	Daily	Verify Operation and Collection; **clean with hot water** (2)
Weir Assembly	Scum Blanket	Daily	Check Scum Density (2)
Scum Pump	Mechanical seals	1 Year	Inspection

General Maintenance Notes:

(1) Verify chain operation is smooth and not binding on sprocket(s).
(2) Clean flight assemblies and sides of concentrator tank to remove scum build-up.

Service Contact Information:

EnviroCare International, Inc.

507 Green Island Road

American Canyon, CA 94503

Phone: 707.638.6800
Fax: 707.638.6898

www.envirocare.com

5.3 Open Chain Lubricant

Whitmore's Open Chain Lubricant is specifically formulated to meet the exacting lubrication requirements of chain drives. Its penetrating action draws the lubricant to the pins and bushings of a chain where lubrication is most needed. It quickly displaces moisture and contaminants, while preventing rust and corrosion.

TYPICAL CHARACTERISTICS

ISO Grade	32
Kinematic Viscosity (ASTMD-445)	
cSt @ 40 Deg. C	32
cSt @100 Deg. C	6
Saybolt Viscosity (ASTMD-2161)	
SUS @ 100 Deg. F	165
SUS @ 210 Deg. F	46
Viscosity Index	105
Flash Point (ASTMD-92) °F (°C)	375 (190)
Fire Point (ASTMD-92) F (°C)	410 (210)
Pour Point (ASTMD-97) Deg. F (Deg. C)	-35 (-37)
Density (Gardner Method), lb/gal (g/cc) @ 60 °F	7.32 (.879)
Timken Load (ASTMD-2782) lbs.	40

Operating Range: -25 °F to 375 °F (-31 °C to 190°C)

APPLICATIONS:

Open Chain Lubricant is ideal for chain drives of all sizes. It is packaged in a variety of bulk containers as well as convenient aerosol cans to suit any application. Whitmore's Open Chain Lubricant may be either sprayed or dripped on to the chains.

PACKAGING:

Pails:	35 lbs.
Non-Aerosol Spray:	12 oz.

5.4 Disassembly, Re-assembly, and Realignment

The scum concentrator system consists of the Concentrator Tank and the concentrated scum Holding Tank. Prior to disassembly, it is important to first steam-clean any parts from the tank interior to be worked on. This eliminates any slippery buildup accumulated from normal operation and makes handling of parts safer. If working inside of a tank, disconnect all power, lockout valves, and steam clean the tank interior.

5.4.1 Bearings, Shafts, Collector Chain

To service any of the interior shafts, bearings, sprockets, or chain links, it will most likely be necessary to open up one or both collector chains. Disconnect power to skimmer drive motor before any chain maintenance. To open up either skimmer chain it will be necessary to work inside of the tank. Empty the concentrator tank and steam-clean to remove slippery scum. Position the skimmer chain link to be opened at the bottom center of the chain run, mark the positions of the tail and adjustable idler shaft (at the base of the beach plate), then adjust shafts to permit maximum sag in the chain. The skimmer chains and skimmer blades are heavy and could cause injury if allowed to hang or drop without support. Lash together two chain links (with rope, cable or "come-along") five links away from the link to be opened and remove tension on the section of chain to be opened by tightening the rope or cable. Open the chain in the desired position by removing a pin or link. If the chains must be completely opened (for servicing the tail shaft for example), remove all of the skimmer blades first, and use a 50 ft long rope and slowly allow slack in the rope until the chain rests on the floor of the concentrator tank. Repeat with other chain. Depending on available lifting equipment, it may be necessary to break the chain in several places to remove chain from the tank. With the chains removed, all drive components are accessible.

To reinstall a skimmer chain, drape the chain over the sprockets with the F2 chain attachments for the skimmer blades facing away from the shafts, and pull ends of chain together using a strong rope (or "come-along") lashed two links from the open ends of the chain. Replace pin in link and remove the rope. If no link has been added or removed, adjust shafts to the position marked at start of maintenance. If a link has been added or removed, readjust shafts and reconnect power to skimmer drive motor. Please note that when removing links from a collector chain run the same number of links should also be removed from the other collector chain.

5.4.2 Skimmer Drive Chain

To disassemble the skimmer drive chain, disconnect power to motor, remove chain guard, loosen drive mounting hardware to provide sufficient slack in drive chain. If it is not possible to lift chain off of sprockets, open the chain by removing the master link.

To reassemble a drive chain, wrap chain around sprockets and install master link. Adjust drive position to take-up chain slack. Chain should have a 1/8" to 1/4" of slack.

5.4.3 Skimmer Drive

To remove the adjustable weir, drain the concentrator tank and remove the drive chain from weir assembly. Remove all mounting hardware from the 6" weir pipe assembly flanged connections inside the tank. Lift weir pipe out of tank. (Approximate weight of pipe =75lbs) Replace in opposite order.

5.4.4 Adjustable Weir

To remove the adjustable weir, drain the concentrator tank and remove the linkage from the weir assembly. Remove all mounting hardware from the weir door assembly inside the tank. Lift weir door out of tank. Replace in reverse order.

5.4.5 Heater Elements

To remove a heater element or pair of elements, disconnect the 460 V power and remove the heat shield enclosure on the conical section of the holding tank. The knifegate yoke stem may be removed to facilitate removal of the heat shield. The non-operating heaters may be

identified from the array by checking the resistance across the elements. The heater elements are easily removed by disconnecting the wiring from the terminals and loosening the fastening hardware. To install replacement elements, follow this sequence in the opposite order.

5.4.6 Mixer

To remove the mixer or any portion of the mixer, disconnect and lockout power. If the motor or drive needs to be removed, this work may be done without entering the tank. The motor may be removed by disconnecting the power wiring and uncoupling the motor from the drive. The drive may be removed by removing the hardware from the drive support structure and uncoupling the mixer shaft. The mixer shaft should be temporarily support if the drive is removed.

If the mixer shaft or impellers need to be removed, the tank contents should be emptied and the tank interior should be steam cleaned to permit entering the tank. One section of the holding tank lid is removable to facilitate access. See manufacturer's service manual for additional details.

5.4.7 Scum Pump

To remove the scum pump, disconnect power, remove wiring at the motor, and disconnect the seal water plumbing. Remove the fastening hardware between the holding discharge and the scum pump inlet. Remove the fastening hardware between the pump discharge and the interconnecting piping. The pump is now ready to be separated from the tank. Loosen the bolts at each end of the holding tank C15 pump support frame. The bolts are in slotted holes to allow the pump / frame to be lowered. Once the pump assembly is lowered, remove the fastening hardware that connects the scum pump frame to the holding tank C15 frame. The pump should now be able to be carefully removed. See manufacturer's service manual for additional details.

***NOTE - See Section 8 for individual component manufacturer's service manuals.**

6.0 Equipment List

6.1 Concentrator Tank Components

B/M#	Item#	Description	Size	Qty.
B510-1194	0	Model 60 Concentrator Tank	60 GPM	1
B520-1194	6	Adjustable Weir Flange Bearing	1” Ø	2
B520-1194	16	Adjustable Weir Shaft Collar	1” Ø	2
B530-1194	1	SEW Skimmer Drive	1/2 HP	1
B530-1194	3	Wiper Blade ONLY – Neoprene 3/8” X 2”	45” LG	8
B530-1194	5	Skimmer Collector - Acetal NH78 Chain	2.609 X 10 FT	5
B530-1194	6A	Skimmer Collector Flight Attachment - Rex F2 Attachment	2.609”	16
B530-1194	6B	Pin for F2 Attachment		16
B530-1194	12	Skimmer Collector Shaft Take-up Frame	1 15/16”	6
B530-1194	13	Skimmer Collector Shaft Take-up Bearing	1 15/16”	6
B530-1194	14	Skimmer Collector Shaft Flange Bearing	1 15/16”	2
B530-1194	15	2-Piece Split Shaft Safety Collar	1 15/16”	8
B530-1194	16A	Skimmer Collector Nylon Sprocket w/ Keyway, 2.609" Pitch	10 tooth	5
B530-1194	16B	Skimmer Collector Nylon Sprocket w/o Keyway, 2.609" Pitch	10 tooth	3

B/M#	Item#	Description	Size	Qty.
B530-1194	17	Skimmer Assembly Driven Sprocket, 1" Pitch	60 tooth	1
B530-1194	18	Skimmer Assembly Drive Sprocket, 1" Pitch	15 tooth	1
B530-1194	19A	Drive Chain, A.S.A 80 Roller Chain	1” X 10 FT	1
B530-1194	19B	Drive Chain Link, A.S.A 80 Roller Chain	1” pitch	1
B540-1194	0	Model 60-500 Concentrator Tank Mounting Frame		1
B550-1194	0	Concentrator Tank FRP Odor Abatement Lid	1/4” THK x30.5"x46"	6

6.2 Holding Tank Components

B/M#	Item#	Description	Size	Qty.
B610-1194	0	Model 500 Scum Storage Tank	500 gallon	1
B612-1194	5A	Holding Tank 240V Strip Heater	750W	12
B612-1194	5B	Silicone Boot Kit for 240V Strip Heater		12
B620-1194	3A	Type K Thermocouple	1/4” Ø x 6” LG	1
B620-1194	4	6” Capacitive Level Switch	120VAC	3
B620-1194	5	10” Capacitive Level Switch	120VAC	1
B620-1194	6	Stainless Steel Knifegate Valve	12”	1
B630-1194	1	Mixer & Gearbox Assembly	2 HP	1
B650-1194	1	Netzsch Progressive Cavity Pump Assy.	3 HP	1

6.3 Control Panel Components

B/M#	Item#	Description	Size	Qty.
B700-1194	1	Electrical Enclosure, NEMA 4X	60 X 49 X 12	1
B700-1194	4	28 in Work Light, Flourescent	28 in	1
B700-1194	10	Push-to-Test Pilot Light, Amber	120 VAC	11
B700-1194	11	Push-to-Test Pilot Light, Green	120 VAC	5
B700-1194	12	Push-to-Test Pilot Light, White	120 VAC	3
B700-1194	13	Non-Ill. PB, 1no-1nc, Green		3
B700-1194	14	Non-Ill. PB, 1no-1nc, Black		5
B700-1194	15	Non-Ill. PB, 1no-1nc, Red		6
B700-1194	16	Detented Red Mushroom Push/Pull Button, 2PNC		1
B700-1194	17	Selector Switch, 2-Position		3
B700-1194	35	Panel Temp. Controller Relay Out	120VAC	1
B700-1194	50	Control Relay, 4 Contact	120 VAC	28
B700-1194	63	Square D Circuit Breaker	50 Amp	1
B700-1194	72	NEMA Size 00 Motor Starter	120 VAC	2
B700-1194	73	NEMA Size 0 Motor Starter	120 VAC	1
B700-1194	74	NEMA Size 2 Motor Starter	120 VAC	1

7.0 Recommended Spare Parts

All orders and requests for quotation may be faxed or emailed to:

EnviroCare International
Ph 707.638.6800 / Fax 707.638.6898

Email: info@envirocare.com

P/N	Item#	Description	Size	Qty.
B530-1194	1	SEW Skimmer Drive	1/2 HP	1
B530-1194	3	Wiper Blade ONLY – Neoprene 3/8" X 2"	45" LG	8
B530-1194	5	Skimmer Collector - Acetal NH78 Chain	2.609 X 10 FT	2
B530-1194	6A	Skimmer Collector Flight Attachment - Rex F2 Attachment	2.609"	16
B530-1194	13	Skimmer Collector Shaft Take-up Bearing	1 15/16"	2
B530-1194	14	Skimmer Collector Shaft Flange Bearing	1 15/16"	2
B530-1194	16A	Skimmer Collector Nylon Sprocket w/ Keyway, 2.609" Pitch	10 tooth	5
B530-1194	16B	Skimmer Collector Nylon Sprocket w/o Keyway, 2.609" Pitch	10 tooth	3
B612-1194	5A	Holding Tank 240V Strip Heater	750W	2
B620-1194	3A	Type K Thermocouple	1/4" Ø x 6" LG	1
B620-1194	4	6" Capacitive Level Switch	120VAC	1
B620-1194	5	10" Capacitive Level Switch	120VAC	1
B650-1194	1-R	Netzsch Pump Replacement Rotor		1
B650-1194	1-S	Netzsch Pump Replacement Stator Buna		1
B650-1194	1-M	Netzsch Pump Replacement Mech Seal		1

P/N	Item#	Description	Size	Qty.
B650-1194	1-G	Netzsch Pump Replacement Joint Kit		1

7.1 Spare Parts Purchased with Original Contract

P/N	Item#	Description	Size	Qty.
B530-1194	3	Wiper Blade ONLY – Neoprene 3/8" X 2"	45" LG	8
B530-1194	13	Skimmer Collector Shaft Take-up Bearing	1 15/16"	2
B530-1194	16A	Skimmer Collector Nylon Sprocket w/ Keyway, 2.609" Pitch	10 tooth	1
B530-1194	16B	Skimmer Collector Nylon Sprocket w/o Keyway, 2.609" Pitch	10 tooth	1
B530-1194	19A	Drive Chain, A.S.A 80 Roller Chain	1" X 10 FT	1
B530-1194	19B	Drive Chain Link, A.S.A 80 Roller Chain	1" pitch	1

8.0 Manufacturers' Literature

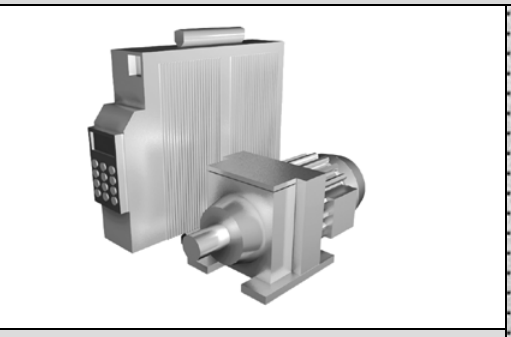
Concentrator Tank

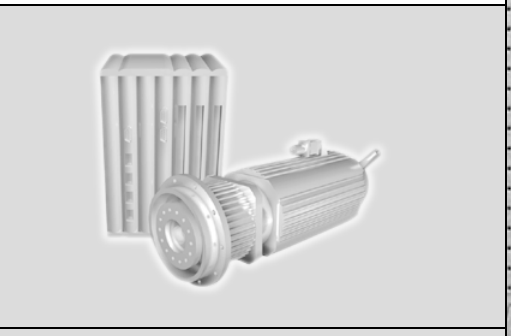
Holding Tank

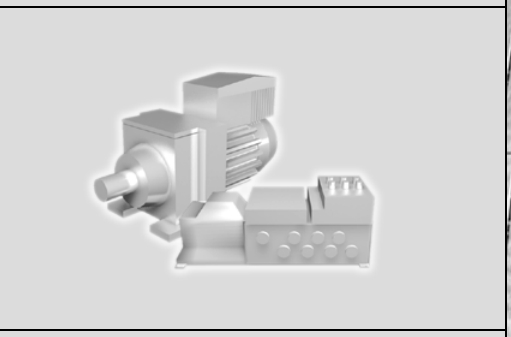
Main Control Panel

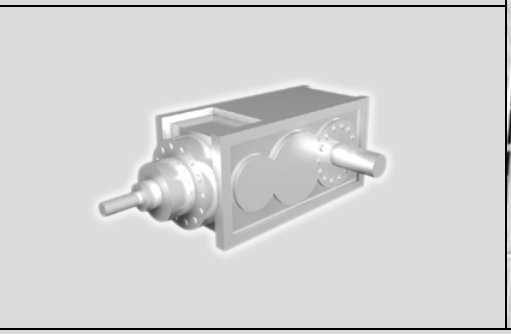
TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
SKIMMER DRIVE P/N: R37 D16BMOTOR
P/N: DRN71M4/DH

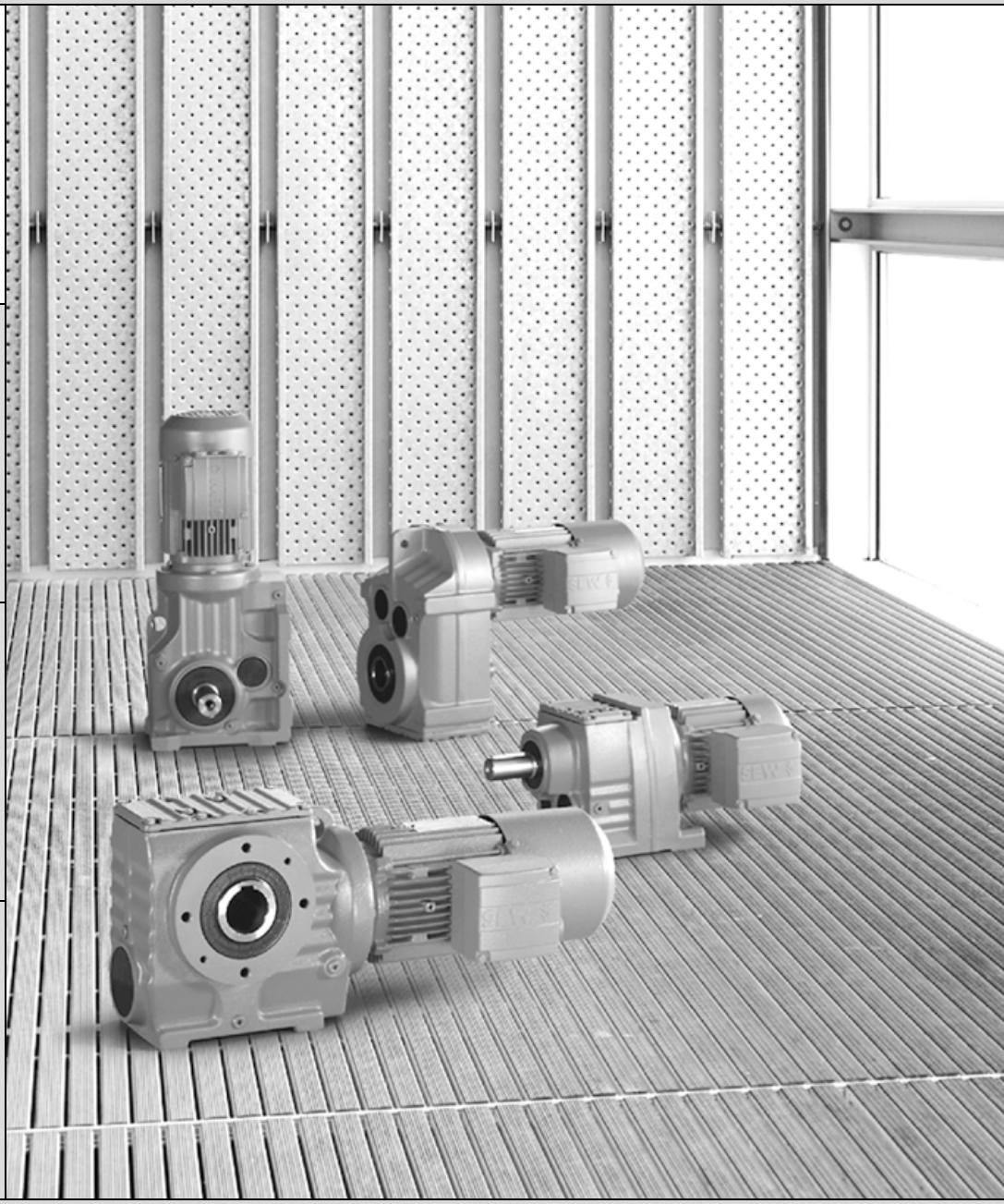
SEW EURODRIVE











Gear Units, R..7, F..7, K..7, S..7 Series, SPIROPLAN® W

Edition 10/2007
11226811 / US

Operating Instructions

SEW EURODRIVE

1 Important Notes

Safety and warning instructions

Always follow the safety and warning instructions in this publication!

Electrical hazard
Possible consequences: Severe or fatal injuries.

Hazard
Possible consequences: Severe or fatal injuries.

Hazardous situation
Possible consequences: Slight or minor injuries.

Harmful situation
Possible consequences: Damage to the drive and the environment.

Tips and useful information.

You must adhere to the operating instructions to ensure:

- Trouble-free operation
- Fulfillment of any rights to claim under guarantee

Consequently, read the operating instructions before you start working with the gear unit!

The operating instructions contain important information about servicing. Therefore, keep the operating instructions close to the gear unit.

- Adjust the lubricant fill volume and position of the breather valve accordingly in the event of a change of mounting position (see Sec. "Lubricants" and "Mounting Positions").
- Follow the instructions in Sec. "Mechanical installation" / "Installing the gear unit"!

Waste disposal

Please follow the latest instructions: Dispose of the following materials in accordance with the regulations in force:

- Steel scrap:
  - Housing parts
  - Gears
  - Shafts
  - Anti-friction bearing
  - Gray-cast iron (if there is no special collection)
- Parts of the worm gears are made of non-ferrous metals. Dispose of the worm gears as appropriate.
- Collect waste oil and dispose of it correctly.

2 Safety Notes

Preface

The following safety notes are primarily concerned with the use of gear units. If using **gearmotors**, please also refer to the safety notes for motors in the relevant operating instructions.

Please also consider the supplementary safety notes in the individual sections of these operating instructions.

General information

During and after operation, gearmotors, gear units and motors have:

- Live parts
- Moving parts
- Hot surfaces (may be the case)

Only qualified personnel may carry out the following work:

- Transportation
- Putting into storage
- Installation / assembly
- Connection
- Startup
- Maintenance
- Servicing

The following information and documents must be observed during these processes:

- Relevant operating instructions and wiring diagrams
- Warning and safety signs on the gear unit / gearmotor
- System-specific regulations and requirements
- National / regional regulations governing safety and the prevention of accidents

Serious injuries and property damage may result from:

- Improper use
- Incorrect installation or operation
- Unauthorized removal of necessary protection covers or the housing

Designated use

Gearmotors / gear units from SEW are intended for industrial systems. They correspond to the applicable standards and regulations.

Technical data and information about the permitted conditions can be found on the nameplate and in the documentation.

It is essential that you follow all the instructions!

Transportation

Inspect the shipment for any damage that may have occurred in transit as soon as you receive the delivery. Inform the shipping company immediately. It may be that you are not permitted to startup the drive due to the damage.

Tighten installed eyebolts. The eyebolts are only designed for the weight of the gearmotor / gear unit. Do not attach any additional loads.

The installed lifting eyebolts comply with DIN 580. The loads and regulations specified in this standard must always be observed. If two eyebolts are available, use both of them for transport. In this case, the tension force vector of the slings must not exceed a 45° angle in accordance with DIN 580.

Use suitable, sufficiently rated handling equipment if necessary. Remove any transportation fixtures prior to startup.

Extended storage of gear units

Gear units of the "extended storage" type have:

- An oil fill suitable for the mounting position so the unit is ready to run (mineral oil CLP and synthetic oil CLP HC). You should still check the oil level before startup (see Sec. "Inspection / Maintenance" / "Inspection and maintenance of the gear unit").
- A higher oil level in some cases (synthetic oil CLP PG / food grade oil). Correct the oil level before startup (see Sec. "Inspection / Maintenance" / "Inspection and maintenance of the gear unit").

Comply with the storage conditions specified in the following table for extended storage:

Climate zone	Packaging[1)]	Storage location	Storage time
Temperate (Europe, USA, Canada, China and Russia, excluding tropical zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap.	With roof, protected against rain and snow, no shock loads.	Up to three years with regular checks on the packaging and moisture indicator (relative atmospheric humidity < 50 %).
	Open	With roof, enclosed at constant temperature and atmospheric humidity (5 °C < ϑ < 60 °C, < 50 % relative atmospheric humidity). No sudden temperature fluctuations and controlled ventilation with filter (free from dirt and dust). No aggressive vapors and no shock loads.	Two years or more given regular inspections. Check for cleanliness and mechanical damage as part of the inspection. Check corrosion protection.
Tropical (Asia, Africa, Central and South America, Australia, New Zealand excluding temperate zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap. Protected against insect damage and mildew by chemical treatment.	With roof, protected against rain, no shock loads.	Up to three years with regular checks on the packaging and moisture indicator (relative atmospheric humidity < 50 %).
	Open	With roof, enclosed at constant temperature and atmospheric humidity (5 °C < ϑ < 60 °C, < 50 % relative atmospheric humidity). No sudden temperature fluctuations and controlled ventilation with filter (free from dirt and dust). No aggressive vapors and no shock loads. Protection against insect damage.	Two years or more given regular inspections. Check for cleanliness and mechanical damage as part of the inspection. Check corrosion protection.

1) Packaging must be performed by an experienced company using the packaging materials that have been expressly specified for the particular application.

Installation / assembly	Observe the instructions in the sections "Installation" and "Assembly/Removal"!
Startup / operation	Check that the direction of rotation is correct in **decoupled** status. Listen out for unusual grinding noises as the shaft rotates. Secure the shaft keys for test mode without drive components. Do not render monitoring and protection equipment inoperative even for test mode. Switch off the gearmotor if in doubt whenever changes occur in relation to normal operation (e.g. increased temperature, noise, vibration). Determine the cause; contact SEW-EURODRIVE if necessary.
Inspection / maintenance	Follow the instructions in the section "Inspection and Maintenance"!

3 Gear Unit Structure

The following figures are block diagrams. Their purpose is only to make it easier to assign components to the spare parts lists. Discrepancies may occur depending on the gear unit size and version!

3.1 Basic structure of helical gear units

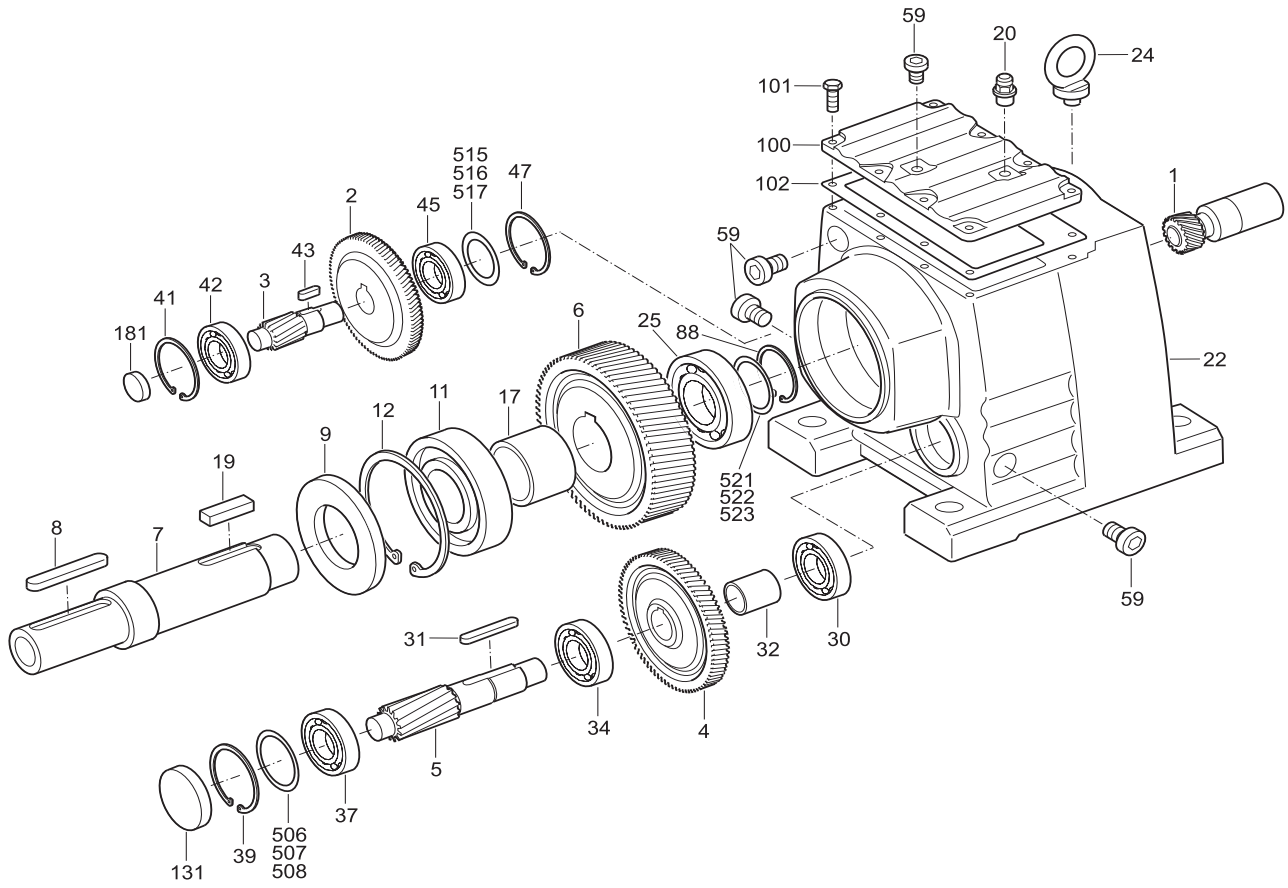


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Figure 1: Basic structure of helical gear units

Key

1	Pinion	19	Key	42	Anti-friction bearing	507	Shim ring
2	Gear	20	Breather valve	43	Key	508	Shim ring
3	Pinion shaft	22	Gearcase	45	Anti-friction bearing	515	Shim ring
4	Gear	24	Lifting eyebolt	47	Circlip	516	Shim ring
5	Pinion shaft	25	Anti-friction bearing	59	Screw plug	517	Shim ring
6	Gear	30	Anti-friction bearing	88	Circlip	521	Shim ring
7	Output shaft	31	Key	100	Gearcase cover	522	Shim ring
8	Key	32	Spacer	101	Hex head bolt	523	Shim ring
9	Oil seal	34	Anti-friction bearing	102	Gasket		
11	Anti-friction bearing	37	Anti-friction bearing	131	Closing cap		
12	Circlip	39	Circlip	181	Closing cap		
17	Spacer	41	Circlip	506	Shim ring		

3.2 Basicstructure of parallel shaft helical gear units

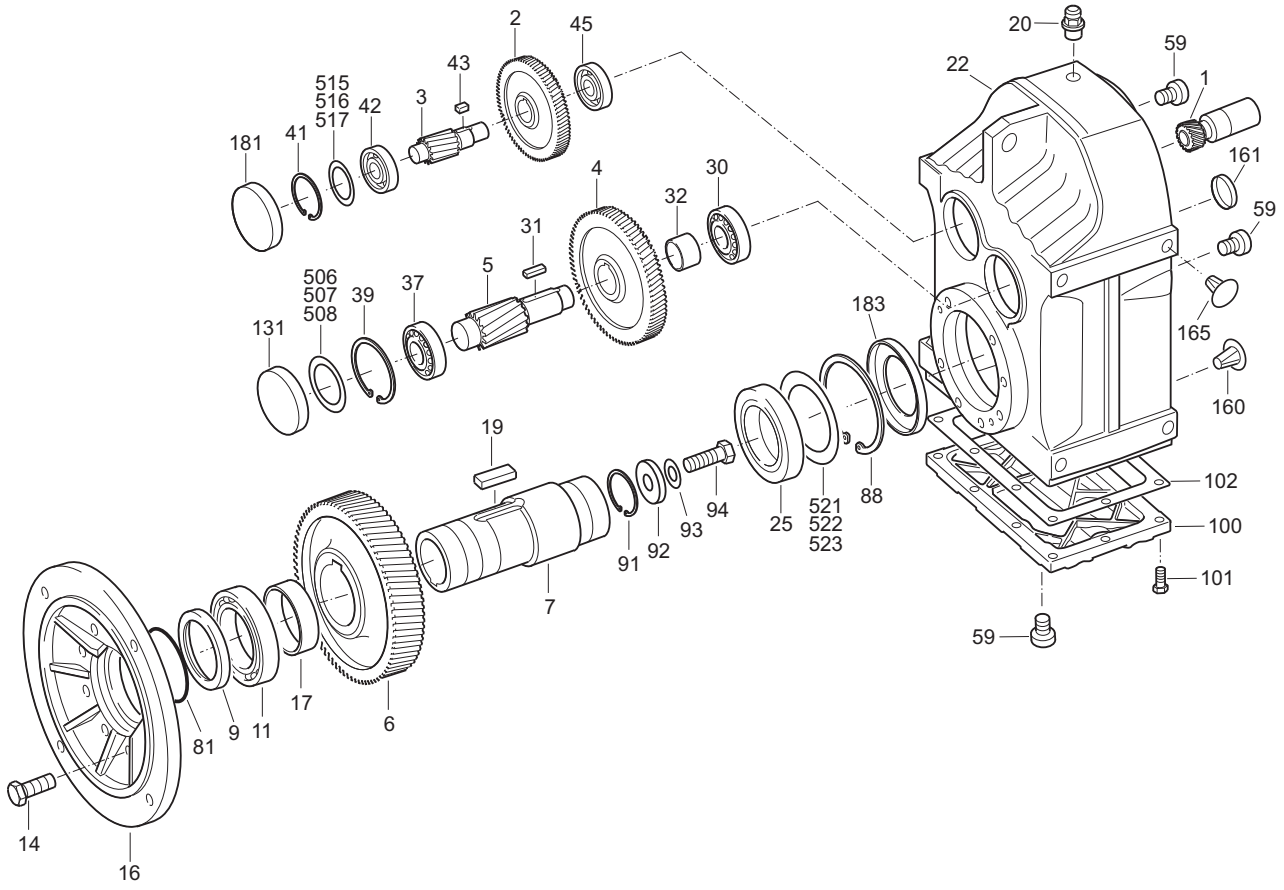

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Figure 2: Basic structure of parallel shaft helical gear units

Key

1	Pinion	22	Gearcase	91	Circlip	506	Shim ring
2	Gear	25	Anti-friction bearing	92	Washer	507	Shim ring
3	Pinion shaft	30	Anti-friction bearing	93	Lock washer	508	Shim ring
4	Gear	31	Key	94	Hex head bolt	515	Shim ring
5	Pinion shaft	32	Spacer	100	Gearcase cover	516	Shim ring
6	Gear	37	Anti-friction bearing	101	Hex head bolt	517	Shim ring
7	Hollow shaft	39	Circlip	102	Gasket	521	Shim ring
9	Oil seal	41	Circlip	131	Closing cap	522	Shim ring
11	Anti-friction bearing	42	Anti-friction bearing	160	Closing plug	523	Shim ring
14	Hex head bolt	43	Key	161	Closing cap		
16	Output flange	45	Anti-friction bearing	165	Closing plug		
17	Spacer	59	Screw plug	181	Closing cap		
19	Key	81	O-ring	183	Oil seal		
20	Breather valve	88	Circlip				

3.3 Basic structure of helical-bevel gear units

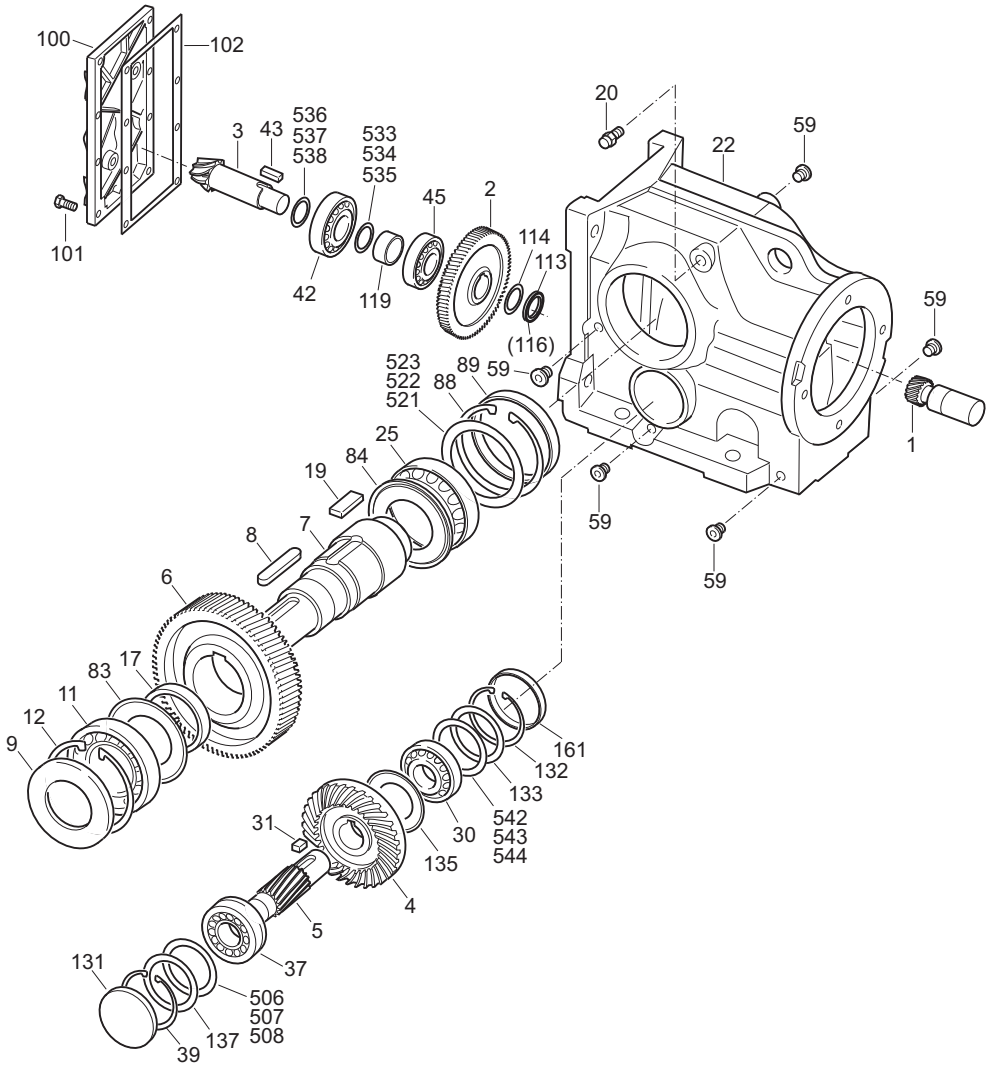

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Figure 3: Basic structure of helical-bevel gear units

Key

1 Pinion	25 Anti-friction bearing	102 Adhesive and sealing compound	522 Shim ring
2 Gear	30 Anti-friction bearing	113 Slotted round nut	523 Shim ring
3 Pinion shaft	31 Key	114 Multi-tang washer	533 Shim ring
4 Gear	37 Anti-friction bearing	116 Thread lock	534 Shim ring
5 Pinion shaft	39 Circlip	119 Spacer	535 Shim ring
6 Gear	42 Anti-friction bearing	131 Closing cap	536 Shim ring
7 Output shaft	43 Key	132 Circlip	537 Shim ring
8 Key	45 Anti-friction bearing	133 Spacer	538 Shim ring
9 Oil seal	59 Screw plug	135 Nilos ring	542 Shim ring
11 Anti-friction bearing	83 Nilos ring	161 Closing cap	543 Shim ring
12 Circlip	84 Nilos ring	506 Shim ring	544 Shim ring
17 Spacer	88 Circlip	507 Shim ring	
19 Key	89 Closing cap	508 Shim ring	
20 Breather valve	100 Gearcase cover	521 Shim ring	
22 Gearcase	101 Hex head bolt	521 Shim ring	

3.4 Basic structure of helical-worm gear units

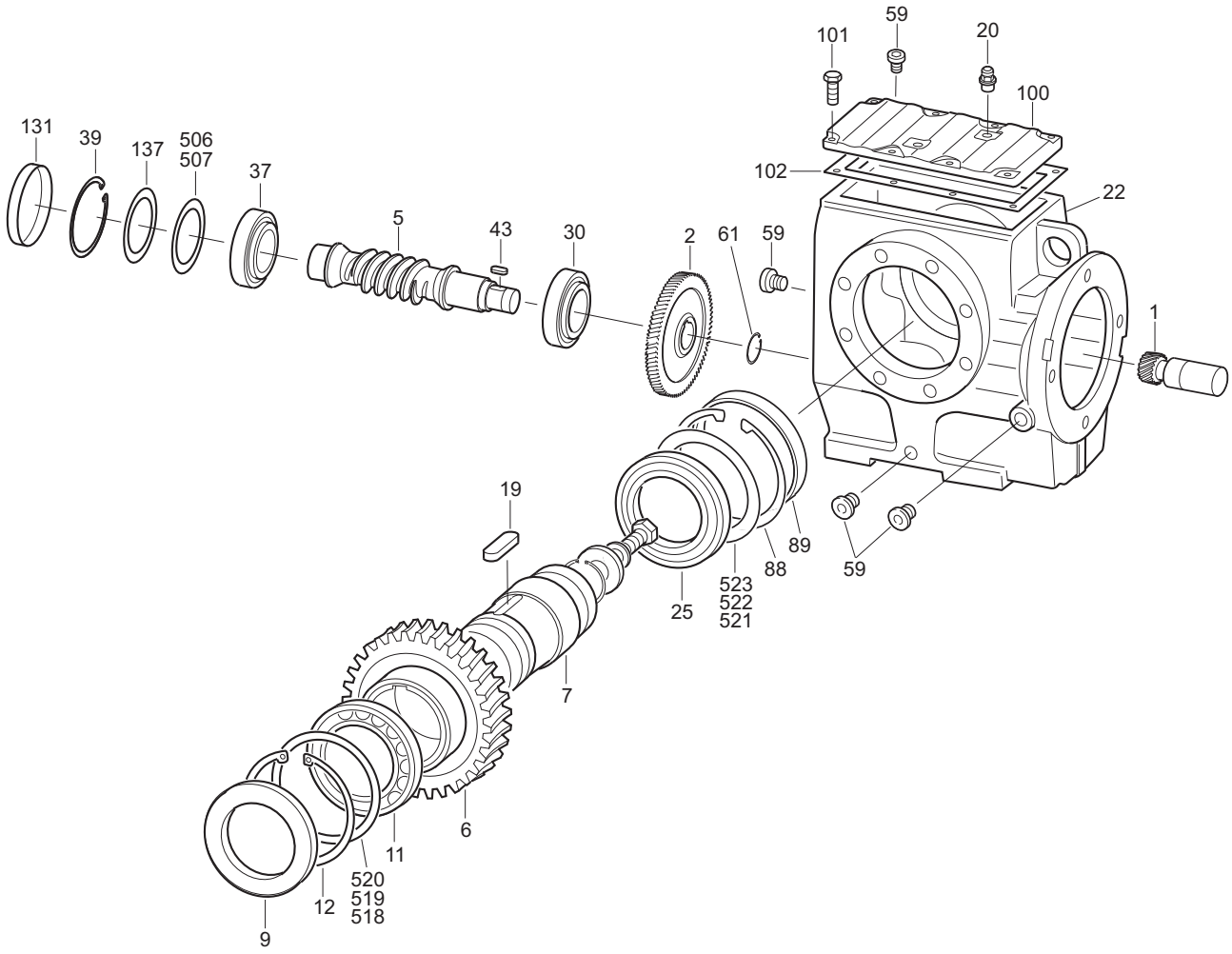

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Figure 4: Basic structure of helical-worm gear units

Key

1	Pinion	20	Breather valve	88	Circlip	518	Shim ring
2	Gear	22	Gearcase	89	Closing cap	519	Shim ring
5	Worm	25	Anti-friction bearing	100	Gearcase cover	520	Shim ring
6	Worm gear wheel	30	Anti-friction bearing	101	Hex head bolt	521	Shim ring
7	Output shaft	37	Anti-friction bearing	102	Rubber seal	522	Shim ring
9	Oil seal	39	Circlip	131	Closing cap	523	Shim ring
11	Anti-friction bearing	43	Key	137	Spacer		
12	Circlip	59	Screw plug	506	Shim ring		
19	Key	61	Circlip	507	Shim ring		

3.5 Basic structure of SPIROPLAN® gear units

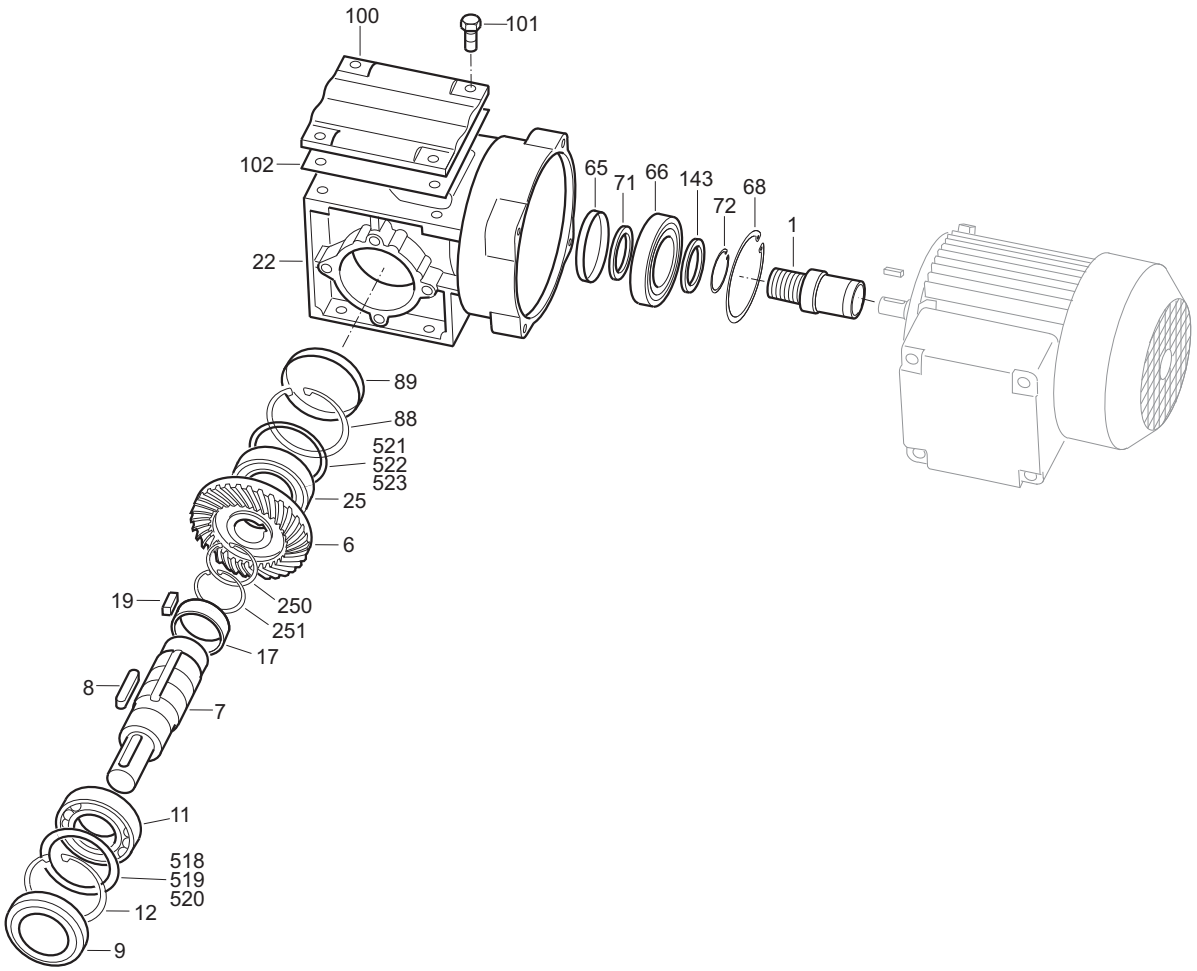

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Figure 5: Basic structure of SPIROPLAN® gear units

Key

1	Pinion	19	Key	88	Circlip	251	Circlip
6	Gear	22	Gearcase	89	Closing cap	518	Shim ring
7	Output shaft	25	Anti-friction bearing	100	Gearcase cover	519	Shim ring
8	Key	65	Oil seal	101	Hex head bolt	520	Shim ring
9	Oil seal	66	Anti-friction bearing	102	Gasket	521	Shim ring
11	Anti-friction bearing	71	Spacer	132	Circlip	522	Shim ring
12	Circlip	72	Circlip	183	Oil seal	523	Shim ring
17	Spacer	143	Spacer	250	Circlip		

3.6 Nameplate, unit designation

Sample nameplate

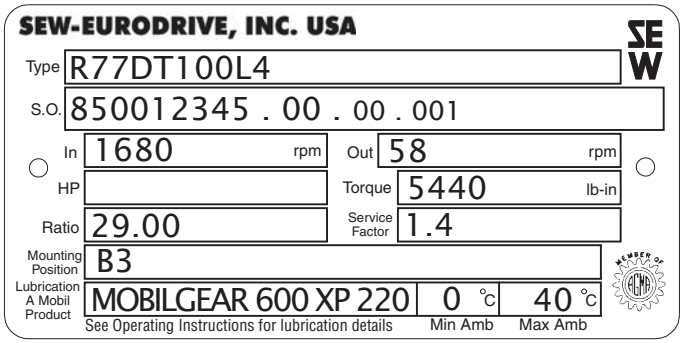

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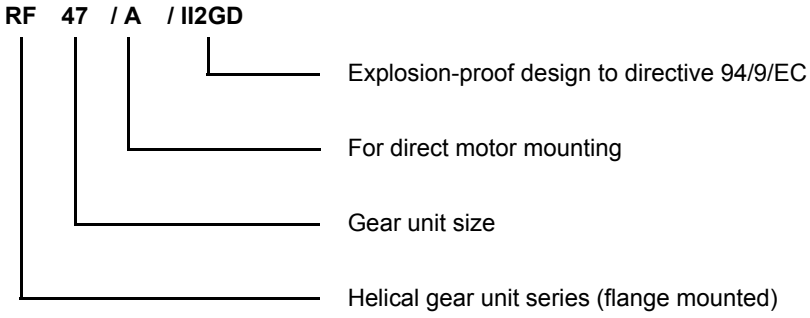
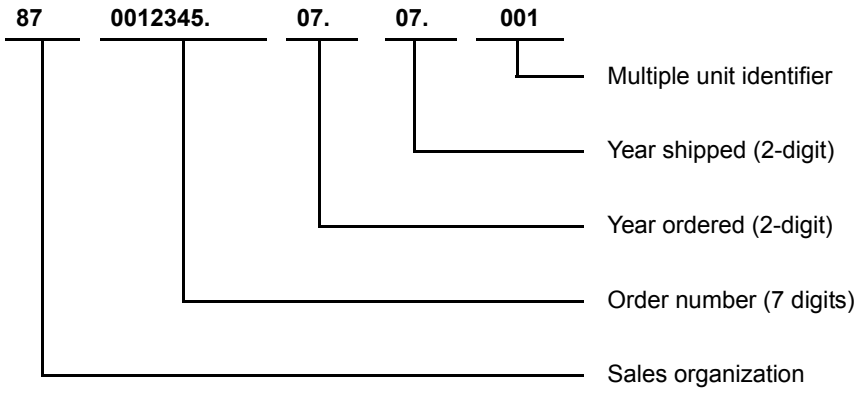
Figure 6: Sample nameplate

Unit designation

Example: Helical gear unit, category II2GD



Example: Serial number



4 Mechanical Installation

4.1 Required tools / aids

- Set of spanners
- Torque wrench for:
  - Shrink discs
  - AQH motor adapter
  - Input shaft assembly with centering shoulder
- Mounting device
- Shims and distance rings if necessary
- Fixing devices for input and output elements
- Lubricant (e.g. NOCO® Fluid)
- Bolt adhesive (for input shaft assembly with centering shoulder), e.g. Loctite® 243
- Standard parts are not part of the delivery

Installation tolerances

Shaft end	Flanges
Diameter tolerance in accordance with DIN 748 • ISO k6 for solid shafts with ∅ ≤ 50 mm (1.97") • ISO m6 for solid shafts with ∅ > 50 mm (1.97") • ISO H7 for hollow shafts • Center bore in accordance with DIN 332, shape DR	Centering shoulder tolerance in accordance with DIN 42948 • ISO j6 with b1 ≤ 230 mm (9.06") • ISO h6 with b1> 230 mm (9.06")

4.2 Prerequisites for assembly

Check that the following conditions have been met:

- The data on the nameplate of the gearmotor matches the voltage supply system.
- The drive has not been damaged during transportation or storage.
- Ensure that the following requirements have been met:
  - **For standard gear units:**
    Ambient temperature according to the lubricant table in Sec. "Lubricants" (see standard).
    The drive must not be assembled in the following ambient conditions:
    - Potentially explosive atmosphere
    - Oil
    - Acids
    - Gas
    - Vapors
    - Radiation
  - **For special versions:**
    The drive configured in accordance with the ambient conditions.
  - **For helical-worm / SPIROPLAN® W gear units:**
    No large external mass moments of inertia which could exert a retrodriving load on the gear unit.
    [At η' (retrodriving) = $2 - 1/\eta < 0.5$ self-locking]

- You must clean the output shafts and flange surfaces thoroughly to ensure they are free of anti-corrosion agents, contamination or similar. Use a commercially available solvent. Do not let the solvent come into contact with the sealing lips of the oil seals – danger of damage to the material!
- When the drive is installed in abrasive ambient conditions, protect the output end oil seals against wear.

4.3 Installing the gear unit

The gear unit or gearmotor is only allowed to be installed in the specified mounting position. SPIROPLAN® gear units are not dependent on the mounting position.

The support structure must have the following characteristics:

- Level
- Vibration damping
- Torsionally rigid

Maximum permitted flatness error for foot and flange mounting (approximate values with reference to DIN ISO 1101):

- Gear unit size ≤ 67: max. 0.4 mm (0.016")
- Gear unit size 77 ... 107: max. 0.5 mm (0.020")
- Gear unit size 137 ... 147: max. 0.7 mm (0.028")
- Gear unit size 157 ... 187: max. 0.8 mm (0.031")

Do not tighten the housing legs and mounting flanges against one another and ensure that you comply with the permitted overhung and axial loads!

Secure the gearmotors with bolts of quality 8.8.

Secure the following gearmotors with bolts of quality 10.9:

- RF37, R37F with flange ∅ 120 mm (4.72")
- RF47, R47F with flange ∅ 140 mm (5.51")
- RF57, R57F with flange ∅ 160 mm (6.30")

The oil checking and drain screws and the breather valves must be freely accessible!

At the same time, also check that the oil fill is as specified for the mounting position (see Sec. "Lubricants" / "Lubricant fill quantities" or refer to the information on the nameplate). The gear units are filled with the required oil volume at the factory. There may be slight deviations at the oil level plug as a result of the mounting position, which are permitted within the manufacturing tolerances.

Adjust the lubricant fill volumes and the position of the breather valve accordingly in the event of a change of mounting position.

Please contact our SEW customer service if you change the mounting position of K gear units to M5 or M6 or between M5 and M6.

Please contact our SEW customer service if you change the mounting position of size S47 S97 S gear units to mounting position M2.

Use plastic inserts (2 ... 3 mm thick) if there is a risk of electrochemical corrosion between the gear unit and the driven machine. The material used must have an electrical bleeder resistor < 10^9 Ω. Electrochemical corrosion can occur between various metals, for example, cast iron and high-grade steel. Also install the bolts with plastic washers! Ground the housing additionally – use the grounding bolts on the motor.

Installation in damp locations or in the open

Drives are supplied in corrosion-resistant versions for use in damp areas or in the open air. Repair any damage to the paint work (e.g. on the breather valve).

When mounting the motors onto AM, AQ, AR, AT adapters, seal the flange areas with a suitable sealing compound, e.g. Loctite® 574.

Gear unit venting

No breather plug is required for the following gear units:

- R07 in mounting positions M1, M2, M3, M5 and M6
- R17, R27 and F27 in mounting positions M1, M3, M5 and M6
- SPIROPLAN® W gear units

SEW-EURODRIVE supplies all other gear units with the breather valve installed and activated according to the particular mounting position.

Exceptions:

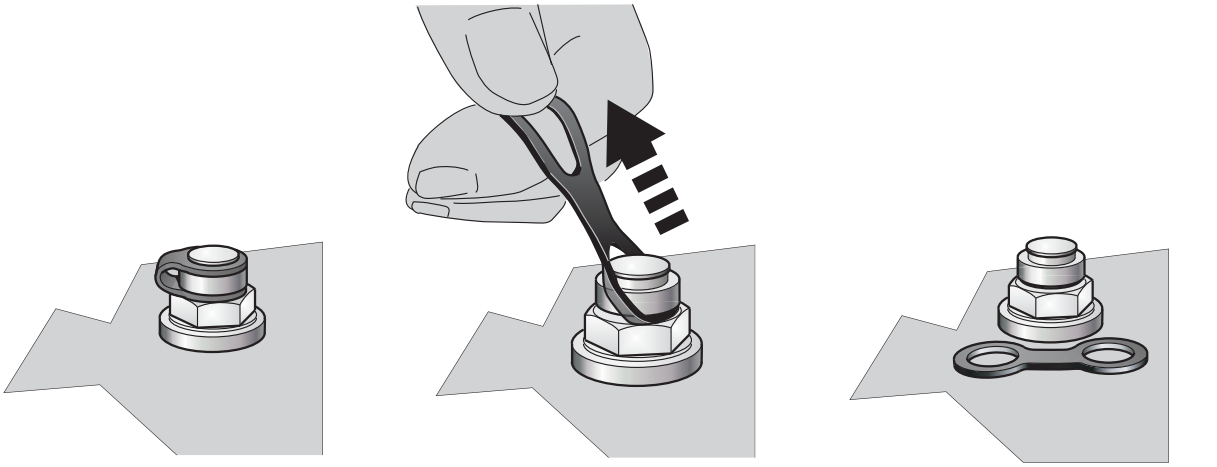
1. SEW supplies the following gear units with a screw plug on the vent hole provided:
   - Gear units for extended storage
   - Pivoted mounting positions, if possible
   - Gear units for mounting on a slant

   The breather valve is supplied with the unit. Before startup, you must install the breather plug in the location specified.
2. SEW supplies a breather valve in a plastic bag for **gear head units** requiring venting on the input end.
3. **Enclosed gear units** are supplied without a breather valve.

Activating the breather valve

If the breather valve has not been activated, you must remove the transport fixture from the breather valve before starting up the gear unit!

1. Breather valve with transport fixture
2. Remove the transport fixture
3. Breather valve activated



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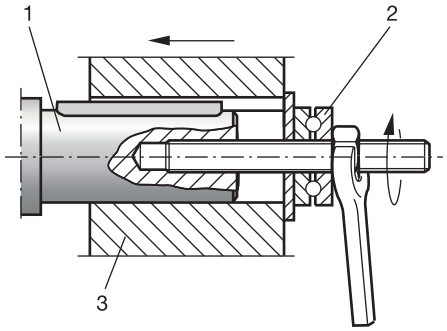
Painting the gear unit

If you paint or respray the drive, ensure that you cover the breather valve and oil seals carefully. Remove the strips of tape after completing the painting work.

4.4 Gear unit with solid shaft

Installing input and output elements

The following figure shows a mounting device for installing couplings or hubs on gear unit or motor shaft ends. It may be possible to dispense with the thrust bearing on the mounting device.



1) Gear shaft end
2) Thrust bearing
3) Coupling hub

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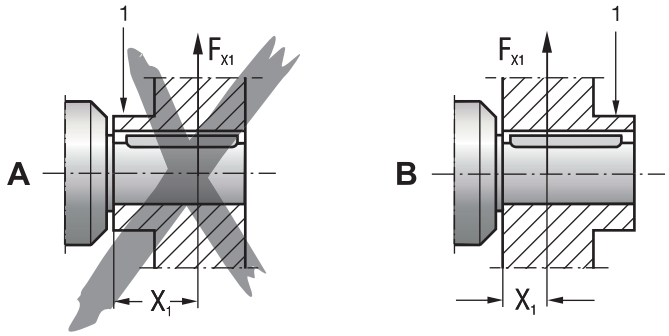
Avoid impermissibly high overhung loads: Install the gear or chain sprocket according to figure **B**.



1 = Hub

A = Unfavorable
B = Correct

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- Only use a mounting device for installing input and output elements. Use the center bore and the thread on the shaft end for positioning.
- **Never drive belt pulleys, couplings, pinions, etc. onto the shaft end by hitting them with a hammer This will damage the bearings, housing and the shaft!**
- **In the case of belt pulleys, make sure the belt is tensioned correctly in accordance with the manufacturer's instructions.**
- Power transmission elements should be balanced after fitting and must not give rise to any impermissible radial or axial forces (see the "Gearmotor" or "Explosion-Proof Drives" catalogs for permitted values).

Note:

Assembly is easier if you first apply lubricant to the output element or heat it up briefly to 80 ... 100 °C (176 ... 212°F).

Installing couplings

Couplings must be mounted and balanced according to the information provided by the coupling manufacturer:

a) Maximum and minimum clearance

b) Axial misalignment

c) Angular misalignment

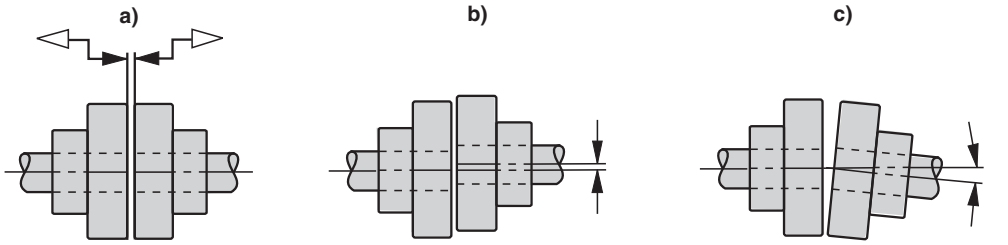

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Figure 7: Clearance and misalignment for coupling installation

Input and output elements such as belt pulleys, couplings, etc. must be protected against contact!

4.5 Torque arms for shaft mounted gear units

Do not place torque arms under strain during installation!

Parallel shaft helical gear units

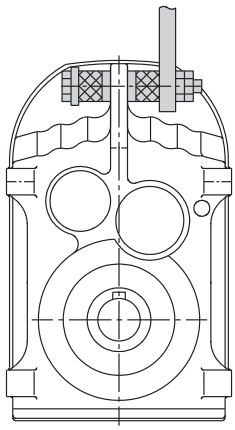

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Figure 8: Torque arm for parallel shaft helical gear units

Helical-bevel gear units

- Secure on each side of torque arm→ (1).
- Install connection end B as a mirror image of A.

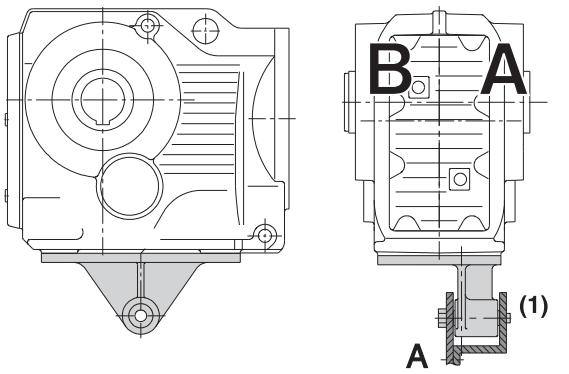

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Figure 9: Torque arm for helical-bevel gear units

Gear unit	Bolts	Tightening torque
KA37	4 × M10 × 25 – 8.8	48 Nm (425 lb-in)
KA47	4 × M10 × 30 – 8.8	48 Nm (425 lb-in)
KA67	4 × M12 × 35 – 8.8	86 Nm (761 lb-in)
KA77	4 × M16 × 40 – 8.8	210 Nm (1858 lb-in)
KA87	4 × M16 × 45 – 8.8	210 Nm (1858 lb-in)
KA97	4 × M20 × 50 – 8.8	410 Nm (3628 lb-in)
KA107	4 × M24 × 60 – 8.8	710 Nm (6283 lb-in)
KA127	4 × M36 × 130 – 8.8	2500 Nm (22125 lb-in)
KA157	4 × M36 × 130 – 8.8	2500 Nm (22152 lb-in)

Helical-worm gear units

- Secure on each side of torque arm → (1).

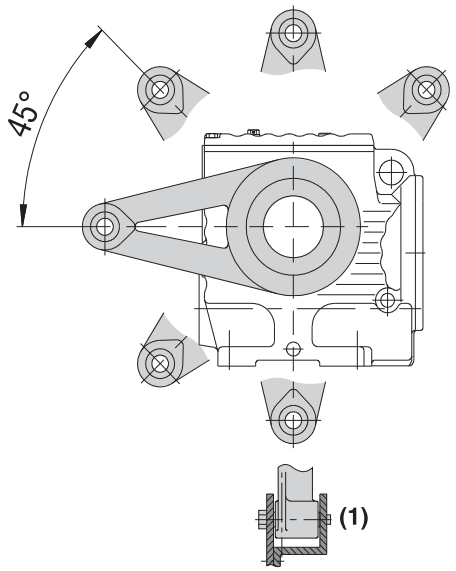


Figure 10: Torque arm for helical-worm gear units

Gear unit	Bolts	Tightening torque
SA37	M6 × 16 – 8.8	11 Nm (97 lb-in)
SA47	M8 × 20 – 8.8	25 Nm (222 lb-in)
SA57	M8 × 20 – 8.8	25 Nm (222 lb-in)
SA67	M12 × 25 – 8.8	86 Nm (761 lb-in)
SA77	M12 × 35 – 8.8	86 Nm (761 lb-in)
SA87	M16 × 35 – 8.8	210 Nm (1858 lb-in)
SA97	M16 × 35 – 8.8	210 Nm (1858 lb-in)

SPIROPLAN® W gear units

- Secure on each side of torque arm → (1)

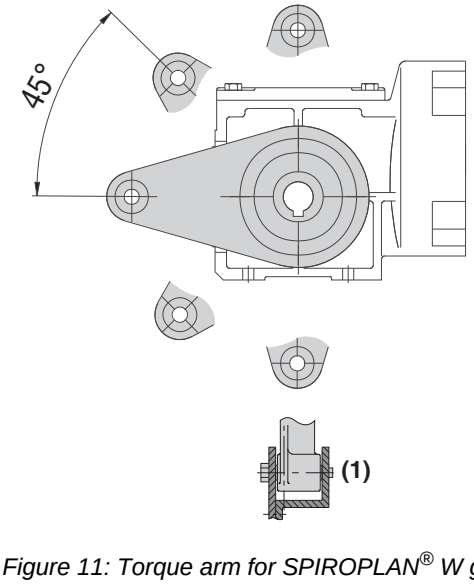


Figure 11: Torque arm for SPIROPLAN® W gear units

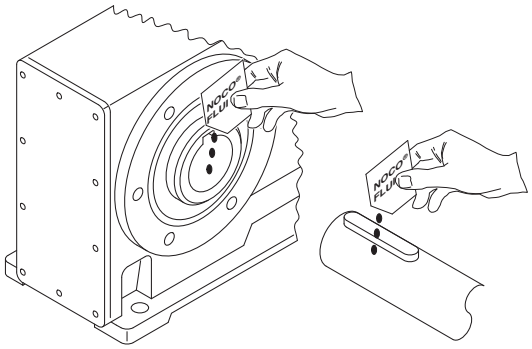
Gear unit	Bolts	Tightening torque
WA10	M6 × 16	11 Nm (97 lb-in)
WA20	M6 × 16	11 Nm (97 lb-in)
WA30	M6 × 16	11 Nm (97 lb-in)

4.6 Mounted gear unit with keyway or splined hollow shaft

For the configuration of customer shafts, please also refer to the design notes in the Gearmotors catalog!

Installation notes

1. Apply NOCO® fluid.



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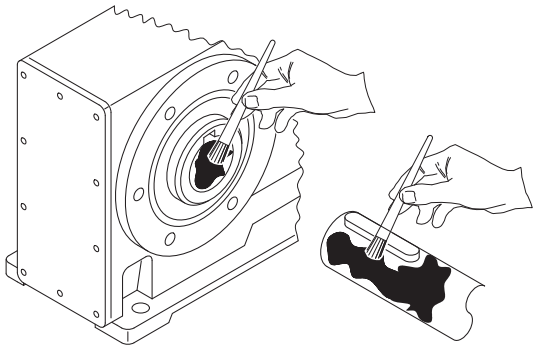
2. Distribute the NOCO® fluid carefully.



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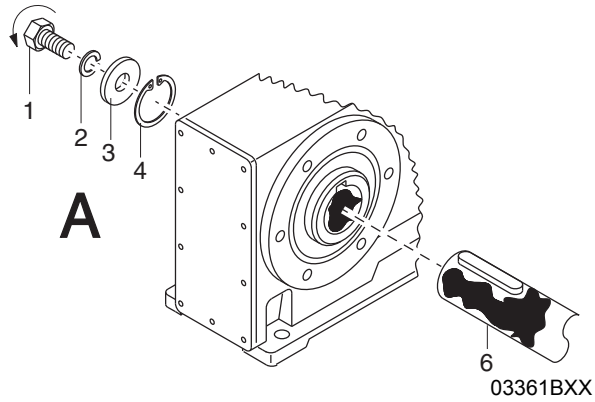
3. Install the shaft and secure it axially
   (mounting is facilitated by using a mounting device)
   3A: Mounting with standard scope of delivery



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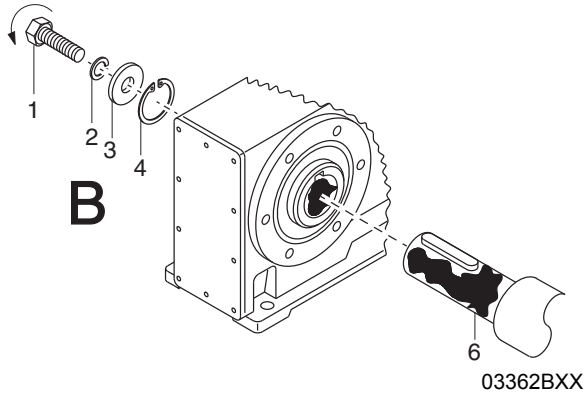
1 Short retaining bolt (standard scope of delivery)
2 Lock washer
3 Washer
4 Circlip
6 Customer shaft

3B: Assembly with SEW-EURODRIVE assembly/disassembly kit (→ page 26)

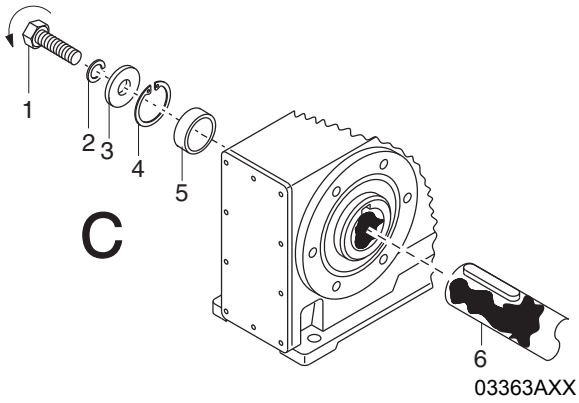
– Customer's shaft **with** contact shoulder



1 Retaining bolt
2 Lock washer
3 Washer
4 Circlip
6 Customer's shaft with contact shoulder

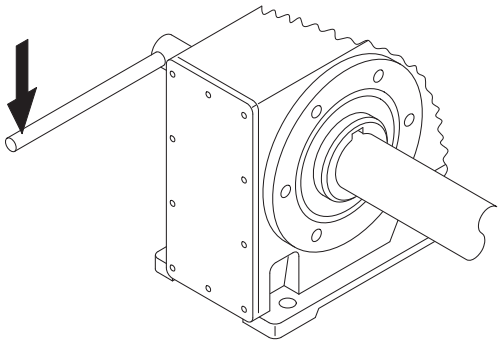
3C: Assembly with SEW-EURODRIVE assembly/disassembly kit (→ page 26)

– Customer's shaft **without** contact shoulder



1 Retaining bolt
2 Lock washer
3 Washer
4 Circlip
5 Spacer
6 Customer's shaft without contact shoulder

4. Tighten the retaining bolt to the appropriate torque (see table).



Bolt	Tightening torque
M5	5 Nm (44 lb-in)
M6	8 Nm (70 lb-in)
M10/12	20 Nm (177 lb-in)
M16	40 Nm (354 lb-in)
M20	80 Nm (708 lb-in)
M24	200 Nm (1770 lb-in)

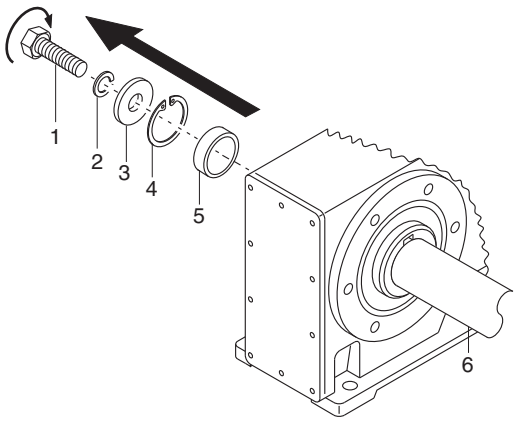
Note:

To avoid contact corrosion, we recommend that the customer's shaft should additionally be recessed between the two contact surfaces!

Removal notes

This description is only applicable when the gear unit was assembled using the installation/removal kit from SEW-EURODRIVE(→ page 26) (see the previous description, point 3B or 3C).

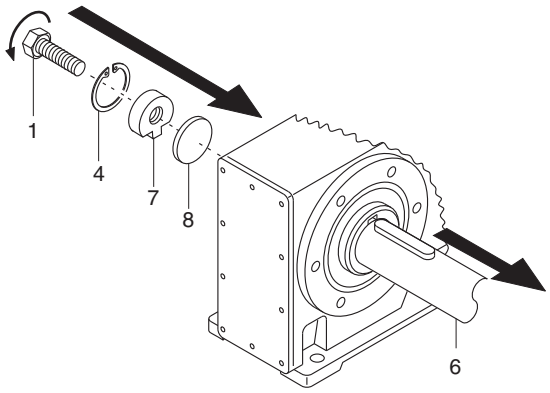
1. Loosen the retaining bolt [1].
2. Remove parts 2 to 4 and, if fitted, spacer 5.



1 Retaining bolt
2 Lock washer
3 Washer
4 Circlip
5 Spacer
6 Customer shaft

03366AXX

3. Insert the forcing washer [8] and the fixed nut [7] from the SEW-EURODRIVE installation/removal kit between the customer's shaft [6] and the circlip [4].
4. Re-insert the circlip [4].
5. Screw the retaining bolt [1] back in. Now you can force the gear unit off the shaft by tightening the bolt.



1 Retaining bolt
4 Circlip
6 Customer shaft
7 Fixed nut
8 Forcing washer

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SEW installation/removal kit

The SEW-EURODRIVE installation/removal kit can be ordered under the following part number. The kits are currently only available for metric shaft sizes.

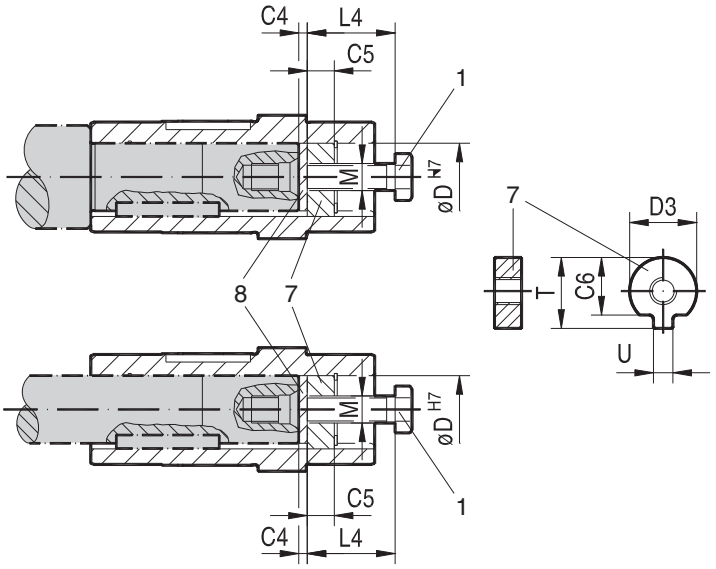

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Figure 12: SEW-EURODRIVE installation/removal kit

1 Retaining bolt
7 Fixed nut for disassembly
8 Forcing washer

Type	D^{H7} [mm]	M[1)]	C4 [mm]	C5 [mm]	C6 [mm]	$U^{-0.5}$ [mm]	$T^{-0.5}$ [mm]	$D3^{-0.5}$ [mm]	L4 [mm]	Part number of installation/removal kit
WA..10	16	M5	5	5	12	4.5	18	15.7	50	643 712 5
WA..20	18	M6	5	6	13.5	5.5	20.5	17.7	25	643 682 X
WA..20, WA..30, SA..37	20	M6	5	6	15.5	5.5	22.5	19.7	25	643 683 8
FA..27, SA..47	25	M10	5	10	20	7.5	28	24.7	35	643 684 6
FA..37, KA..37, SA..47, SA..57	30	M10	5	10	25	7.5	33	29.7	35	643 685 4
FA..47, KA..47, SA..57	35	M12	5	12	29	9.5	38	34.7	45	643 686 2
FA..57, KA..57, FA..67, KA..67, SA..67	40	M16	5	12	34	11.5	41.9	39.7	50	643 687 0
SA..67	45	M16	5	12	38.5	13.5	48.5	44.7	50	643 688 9
FA..77, KA..77, SA..77	50	M16	5	12	43.5	13.5	53.5	49.7	50	643 689 7
FA..87, KA..87, SA..77, SA..87	60	M20	5	16	56	17.5	64	59.7	60	643 690 0
FA..97, KA..97, SA..87, SA..97	70	M20	5	16	65.5	19.5	74.5	69.7	60	643 691 9
FA..107, KA..107, SA..97	90	M24	5	20	80	24.5	95	89.7	70	643 692 7
FA..127, KA..127	100	M24	5	20	89	27.5	106	99.7	70	643 693 5
FA..157, KA..157	120	M24	5	20	107	31	127	119.7	70	643 694 3

1) Retaining bolt

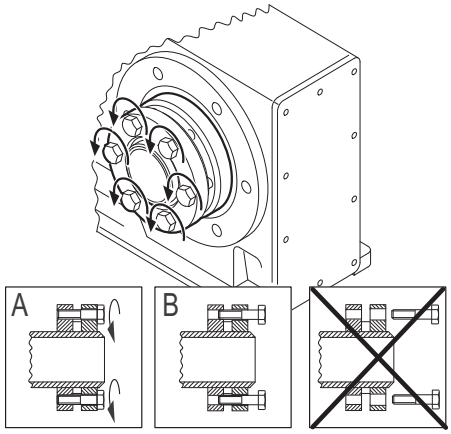
The SEW assembly kit for mounting the customer shaft is a recommendation from SEW-EURODRIVE. You must always check whether this design can compensate the axial loads. In particular applications (e.g. mounting mixer shafts), a different design may have to be used to secure the shaft axially. In these cases, customers can use their own devices. However, you must ensure that these designs do not cause potential sources of combustion according to DIN EN 13463 (for example, impact sparks).

4.7 Mounted gear units with shrink disc

Installation notes

- Do not tighten the locking bolts unless the shaft is installed - the hollow shaft could become deformed!

1. Loosen the locking bolts by a few turns (do not unscrew them completely!).



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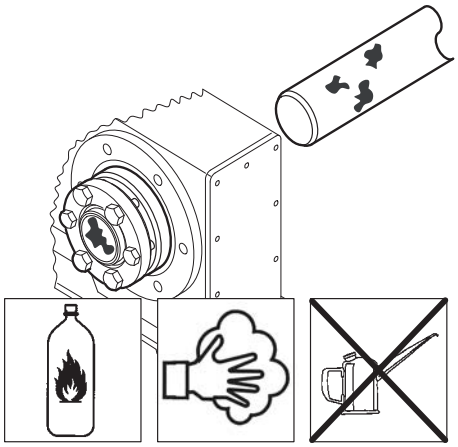
2. Carefully degrease the hollow shaft hole and the input shaft.



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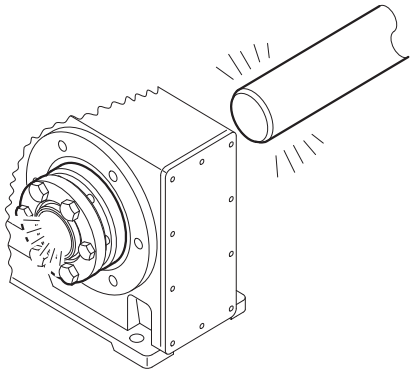
3. Hollow shaft/input shaft after degreasing



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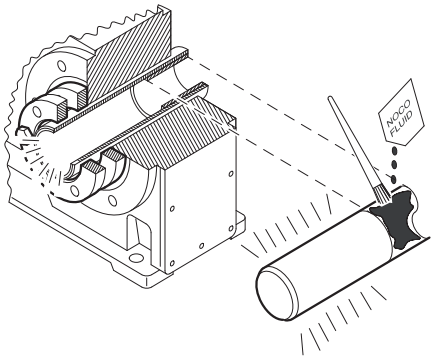
4. Apply NOCO® fluid to the input shaft[1] in the area of the bushing.



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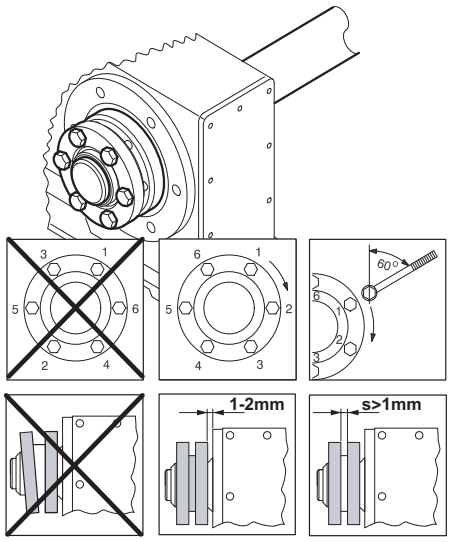
STOP

[1] It is essential to make sure that the clamping area of the shrink disk is free from grease!
For this reason, never apply NOCO® fluid directly to the bushing as the paste may be able to get into the clamping area of the shrink disk when the input shaft is put on.

5. Install the input shaft, making sure that the locking collars of the shrink disk are installed in parallel to each other[2)]. For gear unit housing **with a shaft collar**, mount the **shrink disc to the stop on the shaft collar**. For gear unit housing **without a shaft collar**, mount the **shrink disk with a clearance of 1 to 2 mm from the gear unit housing**. Tighten the locking bolts with the torque wrench by working round several times from one bolt to the next (not in diametrically opposite sequence) until the bolts cannot be tightened any more. See the following table for tightening torques.



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2)After installation

- There must be a gap s > 1 mm between the locking collars
- Grease the outside of the hollow shaft in the area of the shrink disk to prevent corrosion.

Gear unit type			Bolt	Nm (lb-in)	◁ max.[1)]
		SH37	M5	5 Nm (44 lb-in)	60°
KH37...77	FH37...77	SH47...77	M6	12 Nm (106 lb-in)	
KH87/97	FH87/97	SH87/97	M8	30 Nm (265 lb-in)	
KH107	FH107		M10	59 Nm (522 lb-in)	
KH127/157	FH127		M12	100 Nm (885 lb-in)	
KH167			M16	250 Nm (2212 lb-in)	
KH187			M20	470 Nm (4159 lb-in)	

1) Maximum tightening angle per cycle

Notes on removing the shrink disk

1. Unscrew the locking bolts evenly one after the other. Each locking bolt may only be unscrewed by about one quarter turn in the initial cycle. This is in order to avoid tilting and jamming the locking collars. Do not fully unscrew the locking bolts!
2. Remove the shaft or pull the hub off the shaft. (You must first remove any rust that may have formed between the hub and the end of the shaft.)
3. Pull the shrink disk off the hub.

Caution!

Risk of injury if the shrink disk is not removed correctly!

Cleaning and lubricating the shrink disk

There is no need to strip down and re-grease disassembled shrink disks before they are screwed back on.

The shrink disk only needs to be cleaned and re-greased if it is contaminated.

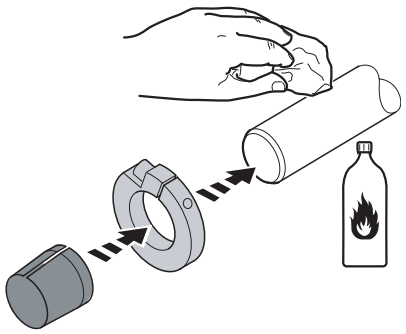
Use one of the following solid lubricants for the tapered surfaces.

Lubricant (Mo S2)	Sold as
Molykote 321 (lube coat)	Spray
Molykote spray (powder spray)	Spray
Molykote G Rapid	Spray or paste
Aemasol MO 19P	Spray or paste
Aemasol DIO-sétral 57 N (lube coat)	Spray

Grease the locking bolts with a multipurpose grease such as Molykote BR 2 or similar.

4.8 Mounted gear units with TorqLOC®

1. Clean the inside of the hollow shaft and the customer shaft. Ensure that all traces of grease or oil are removed.
2. Install the split ring and the bushing on the customer shaft.



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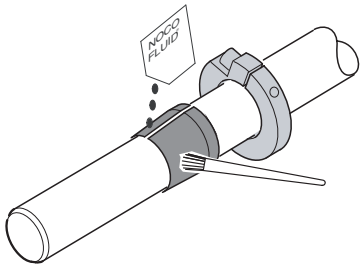
3. Apply NOCO® fluid to the bushing and distribute it carefully.



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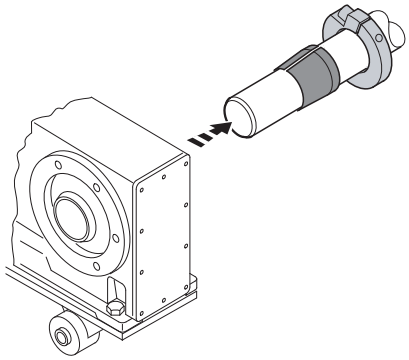
4. Push the gear unit onto the customer shaft.



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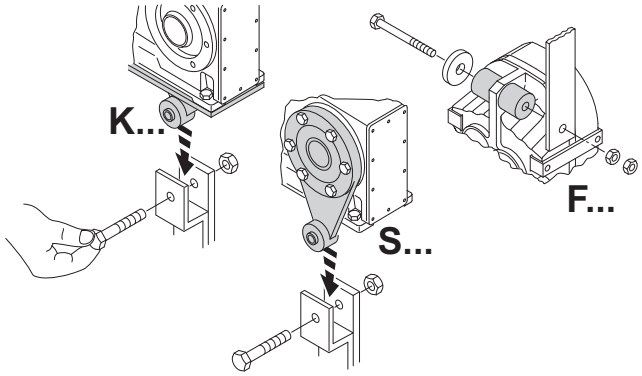
5. Preassemble the torque arm (do not tighten the bolts). Refer to "Torque arms for shaft mounted gear units" on page 21.



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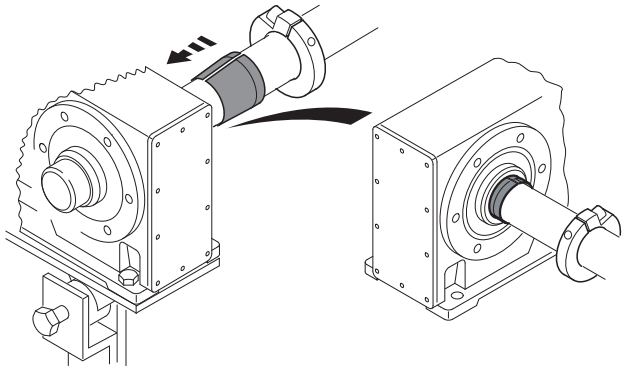
6. Push the bushing onto the gear unit up to the stop.



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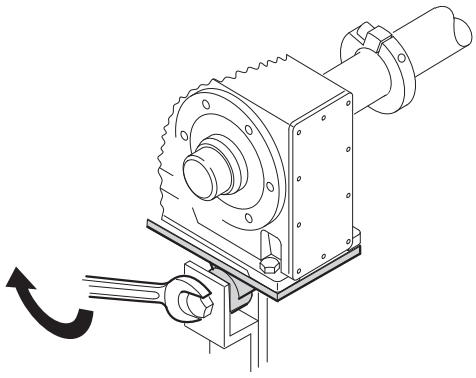
7. Tighten all the retaining bolts for the torque arm. Refer to "Torque arms for shaft mounted gear units" on page 21.



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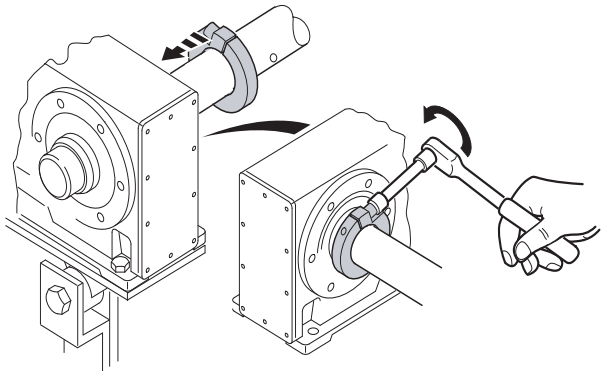
8. Secure the bushing with the split ring. Tighten the split ring on the bushing using the appropriate torque as specified in the following table.



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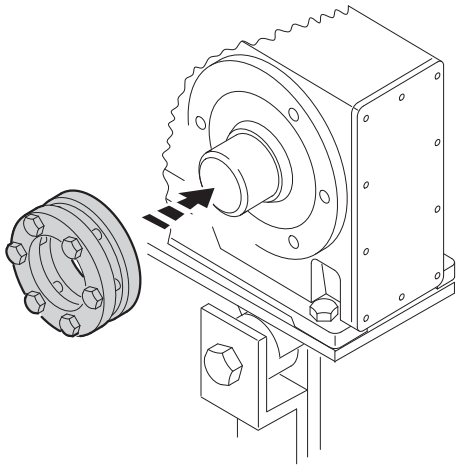
Type		Torque [Nm (lb-in)]	
KT/FT	ST	Steel	Stainless steel
-	37	18 (159)	7.5 (66)
37	47	18 (159)	7.5 (66)
47	57	18 (159)	7.5 (66)
57, 67	67	35 (309)	18 (159)
77	77	35 (309)	18 (159)
87	87	35 (309)	18 (159)
97	97	35 (309)	18 (159)

9. Slide the shrink disk onto the hollow shaft. Ensure that all bolts have been loosened.



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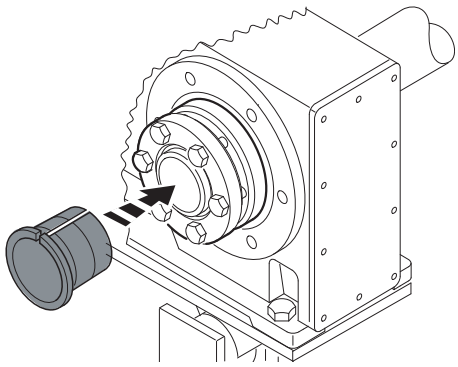
10. Push the counter bushing onto the customer shaft and into the hollow shaft or shrink disk right into the seat.



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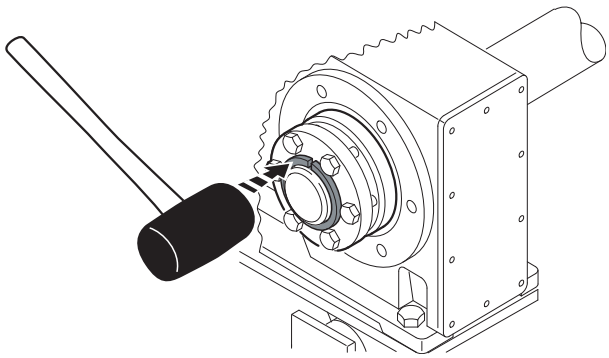
11. Tap lightly on the flange of the counter bushing to ensure that the socket is fitted securely in the hollow shaft.



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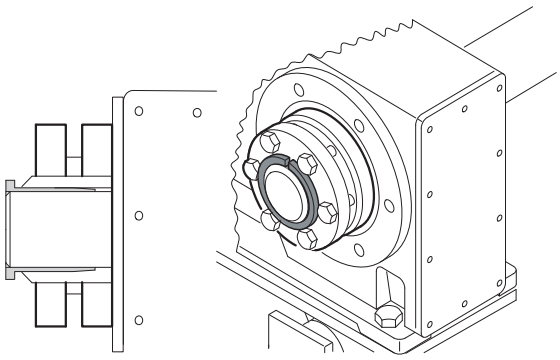
12. Ensure that the customer shaft is fitted in the counter bushing.



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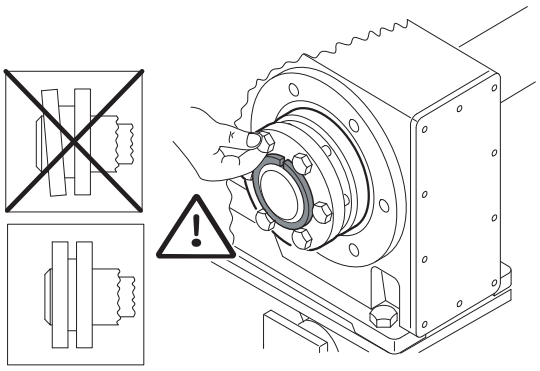
13. Tighten the bolts of the shrink disk by hand and ensure that the end rings of the shrink disc are parallel.



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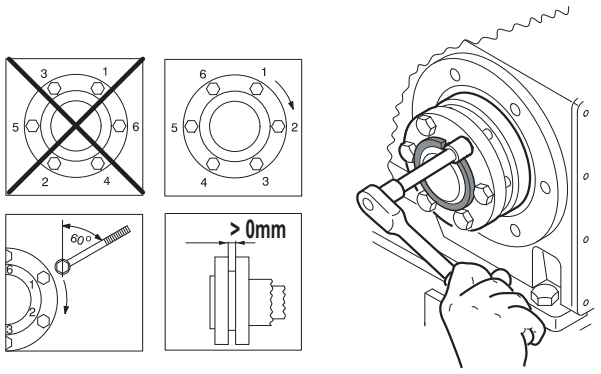
14. Tighten the locking bolts by working round several times from one bolt to the next (not in diametrically opposite sequence). See the table for tightening torques.

After installation, the remaining gap between the outer rings of the shrink discs must be > 0 mm.



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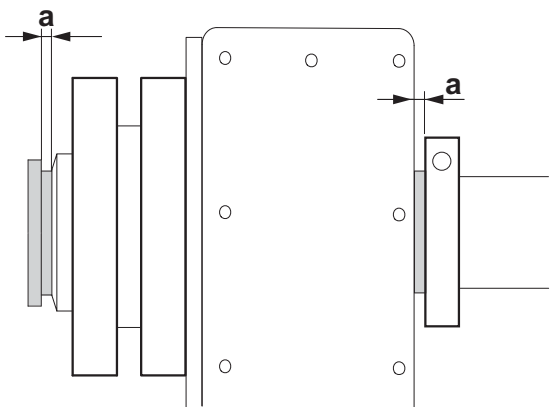
Type		Steel	Stainless steel
KT/FT	ST	Torque [Nm (lb-in)]	
-	37	4.1 (36)	6.8 (60)
37	47	10 (89)	6.8 (60)
47	57	12 (106)	6.8 (60)
57, 67	67	12 (106)	15 (133)
77	77	30 (266)	30 (266)
87	87	30 (266)	50 (443)
97	97	30 (266)	50 (443)

15. The distance between the counter bushing and the hollow shaft end and between the split ring and the clamping ring must not exceed the following values. The following table lists the maximum and minimum gap width.



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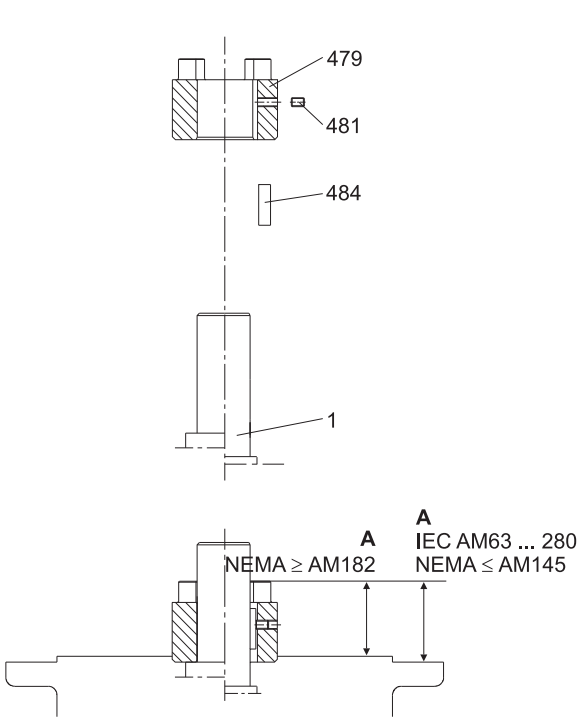
Type		Distance [mm (in)]	
KT/FT	ST	a min.	a max.
-	37	3.3 (0.130)	5.6 (0.220)
37	47	3.3 (0.130)	5.6 (0.220)
47	57	5.0 (0.197)	7.6 (0.299)
57, 67	67	5.0 (0.197)	7.6 (0.299)
77	77	5.0 (0.197)	7.6 (0.299)
87	87	5.8 (0.228)	8.6 (0.339)
97	97	5.8 (0.228)	8.6 (0.339)

4.9 AM adapter coupling

IEC adapter AM63 225 / NEMA adapter AM56 365



1. Clean the motor shaft and flange surfaces of the motor and adapter.
2. Remove the key from the motor shaft and replace it with the supplied key (484) (not AM63 and AM250).
3. Heat the coupling half (479) to approx. 80 – 100 °C (176 – 212°F) and push the coupling half onto the motor shaft until stop at motor shaft shoulder (position to point **A** for AM250 / AM280 and NEMA).
4. Secure key and coupling half using set screw (481) and tightening torque T_A on motor shaft according to the table.
5. Check point **A**.
6. Seal the contact surfaces between the adapter and motor using a suitable sealing compound.
7. Mount the motor on the adapter. When doing this, make sure the coupling jaws of the adapter shaft engage the plastic spider.

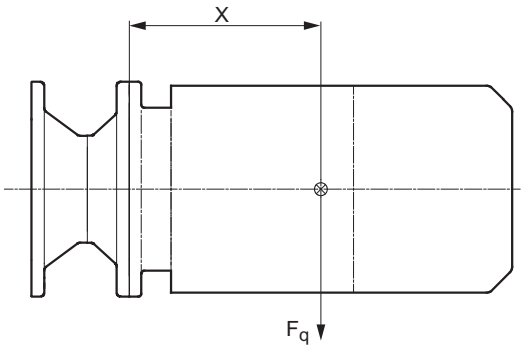
IEC AM	uom	63 / 71	80 / 90	100 / 112	132	160 / 180	200	225	250 / 280
A	mm	24.5	31.5	41.5	54	76	78.5	93.5	139
	in	0.965	1.240	1.634	2.126	2.992	3.091	3.681	5.472
T_A	Nm	1.5	1.5	4.8	4.8	10	17	17	17
	lb-in	13.3	13.3	42.5	42.5	88.5	150	150	150
Thread		M4	M4	M6	M6	M8	M10	M10	M10
NEMA AM	uom	56	143 / 145	182 / 184	213 / 215	254 / 256	284 / 286	324 / 326	364 / 365
A	mm	46	43	55	63.5	78.5	85.5	107	107
	in	1.811	1.693	2.165	2.500	3.091	3.366	4.213	4.213
T_A	Nm	1.5	1.5	4.8	4.8	10	17	17	17
	lb-in	13.3	13.3	42.5	42.5	88.5	150	150	150
Thread		M4	M4	M6	M6	M8	M10	M10	M10

To avoid contact corrosion, we recommend applying NOCO® fluid to the motor shaft before mounting the coupling half.

When installing a motor onto the adapter, you must use an anaerobic sealant to ensure that moisture cannot penetrate the adapter.

Permitted loads

The load data specified in the following table must not be exceeded when a motor is mounted.



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Adapter type			F_q [1] [N (lb)]	
IEC	NEMA	x [1] [mm (in)]	IEC adapter	NEMA adapter
AM63/71	**AM56**	77 (3.03)	530 (119)	410 (92)
AM80/90	**AM143/145**	113 (4.45)	420 (94)	380 (85)
AM100/112	**AM182/184**	144 (5.67)	2000 (450)	1760 (396)
AM132 [2]	**AM213/215** [2]	186 (7.32)	1600 (360)	1250 (281)
AM132..	**AM213/215**		4700 (1057)	3690 (830)
AM160/180	**AM254/286**	251 (9.88)	4600 (1034)	4340 (976)
AM200/225	**AM324 - AM365**	297 (11.69)	5600 (1259)	5250 (1180)
AM250/280	**-**	390 (15.35)	11200 (2518)	-

1) The maximum permitted weight of the attached motor F_{qmax} must be reduced proportionally as the distance between the adapter flange and the middle of the motor (x) increases. When this distance is reduced, the maximum permitted weight F_{qmax} cannot be increased.

2) Diameter of the adapter drive flange: 160 mm (6.30 in)

Adapter AM with backstop AM../RS

Check the direction of rotation of the drive before installation and startup. Please inform the SEW-EURODRIVE customer service if the direction of rotation is incorrect.

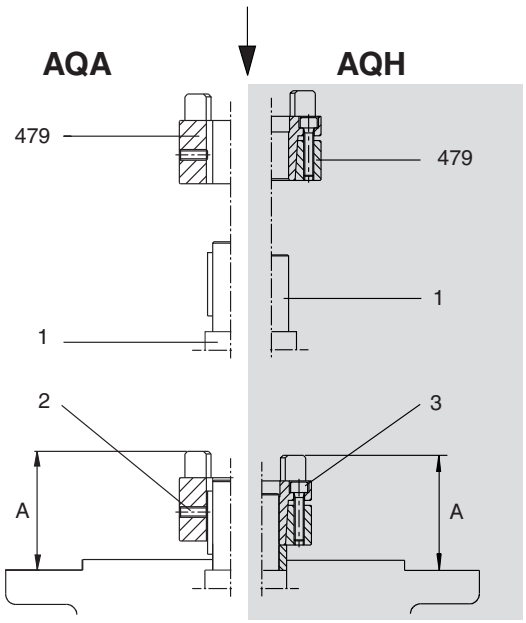
The backstop is maintenance-free in operation, and does not require any further maintenance work.

The backstops have a minimum lift-off speed depending on the size (→ following table). If the minimum lift-off speeds are violated, the backstops are subject to wear, and the resulting friction causes the temperature to increase.

Type	Maximum locking torque of backstop [Nm (lb-in)]	Minimum lift-off speed [rpm]
AM80/90/RS, AM143/145/RS	90 (797)	640
AM100/112/RS, AM182/184/RS	340 (3009)	600
AM132/RS, AM213/215/RS	700 (6195)	550
AM160/180/RS, AM254/286/RS	1200 (10620)	630
AM200/225/RS, AM324-365/RS	1450 (12832)	430

In rated operation, the lift-off speeds must not drop below the minimum values. The lift-off speeds are only permitted to drop below the minimum values during start-up or braking.

4.10 AQ adapter coupling



1 Motor shaft
2 Setscrew
3 Bolt

AQA = With keyway
AQH = Without keyway

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1. Clean the motor shaft and flange surfaces of the motor and adapter.
2. **Type AQH:** Unscrew the bolts of the coupling half (479) and loosen the conical connection.
3. Heat the coupling half 80°C – 100°C (176°F – 212°F) and push it onto the motor shaft.

   Type AQA / AQH: Up to clearance "A" (see table).

4. **Type AQH:** Tighten the bolts on the coupling half in diametrically opposite sequence (work round several times tightening the bolts evenly one after the other) until all bolts reach the tightening torque T_A specified in the table.

   Type AQA: Use a setscrew to secure the coupling half (see table).

5. Check the position of the coupling half (clearance "A", see table).

   Install motor onto the adapter making sure that the dogs of the two coupling halves engage in each other. The force that must be applied when joining the two coupling halves is dissipated after final assembly, so there is no risk of any axial load being applied to adjacent bearings.

Only for AQA, not permitted for AQH: To avoid contact corrosion, we recommend applying NOCO® fluid to the motor shaft before mounting the coupling half.

When installing a motor onto the adapter, you must use an anaerobic sealant to ensure that moisture cannot penetrate the adapter.

Setting dimensions, tightening torques

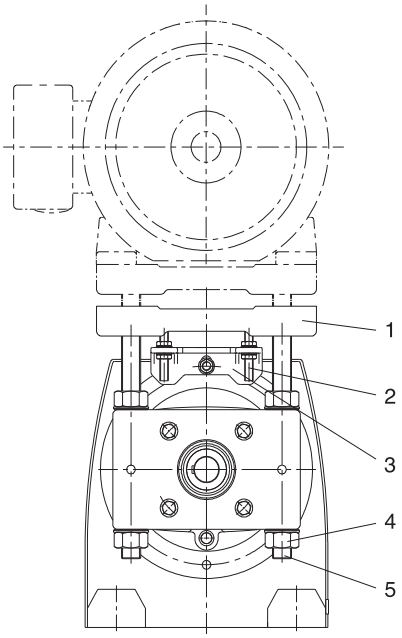
Type	Coupling size	Clearance "A" [mm (in)]	Bolts DIN 912		Tightening torque T_A [Nm (lb-in)]	
			AQA	AQH	AQA	AQH
AQA /AQH 80 /1/2/3	19/24	44.5 (1.75)	M5	M4	2 (17.7)	3 (26.5)
AQA /AQH 100 /1/2		39 (1.54)				
AQA /AQH 100 /3/4		53 (2.09)				
AQA /AQH 115 /1/2		62 (2.44)				
AQA /AQH 115 /3	24/28	62 (2.44)	M5	M5	2 (17.7)	6 (53.1)
AQA /AQH 140 /1/2		62 (2.44)				
AQA /AQH 140 /3	28/38	74.5 (2.93)	M8	M5	10 (88.5)	6 (53.1)
AQA /AQH 190 /1/2		76.5 (3.01)				
AQA /AQH 190 /3	38/45	100 (3.94)	M8	M6	10 (88.5)	10 (88.5)

4.11 AD input shaft assembly

Please refer to Sec. "Installing input and output shafts" for information on mounting of input elements.

Cover with motor mounting platform AD../P

Mounting the motor and adjusting the motor mounting platform.



1 Motor mounting platform
2 Stud bolt (only AD6/P / AD7/P)
3 Support (only AD6/P / AD7/P)
4 Nut
5 Threaded column

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1. Set the motor mounting platform to the required mounting position by evenly tightening the adjusting nuts. It may be necessary to remove the lifting eyebolt from helical gear units in order to achieve the lowest adjustment position. Touch up any damage to the paint work.
2. Align the motor on the motor mounting platform (shaft ends must be in alignment) and secure it.
3. Mount the input elements on the input shaft end and the motor shaft. Line them up with one another. Correct the motor position again if necessary.
4. Put on traction elements (V-belt, chain, etc.) and apply a preload by evenly adjusting the motor mounting platform. Do not stress the motor mounting platform and the columns against one another when doing this.
5. Tighten the threaded columns using the nuts which are not used for adjustment.

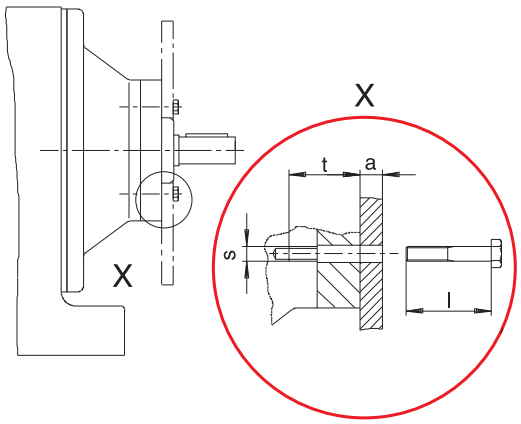
Only AD6/P and AD7/P:

Unscrew the nuts on the stud bolts before adjustment to allow the stud bolts to move axially in the support without restriction. Do not tighten the nuts until the final adjustment position has been achieved. Do not adjust the motor mounting platform using the support.

Type with centering shoulder AD../ZR

Mounting applications on the input shaft assembly with centering shoulder.

1. Retaining bolts of a suitable length must be used to secure the application. The length l of the new bolts is calculated as follows:



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l = t + a
t = Screw-in depth (see table)
a = Thickness of the application
s = Retaining thread (see table)

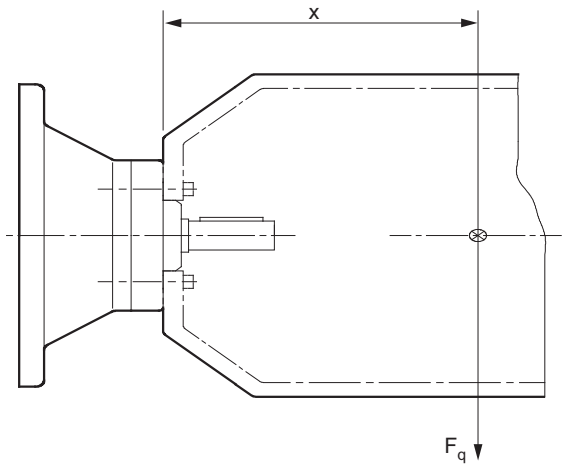
Round down the calculated bolt length to the next smaller standard length.

2. Remove the retaining bolts from the centering shoulder.
3. Clean the contact surface and the centering shoulder.
4. Clean the threads of the new bolts and apply a bolt locking compound (e.g. Loctite 243) to the first few threads.
5. Position the application against the centering shoulder and tighten the retaining bolts to the specified tightening torque T_A (see table).

Type	Screw-in depth t [mm (in)]	Retaining thread s	Tightening torque T_A for connection bolts in strength class 8.8 [Nm (lb-in)]
AD2/ZR	25.5 (1.00)	M8	25 (221)
AD3/ZR	31.5 (1.24)	M10	48 (425)
AD4/ZR	36 (1.42)	M12	86 (761)
AD5/ZR	44 (1.73)	M12	86 (761)
AD6/ZR	48.5 (1.91)	M16	210 (1859)
AD7/ZR	49 (1.93)	M20	410 (3629)
AD8/ZR	42 (1.65)	M12	86 (761)

Permitted loads

The load values specified in the following table must not be exceeded.



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Type	x[1)] [mm (in)]	F_q[1)] [N (lb)]
AD2/ZR	193 (7.60)	330 (74)
AD3/ZR	274 (10.79)	1400 (315)
AD4/ZR[2)]	361 (14.21)	1120 (252)
AD4/ZR		3300 (742)
AD5/ZR	487 (19.17)	3200 (719)
AD6/ZR	567 (22.32)	3900 (877)
AD7/ZR	663 (26.10)	10000 (2248)
AD8/ZR	516 (20.31)	4300 (967)

1) Maximum load values for connection bolts in strength class 8.8. The maximum permitted weight of the attached motor F_{qmax} must be reduced proportionally as the distance between the adapter flange and the middle of the motor (x) increases When this distance is reduced, the F_{qmax} cannot be increased.

2) Diameter of the adapter output flange: 160 mm (6.30 in)

Cover with backstop AD../RS

Check the direction of rotation of the drive before installation and startup. Please inform the SEW-EURODRIVE customer service if the direction of rotation is incorrect.

The backstop is maintenance-free in operation, and does not require any further maintenance work.

The backstops have a minimum lift-off speed depending on the size (→ following table). If the minimum lift-off speeds are violated, the backstops are subject to wear, and the resulting friction causes the temperature to increase.

Type	Maximum locking torque of backstop [Nm (lb-in)]	Minimum lift-off speed [rpm]
AD2/RS	90 (797)	640
AD3/RS	340 (3009)	600
AD4/RS	700 (6195)	550
AD5/RS	1200 (10620)	630
AD6/RS	1450 (12833)	430
AD7/RS	1450 (12833)	430
AD8/RS	2860 (25311)	430

In rated operation, the lift-off speeds must not drop below the minimum values. The lift-off speeds are only permitted to drop below the minimum values during start-up or braking.

5 Startup

Prior to startup check that the oil level is as specified for the mounting position. The oil checking and drain screws and the breather valves must be freely accessible.

5.1 Startup of helical-worm and SPIROPLAN® W gear units

Note: The direction of rotation of the output shaft in series S..7 helical-worm gear units has been changed from CW to CCW; this is different from the S..2 series. Change direction of rotation: Swap over two motor feeder cables.

Run-in period

SPIROPLAN® and helical-worm gear units require a run-in period of at least 24 hours before reaching their maximum efficiency. A separate run-in period applies for each direction of rotation if the gear unit is operated in both directions of rotation. The table shows the average power reduction during the run-in period.

No. of starts	Worm		Spiroplan®	
	Power reduction	i range	Power reduction	i range
1 start	ca. 12 %	ca. 50...280	ca. 15 %	approx. 40 ... 75
2 start	ca. 6 %	ca. 20...75	ca. 10 %	ca. 20...30
3 start	ca. 3 %	ca. 20...90	ca. 8 %	ca. 15
4 start	-	-	ca. 8 %	ca. 10
5 start	ca. 3 %	ca. 6...25	ca. 5 %	ca. 8
6 start	ca. 2 %	ca. 7...25	-	-

5.2 Startup of helical, parallel shaft helical and helical-bevel gear units

No special startup instructions are required for helical, parallel shaft helical and helical-bevel gear units providing the gear units have been installed in accordance with Sec. "Mechanical Installation".

6 Inspection and Maintenance

6.1 Inspection and maintenance intervals

Frequency	What to do?
• Every 3000 machine hours, at least every 6 months.	• Check oil and oil level. • Check the seals visually for leakage. • For gear units with a torque arm: Check the rubber buffer and change it, if necessary
• Depending on the operating conditions (see chart below), every 3 years at the latest. • According to oil temperature.	• Change mineral oil.
	• Replace anti-friction bearing grease (recommendation). • Replace oil seal (do not install it in the same track).
• Depending on the operating conditions (see chart below), every 5 years at the latest. • According to oil temperature.	• Change synthetic oil
	• Replace anti-friction bearing grease (recommendation). • Replace oil seal (do not install it in the same track).
• Gear unitsR07, R17, R27, F27 and Spiroplan® are have lubrication for life and are therefore maintenance-free	
• Varying (depending on external factors).	• Touch up or renew the surface/anticorrosion coating.

6.2 Lubricant change intervals

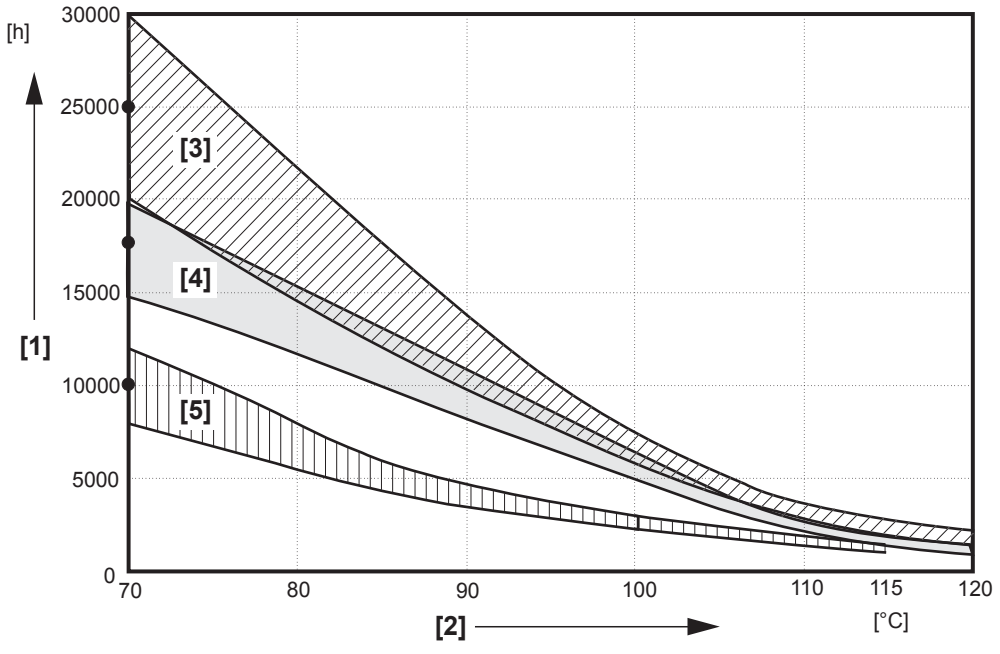

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Figure 13: Oil change intervals for standard gear units under normal environmental conditions

[1] Operating hours
[2] Sustained oil bath temperature
- Average value per oil type at 70 °C

[3] CLP PG
[4] CLP HC / HCE
[5] CLP / HLP / E

6.3 Inspection and maintenance of the gear unit

Do not intermix synthetic lubricants and do not mix synthetic and mineral lubricants together!

The standard lubricant is mineral oil (except for Spiroplan® gear units).

The position of the oil level and oil drain plug and the breather valve depends on the mounting position. Refer to the diagrams of the mounting positions.

Checking the oil level

1. **De-energize the gearmotor and secure it to prevent it from being switched on inadvertently!**

   Wait until the gear unit has cooled off – Danger of burns!
2. Refer to Sec. "Installing the gear unit" when changing the mounting position!
3. For gear units with an oil level plug: Remove the oil level plug, check the fill level and correct it if necessary. Screw the oil level plug back in.

Checking the oil

1. **De-energize the gearmotor and secure it to prevent it from being switched on inadvertently!**

   Wait until the gear unit has cooled off – Danger of burns!
2. Remove a little oil from the oil drain plug.
3. Check the oil consistency.
   - Viscosity
   - If you can see that the oil is heavily contaminated, we recommend that you change the oil even if this is outside the service intervals specified in "Inspection and maintenance periods".
4. For gear units with an oil level plug: Remove the oil level plug, check the fill level and correct it if necessary. Screw the oil level plug back in.

Changing the oil

Only change the oil when the gear unit is at operating temperature.

De-energize the gearmotor and secure it to prevent it from being switched back on inadvertently!

Wait until the gear unit cools down - Danger of burns!

Note: The gear unit must still be warm otherwise the high viscosity of excessively cold oil will make it harder to drain the oil correctly.

With oil drain plug / oil level screw

1. Place a container underneath the oil drain plug
2. Remove the oil level plug, breather plug/breather valve and oil drain plug.
3. Drain all the oil.
4. Screw in the oil drain plug.
5. Pour in new oil of the same type through the vent hole (if changing the oil type, please first contact our customer service). Do not mix synthetic lubricants.
   - Pour in the volume of oil in accordance with the mounting position (see Sec. "Lubricant fill quantities") or as specified on the nameplate.
   - Check at the oil level plug.
6. Screw the oil level plug back in
7. Screw in the breather plug/breather valve.

Without oil drain plug / oil level plug

1. Remove cover plate.
2. Drain the oil through the cover plate opening.
3. Pour in new oil of the same type through the vent hole (if changing the oil type, please first contact our customer service). Do not mix synthetic lubricants.
   – Pour in the volume of oil in accordance with the mounting position (see Sec. "Lubricant fill quantities") or as specified on the nameplate.
4. Check the oil level (→ Sec. "Check oil level for gear units with oil level plug")
5. Attach cover plate (observe the tightening torque and series → Sec. "Check the oil level for gear units without an oil level plug")

Changing the oil seal

1. **De-energize the gearmotor and secure it to prevent it from being switched on inadvertently!**

   Wait until the gear unit has cooled off – Danger of burns!
2. When changing the oil seal, ensure that there is a sufficient grease reservoir between the dust lip and protective lip, depending on the type of gear unit.
3. If you use double oil seals, the space has to be filled one-third with grease.

6.4 Inspection / maintenance of AM / AQA adapters

Frequency	What to do?
• Every 3000 machine hours, at least every 6 months	• Check torsional play • Visually check the elastic annular gear • Check the adapter visually for leakage
• After 25000 - 30000 machine hours	• Renew the anti-friction bearing grease • Replace oil seal (do not install it in the same track) • Change the elastic coupling spider

6.5 Inspection / maintenance of AD adapters

Frequency	What to do?
• Every 3000 machine hours, at least every 6 months	• Check running noise for possible bearing damage • Check the adapter visually for leakage
• After 25000 - 30000 machine hours	• Renew the anti-friction bearing grease
	• Change the oil seal

7 Malfunctions

Customer service

Please have the following information to hand if you require the assistance of our customer service:
- Data from the nameplate (complete)
- Nature and extent of the fault
- Time and peripheral circumstances of the fault
- Presumed cause

7.1 Gear unit malfunctions

Problem	Possible cause	Remedy
Unusual, regular running noise	A Meshing/grinding noise: Bearing damage. B Knocking noise: Irregularity in the gearing	A Check the oil (see Sec. "Inspection and Maintenance"), change bearings B Contact customer service
Unusual, irregular running noise	Foreign bodies in the oil	• Check the oil (see Sec. "Inspection and Maintenance") • Stop the drive, contact customer service
Oil leaking[1)] • From the gear cover plate • From the motor flange • From the motor oil seal • From the gear unit flange • From the output end oil seal	A Rubber seal on the gear cover plate leaking B Seal defective C Gear unit not vented	A Tighten the bolts on the gear cover plate and observe the gear unit. Oil still leaking: Contact customer service B Contact customer service C Vent the gear unit (see Sec. "Mounting Positions")
Oil leaking from breather valve	A Too much oil B Drive operated in incorrect mounting position C Frequent cold starts (oil foams) and/or high oil level	A Correct the oil level (see Sec. "Inspection and Maintenance") B Mount the breather valve correctly (see Sec. "Mounting Positions") and correct the oil level (see "Lubricants")
Output shaft does not turn although the motor is running or the input shaft is rotated	Connection between shaft and hub in gear unit interrupted	Send in the gear unit/gearmotor for repair

1) Short-term oil/grease leakage at the oil seal is possible in the run-in phase (24 hours running time).

7.2 AM / AQA / AL adapter malfunctions

Problem	Possible cause	Remedy
Unusual, regular running noise	Meshing/grinding noise: Bearing damage	Contact SEW-EURODRIVE customer service
Oil leaking	Seal defective	Contact SEW-EURODRIVE customer service
Output shaft does not turn although the motor is running or the input shaft is rotated	Connection between shaft and hub in gear unit interrupted	Send the gear unit to SEW-EURODRIVE for repair.
Change in running noise and / or vibrations occur	A Annular gear wear, short-term torque transfer through metal contact B Bolts to secure hub axially are loose.	A Change the coupling spider B Tighten the bolts
Premature wear in annular gear	A Contact with aggressive fluids / oil; ozone influence; too high ambient temperatures etc, which can cause a change in the physical properties of the annular gear. B Impermissibly high ambient/contact temperature for the annular gear; maximum permitted temperature –20 °C to +80 °C. C Overload	Contact SEW-EURODRIVE customer service

7.3 AD input shaft assembly malfunctions

Problem	Possible cause	Remedy
Unusual, regular running noise	Meshing/grinding noise: Bearing damage.	Contact SEW-EURODRIVE customer service
Oil leaking	Seal defective	Contact SEW-EURODRIVE customer service
Output shaft does not turn although the input shaft is rotated.	Connection between shaft and hub in gear unit or cover interrupted	Send the gear unit to SEW-EURODRIVE for repair.

8 Mounting Positions

8.1 General information on mounting positions

Mounting position designation

SEW differentiates between six mounting positions M1 ... M6 for gear units. The following figure shows the spatial orientation of the gearmotor in mounting positions M1 ... M6.

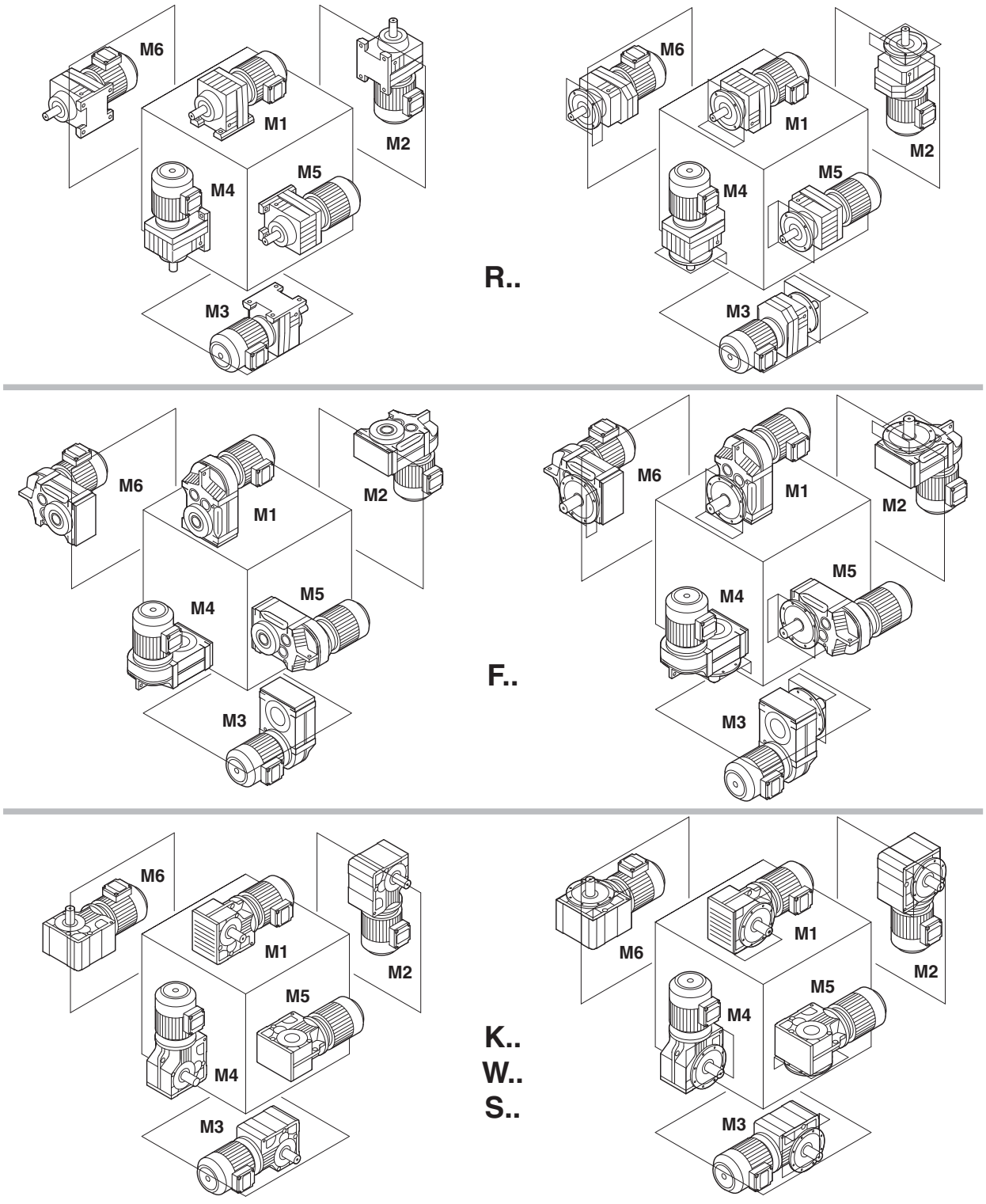

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Figure 14: Depiction of mounting positions M1 ... M6

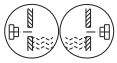
8.2 Key to the mounting position sheets

SPIROPLAN® gearmotors do not depend on any particular mounting position. However, mounting positions M1 to M6 are also shown for SPIROPLAN® gearmotors to assist you in working with this documentation.

Important: SPIROPLAN® gearmotors cannot be equipped with breather valves, oil level plugs or drain plugs.

Symbols used

The following table shows the symbols used in the mounting position sheets and what they mean:

Symbol	Meaning
	Breather valve
	Oil level plug
	Oil drain plug

Churning losses

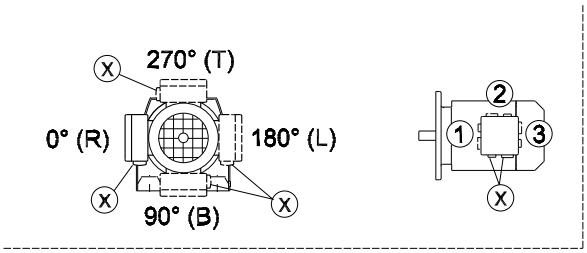
Increased churning losses may arise in some mounting positions. Contact SEW-EURODRIVE in case of the following combinations:

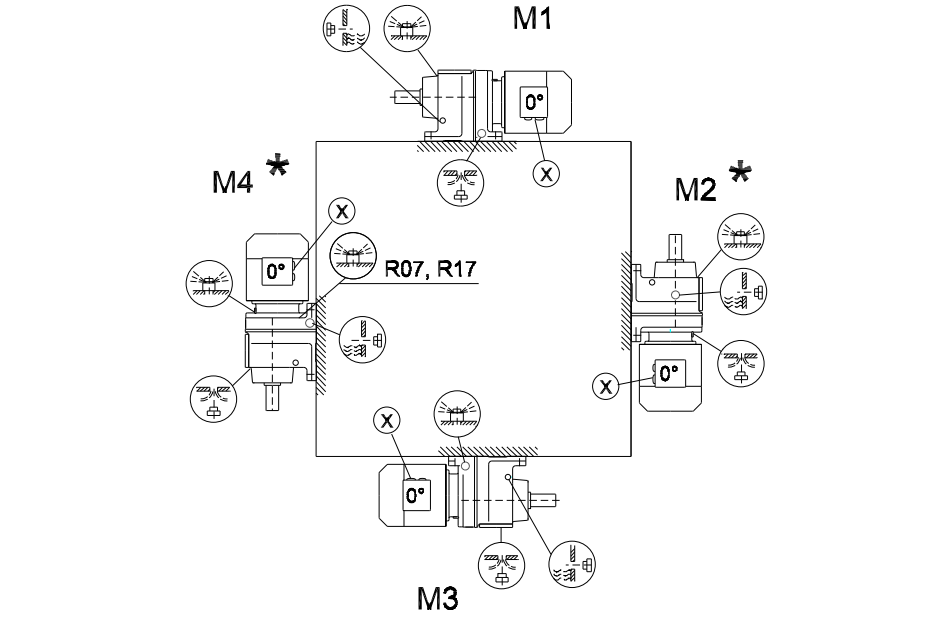
Mounting position	Gear unit type	Gear unit size	Input speed [rpm]
M2, M4	R	97 ... 107	> 2500
		> 107	>1500
M2, M3, M4, M5, M6	F	97 ... 107	> 2500
		> 107	> 1500
	K	77 ... 107	> 2500
		> 107	> 1500
	S	77 ... 97	> 2500

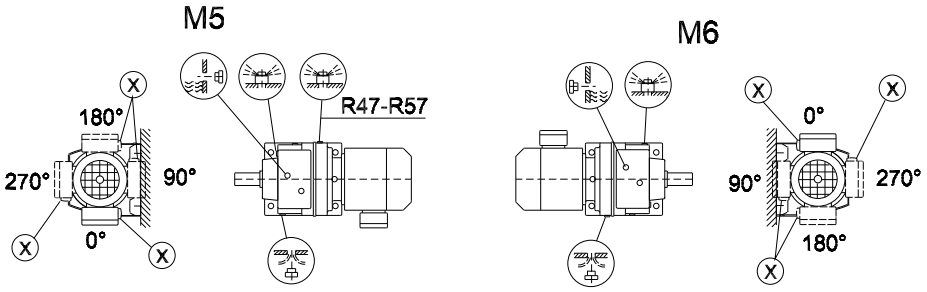
8.3 Mounting positions for R helical gearmotors

R07-R167

04 040 200



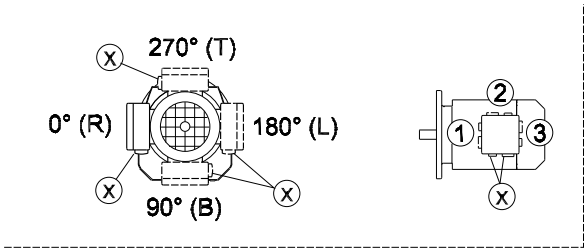




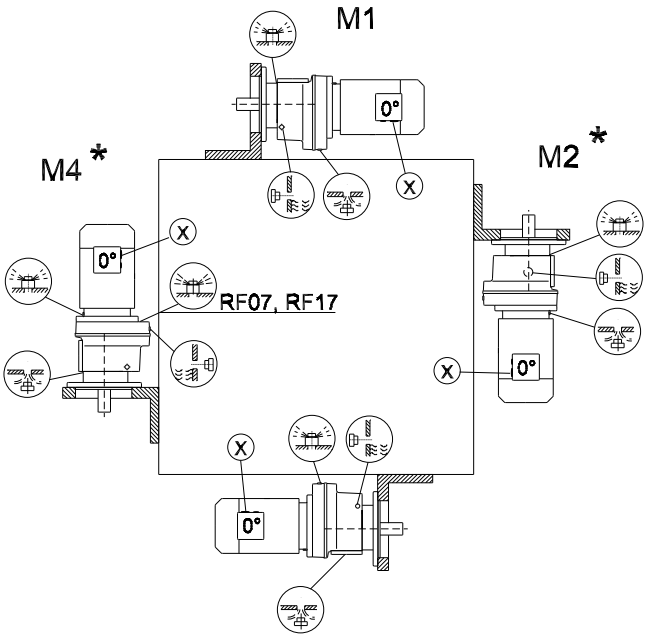
R07		M1, M2 , M3 , M5 , M6
R17, R27		M1, M3 , M5 , M6
R07, R17, R27		
R47, R57		M5

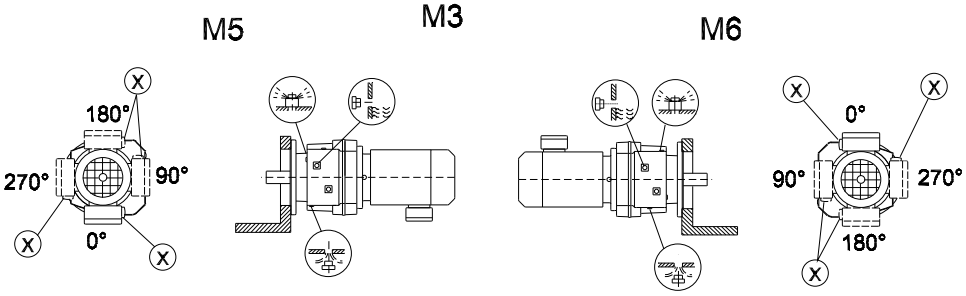
* → page 51

RF07-RF167



04 041 200

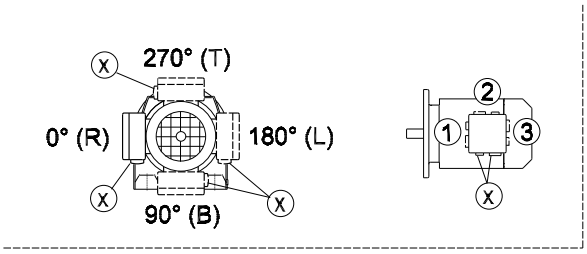


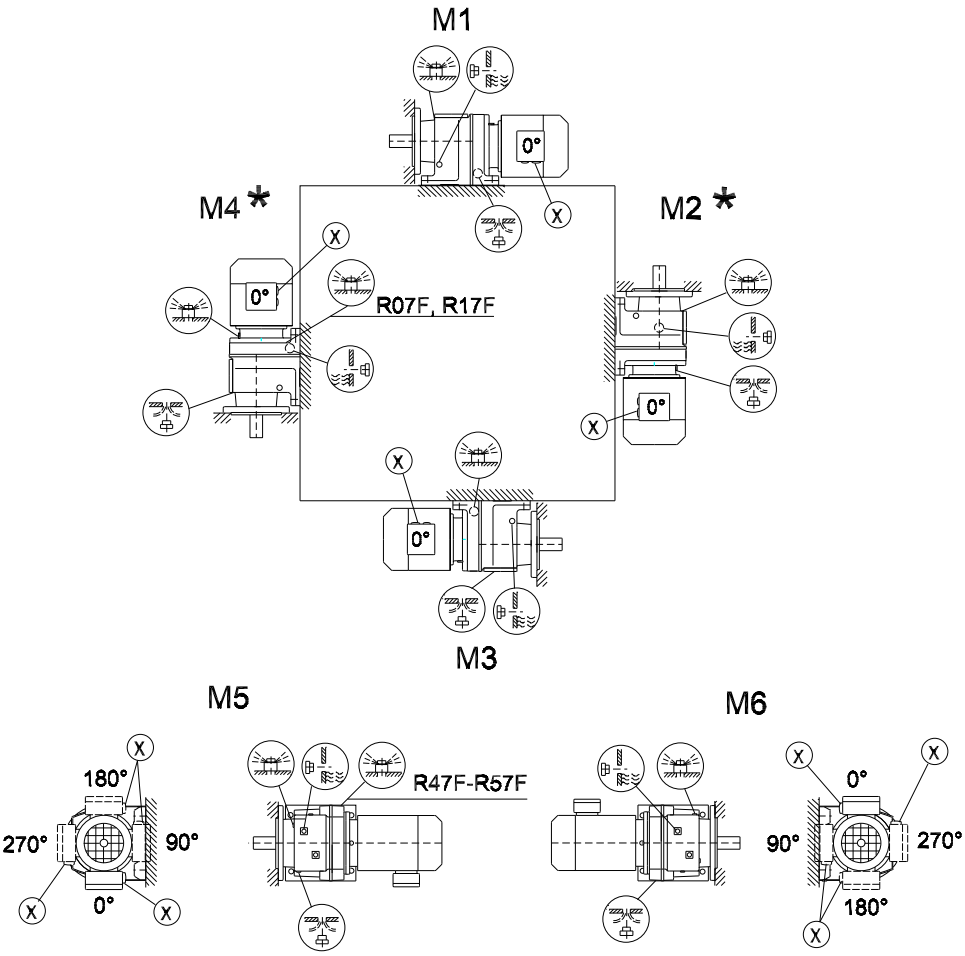


RF07		M1, M2 , M3 , M5 , M6
RF17, RF27		M1, M3 , M5 , M6
RF07, RF17, RF27		
RF47, RF57		M5

* → page 51

R07F-R87F





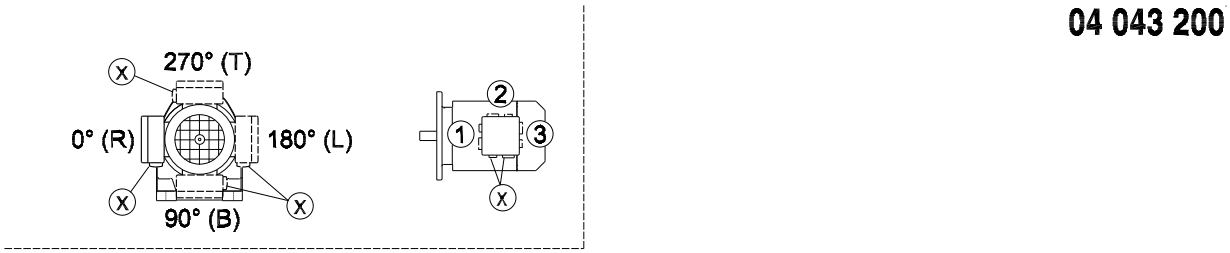
R07F		M1, M2 , M3 , M5 , M6
R17F, R27F		M1, M3 , M5 , M6
R07F, R17F, R27F		
R47F, R57F		M5

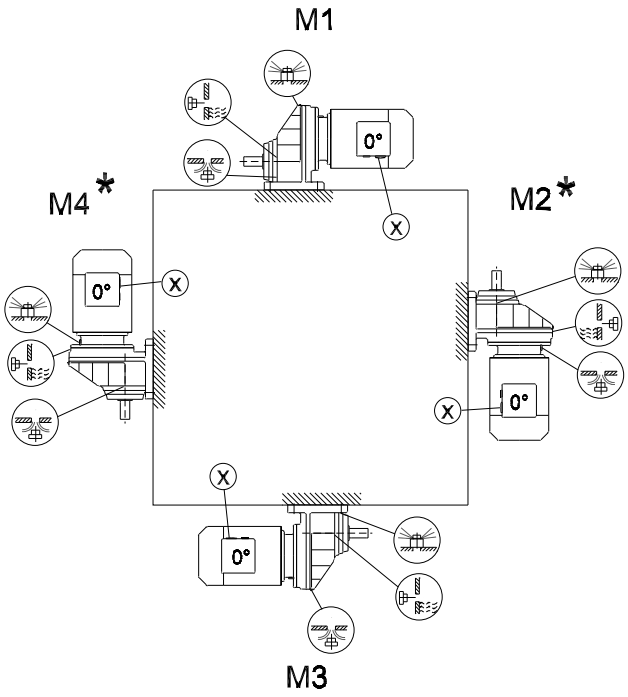
* → page 51

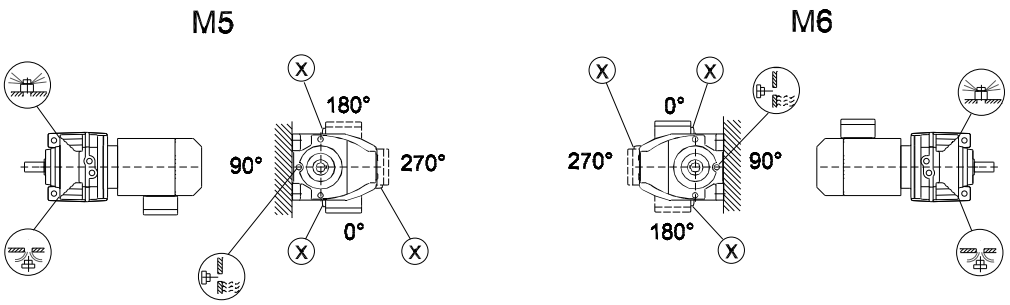
Important: See the (i) information in the "Gearmotors" catalog, section "Project Planning for Gear Units/Overhung and axial loads."

8.4 Mounting positions of RX helical gearmotors

RX57-RX107



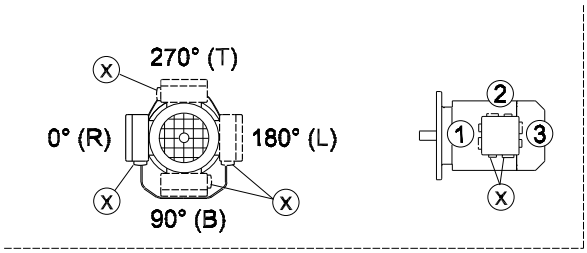


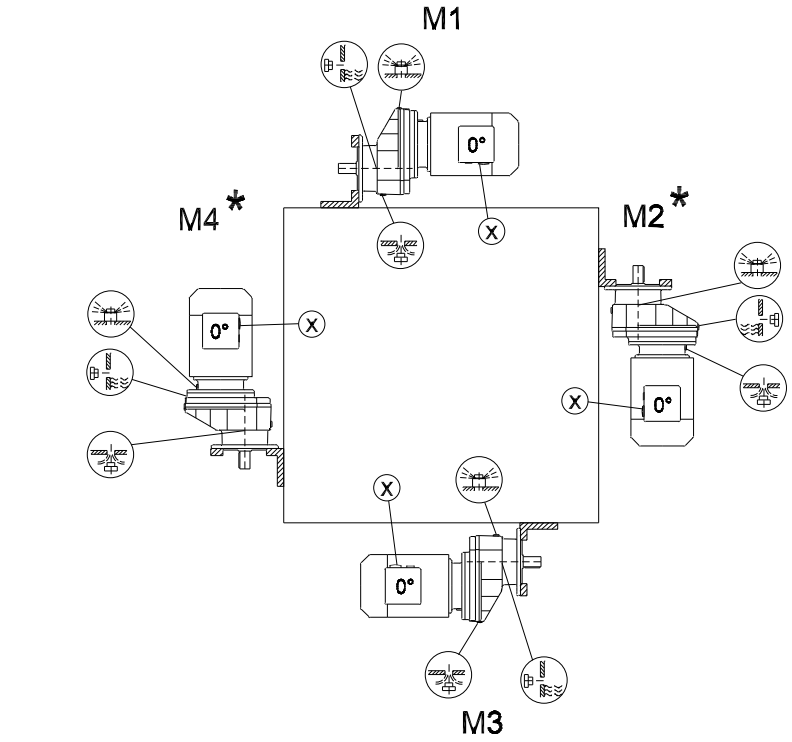


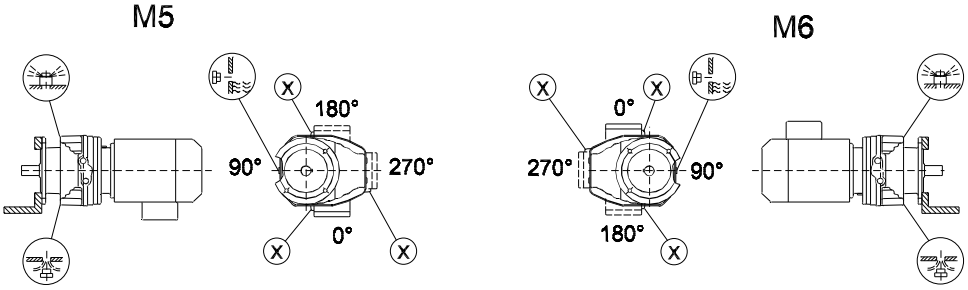
* → page 51

RXF57 - RXF107

04 044 200



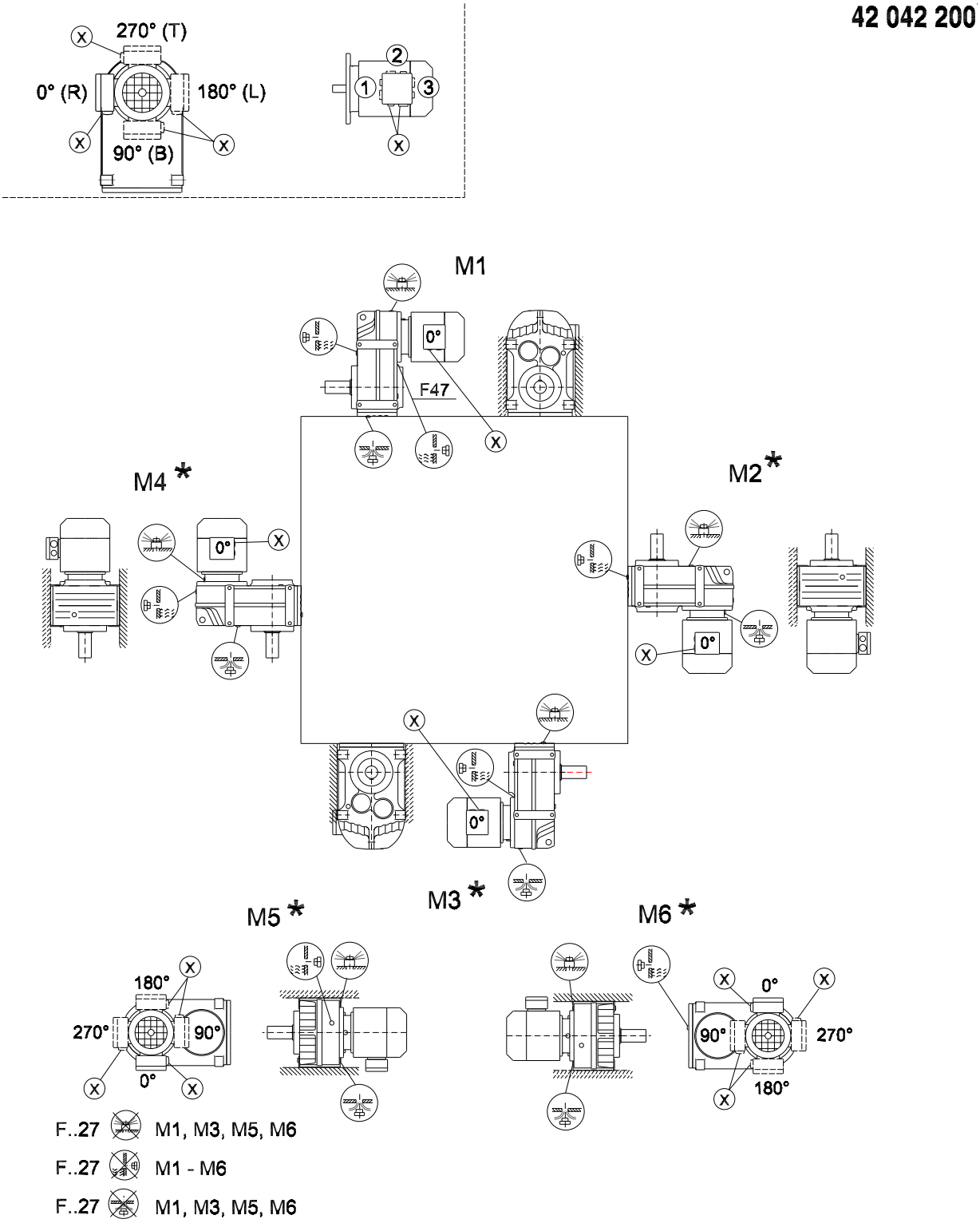




* → page 51

8.5 Mounting positions for parallel shaft helical gearmotors

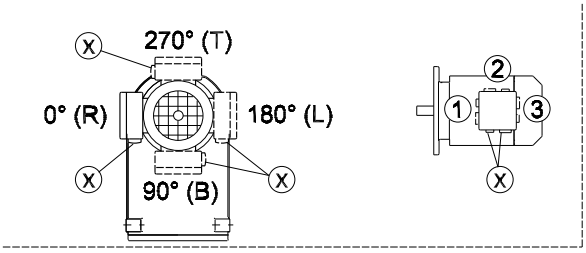
F/FA..B/FH27B-157B, FV27B-107B

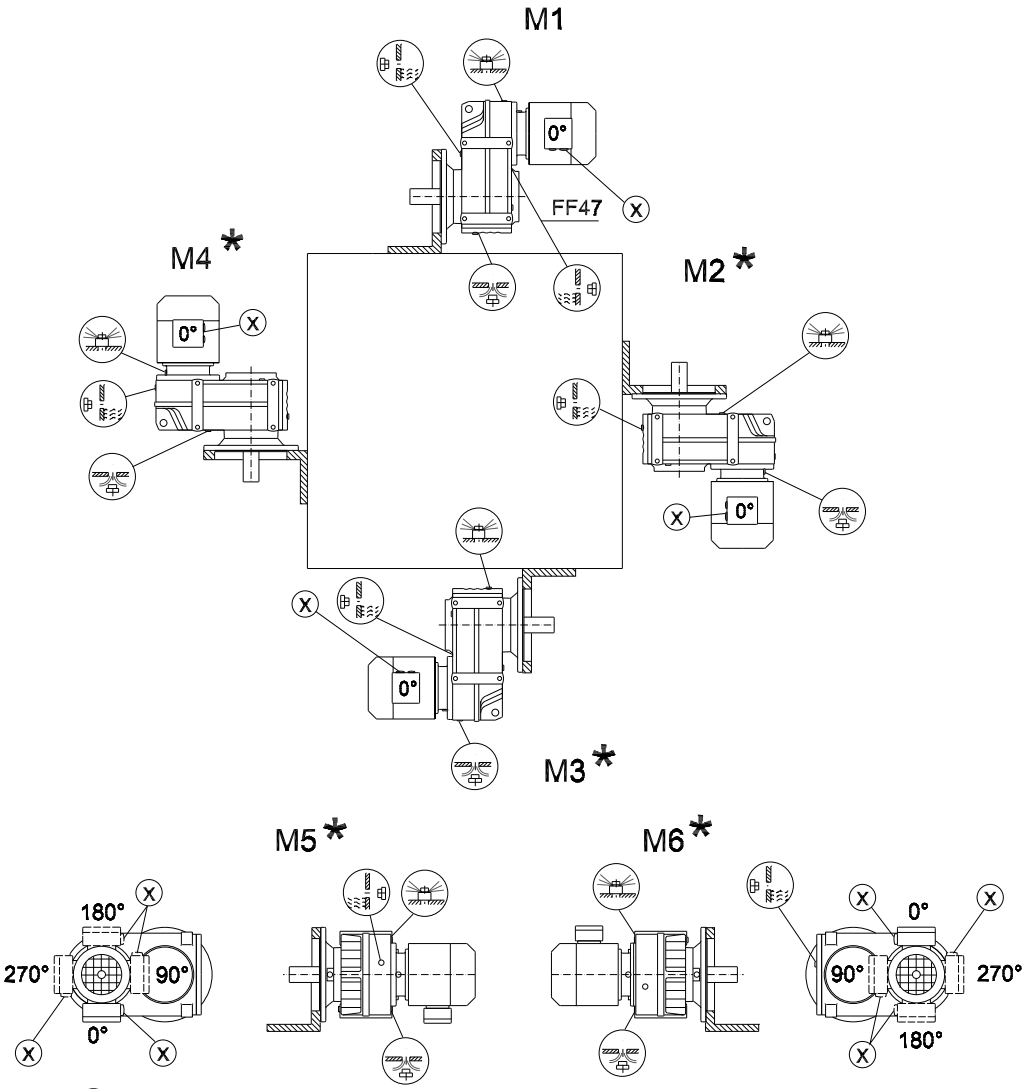


* → page 51

FF/FAF/FHF/FAZ/FHZ27-157, FVF/FVZ27-107

42 043 200





F..27 M1, M3, M5, M6

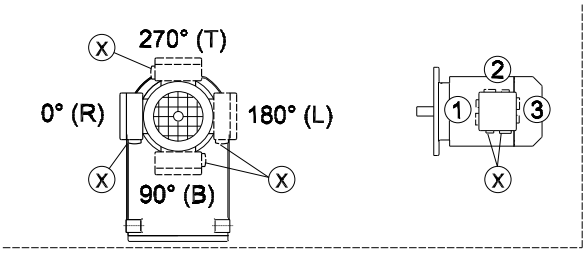
F..27 M1 - M6

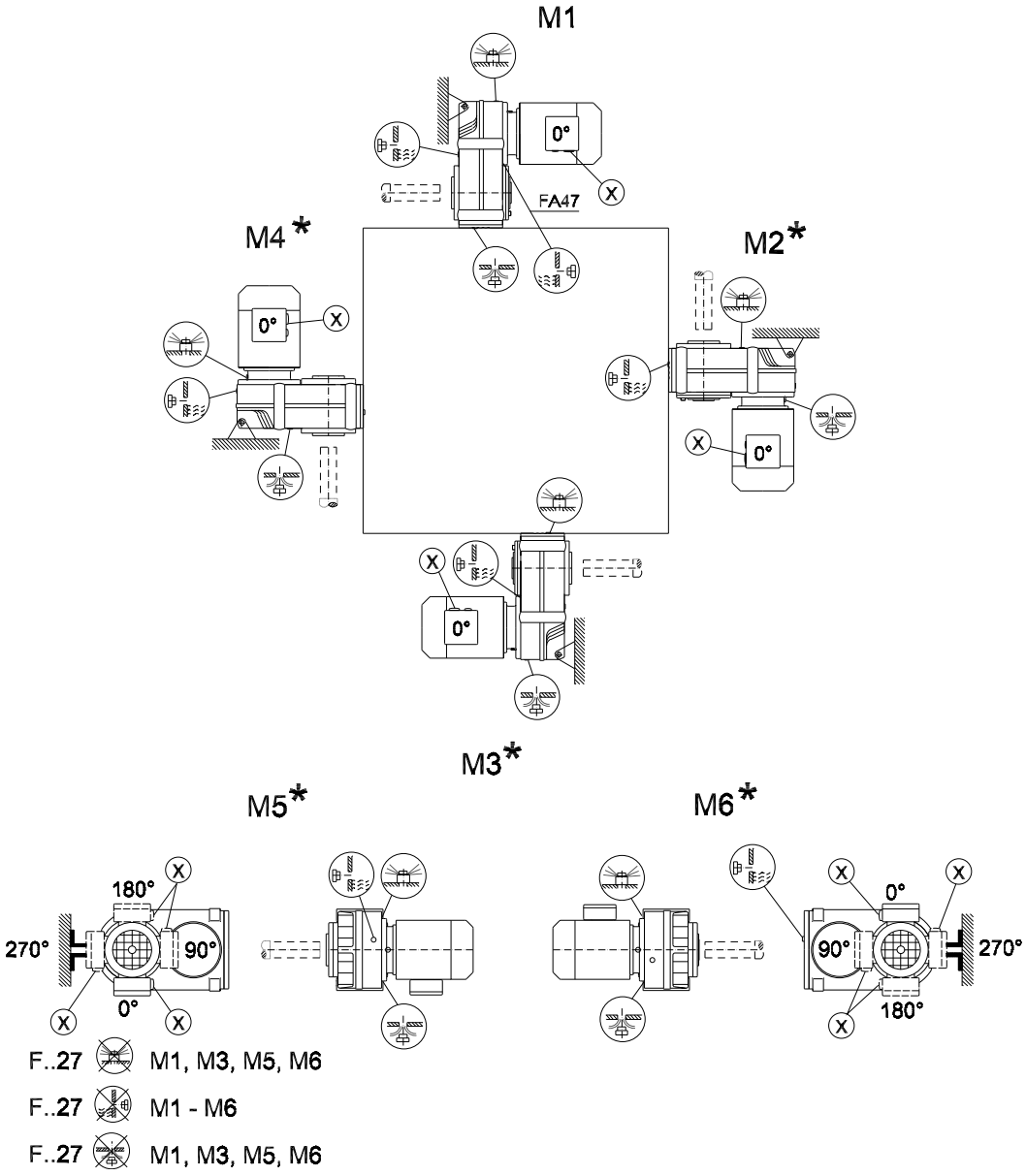
F..27 M1, M3, M5, M6

* → page 51

FA/FH27-157, FV27-107, FT37-97

42 044 200





F..27 M1, M3, M5, M6

F..27 M1 - M6

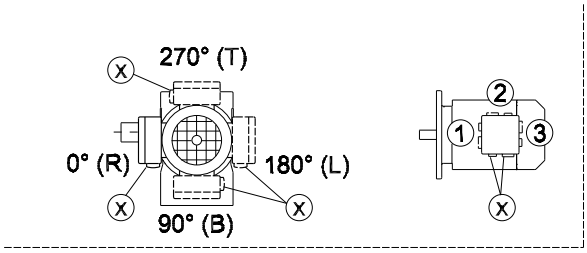
F..27 M1, M3, M5, M6

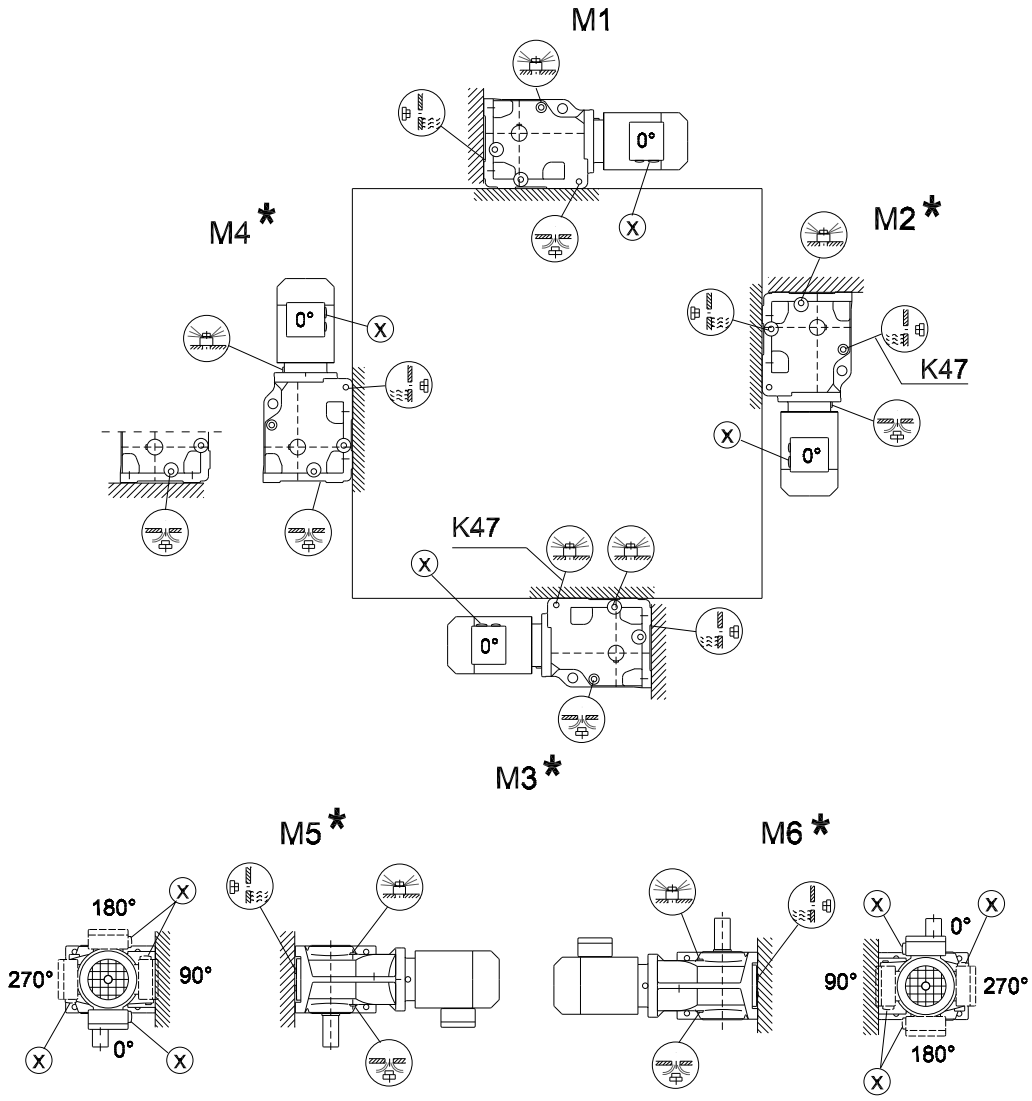
* → page 51

8.6 Mounting positions for helical-bevel gearmotors

K/KA..B/KH37B-157B, KV37B-107B

34 025 200



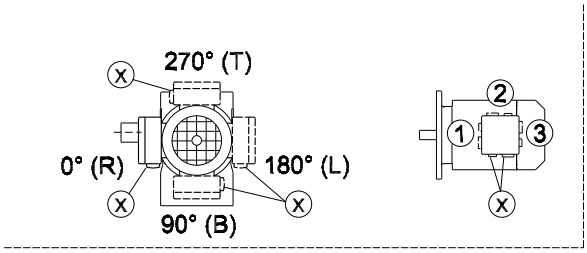


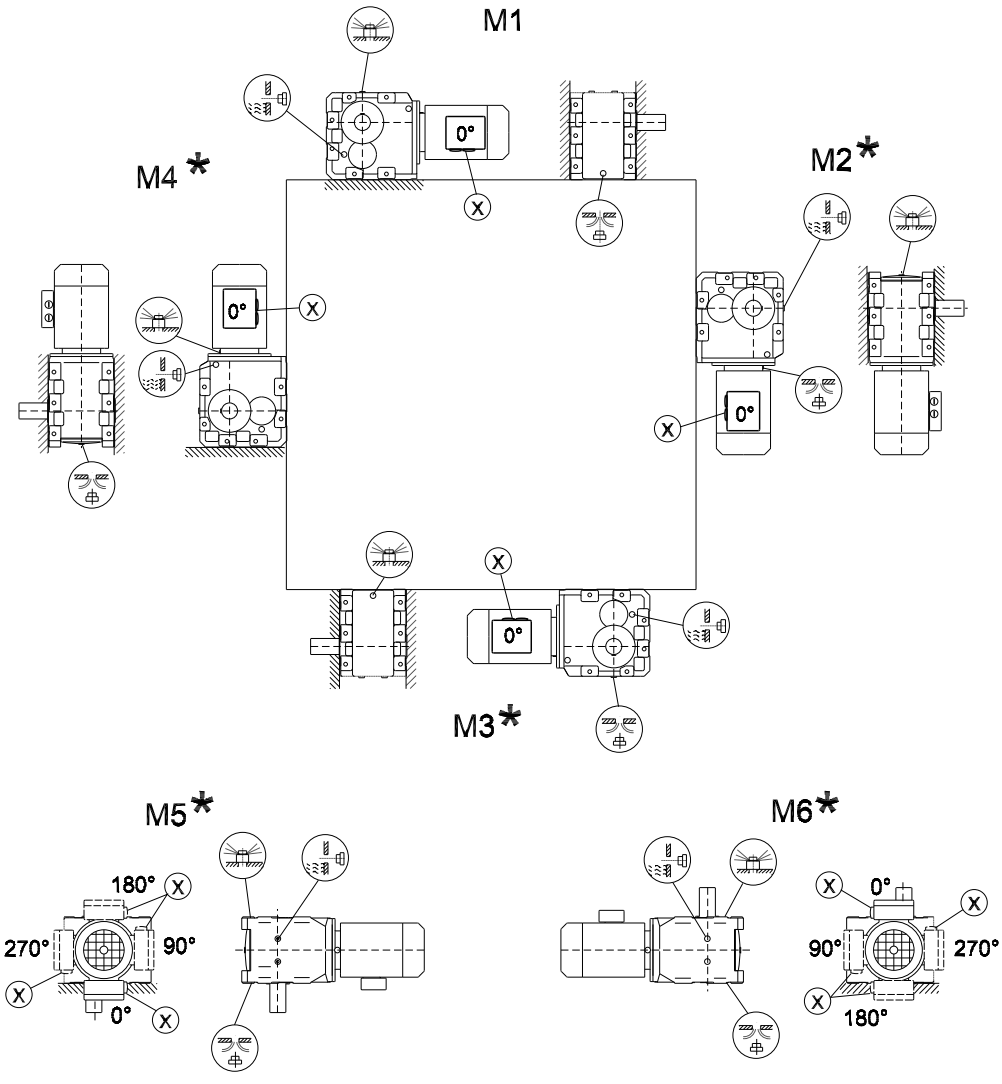
* → page 51

Important: See the (i) information in the "Gearmotors" catalog, section "Project Planning for Gear Units/Overhung and axial loads."

K167-187, KH167B-187B

34 026 200



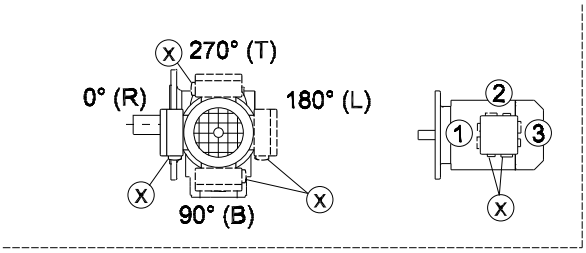


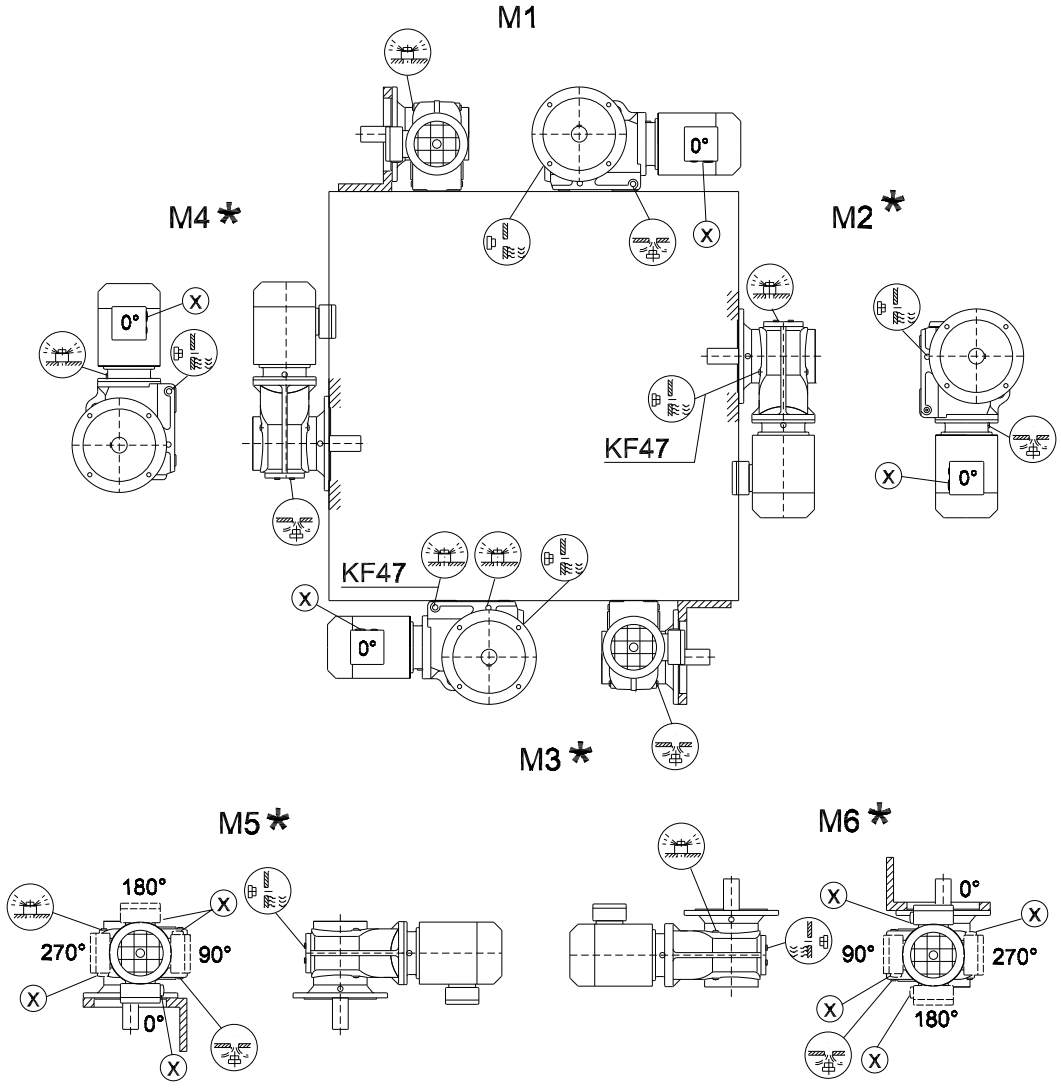
* → page 51

Important: See the (i) information in the "Gearmotors" catalog, section "Project Planning for Gear Units/Overhung and axial loads."

KF/KAF/KHF/KAZ/KHZ37-157, KVF/KVZ37-107

34 027 200

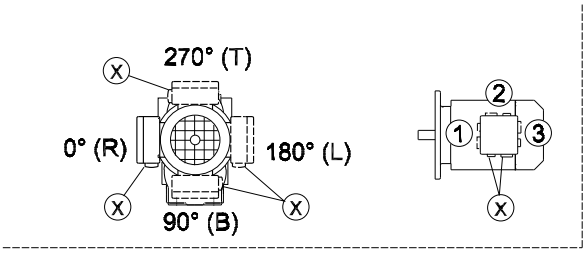


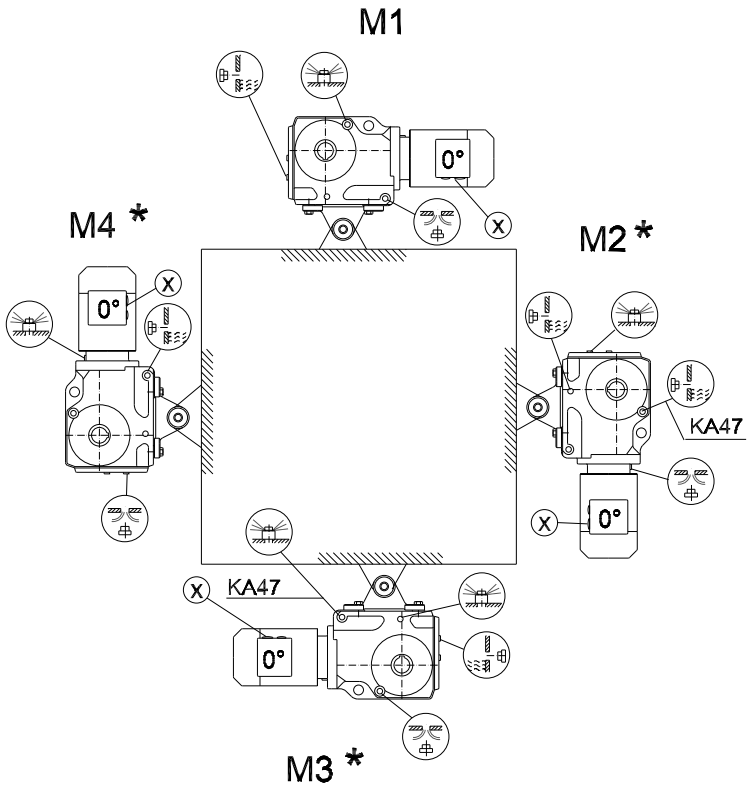


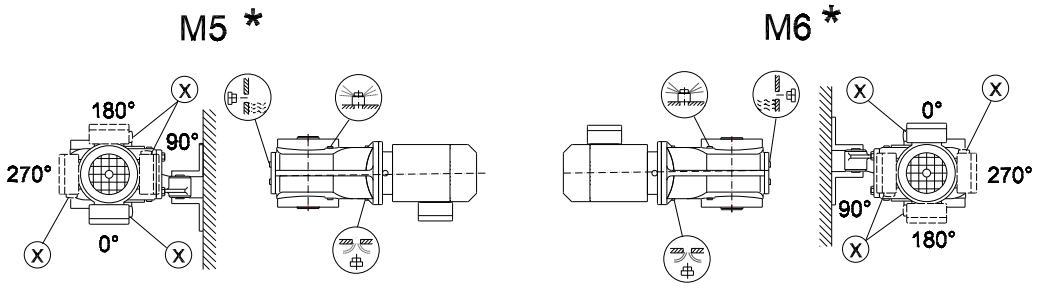
* → page 51

KA/KH37-157, KV37-107, KT37-97

39 025 200



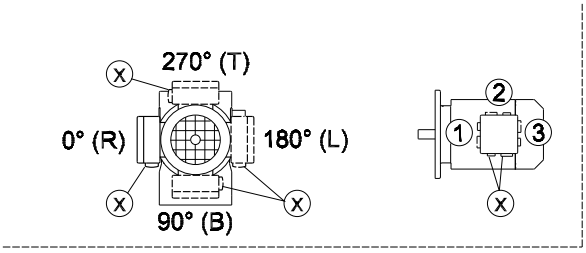


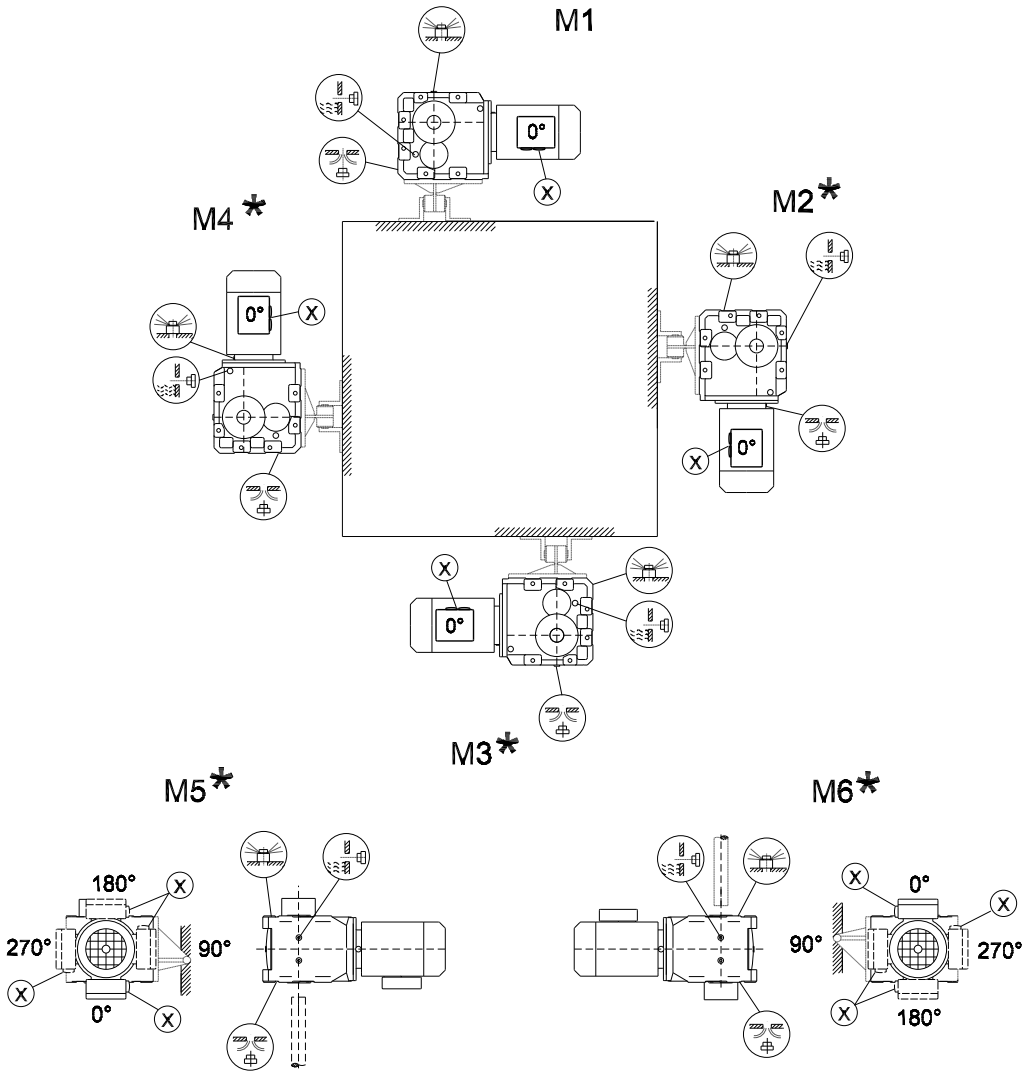


* → page 51

KH167-187

39 026 200

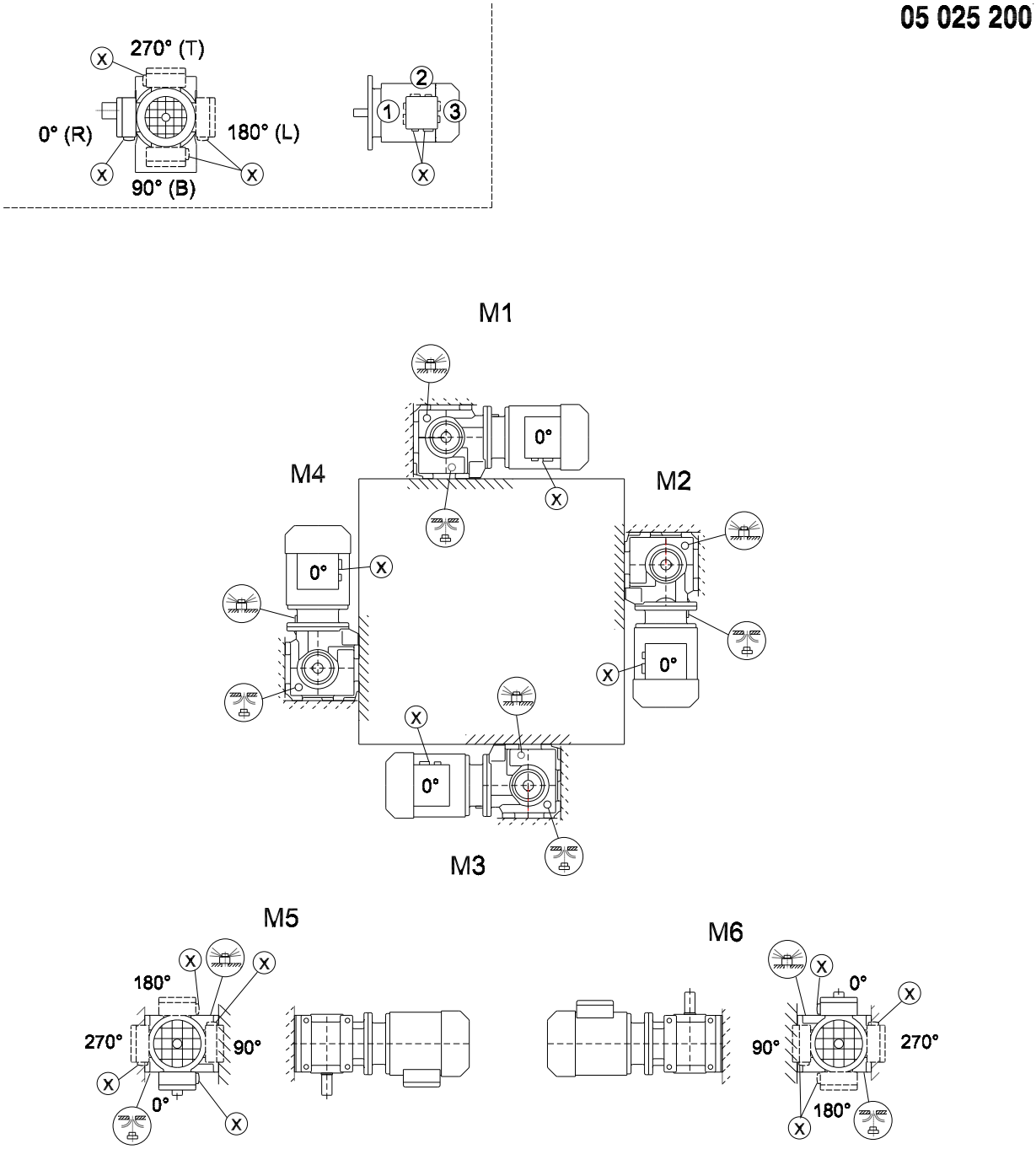




* → page 51

8.7 Mounting positions for helical-worm gearmotors

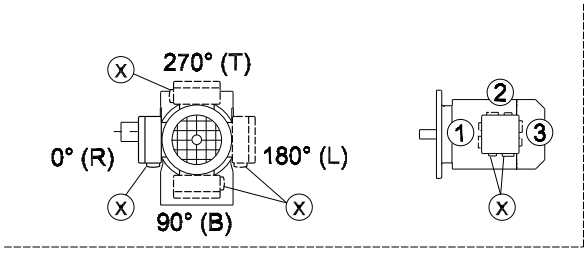
S37

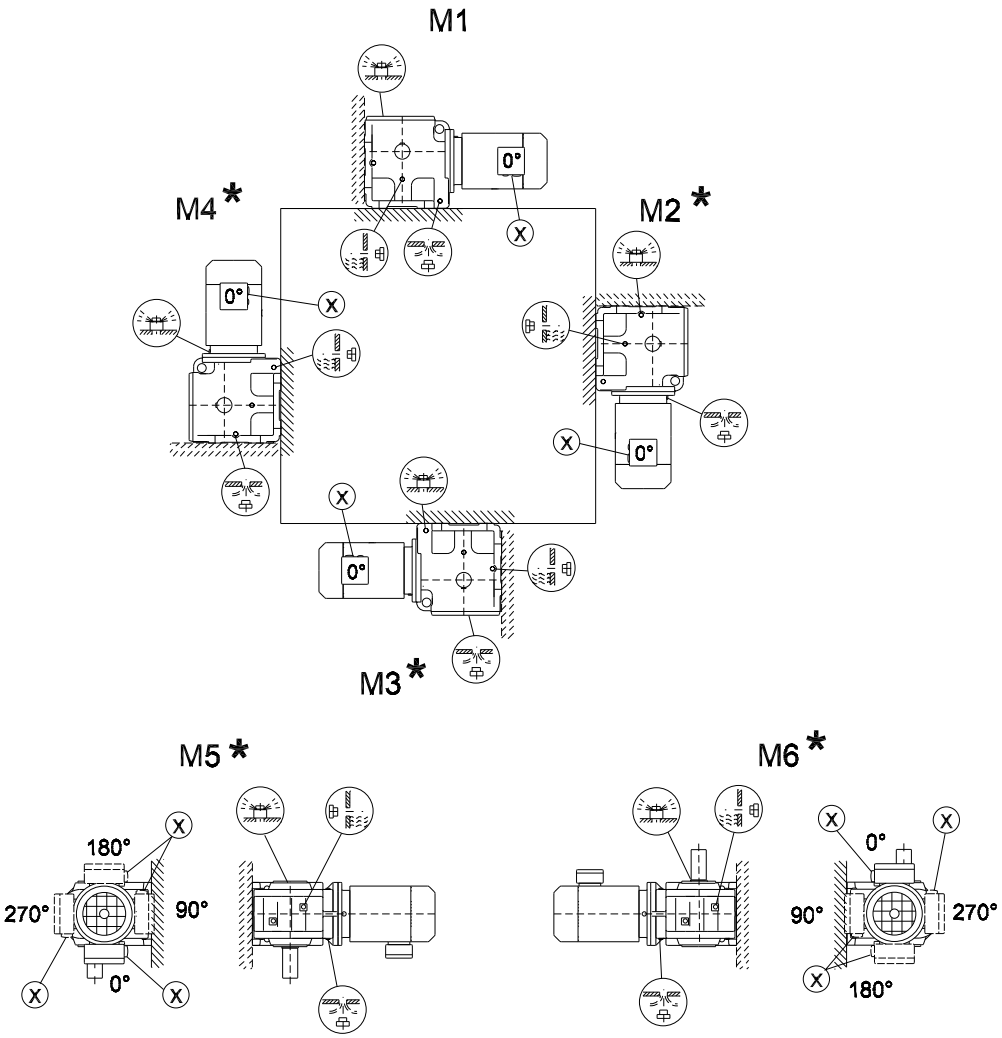


Important: See the (i) information in the "Gearmotors" catalog, section "Project Planning for Gear Units/Overhung and axial loads."

S47 - S97

05 026 200



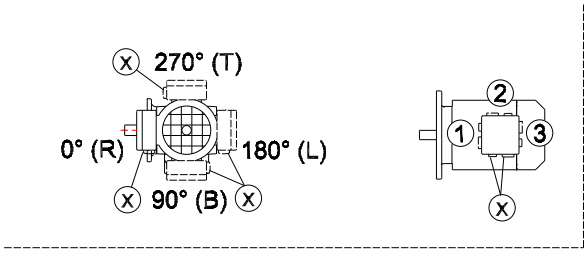


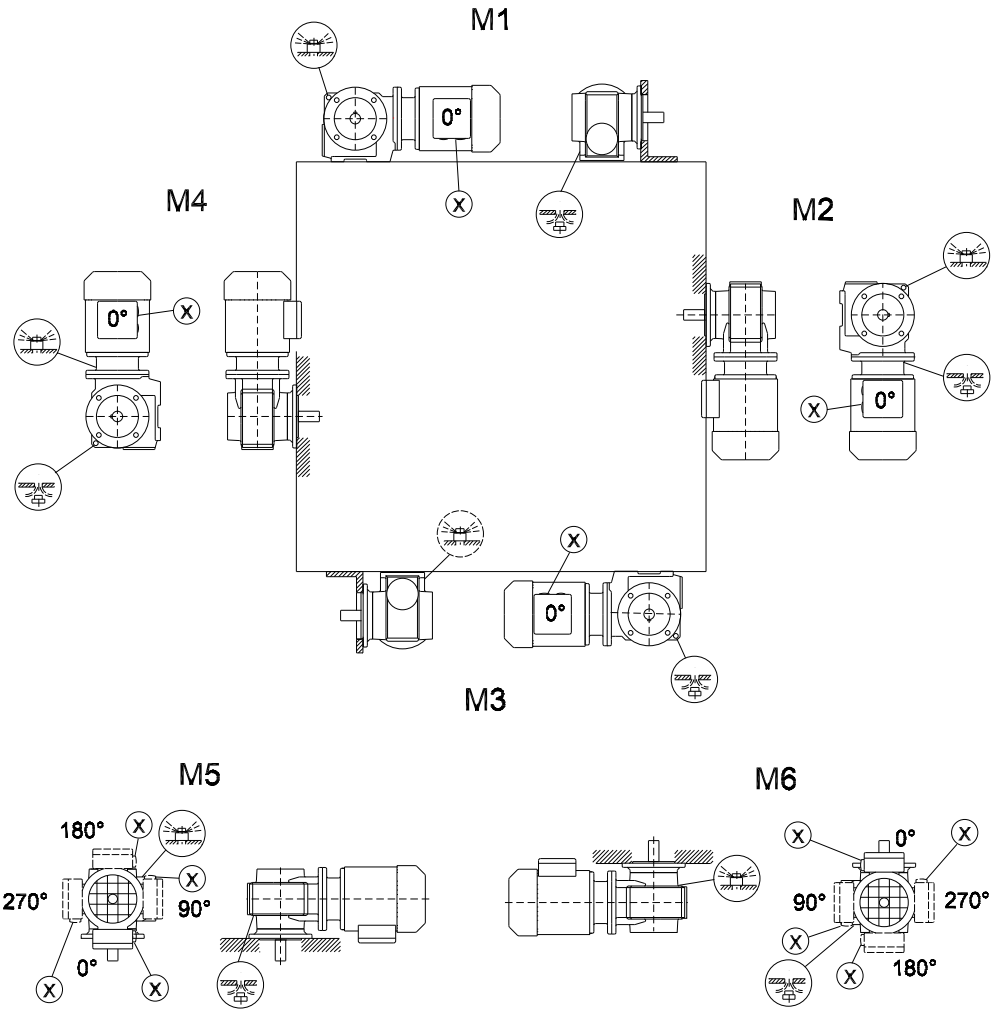
* → page 51

Important: See the ⓘ information in the "Gearmotors" catalog, section "Project Planning for Gear Units/Overhung and axial loads."

SF/SAF/SHF37

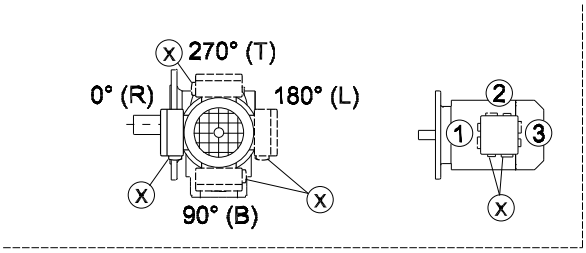
05 027 200

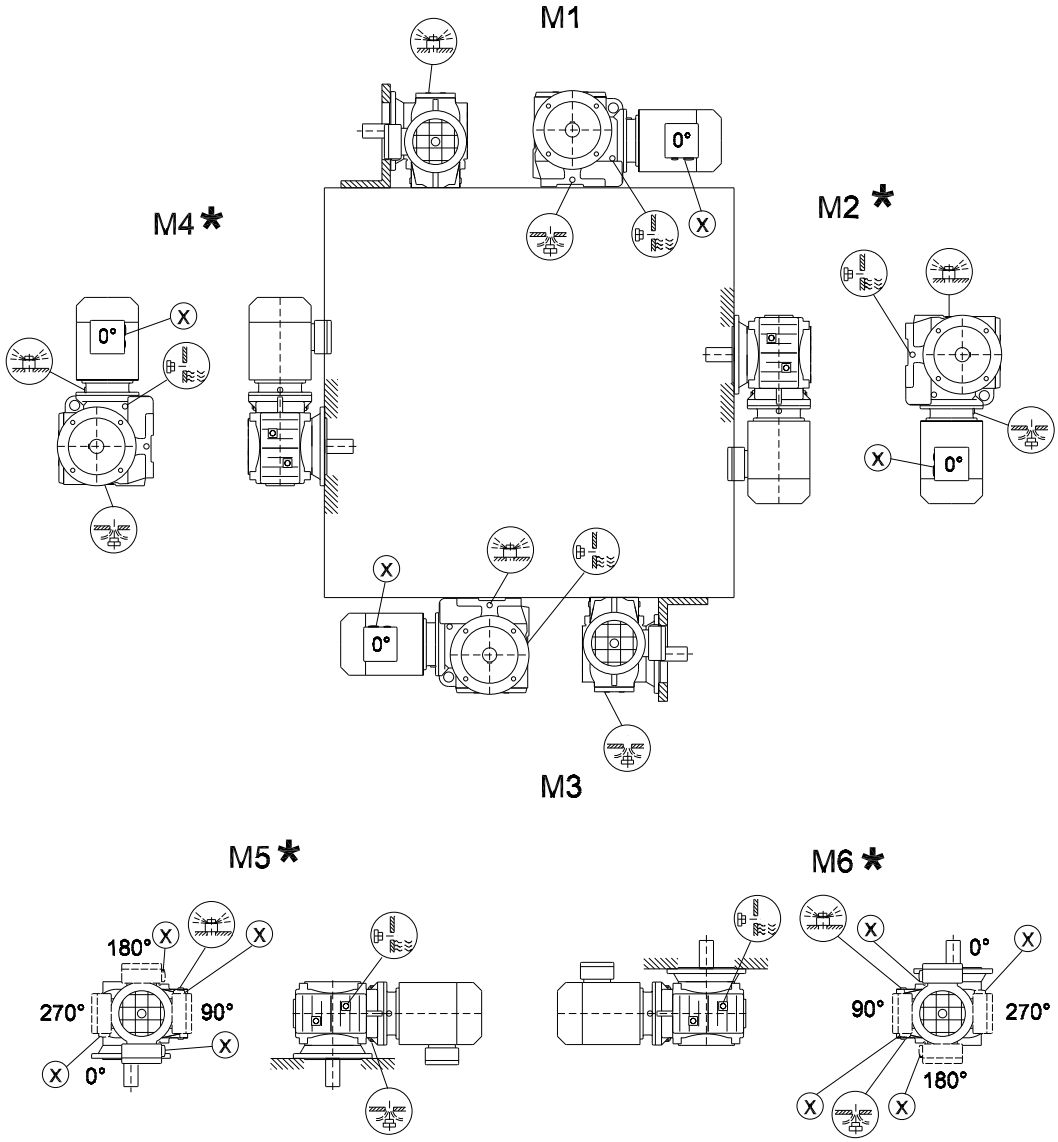




SF/SAF/SHF/SAZ/SHZ47-97

05 028 200

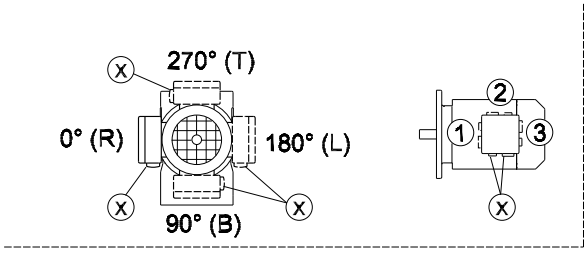


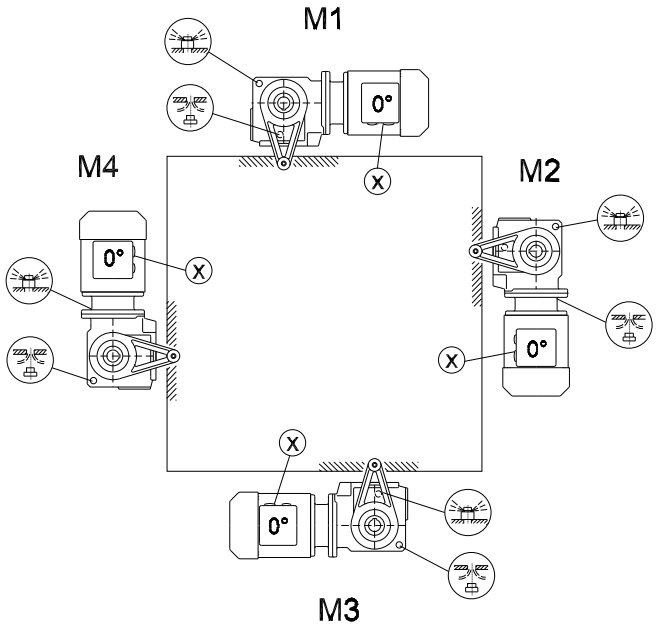


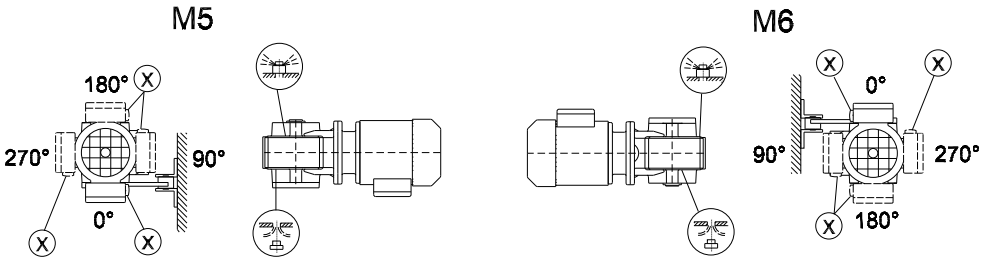
* → page 51

SA/SH/ST37

28 020 200

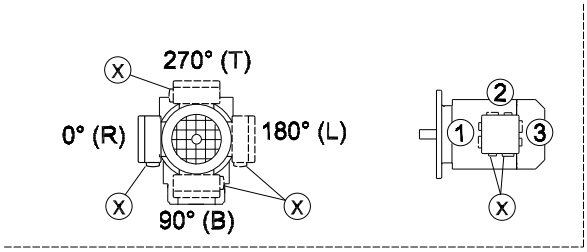


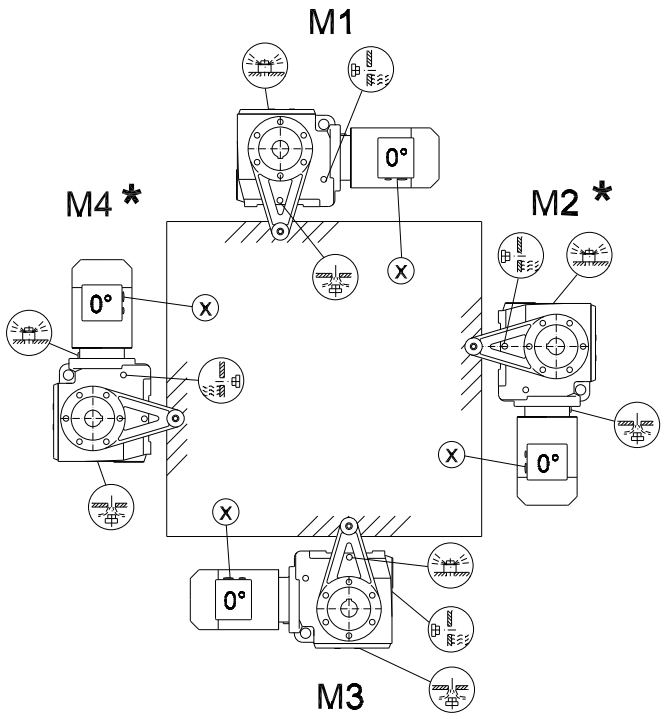


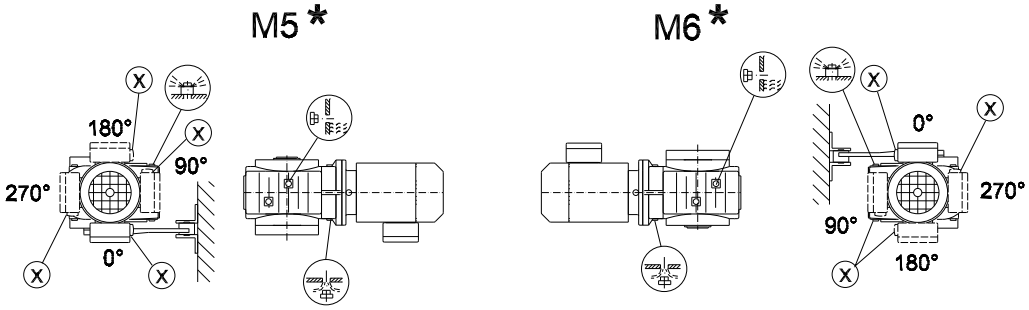


SA/SH/ST47-97

28 021 200





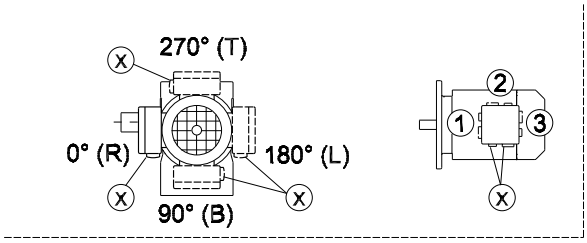


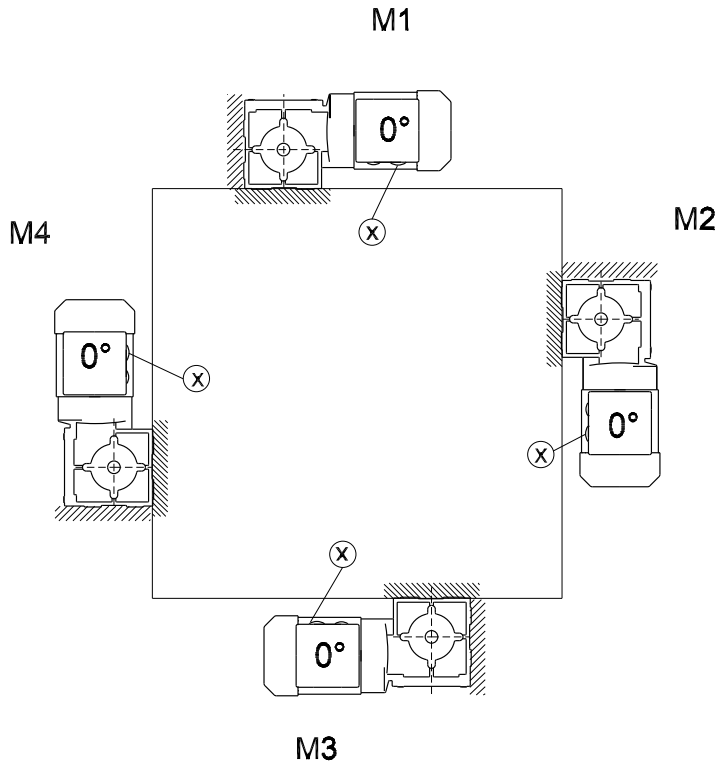
* → page 51

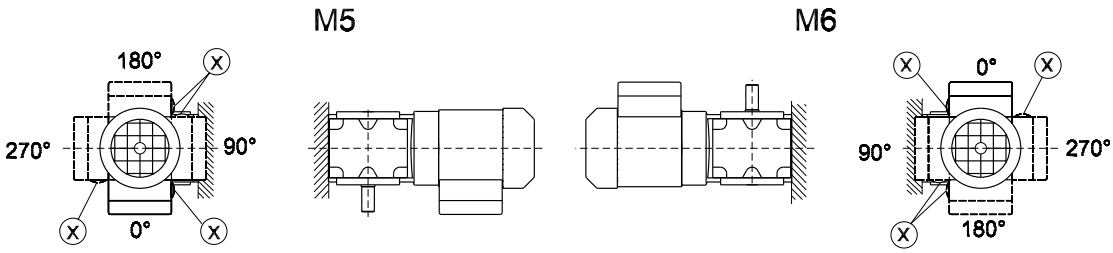
8.8 Mounting positions for SPIROPLAN® W gearmotors

W10-30

20 001 002

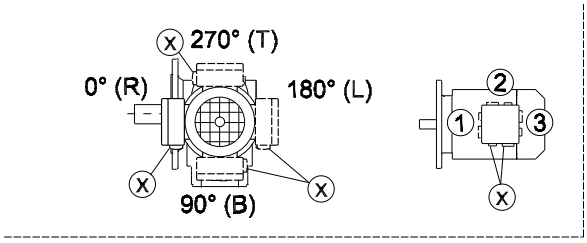


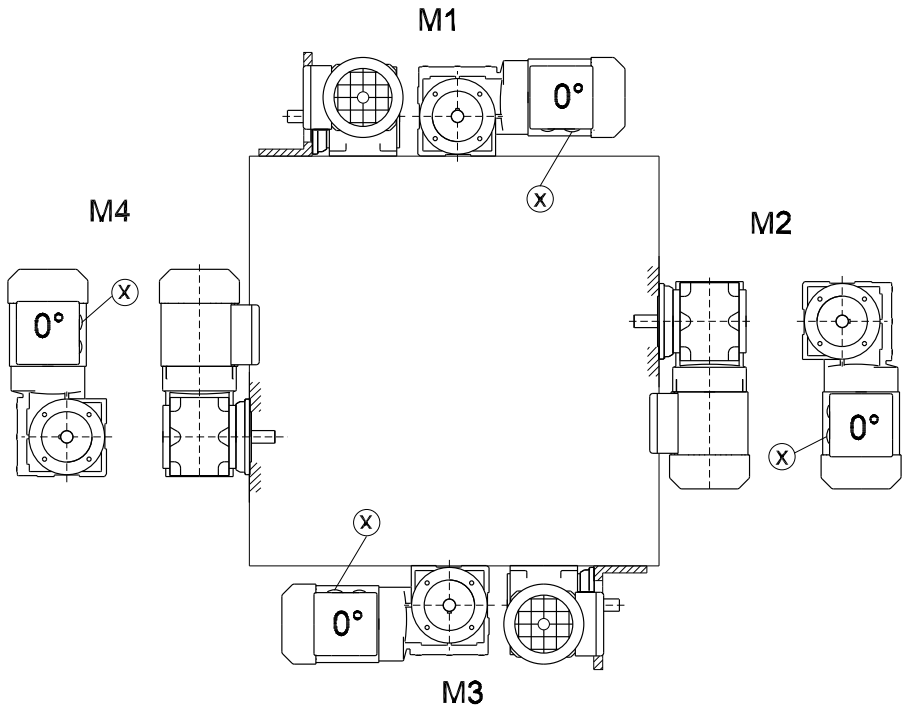


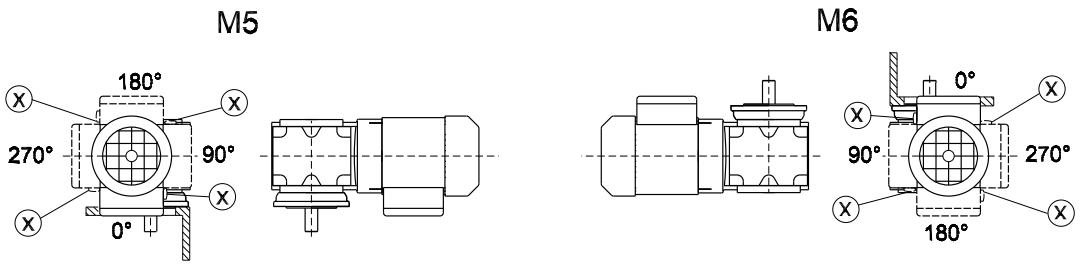


WF/WAF10-30

20 002 002

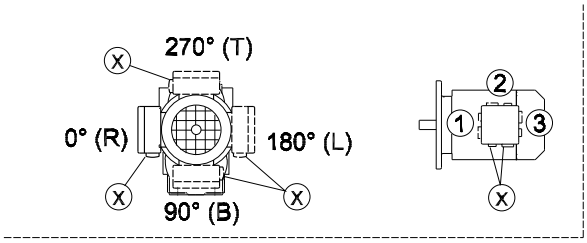


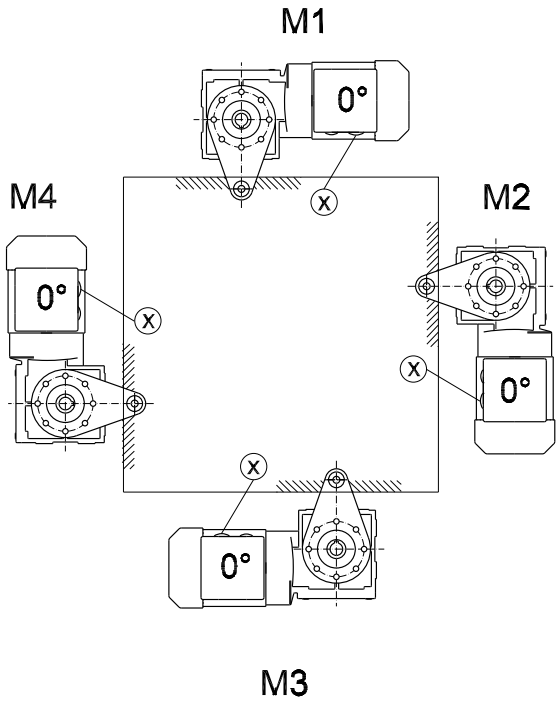


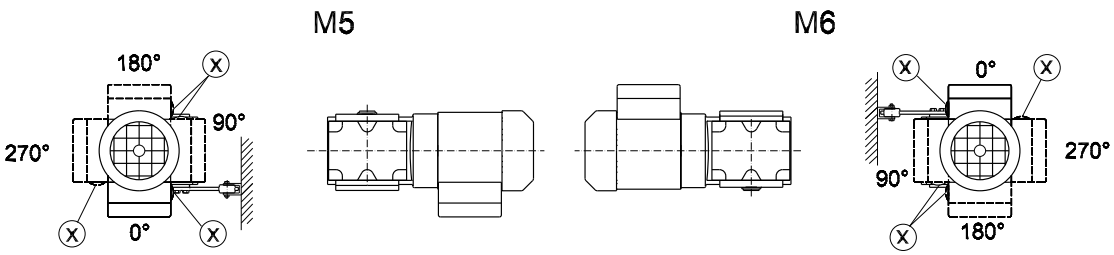


WA10-30

20 003 002







9 Lubricants

General information

Unless a special arrangement is made, SEW-EURODRIVE supplies the drives with a lubricant fill adapted for the specific gear unit and mounting position. The decisive factor is the mounting position (M1 ... M6, → Sec. "Mounting Positions and Important Order Information") specified when ordering the drive. You must adapt the lubricant fill to any subsequent changes made to the mounting position (→ Lubricant fill quantities).

9.1 Lubricant table

The lubricant table on the following page shows the permitted lubricants for SEW-EURODRIVE gear units. Please note the following key to the lubricant table.

Key to the lubricant table

Abbreviations used, meaning of shading and notes:

CLP	= Mineral oil
CLP PG	= Polyglycol (W gear units, NSF cerfitied H1)
CLP HC	= Synthetic hydrocarbons
E	= Ester oil (water hazard class 1 (German regulation))
HCE	= Synthetic hydrocarbons + ester oil (NSF certified H1)
HLP	= Hydraulic oil
	= Synthetic lubricant (= synthetic-based anti-friction bearing grease)
	= Mineral lubricant (= mineral-based anti-friction bearing grease)
1)	Helical-worm gear units with PG oil: Please contact SEW-Eurodrive
2)	Special lubricant for Spiroplan® gear units only
3)	SEW $f_B \geq 1.2$ required
4)	Pay attention to critical starting behavior at low temperatures!
5)	Ambient temperature
	Lubricant for the food industry (food grade oil)
	Biodegradable oil (lubricant for use in agriculture, forestry and water resources)

Anti-friction bearing greases

The anti-friction bearings in gear units and motors are given a factory-fill with the greases listed below. SEW-EURODRIVE recommends regreasing anti-friction bearings with a grease fill at the same time as changing the oil.

	Ambient temperature	Manufacturer	Type
Anti-friction bearing in gear unit	-20 °C ... +60°C	Mobil	Mobilux EP2
	-40 °C ... +60 °C	Mobil	Mobiltemp SHC 100
Anti-friction bearing in motor[1)2)]	-20 °C ... +80 °C	Esso	Polyrex EM
	+20 °C ... +100 °C	Klüber	Barrierta L55/2
	-40 °C ... +60 °C	Kyodo Yushi	Multemp SRL[3)]
Special greases for anti-friction bearings in gear units:			
	-35 °C ... +40 °C	Shell	Shell Cassida Grease EPS 2
	-25 °C ... +40 °C	Klüber	Klübersynth UH1 14-222
	-40 °C ... +40 °C	Klüber	Klüberbio M 72-82

1) The motor anti-friction bearings are covered on both sides and cannot be regreased.

2) Greases providing equivalent performance are acceptable

3) Recommended for continuous operation at ambient temperature below 0°C, example in a cold storage.

The following grease quantities are required:

- For fast-running bearings (motor and gear unit input end): Fill the cavities between the rolling elements one third full with grease.
- For slow-running bearings (in gear units and at gear unit output end): Fill the cavities between the rolling elements two thirds full with grease.

Lubricant table

01 805 09 92US

	5) °C -50 0 +50 +100	DIN (ISO)	ISO,NLGI	ExxonMobil	Shell	Klüber	ARAL	bp	Tribol	TEXACO	Optimol	FUCHS	TOTAL
R...	Standard -10 +40	CLP(CC)	VG 220	Mobilgear 600XP 220	Shell Omala 220	Klüberoil GEM 1-220 N	Aral Degol BG 220	BP Energol GR-XP 220	Tribol 1100/220	Meropa 220	Optigear BM 220	Renolin CLP 220	Carter EP 220
K...(HK...)	-25 +80	CLP PG	VG 220	Mobil Glygoyle 30	Shell Tivela S 220	Klübersynth GH 6-220	Aral Degol GS 220	BP Enersyn SG-XP 220	Tribol 800/220	Synlube CLP 220	Optiflex A 220		Carter SY 220
	4) -40 +80	CLP HC	VG 220	Mobil SHC 630	Shell Omala HD 220	Klübersynth GEM 4-220 N	Aral Degol PAS 220		Tribol 1510/220	Pinnacle EP 220	Optigear Synthetic A 220	Renolin Unisyn CLP 220	
	4) -40 +40		VG 150	Mobil SHC 629	Shell Omala HD 150	Klübersynth GEM 4-150 N				Pinnacle EP 150			Carter SH 150
F...	-20 +25	CLP (CC)	VG 150 VG 100	Mobilgear 600XP 100	Shell Omala 100	Klüberoil GEM 1-150 N	Aral Degol BG 100	BP Energol GR-XP 100	Tribol 1100/100	Meropa 150	Optigear BM 100	Renolin CLP 150	Carter EP 100
	-30 +10	HLP (HM)	VG 68-46 VG 32	Mobil D.T.E. 13M	Shell Tellus T 32	Klüberoil GEM 1-68 N	Aral Degol BG 46		Tribol 1100/68	Rando EP Ashless 46	Optigear 32	Renolin B 46 HVI	Equivis ZS 46
	4) -40 +10	CLP HC	VG 32	Mobil SHC 624		Klüber-Summit HySyn FG-32				Cetus PAO 46			Dacnis SH 32
	4) -40 -20	HLP (HM)	VG 22 VG 15	Mobil D.T.E. 11M	Shell Tellus T 15	Isoflex MT 30 ROT		BP Energol HLP-HM 15		Rando HDZ 15			Equivis ZS 15
S...(HS...)	Standard 0 +40	CLP (CC)	VG 680	Mobilgear 600XP 680	Shell Omala 680	Klüberoil GEM 1-680 N	Aral Degol BG 680	BP Energol GR-XP 680	Tribol 1100/680	Meropa 680	Optigear BM 680	Renolin CLP 680	Carter EP 680
	-20 +60	CLP PG	VG 680 [1]		Shell Tivela S 680	Klübersynth GH 6-680		BP Enersyn SG-XP 680	Tribol 800/680	Synlube CLP 680			
	4) -30 +80	CLP HC	VG 460	Mobil SHC 634	Shell Omala HD 460	Klübersynth GEM 4-460 N				Pinnacle EP 460			
	4) -40 +10		VG 150	Mobil SHC 629	Shell Omala HD 150	Klübersynth GEM 4-150 N				Pinnacle EP 150			Carter SH 150
	-20 +10	CLP (CC)	VG 150 VG 100	Mobilgear 600XP 100	Shell Omala 100	Klüberoil GEM 1-150 N	Aral Degol BG 100	BP Energol GR-XP 100	Tribol 1100/100	Meropa 150	Optigear BM 100	Renolin CLP 150	Carter EP 100
	-25 +20	CLP PG	VG 220 [1]	Mobil Glygoyle 30	Shell Tivela S 220	Klübersynth GH 6-220	Aral Degol GS 220	BP Enersyn SG-XP 220	Tribol 800/220	Synlube CLP 220	Optiflex A 220		Carter SY 220
	4) -40 0	CLP HC	VG 32	Mobil SHC 624		Klüber-Summit HySyn FG-32				Cetus PAO 46			Dacnis SH 32
R...,K...(HK...), F...,S...(HS...)	Standard -20 +40	CLP PG	VG 460 [1]			Klübersynth UH1 6-460							
	4) -30 +40	HCE	VG 460		Shell Cassida Fluid GL 460	Klüberoil 4UH1-460 N	Aral Eural Gear 460				Optileb GT 460		
	-20 +40	E	VG 460			Klüberbio CA2-460	Aral Degol BAB 460				Optisynt BS 460		
W...(HW...)	Standard -20 +40	SEW PG	VG 460 [2]			Klüber SEW HT-460-5							
	4) -40 +10	API GL5	SAE 75W90 (~VG 100)	Mobilube SHC 75 W90-LS									
	-20 +40	CLP PG	VG 460 [3]			Klübersynth UH1 6-460							

9.2 Lubricant fill quantities

The specified fill quantities are **recommended values**. The precise values vary depending on the number of stages and gear ratio. When filling, it is essential to check the **oil level plug since it indicates the precise oil capacity**.

The following tables show guide values for lubricant fill quantities in relation to the mounting position M1 ... M6.

Helical (R) gear units

Gear unit type R.., R..F	Fill quantity in liters					
	M1[1)]	M2[1)]	M3	M4	M5	M6
R07/R07F	0.12	0.20	0.20	0.20	0.20	0.20
R17/R17F	0.25	0.55	0.35	0.55	0.35	0.35
R27/R27F	0.25/0.40	0.70	0.50	0.70	0.50	0.50
R37/R37F	0.30/0.95	0.85	0.95	1.05	0.75	0.95
R47/R47F	0.70/1.50	1.60	1.50	1.65	1.50	1.50
R57/R57F	0.80/1.70	1.90	1.70	2.10	1.70	1.70
R67/R67F	1.10/2.30	2.60/3.50	2.80	3.20	1.80	2.00
R77/R77F	1.20/3.00	3.80/4.10	3.60	4.10	2.50	3.40
R87/R87F	2.30/6.0	6.7/8.2	7.2	7.7	6.3	6.5
R97	4.60/9.8	11.7/14.0	11.7	13.4	11.3	11.7
R107	6.0/13.7	16.3	16.9	19.2	13.2	15.9
R137	10.0/25.0	28.0	29.5	31.5	25.0	25.0
R147	15.4/40.0	46.5	48.0	52.0	39.5	41.0
R167	27.0/70.0	82.0	78.0	88.0	66.0	69.0
Gear unit type RF.. / RM..	**Fill quantity in liters**					
	M1[1)]	**M2[1)]**	**M3**	**M4**	**M5**	**M6**
RF07	0.12	0.20	0.20	0.20	0.20	0.20
RF17	0.25	0.55	0.35	0.55	0.35	0.35
RF27	0.25/0.40	0.70	0.50	0.70	0.50	0.50
RF37	0.35/0.95	0.90	0.95	1.05	0.75	0.95
RF47	0.65/1.50	1.60	1.50	1.65	1.50	1.50
RF/RM57	0.80/1.70	1.80	1.70	2.00	1.70	1.70
RF/RM67	1.20/2.50	2.70/3.60	2.70	2.60	1.90	2.10
RF/RM77	1.20/2.60	3.80/4.10	3.30	4.10	2.40	3.00
RF/RM87	2.40/6.0	6.8/7.9	7.1	7.7	6.3	6.4
RF/RM97	5.1/10.2	11.9/14.0	11.2	14.0	11.2	11.8
RF/RM107	6.3/14.9	15.9	17.0	19.2	13.1	15.9
RF/RM137	9.5/25.0	27.0	29.0	32.5	25.0	25.0
RF/RM147	16.4/42.0	47.0	48.0	52.0	42.0	42.0
RF/RM167	26.0/70.0	82.0	78.0	88.0	65.0	71.0

1) The output end gear unit of multi-stage gear units must be filled with the larger oil volume.

Helical (RX) gear units

Gear unit type RX..	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
RX57	0.60	0.80	1.30	1.30	0.90	0.90
RX67	0.80	0.80	1.70	1.90	1.10	1.10
RX77	1.10	1.50	2.60	2.70	1.60	1.60
RX87	1.70	2.50	4.80	4.80	2.90	2.90
RX97	2.10	3.40	7.4	7.0	4.80	4.80
RX107	3.90	5.6	11.6	11.9	7.7	7.7
Gear unit type RXF..	**Fill quantity in liters**					
	M1	**M2**	**M3**	**M4**	**M5**	**M6**
RXF57	0.50	0.80	1.10	1.10	0.70	0.70
RXF67	0.70	0.80	1.50	1.40	1.00	1.00
RXF77	0.90	1.30	2.40	2.00	1.60	1.60
RXF87	1.60	1.95	4.90	3.95	2.90	2.90
RXF97	2.10	3.70	7.1	6.3	4.80	4.80
RXF107	3.10	5.7	11.2	9.3	7.2	7.2

Parallel shaft helical (F) gear units

F.., FA..B, FH..B, FV..B:

Gear unit type	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
F..27	0.60	0.80	0.65	0.70	0.60	0.60
F..37	0.95	1.25	0.70	1.25	1.00	1.10
F..47	1.50	1.80	1.10	1.90	1.50	1.70
F..57	2.60	3.50	2.10	3.50	2.80	2.90
F..67	2.70	3.80	1.90	3.80	2.90	3.20
F..77	5.9	7.3	4.30	8.0	6.0	6.3
F..87	10.8	13.0	7.7	13.8	10.8	11.0
F..97	18.5	22.5	12.6	25.2	18.5	20.0
F..107	24.5	32.0	19.5	37.5	27.0	27.0
F..127	40.5	54.5	34.0	61.0	46.3	47.0
F..157	69.0	104.0	63.0	105.0	86.0	78.0

FF..:

Gear unit type	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
FF27	0.60	0.80	0.65	0.70	0.60	0.60
FF37	1.00	1.25	0.70	1.30	1.00	1.10
FF47	1.60	1.85	1.10	1.90	1.50	1.70
FF57	2.80	3.50	2.10	3.70	2.90	3.00
FF67	2.70	3.80	1.90	3.80	2.90	3.20
FF77	5.9	7.3	4.30	8.1	6.0	6.3
FF87	10.8	13.2	7.8	14.1	11.0	11.2
FF97	19.0	22.5	12.6	25.6	18.9	20.5
FF107	25.5	32.0	19.5	38.5	27.5	28.0
FF127	41.5	55.5	34.0	63.0	46.3	49.0
FF157	72.0	105.0	64.0	106.0	87.0	79.0

FA.., FH.., FV.., FAF.., FHF.., FVF.., FAZ.., FHZ.., FVZ..:

Gear unit type	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
F..27	0.60	0.80	0.65	0.70	0.60	0.60
F..37	0.95	1.25	0.70	1.25	1.00	1.10
F..47	1.50	1.80	1.10	1.90	1.50	1.70
F..57	2.70	3.50	2.10	3.40	2.90	3.00
F..67	2.70	3.80	1.90	3.80	2.90	3.20
F..77	5.9	7.3	4.30	8.0	6.0	6.3
F..87	10.8	13.0	7.7	13.8	10.8	11.0
F..97	18.5	22.5	12.6	25.2	18.5	20.0
F..107	24.5	32.0	19.5	37.5	27.0	27.0
F..127	39.0	54.5	34.0	61.0	45.0	46.5
F..157	68.0	103.0	62.0	104.0	85.0	77.0

Helical-bevel (K) gear units

K.., KA..B, KH..B, KV..B:

Gear unit type	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
K..37	0.50	1.00	1.00	1.25	0.95	0.95
K..47	0.80	1.30	1.50	2.00	1.60	1.60
K..57	1.20	2.30	2.50	2.80	2.60	2.40
K..67	1.10	2.40	2.60	3.45	2.60	2.60
K..77	2.20	4.10	4.40	5.8	4.20	4.40
K..87	3.70	8.0	8.7	10.9	8.0	8.0
K..97	7.0	14.0	15.7	20.0	15.7	15.5
K..107	10.0	21.0	25.5	33.5	24.0	24.0
K..127	21.0	41.5	44.0	54.0	40.0	41.0
K..157	31.0	62.0	65.0	90.0	58.0	62.0
K..167	33.0	95.0	105.0	123.0	85.0	84.0
K..187	53.0	152.0	167.0	200	143.0	143.0

KF..:

Gear unit type	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
KF37	0.50	1.10	1.10	1.50	1.00	1.00
KF47	0.80	1.30	1.70	2.20	1.60	1.60
KF57	1.30	2.30	2.70	3.15	2.90	2.70
KF67	1.10	2.40	2.80	3.70	2.70	2.70
KF77	2.10	4.10	4.40	5.9	4.50	4.50
KF87	3.70	8.2	9.0	11.9	8.4	8.4
KF97	7.0	14.7	17.3	21.5	15.7	16.5
KF107	10.0	21.8	25.8	35.1	25.2	25.2
KF127	21.0	41.5	46.0	55.0	41.0	41.0
KF157	31.0	66.0	69.0	92.0	62.0	62.0

KA.., KH.., KV.., KAF.., KHF.., KVF.., KAZ.., KHZ.., KVZ..:

Gear unit type	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
K..37	0.50	1.00	1.00	1.40	1.00	1.00
K..47	0.80	1.30	1.60	2.15	1.60	1.60
K..57	1.30	2.30	2.70	3.15	2.90	2.70
K..67	1.10	2.40	2.70	3.70	2.60	2.60
K..77	2.10	4.10	4.60	5.9	4.40	4.40
K..87	3.70	8.2	8.8	11.1	8.0	8.0
K..97	7.0	14.7	15.7	20.0	15.7	15.7
K..107	10.0	20.5	24.0	32.4	24.0	24.0
K..127	21.0	41.5	43.0	52.0	40.0	40.0
K..157	31.0	66.0	67.0	87.0	62.0	62.0
KH167	33.0	95.0	105.0	123.0	85.0	84.0
KH187	53.0	152.0	167.0	200	143.0	143.0

Spiroplan® (W) gear units

The fill quantity of Spiroplan® gear units does not vary, irrespective of their mounting position:

Gear unit type	Fill quantity in liters, regardless of mounting position
W..10	0.16
W..20	0.26
W..30	0.50

Helical-worm (S) gear units

S..:

Gear unit type	Fill quantity in liters					
	M1	M2	M3[1)]	M4	M5	M6
S37	0.25	0.40	0.50	0.55	0.40	0.40
S47	0.35	0.80	0.70/0.90	1.00	0.80	0.80
S57	.50	1.20	1.00/1.20	1.45	1.30	1.30
S67	1.00	2.00	2.20/3.10	3.10	2.60	2.60
S77	1.90	4.20	3.70/5.4	5.9	4.40	4.40
S87	3.30	8.1	6.9/10.4	11.3	8.4	8.4
S97	6.8	15.0	13.4/18.0	21.8	17.0	17.0

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

SF..:

Gear unit type	Fill quantity in liters					
	M1	M2	M3[1)]	M4	M5	M6
SF37	0.25	0.40	0.50	0.55	0.40	0.40
SF47	0.40	0.90	0.90/1.05	1.05	1.00	1.00
SF57	0.50	1.20	1.00/1.50	1.55	1.40	1.40
SF67	1.00	2.20	2.30/3.00	3.20	2.70	2.70
SF77	1.90	4.10	3.90/5.8	6.5	4.90	4.90
SF87	3.80	8.0	7.1/10.1	12.0	9.1	9.1
SF97	7.4	15.0	13.8/18.8	22.6	18.0	18.0

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

SA.., SH.., SAF.., SHF.., SAZ.., SHZ..:

Gear unit type	Fill quantity in liters					
	M1	M2	M3[1)]	M4	M5	M6
S..37	0.25	0.40	0.50	0.50	0.40	0.40
S..47	0.40	0.80	0.70/0.90	1.00	0.80	0.80
S..57	0.50	1.10	1.00/1.50	1.50	1.20	1.20
S..67	1.00	2.00	1.80/2.60	2.90	2.50	2.50
S..77	1.80	3.90	3.60/5.0	5.8	4.50	4.50
S..87	3.80	7.4	6.0/8.7	10.8	8.0	8.0
S..97	7.0	14.0	11.4/16.0	20.5	15.7	15.7

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

10 Appendix

10.1 Index of changes

The following additions and changes have been made compared to the previous edition of the "Explosion-Proof Gear Units R..7, F..7, K..7, S..7, SPIROPLAN® W" (publication number: 1055520x, edition 11/2002) operating instructions:

General additions and corrections.

Mechanical installation

- Installing the gear unit: Data on flatness error
- Installing torque arms for mounted gear units: Data on retaining bolts
- Mounted gear units with shrink disks: Information on assembly / removal has been added
- Mounted gear units with TorqLOC®
- AM adapter coupling: Point A

Inspection and maintenance

- Lubricant change intervals

General

Manual adapted for US market.

11 Index

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		Edward Tucker 806 Front Street Glendora, NJ 08029	Tel. 856 939-2535 Fax 856 939 2114 etucker@seweurodrive.com
	Massachusetts	David Danforth 9 Windmill Road Ellington, CT 06029	Tel. 860 875-7938 Fax 860 870-1025 ddanforth@seweurodrive.com
		Kevin Molloy 84 Pear Tree Lane Newmarket, NH 03857	Tel. 603 659-3361 Fax 603 659-3365 kmolloy@seweurodrive.com
	Michigan	Charles F. McLaughlin 2918 Walmsley Circle Lake Orion, MI 48360	Tel. 248 391-0543 Fax 248 391-0563 cmclaughlin@seweurodrive.com
		Jeff Robinson 17443 Harley Woods Drive Bowling Green, OH 43402	Tel. 419 823-0920 Fax 419 823-0950 jrobinson@seweurodrive.com
		Automotive Technical Sales Center 51183 West Pontiac Trail Wixom, MI 48393	Tel. 248 668-0404 Fax 248 668-9363
		District Sales Representative L.H. Flaherty Company Larry Flaherty / Denny Duimstra 1577 Jefferson, S.E. Grand Rapids, MI 49507	Tel. 616 245-9266 / 800 878-0081 Fax 616 241-0954
	Minnesota	Andy Semelis 154 147th Street Deer Park, WI 54007	Tel. 715 248-4892 Fax 715 248-7890 asemelis@seweurodrive.com
	Mississippi	Sheldon Anderson 4949 Stumberg Lane #117 Baton Rouge, LA 70816	Tel. 225 223-6440 Fax 225 223-6447 sanderson@seweurodrive.com
		Russell Mook 2501 Golden Pond Lane Spring Hill, TN 37174	Tel. 931 486-3242 Fax 931 486-1281 rmook@seweurodrive.com
	Missouri	Gregory R. Tucker 3618 Coffee Tree Court St. Louis, MO 63129	Tel. 314 845-6128 Fax 314 845-6129 Mobile 314 973-7060 gtucker@seweurodrive.com
		Greg White 7634 Bell Road Shawnee, KS 66217	Tel. 913 310-0399 Fax 913 310-0323 gwhite@seweurodrive.com

USA			
District Sales Offices (Cont.)	**Montana**	Duwayne Hogan 3622 Hillcrest Drive Coeur d'Alene, ID 83815	Tel. 208 667-0414 dhogan@seweurodrive.com
	Nebraska	Mike Marksbury 3510 Lindenwood Street Sioux City, IA 51104	Tel. 712 255-3662 Fax 712 258-9299 mmarksbury@seweurodrive.com
	Nevada	Rick A. Burdick 3942 Canyon Terrace Yorba Linda, CA 92886	Tel./Fax 714 970-6197 rburdick@seweurodrive.com
		Michael Haskins 7750 Chisamore Ranch Lane Vacaville, CA 95688	Tel./Fax 707 453-1550 mhaskins@seweurodrive.com
	New Hampshire	Kevin Molloy 84 Pear Tree Lane Newmarket, NH 03857	Tel. 603 659-3361 Fax 603 659-3365 kmolloy@seweurodrive.com
	New Jersey	Edward McLaughlin 7 Ridgeview Lane Port Jervis, NY 12771	Tel. 845 856-8811 Fax 845 856-8844 emclaughlin@seweurodrive.com
		Edward Tucker 806 Front Street Glendora, NJ 08029	Tel. 856 939-2535 Fax 856 939 2114 etucker@seweurodrive.com
	New Mexico	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, CA 94544	Tel. 510 487-3560 Fax 510 487-6381 cshayward@seweurodrive.com
	New York	Art Conner 6273 Pine Cone Ct. Clarence Center, NY 14032	Tel. 716 741-7728 Fax 716 568-8441 aconner@seweurodrive.com
		Richard Maggio 38 Roe Street Melville, NY 11747	Tel. 631 549-8750 Fax 631 351-0872 rmaggio@seweurodrive.com
		Edward McLaughlin 7 Ridgeview Lane Port Jervis, NY 12771	Tel. 845 856-8811 Fax 845 856-8844 emclaughlin@seweurodrive.com
		Peter T. Schmitt 4627 Slippery Rock Manlius, NY 13104	Tel. 315 682-5369 Fax 315 682-3556 pschmitt@seweurodrive.com
	North Carolina	Brent Craft 4004 Smithfield Road Greensboro, NC 27406	Tel. 336 674-5361 Tax 336 674-1290 bcraft@seweurodrive.com
		Jack F. Jung 117 N. Brackenbury Lane Charlotte, NC 28270	Tel. 704 362-2674 Fax 704 362-2961 jjung@seweurodrive.com
	North Dakota	Mike Marksbury 3510 Lindenwood Street Sioux City, IA 51104	Tel. 712 255-3662 Fax 712 258-9299 mmarksbury@seweurodrive.com
	Ohio	Lowell Bishop 4080 Bayberry Court Columbus, OH 43220	Tel. 614 538-0880 Fax 614 538-0889 lbishop@seweurodrive.com
		Guy Borchers 82 Countryside Drive N. Troy, OH 45373	Tel. 937 339-1333 Fax 937 339-1140 gborchers@seweurodrive.com
		John Herstine 248 Plain Street PO Box 82 Magnolia, OH 44643	Tel. 330 866-2544 Fax 330 886-2553 jherstine@seweurodrive.com
		Mike Kushman 20610 Sugar Ridge Lane Lawrenceburg, IN 47025	Tel. 812 537-9318 Fax 812 537-4268 mkushman@seweurodrive.com

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	Oklahoma	Louis Brankel 3301 S. 139th E. Avenue Tulsa, OK 74134	Tel. 918 437-4370 Fax 918 437-4390 lbrankel@seweurodrive.com
	Oregon	Michael S. Johnson 15804 N.E. 160 Ct. Brush Prairie, WA 98606	Tel./Fax 360 256-1785 mjohnson@seweurodrive.com
	Pennsylvania	Scott Bansky 1213 Milton Street Pittsburgh, PA 15218	Tel. 412 243-9040 Fax 412 243-9041 sbansky@seweurodrive.com
		Mark Betzer 17 West Main Street Canton, PA 17724	Tel. 570 673-3443 Fax 570 673-3552 mbetzer@seweurodrive.com
		Paul E. Decker 245 Washington Street Red Hill, PA 18076	Tel. 215 679-5638 Fax 215 679-6281 pdecker@seweurodrive.com
		John Shoop 4 Crestview Court Milton, PA 17847	Tel. 570 713-1593 Fax 570 713-1595 jshoop@seweurodrive.com
	Rhode Island	Kevin Molloy 84 Pear Tree Lane Newmarket, NH 03857	Tel. 603 659-3361 Fax 603 659-3365 kmolloy@seweurodrive.com
	South Carolina	Bill Kinard 20 Wrenwood Court Greer, SC 29651	Tel. 864 288-2725 Fax 864 288-3573 bkinard@seweurodrive.com
	South Dakota	Mike Marksbury 3510 Lindenwood Street Sioux City, IA 51104	Tel. 712 255-3662 Fax 712 258-9299 mmarksbury@seweurodrive.com
	Tennessee	Russell Mook 2501 Golden Pond Lane Spring Hill, TN 37174	Tel. 931 486-3242 Fax 931 486-1281 rmook@seweurodrive.com
	Texas	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, CA 94544	Tel. 510 487-3560 Fax 510 487-6381 cshayward@seweurodrive.com
		John Hill 956 Benchmark Trail Belton, TX 76513	Tel. 254 939-0033 Fax 254 939-0040 jhill@seweurodrive.com
		Ed Lockett 1402 Trails Edge Drive Conway, AR 72032	Tel. 501 336-8620 Fax 501 327-8579 elockett@seweurodrive.com
		Kyle M. Sandy 3804 Southwestern Blvd. Dallas, TX 75225	Tel. 214 696-5595 Fax 214 696-0242 ksandy@seweurodrive.com
		Stewart Sappington 13519 Fawcett Houston, TX 77069	Tel. 281 893-2377 Fax 281 893-1554 ssappington@seweurodrive.com
		Mike Stewart 2903 Shadwell Lane Mesquite, TX 75149	Tel. 972 289-7996 Fax 972 288-3549 mstewart@seweurodrive.com
	Utah	Steven Jacobson 5520 S. 225 E. Ogden, UT 84405	Tel. 801 612-9558 Fax 801 612-9561 sjacobson@seweurodrive.com
	Vermont	Kevin Molloy 84 Pear Tree Lane Newmarket, NH 03857	Tel. 603 659-3361 Fax 603 659-3365 kmolloy@seweurodrive.com

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		Edward Tucker 806 Front Street Glendora, NJ 08029	Tel. 856 939-2535 Fax 856 939 2114 etucker@seweurodrive.com
	Washington	William A. Aschenbrenner 4132 B Place N.W. Suite 200 Auburn, WA 98001	Tel. 253 333-8517 Fax 253 333-8518 baschenbrenner@seweurodrive.com
		Duwayne Hogan 3622 Hillcrest Drive Coeur d'Alene, ID 83815	Tel. 208 667-0414 dhogan@seweurodrive.com
		Michael S. Johnson 15804 N.E. 160 Ct. Brush Prairie, WA 98606	Tel./Fax 360 256-1785 mjohnson@seweurodrive.com
	West Virginia	Lowell Bishop 4080 Bayberry Court Columbus, OH 43220	Tel. 614 538-0880 Fax 614 538-0889 lbishop@seweurodrive.com
		Todd Bauer 35 Kenwood Drive Verona, VA 24482	Tel. 540 248-2420 Fax 540 248-2430 tbauer@seweurodrive.com
		John Herstine 248 Plain Street PO Box 82 Magnolia, OH 44643	Tel. 330 866-2544 Fax 330 886-2553 jherstine@seweurodrive.com
	Wisconsin	Frank Carr 1171 W. Cecil Street Neenah, WI 54956	Tel. 920 751-3871 Fax 920 751-0107 fcarr@seweurodrive.com
		John Hohnstein 10505 Hawks Haven Road Cedar Rapids, IA 52411	Tel. 319 378-1642 Fax 319 378-5585 jhohnstein@seweurodrive.com
		Andy Semelis 154 147th Street Deer Park, WI 54007	Tel. 715 248-4892 Fax 715 248-7890 asemelis@seweurodrive.com
		Walter Sturgeon 17065 El Dorado Drive Brookfield, WI 53005	Tel. 262 790-9715 Fax 262 790-9716 Mobile 414 418-9993 wsturgeon@seweurodrive.com
	Wyoming	Robert Stevenson 604 Alpine Road Dillon, CO 80435	Tel./Fax 970 513-4482 rstevenson@seweurodrive.com
		Steven Jacobson 5520 S. 225 E. Ogden, UT 84405	Tel. 801 612-9558 Fax 801 612-9561 sjacobson@seweurodrive.com
		Duwayne Hogan 3622 Hillcrest Drive Coeur d'Alene, ID 83815	Tel. 208 667-0414 dhogan@seweurodrive.com
	Additional addresses for service in the USA provided on request!		

Germany			
Headquarters **Production** **Sales**	**Bruchsal**	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 42 D-76646 Bruchsal P.O. Box Postfach 3023 • D-76642 Bruchsal	Tel. +49 7251 75-0 Fax +49 7251 75-1970 http://www.sew-eurodrive.de sew@sew-eurodrive.de
Service Competence Center	**Central**	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 1 D-76676 Graben-Neudorf	Tel. +49 7251 75-1710 Fax +49 7251 75-1711 sc-mitte@sew-eurodrive.de

Germany			
	North	SEW-EURODRIVE GmbH & Co KG Alte Ricklinger Straße 40-42 D-30823 Garbsen (near Hannover)	Tel. +49 5137 8798-30 Fax +49 5137 8798-55 sc-nord@sew-eurodrive.de
	East	SEW-EURODRIVE GmbH & Co KG Dänkritzer Weg 1 D-08393 Meerane (near Zwickau)	Tel. +49 3764 7606-0 Fax +49 3764 7606-30 sc-ost@sew-eurodrive.de
	South	SEW-EURODRIVE GmbH & Co KG Domagkstraße 5 D-85551 Kirchheim (near München)	Tel. +49 89 909552-10 Fax +49 89 909552-50 sc-sued@sew-eurodrive.de
	West	SEW-EURODRIVE GmbH & Co KG Siemensstraße 1 D-40764 Langenfeld (near Düsseldorf)	Tel. +49 2173 8507-30 Fax +49 2173 8507-55 sc-west@sew-eurodrive.de
	Electronics	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 42 D-76646 Bruchsal	Tel. +49 7251 75-1780 Fax +49 7251 75-1769 sc-elektronik@sew-eurodrive.de
	Drive Service Hotline / 24 Hour Service		+49 180 5 SEWHELP +49 180 5 7394357
	Additional addresses for service in Germany provided on request!		

France			
Production **Sales** **Service**	**Haguenau**	SEW-USOCOME 48-54, route de Soufflenheim B. P. 20185 F-67506 Haguenau Cedex	Tel. +33 3 88 73 67 00 Fax +33 3 88 73 66 00 http://www.usocome.com sew@usocome.com
Production	**Forbach**	SEW-EUROCOME Zone Industrielle Technopôle Forbach Sud B. P. 30269 F-57604 Forbach Cedex	Tel. +33 3 87 29 38 00
Assembly **Sales** **Service**	**Bordeaux**	SEW-USOCOME Parc d'activités de Magellan 62, avenue de Magellan - B. P. 182 F-33607 Pessac Cedex	Tel. +33 5 57 26 39 00 Fax +33 5 57 26 39 09
	Lyon	SEW-USOCOME Parc d'Affaires Roosevelt Rue Jacques Tati F-69120 Vaulx en Velin	Tel. +33 4 72 15 37 00 Fax +33 4 72 15 37 15
	Paris	SEW-USOCOME Zone industrielle 2, rue Denis Papin F-77390 Verneuil l'Etang	Tel. +33 1 64 42 40 80 Fax +33 1 64 42 40 88
	Additional addresses for service in France provided on request!		

Algeria			
Sales	**Alger**	Réducom 16, rue des Frères Zaghnoun Bellevue El-Harrach 16200 Alger	Tel. +213 21 8222-84 Fax +213 21 8222-84 reducom_sew@yahoo.fr

Argentina			
Assembly **Sales** **Service**	**Buenos Aires**	SEW EURODRIVE ARGENTINA S.A. Centro Industrial Garin, Lote 35 Ruta Panamericana Km 37,5 1619 Garin	Tel. +54 3327 4572-84 Fax +54 3327 4572-21 sewar@sew-eurodrive.com.ar

Australia			
Assembly **Sales** **Service**	**Melbourne**	SEW-EURODRIVE PTY. LTD. 27 Beverage Drive Tullamarine, Victoria 3043	Tel. +61 3 9933-1000 Fax +61 3 9933-1003 http://www.sew-eurodrive.com.au enquires@sew-eurodrive.com.au
	Sydney	SEW-EURODRIVE PTY. LTD. 9, Sleigh Place, Wetherill Park New South Wales, 2164	Tel. +61 2 9725-9900 Fax +61 2 9725-9905 enquires@sew-eurodrive.com.au
	Townsville	SEW-EURODRIVE PTY. LTD. 12 Leyland Street Garbutt, QLD 4814	Tel. +61 7 4779 4333 Fax +61 7 4779 5333 enquires@sew-eurodrive.com.au

Austria			
Assembly **Sales** **Service**	**Wien**	SEW-EURODRIVE Ges.m.b.H. Richard-Strauss-Strasse 24 A-1230 Wien	Tel. +43 1 617 55 00-0 Fax +43 1 617 55 00-30 http://sew-eurodrive.at sew@sew-eurodrive.at

Belarus			
Sales	**Minsk**	SEW-EURODRIVE BY RybalkoStr. 26 BY-220033 Minsk	Tel.+375 (17) 298 38 50 Fax +375 (17) 29838 50 sales@sew.by

Belgium			
Assembly **Sales** **Service**	**Brüssel**	SEW Caron-Vector S.A. Avenue Eiffel 5 B-1300 Wavre	Tel. +32 10 231-311 Fax +32 10 231-336 http://www.sew-eurodrive.be info@caron-vector.be

Brazil			
Production **Sales** **Service**	**Sao Paulo**	SEW-EURODRIVE Brasil Ltda. Avenida Amâncio Gaiolli, 50 Caixa Postal: 201-07111-970 Guarulhos/SP - Cep.: 07251-250	Tel. +55 11 6489-9133 Fax +55 11 6480-3328 http://www.sew.com.br sew@sew.com.br
	Additional addresses for service in Brazil provided on request!		

Bulgaria			
Sales	**Sofia**	BEVER-DRIVE GmbH Bogdanovetz Str.1 BG-1606 Sofia	Tel. +359 2 9151160 Fax +359 2 9151166 bever@fastbg.net

Cameroon			
Sales	**Douala**	Electro-Services Rue Drouot Akwa B.P. 2024 Douala	Tel. +237 33 431137 Fax +237 33 431137

Canada			
Assembly **Sales** **Service**	**Toronto**	SEW-EURODRIVE CO. OF CANADA LTD. 210 Walker Drive Bramalea, Ontario L6T3W1	Tel. +1 905 791-1553 Fax +1 905 791-2999 http://www.sew-eurodrive.ca marketing@sew-eurodrive.ca
	Vancouver	SEW-EURODRIVE CO. OF CANADA LTD. 7188 Honeyman Street Delta. B.C. V4G 1 E2	Tel. +1 604 946-5535 Fax +1 604 946-2513 marketing@sew-eurodrive.ca
	Montreal	SEW-EURODRIVE CO. OF CANADA LTD. 2555 Rue Leger LaSalle, Quebec H8N 2V9	Tel. +1 514 367-1124 Fax +1 514 367-3677 marketing@sew-eurodrive.ca
	Additional addresses for service in Canada provided on request!		

Chile			
Assembly **Sales** **Service**	**Santiago de Chile**	SEW-EURODRIVE CHILE LTDA. Las Encinas 1295 Parque Industrial Valle Grande LAMPA RCH-Santiago de Chile P.O. Box Casilla 23 Correo Quilicura - Santiago - Chile	Tel. +56 2 75770-00 Fax +56 2 75770-01 http://www.sew-eurodrive.cl ventas@sew-eurodrive.cl

China			
Production **Assembly** **Sales** **Service**	**Tianjin**	SEW-EURODRIVE (Tianjin) Co., Ltd. No. 46, 7th Avenue, TEDA Tianjin 300457	Tel. +86 22 25322612 Fax +86 22 25322611 info@sew-eurodrive.cn http://www.sew-eurodrive.cn
Assembly **Sales** **Service**	**Suzhou**	SEW-EURODRIVE (Suzhou) Co., Ltd. 333, Suhong Middle Road Suzhou Industrial Park Jiangsu Province, 215021 P. R. China	Tel. +86 512 62581781 Fax +86 512 62581783 suzhou@sew-eurodrive.cn
	Guangzhou	SEW-EURODRIVE (Guangzhou) Co., Ltd. No. 9, JunDa Road East Section of GETDD Guangzhou 510530 P. R. China	Tel. +86 20 82267890 Fax +86 20 82267891 guangzhou@sew-eurodrive.cn
	Shenyang	SEW-EURODRIVE (Shenyang) Co., Ltd. 10A-2, 6th Road Shenyang Economic Technological Development Area Shenyang, 110141 P. R. China	Tel. +86 24 25382538 Fax +86 24 25382580 shenyang@sew-eurodrive.cn
	Additional addresses for service in China provided on request!		

Colombia			
Assembly **Sales** **Service**	**Bogotá**	SEW-EURODRIVE COLOMBIA LTDA. Calle 22 No. 132-60 Bodega 6, Manzana B Santafé de Bogotá	Tel. +57 1 54750-50 Fax +57 1 54750-44 http://www.sew-eurodrive.com.co sewcol@sew-eurodrive.com.co

Croatia			
Sales **Service**	**Zagreb**	KOMPEKS d. o. o. PIT Erdödy 4 II HR 10 000 Zagreb	Tel. +385 1 4613-158 Fax +385 1 4613-158 kompeks@net.hr

Czech Republic			
Sales	**Praha**	SEW-EURODRIVE CZ S.R.O. Business Centrum Praha Lužná 591 CZ-16000 Praha 6 - Vokovice	Tel. +420 220121234 Fax +420 220121237 http://www.sew-eurodrive.cz sew@sew-eurodrive.cz

Denmark			
Assembly **Sales** **Service**	**Kopenhagen**	SEW-EURODRIVEA/S Geminivej 28-30 DK-2670 Greve	Tel. +45 43 9585-00 Fax +45 43 9585-09 http://www.sew-eurodrive.dk sew@sew-eurodrive.dk

Egypt			
Sales **Service**	**Cairo**	Copam Egypt for Engineering & Agencies 33 El Hegaz ST, Heliopolis, Cairo	Tel. +20 2 22566-299 + 1 23143088 Fax +20 2 22594-757 http://www.copam-egypt.com/ copam@datum.com.eg

Estonia			
Sales	**Tallin**	ALAS-KUUL AS Reti tee 4 EE-75301 Peetri küla, Rae vald, Harjumaa	Tel. +372 6593230 Fax +372 6593231 veiko.soots@alas-kuul.ee

Finland			
Assembly **Sales** **Service**	**Lahti**	SEW-EURODRIVE OY Vesimäentie 4 FIN-15860 Hollola 2	Tel. +358 201 589-300 Fax +358 3 780-6211 sew@sew.fi http://www.sew-eurodrive.fi
Production **Assembly** **Service**	**Karkkila**	SEW Industrial Gears OY Valurinkatu 6 FIN-03600 Karkkila	Tel. +358 201 589-300 Fax +358 201 589-310 sew@sew.fi http://www.sew-eurodrive.fi

Gabon			
Sales	**Libreville**	Electro-Services B.P. 1889 Libreville	Tel. +241 7340-11 Fax +241 7340-12

Great Britain			
Assembly **Sales** **Service**	**Normanton**	SEW-EURODRIVE Ltd. Beckbridge Industrial Estate P.O. Box No.1 GB-Normanton, West- Yorkshire WF6 1QR	Tel. +44 1924 893-855 Fax +44 1924 893-702 http://www.sew-eurodrive.co.uk info@sew-eurodrive.co.uk

Greece			
Sales **Service**	**Athen**	Christ. Boznos & Son S.A. 12, Mavromichali Street P.O. Box 80136, GR-18545 Piraeus	Tel. +30 2 1042 251-34 Fax +30 2 1042 251-59 http://www.boznos.gr info@boznos.gr

Hong Kong			
Assembly **Sales** **Service**	**Hong Kong**	SEW-EURODRIVE LTD. Unit No. 801-806, 8th Floor Hong Leong Industrial Complex No. 4, Wang Kwong Road Kowloon, Hong Kong	Tel. +852 2 7960477 + 79604654 Fax +852 2 7959129 contact@sew-eurodrive.hk

Hungary			
Sales **Service**	**Budapest**	SEW-EURODRIVE Kft. H-1037 Budapest Kunigunda u. 18	Tel. +36 1 437 06-58 Fax +36 1 437 06-50 office@sew-eurodrive.hu

India			
Assembly **Sales** **Service**	**Baroda**	SEW-EURODRIVE India Pvt. Ltd. Plot No. 4, Gidc Por Ramangamdi • Baroda - 391 243 Gujarat	Tel. +91 265 2831086 Fax +91 265 2831087 http://www.seweurodriveindia.com mdoffice@seweurodriveindia.com

Ireland			
Sales **Service**	**Dublin**	Alperton Engineering Ltd. 48 Moyle Road Dublin Industrial Estate Glasnevin, Dublin 11	Tel. +353 1 830-6277 Fax +353 1 830-6458 info@alperton.ie

Israel			
Sales	**Tel-Aviv**	Liraz Handasa Ltd. Ahofer Str 34B / 228 58858 Holon	Tel. +972 3 5599511 Fax +972 3 5599512 office@liraz-handasa.co.il

Italy			
Assembly **Sales** **Service**	**Milano**	SEW-EURODRIVE di R. Blickle & Co.s.a.s. Via Bernini,14 I-20020 Solaro (Milano)	Tel. +39 02 96 9801 Fax +39 02 96 799781 http://www.sew-eurodrive.it sewit@sew-eurodrive.it

Ivory Coast			
Sales	**Abidjan**	SICA Ste industrielle et commerciale pour l'Afrique 165, Bld de Marseille B.P. 2323, Abidjan 08	Tel. +225 2579-44 Fax +225 2584-36

Japan			
Assembly **Sales** **Service**	**Iwata**	SEW-EURODRIVE JAPAN CO., LTD 250-1, Shimoman-no, Iwata Shizuoka 438-0818	Tel. +81 538 373811 Fax +81 538 373814 http://www.sew-eurodrive.co.jp sewjapan@sew-eurodrive.co.jp

Korea			
Assembly **Sales** **Service**	**Ansan-City**	SEW-EURODRIVE KOREA CO., LTD. B 601-4, Banweol Industrial Estate 1048-4, Shingil-Dong Ansan 425-120	Tel. +82 31 492-8051 Fax +82 31 492-8056 http://www.sew-korea.co.kr master@sew-korea.co.kr
	Busan	SEW-EURODRIVE KOREA Co., Ltd. No. 1720 - 11, Songjeong - dong Gangseo-ku Busan 618-270	Tel. +82 51 832-0204 Fax +82 51 832-0230 master@sew-korea.co.kr

Latvia			
Sales	**Riga**	SIA Alas-Kuul Katlakalna 11C LV-1073 Riga	Tel. +371 7139253 Fax +371 7139386 http://www.alas-kuul.com info@alas-kuul.com

Lebanon			
Sales	**Beirut**	Gabriel Acar & Fils sarl B. P. 80484 Bourj Hammoud, Beirut	Tel. +961 1 4947-86 +961 1 4982-72 +961 3 2745-39 Fax +961 1 4949-71 gacar@beirut.com

Lithuania			
Sales	**Alytus**	UAB Irseva Naujoji 19 LT-62175 Alytus	Tel. +370 315 79204 Fax +370 315 56175 info@irseva.lt http://www.sew-eurodrive.lt

Luxembourg			
Assembly **Sales** **Service**	**Brüssel**	CARON-VECTOR S.A. Avenue Eiffel 5 B-1300 Wavre	Tel. +32 10 231-311 Fax +32 10 231-336 http://www.sew-eurodrive.lu info@caron-vector.be

Malaysia			
Assembly **Sales** **Service**	**Johore**	SEW-EURODRIVE SDN BHD No. 95, Jalan Seroja 39, Taman Johor Jaya 81000 Johor Bahru, Johor West Malaysia	Tel. +60 7 3549409 Fax +60 7 3541404 sales@sew-eurodrive.com.my

Mexico			
Assembly **Sales** **Service**	**Queretaro**	SEW-EURODRIVE MEXIKO SA DE CV SEM-981118-M93 Tequisquiapan No. 102 Parque Industrial Queretaro C.P. 76220 Queretaro, Mexico	Tel. +52 442 1030-300 Fax +52 442 1030-301 http://www.sew-eurodrive.com.mx scmexico@seweurodrive.com.mx

Morocco			
Sales	**Casablanca**	Afit 5, rue Emir Abdelkader MA 20300 Casablanca	Tel. +212 22618372 Fax +212 22618351 ali.alami@premium.net.ma

Netherlands			
Assembly **Sales** **Service**	**Rotterdam**	VECTOR Aandrijftechniek B.V. Industrieweg 175 NL-3044 AS Rotterdam Postbus 10085 NL-3004 AB Rotterdam	Tel. +31 10 4463-700 Fax +31 10 4155-552 http://www.vector.nu info@vector.nu

New Zealand			
Assembly **Sales** **Service**	**Auckland**	SEW-EURODRIVE NEW ZEALAND LTD. P.O. Box 58-428 82 Greenmount drive East Tamaki Auckland	Tel. +64 9 2745627 Fax +64 9 2740165 http://www.sew-eurodrive.co.nz sales@sew-eurodrive.co.nz
	Christchurch	SEW-EURODRIVE NEW ZEALAND LTD. 10 Settlers Crescent, Ferrymead Christchurch	Tel. +64 3 384-6251 Fax +64 3 384-6455 sales@sew-eurodrive.co.nz

Norway			
Assembly **Sales** **Service**	**Moss**	SEW-EURODRIVE A/S Solgaard skog 71 N-1599 Moss	Tel. +47 69 241-020 Fax +47 69 241-040 http://www.sew-eurodrive.no sew@sew-eurodrive.no

Peru			
Assembly **Sales** **Service**	**Lima**	SEW DEL PERU MOTORES REDUCTORES S.A.C. Los Calderos, 120-124 Urbanizacion Industrial Vulcano, ATE, Lima	Tel. +51 1 3495280 Fax +51 1 3493002 http://www.sew-eurodrive.com.pe sewperu@sew-eurodrive.com.pe

Poland			
Assembly **Sales** **Service**	**Lodz**	SEW-EURODRIVE Polska Sp.z.o.o. ul. Techniczna 5 PL-92-518 Łódź	Tel. +48 42 67710-90 Fax +48 42 67710-99 http://www.sew-eurodrive.pl sew@sew-eurodrive.pl

Portugal			
Assembly **Sales** **Service**	**Coimbra**	SEW-EURODRIVE, LDA. Apartado 15 P-3050-901 Mealhada	Tel. +351 231 20 9670 Fax +351 231 20 3685 http://www.sew-eurodrive.pt infosew@sew-eurodrive.pt

Romania			
Sales **Service**	**Bucureşti**	Sialco Trading SRL str. Madrid nr.4 011785 Bucuresti	Tel. +40 21 230-1328 Fax +40 21 230-7170 sialco@sialco.ro

Russia			
Assembly **Sales** **Service**	**St. Petersburg**	ZAO SEW-EURODRIVE P.O. Box 36 195220 St. Petersburg Russia	Tel. +7 812 3332522 +7 812 5357142 Fax +7 812 3332523 http://www.sew-eurodrive.ru sew@sew-eurodrive.ru

Senegal			
Sales	**Dakar**	SENEMECA Mécanique Générale Km 8, Route de Rufisque B.P. 3251, Dakar	Tel. +221 849 47-70 Fax +221 849 47-71 senemeca@sentoo.sn

Serbia			
Sales	**Beograd**	DIPAR d.o.o. Ustanicka 128a PC Košum, IV floor SCG-11000 Beograd	Tel. +381 11 347 3244 / +381 11 288 0393 Fax +381 11 347 1337 dipar@yubc.net

Singapore			
Assembly **Sales** **Service**	**Singapore**	SEW-EURODRIVE PTE. LTD. No 9, Tuas Drive 2 Jurong Industrial Estate Singapore 638644	Tel. +65 68621701 Fax +65 68612827 http://www.sew-eurodrive.com.sg sewsingapore@sew-eurodrive.com

Slovakia			
Sales	**Bratislava**	SEW-Eurodrive SK s.r.o. Rybničná 40 SK-83554 Bratislava	Tel. +421 2 49595201 Fax +421 2 49595200 sew@sew-eurodrive.sk http://www.sew-eurodrive.sk
	Žilina	SEW-Eurodrive SK s.r.o. ul. Vojtecha Spanyola 33 SK-010 01 Žilina	Tel. +421 41 700 2513 Fax +421 41 700 2514 sew@sew-eurodrive.sk
	Banská Bystrica	SEW-Eurodrive SK s.r.o. Rudlovská cesta 85 SK-97411 Banská Bystrica	Tel. +421 48 414 6564 Fax +421 48 414 6566 sew@sew-eurodrive.sk

Slovenia			
Sales **Service**	**Celje**	Pakman - Pogonska Tehnika d.o.o. UI. XIV. divizije 14 SLO - 3000 Celje	Tel. +386 3 490 83-20 Fax +386 3 490 83-21 pakman@siol.net

South Africa			
Assembly **Sales** **Service**	**Johannesburg**	SEW-EURODRIVE (PROPRIETARY) LIMITED Eurodrive House Cnr. Adcock Ingram and Aerodrome Roads Aeroton Ext. 2 Johannesburg 2013 P.O.Box 90004 Bertsham 2013	Tel. +27 11 248-7000 Fax +27 11 494-3104 http://www.sew.co.za dross@sew.co.za
	Capetown	SEW-EURODRIVE (PROPRIETARY) LIMITED Rainbow Park Cnr. Racecourse & Omuramba Road Montague Gardens Cape Town P.O.Box 36556 Chempet 7442 Cape Town	Tel. +27 21 552-9820 Fax +27 21 552-9830 Telex 576 062 dswanepoel@sew.co.za

South Africa			
	Durban	SEW-EURODRIVE (PROPRIETARY) LIMITED 2 Monaceo Place Pinetown Durban P.O. Box 10433, Ashwood 3605	Tel. +27 31 700-3451 Fax +27 31 700-3847 dtait@sew.co.za

Spain			
Assembly **Sales** **Service**	**Bilbao**	SEW-EURODRIVE ESPAÑA, S.L. Parque Tecnológico, Edificio, 302 E-48170 Zamudio (Vizcaya)	Tel. +34 94 43184-70 Fax +34 94 43184-71 http://www.sew-eurodrive.es sew.spain@sew-eurodrive.es

Sweden			
Assembly **Sales** **Service**	**Jönköping**	SEW-EURODRIVE AB Gnejsvägen 6-8 S-55303 Jönköping Box 3100 S-55003 Jönköping	Tel. +46 36 3442-00 Fax +46 36 3442-80 http://www.sew-eurodrive.se info@sew-eurodrive.se

Switzerland			
Assembly **Sales** **Service**	**Basel**	Alfred Imhof A.G. Jurastrasse 10 CH-4142 Münchenstein bei Basel	Tel. +41 61 417 1717 Fax +41 61 417 1700 http://www.imhof-sew.ch info@imhof-sew.ch

Thailand			
Assembly **Sales** **Service**	**Chonburi**	SEW-EURODRIVE (Thailand) Ltd. 700/456, Moo.7, Donhuaroh Muang Chonburi 20000	Tel. +66 38 454281 Fax +66 38 454288 sewthailand@sew-eurodrive.com

Tunisia			
Sales	**Tunis**	T. M.S. Technic Marketing Service 5, Rue El Houdaibiah 1000 Tunis	Tel. +216 71 4340-64 + 71 4320-29 Fax +216 71 4329-76 tms@tms.com.tn

Turkey			
Assembly **Sales** **Service**	**Istanbul**	SEW-EURODRIVE Hareket Sistemleri San. ve Tic. Ltd. Sti. Bagdat Cad. Koruma Cikmazi No. 3 TR-34846 Maltepe ISTANBUL	Tel. +90 216 4419163 / 164 3838014/15 Fax +90 216 3055867 http://www.sew-eurodrive.com.tr sew@sew-eurodrive.com.tr

Ukraine			
Sales **Service**	**Dnepropetrovsk**	SEW-EURODRIVE Str. Rabochaja 23-B, Office 409 49008 Dnepropetrovsk	Tel. +380 56 370 3211 Fax +380 56 372 2078 http://www.sew-eurodrive.ua sew@sew-eurodrive.ua

USA			
Production **Assembly** **Sales** **Service**	**Greenville**	SEW-EURODRIVE INC. 1295 Old Spartanburg Highway P.O. Box 518 Lyman, S.C. 29365	Tel. +1 864 439-7537 Fax Sales +1 864 439-7830 Fax Manuf. +1 864 439-9948 Fax Ass. +1 864 439-0566 Telex 805 550 http://www.seweurodrive.com cslyman@seweurodrive.com
Assembly **Sales** **Service**	**San Francisco**	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, California 94544-7101	Tel. +1 510 487-3560 Fax +1 510 487-6381 cshayward@seweurodrive.com

USA			
	Philadelphia/PA	SEW-EURODRIVE INC. Pureland Ind. Complex 2107 High Hill Road, P.O. Box 481 Bridgeport, New Jersey 08014	Tel. +1 856 467-2277 Fax +1 856 845-3179 csbridgeport@seweurodrive.com
	Dayton	SEW-EURODRIVE INC. 2001 West Main Street Troy, Ohio 45373	Tel. +1 937 335-0036 Fax +1 937 440-3799 cstroy@seweurodrive.com
	Dallas	SEW-EURODRIVE INC. 3950 Platinum Way Dallas, Texas 75237	Tel. +1 214 330-4824 Fax +1 214 330-4724 csdallas@seweurodrive.com
	Additional addresses for service in the USA provided on request!		

Venezuela			
Assembly **Sales** **Service**	**Valencia**	SEW-EURODRIVE Venezuela S.A. Av. Norte Sur No. 3, Galpon 84-319 Zona Industrial Municipal Norte Valencia, Estado Carabobo	Tel. +58 241 832-9804 Fax +58 241 838-6275 http://www.sew-eurodrive.com.ve ventas@sew-eurodrive.com.ve sewfinanzas@cantv.net

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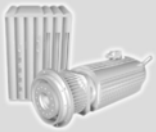

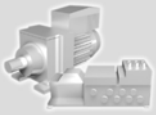

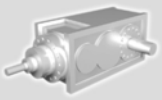

SEW-Eurodrive ...Wherever you are, we are

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Troy, OH
Tel. (937) 335-0036
Fax (937) 440-3799
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SEW-Eurodrive, Inc.
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FAX (856) 845-3179
csbridgeport@seweurodrive.com

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Tel. (864) 439-7537
Fax (864) 439-7830
cslyman@seweurodrive.com

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Assembly Center
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Dallas, TX
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Fax (214) 330-4724
csdallas@seweurodrive.com

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SEW-Eurodrive, Inc.
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Fax (905) 791-2999
marketing@sew-eurodrive.ca

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Tel. (604) 946-5535
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SEW-Eurodrive Co. of Canada Ltd.
LaSalle, Quebec
Tel. (514) 367-1124
Fax (514) 367-3677
marketing@sew-eurodrive.ca

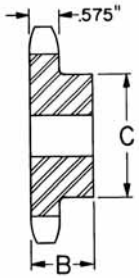
SEW EURODRIVE

www.seweurodrive.com (U.S.)
www.seweurodrive.ca (Canada)

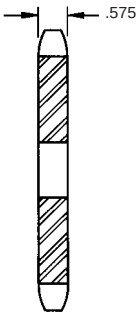
TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
CONCENTRATOR TANK
SKIMMER DRIVE
SPROCKET P/N: 105112
SKIMMER DRIVEN SPROCKET P/N: 105131

SPECIFICATION

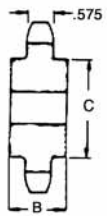
No. 80 for 1" Pitch Single Strand Ch



TYPE B



TYPE A



TYPE C

REBORABLE SPROCKETS–TYPE B									PLATE–TYPE A			
No. Teeth	Spkt. O.D.	Description +	Part No.	Wt.	Bore		B	C Hub Dia.	Spkt. No.	Part No.	Wt.	Stock Bore
					Stock	Max.						
9	3.348	80B9	**105360**	1.8	1	1-3/8	1.56	2.28◊	. . . .	. . . . .	. . . .	. . . .
10	3.678	80B10	**105361**	1.9	1	1-1/2	1.56	2.56◊	. . . .	. . . . .	. . . .	. . . .
11	4.006	80B11	**105108**	2.3	1	1-5/8	1.56	2.81◊	. . .	. . . . .	. . . .	. . .
12	4.332	80B12	**105109**	2.4	1	1-7/8	1.56	3.13◊	80A12	**103135**	1.9	1
13	4.657	80B13	**105110**	3.5	1	2	1.56	3.03	80A13	**103136**	2.2	1
14	4.981	80B14	**105111**	4.3	1	2-1/4	1.56	3.25	80A14	**103137**	2.5	1
15	5.304	80B15	**105112**	5.0	1	2-3/8	1.56	3.67	80A15	**103138**	2.7	1
16	5.627	80B16	**105113**	5.8	1	2-7/16	1.63	3.75	80A16	**103139**	3.0	1
17	5.949	80B17	**105114**	6.3	1	2-7/16	1.63	3.75	80A17	**103140**	3.5	1
18	6.271	80B18	**105115**	7.9	1	2-7/16	1.63	3.75	80A18	**103141**	3.9	1
19	6.593	80B19	**105116**	8.3	1	2-7/16	1.63	3.75	80A19	**103142**	4.3	1
20	6.914	80B20	**105117**	9.2	1	2-15/16	1.63	4.50	80A20	**103143**	4.8	1
21	7.235	80B21	**105118**	9.6	1	2-15/16	1.63	4.50	80A21	**103144**	5.2	1
22	7.555	80B22	**105119**	10	1	2-15/16	1.63	4.50	80A22	**103145**	5.8	1
23	7.876	80B23	**105120**	11	1	2-15/16	1.63	4.50	80A23	**103146**	6.3	1
24	8.196	80B24	**105121**	11	1	2-15/16	1.63	4.50	80A24	**103147**	7.0	1
25	8.516	80B25	**105122**	12	1	2-15/16	1.88	4.50	80A25	**103148**	7.6	1
26	8.836	80B26	**105123**	13	1-3/8	3-1/4	1.88	4.75	80A26	**103149**	8.7	1-3/8
27	9.156	80B27	**105362**	15	1-3/8	3-1/4	1.88	4.75	80A27	**103150**	9.3	1-3/8
28	9.475	80B28	**105363**	15	1-3/8	3-1/4	1.88	4.75	80A28	**103151**	10	1-3/8
30	10.114	80B30	**105124**	15	1-3/8	3-1/4	1.88	4.75	80A30	**103152**	12	1-3/8
32	10.753	80B32	**105125**	17	1-3/8	3-1/4	1.88	4.75	80A32	**103153**	13	1-3/8
35	11.711	80B35	**105364**	19	1-3/8	3-1/4	1.88	4.75	80A35	**103154**	16	1-3/8
36	12.030	80B36	**105126**	20	1-3/8	3-1/4	1.88	4.75	80A36	**103155**	17	1-3/8
40	13.306	80B40	**105127**	24	1-3/8	3-1/4	1.88	4.75	80A40	**103156**	21	1-3/16
45	14.901	80B45	**105128**	33	1-3/8	3-1/4	1.88	4.75	80A45	**103157**	25	1-3/8
48	15.857	80B48	**105129**	36	1-3/8	3-1/4	1.88	4.75	80A48	**103158**	28	1-3/8
50	16.495	80B50	**105365**	39	1-3/8	3-1/4	1.88	4.75	80A50	**103159**	33	1-3/8
54	17.769	80B54	**105130**	44	1-3/8	3-1/4	1.88	4.75	80A54	**103160**	35	1-3/8
60	19.681	80B60	**105131**	52	1-3/8	3-1/4	1.88	4.75	80A60	**103161**	44	1-3/8
70	22.867	80C70	**105656**	76	1-3/8	4-1/8	3.25	6.25	80A70	**103162**	57	1-3/8
80	26.052	80C80	**105657**	90	1-3/8	4-1/8	3.25	6.25	80A80	**103163**	77	1-3/8

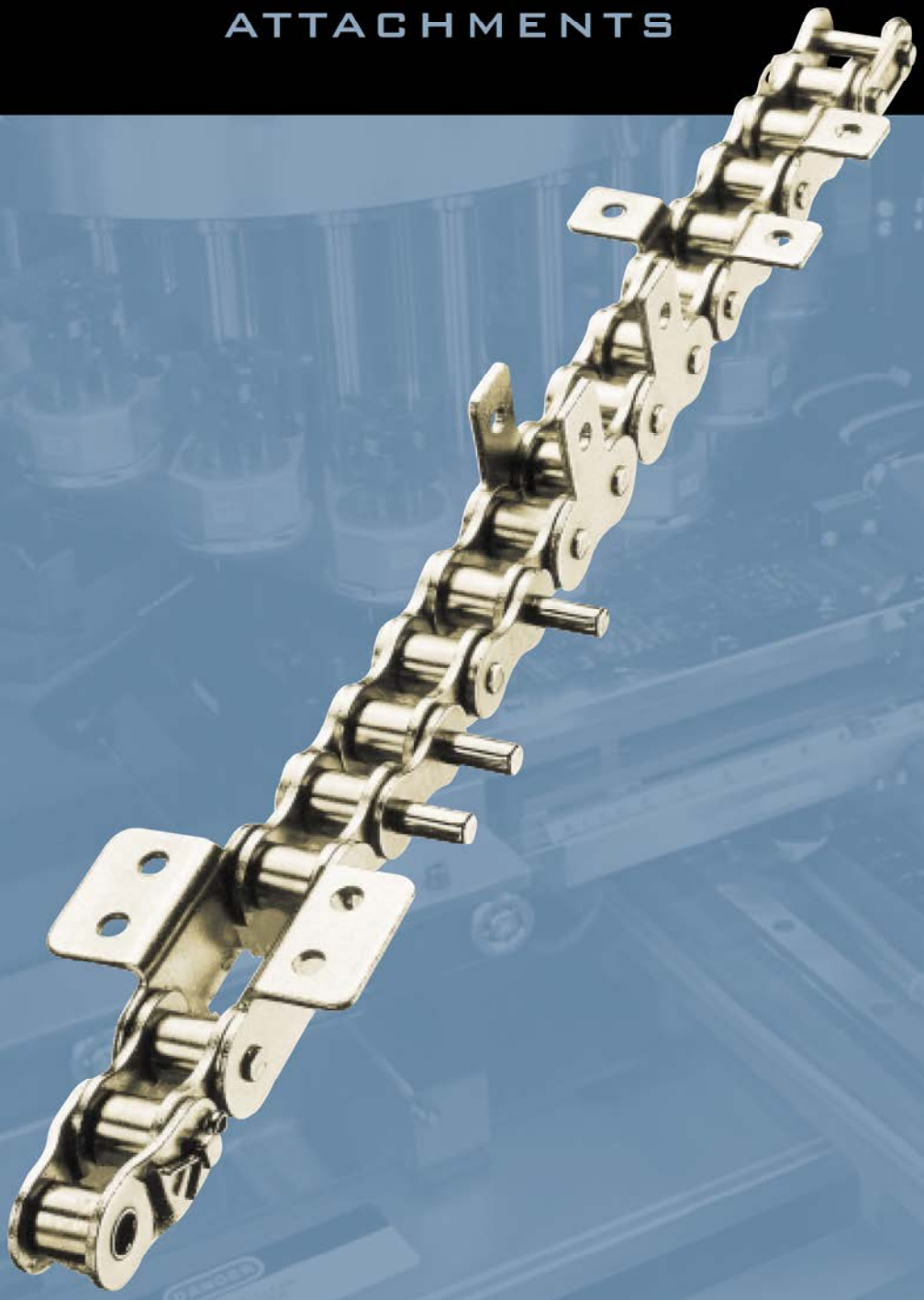
◊ Hub grooved for chain clearance.

+ "H" suffix indicates Hardened Teeth.

See List Price Book MLP for alteration charges.

TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
CONCENTRATOR TANK
SKIMMER DRIVE CHAIN P/N: ASA 80 STEEL

PRECISION ROLLER
WITH INDUSTRY ST
ATTACHMENTS



Rexnord

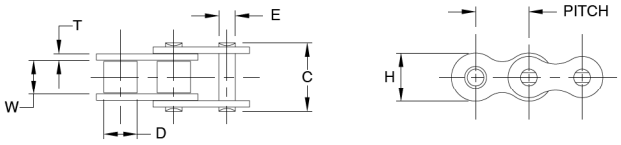
ROLLER CHAIN DIMENSIONS

Rex® and Link-Belt® Roller Chains have dominated the power transmission industry for over 125 years. These brand names are synonymous with high quality and superior performance.

The standard attachment chain market is one that has been served by Rexnord for years focusing on a core product offering that has become the industry standard. Rexnord's precision roller chain is manufactured in an ISO9001 environment by men and women who have unique expertise and unparalleled dedication to providing a quality product on time – every time.

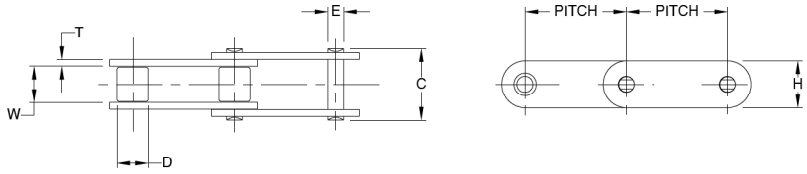
Consult your Rexnord salesperson or service center for program details on large quantity purchases and leadtime requirements.

We look forward to servicing your standard attachment needs.



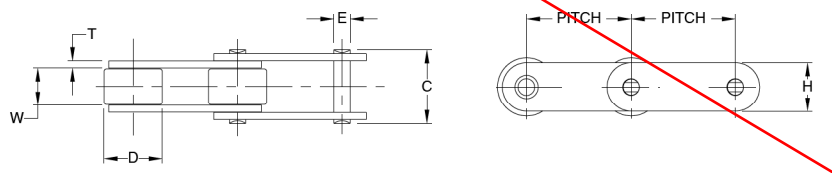
STANDARD SERIES ROLLER CHAIN

Size	Pitch	Dimensions-Inches					Pin Diam.	Average Ultimate Tensile Strength Lbs.	Average Weight Per Foot Lbs.
		Roller/Bushing		Over-All Width	Link-Plate				
		Width	Diameter		Height	Thickness			
		W	D	C	H	T	E		
35	0.375	0.188	0.200	0.461	0.359	0.050	0.141	2,600	0.220
40	0.500	0.312	0.312	0.634	0.473	0.060	0.156	4,300	0.390
50	0.625	0.375	0.400	0.800	0.591	0.080	0.200	7,166	0.720
60	0.750	0.500	0.469	1.000	0.709	0.094	0.234	9,923	1.070
80	1.000	0.625	0.625	1.286	0.949	0.125	0.312	17,640	1.870



CONVEYOR SERIES - STANDARD ROLLER

Size	Pitch	Dimensions-Inches					Pin Diam.	Average Ultimate Tensile Strength Lbs.	Average Weight Per Foot Lbs.
		Roller/Bushing		Over-All Width	Link-Plate				
		Width	Diameter		Height	Thickness			
		W	D	C	H	T	E		
C2040	1.000	0.312	0.312	0.634	0.742	0.060	0.156	4,290	0.340
C2050	1.250	0.375	0.400	0.799	0.591	0.080	0.200	7,040	0.580
C2060H	1.500	0.500	0.469	1.130	0.677	0.125	0.234	9,790	1.010
C2080H	2.000	0.625	0.625	1.413	0.945	0.156	0.312	16,500	1.600

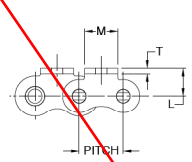


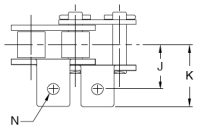
CONVEYOR SERIES - LARGE ROLLER

Size	Pitch	Dimensions-Inches					Pin Diam.	Average Ultimate Tensile Strength Lbs.	Average Weight Per Foot Lbs.
		Roller/Bushing		Over-All Width	Link-Plate				
		Width	Diameter		Height	Thickness			
		W	D	C	H	T	E		
C2042	1.000	0.312	0.625	0.634	0.742	0.060	0.156	4,290	0.580
C2052	1.250	0.375	0.750	0.799	0.591	0.080	0.200	7,040	0.900
C2062H	1.500	0.500	0.875	1.130	0.677	0.125	0.234	9,790	1.460
C2082H	2.000	0.625	1.125	1.413	0.945	0.156	0.312	16,500	2.450

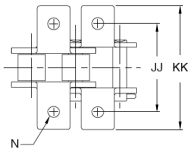
NOTE: DIMENSIONS SUBJECT TO CHANGE

ROLLER CHAIN ATTACHMENTS FOR STANDARD CHAINS





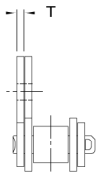
A1



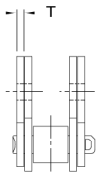
K1

A-1 AND K-1 BENT ONE-HOLE ATTACHMENTS

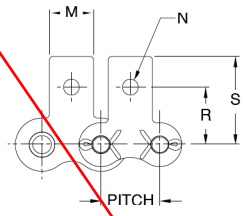
Chain No.	Dimensions-Inches									Average Weight Per Attachment Lbs.	
	Pitch	J	N	M	L	K	JJ	KK	T	A-1	K-1
35	0.375	0.375	0.102	0.311	0.250	0.563	0.750	1.126	0.049	0.002	0.004
40	0.500	0.500	0.142	0.375	0.312	0.681	1.000	1.362	0.060	0.002	0.004
50	0.625	0.625	0.205	0.500	0.406	0.917	1.250	1.834	0.080	0.009	0.018
60	0.750	0.750	0.205	0.625	0.469	1.106	1.500	2.212	0.094	0.015	0.031
80	1.000	1.000	0.268	0.750	0.625	1.413	2.000	2.826	0.125	0.024	0.048



M35

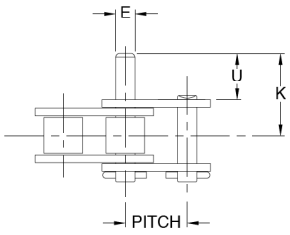


M1

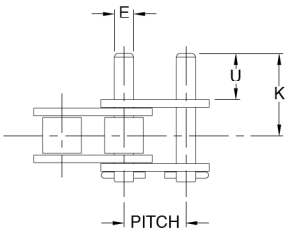


M-35 AND M-1 STRAIGHT ONE-HOLE ATTACHMENTS

Chain No.	Dimensions-Inches						Average Weight Per Attachment Lbs.	
	Pitch	R	N	M	S	T	M-35	M-1
35	0.375	0.374	0.102	0.311	0.571	0.049	0.002	0.004
40	0.500	0.500	0.142	0.375	0.685	0.060	0.002	0.004
50	0.625	0.625	0.205	0.500	0.907	0.080	0.009	0.018
60	0.750	0.720	0.205	0.625	1.051	0.094	0.015	0.031
80	1.000	0.969	0.268	0.750	1.358	0.125	0.024	0.048



D1



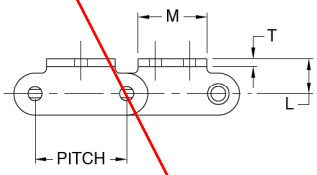
D3

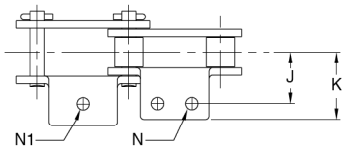
D-1 AND D-3 EXTENDED PINS

Chain No.	Dimensions-Inches				Average Weight Per Attachment Lbs.	
	Pitch	E	U	K	D-1	D-3
35	0.375	0.141	0.374	0.575	0.0015	0.003
40	0.500	0.156	0.374	0.661	0.002	0.004
50	0.625	0.200	0.469	0.827	0.004	0.008
60	0.750	0.234	0.563	1.018	0.006	0.012
80	1.000	0.313	0.752	1.335	0.020	0.040

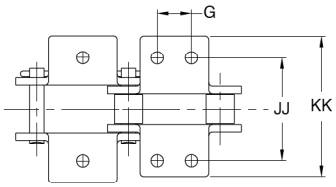
NOTE: DIMENSIONS SUBJECT TO CHANGE

ROLLER CHAIN ATTACHMENTS FOR DOUBLE PITCH CONVEYOR CHAINS





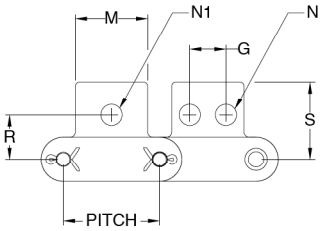
A1/A2

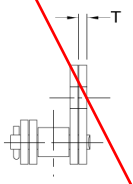


K1/K2

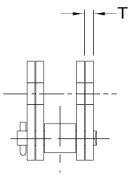
A-1, A-2, K-1, K-2 BENT ATTACHMENTS

Chain No.		Dimensions-Inches											Average Weight Per Attachment Lbs.	
Std. Roller	Large Roller	Pitch	J	N	N1	M	L	G	K	JJ	KK	T	A-1/A-2	K-1/K-2
C2040	C2042	1.000	0.500	0.142	0.205	0.750	0.358	0.375	0.750	1.000	1.500	0.060	0.006	0.013
C2050	C2052	1.250	0.625	0.205	0.268	0.937	0.437	0.469	0.953	1.250	1.906	0.080	0.013	0.026
C2060H	C2062H	1.500	0.844	0.205	0.346	1.126	0.578	0.562	1.230	1.688	2.460	0.125	0.037	0.075
C2080H	C2082H	2.000	1.094	0.268	0.406	1.500	0.750	0.752	1.598	2.188	3.196	0.156	0.082	0.163





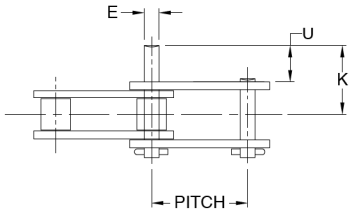
M35/M35-2



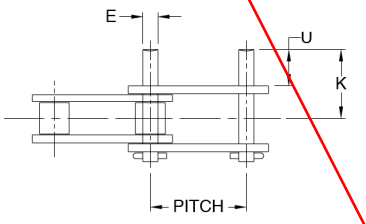
M1/M2

M-35, M-35-2, M-1, M-2 STRAIGHT ATTACHMENTS

Chain No.		Dimensions-Inches									Average Weight Per Attachment Lbs.	
Std. Roller	Large Roller	Pitch	R	R1	N	N1	M	S	G	T	M-35/M-35-2	M-1/M-2
C2040	C2042	1.000	0.531	0.437	0.142	0.205	0.750	0.780	0.375	0.060	0.006	0.013
C2050	C2052	1.250	0.625	0.563	0.205	0.268	0.937	0.969	0.469	0.080	0.013	0.026
C2060H	C2062H	1.500	0.750	0.689	0.205	0.346	1.126	1.205	0.562	0.125	0.037	0.075
C2080H	C2082H	2.000	1.000	0.874	0.268	0.406	1.500	1.583	0.752	0.156	0.082	0.163



D1



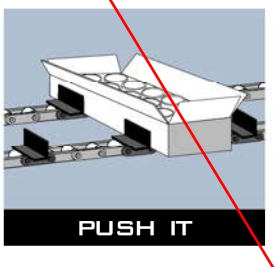
D3

D-1 AND D-3 EXTENDED PIN ATTACHMENTS

Chain No.		Dimensions-Inches				Average Weight Per Attachment Lbs.	
Std. Roller	Large Roller	Pitch	E	U	K	D-1	D-3
C2040	C2042	1.000	0.156	0.374	0.663	0.002	0.004
C2050	C2052	1.250	0.200	0.469	0.833	0.004	0.008
C2060H	C2062H	1.500	0.234	0.563	1.083	0.006	0.012
C2080H	C2082H	2.000	0.313	0.752	1.401	0.020	0.040

NOTE: DIMENSIONS SUBJECT TO CHANGE

Applications



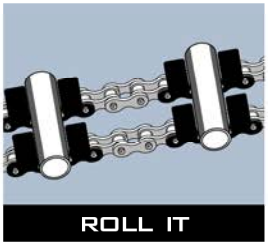
PUSH IT

M-35 on Single Pitch

M-35 on Double-Pitch

M-2 on Double-Pitch

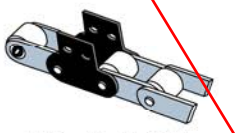
M Type on Double-Pitch



ROLL IT

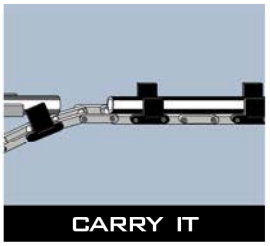
D-3 on Single Pitch

M Type on Double-Pitch



M-2 on Double-Pitch
Carrier Roller

A Type on Single Pitch



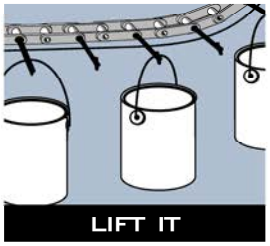
CARRY IT

K-1 on Double-Pitch

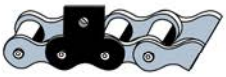
A Type on Single Pitch

K-2 on Double-Pitch

A Type on Double-Pitch



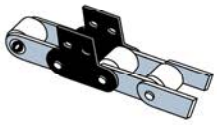
LIFT IT



M-35 on Single Pitch

M-35 on Double-Pitch

D-3 on Double-Pitch



M-2 on Double-Pitch

K Type on Double-Pitch

- Superior Quality for Longer Chain Life
- Precise Attachment Dimensions for Accurate Conveying
- Standard Sizes and Spacing Available From Stock
- Consult Rexnord on all aspects of Attachment Chain Applications

World Class Customer Service

For over 100 years the dedicated people of Rexnord have delivered excellence in quality and service to our customers around the globe. Rexnord is a trusted name when it comes to providing skillfully engineered products that improve productivity and efficiency for industrial applications worldwide. We are committed to exceeding customer expectations in every area of our business: product design, application engineering, operations and customer service.

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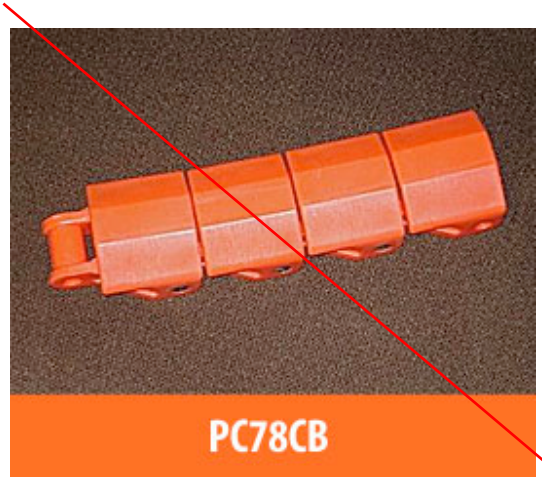
TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
SKIMMER CHAIN TYPE PC78

CAN-AM CHAINS

PC-78 STANDARD / ~~PC-78 CAMEL BACK~~

PC78



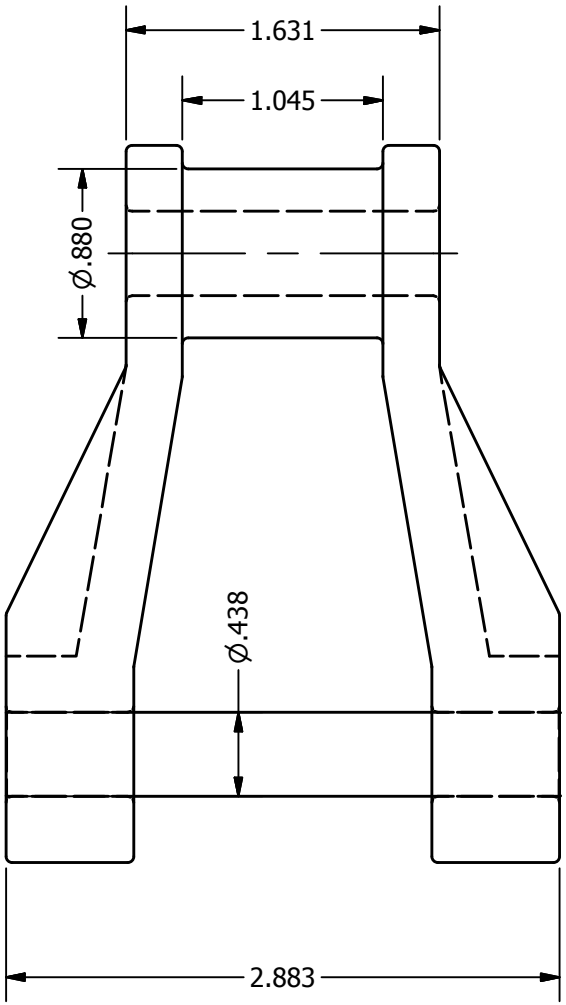
PC78CB

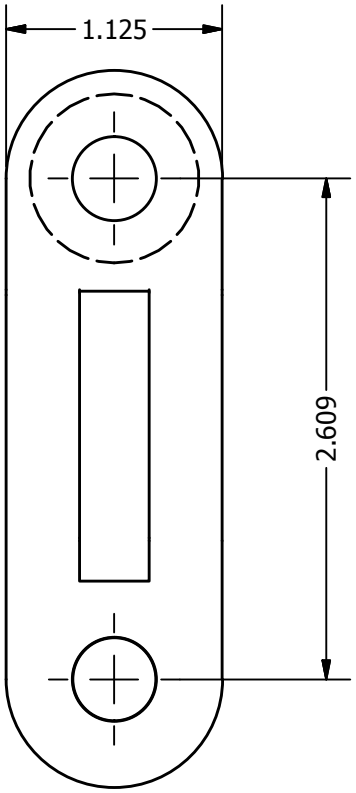
2.609 ACETAL CHAINS

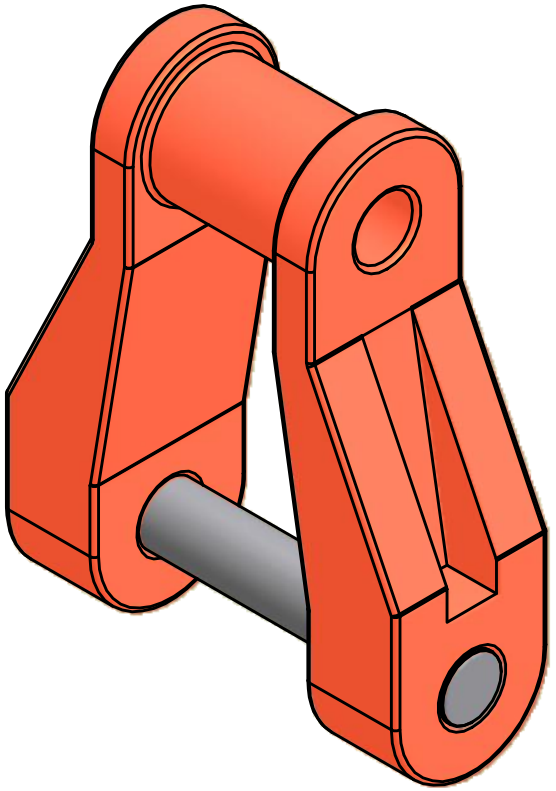
CAN-AM Acetal chains are designed for use in non-marking and corrosive applications. They are great alternatives to conventional steel chains, when conditions demand the unique features.

CAN-AM Acetal chains are used in and around dip tanks, finished lumber, and sewage treatment, just a couple of examples of environments that call for alternative solutions**.**

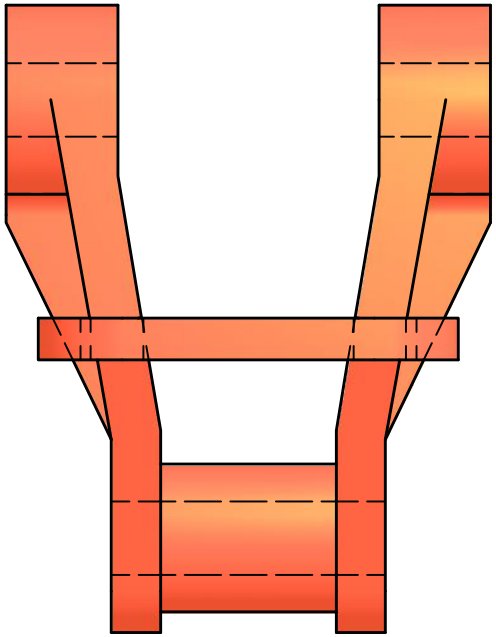
Specifications:
Ultimate Strength: 5,000#
Lengths: 10 ft
Material: Acetal
Packaging: 50 ft/box
Pins: Stainless Steel
Color: Safety Orange

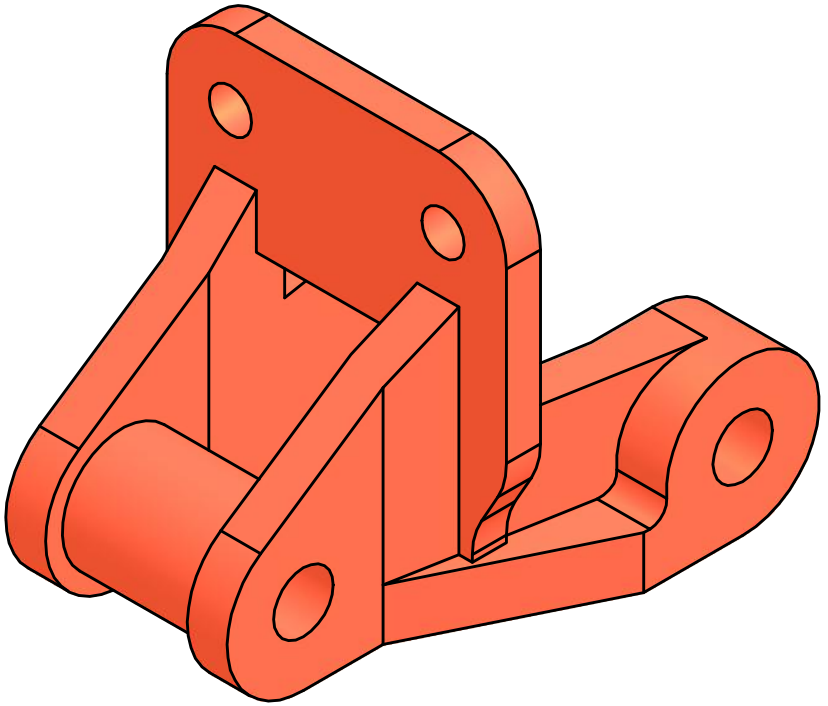


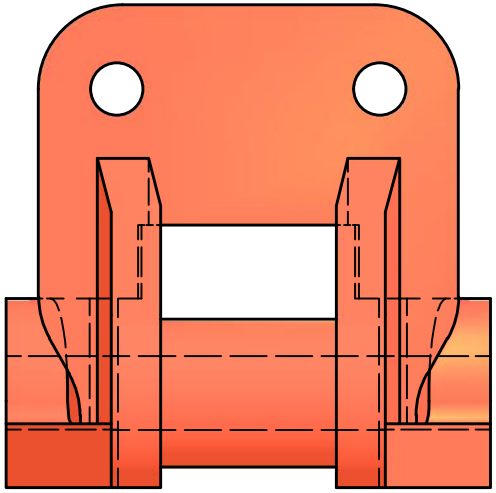


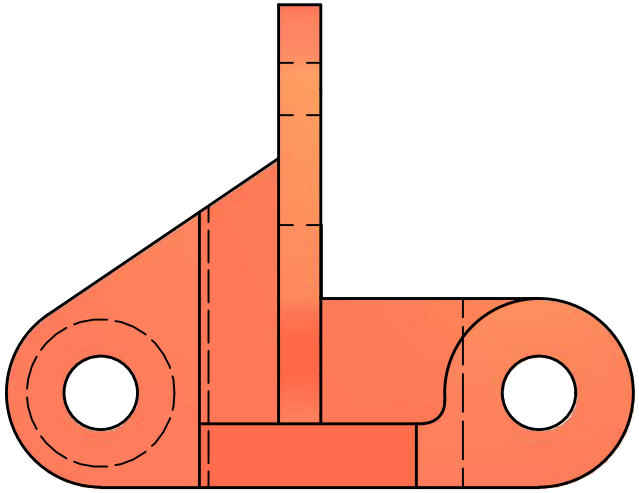


CAN-AM GROUP	DRAWN JANELL ZWEIG 11/27/2007	BRANCH
	CUSTOMER	
	TITLE PC78 CHAIN	
MAT'L ACETAL	DESCRIPTION ACETAL CHAIN W/ STAINLESS STEEL PINS	
DWG NO		REV





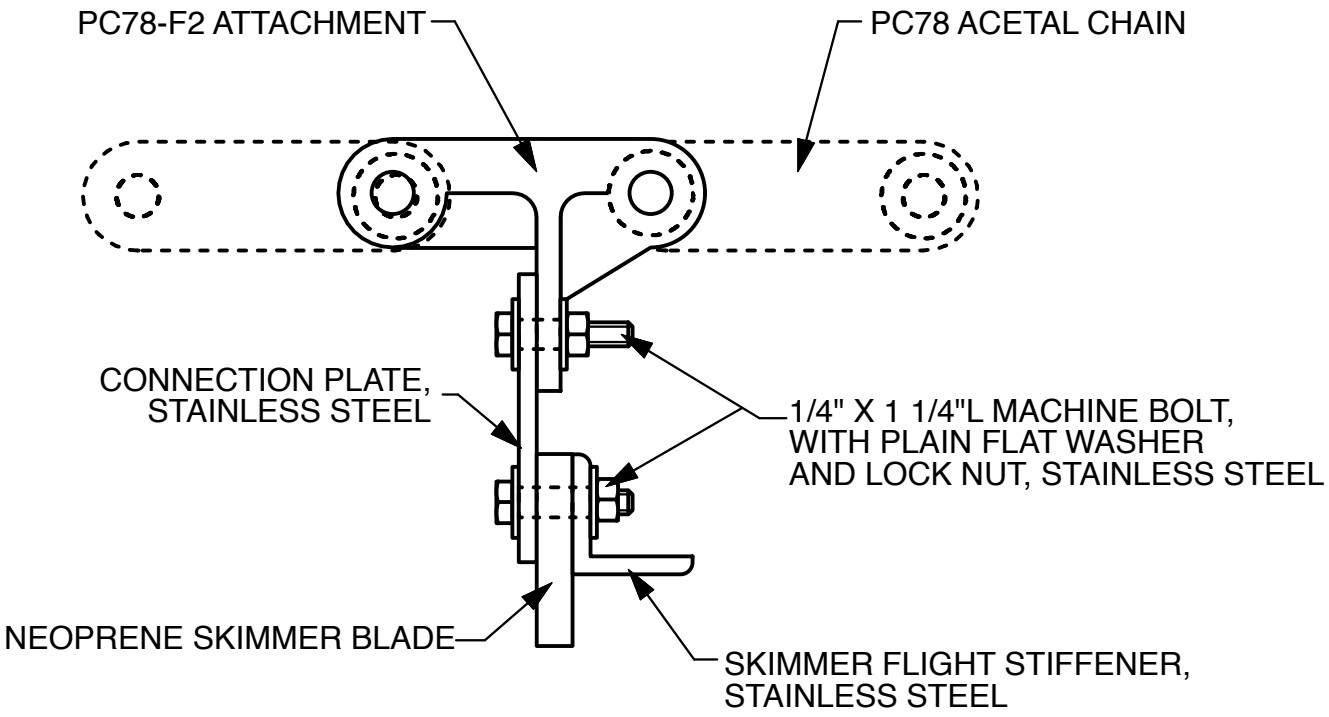




CONCEPT DRAWING

CAN-AM CHAINS

DRAWN JANELL ZWEIG	3/3/2010	MAT'L
TITLE PC78 W/ F2		
DWG NO PC78-F2	REV	SHEET 1 OF 1



SKIMMING DIRECTION @ ~9FPM

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TITLE

SKIMMER CHAIN AND FLIGHT DIAGRAM

PROJECT

Post Point Scum Concentrator, Bellingham, WA

CITY OF BELLINGHAM, WA
POST POINT SCUM CONCENTRATOR
SPEC SECTION #11180
SKIMMER SPROCKET - 10 TOOTH

CAN-AM®

CAN-AM CHAINS

Northex™ 81X - H78 Nylon Sprockets (2.609" PITCH)

NEW

AVAILABLE IN 9,12,13,14 TOOTH PROFILES

Features & Benefits:

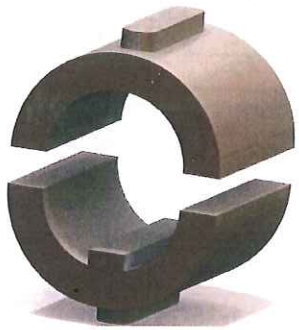
- Light-weight
- Long-lasting
- Quiet
- Cost-effective
- Super strong GSM nylon
- Northane 75DM self-lubricating replaceable / interchangeable bearing inserts fit a variety of shaft sizes
- Alignment tabs on split line add strength
- Increases chain life
- Split for easy installation and replacement
- ASME / ANSI Standard tooth profile
- 2 Grease fittings (optional)

AVAILABLE BORE SIZES:

1-7/16" (107)	c/w 3" THROUGH BORE
1-15/16" (115)	c/w 3" OR 4" THROUGH BORE
2-3/16" (203)	c/w 3" OR 4" THROUGH BORE
2-7/16" (207)	c/w 3" OR 4" THROUGH BORE
2-15/16" (215)	c/w 3" THROUGH BORE

KEYED DRIVE HUBS:

Cast from ZA12 for light to medium duty drive applications



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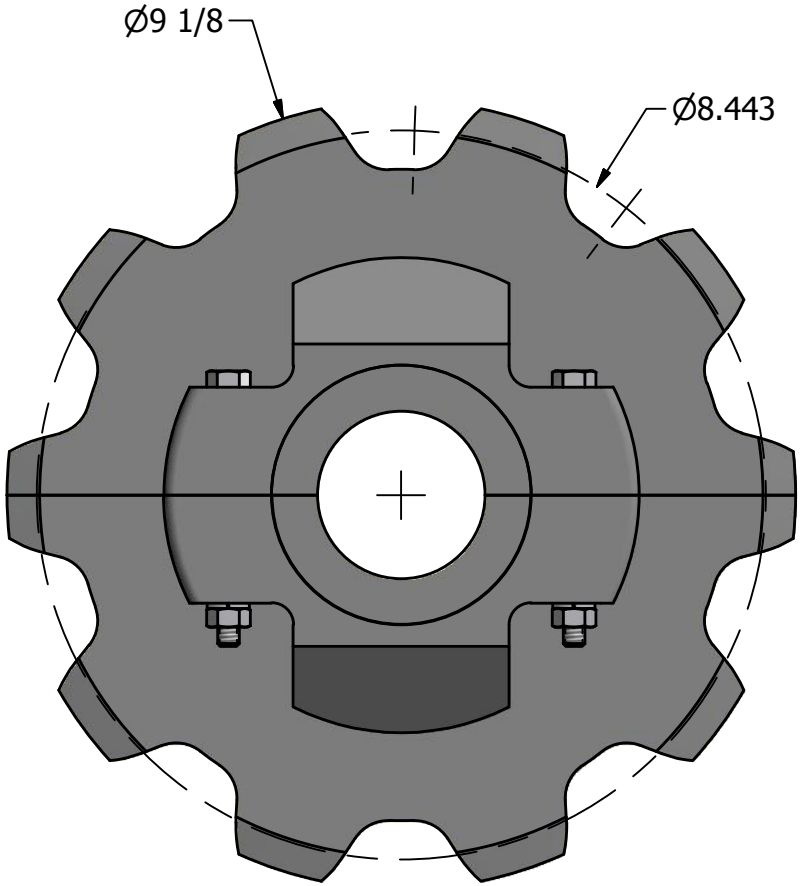
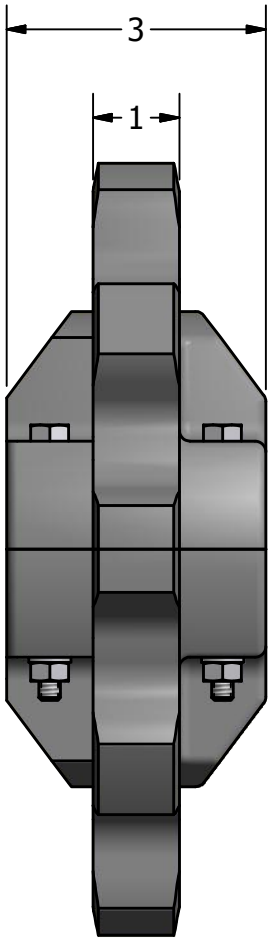
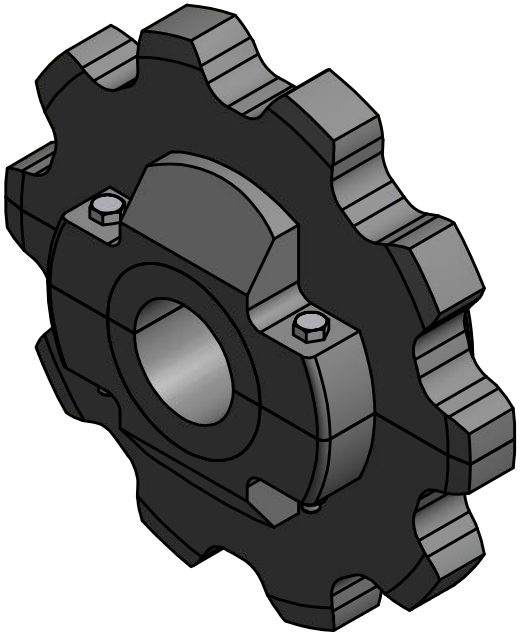






CONCEPT DRAWING

CAN-AM CHAINS

DRAWN JANELL ZWEIG	3/3/2010	MAT'L
TITLE PC78 C10T SPLIT NYLON SPROCKET		
DWG NO	REV	SHEET 1 OF 1

TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
CONCENTRATOR TANK SKIMMER FLIGHT CHAIN
TAKE-UP BEARING P/N: NS-400X6-TUFR
FRAME P/N: 125158

SELECTION/DIMENSIONS

Take-up Frames–NS

TAKE-UP BEARINGS FOR NARROW SLOT BALL BEARING TAKE-UP FRAMES

SETSCREW BALL BEARINGS - INCH

SC Normal Duty Narrow Slot Take-Up Bearings

Shaft Size	Part Number	Bearing Description	Weight lbs.	Take-Up Frame No. Ref.	A	L
1/2 5/8 3/4	125328 125329 125050	NSTU-SC-008 NSTU-SC-010 NSTU-SC-012	1.6 1.5 1.4	NS-210	1-5/32	2-9/64
7/8 15/16 1	125365 125051 125052	NSTU-SC-014 NSTU-SC-015 NSTU-SC-100	1.7 1.6 1.5	NS-210	1-3/16	2-3/16
1-1/16 1-1/8 1-3/16 1-1/4	125366 125367 125153 123174	NSTU-SC-101 NSTU-SC-102 NSTU-SC-103 NSTU-SC-104S	2.9 2.8 2.6 2.5	NS-308	1-25/64	2-11/32
1-1/4 1-5/16 1-3/8 1-7/16	125154 125368 125369 125155	NSTU-SC-104 NSTU-SC-105 NSTU-SC-106 NSTU-SC-107	2.8 2.7 2.6 2.5	NS-308	1-35/64	2-15/32
1-1/2 1-5/8	125156 125370	NSTU-SC-108 NSTU-SC-110	4.7 4.6	NS-400	1-11/16	3-1/64
1-5/8 1-11/16 1-3/4	@ 125157 125371	NSTU-SC-110L NSTU-SC-111 NSTU-SC-112	4.9 4.8 4.7	NS-400	1-23/32	3-3/64
1-15/16 2	125158 125372	NSTU-SC-115 NSTU-SC-200	4.9 4.8	NS-400	1-3/4	3-5/64
2 2-3/16 2-1/4	135171 125160 125373	NSTU-SCM-200 NSTU-SC-203 NSTU-SC-204	6.8 6.6 6.5	NS-407	1-27/32	3-9/64
2-1/4 2-7/16	135172 125162	NSTU-SCM-204 NSTU-SC-207	8.7 8.4	NS-415	1-63/64	3-15/64

@ Assembled to order.

SETSCREW BALL BEARINGS - INCH

SCM Medium Duty Narrow Slot Take-Up Bearings

Shaft Size	Part Number	Bearing Description	Weight lbs.	Take-Up Frame No. Ref.	A	L
1	135102	NSTU-SCM-100	3.0	NS-308	1-25/64	2-11/32
1-3/16 1-1/4	135081 125154	NSTU-SCM-103 NSTU-SC-104	2.9 2.8	NS-308	1-17/32	2-31/64
1-7/16	135105	NSTU-SCM-107	4.7	NS-400	1-11/16	2-31/32
1-1/2	135106	NSTU-SCM-108	5.0	NS-400	1-23/32	3
1-11/16 1-3/4	135107 135170	NSTU-SCM-111 NSTU-SCM-112	5.3 5.2	NS-400	1-3/4	3-12/32
1-15/16 2	135109 135171	NSTU-SCM-115 NSTU-SCM-200	7.0 6.8	NS-407	1-27/32	3-7/64
2-3/16 2-1/4	135111 135172	NSTU-SCM-203 NSTU-SCM-204	8.9 8.7	NS-415	1-63/64	3-3/16

SETSCREW BALL BEARINGS- METRIC

SC Normal Duty Narrow Slot Metric Take-Up Bearings

Shaft Size mm	Part Number	Bearing Description	Weight kg	Take-Up Frame No. Ref.	A	L
20	125900	NSTU-SC-20M	0.6	NS-210	1-5/32	2-9/64
25	125901	NSTU-SC-25M	0.7	NS-210	1-3/16	2-3/16
30	125902	NSTU-SC-30M	1.2	NS-308	1-25/64	2-11/32
35	125903	NSTU-SC-35M	1.2	NS-308	1-35/64	2-15/32
40	125904	NSTU-SC-40M	2.1	NS-400	1-11/16	3-1/64
45	125905	NSTU-SC-45M	2.1	NS-400	1-23/32	3-3/64
50	125906	NSTU-SC-50M	2.2	NS-400	1-3/4	3-5/64
55	125907	NSTU-SC-55M	3.0	NS-407	1-27/32	3-9/64
60	125908	NSTU-SC-60M	4.9	NS-415	1-63/64	3-15/64

D–LOK BALL BEARINGS

Shaft Size mm	Part Number	Bearing Description	Weight kg	Take-Up Frame No. Ref.	A	L
3/4	052626	NSTU-DL-012	1.4	NS210	1-9/32	2-17/32
1-7/16	053493	NSTU-DL-107	2.5	NS308	1-3/4	3-9/32

SETSCREW BALL BEARINGS – METRIC

SCM MEDIUM DUTY NARROW SLOT METRIC TAKE-UP BEARINGS

Shaft Size mm	Part Number	Bearing Description	Weight kg	Take-Up Frame No. Ref.	A	L
25	125980	NSTU-SCM-25M	1.2	NS-308	1-25/64	2-11/32
30	125981	NSTU-SCM-30M	1.3	NS-308	1-17/32	2-31/64
40	125982	NSTU-SCM-35M	2.2	NS-400	1-11/16	2-31/32
35	125983	NSTU-SCM-40M	2.3	NS-400	1-23/32	3
45	125984	NSTU-SCM-45M	2.4	NS-400	1-3/4	3-1/32
50	125985	NSTU-SCM-50M	3.2	NS-407	1-27/32	3-7/64
55	125986	NSTU-SCM-55M	4.0	NS-415	1-63/64	3-3/16

DIMENSIONS SC NARROW SLOT PAGE B2–80	DIMENSIONS SCM NARROW SLOT INCH PAGE B2–84		

Take-up Frames–NS

TAKE-UP BEARINGS FOR NARROW SLOT BALL BEARING TAKE-UP FRAMES

ECCENTRIC COLLAR BALL BEARINGS - INCH

SXV Intermediate Duty Narrow Slot Take-Up Bearings

Shaft Size	Part Number	Bearing Description	Weight lbs.	Take-Up Frame No. Ref.	A	L
3/4	131186	NSTU-SXV-012	1.30	NS-210	1-7/32	2-11/32
7/8 15/16 1	131187 131188 131189	NSTU-SXV-014 NSTU-SXV-015 NSTU-SXV-100	1.73 1.63 1.53	NS-210	1-7/32	2-21/64
1-1/16 1-1/8 1-3/16 1-1/4	131190 131191 131192 131193	NSTU-SXV-101 NSTU-SXV-102 NSTU-SXV-103 NSTU-SXV-104S	2.93 2.83 2.63 2.53	NS-308	1-13/32	2-15/32
1-1/4 1-5/16 1-3/8 1-7/16	131194 131195 131196 131197	NSTU-SXV-104 NSTU-SXV-105 NSTU-SXV-106 NSTU-SXV-107	2.83 2.73 2.63 2.53	NS-308	1-17/32	2-9/16
1-1/2	131198	NSTU-SXV-108	4.73	NS-400	1-23/32	3-5/32
1-11/16 1-3/4	130340 130341	NSTU-SXV-111 NSTU-SXV-112	4.83 4.73	NS-400	1-23/32	3-5/32
1-15/16 2	130342 130343	NSTU-SXV-115 NSTU-SXV-200	4.93 4.83	NS-400	1-23/32	3-5/32
2 2-3/16	130344 130345	NSTU-SXV-200L NSTU-SXV-203	6.83 6.63	NS-407	1-23/32	3-5/16

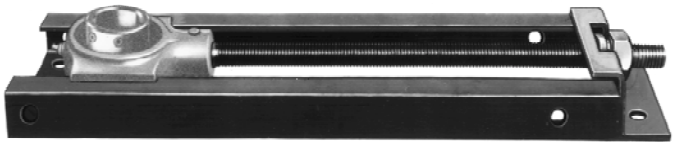
ECCENTRIC COLLAR BALL BEARINGS - INCH

SXR Normal Duty Narrow Slot Take-Up Bearings

Shaft Size	Part Number	Bearing Description	Weight lbs.	Take-Up Frame No. Ref.	A	L
3/4	131154	NSTU-SXR-012	1.5	NS-210	1-23/32	2-35/64
7/8 15/16 1	131156 131157 131158	NSTU-SXR-014 NSTU-SXR-015 NSTU-SXR-100	1.7 1.6 1.5	NS-210	1-3/4	2-37/64
1-1/16 1-1/8 1-3/16	131159 131160 131161	NSTU-SXR-101 NSTU-SXR-102 NSTU-SXR-103	2.9 2.8 2.6	NS-308	1-29/32	2-21/32
1-1/4 1-5/16 1-3/8 1-7/16	131163 131164 131165 131166	NSTU-SXR-104 NSTU-SXR-105 NSTU-SXR-106 NSTU-SXR-107	3.0 2.8 2.7 2.5	NS-308	2-1/64	2-3/4
1-1/2	131167	NSTU-SXR-108	5.0	NS-400	2-7/32	3-11/32
1-5/8 1-11/16 1-3/4	131170 131171 131172	NSTU-SXR-110 NSTU-SXR-111 NSTU-SXR-112	5.4 5.2 5.0	NS-400	2-7/32	3-11/32
1-15/16 2	131175 131177	NSTU-SXR-115 NSTU-SXR-200	5.7 5.3	NS-400	2-15/32	3-15/32
2 2-3/16	@ 131180	NSTU-SXR-200L NSTU-SXR-203	7.4 7.2	NS-407	2-13/16	3-45/64
2-1/4 2-7/16	131182 131185	NSTU-SXR-204 NSTU-SXR-207	10.0 9.0	NS-415	3-1/16	3-29/32

@ Assembled to order.

NARROW SLOT BALL BEARING TAKE-UP FRAMES



Frame Size Description	Part No.	Wt. (Lbs.)
NS-210X6-TUFR	038109	5.5
NS-308X6-TUFR NS-308X12-TUFR	038110 038111	5.8 8.0
NS-400X6-TUFR NS-400X9-TUFR NS-400X12-TUFR NS-400X18-TUFR	038112 038113 038114 038115	9.2 11.3 12.5 16.3
NS-407X9-TUFR NS-407X18-TUFR	038116 038117	13.1 18.6
NS-415X9-TUFR NS-415X18-TUFR	038118 038119	15.5 19.0

SETSCREW BALL BEARINGS - INCH

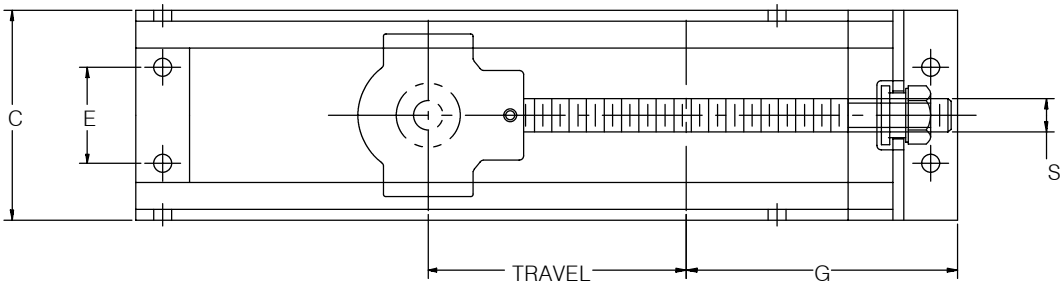
VSC Intermediate Duty Narrow Slot Take-Up Bearings

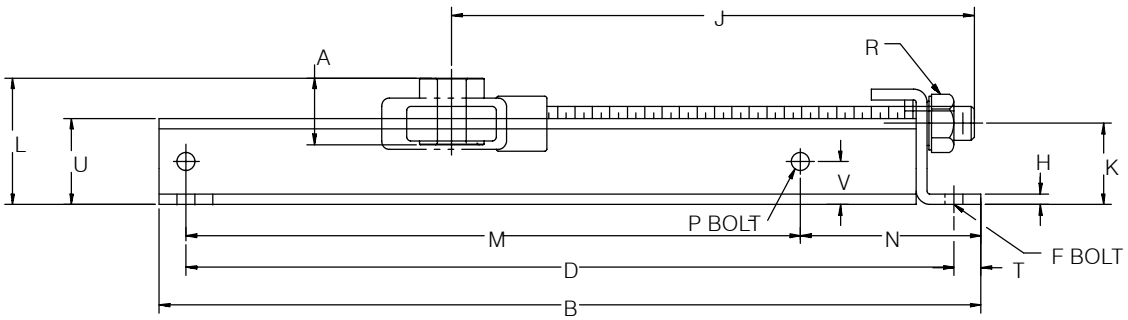
Shaft Size	Part Number	Bearing Description	Weight lbs.	Take-Up Frame No. Ref.	A	L
3/4	125533	NSTU-VSC-012	1.25	NS-210	1-1/16	2-9/64
7/8 15/16 1	125534 125535 125536	NSTU-VSC-014 NSTU-VSC-015 NSTU-VSC-100	1.68 1.58 1.48	NS-210	1-3/32	2-11/64
1-1/8 1-3/16 1-1/4	125537 125538 125540	NSTU-VSC-102 NSTU-VSC-103 NSTU-VSC-104S	2.78 2.58 2.48	NS-308	1-19/64	2-5/16
1-1/4 1-3/8 1-7/16	125539 125541 123680	NSTU-VSC-104 NSTU-VSC-106 NSTU-VSC-107	2.78 2.58 2.48	NS-308	1-7/16	2-7/16
1-1/2	125542	NSTU-VSC-108	4.68	NS-400	1-9/16	2-31/32
1-11/16 1-3/4	125543 125544	NSTU-VSC-111 NSTU-VSC-112	4.78 4.68	NS-400	1-19/32	3
1-15/16 2	125545 125546	NSTU-VSC-115 NSTU-VSC-200	4.88 4.78	NS-400	1-5/8	3-1/32
2 2-3/16	125547 125548	NSTU-VSC-200L NSTU-VSC-203	6.78 6.58	NS-407	1-23/32	3-31/32

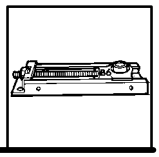
DIMENSIONS SXV NARROW SLOT PAGE B3–62	DIMENSIONS SXR NARROW SLOT PAGE B3–56	DIMENSIONS VSC NARROW SLOT PAGE B2–32	DIMENSIONS NARROW SLOT T.U. FRAME PAGE B13–10

Take-up Frames–NS

NARROW SLOT BALL BEARING TAKE-UP FRAMES





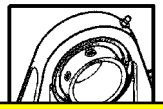


Take-up Frames–NS

NARROW SLOT BALL BEARING TAKE-UP FRAMES

Frame Description	Part No.	Wt. (Lbs.)	A	B	C	D	E	F Base Bolt		G	H
								No.	Dia.		
NS-210x6-TUFR	**038109**	5.5		13-5/8	3-13/16	12-1/8	1-5/8	4	1/2	4-7/8	1/4
NS-308x6-TUFR	**038110**	5.8		13-5/8	4-11/16	12-1/8	2-1/4	4	1/2	5-3/8	1/4
NS-308x12-TUFR	**038111**	8.0		19-5/8		18-1/8					
NS-400x6-TUFR	**038112**	9.2	See Table	14-9/16		13-1/16					
NS-400x9-TUFR	**038113**	11.3	On Page	18-5/8	6-1/16	17-1/8	2-1/2	4	1/2	6	1/4
NS-400x12-TUFR	**038114**	12.5	B13–8 –	20-9/16		19-1/16					
NS-400x18-TUFR	**038115**	16.3	B13–9	27-5/8		26-1/8					
NS-407x9-TUFR	**038116**	13.1		19-1/8	6-1/2	17-3/8	2-3/4	4	5/8	7-1/8	5/16
NS-407x18-TUFR	**038117**	18.6		28-1/8		26-3/8					
NS-415x9-TUFR	**038118**	15.5		19-1/8	7	17-3/8	3	4	5/8	7-3/8	5/16
NS-415x18-TUFR	**038119**	19.0		28-1/8		26-3/8					

Frame Description	J	K	L	M	N	P Side Bolt		R Hex	S	T	U	V	Channel
						No.	Dia.						
NS-210x6-TUFR	11-1/32	1-13/32		9-5/16	3-9/16	4	1/2	1-5/16	3/4-10	3/4	1-1/2	3/4	1-1/2 x 9/16 x 3/16
NS-308x6-TUFR	10-13/16	1-13/32		9-5/16	3-9/16	4	1/2	1-5/16	3/4-10	3/4	1-1/2	3/4	1-1/2 x 9/16 x 3/16
NS-308x12-TUFR	16-13/16			15-5/16									
NS-400x6-TUFR	11-1/16		See Table	10-1/16									
NS-400x9-TUFR	14-1/16	1-7/8	On Page	14-1/8	3-3/4	4	5/8	1-1/2	7/8-9	3/4	2	1	2 x 1 x 3/16
NS-400x12-TUFR	17-1/16		B13–8 –	16-1/16									
NS-400x18-TUFR	23-1/16		B13–9	23-1/8									
NS-407x9-TUFR	15-19/32	1-7/8		14-1/8	4-1/4	4	5/8	1-5/8	1-8	1	2	1	2 x 1 x 3/16
NS-407x18-TUFR	24-19/32			23-1/8									
NS-415x9-TUFR	15-27/32	1-7/8		14-1/8	4-1/4	4	5/8	1-5/8	1-8	1	2	1	2 x 1 x 3/16
NS-415x18-TUFR	24-27/32			23-1/8									

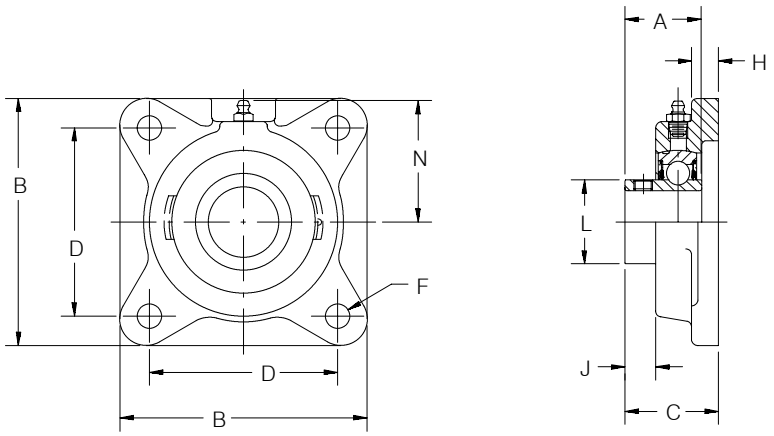


SELECTION/DIMENSIONS

TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
CONCENTRATOR TANK
IDLER BEARING P/N: 124213
WEIR SHAFT BEARING P/N: 124103

Setscrew Ball Bearings

SC NORMAL DUTY 4–BOLT FLANGE BEARINGS



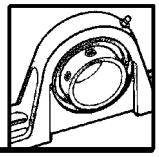
Series	Shaft Size	Relube		No–Lube/Sealed for Life (–NL)		With Flingers	
		Part Number	Description	Part Number	Description	Part Number	Description
203	1/2	**124048**	F4B-SC-008	@	F4B-SC-008–NL	@	F4B-SC-008–FF
	5/8	**124049**	F4B-SC-010	@	F4B-SC-010–NL	@	F4B-SC-010–FF
	17mm	***125885***	*F4B-SC-17M*	@	*F4B–SC–17M–NL*	@	*F4B–SC–17M–FF*
204	1/2	**124098**	F4B-SC-008L	@	F4B-SC-008L–NL	@	F4B-SC-008L–FF
	5/8	**124099**	F4B-SC-010L	@	F4B-SC-010L–NL	**054528**	F4B-SC-010L–FF
	3/4	**124100**	F4B-SC-012	**052010**	F4B-SC-012–NL	**050917**	F4B-SC-012–FF
		124567	F4B-SC-013	@	*F4B–SC–20M–NL*	@	F4B-SC-013–FF
		125886	*F4B–SC–20M*	@		@	*F4B–SC–20M–FF*
205	7/8	**124101**	F4B-SC-014	@	F4B-SC-014–NL	@	F4B-SC-014–FF
	15/16	**124102**	F4B-SC-015	**126524**	F4B-SC-015–NL	@	F4B-SC-015–FF
	1	**124103**	F4B-SC-100	**126525**	F4B-SC-100–NL	**123007**	F4B-SC-100–FF
	25mm	***125887***	*F4B–SC–25M*	@	*F4B–SC–25M–NL*	@	*F4B–SC–25M–FF*
206	1-1/16	**124218**	F4B-SC-101	@	F4B-SC-101–NL	@	F4B-SC-101–FF
	1-1/8	**124204**	F4B-SC-102	**126526**	F4B-SC-102–NL	**125156**	F4B-SC-102–FF
	1-3/16	**124205**	F4B-SC-103	**050834**	F4B-SC-103–NL	**125148**	F4B-SC-103–FF
	1-1/4	**123173**	F4B-SC-104S	**051987**	F4B-SC-104S–NL	@	F4B-SC-104S–FF
	30mm	***125888***	*F4B–SC–30M*	@	*F4B–SC–30M–NL*	@	*F4B–SC–30M–FF*
207	1-1/4	**124206**	F4B-SC-104	**126528**	F4B-SC-104–NL	**052508**	F4B-SC-104–FF
	1-5/16	**124219**	F4B-SC-105	@	F4B-SC-105–NL	@	F4B-SC-105–FF
	1-3/8	**124207**	F4B-SC-106	**052009**	F4B-SC-106–NL	@	F4B-SC-106–FF
	1-7/16	**124208**	F4B-SC-107	**050835**	F4B-SC-107–NL	**057696**	F4B-SC-107–FF
	35mm	***125889***	*F4B–SC–35M*	@	F4B–SC–35M–NL	@	*F4B–SC–35M–FF*
208	1-1/2	**124209**	F4B-SC-108	**051991**	F4B-SC-108–NL	**054523**	F4B-SC-108–FF
	1-5/8	**124210**	F4B-SC-110	**052008**	F4B-SC-110–NL	@	F4B-SC-110–FF
	40mm	***125890***	*F4B–SC–40M*	@	F4B–SC–40M–NL	@	*F4B–SC–40M–FF*
	1-5/8	**125170**	F4B-SC-110L	@	F4B-SC-110L–NL	@	F4B-SC-110L–FF
	1-11/16	**124211**	F4B-SC-111	@	F4B-SC-111–NL	**057850**	F4B-SC-111–FF
			F4B-SC-112	**126531**	F4B-SC-112–NL	**054839**	F4B-SC-112–FF
			F4B–SC–45M	@	*F4B–SC–45M–NL*	@	*F4B–SC–45M–FF*
210	1-15/16	**124213**	F4B-SC-115	**051992**	F4B-SC-115–NL	**124564**	F4B-SC-115–FF
	2	**124214**	F4B-SC-200	**050867**	F4B-SC-200–NL	**050169**	F4B-SC-200–FF
	50mm	***125892***	*F4B–SC–50M*	@	*F4B–SC–50M–NL*	@	*F4B–SC–50M–FF*
211	2	**126192**	F4B-SCM-200	**052004**	F4B-SCM-200–NL	**126132**	F4B-SCM-200–FF
	2-3/16	**124215**	F4B-SC-203	**052007**	F4B-SC-203–NL	**124921**	F4B-SC-203–FF
	2-1/4	**124216**	F4B-SC-204	**052006**	F4B-SC-204–NL	@	F4B-SC-204–FF
	55mm	***125893***	*F4B–SC–55M*	@	*F4B–SC–55M–NL*	@	*F4B–SC–55M–FF*
212	2-1/4	**126283**	F4B-SCM-204	**126537**	F4B-SCM-204–NL	**054482**	F4B-SCM-204–FF
	2-7/16	**124217**	F4B-SC-207	**050843**	F4B-SC-207–NL	**124728**	F4B-SC-207–FF
	60mm	***125894***	*F4B–SC–60M*	@	*F4B–SC–60M–NL*	@	*F4B–SC–60M–FF*
214	2-1/2	**126195**	F4B-SCM-208	@	F4B-SCM-208–NL	**126326**	F4B-SCM-208–FF
	2-11/16	**124261**	F4B-SC-211	@	F4B-SC-211–NL	@	F4B-SC-211–FF
	70mm	***125895***	*F4B–SC–70M*	@	*F4B–SC–70M–NL*	@	*F4B–SC–70M–FF*
215	2-15/16	**124220**	F4B-SC-215	**052291**	F4B-SC-215–NL	@	F4B-SC-215–FF
	75mm	***125896***	*F4B–SC–75M*	@	*F4B–SC–75M–NL*	@	*F4B–SC–75MFF*

WEIR FLANGE BEARING

CONCENTRATOR IDLER BEARING

@ Assemble to order

FEATURE/BENEFITS SETSCREW BALL BEARINGS PAGE B2–2	HOW TO ORDER/ NOMENCLATURE PAGE B2–4	SELECTION PAGE B2–5	



Setscrew Ball Bearings

SC NORMAL DUTY 4–BOLT FLANGE BEARINGS

Series	Shaft Size	Weight lbs. *kgs.*	A	B	C	D	F Bolt Dia.	H	J	L	N
203	1/2 5/8 *17mm*	1.1 1.0 *0.5*	1 *25.4*	3 *76.2*	1-3/16 *30.2*	2-1/8 *54.0*	3/8 *M10*	7/16 *11.1*	11/32 *8.7*	31/32 *24.6*	1-11/16 *42.9*
204	1/2 5/8 3/4 13/16 *20mm*	1.8 1.7 1.6 1.5 *0.8*	1-5/32 *29.4*	3-3/8 *85.7*	1-3/8 *34.9*	2-1/2 *63.5*	3/8 *M10*	7/16 *11.1*	25/64 *9.9*	1-1/8 *28.6*	1-15/16 *49.2*
205	7/8 15/16 1 *25mm*	2.0 1.9 1.8 *0.9*	1-3/16 *30.2*	3-3/4 *95.3*	1-23/64 *34.5*	2-3/4 *69.9*	7/16 *M10*	1/2 *12.7*	25/64 *9.9*	1-5/16 *33.3*	2-1/16 *52.4*
206	1-1/16 1-1/8 1-3/16 1-1/4 *30mm*	2.9 2.8 2.7 2.6 *1.3*	1-25/64 *35.3*	4-1/4 *108.0*	1-17/32 *38.9*	3-1/4 *82.6*	7/16 *M10*	1/2 *12.7*	15/32 *11.9*	1-37/64 *40.1*	2-3/16 *55.6*
207	1-1/4 1-5/16 1-3/8 1-7/16 *35mm*	4.0 3.9 3.8 3.7 *1.7*	1-17/32 *38.9*	4-3/4 *120.7*	1-3/4 *44.5*	3-5/8 *92.1*	1/2 *M12*	9/16 *14.3*	17/32 *13.5*	1-27/32 *46.8*	2-7/16 *61.9*
208	1-1/2 1-5/8 *40mm*	4.8 4.7 *2.1*	1-11/16 *42.9*	5-1/8 *130.2*	1-7/8 *47.6*	4 *101.6*	1/2 *M12*	9/16 *14.3*	17/32 *13.5*	2-3/64 *52.0*	2-3/8 *60.3*
209	1-5/8 1-11/16 1-3/4 *45mm*	6.1 6.0 5.9 *2.7*	1-23/32 *43.7*	5-3/8 *136.5*	1-15/16 *49.2*	4-1/8 *104.8*	1/2 *M14*	5/8 *15.9*	17/32 *13.5*	2-7/32 *56.4*	2-3/4 *69.9*
210	1-15/16 2 *50mm*	6.7 6.6 *3.0*	1-3/4 *44.5*	5-5/8 *142.9*	2 *50.8*	4-3/8 *111.1*	1/2 *M16*	5/8 *15.9*	17/32 *13.5*	2-7/16 *61.9*	2-7/8 *73.0*
211	2 2-3/16 2-1/4 *55mm*	9.3 9.0 8.9 *4.1*	1-27/32 *46.8*	6-1/2 *165.1*	2-5/32 *54.8*	5-1/8 *130.2*	5/8 *M16*	11/16 *17.5*	9/16 *14.3*	2-23/32 *69.1*	3-1/4 *82.6*
212	2-1/4 2-7/16 *60mm*	11.1 10.6 *6.0*	1-63/64 *50.4*	6-7/8 *174.6*	2-9/32 *57.9*	5-5/8 *142.9*	5/8 *M16*	11/16 *17.5*	9/16 *14.3*	2-31/3 *75.4*	3-1/2 *88.9*
214	2-1/2 2-11/16 *70mm*	16.0 15.4 *6.9*	2-15/64 *56.8*	7-3/8 *187.3*	2-3/4 *69.9*	5-7/8 *149.2*	5/8 *M16*	11/16 *17.5*	9/16 *14.3*	3-5/16 *84.1*	3-11/16 *93.7*
215	2-15/16 *75mm*	17.6 *8.0*	2-9/32 *57.9*	7-3/4 *196.9*	2-57/64 *73.4*	6 *152.4*	3/4 *M18*	1 *25.4*	41/6 *16.34*	3-5/8 *92.1*	3-7/8 *98.4*

DIMENSIONS
SC INSERTS
PAGE B2–108

MODIFICATIONS
PAGE B2–119

RELATED PRODUCTS
PAGE B2–43

TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317SCUM
CONCENTRATOR HOLDING TANK
MIXER / BLENDER MODEL: 2N2-17

OPERATION & MAINTENANCE MANUAL

FOR

SHARPE MIXERS LIQUID AGITATION EQUIPMENT

READ BEFORE UNPACKING MIXER

YOUR MIXER HAS BEEN TESTED AND SHAFT STRAIGHTNESS VERIFIED PRIOR TO SHIPMENT. CAREFUL HANDLING OF SHAFT PRIOR TO AND DURING INSTALLATION WILL ENSURE PROPER OPERATION. THE FOLLOWING CRITERIA MUST BE ADHERED TO IN ORDER TO PREVENT DAMAGE TO EQUIPMENT OR SERIOUS INJURY TO OPERATING PERSONNEL:

WARNING

- HIGH VOLTAGE AND ROTATING PARTS CAN CAUSE SERIOUS OR FATAL INJURY. ONLY EXPERIENCED PERSONNEL MUST OPERATE OR SERVICE THIS EQUIPMENT.
- **NEVER** ENTER TANK WITHOUT LOCKING-OUT POWER TO MIXER.
- LOCKOUT POWER PRIOR TO REMOVING ANY GUARDS OR SERVICING ANY PART OF THIS EQUIPMENT, INCLUDING INITIAL INSTALLATION AND/OR INSPECTION.
- THIS MANUAL MUST FIRST BE FULLY READ AND UNDERSTOOD PRIOR TO INSTALLATION BY ALL PERSONNEL INSTALLING AND/OR OPERATING THIS, OR NEAR THIS EQUIPMENT.
- **NEVER** USE THIS EQUIPMENT FOR ANY USE OTHER THAN DESCRIBED IN THE ORIGINAL PROPOSAL AND APPLICATION BOX ON THE DATA SHEET.
- MODIFICATIONS UNAUTHORIZED BY SHARPE MIXERS TO THIS EQUIPMENT MAY DAMAGE EQUIPMENT OR CAUSE SERIOUS INJURY TO PERSONNEL.

CAUTION

- **ALWAYS** READ THE SERVICE MANUAL THOROUGHLY BEFORE INSTALLATION AND START-UP.
- OPERATION OF MIXER IN AIR IS NOT RECOMMENDED.
- **ALWAYS** FOLLOW MOUNTING RECOMMENDATIONS DESCRIBED IN ORIGINAL PROPOSAL. MIXER PLATFORM MUST BE STABLE.
- EXTENDED OPERATION OF MIXER WHEN LIQUID LEVEL IS AT OR NEAR BOTTOM IMPELLER IS NOT RECOMMENDED.
- **ALWAYS** ROTATE THE SHAFT BY HAND TO VERIFY STRAIGHTNESS PRIOR TO OPERATION IN LIQUID.
- **ALWAYS** CHECK ASSEMBLY DRAWING AND DATA SHEET FOR SPECIAL OPERATING SPEED REQUIREMENTS IF USING A VARIABLE SPEED DRIVE.
- **ALWAYS** FLUIDIZE SETTLED SOLIDS BEFORE STARTING MIXER.
- **NEVER** LIFT MIXER BY SHAFT.

ANY EXCEPTIONS TO THE ABOVE MUST BE AGREED UPON IN WRITING BY ***SHARPE MIXERS*** AND NOTED ON THE ASSEMBLY DRAWING.

SHARPE MIXERS
P.O. BOX 3906
SEATTLE, WA 98124
(206) 767-5660 • FAX (206) 767-9170
(800) 237-8815

SERIAL NO.: 59264

SHARPE MIXERS

STANDARD TERMS & CONDITIONS OF SALE

In consideration of the mutual promises and agreements contained herein, the buyer ("Buyer") and SHARPE MIXERS, INC. ("SHARPE" or "WE") hereby agree to the following terms and conditions; provided, that the terms and conditions (including the price quotations) shall only become binding on SHARPE upon the mailing or other transmission of SHARPE's Acknowledgment Form as described in Section 6 Below.

1. Warranty

We warrant that we shall repair or replace, without additional charge, or refund the price of, the products provided to the Buyer herewith (collectively "Mixer") if the Mixer (a) is defective in materials or workmanship, (b) fails to provide the process results specified in SHARPE's proposal ("Proposal"), or (c) if no process results are specified in SHARPE's proposal, Mixer fails to provide the process results described in Buyer's written specifications. While we warrant that the Mixer is made from the materials specified in the Proposal or its commercial equivalent, WE DO NOT GUARANTEE THE MIXER AGAINST CHEMICAL ATTACK OR OTHER DETERIORATION DUE TO EXPOSURE.

THE FOREGOING WARRANTIES EXTEND ONLY FOR TWELVE (12) MONTHS AFTER FIRST INSTALLATION OF THE MIXER AT BUYER'S FACILITY OR FOR EIGHTEEN (18) MONTHS AFTER ITS SHIPMENT FROM SHARPE'S FACILITY, WHICHEVER PERIOD IS SHORTER. ADDITIONALLY, SUCH WARRANTIES ARE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, ORAL OR WRITTEN, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND OF ALL OTHER OBLIGATIONS OR LIABILITIES ON THE PART OF SHARPE. THESE WARRANTIES SHALL NOT APPLY TO FAILURES RESULTING FROM (A) NORMAL WEAR AND TEAR, (B) ACCIDENT, NEGLIGENCE, ALTERATION, ABUSE, MISUSE OR USE INCONSISTENT WITH ANY INSTRUCTIONS PROVIDED AS TO STORAGE, HANDLING, MAINTENANCE, LUBRICATION, INSTALLATION, STARTUP, OPERATION AND SAFETY, (C) IMPROPER INSTALLATION AND/OR (D) INACCURATE AND/OR INCOMPLETE SPECIFICATIONS, DESIGN CONDITIONS OR OTHER DATA FURNISHED BY OR ON BEHALF OF BUYER. WE MAKE NO WARRANTY WHATSOEVER WITH RESPECT TO ACCESSORIES OR PARTS NOT SUPPLIED BY SHARPE.

2. LIMITATION OF REMEDIES

Buyer's remedy for breach of any of the foregoing warranties shall be limited to those set forth in Section 1 above; provided, WE will not be responsible for removal, loading, installation, freight or similar related expenses in connection with any replacement, repair or return. The determination of which such remedy shall be applicable shall be determined by SHARPE, in its sole discretion. THE ABOVE STATED REMEDIES ARE SHARPE'S ENTIRE AND EXCLUSIVE LIABILITIES AND BUYER'S EXCLUSIVE REMEDIES FOR ANY CLAIM FOR DAMAGES IN CONNECTION HEREWITH. By way of illustration and not limitation, in no event shall we be liable for any direct, indirect, special or consequential damages or delay whatsoever or loss of use, and SHARPE'S liability under no circumstance will exceed the contract price for the Mixer for which liability is claimed. All claims for breach of any of SHARPE'S warranties shall be barred unless Buyer notifies SHARPE in writing within 30 days of discovery of the breach. WE shall not be responsible for any repairs performed by third parties unless the extent, terms and costs of such repairs are authorized by SHARPE in writing in advance. Buyer shall be solely responsible for any agreement that Buyer makes with its customers which is contrary to the foregoing provisions.

3. DELIVERY / SHIPMENTS

Unless otherwise quoted, shipments are F.O.B. shipping point. Risk of loss and damage to the Mixer shall pass to Buyer upon delivery to the carrier and at such time, Buyer shall be solely responsible for the Mixer. We will make every effort to ship on the date specified in the contract; provided, that such dates are approximations only. We will not be liable for or penalized as a result of delays in shipment, for any cause, including but not limited to delays that are beyond our control.

Shipments may not be deferred by Buyer beyond the specified shipment date after commencement of manufacture without SHARPE's written consent. When shipping is deferred for Buyer's convenience, due to lack of shipping instructions, failure to complete credit arrangements satisfactory to SHARPE or late delivery of customer supplied material, Buyer agrees to pay reasonable storage charges, interest and any other expenses incurred by SHARPE due to the delay. Orders on which delivery is deferred shall be invoiced upon completion of manufacture and are subject to finance charges of 1.5% per month.

4. CHANGES

Any changes requested by Buyer and approved by SHARPE with respect to the Mixers shall be subject to adjustments to the delivery schedule and/or price of the Mixer, as shall be determined by SHARPE, in its sole discretion.

5. PRICES / PAYMENT

Price quotations set forth on any Proposals from SHARPE are for informational purposes only and represent an estimate of the prices that will be available to Buyer. Such price quotations are not binding upon SHARPE until an authorized representative of SHARPE (at SHARPE's home office in Seattle, Washington) accepts and confirms in writing any offer to purchase submitted by the Buyer by way of a Contract Acknowledgment. Prices set forth on SHARPE's Acknowledgment Form shall be binding with respect to the order described therein; provided, that orders placed "on-hold" or held over 3 months or more (i.e., awaiting Buyers approval) are subject to price adjustments.

Upon approval of Buyer's credit by SHARPE, unless stated otherwise on the face hereof (in which case such terms shall control), terms are net 30 days, F.O.B. Seattle, WA-Freight Collect; provided, that if, in the sole discretion of SHARPE, (a) the order is for a customized or otherwise unique Mixer or is of a substantial magnitude or for any other reason, or (b) Buyer's credit is not approved or the financial condition of Buyer becomes such that it does not justify continuance of production, shipment or delivery on the terms of payment specified, we may require full or partial payment in advance or payment upon delivery. Prices do not include customs, duties or taxes such as sales, use, excise, retailer's occupation or similar taxes, and if, in connection with this transaction, SHARPE is subject to any such customs, duties or taxes, the same will be added to the purchase price to be paid by Buyer. If payment is not made when due, Buyer shall pay SHARPE a finance charge of 1.5% per month and (ii) ALL WARRANTIES PROVIDED BY SHARPE HEREUNDER SHALL IMMEDIATELY BE NULL AND VOID. All price lists and discount schedules are subject to change without notice.

6. ACCEPTANCE

All orders by Buyer are subject to acceptance by SHARPE's authorized representative at SHARPE's main office; provided, that any terms or conditions which are additional or different to the terms and conditions set forth herein or which may have been included in any communication between Buyer and SHARPE, whether written or oral, are hereby objected to by SHARPE and shall not be effective or binding upon SHARPE unless specifically assented to by a duly authorized officer of SHARPE in Writing. No waiver, alteration or modification of any of the provisions hereof shall be binding on SHARPE unless made in writing and signed by a duly authorized officer of SHARPE. Buyer's acceptance of delivery of the Mixer shall constitute full acceptance of all of the terms and conditions set forth herein. The failure of either party to enforce any of its rights hereunder shall not constitute a waiver of such rights or of any other rights hereunder. The terms and conditions of the Acknowledgment contain the entire agreement of the parties. Clerical and typographical errors are subject to correction.

7. CANCELLATION CHARGES

Orders placed by Buyer may not be canceled without SHARPE's written consent. Buyer agrees to indemnify SHARPE against all loss, damage or expense incurred due to cancellation including, but not limited to the cost of special materials, non-resalable goods, completed or in process, labor, freight, engineering time, overhead and profit. A minimum charge of 20% will be applied in the event of a cancellation.

8. OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

WE do not warrant or represent that any of SHARPE's products by themselves or in a system or with other equipment will conform to or comply with the provisions of the Occupational Safety and Health Act of 1970 and the standards and regulations thereunder, or any other federal, state, or local law or regulation of the same or similar nature.

9. PATENTS

SHARPE certifies that to its knowledge the Mixer does not infringe upon any patents granted to others by the United States of America. WE do not assume any responsibility or liability for any claim of infringement brought against the Buyer, its successors, assigns, customers or users of the Mixer.

10. ATTORNEY FEES

In the event an arbitration, suit or action is brought by any party under this agreement to enforce or interpret any of its terms, or in any appeal therefrom, it is agreed that the prevailing party shall be entitled to reasonable attorneys fees to be fixed by the arbitrator, trial court, and/or appellate court. Buyer shall be responsible for any and all costs of collection incurred by SHARPE in connection herewith, including attorneys fees and costs.

11. JURISDICTION/VENUE

This agreement shall be binding upon the successors and assigns of SHARPE and Buyer, and shall be deemed entered into at Seattle, Washington, and shall be governed by and construed in accordance with the laws of the State of Washington. In the event of litigation between the parties to enforce any terms of the agreement, the parties agree that venue shall be the Superior Court of the State of Washington for King County.

MANUAL: 59264

Sharpe Contact: Cherie Villarias

SHARPE MIXERS
PO BOX 3906, SEATTLE WA 98124-3906
206-767-5660 - FAX 206-767-9170

TERMS	ORDER DATE
NET 30 DAYS O.A.C.	11/2/2015
FOB	CUSTOMER PO
ORIGIN	14593-1122
SHIP VIA	
To Follow	

BILL TO:

ENVIROCARE INTERNATIONAL
507 GREEN ISLAND RD
AMERICAN CANYON CA 94503

SHIP TO:

ATTN: REF #14593-1122 B-630
ENVIROCARE INTERNATIONAL
507 GREEN ISLAND RD
AMERICAN CANYON CA 94503

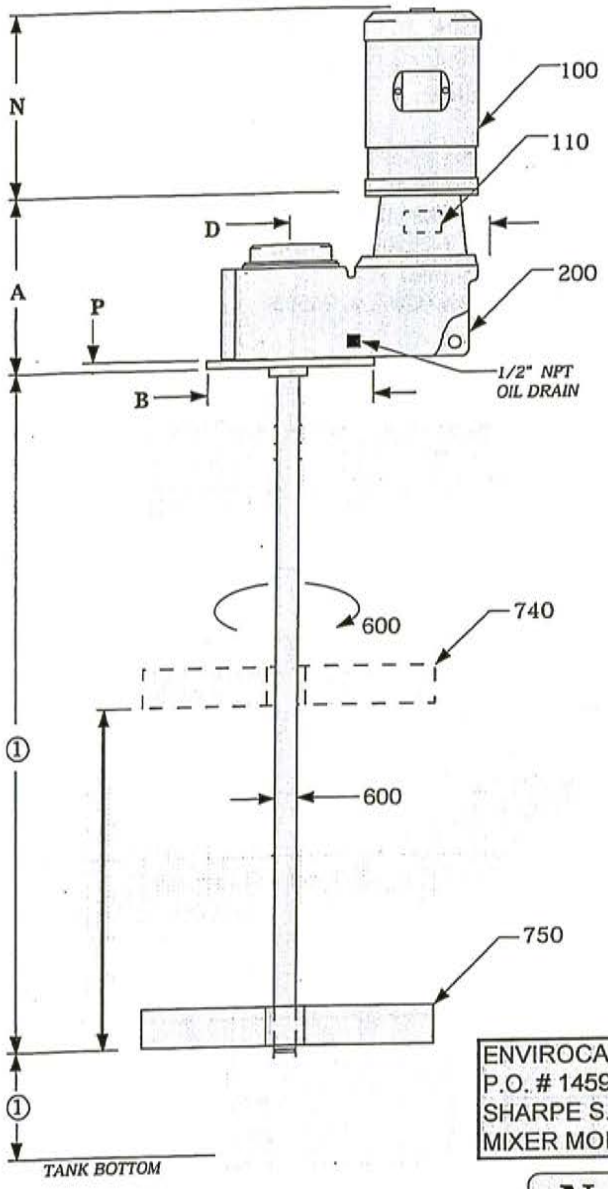
LINE	Sharpe Mixers Part ID	Quantity
1	3N2-17 TOP-ENTRY MIXER	1.00 EA

Serial	Model	Tag
59264	3N2-17	

Application	Scum Mixer Viscosity (CPS) 500; Specific Gravity 1.00
Installation	Tank Dimensions: 60" dia., 98" dia. height, Tank Volume: 1200 gallons Mixer Weight = 300 lbs
Motor Data	3.0 Horsepower Motor Model VECP83661T-4, 182TC frame, IEEE841 TEFC enclosure, 1750 rpm, 460 volts, 3ph, 60hz. Mounted by SHARPE MIXERS, Supplied by SHARPE MIXERS
Drive Data	Double Reduction Helical, N2, Hollow shaft gearbox, Oil Bath Lube, (16.5:1) RATIO
Mounting Data	Mounting Plate Furnished
Wetted Materials	SS316
Shaft Seal	Rubber Excluder Seal
In Tank Shaft	RPM = 106, 1.5" dia. Shaft, 55" long from mounting base No In-Tank Shaft Coupling
Impeller Data	24.0" dia. AFT-455 Axial Flow Impeller, (4) Blades, 1-piece hub 24.0" dia. AFT-455 Axial Flow Impeller, (4) Blades, 1-piece hub

DATA SHEET

Drawing not to scale. Dimensions are for reference only. Use certified



100 - MOTOR ①

110 - FLEXIBLE MOTOR COUPLING

200 - GEAR REDUCER ①

600 - SHAFT ①

740 - UPPER IMPELLER ②

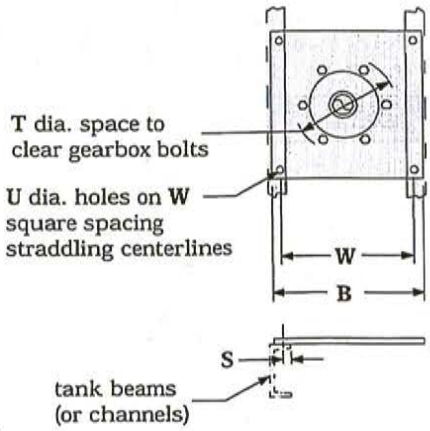
750 - LOWER IMPELLER ①

①Impeller(s), shaft and other details are dependent on specific application and will be described in the Quotation/Data Sheet.

② Items are optional and will be described in the Quotation/Data Sheet if provided

③Basic weight shown in lbs is for mixer drive only, less motor and wetted parts.

MOUNTING DETAIL
PLATE MOUNT
(furnished)



CERTIFIED
GRG 12/3/15

ENVIROCARE INTERNATIONAL
P.O. # 14593-1122
SHARPE S.N. 59264
MIXER MODEL # 3N2-17

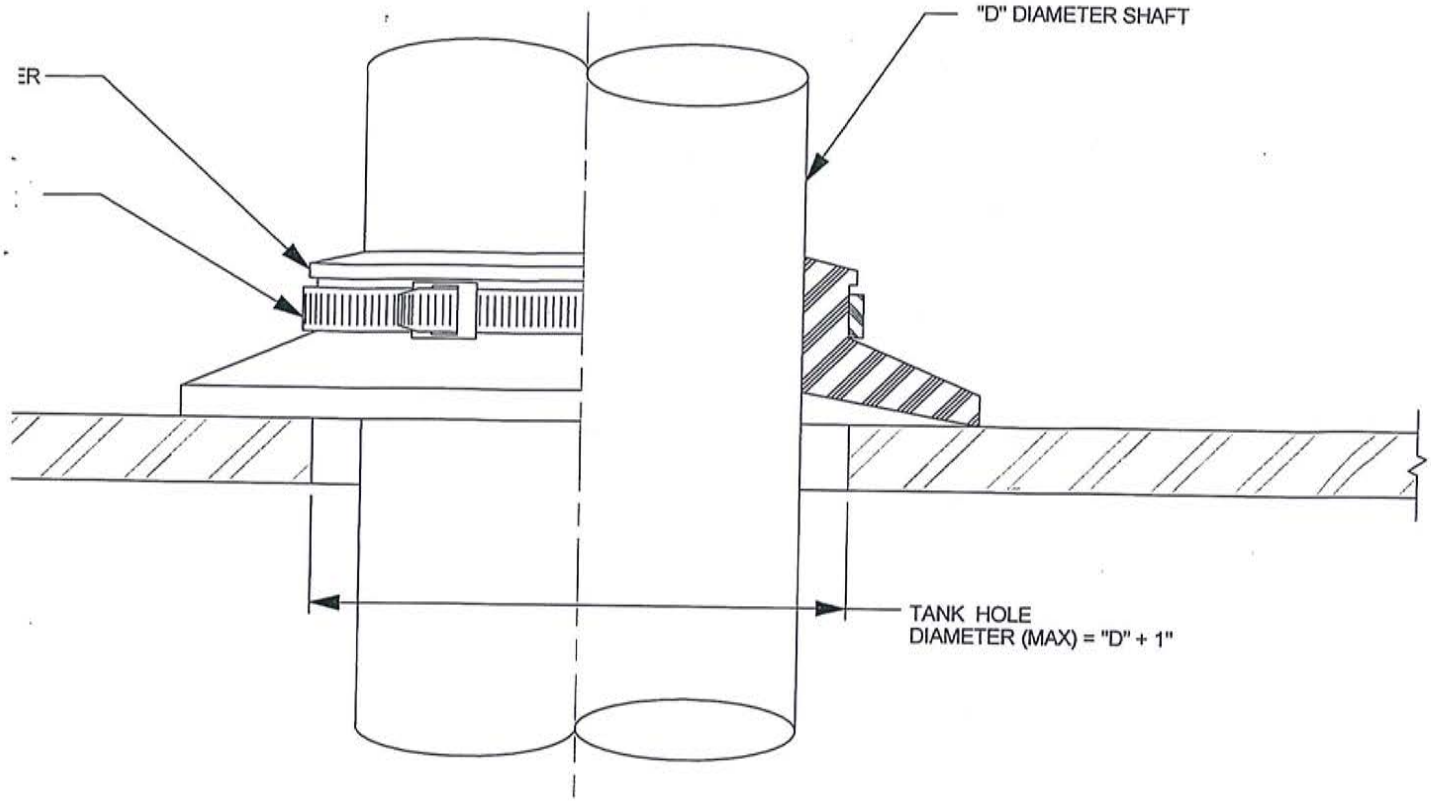
OVERALL DIMENSIONS

	N1	N2	N3	N4	N5
A (MAX)	10.94	11.77	12.83	15.33	17.23
B	11	11	12	14	16
D	7.95	9.73	11.03	13.03	15
J (MAX)	6	6.5	7.5	9	12.5
P	.38	.38	.5	.63	.75
S	.63	.63	.75	.75	.88
T	5.5	6	7.5	8.75	9.5
U	.43	.43	.56	.56	.68
W	9	9	10.5	12	14
③ WT	60	90	120	190	270

N - SERIES HOLLOW GEARBOX OUTPUT PLATE MO

CADD# N.PLATE.HOLLOW.CFACE.S 6-06

SHARPE MIXERS P.O. BOX 3906 SEATTLE, WA 98124 FAX (206) 76



CLUDER, ZIP TIE, SILICONE LUBRICANT & GLUE

F DIRT OR ANY BURRS.

SHAFT INSTALLATION. A LIGHT-WEIGHT OIL
AY BE USED TO EASE MOVEMENT. IF YOU HAVE
ER YOURSELF FOR INSTALLATION, APPLY
IT THE SEAM TOGETHER AND HOLD IN PLACE

NING #111 SILICONE LUBRICANT (OR
EXCLUDER SEAL AND THE TOP SIDE OF THE
HAFT UNTIL A TIGHT SEAL IS FORMED ON THE

ER SEAL AND TIGHTEN IN PLACE. USE PLIERS
AS POSSIBLE. TRIM THE EXCESS FROM THE
IFE.

URFACE PERIODICALLY TO PREVENT
O BE REMOVED, USE A RAZOR BLADE AND

CERTIFIED

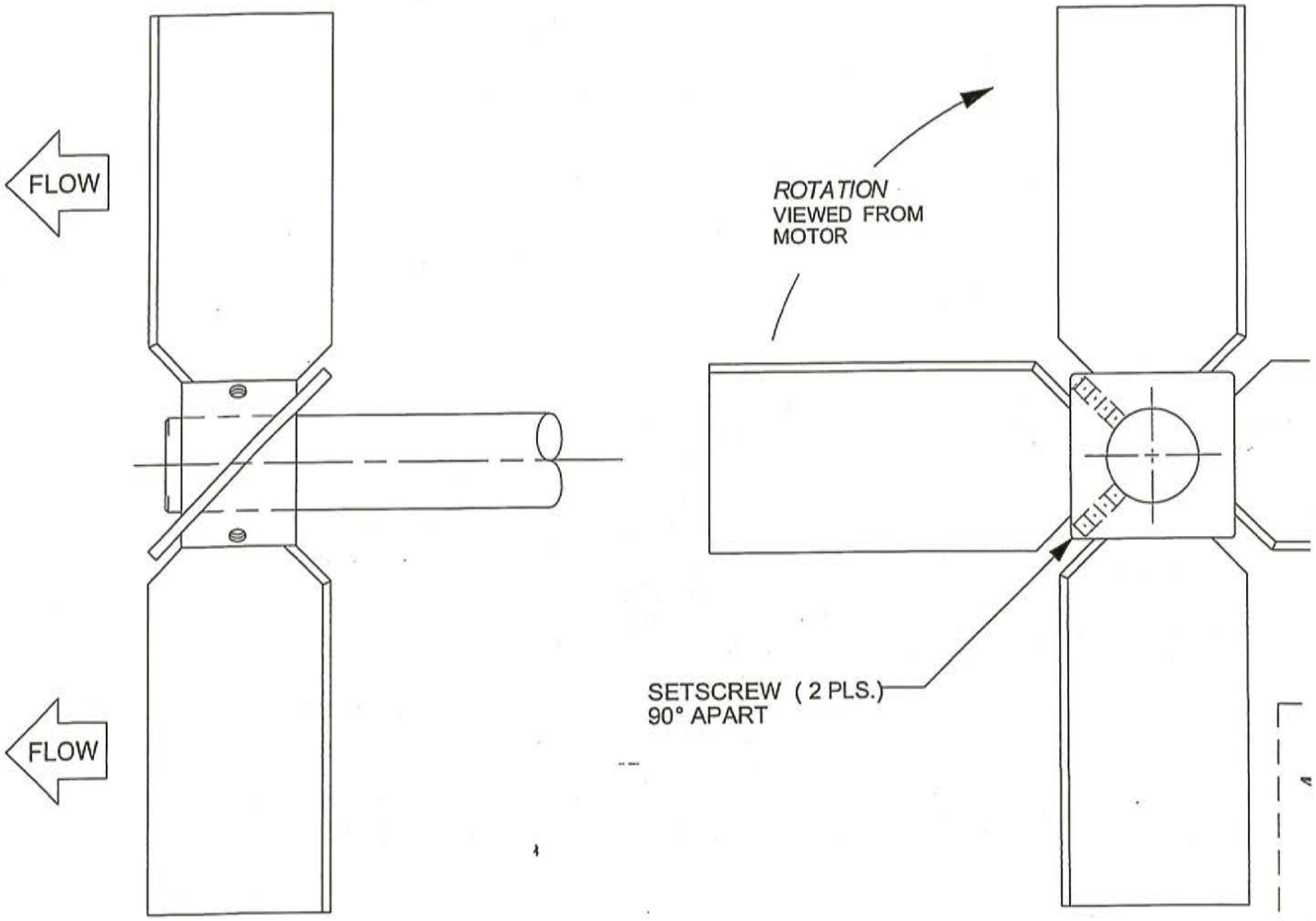
GRG 12/3/15

ENVIROCARE INTERNATIONAL
P.O. # 14593-1122
SHARPE S.N. 59264
MIXER MODEL # 3N2-17

EXCLUDER SEAL

DWG NO.: A11953

P.O.BOX 3906 SEATTLE, WA. 98124 (206) 767-5660 FAX (206) 767-9170



CERTIFIED

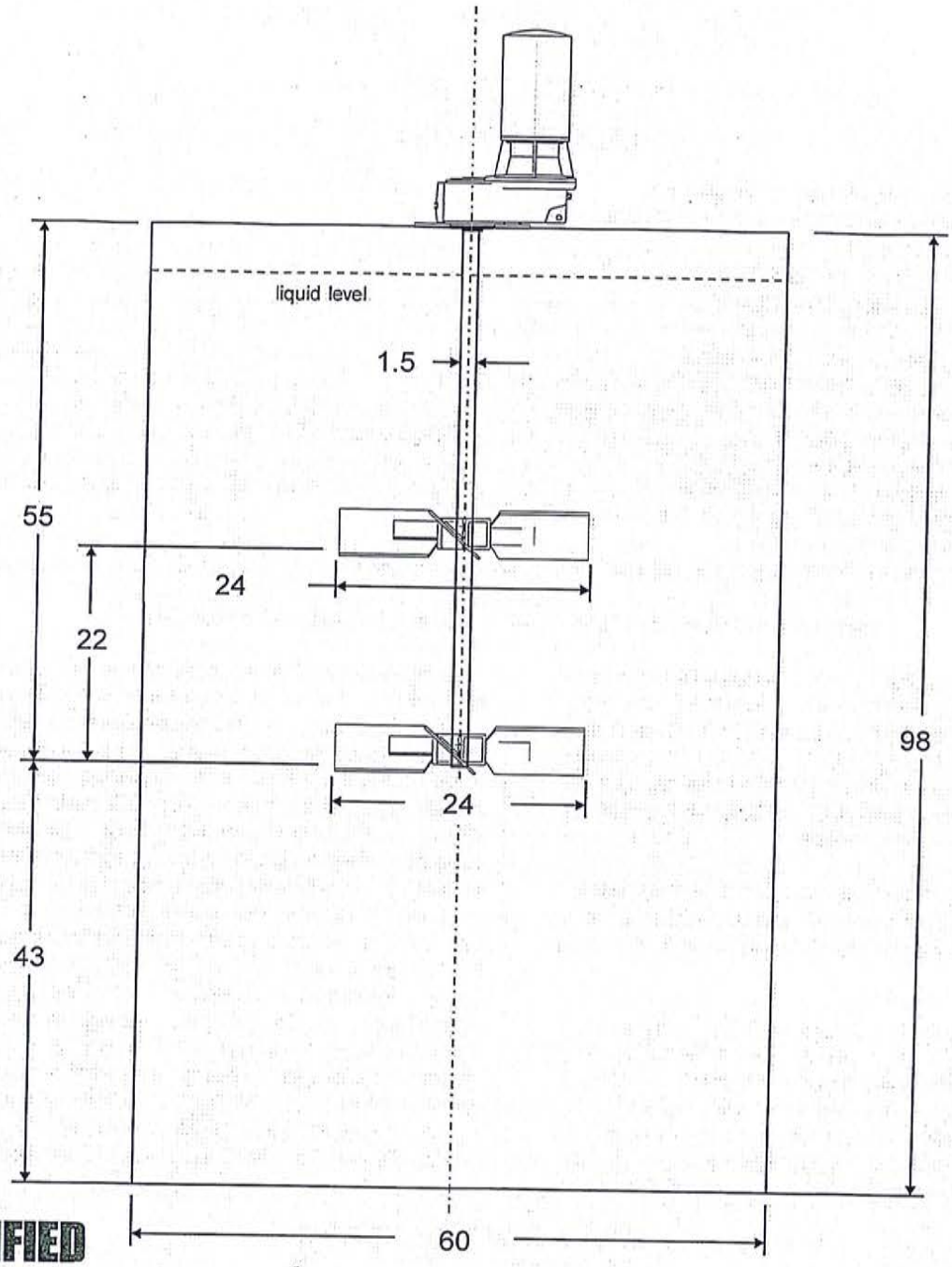
GRG 12/3/15

drawn by: 5/99 revision: 1 - 5-13-05

ENVIROCARE INTERNATIONAL
P.O. # 14593-1122
SHARPE S.N. 59264
MIXER MODEL # 3N2-17

4 BLADE 1-PIECE 45° AFT450 SERIES A
(TWO SETSCREWS)

For reference only; use certified drawings for construction. Dimensions are in inches



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GRG 12/3/15

NOTES: Tank / Mixer Layout intended for scaled view of in-tank components only. Mixer drive proportions may vary slightly depending on motor type or other options. Please review drawing carefully and inform Sharpe Mixers immediately if any tank dimensions are inaccurate. Drawing generated by Sharpe Mixers Q1QP mixer selection program, Copyright 2005, Seattle, WA.

Mixer weight =	300 lbs	
Design Torque =	3085 lbs-in	
Design OHM =	5599 lbs-in	
est. full tank volume =	1200 gal	*(4541 L)*
est. volume @ liquid level =	1140 gal	*(4314 L)*

SHARPE MIXERS

TOP ENTERING MIXER / TANK LAYOUT DETAIL

Mixer Model # 3N2 -17 ***Quantity: 1***

Customer: Envirocare International p.o.#: 14593-1122 Sharpe # ***59264***

Application: Scum Mixer Drawing # ***L9264***

www.sharpemixers.com - P.O. Box 3906 Seattle, WA 98124 - (800) 237-8815 FAX (800) 767-5670

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TOP ENTRY MIXER

SECTION B

TABLE OF CONTENTS

INITIAL INSPECTION, RECEIVING AND STORAGE

B1.1 Immediately upon receipt of the equipment check the crating and contents for any damage that may have occurred in transit. Report any damage immediately to the carrier and to *Sharpe Mixers*. Check against the packing slip to be sure that all parts were received. Report missing items to the carrier and *Sharpe Mixers*.

B1.2 The drive unit, impellers and the mixer shaft are often packed in a separate containers. If space allows, keep shipping containers for possible future use.

B1.3 **Storage:** Storage is when a) mixer has been delivered to the job site and is awaiting installation, b) mixer has been installed, but regular operation is delayed, c) there are long idle periods between operating cycles, d) plant/department operation is shut down. Store mixer in a clean, dry location, with circulating air, free from wide variations in temperature. Electric motors are easily damaged by moisture. Store the entire unit off the floor, covered with plastic, and use desiccants to reduce moisture buildup. Do not seal the plastic cover as this traps moisture. If the motor shows signs of moisture absorption before start-up, dry the motor out by applying 10% voltage on two leads . This will give approximately 50% rated current (if in doubt, measure resistance in windings; one to three meg-ohms is normal). There are also sprays available to help dry out motors. Relubricate motor before start-up when in storage six months or more. Storage of mixers over six months must have gear reducers filled completely with storage oil. Do not install vent plug when in storage. Spray oil on exposed lip seals and unpainted carbon steel parts. Rotate motor and gearbox shafts periodically. When returning to service, drain storage oil, clean with mineral spirits, and replace with correct lubricant (see Section C).

MOUNTING THE DRIVE

B2.1 Mounting structure must be stable and strong enough to handle torque, bending moment, weight specified on assembly drawing, and all additional loads not related to the mixer. The structure must not flex or vibrate when the mixer is in operation. If mounting to an unstable support, mixer loads may cause damage to the equipment, tank, or other hazards. See the assembly drawing in the front of this manual for your mixer mounting configuration.

CAUTION: DO NOT LIFT MIXER BY THE SHAFT. DO NOT LIFT THE MIXER USING THE LIFTING LUG OF THE MOTOR ALONE. USE SLINGS TIGHTENED AROUND THE MIXER DRIVE TO LIFT.

B2.2 Mixer drives with mounting plates may need to be shimmed for shaft to be vertically aligned and then bolted securely to the mounting structure. It is recommended to use lock washers or double nuts on the mounting bolts to prevent bolts from loosening by equipment vibration.

B2.3 When foot mounted motors are supplied, readjust/shim the motor after installation for proper alignment of the flexible coupling (see Paragraph B7.10). Larger motors may require outboard support. Install a pipe leg from the underside of the motor scoop to the tank structure when required.

INSTALLING THE MIXER SHAFT

WARNING: Always lockout power before installing or removing mixer equipment

B3.1 Mixer shafts are installed in the field after the drive has been installed on the tank. Mixers with optional dust seals need those parts to be installed in sequence while installing the mixer shaft. Refer to the detail drawings in front of the manual or on page B-3. Note the type of couple to the drive on the assembly drawings and install shaft per the following means:

B3.2 **Hollow bore drive:** Remove cover over hollow bore on drive (when supplied). Remove hold washer and protective wrap on top of mixer shaft. Clean machined section of shaft. Coat the gearbox bore with NEVER -SEEZ®. Raise mixer shaft from below and through seal (if present). Install the shaft into the drive (see Figure B3.1). Be sure key is in place. Do not hammer parts in place. If keys do not fit, grind to size. Before bolting hold washer in place, add NEVER - SEEZ® compound (supplied) to the top of shaft. Tighten the hold washer securely. Reinstall the hollow bore cover (when supplied).

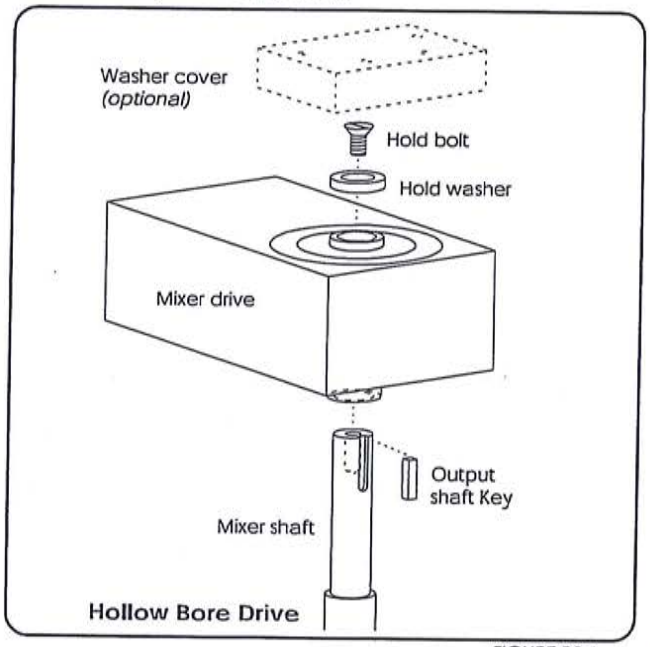


FIGURE B3.1

B3.3 **Split coupling drive:** Remove split coupling from drive shaft. Raise mixer shaft from below and through seal (if present). Bolt hold washer to top of mixer shaft. Install keys on both shafts. Do not hammer parts in place. If keys do not fit, grind to size. Make sure all parts are clean, and assemble split coupling halves onto shafts (see Figure B3.2). The split coupling has one end marked "drive" on each half. These ends must face the gearbox for proper alignment. Make sure gap is even on both sides of coupling. Tighten split coupling bolts to the torque ratings listed in Table B8.1. Tighten from the center out, in an opposite/diagonal sequence.

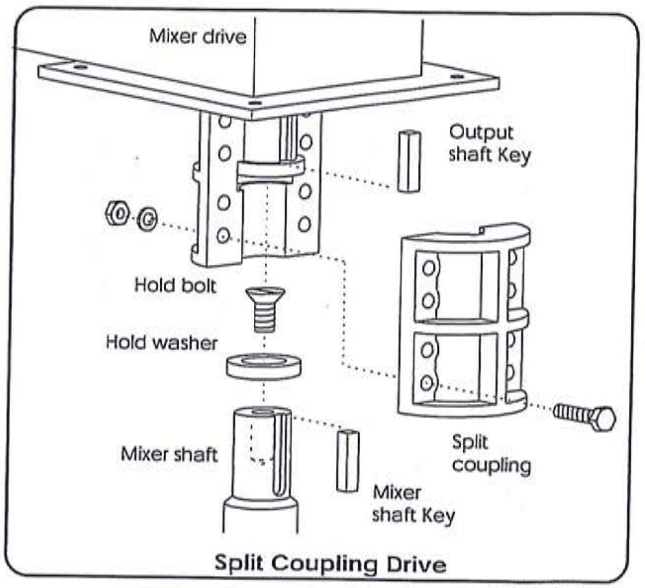


FIGURE B3.2

B3.4 **Removable flange coupling:** Clean mating surfaces of any nicks or grit which may cause misalignment. Tighten hold bolt and setscrews on gearbox output shaft coupling. Raise mixer shaft to mate to flange coupling. Bolt flanges securely together (see Figure B3.3). Tighten flange coupling bolts to the torque ratings listed in Table B8.1. Tighten in an opposite/diagonal sequence. Make sure the flanges mount flush (no gap).

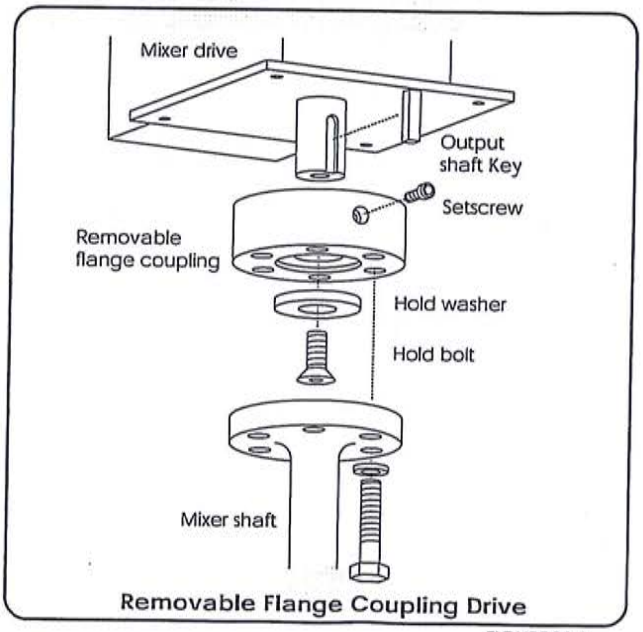
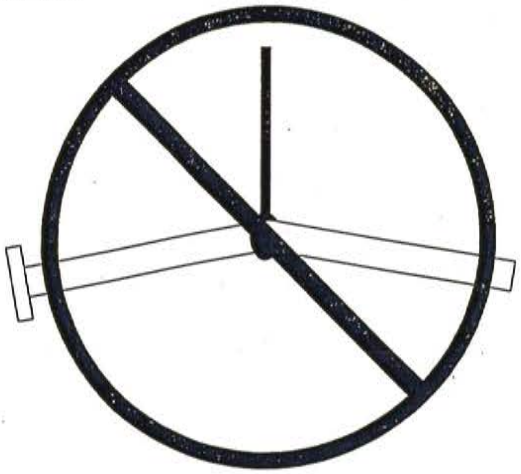


FIGURE B3.3

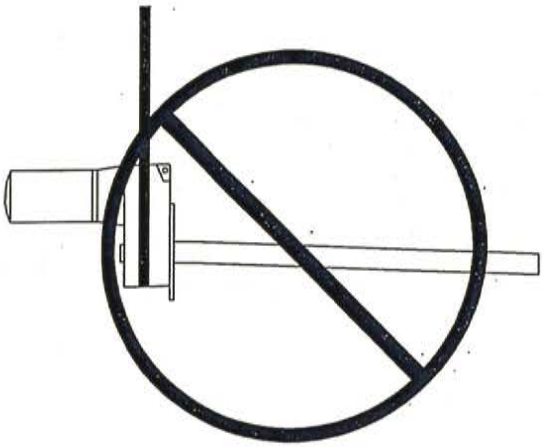
CAUTION: Rubber covered, coated and polished parts required special handling during assembly. Use care to prevent damage to edges and outside corners. Use cardboard or protective padding to protect shafts, impellers and tanks.

FIGURE B3.4



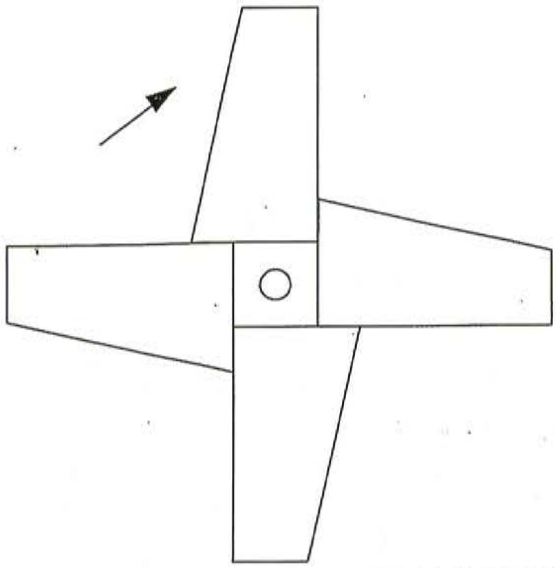
NEVER LIFT SHAFT IN THE CENTER

FIGURE B3.5



DO NOT LIFT DRIVE WITH SHAFT INSTALLED

FIGURE B3.6

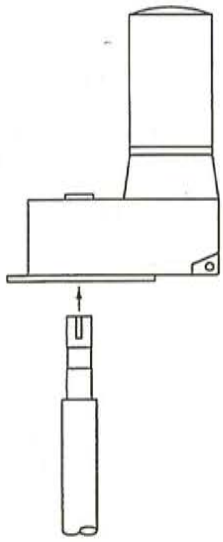


VERIFY CORRECT IMPELLER ROTATION WITH DRAWING IN FRONT OF MANUAL

FIGURE B3.7

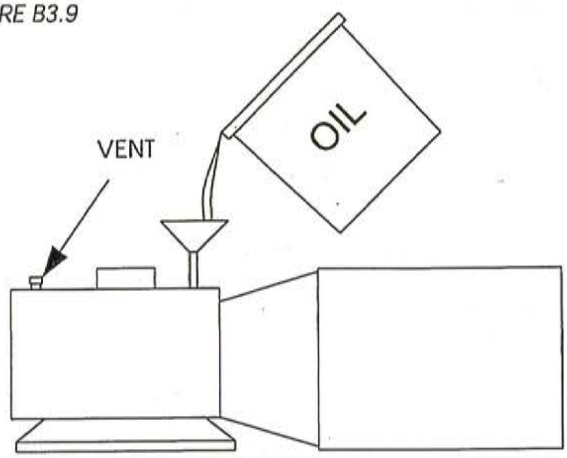
LIFT ON EACH END WHEN POSSIBLE

FIGURE B3.8



INSTALL SHAFT AFTER DRIVE IS SECURELY MOUNTED

FIGURE B3.9



CAUTION:
GEARBOX MUST BE LUBRICATED AND VENTED BEFORE START UP. USE OF ANY LUBRICANTS NOT LISTED ON APPROVED LUBRICANTS LIST IN SECTION C MAY CAUSE GEARBOX DAMAGE AND VOID WARRANTY

VAPOR SEAL MAINTENANCE
(optional equipment)

B4.1 Vapor seals will seal vapors from the product but will not hold pressure. No lubrication is required. Replace vapor seals periodically when wear is apparent. To replace the seals remove mixer shaft from drive. Remove gearbox from flange. Seals may now be removed and replaced. (Figure B4.1)

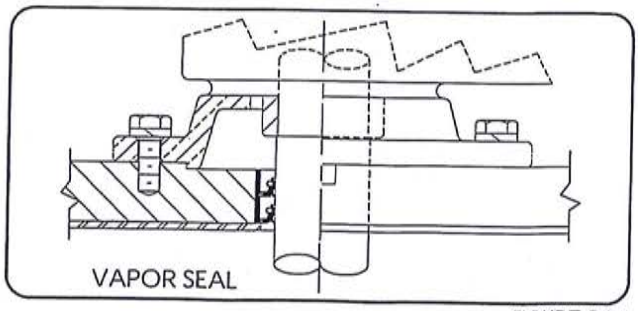


FIGURE B4.1

DUST CUP MAINTENANCE
(optional equipment)

B4.2 Dust cups will keep out dust and particles from the product but will not hold pressure or vapors. Install the dust cup on the shaft while installing the shaft up into the drive. Use a light lubricant on the o-ring to assist in installation on the shaft. To replace the o-ring remove mixer shaft from the drive and remove dust cup from the shaft. (Figure B4.2)

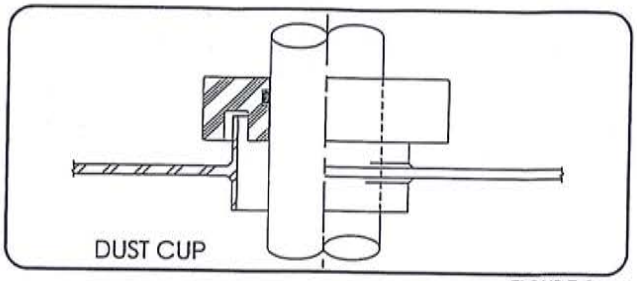


FIGURE B4.2

EXCLUDER SEAL MAINTENANCE
(optional equipment)

B4.3 Excluders ship split from the factory and do not require shaft removal to install. See the excluder drawing in the front of the manual for assembly detail. Excluders will keep out dust and particles from the product but will not hold pressure. Apply lubricant periodically to top of tank and bottom of the excluder to prevent premature wear. (Figure B4.3)

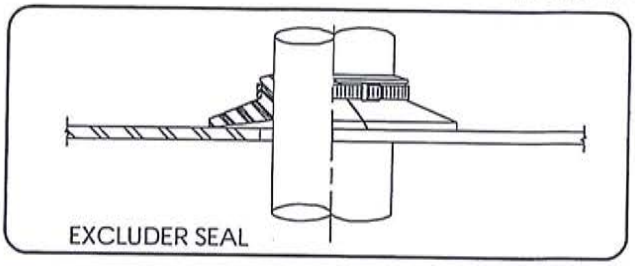


FIGURE B4.3

INSTALLING THE MIXER IMPELLER

B5.1 Install impeller(s) per the assembly drawings in the front of the manual. Verify impeller rotation and location. Torque all bolts per Table B8.1.

B5.2 **1-Piece all welded assembly** : Requires a manway large enough to pass impeller(s).

B5.3 **1-Piece impellers w/setscrews**: Slide the impeller onto the shaft and align set screw with shaft divots (if present). Tighten setscrews securely. (Figure A)

B5.4 **1-Piece impeller w/key** (one set screw): Slide impeller past shaft keyway. Install hook-key on shaft so that the pin fits into the divot in the keyway. Slide impeller over the hook-key until impeller rests on pin. Tighten the setscrew securely. (Figure B)

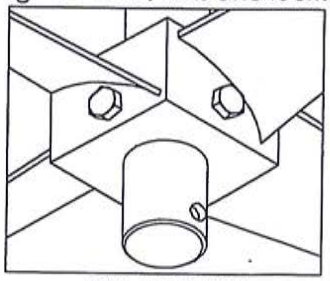
B5.5 **Split hub impeller:** Clamp split hub impeller to shaft. Maintain equal spacing between hub halves. Tighten bolts, nuts and lockwashers securely.

B5.6 **Split hub impeller w/ torque pin:** Align shaft torque pin with the hub divot. Clamp split hub impeller to shaft. Maintain equal spacing between hub halves. Tighten bolts, nuts and lockwashers securely. (Figure C)

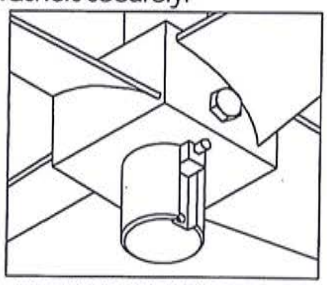
B5.7 **Split hub impeller w/ key:** Align shaft keyway with the split hub key. Clamp split hub impeller to shaft. Maintain equal spacing between hub halves. Tighten bolts, nuts and lockwashers securely. (Figure D)

B5.8 **Bolt on impeller assembly:** Bolt blades to tabs that are welded to shaft (refer to sales drawing for assembly detail). Tighten bolts, nuts and lockwashers securely.

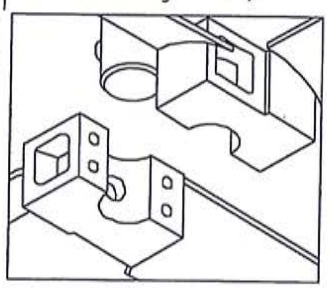
B5.9 **Rubber covered / Coated impellers:** May require special assembly detail (refer to sales drawing for assembly detail).



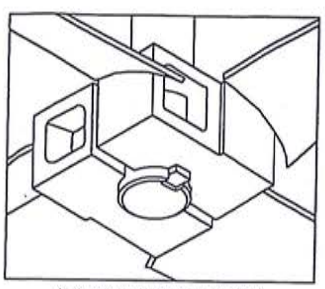
(A) 1-PIECE HUB



(B)1-PIECE HUB W/ HOOK KEY



(C) SPLIT HUB W/ TORQUE PIN



(D) SPLIT HUB W/ KEY

INSTALLING THE STEADY BEARING
(optional equipment)

B6.1 If the mixer was supplied with a steady bearing refer to the data sheet and the drawings in the front of manual to identify the type of steady bearing and mounting configuration.

B6.2 The steady bearing must be installed after the mixer drive and shaft assembly have been installed and firmly bolted in place. Proper steady bearing operation requires the agitator shaft be straight and the steady bearing be centered on the shaft, not the center of the tank.

B6.3 To center the steady bearing, manually rotate the mixer shaft (use the flexible motor coupling or the motor fan) to determine the shafts natural axis of rotation (see figure B5.1). A marking pen placed on the bottom of the shaft will help mark the center of rotation. DO NOT predetermine the bearing location. The tank center line and the shaft center line are not always the same.

B6.4 After the shaft centerline has been determined install the steady bearing. Grind or cut the legs of the steady bearing to fit the tank. Weld/ bolt steady bearing assembly in place. When welding bearing legs tack weld first to locate bearing then final weld (use caution not generate to much heat and distort bearing material). Use weld pads on thin-wall tanks.

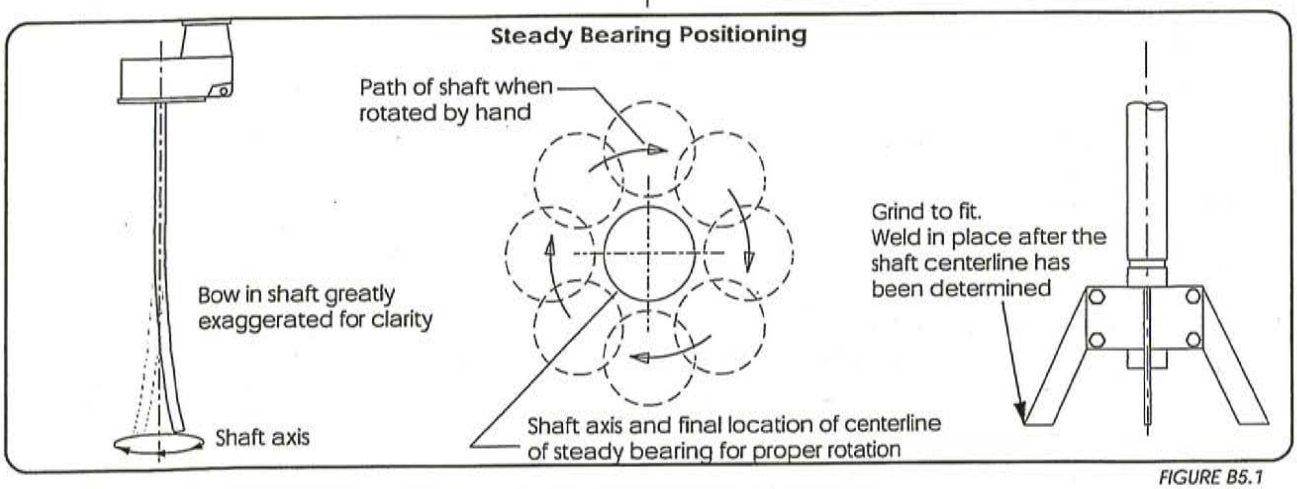


FIGURE B5.1

MOTOR CONNECTIONS, LUBRICATION AND COUPLINGS

B7.1 **WARNING:** High voltage and rotating parts can cause serious or fatal injury. Electric machinery can be hazardous. Installation, operation, and maintenance of electric machinery should be performed by qualified personnel. Familiarity with NEMA safety standards, National Electrical Code and local building codes are required.

B7.2 **Wiring**: Starting and overload control devices must be matched to motor rating. Follow control manufacturer's instructions for proper connections and installation. Ground the mixer motor properly to avoid serious injury to personnel. Grounding needs to be in accordance with the National Electrical Code and consistent with local building codes. See motor conduit box for wiring diagram.

B7.3 **CAUTION:** Motor failures due to overload are not covered by motor manufacturers warranty. Size fuses and overload controls properly to protect the motor from damage.

B7.4 Electrical connections must conform to National Electrical code and all local regulations. Line voltage and wire capacity must match motor rating stamped on motor nameplate.

B7.5 **Electric motors - Single phase:** If your mixer is supplied with a single phase motor it may be wired by the factory with a ten foot cord and an on/ off switch. If no cord or switch is provided refer to the wiring diagram on the motor for correct connections. Check that the switch is in the off position before plugging the cord into a 110 volt outlet. *Check for proper rotation!* Interchange lines if necessary for proper rotation (see data sheet or rotation sticker on drive).

B7.6 **Electric motors - 3 phase:** Motors requiring 3 phase power must be wired according to the wiring diagrams on the motor. Rotation of the impeller must match the data sheet or rotation sticker on the mixer drive. Interchange lines if necessary for proper rotation.

B7.7 **Electric Variable Speed:** Electric motors using an AC variable frequency or SCR controller must be wired following the instructions supplied with the controller. Many adjustments are often required to the controller and instructions must be read carefully before applying power. See data sheet and assembly drawings for possible RPM lockout ranges. Operate only at speeds outlined on those sheets.

CAUTION: VARIABLE SPEED CONTROLLERS MUST BE ADJUSTED TO LIMIT MAXIMUM MOTOR SPEED AND MAXIMUM AMP DRAW TO MOTOR NAMEPLATE SPECIFICATIONS. EXCEEDING THESE VALUES MAY DAMAGE EQUIPMENT AND VOID WARRANTY.

B7.8 Other types of motors (e.g.: hydraulic) must be installed per the motor manufacturer instructions. See data sheet and assembly drawings for possible RPM lockout ranges. Operate only at speeds outlined on those sheets. Damage to equipment or serious injury to personnel can result if speed limitations are not followed.

B7.9 **Motor lubrication:** The motor bearings have been greased by the manufacturer and do not require lubrication at start-up unless the motor has been in storage for six months or longer. Motors with a 145T NEMA frame or smaller usually have sealed for life bearing and need no relubrication. Motors with regreasable bearings should be lubricated on a standard maintenance shedule. See table B7.1and B7.2 for service conditions and lubrications frequency. Relubricate with a No. 2 consistency lithium soap base and petroleum compound. Open and clean zirc and drains. Add grease per table B7.3. Run motor 30-60 minutes before replacing drain plugs. Remove excess grease and replace input plugs.

MOTOR SERVICE CONDITIONS	
Standard Conditions	Eight hours per day, normal or light, loading, clean @ 100°F (40°C) max.
Severe Conditions	Twenty-four hour per day operation or shock, loading, vibration, or in dirt 100-120°F (40-50°C)
Extreme Conditions	Heavy shock or vibration, or dust.

table 7.1

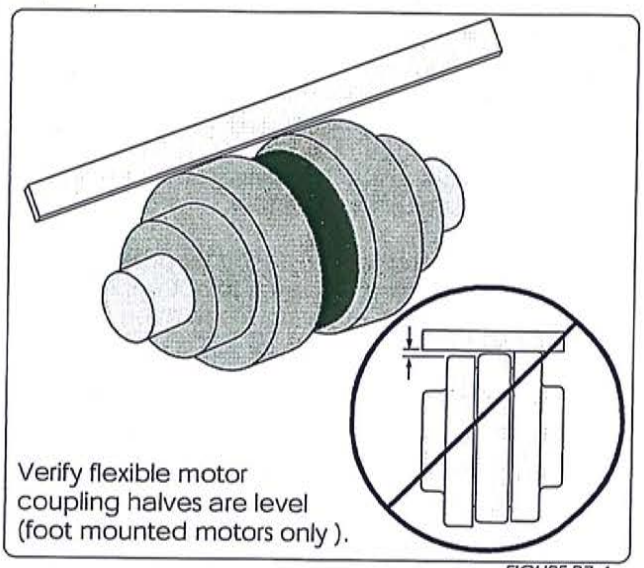
MOTOR LUBRICATION FREQUENCY				
SPEED	NEMA (IEC) Frame	Standard Conditions	Severe Conditions	Extreme Conditions
1800 R.P.M. and Slower	182 (112) Thru 215 (132)	3 years	1 year	6 months
	254 (160) Thru 365 (200)	2 years	6 to 12 months	3 months
	404 (225) Thru 449 (280)	1 years	6 months	1 to 3 months
3600 R.P.M.	All Frames	6 months	3 months	1 month

table 7.2

NEMA (IEC) FRAME SIZE	Approx. Grease Volume in in^3 (cm^3)
182 Thru 215 (223-132)	0.5 (8)
254 Thru 286 (160-180)	1.0 (16)
324 Thru 365 (200-225)	1.5 (24)
404 Thru 449 (250-280)	2.5 (40)

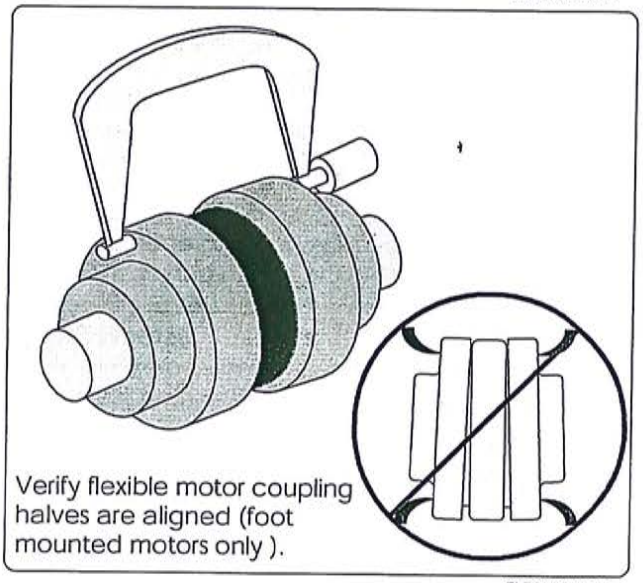
table 7.3

B7.10 **Motor couplings:** C-face motor inputs require no coupling alignment. To remove the motor from the gearbox remove mounting bolts and loosen the coupling set screws. Foot mounted motors require proper alignment. Check parallel alignment by placing a straight edge across the two coupling halves at various points without rotating the motor (see figure B7.4). Offset schould not exceed 0.015". Check angular alignment with micrometers or calipers (see figure B7.5). Measure from the outside of each half at various points without rotating the motor. The differnce between the max and min. dimensions should not exceed 0.015". To realign the motor shim the feet and recheck the alignment. After the coupling has been aligned verify that the keys and setscrews are tight and that the guards are in place.



Verify flexible motor coupling halves are level (foot mounted motors only).

FIGURE B7.4



Verify flexible motor coupling halves are aligned (foot mounted motors only).

FIGURE B7.5

B10.0 TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	SOLUTION
• Shaft will not fit into drive or coupling	• Set screws extend into bore • Shaft over size (proper dia. 0.001" - 0.002" under nominal dia. • Damaged shaft • Oversize key	• Loosen set screws • Measure and consult factory • Consult factory • Grind key to fit
• Mixer will not start	• Incorrect wiring • Loose connections • Blown fuse • Incorrect voltage • Impeller interference • Water damage to motor • Wrong size heaters in starter	• Check wiring diagram and wire correctly • Check and tighten connections • Replace fuse • Wire for correct voltage • Free all debris for rotation • Service or replace motor (consult factory) • Replace heaters
• Mixer will not reach correct speed	• Overload of motor • Loose drive coupling bolts • See "Mixer will not start"	• Check amperage against nameplate data • Check coupling bolt tension (coupling and/or shaft maybe damaged if mixer has been run with slipping coupling)
• Motor runs hot / • Amperage overload	• Low or high voltage • Product too viscous or too heavy • Restricted ventilation • Frequent starting and stopping • Unbalanced voltage between phases • Incorrect rotation • Incorrect rotation or upside-down impeller • Impeller too close to tank floor • Lack of/improper lubricant • Improper output speed • Build up of sediment on tank bottom • Undersized heaters • Product buildup on impeller • Variable frequency drive incompatible with motor	• Wire for correct voltage • Check viscosity and specific gravity of product (consult factory) • Clear vents • Check with factory - a special motor may be required • Consult electrician • Change motor leads per nameplate instructions • Check against assembly drawings - correct if required • raise impeller • Add or change lubricant (see Section C) • Confirm speed - consult factory • Clean or irrigate sediment • Replace with correct heaters • Clean impeller of debris • Consult VF drive manufacturer for motor recommendation

PROBLEM	POSSIBLE CAUSE	SOLUTION
• Noisy	• Insufficient lubricant • Foreign material in lubricant • Incorrect lubricant • Worn or faulty bearings or gears • Incorrect coupling alignment • Bent/broken guards	• Fill proper amount of lubricant • Change lubricant • Change to correct lubricant • Check bearings/gears and replace if necessary • adjust/align coupling • Straighten/replace guard
• Bearing failure	• High temperature product • Excessive overhung load • Water damage • See all items under "Noisy"	• Provide heat shield • Consult factory • Replace bearing (check all other parts)
• Gear failure	• Excessive loading (check amps) • Lack of (or improper) lubrication • Start-stop-start loading (product burying impeller with solids) • Foreign material in lubricant	• Consult factory • Fill with recommended lubricant or equivalent (see Section C) • Free impeller of any solids at start-up (pre stir with air hose or paddle) • Replace lubricant
• Oil leakage	• Excessive lubricant • Damaged/broken gasket • Loose bolts around side plates • Seals worn or damaged • Vent not installed/clogged	• Check manual for proper amount lubricant and drain excess • Replace gasket • Check and tighten bolts • Replace seals • Replace seals - install/unclog vent
• Shaft vibration	• Impeller not immersed in liquid • Impeller too close to surface • Bent mixer shaft • Unstable mounting platform • Loose or improperly assembled coupling • Debris in coupling • Damaged gearbox bearings • Debris on impeller • Loose or bent impeller blades	• Fill tank • Fill tank or lower impeller • Consult factory • Reinforce platform • Assemble securely (see Para. B7.10) • Clean and reassemble • Check and replace if necessary • Clean impeller • Tighten or straighten (consult factory)

Note: Other trouble shooting guides for special optional equipment will be located in Section D (when present).

CAUTION: DO NOT MODIFY MIXER WITHOUT PRIOR AUTHORIZATION FROM SHARPE MIXERS OR WARRANTY WILL BE VOID.

ALWAYS REFERENCE THE MIXER SERIAL NUMBER WHEN PLACING ORDER OR MAKING PARTS INQUIRY. THIS SERIAL NUMBER IS LOCATED ON THE SHARPE MIXER NAMEPLATE & ON THE FRONT COVER OF THE SERVICE MANUAL.

RECOMMENDED SPARE PARTS

B11.0 Recommended spare parts are different for individual needs. The allowable down time is the main factor affecting which parts should be kept on the shelf as spares (allowable time period the mixer can be out of service).

Note: Shafts and impellers, although not normally wearing parts, may be damaged and require repair/ replacement. These parts are long delivery items and should be considered if extended down time is unacceptable. For any downtime, all wearing parts are normally recommended spares. These include: bearings, seals, gears, input couplings, shims/gaskets, steady bearing wear sleaves and bushings when present.

Standard shipment	Recommended parts to stock for repair due to long delivery
10 to 12 weeks	- Complete mixer w/polished or coated wetted parts (Consult factory to expedite)
6 to 8 weeks	- Complete mixer (Consult factory to expedite)
5 weeks	- Hardened shafts, special motors (call for quote)
3 to 4 weeks	- Machined parts, wear sleeves, impellers, mixer shafts, split couplings
2 to 3 weeks	- Complete gearbox (Consult factory to expedite)
2 weeks	- Standard motors
3 to 5 days	- Stock motors, bearings, lip seals
Expedited Services	- Consult factory for price and delivery

End of Section

NOTE: Replacement gearboxes should be purchased through SHARPE MIXERS. SHARPE MIXERS incorporates several modifications to the gearbox casing and internal parts to make the gearbox suitable for operation as an agitator drive. Puchasing the gearbox from other suppliers may result in incorrect selection and possible gearbox failure.

WARRANTY

For standard terms and conditions of sale including warranty, please refer to the inside front cover of this manual. The expressed warranty implies that MIXER was purchased through SHARPE MIXERS. Warranties for MIXERS purchased through distributors must be handled through original distributor.

MAINTENANCE NOTES ,DESCRIPTION	Date	By

SECTION C

N - SERIES GEARBOX LUBRICATION

C1.1 N-SERIES GEARBOXES: See data sheet and/or assembly drawing at the front of this manual to find the model number and number of gear reductions for gearbox supplied. Unit case sizes N9 and smaller have been lubricated at the factory with the proper type (for an ambient temperature range of 20° - 104°F; for different ambient conditions, change to appropriate oil shown in Table C1.3) and amount of lubrication for mixer service. To prevent leakage, the gearbox vent has been replaced with a temporary plug for shipment. The vent is included separately.

WARNING: VENT MUST BE REINSTALLED PRIOR TO START-UP OR DAMAGE TO GEARBOX WILL OCCUR. (If gearbox is supplied with OT or OA, see section at end of manual for venting instruction.)

Check that the oil level is to the proper level before start-up (see Figure C1.1), and that none was lost during shipment/installation. Units with an oil tank(OT) or expansion chamber (OA) will require a lube top off before mixer operation. If an OT or OA is supplied, see section at the end of manual for proper oil level. Change the oil every 10,000 hours or 2 years for mineral lube, 20,000 hours or 4 years with synthetic lube, whichever occurs first. Under extreme conditions it is recommended that the lubricant in the gearbox be changed more frequently. Pipe fittings may be provided to assist in oil draining/filling (see Section C1.2). Refer to Table C1.3 for the lubricant recommended for temperatures in your area. When changing to a different lubricant, clean gearbox with mineral spirits before refilling. Regrease input bearings every 1,000 hours or 6 months, whichever occurs first. See page C-9, Table C2.4 for recommended grease. Open and clean the grease outlet (opposite zirc). Add grease until new grease is forced through the outlet. Remove excess grease. Run one half hour before replacing the grease outlet plugs. Some gearboxes may be supplied with automatic bearing lubricators and will not have a grease fitting on the input. See section C2.3 for more information.

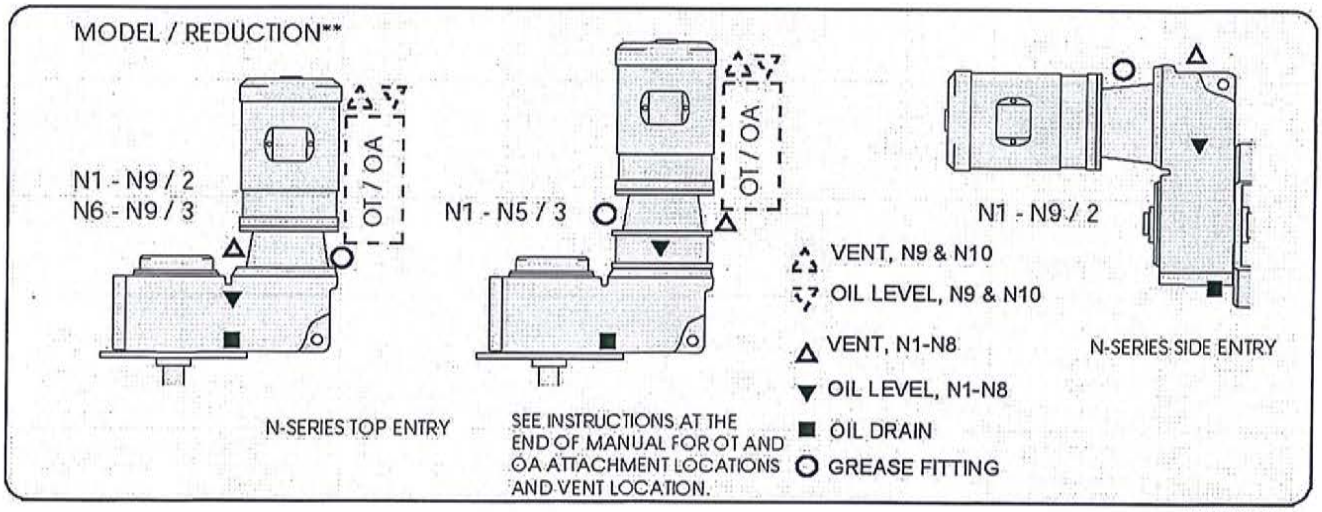


FIGURE C1.1

N-SERIES DOUBLE REDUCTION LUBRICATION CAPACITIES (Qts./LITERS)***

MODEL	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10
SIDE ENTRY	0.95/0.90	1.74/1.65	3.3/3.2	5.0/4.7	7.9/7.5	18.0/17.0	26.4/25.0	39.1/37.0	78.2/74.0	95.1/90.0
TOP ENTRY	1.3/1.2	2.1/2.0	4.3/4.1	5.7/5.4	9.3/8.8	18.5/17.5	28.5/27.0	43.3/41.0	76.1/72.0	95.1/90.0

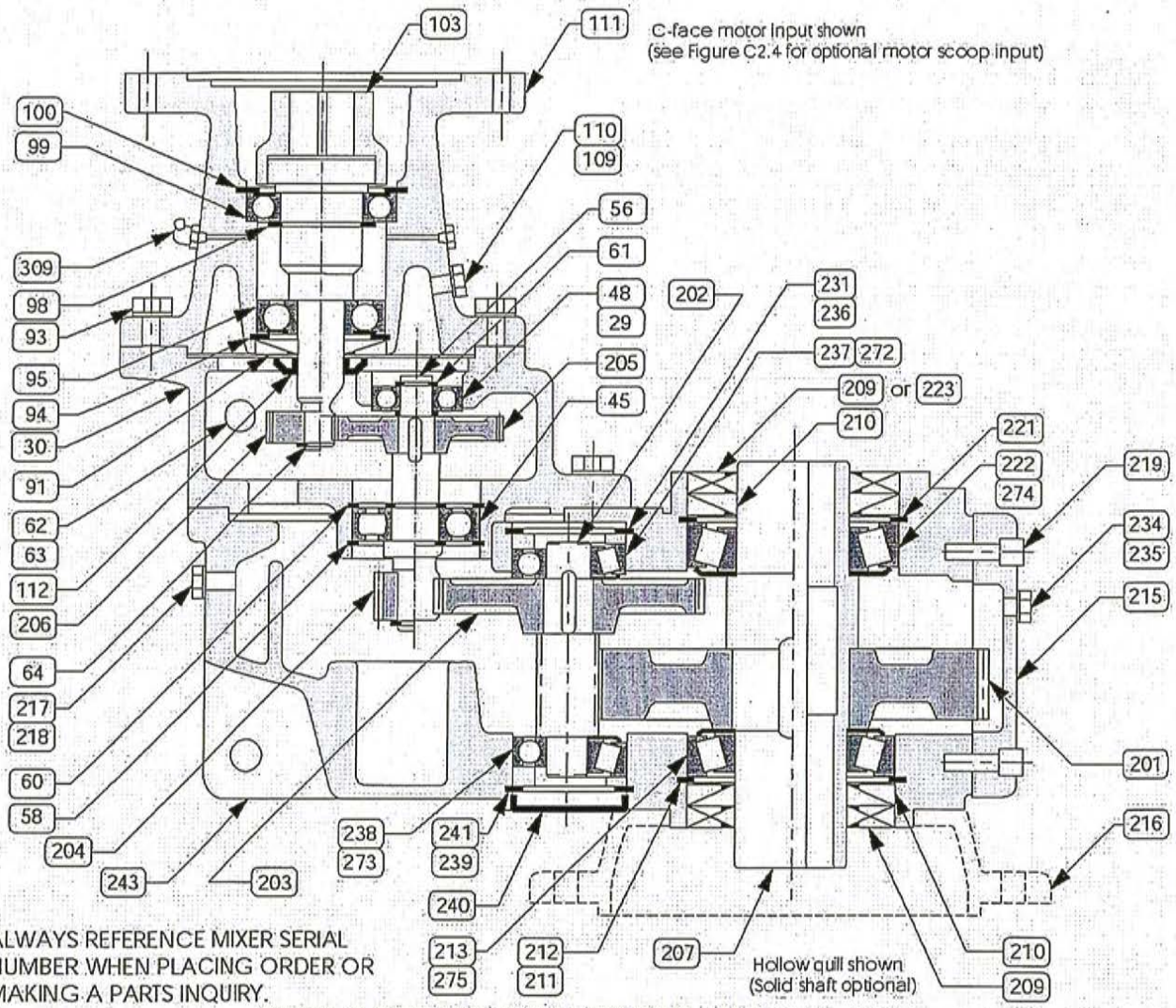
N-SERIES TRIPLE REDUCTION LUBRICATION CAPACITIES (Qts./LITERS)***

MODEL	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10
TOP ENTRY	2.2/2.1	3.3/3.1	5.9/5.6	8.8/8.3	14.8/14.0	19.0/18.0	26.4/25.0	40.2/38.0	78.2/74.0	105.7/100

IF (OT) OR (OA) IS SUPPLIED, SEE BACK OF MANUAL FOR ADDITIONAL LUBRICATION INFORMATION. *TABLE C1.2*

*VOLUMES SHOWN ARE AVERAGE VALUES.

**SEE DATA SHEET IN FRONT OF MANUAL FOR NUMBER OF GEAR REDUCTIONS



ALWAYS REFERENCE MIXER SERIAL NUMBER WHEN PLACING ORDER OR MAKING A PARTS INQUIRY.

TRIPLE REDUCTION PARTS LIST *(N1 - N5)*

ITEM	PART NAME
27	1st stage mounting bolt
29	Spacer
30	1st stage reduction housing
•45	Lower 1st stage bearing
46	Key *(first stage gear)*
•48	Upper 1st stage bearing
52	Snap ring
53	Key *(1st stage pinion)*
54	Snap ring
56	1st stage reduction shaft
57	Snap ring
58	Snap ring
•59	Shim set
60	Snap ring
61	Snap ring
62	Plug
63	Plug gasket
64	Snap ring
66	Key *(input pinion)*
•91	Oil seal
93	Input mounting bolt
•95	Lower input bearing
98	Snap ring
•99	Upper input bearing
100	Snap ring

ITEM	PART NAME
102	Key *(input coupling)*
•103	Input coupling
109	Plug gasket
110	Plug / Vent*
111	C-face motor adapter housing
112	Oil slinger (optional)
116	Spacer
117	Snap ring
•201	Output gear
•202	Output pinion/shaft
•203	Second stage gear
•204	1st stage pinion
•205	1st stage gear
•206	Input pinion/shaft
207	Output shaft
208	Key *(output shaft)*
•209	Oil seal
•210	Oil seal
211	Snap ring
•212	Shim kit
•213	Lower output bearing
215	Inspection cover
216	Ring base adapter *(optional)*
217	Plug / Vent
218	Plug gasket

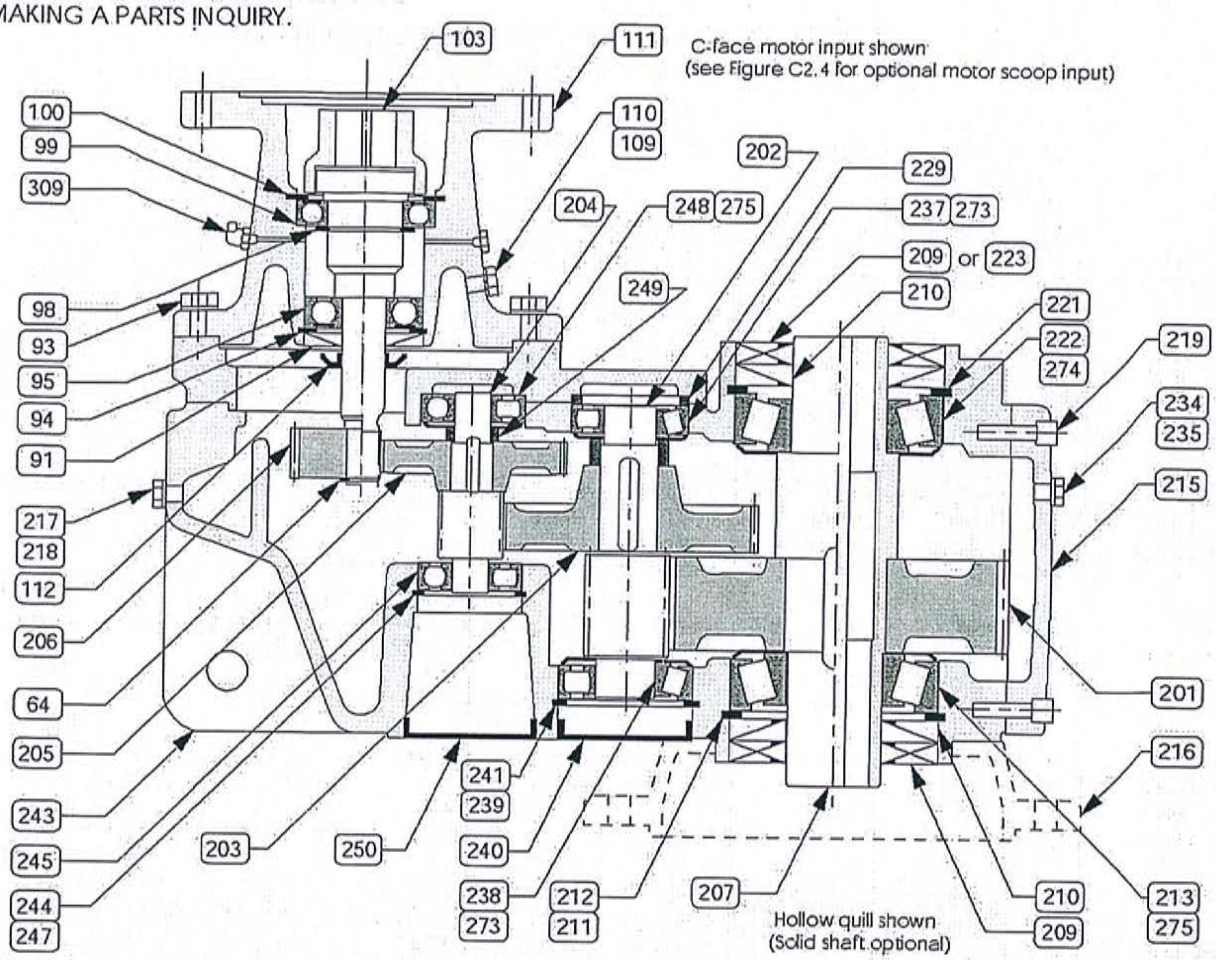
ITEM	PART NAME
219	Inspection cover bolt
220	Key *(output gear)*
221	Snap ring
•222	Upper output bearing
223	Seal plug *(solid output shaft)*
229	Spacer
231	Snap ring
233	Key *(second stage gear)*
234	Plug
235	Plug gasket
236	Spacer
•237	Upper intermediate bearing
•238	Lower intermediate bearing
239	Snap ring
•240	Seal plug
•241	Shim kit
242	Spacer
243	Housing
253	Ring base bolt
••272	Nilos ring
••273	Nilos ring
••274	Nilos ring
••275	Nilos ring
••309	Input bearing grease fitting (See section C2.3 for optional automatic greaser)

• = Recommended spare part
•• = Conditionally used part

*See page C1 for proper vent placement

FIGURE C2.2

ALWAYS REFERENCE MIXER SERIAL NUMBER WHEN PLACING ORDER OR MAKING A PARTS INQUIRY.



TRIPLE REDUCTION PARTS LIST *(N6 - N10)*

ITEM	PART NAME
64	Snap ring
66	Key *(input pinion)*
•91	Oil seal
93	Input mounting bolt
•95	Lower input bearing
98	Snap ring
•99	Upper input bearing
100	Snap ring
102	Key *(input coupling)*
•103	Input coupling
109	Plug gasket
110	Plug / Vent*
111	C-face motor adapter housing
112	Oil slinger (optional)
116	Spacer
117	Snap ring
•201	Output gear
•202	Second stage pinion shaft
•203	Second stage gear
•204	First stage pinion shaft
•205	First stage input gear
•206	Input pinion/shaft
207	Output shaft
208	Key *(output shaft)*
•209	Oil seal
•210	Oil seal

ITEM	PART NAME
211	Snap ring
212	Shim kit
•213	Lower output bearing
215	Inspection cover
216	Ring base adapter *(optional)*
217	Plug / Vent*
218	Plug gasket
219	Inspection cover bolt
220	Key *(output gear)*
221	Snap ring
•222	Upper output bearing
•223	Seal plug *(solid output shaft only)*
227	Input cover bolt
229	Spacer
230	Input cover
233	Key *(second stage gear)*
234	Plug
235	Plug gasket
236	Spacer
•237	Upper 2nd stage bearing
•238	Lower 2nd stage bearing
239	Snap ring
•240	Seal plug
•241	Shim kit
242	Spacer

ITEM	PART NAME
243	Housing
244	Snap ring
•245	Lower 1st stage bearing
•247	Shim kit
•248	Upper 1st stage bearing
249	Spacer
253	Ring base bolt
•250	Seal plug
••271	Nilos ring
••272	Nilos ring
••273	Nilos ring
••274	Nilos ring
••275	Nilos ring
309	Input bearing grease fitting (See section C2.3 for optional automatic greaser)

• = Recommended spare part
•• = Conditionally used part

*See page C1 for proper vent placement

FIGURE C2.3

CN - 7442 - 5 - 0104

DOUBLE REDUCTION INPUT BEARINGS AND SEALS

Contact factory for all other parts.

	C-Face Inputs							Foot Motors	
ITEM	*POS.*	56C	140TC	180TC	210TC	250TC	280TC	*POS.*	MTR SCOOP
N1									***160S***
Oil seal	91	20x52x10A	20x52x10A					67	20x47x7A
Lower bearing	95	6304-Z	6304-Z					71	6204-Z
Upper bearing	99	6007-Z	6007-Z					75	6204-Z
N2									***250S***
Oil seal	91	30x72x10A	30x72x10A	30x72x10A	40x90x12A			67	30x72x10A
Lower bearing	95	6306-Z	6306-Z	6306-Z	6308-Z			71	6306-Z
Upper bearing	99	6007-Z	6007-Z	6208-Z	6211-Z			75	6306-Z
N3									***250S***
Oil seal	91	30x72x10A	30x72x10A	30x72x10A	40x90x12A			67	30x72x10A
Lower bearing	95	6306-Z	6306-Z	6306-Z	6308-Z			71	6306-Z
Upper bearing	99	6007-Z	6007-Z	6208-Z	6211-Z			75	6306-Z
N4									***300S***
Oil seal	91	30x72x10A	30x72x10A	*see factory*	50x80x10A	55x85x10A		67	40x100x10A
Lower bearing	95	6306-Z	6306-Z	*see factory*	6310-Z	6311-Z		71	6309-Z
Upper bearing	99	6207-Z	6207-Z	*see factory*	6311-Z	6312-Z		75	6308-Z
N5									***300S***
Oil seal	91	30x72x10A	30x72x10A	*see factory*	50x80x10A	55x85x10A		67	60x100x12A
Lower bearing	95	6306-Z	6306-Z	*see factory*	6310-Z	6311-Z		71	6309-Z
Upper bearing	99	6207-Z	6207-Z	*see factory*	6311-Z	6312-Z		75	6308-Z
N6									***DIA 250***
Oil seal	91			50x80x10A	50x80x10A	75x115x13A	75x115x13A	67	65x120x10A
Lower bearing	95			6310-Z	6310-Z	NU215mm	NU215mm	71	NU311E
Upper bearing	99			6311-Z	6311-Z	3216-Z	3216-Z	75	6311-Z
N7									***DIA 250***
Oil seal	91			50x80x10A	50x80x10A	75x115x13A	75x115x13A	67	65x120x10A
Lower bearing	95			6310-Z	6310-Z	NU215mm	NU215mm	71	NU311E
Upper bearing	99			6311-Z	6311-Z	3216-Z	3216-Z	75	6311-Z
N8									***DIA 250***
Oil seal	91			50x80x10A	50x80x10A	75x115x13A	75x115x13A	67	65x120x10A
Lower bearing	95			6310-Z	6310-Z	NU215mm	NU215mm	71	NU311E
Upper bearing	99			6311-Z	6311-Z	3216-Z	3216-Z	75	6311-Z
N9									
Oil seal	91			50x80x10A	50x80x10A	75x115x13A	75x115x13A	67	Ratio
Lower bearing	95			6310-Z	6310-Z	NU215mm	NU215mm	71	Dependant
Upper bearing	99			6311-Z	6311-Z	6216-Z	6216-Z	75	*see factory*
N10									
Oil seal	91	CONTACT FACTORY FOR N10 BEARINGS AND SEALS						67	Ratio
Lower bearing	95							71	Dependant
Upper bearing	99							75	*see factory*

TABLE C2.1

C2.2 Input bearings are sheilded on one side only. When replacing bearings, be sure to install them with the sheild facing away from the grease fitting on the input cylinder. NOTE: GEARBOXES SHIPPED BEFORE 1995 MAY REQUIRE DOUBLE SEALED BEARINGS ON THE INPUT. PLEASE CONSULT THE FACTORY TO VERIFY.

CAUTION: DO NOT DISASSEMBLE GEARBOX WITHOUT PRIOR AUTHORIZATION FROM SHARPE MIXERS OR WARRANTY WILL BE VOID. (DISREGARD WHEN MIXER IS OUT OF WARRANTY PERIOD.)

TRIPLE REDUCTION INPUT BEARINGS AND SEALS

Contact factory for all other parts.

	C-Face Inputs							Foot Motors	
ITEM	*POS.*	*56C*	*140TC*	*180TC*	*210TC*	*250TC*	*280TC*	*POS.*	*MTR SCOOP*
N1									***160S***
Oil seal	91	20x52x10A	20x52x10A					67	20x47x7A
Lower bearing	95	6304-Z	6304-Z					71	6204-Z
Upper bearing	99	6007-Z	6007-Z					75	6204-Z
N2									***160S***
Oil seal	91	20x52x10A	20x52x10A					67	20x47x7A
Lower bearing	95	6304-Z	6304-Z					71	6204-Z
Upper bearing	99	6007-Z	6007-Z					75	6204-Z
N3									***160S***
Oil seal	91	20x52x10A	30x72x10A					67	20x47x7A
Lower bearing	95	6304-Z	6304-Z					71	6204-Z
Upper bearing	99	6007-Z	6007-Z					75	6204-Z
N4									***250S***
Oil seal	91	30x72x10A	30x72x10A	*see factory*	40x90x12A			67	30x72x10A
Lower bearing	95	6306-Z	6306-Z	*see factory*	6308-Z			71	6306-Z
Upper bearing	99	6007-Z	6007-Z	*see factory*	6211-Z			75	6306-Z
N5									***250S***
Oil seal	91	30x72x10A	30x72x10A	*see factory*	40x90x12A			67	30x72x10A
Lower bearing	95	6306-Z	6306-Z	*see factory*	6308-Z			71	6306-Z
Upper bearing	99	6007-Z	6007-Z	*see factory*	6211-Z			75	6306-Z
N6									***300S***
Oil seal	91	30x72x10A	30x72x10A	*see factory*	50x80x10A	55x85x10A		67	60x100x12A
Lower bearing	95	6306-Z	6306-Z	*see factory*	6310-Z	6311-Z		71	6309-Z
Upper bearing	99	6207-Z	6207-Z	*see factory*	6311-Z	6312-Z		75	6308-Z
N7									***DIA 250***
Oil seal	91			50x80x10A	50x80x10A	75x115x13A	75x115x13A	67	65x120x10A
Lower bearing	95			6310-Z	6310-Z	NU215mm	NU215mm	71	NU311E
Upper bearing	99			6311-Z	6311-Z	3216-Z	3216-Z	75	6311-Z
N8									***DIA 250***
Oil seal	91			50x80x10A	50x80x10A	75x115x13A	75x115x13A	67	65x120x10A
Lower bearing	95			6310-Z	6310-Z	NU215mm	NU215mm	71	NU311E
Upper bearing	99			6311-Z	6311-Z	3216-Z	3216-Z	75	6311-Z
N9									
Oil seal	91			50x80x10A	50x80x10A	75x115x13A	75x115x13A	67	Ratio
Lower bearing	95			6310-Z	6310-Z	NU215mm	NU215mm	71	Dependant
Upper bearing	99			6311-Z	6311-Z	3216-Z	6216-Z	75	*see factory*
N10									
Oil seal	91							67	Ratio
Lower bearing	95	CONTACT FACTORY FOR N10 BEARINGS AND SEALS						71	Dependant
Upper bearing	99							75	*see factory*

TABLE C2.2

ALWAYS REFERENCE THE MIXER SERIAL NUMBER WHEN PLACING ORDER OR MAKING PARTS INQUIRY. THIS SERIAL NUMBER IS LOCATED ON THE ***SHARPE MIXER*** NAMEPLATE & ON THE FRONT COVER OF THE SERVICE MANUAL.

GEARBOX BEARINGS AND SEALS

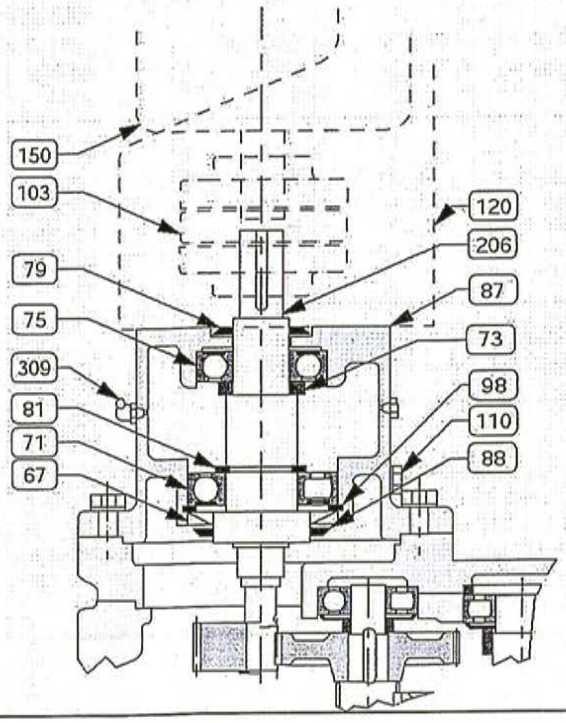
Contact factory for all other parts.

GEARBOX	OIL SEALS	BEARINGS		
MODEL/ REDUCTION	LOW SPEED Pos. Nos. 209/210	INTERMEDIATE Pos. Nos. 245/248 or 45/48	INTERMEDIATE Pos. Nos. 237/238	LOW SPEED Pos. Nos. 213/222
N1 / 2	45x75x7AS/45x75x7A		6302/6302-2Z	32009/32009
N1 / 3	45x75x7AS/45x75x7A	*contact factory*	6302/6302-2Z	32009/32009
N2 / 2	50x90x8AS/50x90x10A		6303TMB/6303TMB	30210/30210
N2 / 3	50x90x8AS/50x90x10A	*contact factory*	6303TMB/6303TMB	30210/30210
N3 / 2	55x100x10AS/55x100x10A		30304/32304	30211/30211
N3 / 3	55x100x10AS/55x100x10A	*contact factory*	30304/32304	30211/30211
N4 / 2	70x125x12AS/70x125x12A		32305/32305	30214/30214
N4 / 3	70x125x12AS/70x125x12A	NUP305E/TMB303	32305/32305	30214/30214
N5 / 2	85x150x12AS/85x150x12A		30306/32306	30217/30217
N5 / 3	85x150x12AS/85x150x12A	NUP307E/NUP304E	30306/32306	30217/30217
N6 / 2	100x180x12AS/100x180x12A		NJ407/22308E	30220/30220
N6 / 3	100x180x12AS/100x180x12A	NJ306E/6404	NJ407/22308E	30220/30220
N7 / 2	110x200x13AS/110x200x13A		32308/32309	30222/30222
N7 / 3	110x200x13AS/110x200x13A	NJ307E/6405	31308E/32309	30222/30222
N8 / 2	130x230x14AS/130x230x14A		32309/32310	30226/30226
N8 / 3	130x230x14AS/130x230x14A	NJ309E/6407	31309/32310	30226/30226
N9 / 2	160x290x18AS/160x290x18A		22311E/22314E	30232/30232
N9 / 3	160x290x18AS/160x290x18A	22308E/22308E	22311E/22314E	30232/30232
N10 / 2 N10 / 3	CONTACT FACTORY FOR N10 BEARINGS AND SEALS			

TABLE C2.3

MOTOR SCOOP INPUT PARTS LIST (ALL SIZES)

Alternate to C-face input assembly shown in Gearbox assemblies, Figures C2.1 through C2.3



ITEM	PART NAME
•67	Oil seal
•71	Lower input bearing
73	Spacer
•75	Upper input bearing
79	Oil slinger
81	Snap ring
87	Input cylinder
88	Oil slinger
98	Snap ring
•103	Input coupling
110	Plug / Vent
120	Motor scoop
150	Motor
•206	Input shaft / pinion
309	Input bearing grease fitting

• = Recommended spare part

FIGURE C2.4

C2.3 The input bearings requires relubrication at regular intervals. To lubricate the bearings of the input shaft, add about 0.75 oz of grease every 1,000 hours or 6 months, whichever occurs first. See C1.1 for instructions and table C2.4 for recommended bearing greases. Automatic lubricators are available on request.

The optional automatic lubricators feed grease lubricant to the outboard adapter bearing continuously over time. The lubricator contains 4 oz. (120 cc) of grease. **Each automatic lubricator must be activated by turning the plastic eyelet into the canister until the eyelet breaks off.** This pressurizes the canister and releases grease. With 8 hours/day of operation it must be replaced every 12 months. For longer operating times the replacement interval decreases accordingly.

The automatic lubricator is designed for normal service conditions at ambient temperatures between 32°F (0°C) and 104°F (40°C). If the ambient temperature is outside this range for prolonged periods of time, special lubricants should be used. Consult factory. A canister with food grade lubricant is also available.

C2.4 When replacing output bearings and seals on the gearbox be sure to re-pack bearings and seals with grease (see figure C2.6). See table C2.4 for recommended grease options.

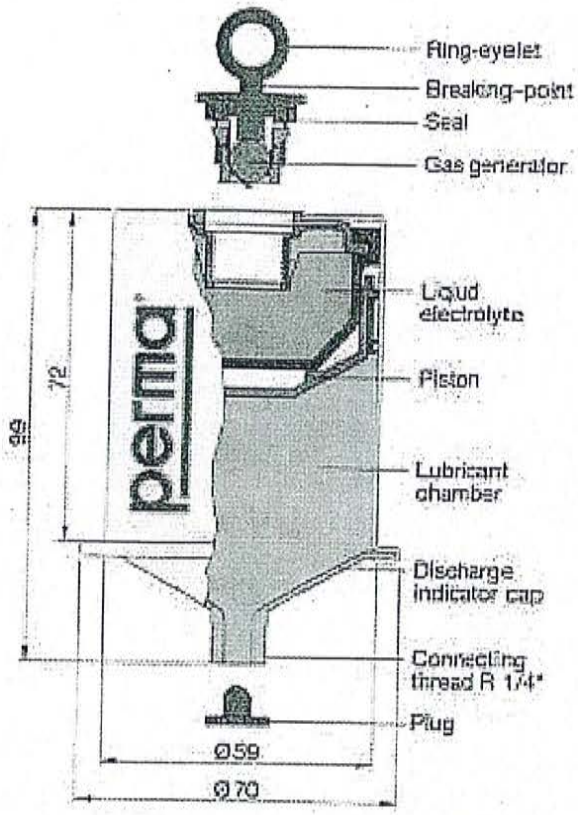


FIGURE C2.5
(dimensions in mm)

Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Type/Thickener	Ambient Temperature Range	Manufacturer Brand/Type
NLGI 2	Standard/Li-Complex	-22 to 140 deg F (-30 to 60 deg C)	Shell Albida EP 2
	High-Temperature/Polyurea	-13 to 176 deg F (-25 to 80 deg C)	Mobil Polyrex EP 2
	Food-Grade/Al-Complex	-13 to 104 deg F (-25 to 104 deg C)	Mobil Grease FM222

TABLE C2.4

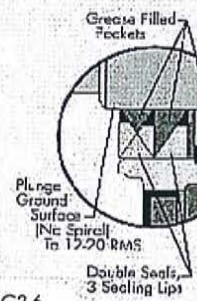


FIGURE C2.6

> QUADRILIP™ shaft seal system – consisting of 2 spring compression lips, 1 trash guard lip and 1 collector grease pack – keeps contaminants out and lubricant inside the gear case.

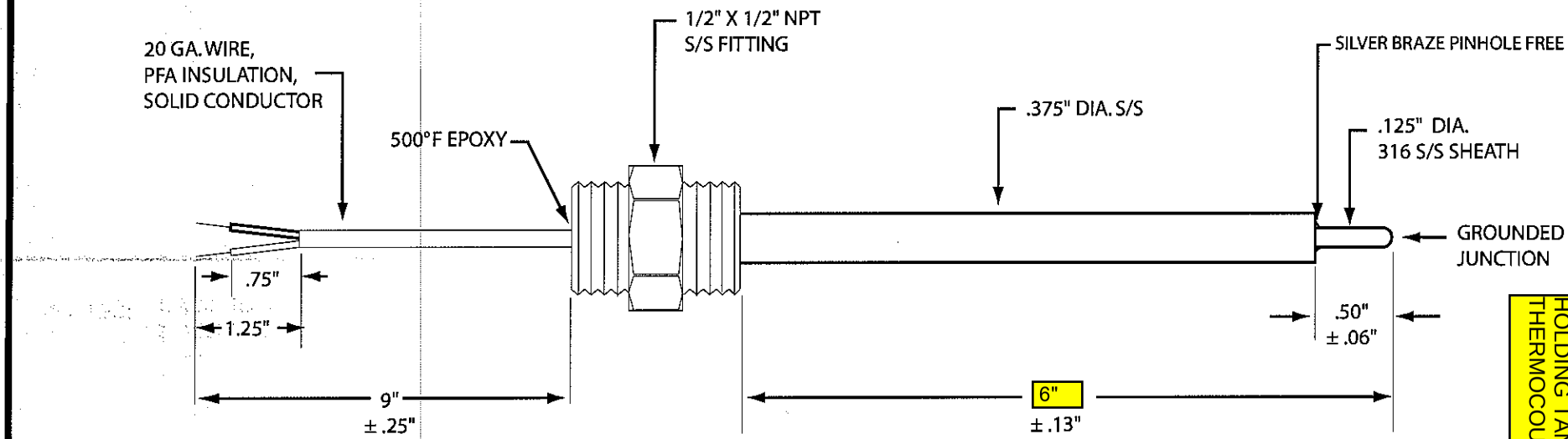
Notes: _____

- END OF SECTION C -

NOTES: 1. MAX.TEMP: 500°C
2. ACCURACY: ±2.2°C OR .75% WHICHEVER IS GREATER

Part No.	Rev.
XTMS809-(CAL)-(LGTH)-(TERM)	A

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES. REMOVE BURRS AND SHARP EDGES.



TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
HOLDING TANK
THERMOCOUPLE P/N: XTMS809-12

ORDERING INFO:
XTMS809-(*)-(*)-(*)

- TERMINATION: "CA" FOR CAST ALUM. HEAD
  "STR09" FOR 9" STRIPPED LEADS
- SHEATH LENGTH IN INCHES
- CALIBRATION: "J" OR "K"

TOLERANCES	THERM-X OF CALIFORNIA	
DECIMAL + -	SURFACES	FAST RESPONSE THERMOCOUPLE
FRACTIONAL + -		
ANGULAR + -		
SCALE + -	DRAWN jrl	DWG. NO. XTMS809-D1-RA
	APPROVED	PAGE 1 OF 1

REV.	DESCRIPTION	DATE
A	LEAD LENGTH WAS 4", NOW 9" LONG.	4/18/03

TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
HOLDING TANK HEATER
CHROMALOX P/N: OT-3007-121275

Chromalox®

Installation Instructions

SERVICE REFERENCE	
DIVISION 4	SECTION GEN
SALES REFERENCE (Supersedes P00400-4)	P00400-5
	161-048339-001
DATE JANUARY, 1999	

General Recommendations on the Use of Chromalox® Electric Heating Elements for Clamp-On, Oven and Air Duct Heating

CHROMALOX ELECTRIC HEATING ELEMENTS FOR CLAMP-ON

The electric heating element(s) supplied herein are ruggedly constructed and if properly installed, operated and maintained, are designed for long life and dependable, trouble-free service.

GENERAL

WARNING: ***Users should install adequate controls and safety devices with their electric heating equipment. Where the consequences of failure may be severe, back-up controls are essential, including GFCI (Ground Fault Circuit Interrupters). Although the safety of the installation is the responsibility of the user, Chromalox will assist in identifying equipment options.***

DANGER: ***Hazard of Fire.*** Since electric heaters are capable of developing high temperatures, extreme care should be taken to:

A. Avoid mounting heaters in an atmosphere containing combustible gases and vapors.
B. Avoid contact between heaters and combustible materials.
C. Keep combustible materials far enough away to be free of the effects of high temperatures.

INSTALLATION

WARNING: ***Hazard of Electric Shock. Disconnect all power before installing heater.***

High heating efficiency, low sheath temperatures and long heater life result when electric heaters are properly installed.

INSTALLATION – CLAMP-ON

1. Clamp strip heaters securely, along their entire length, to smooth metal surface. Use utility clamps spaced 5" apart and 5/16" stainless steel studs or oversized steel studs for clamping. Retighten following initial heat-up. Allow for expansion. When more that one clamp is used, tighteu clamps to avoid bowing of heater, poor heat transfer and possible premature failure. Leave 1/2" space between heater ends clamped in line for expansion. Do not use mounting tabs for clamping to surface.
2. When strips are clamped to tank bottom for melting paraffin, waxes, asphalt, greases, etc., one or two strips should be clamped vertically to the tank side extending above the liquid level. This is necessary to open a passage to the tank surface for the initially melted material.

DANGER: ***Failure to comply with this recommendation could cause a buildup of pressure and could result in dangerous erupting or splashing of hot material.***

3. Clamp ring heaters to smooth metal surface. Use cast iron utility clamps with 1/4" MONEL® or stainless steel studs. Retighten following initial heat-up.
4. Tubular heaters are clamped the same as strips against the metal surface.
5. Allow a minimum of 1" air space between heaters and insulation.

WIRING

WARNING: ***Hazard of Electric Shock. Any installation involving electric elements must have its metal frame effectively grounded in accordance with the National Electrical Code to eliminate shock hazard.***

1. Electric wiring to heating elements must be installed in accordance with National Electrical Code or local electrical codes by a qualified person.
2. Temperatures at heater terminals may require use of high-temperature wire. Check factory for recommendations.
3. Maximum torque on strip heater terminals is 25 in-lbs.

GENERAL INFORMATION

1. Strip heaters of equal wattage and voltage may be series connected for use on a power supply up to 480 volts. Where the power supply is greater than 480 volts (600 volt max.) series connections may be used but secondary insulation bushings must be provided.
2. Ring heaters of equal wattage and voltage with a surface temperature of less than 1000°F may be series connected for use on a power supply up to 240 volts maximum.
3. Tubular heaters of equal wattage and voltage can be series connected for use on a maximum power supply of 480 volts. Heaters for use above 480 volts must be equipped at the factory with special bigh voltage terminal insulation.
4. Use iron or steel sheathed heaters for temperatures up to 750°F maximum sheath temperature. Use chrome steel sheathed rings or strips for temperatures up to 1200°F maximum sheath temperature. Use alloy or INCONEL® sheathed tubular heaters for temperatures up to 1500°F maximum sheath temperature. The sheath temperature is the highest temperature on the surface of the heater when operating.
5. Do not bend or form strip heaters. Do not bend tubular heaters on inside radii of less that 4". When it is required to bend or curve strips or dish rings, or bend tubulars on small radii, consult our factory.
6. Use seamless strips where condensation, spray, oil or fumes are present.
7. Protect terminals from drippings, spray, condensation or spillover. Provide adequate electrical clearance.
8. Use manganese nickel wire or alloy bus bar for making electrical connections within the heater itself, and for bringing leads out through the insulating jacket to a cooler region where insulated copper wire may be attached.

MAINTENANCE

WARNING: ***Hazard of Severe Shock. Disconnect all power to heater before servicing or replacing heaters.***

1. Periodically clean terminals of dust and corrosion to maintain good electrical connections and to permit rapid heat dissipation. Use air-blast and be careful to avoid damage to mica insulation.
2. Check for loose terminal conuections.

(OVER)

CHROMALOX ELECTRIC HEATING ELEMENTS FOR OVEN HEATING – AIR DUCTS

The electric heating element(s) supplied herein are ruggedly constructed and if properly installed, operated and maintained, are designed for long life and dependable, trouble-free service.

GENERAL

Temperature regulating and temperature limiting controls are recommended to be used with electric heaters to control the heating process and safeguard the electric heaters from excessive temperatures that can damage heaters.

DANGER: ***Hazard of Fire.*** Since electric heaters are capable of developing high temperatures, extreme caution should be taken to:

A. Avoid mounting heaters in an atmosphere containing combustible gases and vapors.
B. Avoid contact between heaters and combustible materials.
C. Keep combustible materials far enough away to be free of the effects of high temperatures.

INSTALLATION

WARNING: ***Hazard of Electric Shock. Disconnect all power before installing heater.***

High heating efficiency, low sheath temperatures and long heater life result when electric heaters are properly installed.

INSTALLATION – OVEN HEATING

1. When mounting the strip heaters vertically, locate the terminals at the bottom or cooler parts of the oven. Allow for expansion and contraction by loosely bolting the top mounting tab. Secure the bottom tab firmly.
2. In a forced air system, the width of the strip should be parallel to the direction of air flow.
3. For horizontal installation of strips, the tab on the terminal end should be firmly connected and the opposite end loosely connected to allow for expansion and contraction.
4. Mount strips on edge in horizontal installation across the bottom and along the sides on the oven, allowing 3" minimum air space between the heaters and the bottom of the oven and 1" from the oven wall to allow for proper circulation of heated air. For large ovens, allow a 6" minimum clearance.
5. In horizontal mounting, install a protective screen or grill above the strips at the bottom of the oven.
6. Support long iron sheathed strips on 36" centers and chrome steel sheathed strips on 24" centers to prevent sagging.

INSTALLATION – AIR DUCTS

1. Locate protective thermostat on downstream side of heaters near the top of the duct and close to the heated portion of the heaters.
2. Mount heaters with terminals at the duct bottom to prevent overheating.
3. Where condensation, spray, oil or fumes are present use seamless finstrips, type SSEF, with the terminals placed outside of the air duct.
4. As a safety feature in advent of abnormal temperatures, it is suggested to use a thermal cutout in conjunction with thermostatic control.

WIRING

WARNING: ***Hazard of Electric Shock. Any installation involving electric elements must have its metal frame effectively grounded in accordance with the National Electrical Code to eliminate shock hazard.***

1. Electric wiring to heating elements must be installed in accordance with National Electrical Code or local electrical codes by a qualified person.
2. Temperatures at heater terminals may require use of high-temperature wire. Check factory for recommendations.

GENERAL INFORMATION

1. Strips of equal wattage and voltage can be series connected for a maximum of 480 volts. If a higher voltage (600 volt max.) is necessary use the same series connections and use secondary insulation bushings.
2. Use iron or steel sheathed heaters for temperatures up to 750°F maximum sheath temperature. Use chrome steel sheathed strips for temperatures up to 1200°F maximum sheath temperature. Use alloy or INCONEL® sheathed tubular heaters for temperatures up to 1500°F maximum sheath temperature. The sheath temperature is the highest temperature on the surface of the heater when operating.
3. Do not bend or form strips.
4. Use manganese nickel wire or alloy bus bar for making electrical connections where temperatures are above 350°F. Insulated copper wire may be used in the cooler region.
5. Terminals should always be in the coolest part of the oven. If oven temperature is over 800°F the terminals should be placed outside the oven if possible. If not possible, weld electrical connections to heater terminals. Protect terminals from welding flux.
6. Tubulars are to be mounted the same as strips and supported on 24" centers.

MAINTENANCE

WARNING: ***Hazard of Severe Shock. Disconnect all power to heater before servicing or replacing heaters.***

1. Periodically clean terminals of dust and corrosion to maintain good electrical connections and to permit rapid heat dissipation. Use air-blast and be careful to avoid damage to mica insulation.
2. Check for loose terminal connections.

Chromalox®
PRODUCT SERVICE
2150 N. RULON WHITE BLVD., OGDEN, UT 84404
Phone: 1-800-368-2493

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SCUM CONCENTRATOR
SPEC SECTION #11317
HOLDING TANK
DISCHARGE VALVE P/N: 12' KNIFE GATE, EPDM SEATHOLDING TANK
KNIFE GATE VALVE
P/N: #20-3636-RE

ORBINOX

OPERATION AND MAINTENANCE MANUAL

2” THRU 24”

SERIES 20 (ET)

KNIFE GATE VALVE

M-010712-20

ORBINOX

CONTENTS

1.0 GENERAL

The **SERIES 20** Knife Gate is a uni-directional full flange type valve designed according to the MSS-SP-81[1] standard for industrial service applications.

This manual has instructions and guidelines for the personnel responsible for the installation, operation, and maintenance of the Ser. 20 Knife Gate Valves.

2.0 INSPECTION

The valves have been tested, inspected and properly packaged for shipment from the factory. Upon arrival at the final destination, valves should be carefully inspected. The possibility of damages might occur due to improper handling in transit. In the event “of damage”, a damage claim should be filed immediately with the carrier.

3.0 STORAGE

All Orbinox valves are properly packaged for shipment to final destination from the factory. However sometimes units are not installed immediately and are stored for a period of time. If this is the case, valves should be stored in a clean, cool and dry location and protected from any contaminants such as dirt, dust, etc. The seating and packing areas of the valve should be protected from direct sunlight.

For outdoor storage, units or crates should be wrapped in plastic or properly protected from snow or rain. All instrument components that have plastic caps on the connections such as pneumatic cylinders, limit switches etc. should be replaced with metal pipe plugs. Failure to do so could cause damage or a malfunction of the valve upon start-up.

4.0 SPARE PARTS

Recommended spare parts are listed on the Assembly drawings. One set of parts should be inventoried for each valve size and type.

All replacement parts may be ordered through an Orbinox sales representative. For locations of the nearest representative, please call our customer service department.

[1] Standard practice developed and approved by the manufacturers standardization society of the Valve and Fittings Industry, Inc.

5.0 TECHNICAL ASSISTANCE

For technical assistance, please contact the nearest Orbinox authorized sales representative or our service personnel at the following locations:

ORBINOX CANADA, 2050 Dagenais West, Laval, Quebec, H7L 5W2 Tel: 450-622-8775 Fax: 450-622-6831
e-mail: **orbe@orbevalve.com** / www.orbevalve.com

ORBINOX USA, 311 North Front Street, Amory, Mississippi 38821 Tel: 662-256-2227 Fax: 662-256-2119
e-mail: **orbe@orbevalve.com** / www.orbevalve.com

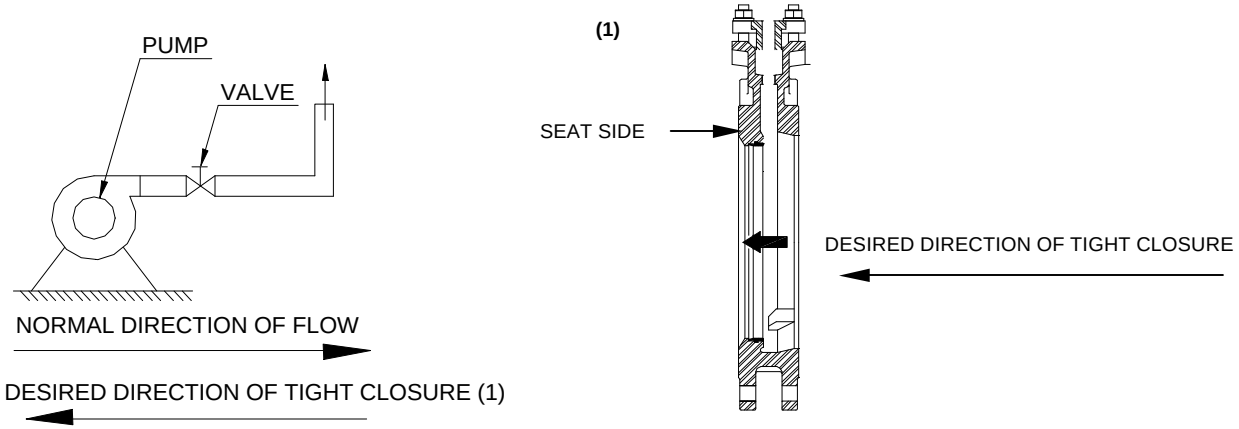
ORBINOX SPAIN, Polig. Ind. Anoeta – Apdo 80 – 20400 Tolosa, Spain Tel: 943-69 80 30 Fax: 943-65 30 66
e-mail: **orbinox@orbinox.com**

6.0 FLOW SHUT-OFF DIRECTION:

Prior to installing the valve, determine the flow in the pipeline and the direction of the desired shut-off of the valve. This is very important since the Ser.20 is a uni-directional Knife Gate Valve. In some cases the valve has to shut-off tightly in the direction opposite to normal flow direction. In this case the valve is fully open when the medium is flowing in one direction, but requires a tight shut-off only against a downstream head when the flow stops.

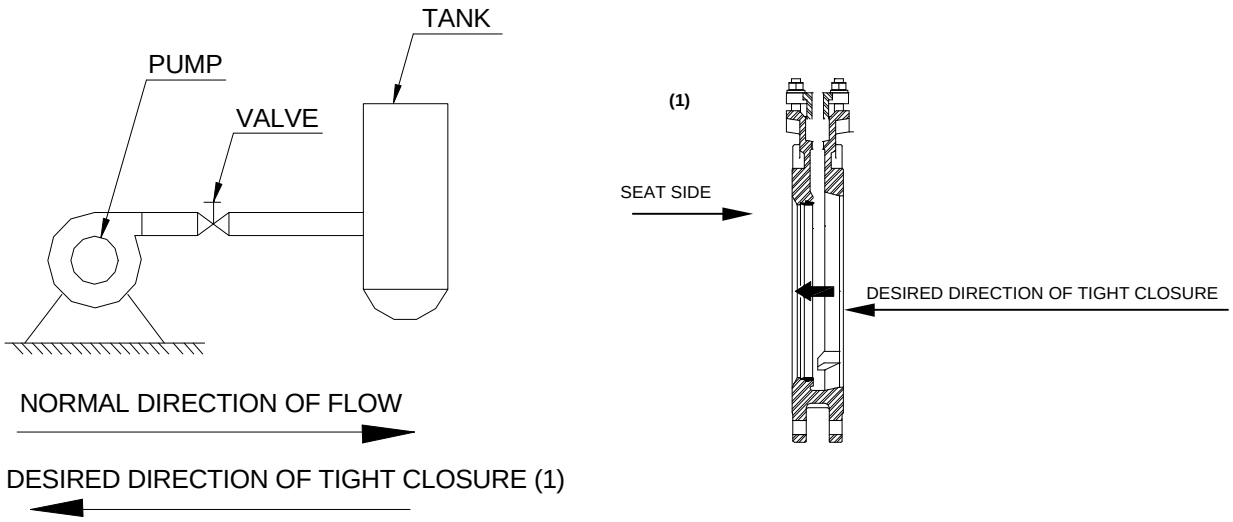
The following are some typical installations:

FIG. 1
PUMPING INTO A RISER



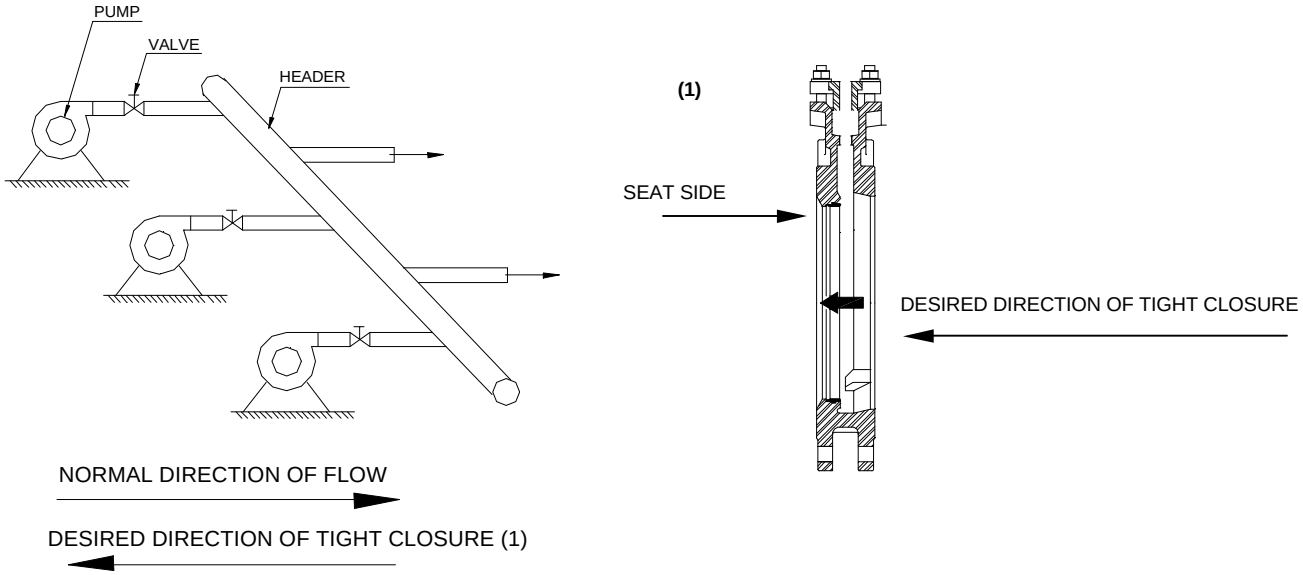
1. Normal flow is from a pump through a fully open valve into a riser.
2. On a pump shutdown, the valve is closed to retain the down-stream flow in the riser.
3. The valve is installed with the seat opposite the normal flow direction.

FIG. 2
PUMPING INTO A PRESSURE VESSEL



1. Normal flow is from a pump through a fully open valve into a pressurized holding vessel.
2. On a pump shutdown, the upstream pressure reduces to 0 PSI and the valve is closed to maintain the pressure inside the vessel.
3. The valve is installed with the seat opposite the normal flow direction.

FIG. 3
MULTIPLE PUMPING INTO A HEADER

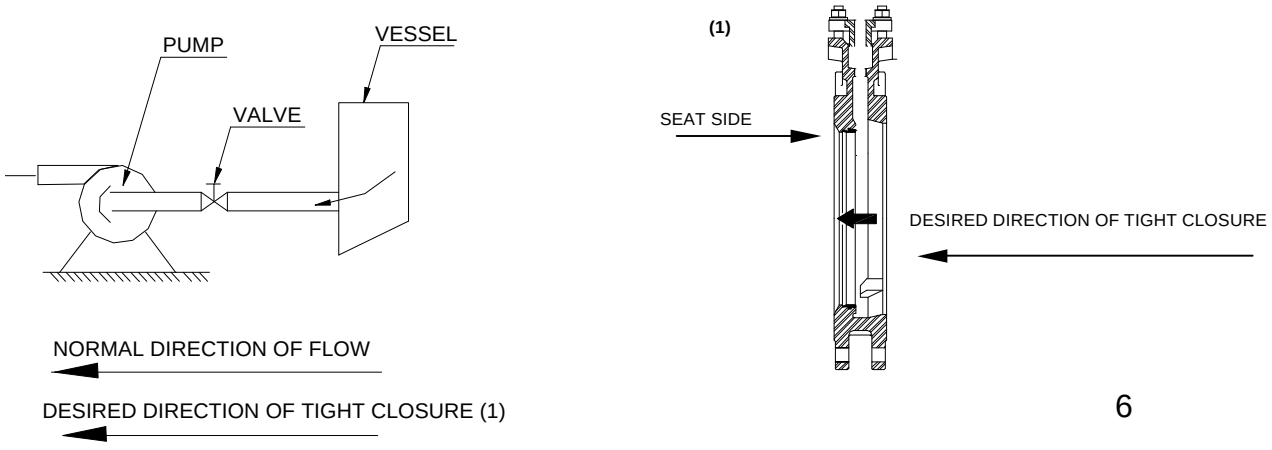


1. Under normal conditions, all 3 pumps with the valve in the full open position pump into a header.

2. On certain occasions one or more pumps are shut down due to maintenance, etc. and the valve(s) are in the closed position to prevent flow back from the header while the other pumps are running.

3. The valve is installed with the seat opposite the normal flow direction.

FIG. 4
PUMPING FROM A VESSEL



1. Normal flow from a vessel through a fully open valve and into the suction end of the pump.

2. During a pump shutdown, the valve is closed to retain the upstream pressure.

3. The valve is installed with the seat side on the same direction as the normal flow.

Note: For Knife Gate Valve installations opposite the normal shut-off, please consult our technical department.

7.0 INSTALLATION:

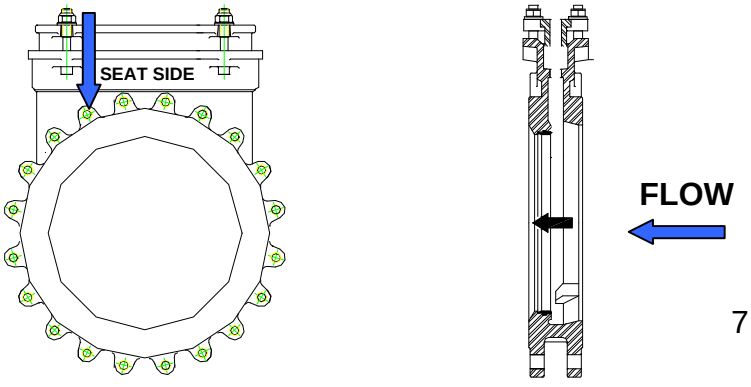
The Series 20 is a uni-directional valve Knife Gate Valve. Before installation, make sure you have identified the correct shut-off direction of the valve. Once this is done, locate the flow direction for shut-off on the valve. Look for the following markings on the valve:

- **SEAT SIDE**
- **FLOW DIRECTION ARROW** →

a) The marking "SEAT SIDE" is located on the face of the valve below the packing chamber. This is the lower pressure side of the valve when in the closed position; the pipeline pressure will assist sealing the valve in the closed position.

b) The flow direction arrow (→) is located on the side of the valve between the lugs or flanges. This indicates the flow direction to be sealed when the valve is in the closed position.

FIG. 8



Prior to installing the valves in the system, please inspect and clean pipeline of any foreign material such as welding rods or spatter, tools, etc. Failure to do so may damage the seat (resilient seat models) or the valve.

The valve shall be installed between ANSI Class 125 or Class 150 pipeline flanges with proper gasket thickness.

- Install the valve according to the desired shut-off direction (section 6).

  NOTE: observe the following points to prevent distortion of the valve body and gate when flange bolts are torqued:

- Align the mating pipeline flanges. Please refer to the illustration below:

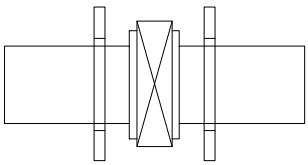


FIG. 5

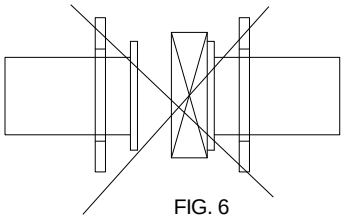


FIG. 6

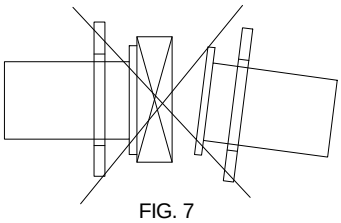
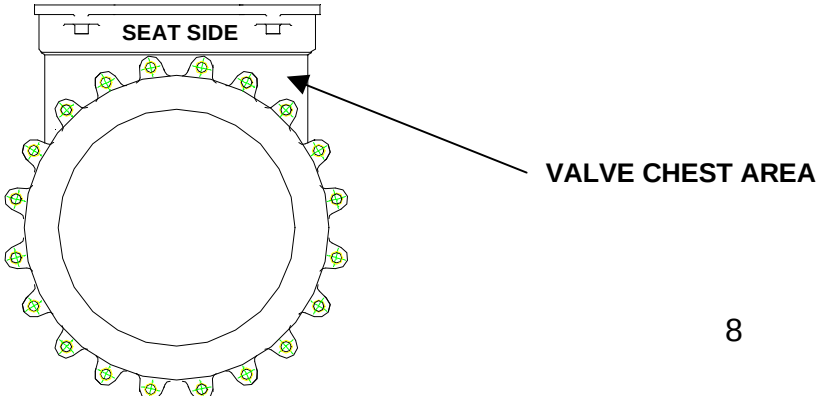


FIG. 7

- Selection of flange bolt lengths should be determined prior to installation. Bolts used in the blind holes in the chest area of the valve should not bottom out when torqued. Failure to do so can cause improper sealing of the gasket between the valve and the pipe flange.

FIG. 9



- Bolts to be torqued evenly in a crisscross pattern.

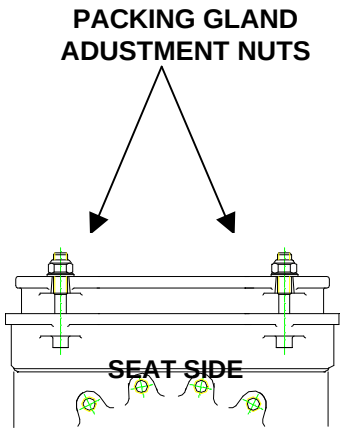
Once the installation is complete, the following check list should be followed before pressurizing the system:

- Gate should be in either the full open position or full closed position.
- Double check that all flange bolts are properly tightened.
- Packing gland compression nuts may come loose during shipment. Ensure that there is enough compression applied on the packing and that gland is not loose. **NOTE, DO NOT OVER TIGHTEN, THIS WILL CAUSE AN INCREASE IN OPERATING THRUST OR TORQUE AND DECREASE THE LIFE OF THE PACKING.**

After the system is pressurized, check for any leaks around the flange and packing area.

- Flange area: Tighten the bolts until the leaks stop. If the leaks continue, stop and de-pressurize the system and re-tighten the bolts.
- Packing adjustment: Tighten the adjustment nuts on top of the packing gland (FIG. 10). Tighten the nuts evenly and gently until the leakage stops. **NOTE, DO NOT OVER TIGHTEN, THIS WILL CAUSE AN INCREASE IN OPERATING THRUST OR TORQUE AND DECREASE THE LIFE OF THE PACKING.**

FIG. 10

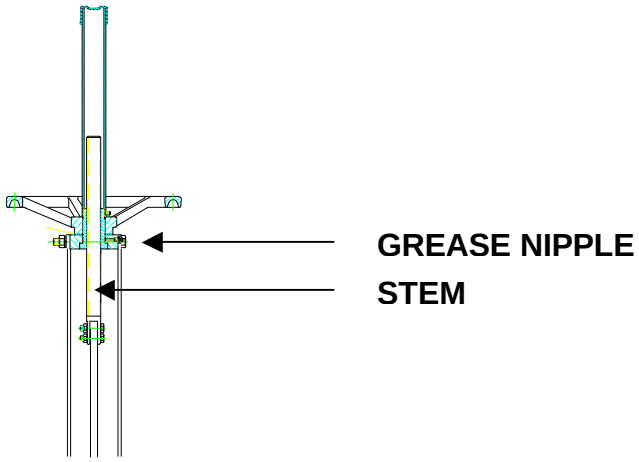


8.0 MAINTENANCE:

8.1 Lubrication:

- The Orbinox valve does not require any lubrication except for the actuator.
- For hand wheel actuators, lubrication is required in the yoke and stem area only (FIG. 11).
- Only water repellent lubrication should be used. Shell RHODINA grease or similar.
- The stem should be lubricated regularly in intervals depending on the number of cycles and the operating environment. Lubricate well over the whole threaded area of the stem.
- The yoke area of the stem nut assembly should be lubricated through the grease nipple when required or at least twice a year.

FIG. 11



- **NOTE: For all other actuators other than the above, please refer to the actuator operating and maintenance manual.**

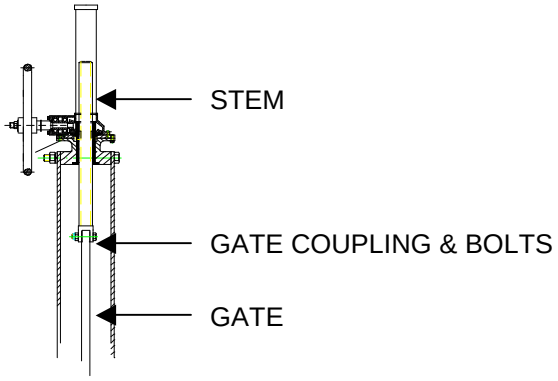
8.2 Packing Replacement:

WARNING

SHUT DOWN SYSTEM AND DE-PRESSURE PIPELINE BEFORE ATTEMPTING TO REPLACE PACKING. FAILURE TO DO SO CAN CAUSE PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Relieve the pressure in the system.
- Cycle the valve to the closed position.
- Remove bolts from the gate coupling (FIG. 12) and cycle valve to the open position. Only actuator should cycle and not the valve.

FIG. 12



- If the valve has a power actuator (pneumatic, electric, etc.) disconnect power supply to prevent accidental operation of the actuator.

WARNING

DISCONNECT POWER SUPPLY TO ACTUATOR BEFORE SERVICING. MOVING PARTS FROM ACCIDENTAL OPERATION OF POWERED ACTUATOR CAN CAUSE PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Remove the gland nuts and packing gland (FIG. 10).
- Remove the used packing from packing chamber.
- Cut new packing rings to the length shown in Table 1.
- With the gate in the closed position, center the gate in the packing chamber.
- Install packing one row at a time with ends together, but not overlapping. Stagger the joints so that they are not all in the same area. The inside and outside edges of each ring are to be packed against the gate and packing chamber, so that each ring is compressed flat and evenly.
- Square-end wood or plastic tool, driven by a hammer or a mallet is recommended for packing each row one at a time.

TABLE 1

SIZE	PACKING SIZE	PACKING LENGTH	NO. OF LAYERS	O-RING SIZE	O-RING LENGTH	NO. OF LAYERS
2"	5/16"	8.5"	2	5/16"	8.25"	1
3"	5/16"	10.25"	2	5/16"	10"	1
4"	5/16"	12"	2	5/16"	11.5"	1
5"	5/16"	14"	2	5/16"	13.5"	1
6"	5/16"	16"	2	5/16"	15.5"	1
8"	5/16"	19.75"	2	3/8"	19.25"	1
10"	3/8"	24"	2	1/2"	23.25"	1
12"	3/8"	27.5"	2	1/2"	26.75"	1
14"	3/8"	31.25"	3	1/2"	30.5"	1
16"	3/8"	34.75"	3	1/2"	34"	1
18"	3/8"	38.5"	3	1/2"	37.75"	1
20"	9/16"	42.5"	3	5/8"	41.5"	1
24"	9/16"	50.25"	3	5/8"	49.5"	1

- Replace the packing gland and finger tighten the nuts evenly. With a wrench tighten only half a turn (FIG.10).
- Reconnect the stem coupling onto the gate and install bolts and nuts (FIG.12).

- For powered actuator, reconnect power supply.

- Pressurize the system and check for any leaks. If leakage occurs, tighten the adjustment nuts on top of the packing gland nuts evenly and gently until the leakage stops. **NOTE, DO NOT OVER TIGHTEN, THIS WILL CAUSE AN INCREASE IN OPERATING THRUST OR TORQUE AND DECREASE THE LIFE OF THE PACKING.**

8.3 SEAT REPLACEMENT:

WARNING

SHUT DOWN SYSTEM AND DE-PRESSURE PIPELINE BEFORE ATTEMPTING TO REPLACE PACKING. FAILURE TO DO SO CAN CAUSE PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Relieve the pressure in the system or pipeline.

- Cycle the valve to the closed position.

- If the valve has a power actuator (pneumatic, electric, etc.) disconnect power supply to prevent accidental operation of the actuator.

WARNING

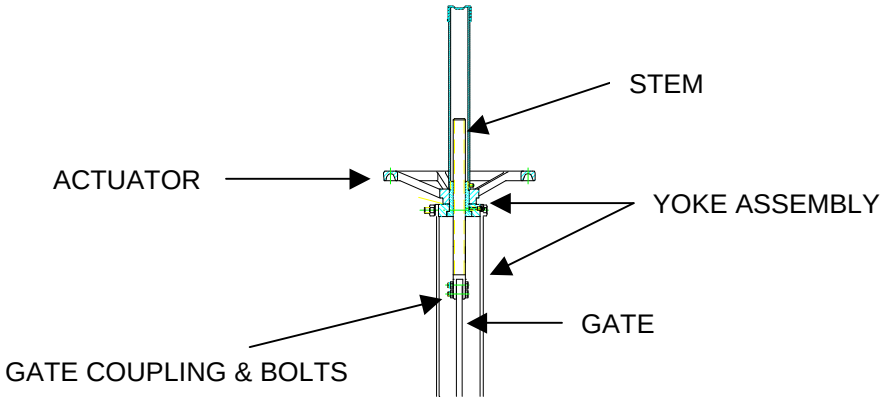
DISCONNECT POWER SUPPLY TO ACTUATOR BEFORE SERVICING. MOVING PARTS FROM ACCIDENTAL OPERATION OF POWERED ACTUATOR CAN CAUSE PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Remove the pipeline flange bolts from both flanges on the valve and remove the valve from the pipeline.

- Remove bolts from the gate coupling and cycle valve to the open position (FIG. 12). Only actuator should cycle and not the valve.

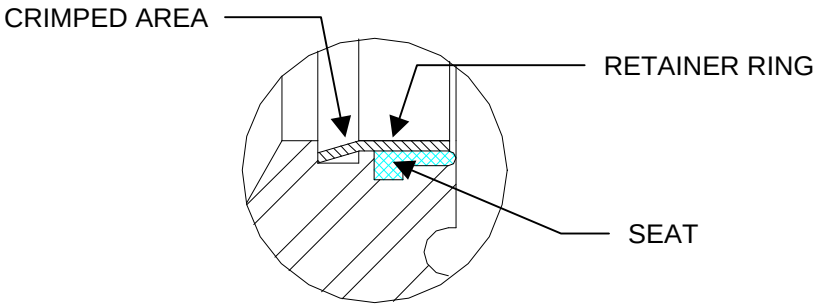
- Remove the actuator and yoke assembly from the valve.

FIG.13



- Remove the packing gland nuts and packing gland (FIG. 10).
- Remove the packing from the packing chamber.
- Remove the gate from the valve body.
- Note that the seat-retaining ring is crimped or bent toward the valve body in several places (FIG. 14).

FIG. 14



- With a flat object (i.e. screwdriver) pry the area between the retainer ring and the valve body in several areas until the ring moves away from the body. Remove the ring from the valve body.
- Inspect the seat retainer ring for any damage. In the event of damage, replace the ring.

- If existing ring is not damaged, un-crimp the crimped areas.

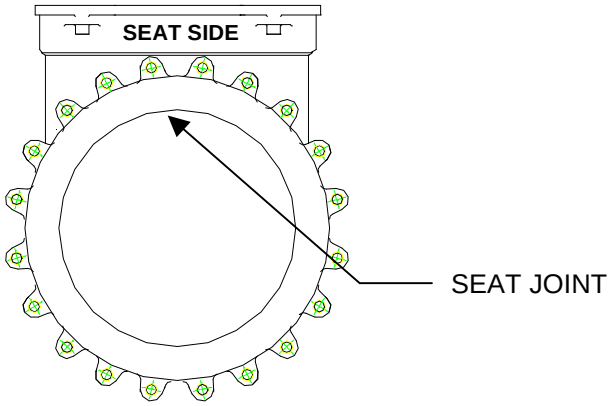
- Remove the damaged seat and replace. When placing the new seat note the following.

    a) Seat length should be approx. 1” longer than the diameter of the valve seat area.

    b) When the seat has been installed, join the edge of the longer end and form a loop. Apply pressure on the loop so that it will sit in place properly.

    c) **IMPORTANT:** Join the two ends of the seat on the upper side of the valve towards the packing area.

FIG. 15



- Inspect and make sure seat is seated properly inside the groove of the body. Exposed seat area should be uniform and smooth on the whole diameter of the valve.

- Lay the seat retainer ring on the inner diameter of the seat. **IMPORTANT: Crimped areas should be straight and not bent. Failure to do so could cause damage to the seat when installing.**

- Tap the ring evenly and gently in a criss cross pattern with a square-end wood or plastic tool, driven by a hammer or

mallet. Continue until the edge of the ring is in contact with the valve body.

- Crimp the areas of the seat retainer ring back in place (FIG. 14).

- Replace the packing. Refer to **section 8.2 "PACKING REPLACEMENT"**.

- Replace the packing gland and finger tighten the nuts evenly. With a wrench tighten only half a turn (FIG. 10)

- Re-assemble Yoke and actuator assembly (FIG. 13).

- Reconnect the stem coupling onto the gate and install bolts and nuts (FIG. 12).

- For powered actuator, reconnect power supply.

- Install valve in pipeline. Refer to **section 7.0 "INSTALLATION".**

- Pressurize the system and check for any leaks. If leakage occurs, tighten the adjustment nuts on top of the packing gland nuts evenly and gently until the leakage stops. **NOTE, DO NOT OVER TIGHTEN, THIS WILL CAUSE AN INCREASE IN OPERATING THRUST OR TORQUE AND DECREASE THE LIFE OF THE PACKING.**

8.4 GATE REPLACEMENT:

WARNING

SHUT DOWN SYSTEM AND DE-PRESSURE PIPELINE BEFORE ATTEMPTING TO REPLACE PACKING. FAILURE TO DO SO CAN CAUSE PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Relieve the pressure in the system or pipeline.

- Cycle the valve to the closed position.

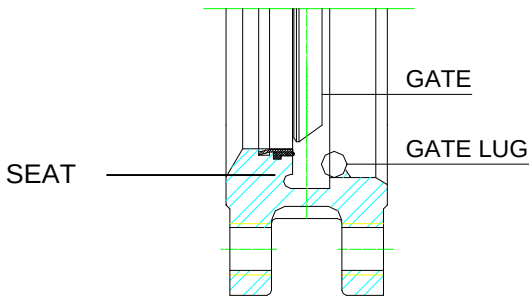
- If the valve has a power actuator (pneumatic, electric, etc.) disconnect power supply to prevent accidental operation of the actuator.

WARNING

DISCONNECT POWER SUPPLY TO ACTUATOR BEFORE SERVICING. MOVING PARTS FROM ACCIDENTAL OPERATION OF POWERED ACTUATOR CAN CAUSE PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Remove the pipeline flange bolts from both flanges on the valve and remove the valve from the pipeline.
- Remove bolts from the gate coupling and cycle valve to the open position. Only actuator should cycle and not the valve (FIG. 12).
- Remove the actuator and yoke assembly from the valve (FIG. 13).
- Remove the packing gland nuts and packing gland (FIG. 10).
- Remove the packing from the packing chamber.
- Remove the gate from the valve body.
- Inspect the seat (for resilient seated models) for any damages. In the event, proceed to **section 8.3 "SEAT REPLACEMENT"**.
- Place the new gate in the body, in the closed position with the beveled edge of the gate facing away from the seat.

FIG. 16



- Replace the packing as described in **section 8.2 “PACKING REPLACEMENT”**.

- Replace the packing gland and finger tighten the nuts evenly. With a wrench tighten only half a turn (FIG. 10).

- Re-assemble Yoke and actuator assembly (FIG. 13).

- Reconnect the stem coupling onto the gate and install bolts and nuts (FIG. 12).

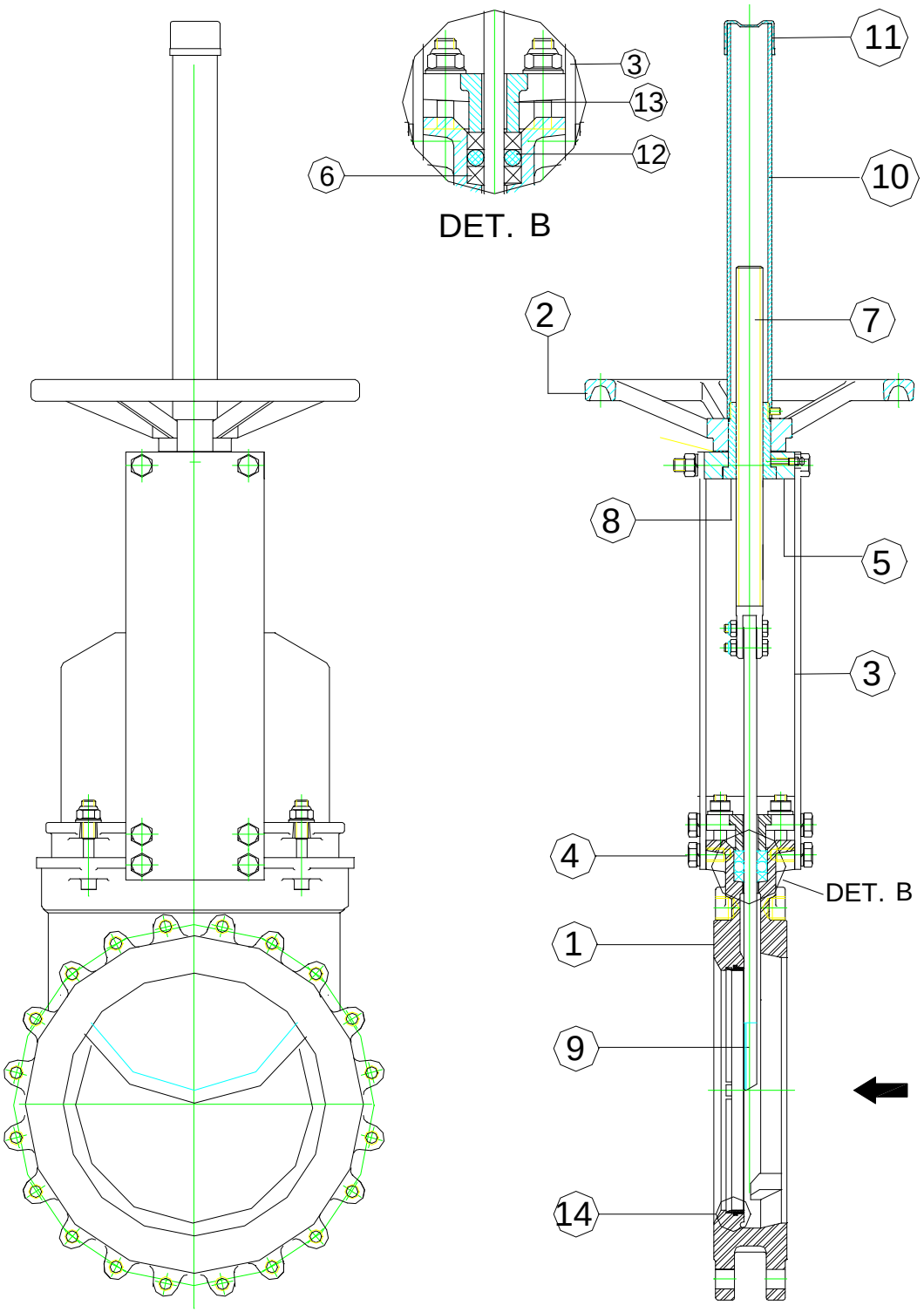
- For powered actuator, reconnect power supply.

- Pressurize the system and check for any leaks. If leakage occurs, tighten the adjustment nuts on top of the packing gland nuts evenly and gently until the leakage stops. **NOTE, DO NOT OVER TIGHTEN, THIS WILL CAUSE AN INCREASE IN OPERATING THRUST OR TORQUE AND DECREASE THE LIFE OF THE PACKING.**

8.5 ACTUATORS & INSTRUMENTS:

For actuators other than hand wheels, solenoids, limit switches, etc.; refer to the equipment manufactures manual.

FIG. 17



ORBINOX

ITEM	PART NAME	QTY	MATERIAL
14	SEAT	1	METAL / RESILIENT
13	PACKING GLAND	1	CF8M
12	O-RING	1	EPDM
11	CAP	1	PLASTIC
10	STEM PROTECTOR	1	STEEL
9	GATE	1	316 SS
8	BUSHING	1	BRONZE
7	STEM	1	STAINLESS STEEL
6	PACKING	-	PTFE
5	BLOCK	1	STEEL
4	BOLTS + NUTS	-	STAINLESS STEEL
3	SUPPORT PLATE	2	STEEL
2	HANDWHEEL	1	CAST IRON
1	BODY	1	CF8M

DIMENSIONS IN INCHES.		DWG#:203/01	
CUSTOMER:		Valves tested conform to standards TIS405-8 and MSS-SP81	
PROJECT:			
ORDER#:		20-3636M	
DATE:	MAY.23.2001		
CUST. APPROVAL:		ORBINOX	
SER.20 VALVE HANDWHEEL ACTUATOR			

TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
HOLDING TANK LEVEL SWITCHES
P/N: LS7000-115VAC-H-6"/LS7000-115VAC-H-10"

LS7000 LEVEL SWITCH
OWNERS MANUAL

- INSTALLATION
- CALIBRATION
- TROUBLESHOOTING
- WARRANTY

BABBITT
INTERNATIONAL, INC.

P.O. Box 70094
Houston, TX 77270
(713) 467-4438

TABLE OF CONTENTS

LS7000 LEVEL SWITCH

1. DESCRIPTION

A. General Description

The LS7000 is a point level switch that detects the presence or absence of material in a bin, silo, tank or other container. The basic unit is made up of a solid stainless steel probe attached to an explosion proof housing. Inside the explosion proof housing are all calibration adjustments and sensing electronics. The unit is calibrated in the absence of material and an internal relay changes state when material is detected.

B. Specifications

Electrical

Power:	115 VAC (±15%) 50/60 Hz. 2 watts, standard. (12 VDC, 24 VDC or 230 VAC optional)
Output	2 Form C contacts, DPDT relay, 5 amp resistive At 125, 250 VAC; 30 VDC
Fuse:	On board, 250 mA @ 125 volts
Fail Safe:	Selectable high or low level
Time Delay:	Selectable: ON or OFF delay Adjustable: 1/8 sec to 2 hrs.
RF Frequency:	Approximately 1.3 MHz

Environmental

Hazardous Area:	Class I, Group D, Class II, Group E, F, G
Temperature:	Probe: -30° F to 400° F Electronics: -40° F to 185° F
Pressure:	Probe: 1500 psi @ 75° F. Higher ranges available on request.
Construction:	Probe: All wetted parts, 316 SS Teflon and Viton. A Halar coating can be applied to the probe when applicable. Electronics: Housed in cast aluminum explosion proof enclosure.

Specifications subject to change without notice.

C. Ordering Information

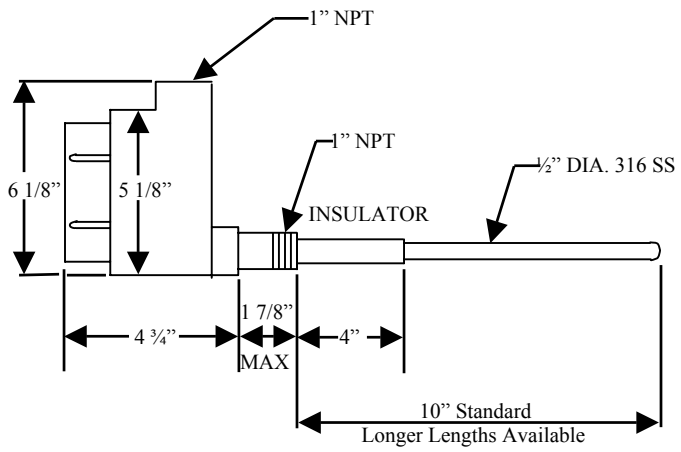


FIGURE 7.1

LS7000 – 115VAC – S – 10*

Model
Supply Voltage
"S" – 316 Stainless Steel Probe
"H" – Halar Coated Probe
Probe length in inches

*This describes an LS7000, powered by a 115 VAC, with a 316 SS probe, 10" long. The probe length is measured from the end of the nipple to the tip of the probe.

2. THEORY OF OPERATION

The LS7000 employs a radio frequency (RF) balanced impedance bridge circuit to detect if the probe is in contact with the material that is to be sensed.
When material is not in contact with the probe, the bridge is balanced by turning the adjustment pot to find the threshold where the red led goes out.
When material is in contact with the probe, the bridge becomes unbalanced and the comparing circuit realizes the change. This causes the relay to change state.

3. INSTALLATION

*CAUTION: ALL INSTALLATION AND WIRING MUST CONFORM TO NEC AND ALL OTHER LOCAL ELECTRICAL CODES. TAKE SPECIAL CARE IN OBSERVING HAZARDOUS AREA SAFETY PROCEDURES. WE ASSUME NO LIABILITY FOR IMPROPERLY INSTALLED OR WIRED UNITS.

A. Inspection and Operation

After unpacking the LS7000, visually inspect the unit for any damages. Please advise the factory or your local distributor of any damage. Before installing the unit, a simple operational check can be performed.

*THIS IS AN EXCELLENT TIME TO SET THE TIME DELAY IF IT IS TO BE USED IN YOUR APPLICATION. (See calibration instructions, section 4, A)

On the bench, hook up the appropriate power to L1 and L2. The operating voltage of the LS7000 is marked on the power supply board.
Hold the unit so that the probe is not touching any surface and press the test switch.
When the test switch is depressed, the red led should come on. This simulates product touching the probe. If a timing mode has been selected it will operate as if installed.

NOTE: The timing mode can be adjusted when checking the unit but the sensitivity adjustment **MUST BE MADE AFTER** the unit is installed where it will be used.

B. Physical Installation

1) The LS7000 is installed into the vessel wall using a 1" NPT connection.
   This can be either a threaded coupling or a tapped entry such as a flange.
2) The teflon insulator should always extend at least 2" through the vessel wall.
3) Always check for physical room around the location you have chosen to allow for installation. Allow 3.25" turning radius to screw the probe in and clearance above for the length of the probe.
4) **CAUTION:** Always take the necessary safety precautions when cutting or welding in the coupling for the LS7000.
   a) Tag and lock out the electrical power to the equipment that services the vessels.
   b) Check liquid or dry powders that create a gas in the vessel for oxygen as well as the explosion factor. (All dust will explode.)
   c) Vessels that are cross vented have to be isolated.
5) Screw the LS7000 into the connection provided. In dry material application, no sealant on threads is required. On liquid, teflon or a good pipe thread sealant may be used.
6) The LS7000 has a 1" NPT conduit entry. When wiring these units, conform to the National Electrical Code and any other city or company codes.
7) Always install the electrical connection into the 1" NPT on the LS7000 so water will not follow the connection routing into the threads of the 1" NPT hub. To guarantee that condensation and water will stay outside the unit, install an EYSM unilet before each LS7000 and fill with explosion proof sealing cement.
8) When required, the LS7000 probe can be bent to meet your special application. Remember to allow 2" of clearance between the probe and the vessel wall. If the probe is to be used in a pressure application, the factory must bend the probe to your specifications.
9) Location of probes on high level installations is more critical on dry material than liquids. Note the following:

a) For dry materials, mount the LS7000 in the top of the vessel whenever possible. (This allows you to lengthen the probe if necessary.)
b) Avoid mounting the LS7000 near the product inlet, vent return lines, dust collectors and vessel discharge openings on dry materials. Turbulence around these areas can cause erratic detection unless the probe is long enough. On old installations it might be wise to fill the vessel first to determine the length or location of the probe. CAUTION: Always take safety precautions before opening vessels for such inspection. We recommend a 36" top mounted high level probe in storage silos and a 24" in smaller vessels such as use bins.
c) On gravity filled vessels, take into consideration the angle of repose formed by the product.
d) On dry product that flows like water (starch), when using the LS7000 to stop the flow by means of a butterfly valve or knifegate, make sure the probe is long enough to allow time to close these slow moving valves.
e) In small vessels where a good location is hard to find, it may be necessary to put a baffle plate between the probe and the product inlet to keep product off of the probe as it fills. (A short time delay could also solve this problem.)

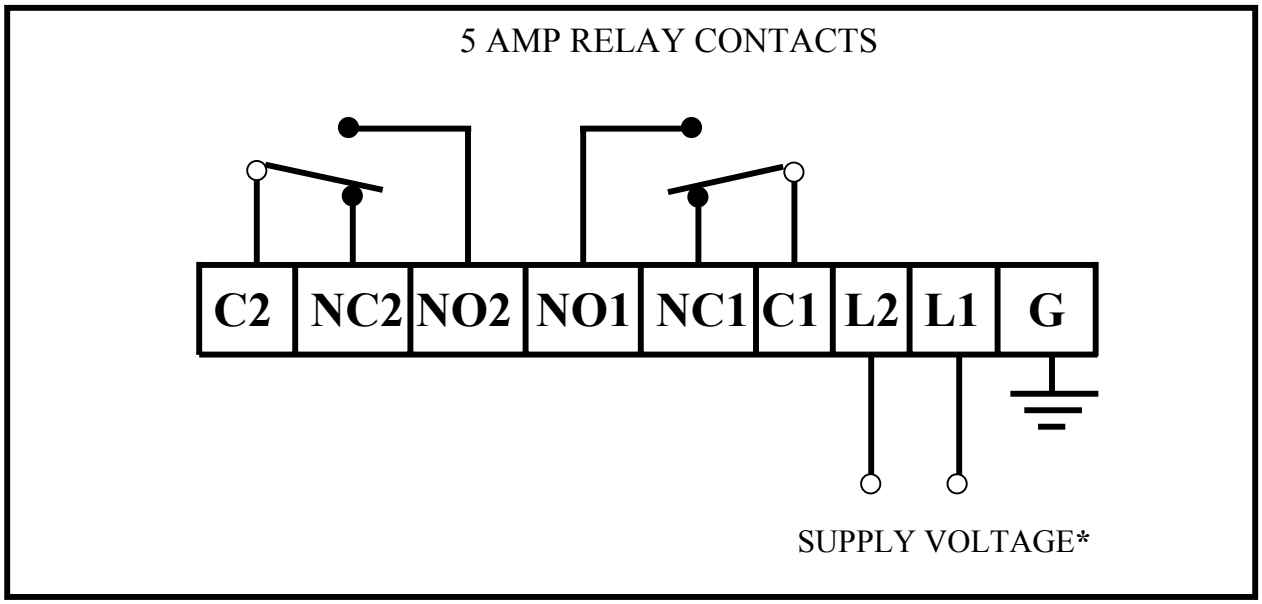
C. Removing the Electronics

1) To remove the sensing card, simply unplug it from the power supply card. When reinstalling, this card is made so that it cannot be plugged in backwards.
2) To remove the power supply card you must:
   a) Disconnect supply power at main power source.
   b) Remove sensing card.
   c) Disconnect wires from terminal strip.
   d) Remove green grounding screw.
   e) Unplug blue antenna lead.
   f) Hold the top of the card guide and lift out.
   To reinstall, reverse the above procedure.

D. Typical Applications and Wiring Diagrams

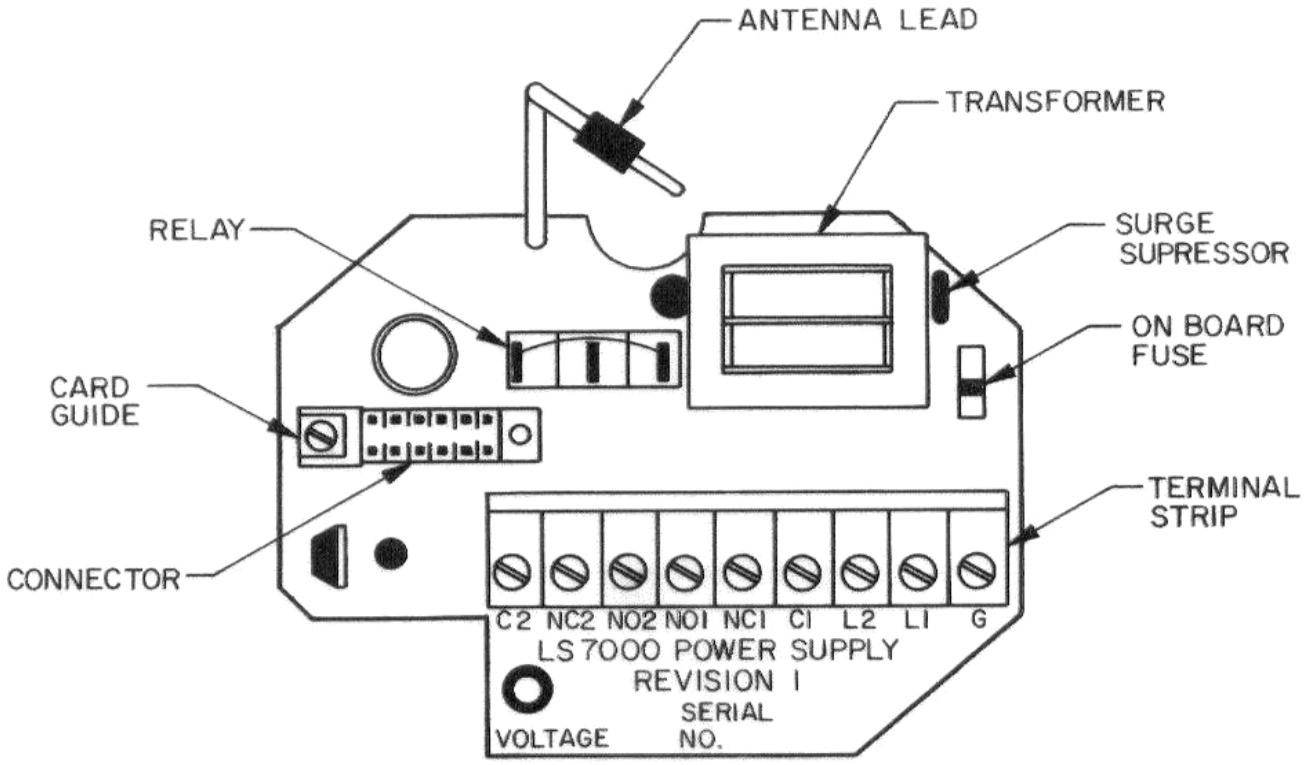
As follows:

LS7000 TERMINAL LAYOUT

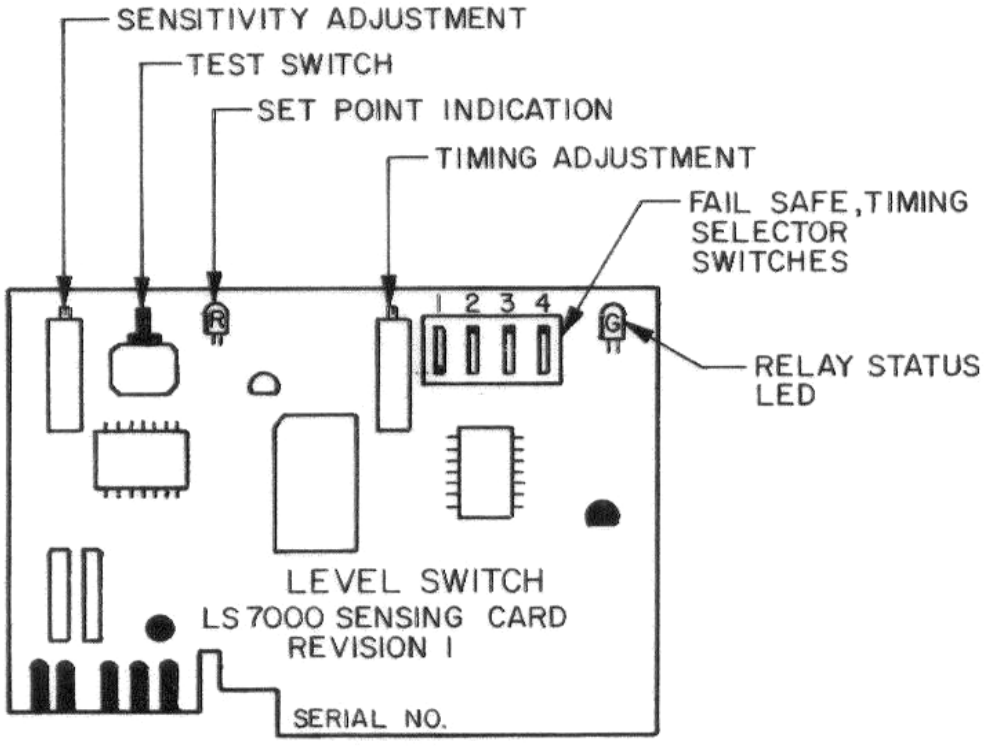


***NOTE:** EACH LS7000 POWER SUPPLY IS INTENDED FOR ONLY ONE SUPPLY VOLTAGE. THIS VOLTAGE IS PRINTED ON THE POWER SUPPLY BOARD. FOR 115 VAC OR 230 VAC UNITS, HOOK UP THE HOT LEAD TO L1 AND THE NEUTRAL TO L2, WITH APPROPRIATE GROUND. FOR 12 VDC OR 24 VDC UNITS, HOOK THE POSITIVE VOLTAGE TO L1 AND THE COMMON OR GROUND TO L2.

FIGURE **7.2**



POWER SUPPLY BOARD

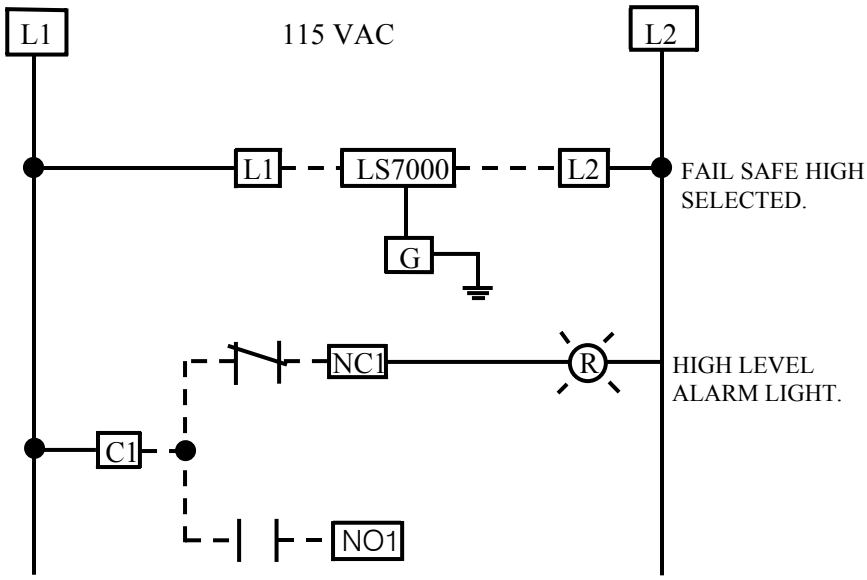


SENSING CARD

FIGURE 7.3

TYPICAL WIRING

APPLICATION
HIGH LEVEL ALARM



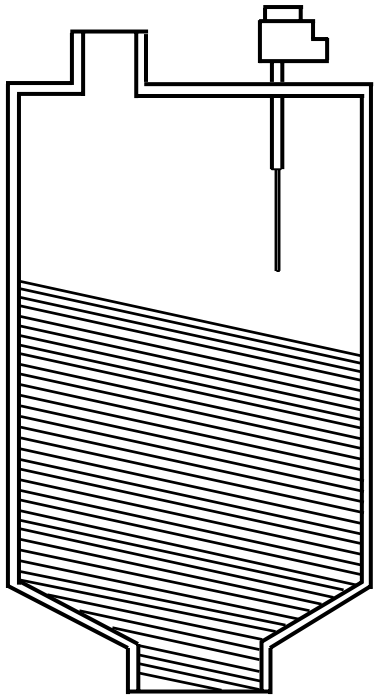
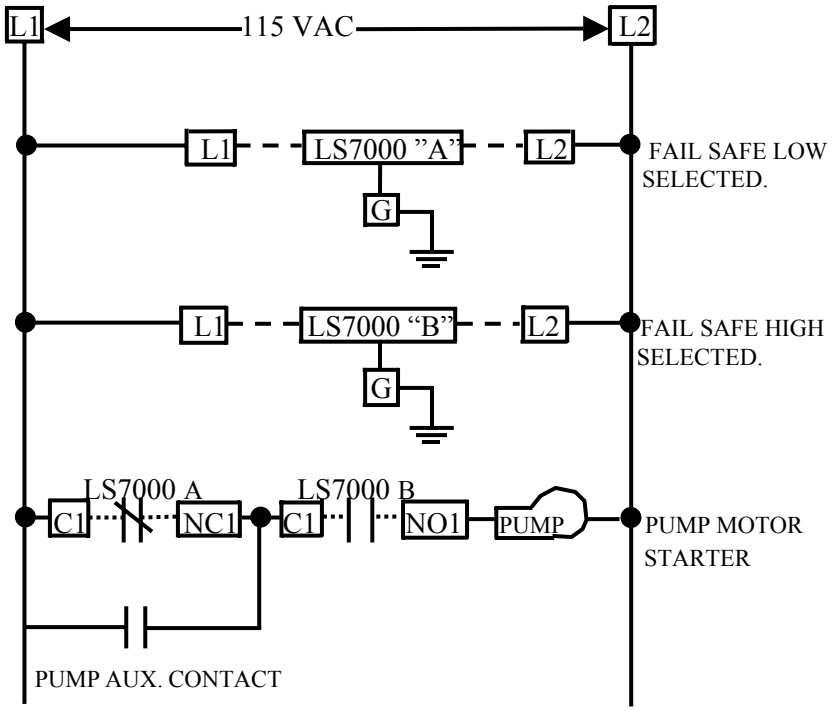


FIGURE 7.4

TYPICAL WIRING

APPLICATION



AUTOMATIC FILLING OF TANK.
(WHEN LEVEL FALLS TO POINT "A",
A PUMP COMES ON TO FILL TO
POINT "B", THEN TURNS OFF.)

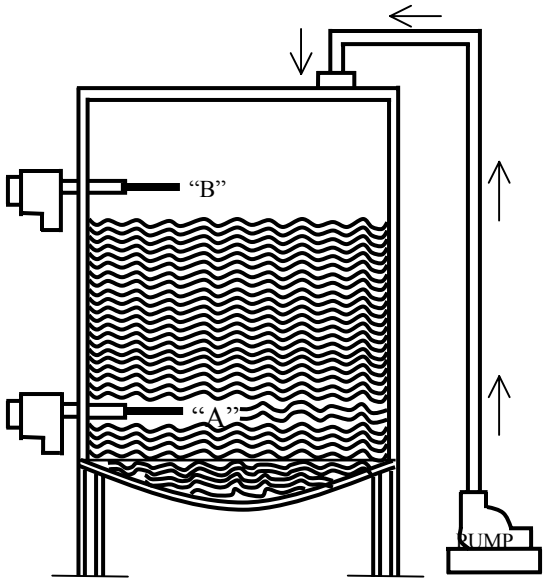
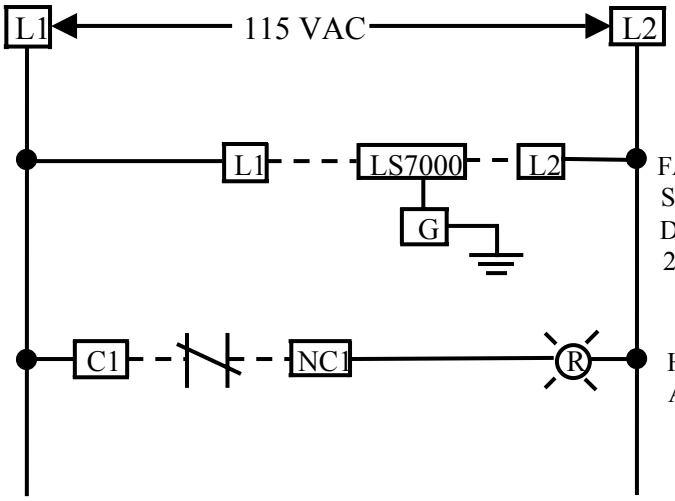


FIGURE 7.5

TYPICAL WIRING



WHEN THE FLUID REACHES POINT "A", IT MUST REMAIN THERE FOR 2 SECONDS BEFORE THE INDICATOR LAMP WILL COME ON.

NOTE: PLEASE REVIEW FAIL SAFE SELECTION INSTRUCTIONS, SECTION IV B.

APPLICATION

HIGH LEVEL ALARM USING THE TIME DELAY TO IGNORE SPLASHING OR WAVE ACTION. (TIME ON, INSTANT OFF)

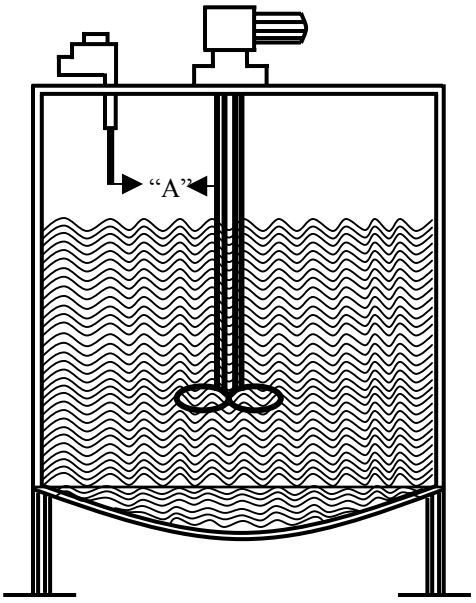
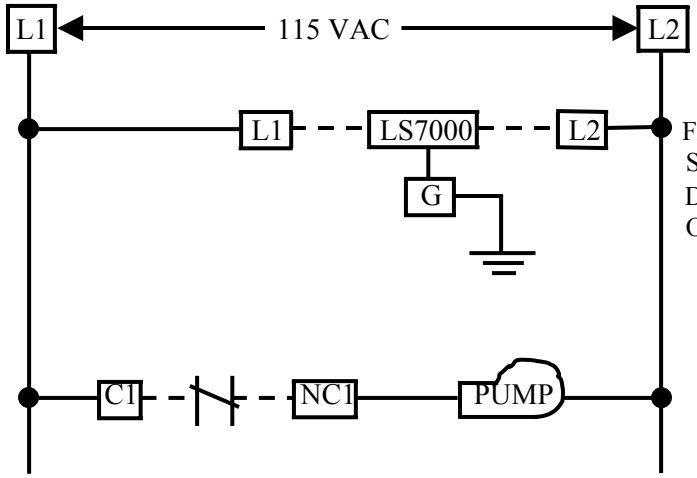


FIGURE 7.6

TYPICAL WIRING



WHEN THE WATER LEVEL REACHES POINT "A", THE PUMP WILL TURN ON AND CONTINUE TO RUN FOR 1 MINUTE AFTER THE WATER FALLS BELOW THE PROBE.

NOTE: PLEASE REVIEW FAIL SAFE SELECTION INSTRUCTIONS, SECTION IV B.

APPLICATION

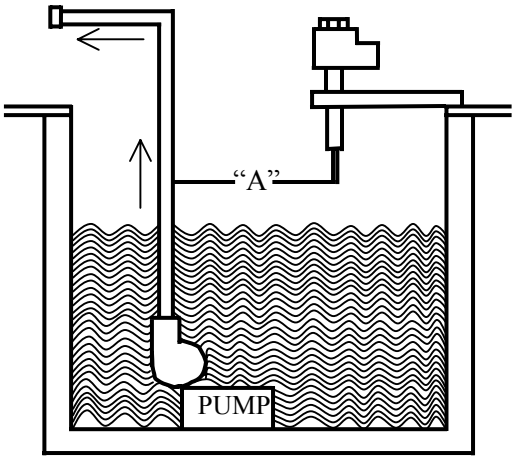


FIGURE 7.7

4. CALIBRATION

PLEASE READ THE ENTIRE CALIBRATION PROCEDURE BEFORE CALIBRATING THE LS7000.

If no time delay is required, turn the time adjustment pot completely CCW and set S1 down, S2 up. The potentiometer has 18 turns and freewheels at the end of its travel without damage. You may hear "clicks" at the end of travel.

A. Setting the Time Delay

1) Setting the timing mode, either on delay or off delay is done by positioning S3 and S4 as shown in the chart below.
   NOTE: S3 and S4 also select fail safe high level (FSH) or fail safe low level (FSL).
2) Select the timing range using S1 and S2 as shown on the chart below.
3) Adjust the time adjustment potentiometer clockwise to increase time or CW to decrease until the exact time delay is arrived at. The test switch may be depressed to start the timing when checking timing sequence.
   NOTE: For long timing ranges you can set the timer for a shorter range, then change the range Switches (S1 and S2) to increase the time. For example, the desired time delay is 15 minutes. This is equal to 900 seconds. By setting S1 down and S2 up and adjusting the timer to approximately 28 seconds, the ratio on this range is 1. To increase this range by 32, move S1 up and S2 up. 32x28 seconds equals approximately 15 minutes.

B. Fail Safe Selection

The fail safe feature provides a "false alarm" in case of power outage or major component failures. When properly selected, the fail safe feature can protect equipment or alert you of a unit failure.
Fail Safe High (FSH) means that the relay is energized when NO PRODUCT is touching the probe. The green led indicates relay status and is on when the relay is energized. When product comes into contact with the probe, the relay is de-energized.
Fail Safe Low (FSL) means that the relay is energized when PRODUCT IS touching the probe.
NOTE: Due to the wide variety of applications and possible control or alarm functions, the proper fail safe selection will depend on your circumstances. Please call your distributor or the factory if you need assistance.

TIMING RANGE

S1	*S2*	*TIME*	*RATIO*
DN	UP	1/8 sec - 35 sec	1
UP	DN	1/2 sec - 140 sec	4
UP	UP	4 sec - 18 min	32
DN	DN	32 sec - 2 hrs	260

FAILSAFE TIMER MODE

S3	*S4*		
UP	UP	ON	FSL
DN	UP	DELAY	FSH
DN	DN	OFF	FSL
UP	DN	DELAY	FSH

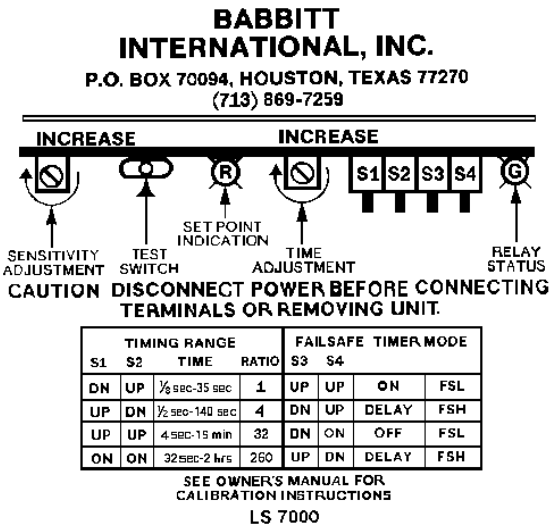
C. Sensitivity Calibration

The LS7000 should be calibrated when no material is touching the probe and when the unit is installed where it will be used.

1) Observe the red LED. If it is on, go to step 3.
2) If the red LED is off, turn the sensitivity adjustment potentiometer CW until it comes on.
3) Turn the sensitivity adjustment pot CCW until the red LED just goes out and continue to turn the pot CCW at least ½ of a turn. This sets the unit to its maximum stable sensitivity. If in your application this is too sensitive, you can turn the sensitivity adjustment pot further CCW. Always bring the product into contact with the probe after calibration to assure proper performance.

NOTE: The green LED indicates relay status. The relay is energized when the green LED is on.

Every LS7000 has a diagram inside the screw cover to serve as a reminder to those who have calibrated the unit before. This shows the calibration adjustments and indicators. This diagram is reproduced below.



TIMING RANGE				FAILSAFE TIMER MODE			
S1	S2	TIME	RATIO	S3	S4		
DN	UP	⅛ SEC-35 SEC	1	UP	UP	ON	FSL
UP	DN	½ SEC-140 SEC	4	DN	UP	DELAY	FSH
UP	UP	4 SEC-15 MIN	32	DN	ON	OFF	FSL
ON	ON	32 SEC-2 HRS	260	UP	DN	DELAY	FSH

SPECIAL CALIBRATION NOTES:

For some products, the LS7000 can be calibrated with product touching the probe. To do this, turn the sensitivity adjust pot CW until the red LED just comes on and continue CW for 1/8 to ¼ of a turn. Always check to see if the unit resets in the absence of product.

5. MAINTENANCE AND TROUBLESHOOTING

No routine maintenance is required other than keeping the interior of the unit clean and free of dirt, dust and other contaminants.

The LS7000 consists of three main sub-assemblies. These are the enclosure with the antenna probe, the power supply board and the sensing card. The following troubleshooting guide will assist in determining how to correct most of the problems which may occur in the field. Review the Installation and Calibration procedures in sections 3 and 4.

PROBLEM	POSSIBLE CAUSE	SOLUTION
RED LED cannot be adjusted to turn on.	Antenna lead not connected. No power to unit. Blown on-board fuse. Bad sensing card.	Plug antenna lead into probe. Check for correct power to unit. Replace fuse. Repair or replace card.
RED LED remains on at all times	Antenna probe is shorted to case or ground. Bad sensing card.	Unplug banana plug and position it so that the bare end is not touching anything. Turn calibration pot 20 turns CCW. LED should go out. If it does, repair, replace or clean antenna probe. If LED does not go out, replace electronics. Repair or replace card.
Unit triggers when material touches probe, but will not reset when material recedes from probe or unit and gives false alarm.	Improper mount of probe. Improper calibration procedure. Excessive material build-up on probe. Probe is mounted in flow of material.	Contact factory or dist. See section 4C. Perform "dirty probe calibration": Recalibrate with built up material on probe. See section 4C. Revise mounting or use time delay. See sec. 4A

Unit will not detect material.	Improper calibration. Antenna lead not plugged into probe. Unit was calibrated with material touching probe.	See calibration instructions, section 4. Plug antenna lead into probe. Be sure material is not touching probe and recalibrate.
Unit will not stay in calibration.	Poor grounding of unit to vessel.	Provide secure ground connection.
Relay operates properly, but no signal at terminals.	Burned or broken lands on the printed circuit board. Bad relay contacts.	Turn off power. Remove module from housing and inspect lands on printed circuit for damage. Replace if necessary. Replace relay or return for repair.

PLEASE CONTACT THE FACTORY OR YOUR DISTRIBUTOR IF YOU HAVE ANY QUESTIONS OR NEED ASSISTANCE.

6. WARRANTY

All components of the LS7000 are warranted to be free from defects in material and workmanship for a period of two years from the date of purchase . This warranty applies to general purchaser and to components installed, serviced and operated according to instructions.

Babbitt International, Inc. will repair or replace, at its option, FOB at its plant or any other location designated, any part which proves to be defective in manufacture or workmanship.

All claims must be made in writing within the warranty period. No claims outside of the warranty period will be honored.

Warranties are not applied to any components which have been damaged by improper installation, use, exposure to unusual atmospheric conditions or components which have been misused, abused, damaged by neglect or accident. This warranty shall not apply to any components which have been altered or repaired without the prior written consent of Babbitt International, Inc.

Babbitt International, Inc. assumes no responsibility or liability for any labor or material back charges, without written authorization. Any products returned must be with prior written authorization.

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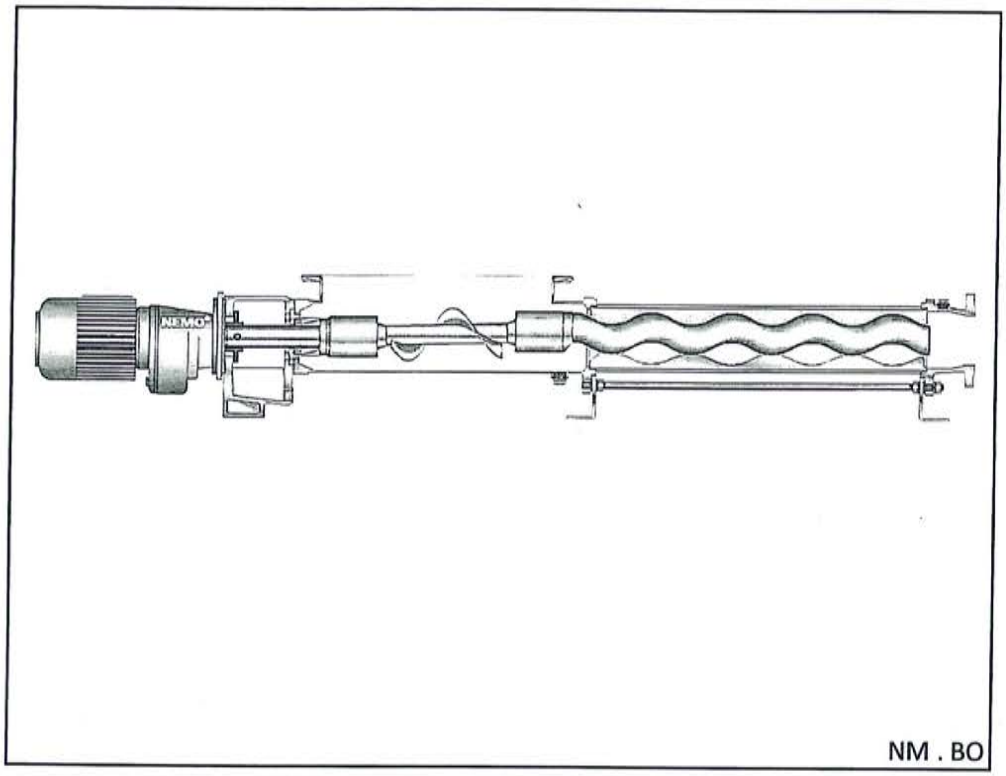
NETZSCH

TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
HOLDING TANK SCUM PUMP
NETZCH P/N: NM03BO02S12B

Operating and Maintenance Instructions



NEMO® Pump

Model Number
NM031

Sales Order/Job Number
MAC2011600115

Machine Number
USB 135192

Date of Issue
2015

Important Note
These operating instructions are designed to familiarize the user with the machine and its designated use.

The Instruction Manual

- Contains important information on how to operate the machine safely, properly and efficiently. Observing these instructions help to avoid danger to reduce repair costs and downtimes and to increase the reliability and life of the machine.

- Must always be available wherever the machine is in use.

- Must be read and applied by any person in charge of carrying out work with and on the machine. Such as:

Operation including setting up, troubleshooting in the course of work, evacuation of production waste, care and disposal of fuels and consumables.

Maintenance (servicing, inspection, and/or repair)

Transport; shall be completed by the end user and authorized personnel with the national requirements in force for the prevention of accidents and the environmental protection.

In addition to the operating instructions and to the mandatoryrules and regulations for accident prevention and environmental protection in the country and place of use of the machine, the generally recognized technical rules for safe and proper working must be observed.

NETZSCH Pumps North America, LLC
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610.363.8010 · Fax 610.363.0971
Email: npa@netzsch.com
www.netzsch.com

WARNING!!!!

When **Variable Frequency Drives (VFD's)**
are being used to vary the speed of the
NETZSCH Progressing Cavity Pumps, then they
MUST be CONSTANT TORQUE VFD's.

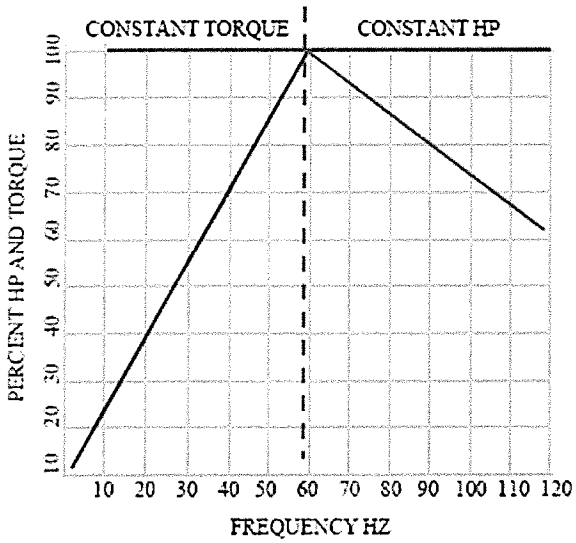
How the pump works

NETZSCH Progressing Cavity Pumps operate at a constant torque requirement for a specific operating pressure. The speed of the pump does NOT affect the torque requirement. **For example:** a pump running at 60psi output pressure at a speed of 200 revolutions per minute requires the same toque input as if it were running at 60psi output pressure at a speed of 600 revolutions per minute. The only exception to this rule is during pump startup; at the moment the pump starts the motor must provide more torque than the pump requires when it is running. This is due to the force of static friction that the motor must overcome in order to begin rotation. Although this is only a momentary force, enough torque has to be available to break the static load.

How the VFD works

Variable Frequency Drives work by taking the supplied power and modulating the supplied power frequency in linear proportion to the supplied voltage. This proportional modulation allows the motors speed to be altered without the motor drawing too many amps and burning out. A VFD can be built to perform this modulation in one of two ways. The VFD can be set to modulate the frequency above the normal supplied 60HZ frequency allowing the output to provide a constant amount of power but the torque will drop off as speed is increased **(THIS IS A CONSTANT HP VFD)** or it can modulate the frequency below the normal supplied 60HZ frequency allowing the output to provide constant Torque but the power will decrease as the speed is reduced **(THIS IS A CONSTANT TORQUE VFD).** This relationship is shown in the detail below. The manufacturers of VFD's typically offer two service factors. Normal Duty; which

has an overload capacity of the VFD's full load ampere rating times 110% - 120% for one minute and Heavy Duty; which has an overload capacity of the VFD's full load ampere rating times 150% for one minute. Typically, constant Hp VFD's are sold with a Normal duty rating since the applications don't call for high starting torque which causes amp draw to spike. Constant torque VFD's are usually sold with heavy duty ratings so that they can supply elevated startup amp draws for high starting torque applications.



VFD Speed Torque Characteristics

Blue = Horsepower
Red = Torque
Green = Motor Nameplate Frequency (60 Hz)

In Constant Torque Area - VFD supplies rated motor nameplate voltage and motor develops full horsepower at 60 hertz base frequency.

In Constant Horsepower Area - VFD delivers motor nameplate rated voltage from 60 Hertz to 120 hertz (or drive maximum). Motor horsepower is constant in this range but motor torque is reduced as frequency increases.
Note: Motor HP = Torque x RPM

Application:

Because while running a progressing cavity pump the torque value required by the pump is fixed; any reduction in supplied torque as a result of operational speed could cause the pump to fail. Also, depending on the running speed required, a constant HP VFD may not be capable of supplying the torque needed for pump startup. This is the reason a **Constant Torque** VFD **MUST** be used to operate a progressing cavity pump.

Brad LaValley / Dan Bachrach
NETZSCH Pumps North America, LLC
Exton, November 2011

	TABLE OF CONTENTS	PAGE 0.0

Remark: Because of data transfer the text sheet printouts of our operating instructions do not contain a personal signature.

1 SAFETY PRECAUTIONS

Always bear in mind your safety during operation, maintenance and installation of equipment. Please adhere to the EC-Directive for machinery including the national regulations and follow the US OSHA regulation #1910.219 & 1910.147 titled Mechanical Power transmission apparatus as well as the European Standard EN 292 with the accidents prevention rules laid down by the trade unions and other appropriate technical institutions.

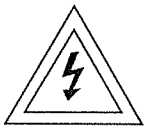
1 Safety Instructions

This manual contains basic instructions which must be observed when installing, operating and servicing the machine / equipment. It is essential therefore for the user / installer or responsible technician to read the manual thoroughly prior to installation and operation.
A copy of the manual must always be at hand where the machine / equipment is being used. In addition to the general safety instructions listed in this main section on safety, it is necessary to observe the special safety rules included in other sections of the manual, eg. for private use.

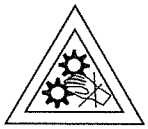
1.1 Safety Signs

The signs below are printed in the manual as general hazard / danger symbols to mark those safety instructions whose non-observance can result in danger to personnel or to the machine / equipment. These signs are:

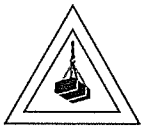
Hazard sign DIN 4844 - W9
Danger to general public



Hazard sign DIN 4844 - W8
Risk of electric shock



Risk of injury from machinery



Danger from suspended loads

Damage to machinery

Risk of injury to your eyes: goggles required.

Continued Page 1.0R

1 SAFETY PRECAUTIONS

Warning plates located directly on the pump/ equipment showing for example the correct direction of rotation or the fluid connections used must always be observed and kept completely legible.

1.2 Personnel Qualifications and Training

Operating, maintenance, inspection and installation staff must possess the correct qualifications for their work. Areas of responsibility, scope of authority and staff supervision must be exactly defined by the user. If personnel do not have the necessary knowledge they must receive due training and instruction. If necessary, the user of the machine / equipment can arrange for such training and instruction to be provided by the manufacturer / supplier. The user must also make sure that the content of the manual is fully understood by the staff concerned.

Responsibilites

All work on and operation of the pump/ equipment should be carried out by trained/ competent and qualified operators, tradesmen and / or engineers as appropriate.

Any person responsible for or in charge of

- **working with lifting gear** and ropes when moving a pump / equipment will have to be duly instructed prior to doing the transportation job;

- **mounting a drive** to a pump / equipment must be qualified / trained as an industrial mechanic / technician;

- **setting up installations into a plant** must be qualified / trained as an industrial mechanic/ technician and must be familiar with the design and functioning of the plant in which the pump / equipment is being installed;

- **doing work on starting up, operation and maintenance** must gain knowledge of the pump / equipment principle prior to performing such works and must study the safety instructions and the manual thoroughly;

- **doing repair works**, and prior to doing such works, must be trained and skilled in the job. He must have due knowledge of the pump/ equipments specific details set up in the repair instructions. Unskilled personnel must be trained and repair works checked.

1.3 Dangers arising from Non-Observance of the Safety Instructions

Non-observance of the safety instructions can result in danger to personnel as well as to the environment and the machine. Non-observance of the safety instructions can result in the loss of claims for compensation.

Non-observance of the safety instructions can have, for example, the following consequences:

- ▲ Failure of essential functions of the machine / equipment
- ▲ Failure of mandatory maintenance and servicing methods

Continued Page 1.1

- ▲ Danger to personnel from electricity, machinery and chemicals
- ▲ Danger to the environment from leakage of hazardous substances.

1.4 Safety Conscious Working

In addition to the safety instructions listed in the manual, it is essential to observe the national accident prevention directives currently in force and any of the users own internal regulations concerning work and safety.

1.5 Safety Instructions for the User / Operator

- ▲ If there is a risk of danger from any hot or cold machine component, the user must fit protective guards to prevent such components from being touched (according to Standard EN 563).
- ▲ Protective guards fitted to prevent contact with moving parts (eg. couplings) must be in position when the machine / equipment is in use.
- ▲ Leakages (eg. from a shaft seal) of hazardous materials (eg. explosive, toxic, hot material) must be discharged in such a way that neither personnel nor the environment are placed at risk. Legal directives must be observed.
- ▲ All possible danger from electricity must be eliminated (for details see eg. the regulations of your local power supply company).

1.6 Safety Instructions for Maintenance, Inspection and Installation

The user must ensure that all maintenance, inspection and installation work is carried out by authorized and qualified personnel who understand the operating instructions and are adequately trained.

Work on a pump / equipment must only be carried out with the machine stopped and electrical power supply turned off. The pump/ equipment must not be under any pressure and must have cooled off. All procedures detailed in these operating instructions on the stoppage of the machine must always be adhered to.

Pumps / equipment which convey harmful media must be decontaminated.

Immediately after the maintenance work is finished all safety devices and guards must be re-installed and the safety trips must be tested.

Before putting the machine back into operation the points detailed in section "Start-up" should be observed.

Continued Page 1.1R

1.7 Unauthorized Modifications and Manufacture of Spares

Modifications or changes to machines / equipment are only permissible with the manufacturer's agreement. Original spare parts and accessories authorized by the manufacturer ensure safety.
The use of other components revokes any liability for consequences which may result.

1.8 Improper Application

Delivered machinery / equipment is only guaranteed safe for the use specified.

This machine / equipment was designed in accordance with the prescribed conditions of use.
The limits of use are laid down in the conditions of use and should in no way be exceeded.

1.9 Specific Points for the Use of a NEMO® Pump

A NEMO® pump must be used for the **purpose only** for which it was sold.

If you change or wish to change the process medium, you must check with either the supplier or manufacturer that the pump is suitable for the new medium. This is especially important with aggressive, poisonous or otherwise hazardous substances.

Pump criteria include:

1. Compatibility with the medium
2. Suitability for seal design / material, especially the shaft seal
3. Resistance to pressure and temperature of the medium.

Please note that NEMO® pumps are progressing cavity pumps and as such can generate very high pressure.

A blockage or the chance closure of a valve in the discharge line can cause a pressure rise **manifold as high as can be tolerated by the installation**. This can result in the bursting of pipes, which must be avoided especially in the case of dangerous media.

Corresponding safety equipment must therefore be installed, for example an emergency stop button, a pressure relief valve with return pipe or a bursting disc.

During maintenance and repair work on the pump please note the following:

1. Ensure that the pump drive **can not** be turned on without authorization.
2. When opening the pump follow the instructions for handling the medium (eg. protective clothing, no smoking etc).
3. Before putting the pump back into operation ensure that all guards and other safety devices (eg. drive-belt protection, coupling protection) are properly re-installed.

Continued Page 1.2

Always bear in mind your safety during operation, maintenance and installation of equipment. Please adhere to the EC-Directive for Machinery including the national regulations and follow the European Standard EN 292 with the accident prevention rules laid down by the trade unions and other appropriate technical institutions.

Continued Page 1.2R

1.10 Notes on Inspection and Repair

The legal regulations for safety at work, such as regulations for the workplace, regulations governing dangerous materials, accident prevention, environmental protection eg. regulations on disposal and water balance obligate all commercial business to protect their employees and / or people and the environment from adverse effects caused by contact with dangerous materials.

Important:

Inspection / repair of machinery and its parts only takes place when a safety conformity certificate has been completed by an authorized and qualified specialist. Please use a copy and leave the original in the operation and maintenance manual.

Where special safety precautions are necessary in spite of careful emptying and cleaning of the machinery, the necessary information must be given.

Machinery operating with radio-active media will only be repaired or inspected by one of our specialist engineers under the safety of the owner.

The safety conformity certificate is part of the inspection / repair service. We reserve the right to refuse acceptance of this order / service for other reasons.

Continued Page 1.3

1.11 Instructions concerning explosion protection

The instructions below are to be considered and kept to when using pumps in potentially explosive areas in order to guarantee durable explosion protection of the pumps and avoid any danger of ignition.

In accordance with the regulations 94 / 9 / EC, the pumps are admitted for use in the area II 2G IIB T 4 or II 2G IIB T 3 (pls. see manufacturer's declaration or declaration of conformity).

It is to be taken into account that in case of aggregates the components (e.g. gears, couplings) mounted on the pumps must comply with the regulations 94 /9 / EC as well. The relevant documentation concerning these components is to be considered.
The application area of aggregates is determined by the application area of the mounted component with the lowest approval and thus may deviate from the allowed application area of the pump.

Temperature category	Max. temperature of the conveying product
T 4	100 °C
T 3	165 °C
T 2	265 °C
T 1	415 °C

The maximum conveying product temperatures apply when mechanical seals of Messrs. Burgmann with **carbide – carbide** and **carbide – carbon** as sliding material combinations are used.
In the case of other manufacturers or other sliding material combinations it is necessary to consult the manufacturer.

1. **Assembly and repair in potentially explosive areas**

   When performing assembly and repair work, it is to be seen to it that no dangers of ignition arise especially during heating up the pump parts. This means e.g. heating up by explosion-proof heating devices or exclusively in non-explosive areas. The temperature of the heated part and the ignition temperature of the materials by which the danger of explosion may be caused are to be considered.

2. **Dry-running protection**

   Under no circumstances is the pump to run dry.
   The pump is to be equipped with an appropriate dry-running protection device.

Continued Page 1.3R

The device for dry-running protection should be self-regulating.
This means that this device can give alarm signals and/or switch off the pump also in case of failures in its own control system.

Dry-running protection concerning stationary immersion pumps (with mounting plate)

Operation is only permitted with redundant or self-regulating automatic devices to guarantee dry-running protection as well as to control the pump capacity.

Dry-running protection concerning movable immersion pumps (drum pumps)

The filling with liquid during the operation is to be ensured by specific requirements of behavior:

- Drum pumps may only be introduced in and removed from the container in switched-off condition
- Drum pumps, after being introduced in the container to be discharged, may only be started after they have immerged in the fluid.
- Drum pumps are to be switched off before they run dry or are to be switched off at once when specific noises ("slurping" or speed rise) suggest that dry running may or will immediately occur.

3. **Overpressure protection**

The pump must not be loaded over the maximum allowable pressure.
The pump is to be equipped with an appropriate overpressure protection device. The pump must not convey against a closed slide valve.
The overpressure protection device should be self-regulating.

4. **Drives**

The drives must be adjusted to the performance of each pump.
In the case of a blocking of the pump, the drives must be turned off automatically by means of a motor protection unit.

5. **Alignment of the drive (concerning the pump types SY / SH / SA / SO / SF / SP)**

It is absolutely necessary that the drive be aligned within the maximum allowable tolerances. Incorrect alignment causes damage to the seals and the shaft bearings.

6. **Potential equalization concerning immersion pumps**

The immersion pumps are to be integrated in the potential equalization of the installation. Hand-operated movable immersion pumps are to be grounded before being introduced in the container.

Continued Page 1.4

The connection to ground is to be maintained until the pump has been completely pulled out of the container.
There must not be any potential difference between the pump and a conductive container. This means that container and pump are to be connected at a common grounding point and thus be conductively connected with each other.
(see information brochure "Statische Elektrizität, Zündgefahren und Schutzmaßnahmen" (Static electricity, dangers of ignition and preventive measures); Publisher: "Internationale Sektion für die Verhütung von Arbeitsunfällen und Berufskrankheiten in der chemischen Industrie der IVSS" (International section for the prevention of employment accidents and occupational diseases in the chemical industry of the ISSA (International Social Security Association)) , Heidelberg 1995).
The hand-operated movable immersion pumps are to be provided with an indication referring to the grounding measure (pay attention to grounding).

7. **Potential equalization concerning all other pump types (no immersion pumps)**

   All conductive parts of the pump are to be integrated in the potential equalization of the pumping set unless the conductive connection to the ground potential is guaranteed by the drive or connecting shafts or otherwise.

8. **Stator**

   The stator is to be regularly checked for wear. When the allowable wear limit is reached, the stator is to be replaced. Before exchanging the conveying product, the pump operator has to consult the manufacturer concerning the durability of the stator unless the stator has already been confirmed for the intended application.

   Inspection and maintenance interval of the stator:
   - **in the case of an operating time of > 16 h/day, at least twice a year**
   - **in the case of an operating time of < 16 h/day, at least once a year.**

9. **Joints / joint lubrication**

   The sealing and the lubrication of the joints are to be regularly checked. If necessary, the seals and the lubricants are to be replaced.

   Inspection and maintenance interval of the joints:
   - **in the case of an operating time of > 16 h/day, at least twice a year**
   - **in the case of an operating time of < 16 h/day, at least once a year.**

10. **Inspection after initial startup**

    The aspects relevant for ensuring the explosion protection (such as lubrication and wear check) are to be checked six months after the initial startup of the pump at the latest.

Continued Page 1.4R

11. **Shaft bearings**
(concerning the pump types SY / SH / SA / SO / SF / SP)

Replacement of the bearings after 14,500 operating hours (according to prEN 13463-5: replacement after 90 % of the designated service life).

12. **Materials**

Although being allowed as material for the pumps, aluminum should be avoided in potentially explosive areas.
The pumps may only be used if, under the particular operating conditions, the materials are resistant to mechanical and/or chemical influences or corrosion such that the explosion protection will be maintained.

13. **Noise development**
(concerning the pump types SO / BO / SF / BF / SP / BP)

As soon as unusual noises (such as knocking or rubbing) are realized, the pump is to be switched off. The cause of the failure is to be eliminated before the pump is reoperated.
Regular check of the paddle equipment.

14. **Direction of flow of immersion pumps**

The direction of flow of immersion pumps always has to be from the end connection piece to the pressure nozzle at the top. The reverse direction of flow is not allowed.

15. **Mechanical seal of immersion pumps**

Before the initial startup and after a prolonged shutdown, the mechanical seal is to be lubricated from outside before the pump is started. In this connection, the compatibility of the lubricant with the sealing material is to be considered.

16. **Impurities in immersion pumps**

Especially in the case of hand-operated movable immersion pumps it is to be seen to it that no impurities can get into the pump. The pumps are to be deposited only on clean and solid ground or else to be suspended. In case of unusual noises or power losses, the immersion pumps are to be switched off immediately.

17. **Gland**

If a gland packing is applied it has to be observed that the permitted temperature corresponding to the temperature category is not exceeded. Recommendation: fasten the screws of the stuffing box gland only with low torque (approx. 5 Nm).

Continued Page 1.5

Safety Conformity Certificate

The machinery and its accessories together with this safety conformity certificate relating to repair / inspection services given to the undersigned by ourselves

Machine Type .....
Number .....
Delivery Date ..... Delivery Note No. .....

was carefully emptied and cleaned both inside and out in preparation for shipment
☐ yes
☐ no

Special safety precautions with regard to health or media endangered by water are to be implemented
☐ necessary
☐ unnecessary

The machinery is set up to transport materials dangerous to health or water and came in contact with media containing harmful substances
☐ yes
☐ no

The following safety precautions are necessary with regard to irrigation media, overflow liquid and waste management:

.....

.....

We confirm that the above mentioned details are correct and complete and that despatch will follow in accordance with the legal requirements:

Company ..... Telephone .....
..... Fax .....
..... Telex .....

Address

.....

.....

Name ..... Position .....

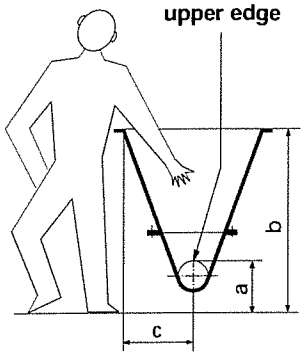
....
Date Company Stamp / Signature

Safety for the Use of Openthroat

NEMO® Pumps with Screw

For safety reasons this type of pump must not be operated without
- inlet hopper (height 1 m minimum from place of installation)
or
- protective grille (please observe EN 294 !)

1. With inlet hopper (EN 294 table 1)



Distance **a** from ground to hazard point	Height **b** to hopper edge						
	2200	2000	1800	1600	1400	1200	1000
	Horizontal distance **c** from hazard point						
2400	100	100	100	100	100	100	100
2200	250	350	400	500	500	600	600
2000	-	350	500	600	700	900	1100
1800	-	-	600	900	900	1000	1100
1600	-	-	500	900	900	1000	1300
1400	-	-	100	800	900	1000	1300
1200	-	-	-	500	900	1000	1400
1000	-	-	-	300	900	1000	1400
800	-	-	-	-	600	900	1300
600	-	-	-	-	-	500	1200
400	-	-	-	-	-	300	1200
200	-	-	-	-	-	200	1100

2. With protective grille (EN 294 table 4)

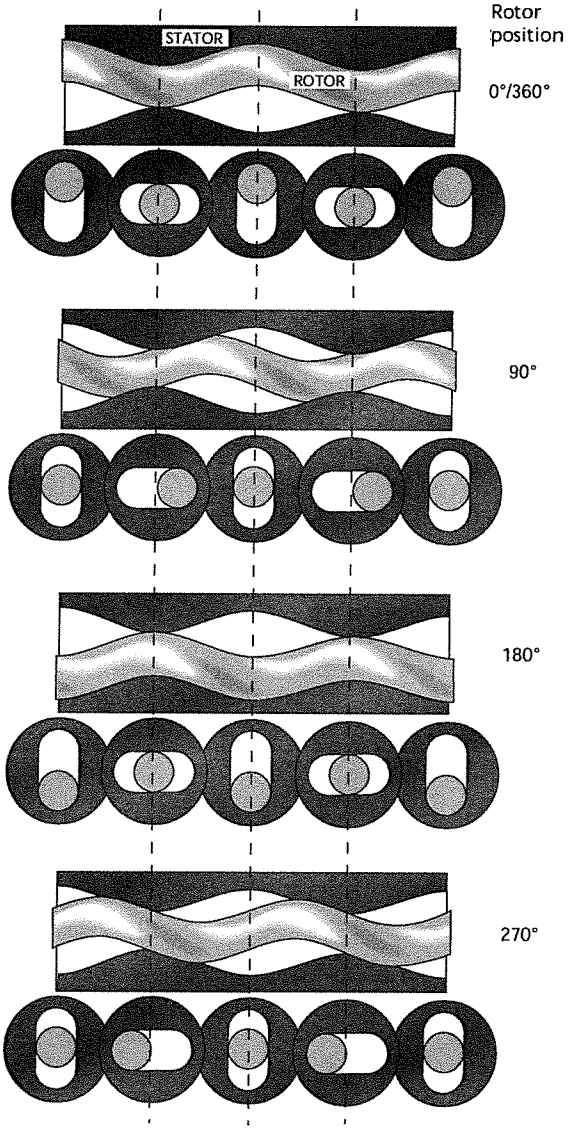
Distance to hazard point = Screw upper edge to grille	Maximum mesh size
≥ 120 mm	< 30 mm
≥ 200 mm	< 40 mm
≥ 850 mm	< 120 mm

2 Description

The NEMO® pump is a progressing cavity pump.
The main components which determine the system discovered by Professor René Moineau are a rotating part, called the rotor and a static part, called the stator.
The rotor is a helical screw with an extremely large pitch, large thread depth and small centre diameter with round cross-section for 1/2-geometry and elliptical cross-section for 2/3-geometry. The stator has a two start or resp. 3 start thread and is double or resp. 1.5 the pitch length of the rotor. This provides space for the medium between the rotor and stator. When the rotor turns round inside the stator the medium moves continuously from the inlet to the outlet.

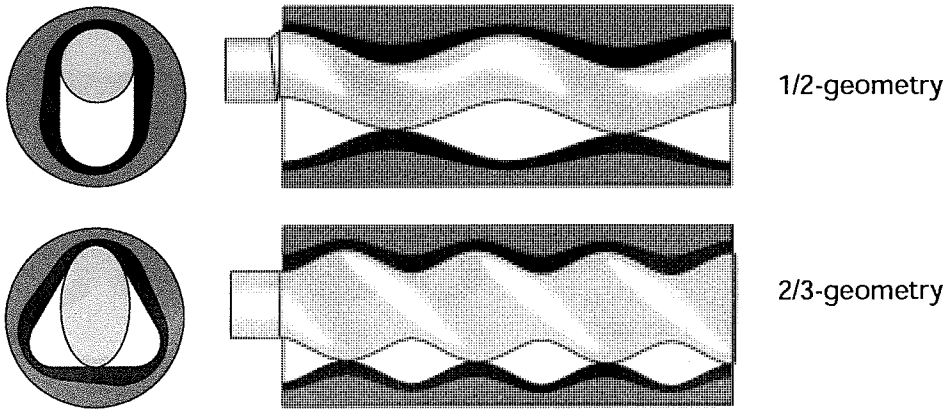
The universal NEMO® pump system unifies many positive characteristics of other pump types:

- Like centrifugal pumps NEMO® pumps have no suction or pressure valves, but do have a stable flow rate in proportion to the number of revolutions.
- Like piston pumps NEMO® pumps have a suction capability of up to 8.5 m vacuum metric.
- Like membrane and peristaltic pumps the NEMO® pump can transport every type of inhomogenous, gaseous and abrasive media, as well as those that are not of a liquid consistency or contain solids and/or fibrous material.
- Like gear pumps and screw pumps the NEMO® pump is capable of coping with high medium viscosities.
- Like piston, membrane, gear or screw pumps the NEMO® pump can perform dosing operations.



Length and cross-sections through the rotor and stator with 1/2-geometry during a rotation.

Continued Page 2.0R



Length and cross-sections through the stator with rotor
with reduced stator wall thickness

2.2 General Data

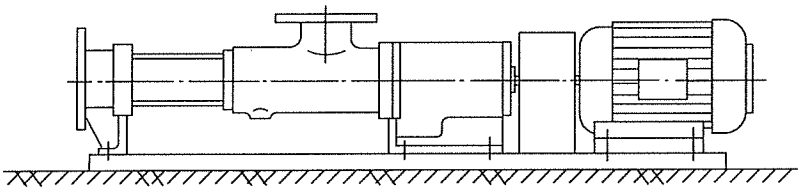
Noise emissions:

The maximum permitted noise emission level at a work place is 70 dB (A).

The noise level was measured in accordance with DIN Standard 45635-24-01-KL2 to assure that the pump does not exceed 70 dB (A).

Noises generated by the drive and pipes are not included in the above emission value.

A prerequisite for the noise emission level of ≤ 70 dB (A) is that the pump is operated in a cavity free regime and is bolted to a concrete base.



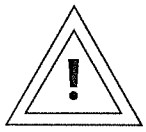
3 Packaging, Transportation, Storage

3.1 Packaging and Transportation

NEMO® pumps are shipped in railroad containers or crates unless the customer specifies otherwise.
The packings are labelled and symbols give the handling instructions in accordance with DIN 55402.
On receipt check for any transport damages.
Transport damages should be reported to the transporter immediately.
The pumps should be transported as closely as possible to the location of installation and only there should they be uncrated.

Uncrated horizontal pumps should be lifted by using a shackle which can be attached to the baseplate. The bolt holes of the frame or the lifting lugs attached to the baseplate could be used as shown on the installation drawing.

Vertical pumps should be lifted by using the bolt down holes, lifting lugs or shackles attached to the baseplate. This is shown on the installation drawing. For most applications, the drive is mounted on top of the pump.



Be careful when lifting top heavy pumps. The centre of gravity may be above the points where the lifting gear is attached to. If the case, secure additionally against tipping over!

Vertical pumps should not be deposited unless they are secured vertically. **Hazards of tipping**! Deposit only in horizontal position!

It is essential to avoid that the total pump unit be suspended with eye bolts of the motor or gear box. These eye bolts should be used for lifting the motor and/or the gear box **only.**

The Accident Prevention Rules, Section 18.4 relating to lifting accessories for the lifting of loads (VBG 9a) must be strictly adhered to.

Because of the variety of possible pump designs and applications, only general instructions can be given here. These should be good enough for experienced assemblymen or transportation experts.
When in doubt, please ask for detailed information on the pump unit concerned.

Continued Page 3.0R

When moving the pump or unit on **wheels** strictly attend to the following:

- Pad lock the motor drive and secure against unintended starting up.
- Move the pump unit carefully and slowly, especially where the ground is uneven. **Hazards of tipping!**
- Ensure a stable position of the pump or unit at the operating/storage place and secure it by actuating **all** clamping devices on **all** the wheels or rollers against voluntary moving away.
- Where fitted loosely, carefully watch the pipe bends when pumping. **Power of repulsion!**
- Where necessary, secure the pump unit additionally with support blocks.

3.2 Storage

The pumps are preserved for transport unless specified otherwise.
In cases of longer storage the pumps should be handled as follows until installation:

- **Stator:**

If the pump is not to be used immediately, then the elastomer along the contact line between rotor and stator may become permanently distorted (compression-set). This will increase the break away torque. Therefore, the stator should be removed and kept separately in a clean, cool and dry environment.
Standard DIN 7716 summarizes detailed information on the storage of rubber products, some of which is gathered here, and the following notice applies to a storage for a period of up to six months.

General

Most of the rubber products may change their physical properties under unfavourable conditions or if treated improperly, which will result in a shorter lifetime.
Or they may become useless through excessive hardening, aging, regenerating or permanent deformation, also because of blistering, cracking or other damages appearing on the surfaces.
The changes may occur under the influence of oxygen, ozone, heat, light, humidity, solvents or because of storing the products under tension.
If stored and treated properly, the rubber products will keep their properties, even over a long period of time (some years), almost unchanged.
This does, however, not apply to uncured rubber compounds.

Continued Page 3.1

Store room

The environment in which rubber products are being kept must be cool, dry, free of dust and rather airy, and they must not be stored in the open, not even in a weather sheltered space.
Rubber products should be kept in surroundings not having less than minus 10 °C and not more than plus 15 °C.
Store rooms should not be damp, and it must be ensured that there will be no condensation.
Most favourable is an environment offering a relative humidity under 65 %.
Rubber products must be protected against light, particularly direct sunlight or artificial light when having a high UV portion.
They should furthermore be kept away from ventilation, especially draught, by wrapping them up.
As ozone is very aggressive and harmful there should be no store room used which houses equipment likely to produce ozone, e.g. electric motors or other equipment which might bring about sparks or other electrical discharges.
There must be no solvents, oil, grease, lubricants or any chemicals kept in a store room.

- **Rotor**

  Please support with wooden blocks and cover up against harm from mechanical impact.
  For rotors of RCC (material number 1.2436):
  coat the surfaces with protective grease to avoid rusting.

- **Shaft Sealing by packing gland**

  Remove the gland and coat the exposed shaft surface with grease.

- **Pump parts in stainless steel**

  No grease coating necessary.

- **Other, non-coated pump parts**

  Protect with grease.

- **Drives**

  Please observe the drive supplier's instructions.

4 Mounting and Installation

If the NEMO® pump was stored and the rotor grease protected: Remove the grease before installing the stator.
Clean the rotor thoroughly in order to avoid unsuitability of the grease with the stator material and the pumping medium.

Screw the pump at all fixing points (bearing housing / drive stool, end stud, support feet) using all fixing bores securely down to the sub-structure (ground plate, machine frame, foundation etc.).

4.1 Direction of Rotation

The direction of rotation of the pump is given on the model plate and in the order confirmation.
For pumps with a feed screw the direction of delivery and rotation of the pump is defined by the screw. Viewed on pump shaft end rotation is anti-clockwise.

4.2 Pressure

If not explicitly confirmed otherwise in the order confirmation, the **maximum permissible pressure inside the funnel housing (A) is 1 bar.**

The maximum permissible pressures inside the end flange (B) is a function of the design applied for connections

- with flange: maximum nominal pressure (e.g. PN 16)
- with threaded internal socket: maximum 25 bar
- with DIN 11851 "dairy" thread up to DN 100 for one or two stage pumps: max. 12 bar, for multi stage pumps: max. 25 bar
- for other versions: maximum permissible pressure of the socket connection, but not more than 6 bar per pump stage, depending on the stator installed.

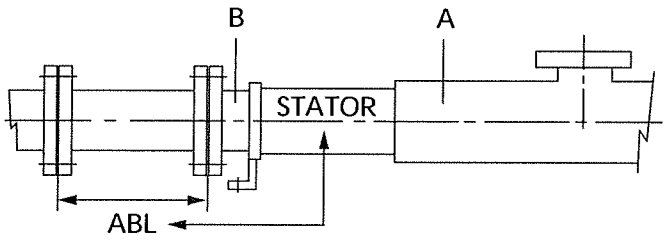
4.3 Piping System

- Arrange suction and pressure pipes so that when the pump is not running, the medium is still present after the pump.
  Sufficient liquid should also remain in the funnel housing in order to lubricate the pump during restart.
  If necessary fill fluid medium into the funnel housing.

Continued Page 4.0R

4 INSTALLATION INSTRUCTIONS

- The installation of a removable distance piece between the end flange (B) and the pipe work is recommended in order to make the dismantling of the stator easy. The distance piece (see sketch) needs to have a minimum "ABL" disassembly length the values of which are shown in the table below, depending on the pump size and the number of stages.



Disassembly length ABL in mm:

Pump size	Number of stages			
	1 *)	2	3	4
0 1 5	90	160	230	310
0 2 1	130	230	340	450
0 3 1	170	310	450	590
0 3 8	230	430	630	830
0 4 5	270	500	730	960
0 5 3	320	600	880	1170
0 6 3	370	690	1010	1330
0 7 6	420	800	1170	1540
0 9 0	500	950	1390	-
1 0 5	630	1180	-	-

*) for one stage pumps with L or P geometry the ABL values of 2 stage pumps are valid

Continued Page 4.1

Type key

Example: **NM 090 BO 02 S 12 B**

Internal
Pump size
Type
Model
Number of stages
Geometry
max. permissible pressure difference
anti-clockwise
Joint

The disassembly length "ABL" is also shown in the arrangement drawings in accordance with our Standard QSH V - TB 01 - 002.

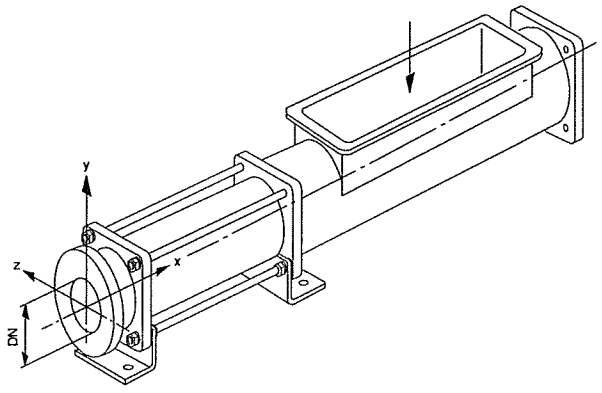
- Clean the pipe work and rinse thoroughly before installing the pump.
- Connect the pipe work ensuring that no external stress attacks the pump body.

  The installation of compensators between the pump and the pipework and eventually between funnel and funnel housing is recommended:

  - No risk of damage to the pump housing from pipelines "resting" on the pump.
  - No risk of damage to the pump housing through vibrating pipelines.

Allowed flange loads and vertical additional load

allowed vertical additional load on the funnel housing (pls. see table)



Continued Page 4.1R

4 INSTALLATION INSTRUCTIONS

- The allowed load, e. g. by a funnel on the funnel housing may be taken from the following table.

Pump type	allowed vertical additional load on the funnel housing [N]
015 / 21	2000
031	3000
038	3000
045	5000
053	6000
063	7000
076	8000
090	9000
105	10 000

- It is important that **no static redundancy** of the system will occur, which may result in undefined stress and forces in the complete aggregate. Then ruptures, e.g. at the housing, will result.

- The twisting loads (F_x, F_y, F_z) and bending loads (M_x, M_y, M_z) permitted to be put on the suction/discharge flange comply with the requirements of API 676 and exceed the requirements of EN ISO 14847. They are shown in the table below.

Pump type NM	**Standard nominal diameter DN**	**F_x, F_y, F_z N**	**M_x, M_y, M_z Nm**	
015 021	(32) G 1¼"	425	(215)	Screwed joints must not be charged with loads which may result in tightening or loosening these joints
31	50	680	350	
38	65	850	435	
45 53	80	1020	520	
63	100	1360	695	
76	125	1700	865	
90 105	150	2040	1040	

Continued Page 4.2

4.4 Shaft Sealing

- Where applicable, ensure that adequate supply lines for the buffer, flushing or quenching fluid for the shaft seals are connected **before** the pump is put into **operation**.
  For more details see Section 7.4!

4.5 Electrical Connection

All work relating to electricity shall only be made by **authorized and qualified personnel** and it should be in compliance with the requirements of the relevant national regulations!

In particular for control systems should the latest version of the **EC-Directive for Machinery 98/37/EEC, Annex I, Section 1.2 Controls** be carefully observed!

Note for frequency converter operation:
It is absolutely necessary to connect the PTC-resistors of the drive in case of frequency converter operation to protect the drive against overheating.

5 Start-up

The NEMO® pump design requires strict attention to the following:

Never run the NEMO® pump dry!
A few rotations in dry condition
will damage the stator!

- Before starting up for the first time, fill the pump with medium.
  In the case of high viscosity media fill with a liquid.
  Pump priming is vital to ensure lubrication of the rubber stator.
  Fill the piping on the pump suction side.
  In anti-clockwise rotation only: Fill the pump housing.

The NEMO® pump is a progressing cavity pump which can produce pressures that may cause the bursting of vessels or pipes.

The power transmission train (shaft, coupling rod, joints, rotor) of the pump may be overloaded thus resulting in damage or breakage.

Also the pump housing parts with their connections may be overloaded and break. There is a table in Section 4 of these Maintenance and Operating Instructions showing the pressure resistance of the pump housing parts.

Never run the pump against a closed inlet or outlet valve!

- **Open valves and vents before starting the pump!**
- **Check the direction of rotation by briefly switching on the pump motor.**

NEMO® pumps supplied for Food duties

When a pump has been supplied for a food application it is important to ensure that the pump is clean prior to initial pump operation.
The cleaning of the pump, before use on food, can be executed in two ways:

A) by dismantling the pump components and manual cleaning of these parts using suitable detergents. No dirt contamination must enter anew during re-assembly.

B) By applying a C.I.P. (**C**leaning **I**n **P**lace) procedure provided the type and execution of the pump suit such a procedure.

Continued Page 5.0R

5 START-UP

A clean in place treatment on the pump should be executed at the following times:

- When the pump is first commissioned for use
- When any spare components are fitted into the wetted area of the pump
- After operations, i.e. before a fairly long idleness of the pump
- After longer idleness, before re-operation.

Many companies have their own C.I.P. procedures which suit to their pumping media, but if you are unsure that your C.I.P. procedure is suitable for the pump supplied then please contact the pump manufacturer.

A recommended C.I.P. procedure is as follows:

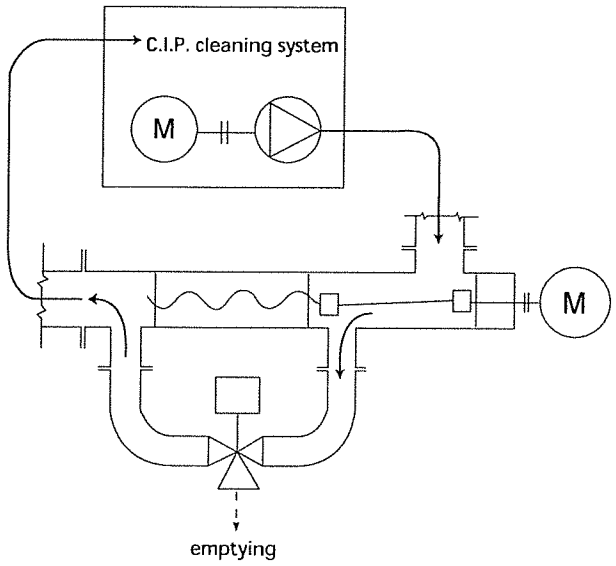
- Towns water pre-rinse to get out product left over inside the pump
- 1-2 % water/volume Sodium Hydroxide for 10-20 minutes at 60-80 °C
- Towns water for 5-10 mins
- 1-1.5 % water/volume Nitric Acid for 5-10 mins at 50-70 °C
- Towns water for 5-10 mins.

The flow rate of the rinsing liquids should not be lower than 1.5 m/s during C.I.P. procedure.
From this requirement follows that a NEMO pump is not suitable as the active pump in a C.I.P. procedure. As a typically slowly running and carefully delivering pump it is not able to reach the necessary high flow rates for the cleaning process.
The C.I.P. procedure must therefore be done by an external cleaning pump with an adequate high flow rate (pls. see figure on next page).

Typical for NEMO pumps integrated in C.I.P. capable plants are the additional cleaning flanges directly before and after the stator. These additional cleaning flanges are connected by a bypass pipe, leading the large flow of cleaning fluid during the C.I.P. cleaning procedure along the delivery elements, the rotor and stator.
Favourably these cleaning flanges are located at the deepest points so that also a complete emptying of the pipes before and after the pump may be done there.
This should be taken into consideration when planning the plant.

Continued Page 5.1

When under C.I.P. treatment, the stator as well as the joints lubricated by medium have to undergo thermal and chemical stress. It is therefore important to ensure that the NEMO® pump is operating in STOP AND GO function during C.I.P. treatment which is **two to three starts with one to two rotations in the course of one minute.** This will provide sufficient cleaning of the rotor/stator conveying cavities and it also reduces the mechanical stress additionally put on the stator through deformation work.



SIP (Sterilization In Place)

The SIP-Cleaning procedure is basically similar to the CIP-cleaning.
The difference is an additional sterilization with steam at a temperature of approximately 130 °C for about 10 – 20 min. During sterilization with steam the thermal stress for the stator is much higher than at the C.I.P. procedure. For this reason the NEMO® -Pump should exclusively run in "STOP AND GO"-operation during the whole process of sterilization.
This guarantees that the whole rotor and stator area will be admitted with steam and while the flexing work will decrease the additional mechanical stress of the stator. We recommend two or three starts per minute each consisting of one or two revolutions.
Please consider the increased starting torques when choosing the size for the drive and control.

DETERMINING WHEN TO LOCKOUT

Having performed a hazard analysis on your company's equipment, you can now determine when machines must be locked out – i.e., when employees are exposed to injury from each (or any) of a machine's hazardous energy sources during servicing or maintenance activities. To do this, use your Hazard Analysis Checklist and the "Four Key Questions for Lockout Implementation."

OSHA Requirements

OSHA rules state that equipment must be locked out during equipment servicing and maintenance whenever employees are exposed to injury from unintentional machine movement or startup. According to OSHA's regulations, servicing or maintenance procedures that require lockout include:

"Workplace activities such as construction, installing, setting up, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning, or un-jamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy."

In addition, lockout is required during any machine service or maintenance that requires an employee to:

- Remove or bypass a safety device; or
- Place any part of his or her body into a point of operation or similar danger zone during a machine's operating cycle.

Routine, Repetitive Activities

Routing and repetitive servicing procedures that take place during normal production operations, such as minor tool changes and adjustments, do not require lockout tagout, as long as the work is performed using "alternative measures which provide effective protection." These "alternative measures" include safeguarding methods approved by OSHA and ANSI (American Standards Institute) to protect operators, such as:

- Presence sensing devices
- Interlocking barrier guards

Remember, the factor that determines whether these or any other safeguarding methods eliminate the need for lockout tagout during routine, repetitive activities is whether the employee is protected from injury.

If lockout is not required, you MUST have clearly written procedure that describe the alternative safeguarding measures used and the tasks that may be performed. Refer to OSHA and ANSI standards for approved safeguarding methods.

6 Temporary Shutdown

- After stopping the pump empty and if necessary rinse it if

  - the medium might freeze due to the temperature surrounding the pump. Especially where there is a danger of frost if the pump is installed outside a building
  - the medium tends to solidify or harden
  - the medium tends to glue up the shaft seal.

- Stator:

  When stored for a long period, the elastomer along the contact line between the rotor and stator may become permanently distorted (compression-set).
  This will increase the break away torque. For this reason, the stator should be removed (please observe Section 9!), and stored in a cool, dry place in air tight package to give protection against light and air.

- Rotor:

  Remove **ceramic rotors** (please observe Section 10!) and store away, safe in the original packing.

  Support **other rotors** on wooden blocks and cover to protect them from mechanical damage, after the stator has been removed.

  Rotors made of RCC (material number 1.2436):
  Protect the rotor surfaces against corrosion with protective grease.

  Remove the grease before re-installing the stator and clean the rotor thoroughly in order to avoid unsuitability of the grease with the pumping medium or the stator material.

- Stand-by pump:

  A stand-by pump is sometimes used as a back-up for the main pump and, when standing idle for longer periods, should be operated from time to time. The pump may otherwise become seized when being started up. This is due to compression set i.e. distortion of the stator against the surface of the rotor.

7 Maintenance

7.1 Pumps in General

- The pumps should be regularly rinsed or cleaned if deposits of medium are likely to build up (sedimentation).

If the pump needs to be opened to do this, ensure that the pump and motor are switched off and cannot be turned on accidently (eg. by removing the fuse).

Periodical standstill to allow for cleaning during operation depends on the medium and type of operation.

- The pump can be cleaned:

  - through the cleaning ports provided in the pump housing

  - manually by dismantling the pump

  - automatically (CIP cleaning) for special housings with a flushing section (important instructions for CIP procedures are given in Section 5 (START UP).

7.2 Lubrication

The NEMO® pump does not require frequent lubrication.

- Maintenance of the drive should be carried out according to the drive manufacturers instructions.

- Maintenance
  - where no manufacturers instructions are available and
  - when normal conditions of use exist:

  - Strip down the drive unit
  - Remove the bearings
  - Clean all parts
  - Renew the lubricant

  every 5000 operating hours or at least every two years.

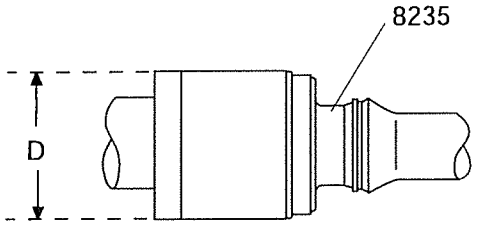
Special lubricants are often specified for mechanically controlled variable speed drives.
It is therefore important to follow the drive manufacturers maintenance instructions.

7.3 Lubricating the Pin Joints with SM-Pin Joint Seals

- It is advisable to change the oil and check the seals of the pin joints:
  - when renewing worn joint parts
  - when opening the pump for any reason.

The quantity of oil added per pin joint is a function of the joint external diameter D:

Joint external diameter D in mm (see sketch)	Joint basic size	Quantity of oil per joint in cm^3
28	NM 015	1,5
30	NM 021	2
40	NM 031	5
54	NM 038	15
65	NM 045	22
76	NM 053	36
83	NM 063	78
102	NM 076	165
125	NM 090	205
148	NM 105	450



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Burgmann
INDUSTRIES

OPERATING MANUAL

This document was drawn up observing the EC directives
"Machinery" 98/37/EG, EN ISO 12100-2 and the German Standard VDI 4500

In case of this mechanical seal is operated in **explosion area an appropriate additional operating manual,** following EC directives 94/9/EC (ATEX 95), has to be observed **by all means**! If required this could be ordered at BURGMANN.

BURGMANN MECHANICAL SEAL (M.S.)

CARTEX-QE/dw-E..

applies to all mechanical seals of the same series

These instructions are intended for the assembly, operating and control personnel and should be kept at hand on site.

PLEASE READ this manual carefully **and** OBSERVE **the information** contained as to:

- **Safety**
- **Start up**
- **Removal**
- Storage
- **Maintenance**
- **Repair**
- **Installation**

If there **are any unclear points please** contact BURGMANN by all means.

TABLE OF CONTENTS

■ KEYWORDS AND SYMBOLS

Following symbols for particularly important information are used:

"Attention, please pay special attention to these sections of text"

DANGER! Draws attention to a direct hazard that will lead to injury or death

WARNING! Draws attention to the risk that a hazard could lead to serious injury or death

CAUTION! Draws attention to a hazard or unsafe method of working that could lead to personal injury or damage to equipment

ATTENTION! Identifies a potentially dangerous situation. If it is not avoided the product or something in its vicinity could be damaged

IMPORTANT! Identifies tips for use and other particularly useful information.

■ GENERAL SAFETY NOTES

Any person being involved in assembly, disassembly, start up, operation and maintenance of the BURGMANN Mechanical Seal must have **read and understood** this Operating Manual and in particular the **safety notes**. We recommend the user to have this confirmed.

BURGMANN Mechanical Seals are manufactured on a **high quality level** (quality management EN ISO 9001: 2000) and they keep a **high working reliability.** Yet, if they are **not operated** within their **intended purpose** or handled **inexpertly** by untrained personnel **they may cause risks.**

The machine has to be put up in such a way that seal leakage can be led off and disposed properly and that any personal injury caused by spurting product in the event of a seal failure is avoided.

Any operation mode that affects the **operational safety** of the mechanical seal is **not permitted**.

Unauthorised modifications or alterations which affect the **operational safety** of the mechanical seal are **not permitted**.

BURGMANN mechanical seals must be operated, maintained or repaired by **authorised, trained and instructed personnel only.**

The responsibilities for the respective jobs to be done have to be determined clearly and **observed** in order to prevent unclear competencies from the point of **safety**.

Any work to be done on the mechanical seal is **only permitted** when the seal is **neither operating nor pressurised.**

Seals that have been used with **hazardous substances must be properly cleaned** so that there is no possible **danger** to personnel or to the environment.

Apart from the notes given in this manual the general **regulations for worker's protection and those for the prevention of accidents** have to be observed.

■ WORKERS PROTECTION

WARNING If the medium to be sealed and/or the barrier/buffer/quench liquid is subject to the Hazardous Substances Regulation (GefStoffV), the instructions for handling dangerous substances (safety data sheets to EU Directive 91/155/EEC) and the accident prevention regulations must be observed.

Medium and/or **supply medium may splash out if the seal fails**. Personal injury may be **prevented by the user** providing for splash protection and wearing safety goggles. Care has to be taken by the user for **proper disposal** of the leakage.

The **user** has to **check** what **effects a failure** of the mechanical seal might have and what **safety measures** have to be taken **to prevent personal injury** or damage to the environment.

■ TRANSPORT

If not specified differently by contract the BURGMANN standard **packing** is used which is suitable for dry transport by truck, train or plane. The warning signs and notes on the packing must be observed.

Notes for income inspection:
- Check packaging for visible damages.
- Open packaging carefully. Do not damage or lose parts supplied separately.
- Check if consignment is complete (delivery note). Inform the supplier immediately in writing if parts are damaged or missing.

Especially inboard side of the mechanical seal has to be protected from damage during transport and storage. The transport case in which the seal is supplied is well suited for this purpose and should be kept for a possible return transport.

■ STORAGE

BURGMANN mechanical seals are super finished and tested machine elements for which special conditions before and during the storage period have to be followed.

For the stock keeping of elastomers special conditions are required. For all rubber-elastic parts the rules of ISO 2230-1973 (E) are valid. For reasons of safety BURGMANN recommend to replace the stock in store after 3 years at the latest.

Sliding materials and elastomers are subject to material-specific and time-based alterations (distortion, ageing) which might reduce the full efficiency of the seals. Yet, this may be avoided by observing the storage instructions.

IMPORTANT! Store the **seal in the original packing** lying on a **flat surface.**

Conveniences for storing of mechanical seals
- dustfree
- moderately ventilated
- constantly tempered
  - relative air humidity below 65 %,
  - temperature between 15 °C and 25 °C.

Protect the seal from
- direct exposure to **heat** (sun, heating)
- **ultraviolet light** (arc welding, halogen or fluorescent lamps, sunlight)
- presence or development of **ozone** (arc welding, mercury vapour lamps, high-voltage devices, electric motors)

➢ **risk of embrittlement** of elastomeric materials

- Check the packaging periodically for damages.
- Plastic sheet packagings with humidity indicators have to be checked every 8 weeks. The check has to be recorded.

➢ Packings **exceeding 50 % rel. humidity** values have to be sent to the manufacturer or the **nearest service centre** for inspection and new packaging.

After a storage period of approx. 2 to 3 years of mechanical seals:
- **Check** for operational tightness by the user

In case of high leakage due to natural distortion:
- **refinishing of the** sliding faces in professional procedure at a BURGMANN-Service centre or a well equipped workshop at the user's.
- **replacing** of all elastomeric parts **for reasons of safety**

Damages caused by improper storage may **not** be claimed on the BURGMANN company with reference **to their warranty.**

These instructions apply to all BURGMANN mechanical seals which have been supplied and stored in their undamaged original packing , as well as to seals which have been installed in a component of a plant (e.g. pump, compressor, agitator etc.) but have not yet been put into operation.

A **preservation** of the BURGMANN mechanical seals is **not necessary.**
- **Do not use** any anticorrosives!

➢ **Risk** of **deposits** and possibly **chemical attack** of the elastomer secondary sealing elements.

Check in case of a **preservation of complete plants** with mechanical seals installed:
- the **compatibility** of the chosen preservation agent with the seal materials and with the elastomers
- **no impairment** of the seal's axial movability by conglutination or by gumming

■ PRODUCT INFORMATION

All technical information given is based on the results of extensive testing and on BURGMANN's long term practical experience. However, in view of the great diversity of possible applications the technical data can only be taken as being of approximate nature. We can only guarantee the safe and efficient functioning of mechanical seals in individual cases if we have been comprehensively informed of the operating conditions to which they will be subject, and if this has been confirmed in a separate agreement.

■ MANUFACTURER

Burgmann Industries GmbH & Co. KG
Äußere Sauerlacher Str. 6-10
82515 Wolfratshausen

Germany

■ DECLARATION

within the meaning of the EC-directive "MACHINERY" 98/37/EG

A mechanical seal does **not function independently**. It is intended to be incorporated into or assembled with machinery.

■ OPERATING LIMITS

ATTENTION! Limit values depending on the materials

Shaft diameter d_1 (d_w)	:	25 - 100 mm and 1" ... 4"
Operating pressure, max.	:	25 bar
Operating temperature	:	-40 ... +220 °C
Sliding speed, max.	:	16 m/s

Operation under **several limit values simultaneously should be avoided** as higher loads (pressure, temperature, speed) can increase wear or lead to **damage of sliding faces or elastomers**. This could result in a **shorter service life** and in the risk of a sudden **seal failure endangering men** and environment.

Selection of the mechanical seal (type, suitability, materials) should be done **by BURGMANN personnel** or any **authorised** office. BURGMANN **cannot be held liable** for wrong selection by unauthorised persons.

■ DESIGNATED USE

Operation under conditions lying **outside** those limits stated in paragraph **"operating limits" is considered contrary to its designated use.**

Should the seal be **operated under different conditions** or **at a different application** BURGMANN has to be asked for **recognition as safe in advance.**

➢ **Changes** of the operating conditions **have to be** recorded.

■ MATERIALS

The materials of the mechanical seal depend on the application and are fixed in the order.

■ DIMENSIONS

The available mounting space was decisive for the design of the housing parts. All connecting dimensions have to be checked by the customer with regard to the BURGMANN drawing.

■ DESCRIPTION

- **cartridge design** with shaft sleeve, cover, assembly fixtures
- **single seal**
- **balanced**
- **bi-directional**
- **rotating seat**
- **stationary seal face**
- **encapsulated multiple springs**
- **axial movability**
  d_1 < 75 mm ±1 mm / d_1 ≥ 75 mm ±1.5 mm
  d_1 ≤ 2.750 " ±0.039 / d_1 >2.750" ±0.059"
- **assembly fixtures for optimum adjustment at works**
- **torque transmission** to the shaft by means of cup-pointed set screws
- **rotary shaft seal at the atmosphere side**
- **cover with supply connections for flushing and quench**

■ SUPPLY OF M.S.

The medium to be sealed must circulate around the mechanical seal during all stages of operation.

For a safe operation of the mechanical seal we recommend to apply at inboard the **most suitable** type of circulation described in **API 610 / 682**. This protects the seal cavity from deposition of solids.

To ensure a safe operation of the mechanical seal a supply with quench fluid is required, either from an external source, as described in **API, plan 62** or from an extemal non pressurised fluid reservoir, as described in **plan 52**.

■ EMISSIONS

A mechanical seal is a dynamic seal that **cannot be free of leakage** due to physical and technical reasons. Seal design, manufacture tolerances, operating conditions, running quality of the machine, etc. mainly define the leakage value. In fact, compared to other sealing systems (e.g. packings) there is **few leakage**.

The leakage can be liquid or gascous. Its aggressiveness corresponds to that of the medium to be sealed.

ATTENTION! Due to the overpressure in the stuffing box the **medium** to be sealed may **penetrate** through the sealing gap of the inboard seal **into the buffer fluid** which will consequently be **contaminated**. For plan 52 BURGMANN recommend a regular **control** and **exchange** of the buffer fluid.

Leakage of the medium to be sealed into the inner seal cavity is flushed out by the quench fluid. There may be a very low leakage of the quench fluid at the lip seal.

IMPORTANT! Components which may get in contact with the leakage have to be corrosion-resistant or have to be adequately protected.

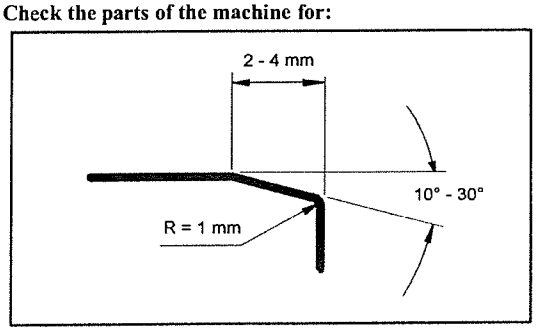
■ UTILITIES & TOOLS

- ethyl alcohol
- cellulose-tissue (no rag, no cloth!)
- suitable lubricant for elastomer-sealing rings: e.g. **"TURMOPOLGREASE SH 2 D"**, make Lubricant Consult (LUBCON)
  - ➢ Elastomers made of **EP-rubber must never** come into contact with lubricants on the base of **mineral oil** (swelling, decomposition).
- liquid screw retention, e.g. **"LOCTITE® No. 243"** , make LOCTITE Corporation
- set of hexagon keys (Allen keys)
- set of open end or ring spanners
- torque wrench

■ PRELIMINARIES

ATTENTION! To prevent **damage** to the seal, **do not remove it from its packaging** until all the work described below has been **completed**.

Check the parts of the machine for:



- **chamfered edges** (sliding cones i.e. 30° / 2 mm or in accordance with EN 12756)
- **radiused transitions**
- **mating fits** and o-ring surfaces: fine finished **Rz 10 µm** (= N7 = CLA 63)
- **shaft surface** in the area of the mech. seal finished: **Ra 0.8 µm** (=N6 = CLA 32).

Check at the machine:
- damage of connecting surfaces to the M.S.
- mating dimensions, rectangularity and concentricity to the shaft axis.

Run-out accuracy of the shaft (acc. to DIN ISO 5199):
- Shaft diameters up to 50 mm: max. 0.05 mm
- Shaft diameters 50 mm – 100 mm: max. 0.08 mm
- Shaft diameters exceeding 100 mm: max. 0.10 mm

- Lubricate the shaft slightly in the area of the seal with suitable grease.

➢ Elastomers made of **EP-rubber must never** come into contact with lubricants on the base of **mineral oil** (swelling, decomposition).

- Prepare the place of assembly, take away any not required tool, cuttings, dirty cleaning wool etc.

- Cover the work bench with clean, non-fibrous cardboard.

■ INSTALLATION

The mechanical seal is supplied as a precisely set cartridge unit, premounted at works, and does not require any adjustment during installation.

For installation the assembly drawing **CARTEX-QE/dw-E..** has to be on hand.

IMPORTANT! The mechanical seal has to be installed under the cleanest conditions and very carefully.

The order of assembly to install the mechanical seal into the machine depends on the design of the machine and should advisably be determined by the machine manufacturer.

ATTENTION! **Avoid unnecessary** rotation of the shaft (sliding faces damage possible).

ATTENTION! **Do never force** during installation.

Possible installation order:

- Make sure that all sealing elements are installed which contact the surrounding machine parts.

- Unpack the seal.

- Check, if the o-ring is installed in the shaft sleeve.

- Insert the sealing element (not BURGMANN's scope of supply) between cover and pump housing.

- Feed the complete seal cartridge onto the shaft.

ATTENTION! Avoid knocking the seal. Damage to mechanical seals has an adverse effect on their safe operation.

- Pay close attention to supply connections and make sure they are oriented as per the drawing.

- Bolt the pump housing to.
- Clamp the M.S. axially by means of the bearing housing to the pump housing

➢ Installation dimensions shown in the drawing **must be adhered to.**

- Crosswise tighten the **accessible** set screws firmly to the shaft.

➢ Degrease the set screws and secure with 1 drop each of liquid screw retention, e.g. LOCTITE® 243.

ATTENTION! Set screws with cup point must be used **only once**. Repeated fastening endangers the safety of force transmission.

- Remove the **colour-marked** assembly fixture.

- Turn the pump shaft **carefully** by hand and tighten the other set screws firmly to the shaft step by step.

➢ **Check** the prescribed torque with a **torque wrench.**

- Remove the **remaining** assembly fixtures.

- Keep the assembly fixtures by **all** means for a later removal of the seal.

- Further assembly of the machine in accordance with the instructions of the machine manufacturer.
- Remove protective plastic caps at the open connections of mechanical seal after installation.
- Close unused supply connections pressure-tight with threaded plugs.

■ SUPPLY CONNECTIONS

The supply connections are designed as threaded female connections according to DIN ISO 228, part 1.

➢ Use DIN ISO 228 connecting threads **only** with encased flat gaskets or with self-sealing pipe unions. Avoid sealing agents for threads (PTFE-tape, etc.) because they may endanger the safe function of the seal if they enter the sealing chamber.

Assignment of the connections:
- Circulation **"IN"** at connection » **FLUSH** « (close with head screw plug #14)
- Quench **"IN"** at connection » **QUENCH** «
- Quench **"OUT** at connection » **QUENCH** «

Supply piping:
- Use pipes of **stainless steel** with a **big cross-section.**
- **Clean** the piping **thoroughly** before connecting to the seal.
- Fasten all pipe connections **pressure-sealed**.

Additionally note for the supply fluid circuit:
- Install the pipes **continuously rising**, as **short** and as **convenient** as possible for the flow to ensure **self-venting**.
- **Avoid air inclusions** and provide for venting connections, if necessary.
- For **turns** use pipe bends
- For **shut off** use ball valves
- **Fasten** the pipes after approx. 2 m distance with elastic pipe clips
- Follow the **operating manual** of the supply system
- Close unused supply connections pressure-tight with threaded plugs.

■ PROCESS AGENTS

Supply fluid according to operating requirements.

➢ For supply fluid preferably such media should be used only which are compatible with the product medium and may leak out to atmosphere at outboard side of seal without risk for staff and environment.

■ SAFE OPERATION

The mechanical seal has to be constantly wetted **by the product in its liquid form**, in particular when the pump is started or stopped. The pump design has to be such as to take this necessity into consideration (e. g. heating of the product).

The temperature of the supply fluid **at the » OUTLET «** port of the mechanical seal must not exceed **60 °C**. The temperature has to be **adjusted by cooling** the supply fluid **inside the storage vessel.**

ATTENTION! Due to the overpressure in the stuffing box the **medium** to be sealed may **penetrate** through the sealing gap of the inboard seal **into the buffer fluid** which will consequently be **contaminated**. For plan 52 BURGMANN recommend a regular **control** and **exchange** of the buffer fluid.

If the operation limit values and the instructions given in this manual are observed a trouble-free operation of the mechanical seal can be expected.

■ TEST RUN

Safety checks before start up
- Seal assembly fixtures removed
- Torque transmission (set screws) between mechanical seal and shaft duly installed
- Supply connections tightened pressure-sealed
- Disposal connections installed environmentally safe

The mechanical seal must **never turn dry**. The seal cartridge **must** be filled with liquid to avoid the risk of a **dry-run** and consequently a **damage** of the sliding faces.

➢ When the shaft turns the filled-in liquid warms up due to frictional heat produced by the sliding faces. An unpermitted pressure increase due to this temperature rise **must** be avoided.

Damages due to dry-running are excluded from the warranty.

ATTENTION! Set screws with cup point must be used **only once**. Repeated fastening endangers the safety of force transmission.

Therefore:
- Replace set screws by new set screws.

■ START UP

Safety checks before start up
- Seal assembly fixtures removed
- Torque transmission (set screws) between mechanical seal and shaft duly installed
- Supply connections tightened pressure-sealed
- Disposal connections installed environmentally safe

For a safe operation of the mechanical seal we recommend to apply at inboard the **most suitable** type of circulation described in **API 610 / 682**. This protects the seal cavity from deposition of solids.

- Flood pump and seal area with medium.
- Thoroughly vent seal and circulation system.
- After a short start up period repeat the venting procedure several times with the pump being at standstill.

➢ For this purpose open head screw plug at seal cover.

ATTENTION! Connection is under the pressure of the medium to be sealed.

To ensure a safe operation of the mechanical seal a supply with quench fluid is required, either from an external source, as described in **API, plan 62** or from an external non pressurised fluid reservoir, as described in **plan 52.**

➢ Quench medium should **flow through** the mechanical seal.

▫ Now the seal is ready for operation.

■ MAINTENANCE

The correctly operated mechanical seal needs **low maintenance**. Wear parts, however, have to be replaced, if necessary.

A duly operation includes a regular check of the following parameters:

- Temperature of supply fluid (max. 60 °C at normal pressure)
- Quantity of supply fluid
- Leakage (drainage) rate of mechanical seal

An inspection of the mechanical seal should be carried out during a revision of the complete plant. We recommend to have this inspection be performed by authorised BURGMANN personnel.

■ TROUBLES

Try to define the kind of failure and record it.

▫ In the event of **excessive leakage**, note changes in the amount and switch the machine off if necessary.
  ➢ If a constant amount is leaking in a steady flow, the mechanical seal is damaged.

▫ In the event of a **prohibited temperature rise**, the machine **must** be stopped for safety reasons.

If there is a malfunction which you cannot correct on your own, or if the cause of malfunction is not clearly recognisable please **immediately contact the nearest BURGMANN agency**, a BURGMANN service centre or the BURGMANN headquarters.

During the warranty period the BURGMANN mechanical seal must not be removed and dismantled without the manufacturer's agreement or unless a representative is present.

■ AFTER-SALES

BURGMANN's customer service department offers a comprehensive service package covering consultancy, engineering, installation, standardisation, commissioning as well as damage analysis right through to seminars on sealing technology.

Addresses are listed in the known BURGMANN Design Manuals as well as in various other BURGMANN brochures.

■ REMOVAL

- **Stop the machine** as instructed, allow to cool, depressurise and ensure that pressure cannot build up again.
- **Work** on the M.S. **is only permitted** when the machine is **at a standstill** and **depressurised.**
- **There must be no product on the M.S.** ⇒ if necessary drain the machine and rinse it out.
- **Isolate the machine** to prevent it starting up unexpectedly.
- **Comply with the safety notes** (safety data sheets).

IMPORTANT! When removing, please observe:
▫ current **accident prevention regulations**
▫ regulations for handling hazardous substances

WARNING! Seals that have been used with hazardous substances must be properly cleaned so that there is no possible danger to people or to the environment.

IMPORTANT! The packaging used to transport the seal must
▫ be **identified** with the relevant **hazard symbol** and
▫ **include** the **safety data sheet** for the product and/or barrier/buffer/quench medium

If the medium to be pumped builds deposits or tends to solidify during cooling down or standstill of the machine the stuffing box has to be flushed with suitable clean liquid. Flow and liquid to be determined by the user.

The order of disassembly to remove the mechanical seal out of the machine depends on the design of the machine and has to be determined by the machine manufacturer.

- Depressurise and shut off (or drain) the supply system.
- Remove the supply piping from the mechanical seal. Collect drained liquid and dispose it properly.
- Drain the mechanical seal. Collect the drained liquid and dispose it properly.
- Insert all assembly fixtures into the groove in the cover and fix them.
- Screw out the cup pointed set screws and dispose.

ATTENTION! Set screws with cup point must be used **only once**. Repeated fastening endangers the safety of force transmission.

ATTENTION! Set screws with cup point must be used **only once**. Repeated fastening endangers the safety of force transmission.

- Loosen all screw connections between seal cartridge and the respective machine parts.
- Remove the seal in the reverse sequence as described for assembly (set up).

■ RECONDITIONING

If **reconditioning** is necessary, the **complete seal** should be sent **to the manufacturer**, as this is the best way to find out which components can be reconditioned or which parts must be replaced.

If, **for compelling reasons, a repair has to be carried out on site** (e.g. no. spare seal on stock, long transport, problems with customs) the seal may be repaired in a clean room by **trained** personnel of the operating company **under the instruction of BURGMANN maintenance personnel.**

■ SPARE PARTS

- **Only BURGMANN original parts** must be used. Otherwise
- **risks** of a seal failure with **danger** for persons and environment.
- ➢ The BURGMANN guarantee **lapses.**
- Store a complete **spare seal** for a quick replacement.

■ HOW TO ORDER

Fehler! AutoText-Eintrag nicht definiert.

Address of headquarters:

Burgmann Industries GmbH & Co. KG
Postfach 1240
D – 82502 Wolfratshausen

Germany

☎ +49 (0) 81 71-23 0
Fax +49 (0) 81 71-23 12 14
www.burgmann.com

■ DISPOSAL

Usually, the BURGMANN mechanical seals can be easily disposed after a thorough cleaning.

- Metal parts (steels, stainless steels, non-ferrous heavy metals) divided into the different groups belong to scrap metal waste.
- Ceramic materials (synthetic carbons, ceramics, carbides) belong to waste products. They can be separated from their housing materials, as are physiologically recognised as safe.
- Synthetic materials/plastics (elastomers, PTFE) belong to special waste.

CAUTION! Material containing fluorine **must not be burnt.**

IMPORTANT! Some of the synthetic materials, divided into the different groups can be recycled.

■ COPYRIGHT

We reserve the right to carry out modifications, even if they have not yet been considered in this manual.

07 March 2005
Department Technical Documentation

7 MAINTENANCE

Lubricating Oil:

Industrial application	Designation DIN 51502	Permitted Product
Food and Beverage Industry only	Authorized for use in foodstuffs — CLP HC 460	"KLÜBER" KLÜBEROIL 4 UH 1 - 460 authorized under USDA H1

This synthetic oil meets both the German "Arzneimittelbuch" requirements and the still stricter US American FDA regulations.
Nevertheless, it is not quite harmless if swallowed in more than minor quantities!

At a sudden break in a joint up to 450 ml of lubricating oil together with metal rubbings may enter the pumping medium. It is therefore of essential importance to regularly check the state of the joint seals and renew in time, if necessary.

If the pin joints operate without lubricating oil or seals, there will be no risk of contaminating the medium with oil. This operation, however, results in a higher amount of rubbed off metal parts through wear on the joints. These metal rubbings will inevitably and continuously come into contact with the pumping medium.

General Industry	CLP 460	"SHELL" Omala 460
	with SM-pin joint seal (8235) of EPDM CLP PG 320	prescribed: KLÜBERSYNTH GH 6-320

8 Trouble-Shooting and Remedying

8.1 Trouble Chart

The chart overleaf lists possible problems

- the type
- the likely reason / cause
- the remedy.

- A problem may have various causes: Several boxes in the vertical column are marked with a cross.
- A reason/cause may result in various problems:
  Several boxes in the horizontal column are marked with a cross.

8.2 How do you trace the kind of problem to find the possible cause ?

- The column describing a possible problem shows one or several boxes marked with a cross.
- On the corresponding lines you will find the possible reasons/cause and some hints how to handle the problem . Thus the actual cause of the problem can be narrowed down and eventually detected.
- If you find further cross-marked boxes on one of the lines and should there appear corresponding problems as well, then the likely cause of the problem has been detected.

- The table helps in finding the root of the problem and will give you the remedy if it is straight forward. For more complicated problems the manufacturer has to be consulted.

Continued Page 8.0R

The NEMO®-pump is a well established product which was thoroughly tested before leaving the factory. If you use the pump in keeping with your Order Specification and treat it in accordance with our Operating and Maintenance Instructions, it will run satisfactorily for a long period of time.

Possible Problems											
The pump is no longer starting	The pump is no longer sucking	The pumped medium is too little	The pressure is too low	The pumped medium is unstable	The pump is running loudly	The pump is stuck	The drive is overloaded	The stator life time is too short	The rotor life time is too short	The shaft seal is leaking	**Possible Causes** (Remedy overleaf)
X							X				In new pumps or stators : the static friction is too great.
X		X	X				X				The pump electrical equipment is not compatible with the electrical supply.
		X					X	X	X		The pressure is too high.
X						X	X				There are foreign bodies in the pump.
X						X	X	X	X		The temperature of the liquid medium is too high, the stator is too ductile.
X						X	X	X			The stator has swollen, the elastomer is not compatible with the medium.
X						X	X	X			The solids content of the medium is too high and leads to blockages.
X						X	X	X	X	X	The liquid medium sediments or hardens when left to stand.
		X	X	X							There is air in the suction pipe.
	X	X	X	X							The suction pipe is leaking.
	X	X	X	X							The shaft seal is leaking.
		X	X								The rpm is too low.
	X	X	X								With reduced diameter rotors : operating temperature has not been reached.
		X	X	X	X			X	X		The suction is too great or pressure too low (cavitation).
		X	X		X	X	X	X			The pump is running dry.
	X	X	X		X						The stator is worn out, or temperature of liquid is too low.
	X	X	X		X			X	X		The stator material is brittle.
	X	X	X		X			X			The rotor is worn out.
					X						The joints are worn out.
					X						The pump and drive are not axially aligned.
					X						The elastic element of the coupling is worn out.
					X					X	The roller bearings are destroyed.
							X				The rpm is too high.
							X				The viscosity is too high.
							X				The specific weight of the medium is too high.
							X			X	The stuffing box is incorrectly tightened.
										X	The packing is not suited to the liquid medium.
	X									X	Mechanical seal : rotation is incorrect.
										X	Mechanical seal : mechanical seal and mating ring have failed.
										X	Mechanical seal : elastomers damaged, swollen or brittle.

Remedy
Fill the pump up, then pump through manually using a suitable appliance; if necessary use glycerine as lubricant in the stator.
Check order information. Examine electrical installation (possibly 2 phase operation).
Measure the pressure with a manometer and check against order details. Reduce the pressure or change the drive.
Remove foreign bodies and eliminate possible damage.
If the liquid medium temperature cannot be lowered, use a reduced diameter rotor.
Check whether the liquid medium agrees with the order requirements. Possibly change stator material..
Increase the liquid part of the medium.
Clean the pump and rinse through after each run.
Increase the suction liquid level, prevent turbulance and air bubbles at the inlet.
Check seals and tighten pipe connections.
Stuffing box : tighten or renew. Mechanical seal : renew seals, eliminate solid deposits.
In the case of adjustable drives : increase the rpm. If necessary change the drive.
Warm up the pump (stator) to operating temperature first of all.
Decrease suction resistance, lower the temperature of the liquid medium, install the pump at a lower location.
Fill up the pump, provide for dry running protection, move the pipes.
Replace with a new stator or ensure correct liquid temperature.
Fit a new stator. Check the liquid medium agrees with order details; if necessary change the stator material.
Change rotor, establish the cause. Wear and tear, corrosion, cavitation; if necessary change to a different material or coating.
Replace relevant parts, carefully reseal and lubricate.
Re-align the unit.
Use a new connection and re-align the pump.
Replace roller bearings, lubricate, reseal. At higher temperatures observe the lubricant and the bearings.
In the case of adjustable drives : lower the rpm.
Measure the viscosity and compare with order details. If necessary adjust viscosity or change the drive.
Measure specific weight and compare with order details. If necessary adjust specific weight or change the drive.
Service stuffing box according to page 7.4, if necessary renew worn shaft.
Replace fitted packing with another packing type.
Change electrical connection.
Replace relevant rings with new ones.
Replace elastomers. Check whether the liquid medium agrees with order details, if necessary change material.

9 Removal and Fitting of End Stud, Stator and Pump Housing

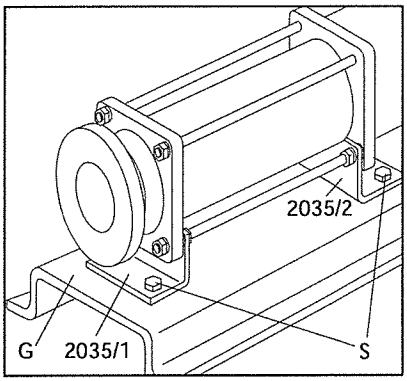
The pump with attached pipework should be empty and must have cooled off!
Disconnect the pipework on the suction side and pressure side of the pump.

Caution for pumps with ceramic rotors!

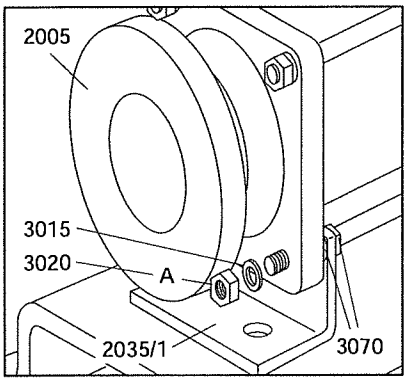
Where a pump is fitted with a **ceramic** rotor (1999) the following operations should be carried out **with great care.**
Do not use any force or sharp tools! Special care must be taken to prevent heavy strokes, vibrations or impact by a hammer.

Dismantling

- Remove the securing screws (S) from support feet (2035) to baseplate (G).



- Unscrew the hex nuts A (3020) and remove with spring washers (3015), then withdraw the end stud (2005) and first support foot (2035/1) with washers (3070).



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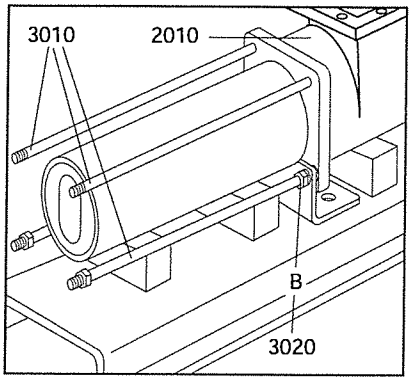
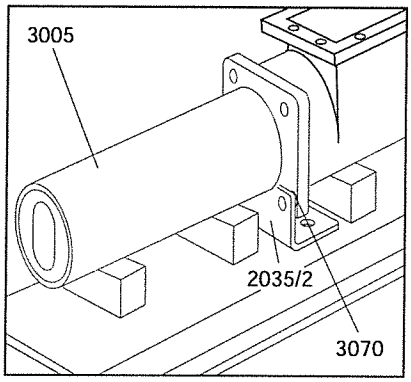
9 DISMANTLING AND ASSEMBLY OF THE PUMP HOUSING

- Support pump housing (2010) and stator (3005) with wooden blocks.
- Loosen the hex nuts B (3020), where fitted, and remove the thru bolts (3010).

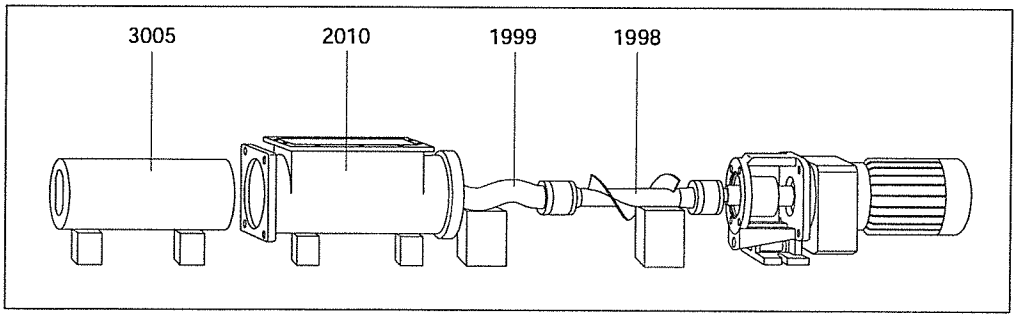


- Where fitted, remove the second support foot (2035/2) and the washers (3070).



Caution for pumps with ceramic rotors!

When the stator (3005) is removed from the **ceramic** rotor (1999), the stator must be supported to prevent it from suddenly tilting away downwards. The same applies to the rotor (1999) as soon as it is disengaged from the stator (3005). Removing the stator (3005) from the **ceramic** rotor (1999) is easier by using an extractor. This should be done slowly and with care in a rotating movement. When sliding pump housing (2010) over **ceramic** rotor (1999), both coupling rod (1998) and rotor (1999) should be lifted as the **ceramic** rotor (1999) must not knock onto the pump housing (2010).



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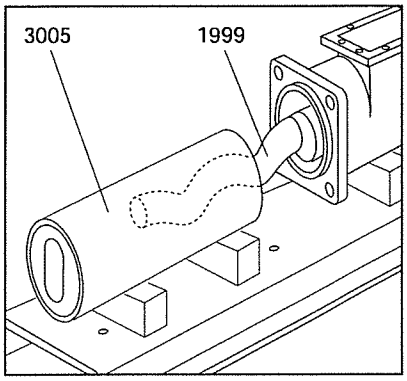
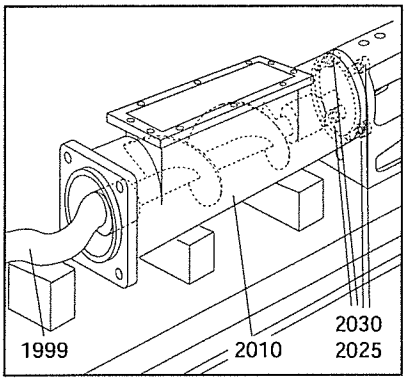
Caution for pumps with tubular rotors:

Where the walls of tubular rotors are worn in the wear zones, pumping medium may occur inside the rotor and may come out when pulling off the stator.
Ensure that protective measures have been taken when pumping dangerous media!

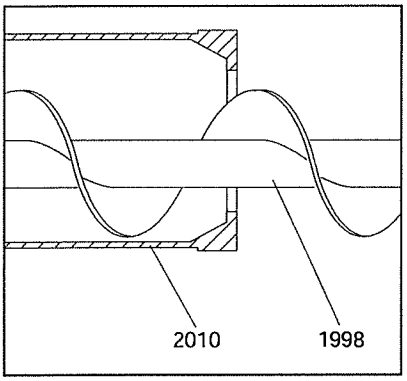


- Pull the stator (3005) out forward.
  A stator extractor can be supplied as special accessory.

- Remove the hex nuts (2030) with spring washers (2025).

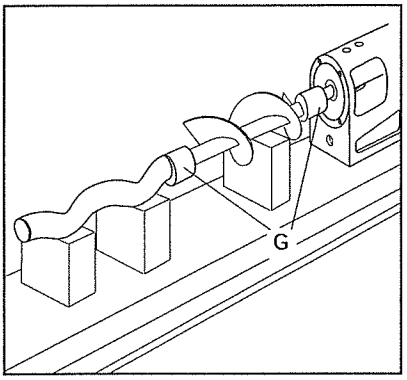


- The pump housing (2010) cannot be pulled out straight forward since the diameter of coupling rod plus feed screw (1998) is larger than the housing (2010) passage.
  Therefore pull the pump housing (2010) out in a spiral movement with its passage cautiously sliding over each worm of the screw of coupling rod (1998).



The joints (G) are now freed.

Refitting is a simple reversal of the above procedure.



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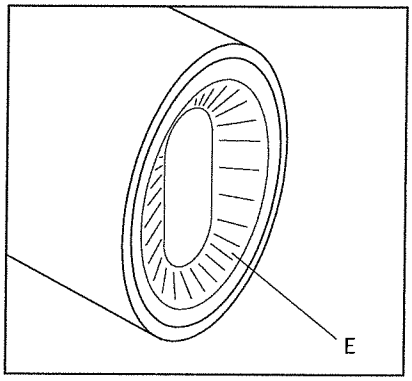
9 DISMANTLING AND ASSEMBLY OF THE PUMP HOUSING

Assembly

- Refitting is a simple reversal of this procedure.

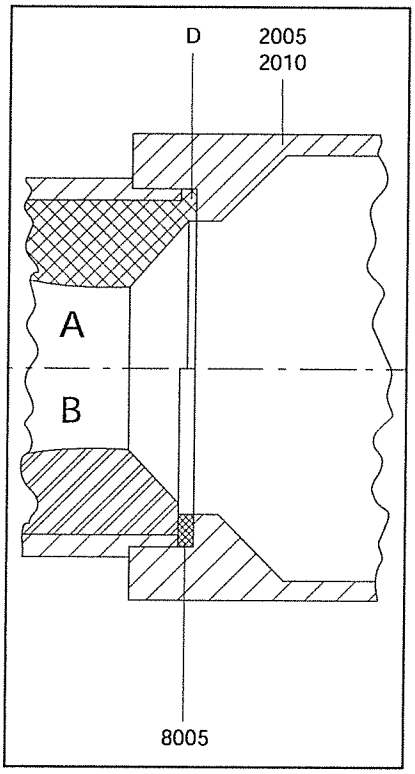
  When refitting the stator (3005) check direction of stator (3005) is correct! The funnel-shaped inflow side (E) of the stator (3005) must show to
  - the pump housing (2010) when rotation is **anti-clockwise**
  - the end stud (2005) when rotation is **clockwise**

  when viewed on pump shaft end.



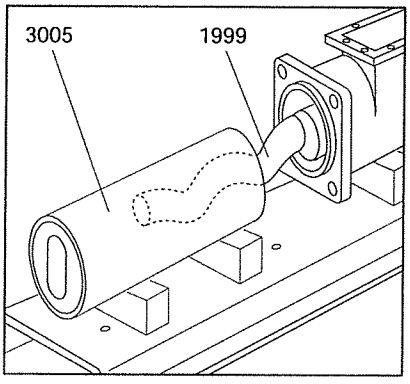
- **Elastomer stators (A)** have integrated front side sealing profiles (D). They don't need additional gaskets for sealing off the end stud (2005) and the pump housing (2010).

- **Solid stators (B)** have **no** integrated front side sealing profiles. Therefore additional gaskets (8005) should be installed to seal off the end stud (2005) as well as the pump housing (2010).



Be careful when engaging the stator (3005) and rotor (1999). Do not trap your fingers!
Do not reach inside the stator!

- Push the stator (3005) with a rotating movement on to rotor (1999).
  Apply an assembly device and some glycerine to ease engaging the stator (3005) and rotor (1999).



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- When tightening hex nuts (2030) a gap will remain between drive stool (0085) and pump housing (2010).

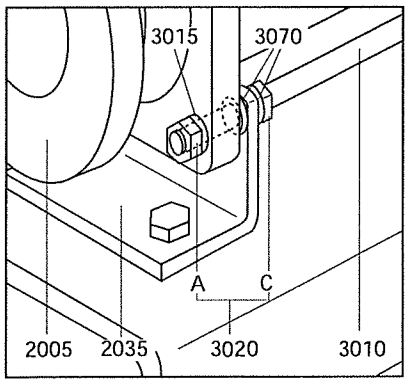
Please do not try to close this gap by overtightening the nuts! Drive stool (0085) may break!

Torque values for hex nuts (2030):

Size	M6	M8	M10	M12	M16	M20	M24	M30
Required torque Nm	8	15	30	45	75	80	100	120

- Fastening the end stud (2005):

Screw the hex nuts C (3020) down into the thru bolts (3010) as far as possible.
Slip on the first washers (3070), the support foot (2035), the second washers (3070), the end stud (2005) and tighten with spring washers (3015) and hex nuts A (3020).
Finally, fasten the support foot (2035) from behind with the two hex nuts C (3020).



Ensure during refitting that the O-ring (8015) or, where a heating jacket (3025) is installed, the O-rings (8030) are in perfect condition and will sit correctly.

Ensure that the drain plug (2015) is not screwed too tightly into the pump housing (2010), since otherwise its conical thread may break the pump housing (2010).
The torque should be about 40 - 50 Nm.

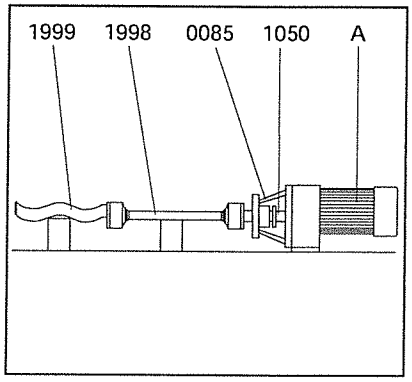
10 Dismantling and Assembly of the Rotating Parts with Pin Joints with SM-Pin Joint Seal

10.1 Removal of Rotor and Coupling Rod

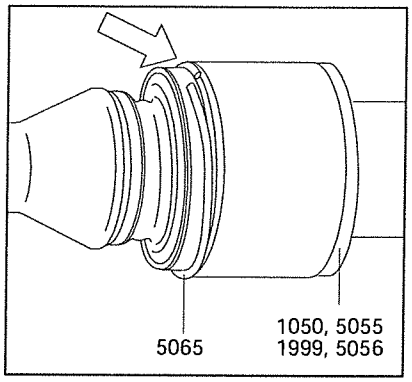
Where a pump is fitted with a **ceramic** rotor (1999) the following operations should be carried out **with great care.**
Do not use any force or sharp tools! Special care must be taken to prevent heavy strokes, vibrations or impact by a hammer.

For removal of the rotor (1999) and coupling rod (1998) the pin joints should be dismantled as follows:

- Place the dismantled unit – consisting of drive stool (0085) with drive (A) and connecting shaft (1050), coupling rod (1998) and rotor (1999) – on the work-bench with a wooden block supporting the rotor (1999).

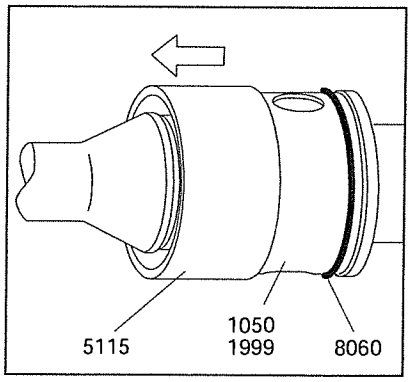


- Push circlip (5065) out of its groove and slip off over the head of rotor (1999 or connecting shaft (1050).



- **Pumps fitted with a ceramic rotor (1999):**
  Carefully turn safety sleeve (5115) with a squeeze belt wrench, and remove.
  The following method should **not** be employed for pumps fitted with a **ceramic** rotor.

Pumps fitted with a metallic rotor (1999):
If necessary hit the edge of sleeve (5115) at an angle with the help of a wooden block and a plastic hammer. Taking care not to damage the O-rings (8060)!



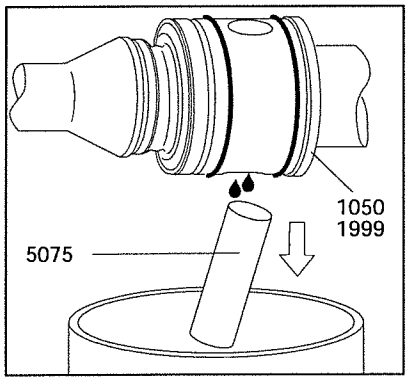
Continued Page 10.0R

10 DISMANTLING AND ASSEMBLY OF THE ROTATING PARTS

- Press the pin (5075) out of the head of rotor (1999) or connecting shaft (1050). If necessary use a hammer and a thin cylindrical pin (DIN 6450 C).
  Drain the oil into a receptacle.

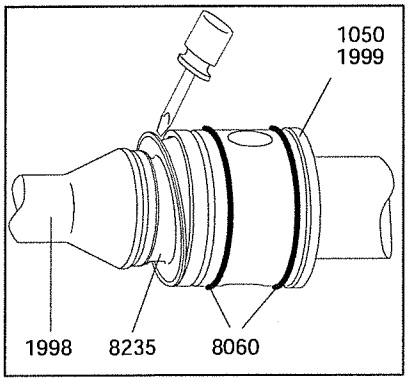
  Caution for pumps with ceramic rotors!

  Where a pin (5075) may not come out easily, the metallic head of rotor (1999) should be supported on wooden blocks. Then the pin (5075) can be driven out with the help of a pin punch (DIN 6450 C). This should be done **with care**, holding the **ceramic** rotor with your hands.
  Please dispose of this oil in the proper manner.

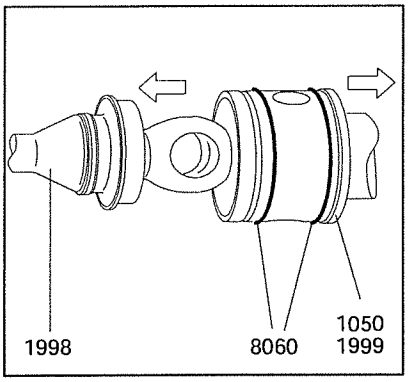


- Using a screwdriver, carefully lever the SM-pin joint seal (8235) out of the head of rotor (1999) or connecting shaft (1050).

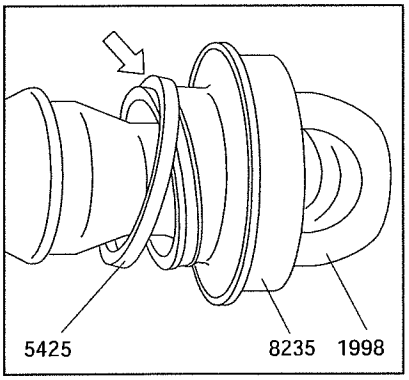
  Taking care not to damage the SM-pin joint seal (8235)!



- Pull apart the rotor (1999)/ coupling rod (1998) / connecting shaft (1050) assembly. Remove the O-rings (8060).



- Push the SM-pin joint seal (8235) towards the head of coupling rod (1998). In the narrow coupling rod section press the clamp ring (5425) out of the groove of the seal. Then slip the SM-pin joint seal (8235) and clamp ring (5425) off over the head of the coupling rod (1998).

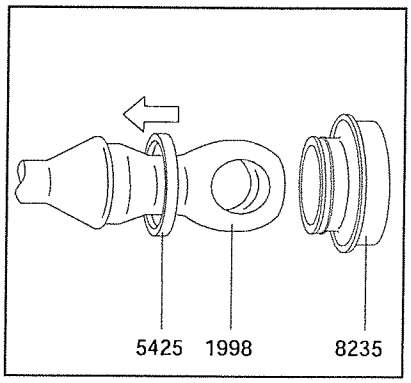


Continued Page 10.1

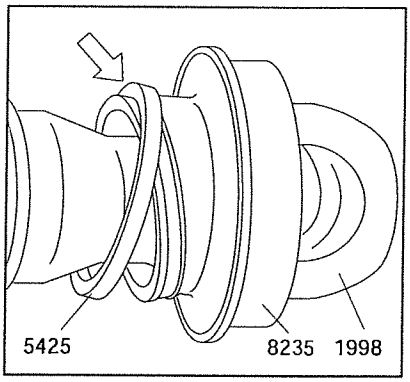
10.2 Fitting the Rotor and Coupling Rod

For fitting the rotor (1999) with coupling rod (1998), the two pin joints should be assembled as follows:

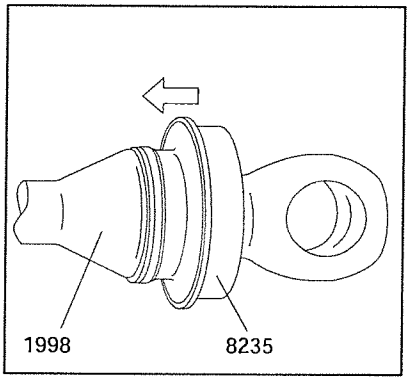
- Slip the clamp ring (5425) over the head of coupling rod (1998).



- Push the SM-pin joint seal (8235) over the head of coupling rod (1998) towards its narrow section, there sqeezing the clamp ring (5425) into the groove of the SM-pin joint seal (8235).



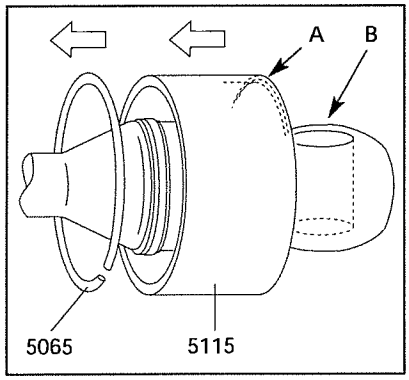
- Push the SM-pin joint seal (8235) with the correctly placed clamp ring (5425) up to the shoulder of coupling rod (1998).



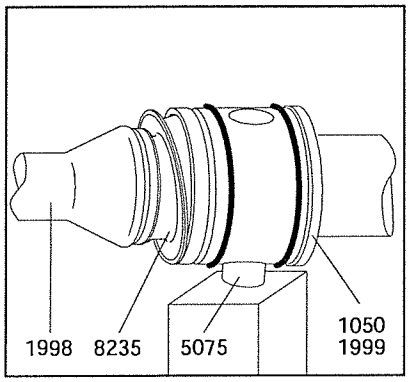
Continued Page 10.1R

10 DISMANTLING AND ASSEMBLY OF THE ROTATING PARTS

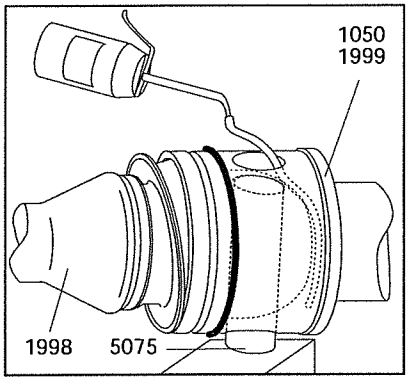
- Slip the circlip (5065) on to the coupling rod (1998). Slide the sleeve (5115) on to coupling rod (1998) so the inside diameter of chamfering (A) is being placed towards the coupling rod (1998) extension. Chamfering (A) will later on ease the installation over the O-rings (8060).
  Orient the head of coupling rod (1998) until it is in vertical position for the bore (B) for the pin (5075).



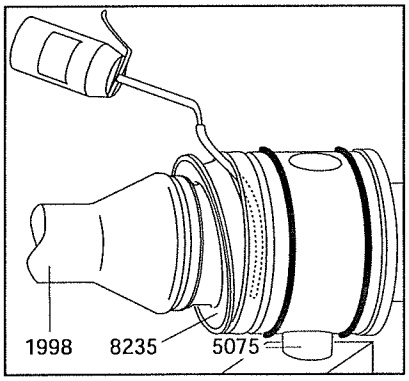
- Slide the coupling rod (1998) with SM-pin joint seal (8235) into the bore of rotor (1999) or connecting shaft (1050) and insert the pin (5075) from below and push up to the upper edge of coupling rod (1998).
  Support the pin (5075) against dropping out.
  Slide the SM-pin joint seal (8235) into the rotor (1999) or connecting shaft (1050) only from below, and in a slightly slanted position.



- For lubrication, use an oil can which should be fitted with a thin plastic hose having an outside diameter of not more than 4 mm.
  Insert this hose into the upper oil port opening in the rotor (1999) or connecting shaft (1050). Then slide the hose end past the coupling rod (1998) all the way down to the bottom section of the rotor head (1999) or connecting shaft (1050).
  Slowly fill with lubricating oil up to the filling port.

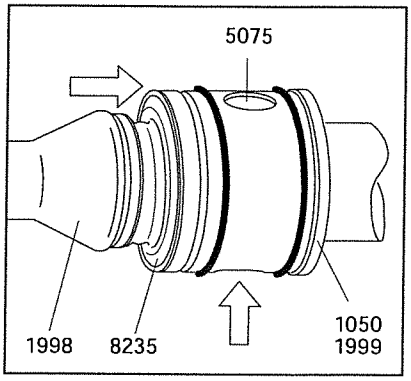


- Pull the hose out.
  Then insert the hose end through the small gap on the topside of SM-pin joint seal (8235) and guide it down to the bottom of the hollow space between coupling rod (1998) and SM-pin joint seal (8235).
  Slowly fill with lubricating oil up to the gap.

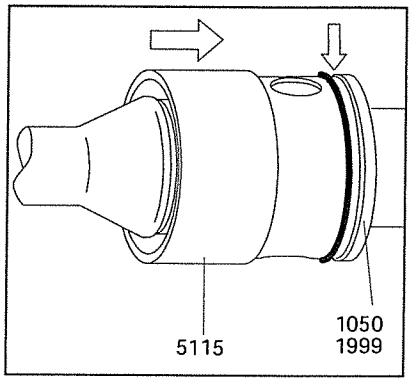


Continued Page 10.2

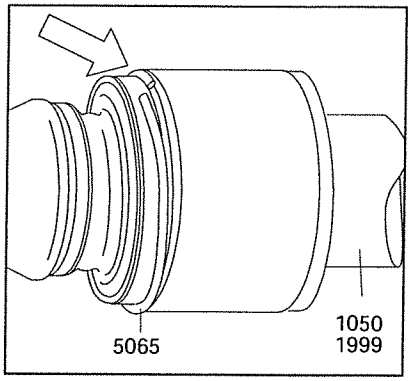
- Pull the hose out.
  Push the pin (5075) entirely into the bore of head of rotor (1999) or connecting shaft (1050) and retain in place.
  Only now, press the SM-pin joint seal (8235) into the bore of head of rotor (1999) or connecting shaft (1050) and push up to the shoulder. In doing so the SM-pin joint seal (8235) should be slightly bulbous around the outer surface. Wipe off overflow oil. Use this oil for lubricating the O-rings (8060).



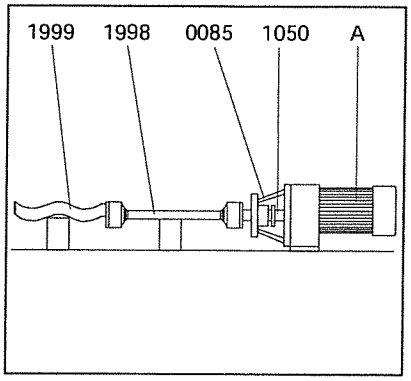
- Slip the sleeve (5110) or (5115), with its chamfering (A) forward, on to the head of rotor (1999) or connecting shaft (1050) and push up to the shoulder.



- Place the circlip (5065) into its groove on the rotor head (1999) or connecting shaft (1050) and carefully snap in place all around.



- Drive connecting shaft (1050), coupling rod (1998) and rotor (1999) are now joined by means of the two pin joints.
  Pump housing (2010), stator (3005) and end stud (2005) may now be fitted.



11 Removal and Fitting of the Connecting Shaft with Shaft Seal

Removal:

- Push the circlip (1035) in the direction to the mechanical seal.
- Remove pin (1030).
- Remove the shaft seal housing (7005) and mechanical seal (7010) together with connecting shaft (1050) and set ring (1035) from drive stool (0085) and the drive shaft.
  The thread of cylindrical head screw (1040) can be used as forcing screw.
- If a mechanical seal is installed, see description "Removal and Fitting of Mechanical Seal" after Page 12.0.

Fitting:

- Apply grease into the bore of the connecting shaft (1050) to avoid rust (e.g. TCE-Metallic 600).
- Assemble the shaft seal housing (7005) and mechanical seal (7010) together with connecting shaft (1050) and set ring (1035) with drive stool (0085) and push connecting shaft (1050) on to the drive shaft.
  At this please observe the installation direction of set ring (1035) (please see mark).
- If a mechanical seal is installed, see description "Removal and Fitting of Mechanical Seal" after Page 12.0.
- Connect the connecting shaft (1050) and the drive shaft by pin (1030).
  Push set ring (1035) on pin (1030).

12.1 Removal and Fitting of the Single Mechanical Seal

- **Carefully** slide out mechanical seal housing (7005) together with the parts of the mechanical seal contained in it from connecting shaft (1050).
- **Carefully** push mechanical seal (7010) stationary seat out of mechanical seal housing (7005).

Refitting is a simple reversal of the above procedure.

- To reduce frictional forces during seal assembly, apply some glycerine to the shaft and the seal housing in the area of the gaskets.
- Special care must be taken when fitting double PTFE-coated gaskets: the **joint** of the outer coating must point away from the seal assembly direction, otherwise the coating may open or be pulled off!

Ensure that the distribution of pressure is uniform when inserting the pressure sensitive counter rings. When inserting larger rings, use a suitable mandrel.
Do not allow any foreign bodies to get between the sliding surfaces.

- Exactly keep to the seal installation dimensions and ensure that the sealing faces are correctly pressed together (see table on sectional drawing W 209.000 or W 210.000).
- Insert mechanical seal (7010) stationary seat into mechanical seal housing (7005).
- Insert mechanical seal housing (7005) together with the stationary seat into the drive stool **without the installed connecting shaft (1050).**
- If necessary take the installation dimension from the table and add the thickness S of the set ring (7086) when existing.
- Mark this installation dimension on the connecting shaft (1050).
- Fix the rotating unit of the mechanical seal (7010) on the connceting shaft (1050) depending on the installation dimension so that the rotating unit of the mechanical seal (7010) or the set ring (7086) is at the mark.
- Insert connecting shaft (1050) with the rotating unit of the mechanical seal (7010) into drive stool (0085) and install lip seal (7091, if existing. Push the set ring (1035) on to connecting shaft (1050) and observe at this the installation direction (see mark).
  Push connecting shaft (1050) on to the drive shaft and connect with pin (1030). Push the set ring (1035) on pin (1030).

14 Recommended Spare Parts

In general, we have all spare parts in stock. Our subsidiaries and exclusive representatives also hold a certain stock. For special cases and when short waiting periods are not acceptable, we recommend to keep an amount of spare parts, corresponding to the pump, in stock on site (please see table below).

- **Rotor**
- **Stator**
- **Elastomer parts as O-rings and sleeves**
- **joint parts**
- **shaft seals.**

To avoid mistakes in delivery, please identify the parts by their position number shown in the spare parts list or on the sectional drawing.

For placing a spare parts order, it is absolutely necessary to give the following details:

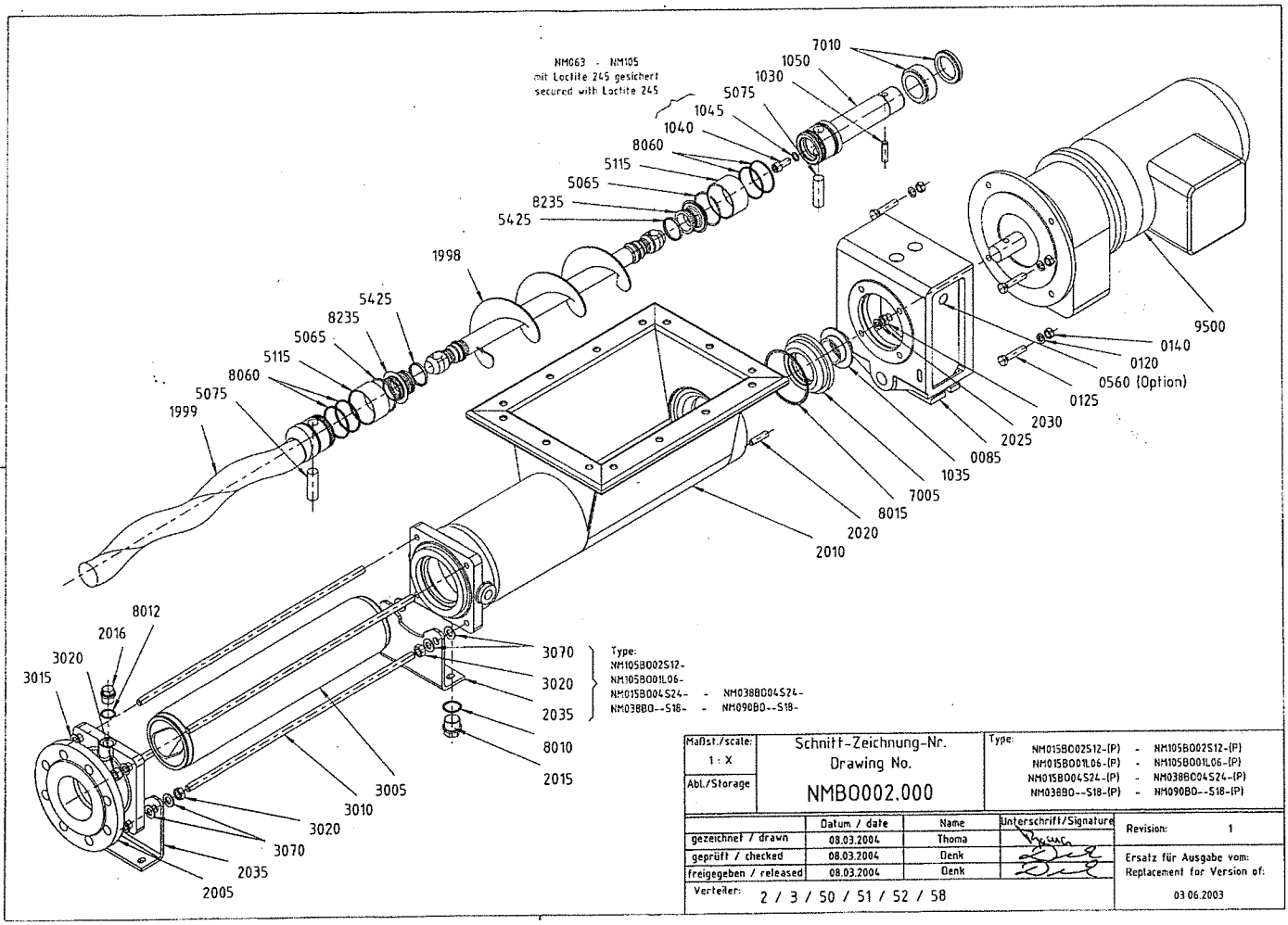
Pieces	-	Designation	-	Identification Number
(see column 2)		(see column 3)		(see column 4)

The column details are taken from the spare parts list. See example.

Example:

SPARE PARTS LIST		10.05.94		10:50:18	Page: 1 / 5
1		2		3	4
PART EURO	POS.	Quantity	Unit	Designation Size – Norm – Material/Surface	Ident-Number
3410	0005	1,000	pc	bearing housing	850221
2910	0010	1,000	pc	distance sleeve	850220
3520	0015	1,000	pc	bearing cover	850222

15 Sectional Drawings and List of Spare Parts



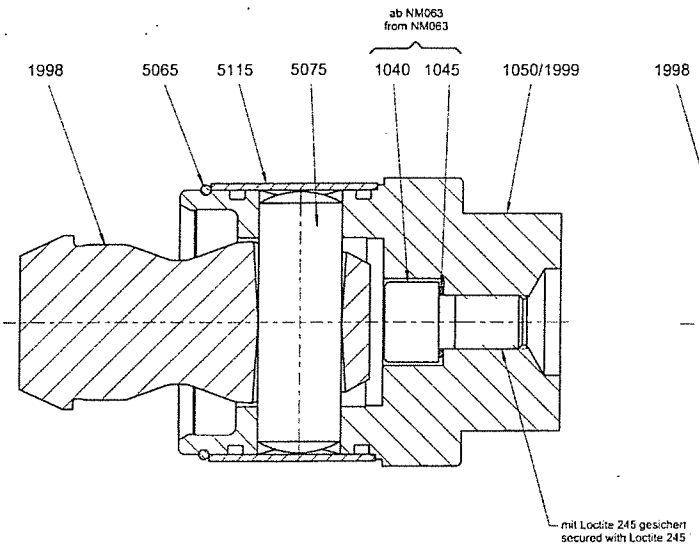
Maßst./scale: 1 : X	Schnitt-Zeichnung-Nr. Drawing No. NMB0002.000	Type:	NM015B002S12-(P) - NM105B002S12-(P) NM015B001L06-(P) - NM105B001L06-(P) NM015B004S24-(P) - NM038B004S24-(P) NM038B0--S18-(P) - NM090B0--S18-(P)
Abl./Storage			

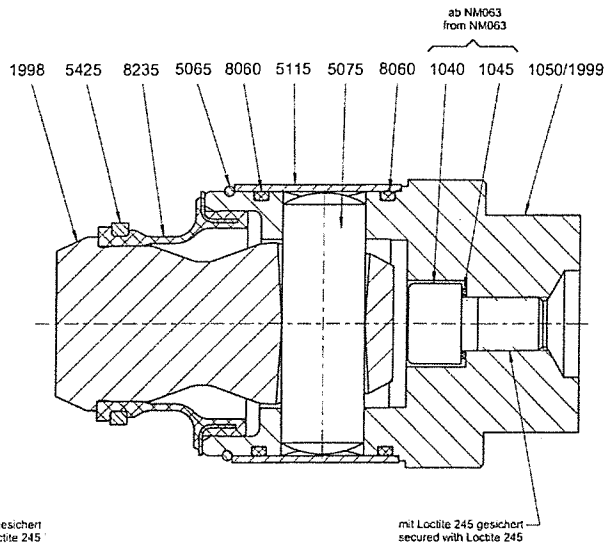
	Datum / date	Name	Unterschrift/Signature
gezeichnet / drawn	08.03.2004	Thoma	
geprüft / checked	08.03.2004	Denk	
freigegeben / released	08.03.2004	Denk	

Verteiler: 2 / 3 / 50 / 51 / 52 / 58

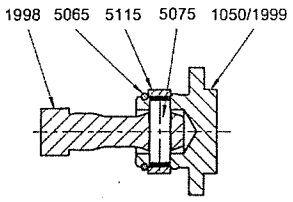
Revision: 1

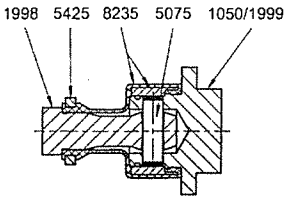
Ersatz für Ausgabe vom: Replacement for Version of: 03.06.2003





nur/only NM015B- (P)





Maßst./Scale: 1 : X	Schnitt-Zeichnung-Nr.: Drawing No.:	Bolzengelenk ohne/mit SM-Bolzenabdichtung Pin Joint without/with SM-Pin Joint Seal	Type: NM015B- (P) NM105B- (P)
Abl./Storage: -	G146.000		

	Datum / date	Name	Unterschrift/Signature
gezeichnet / drawn	14.10.2003	Preintner	
geprüft / checked	14.10.2003	Thoma	
freigegeben / released	14.10.2003	Thoma	
Verteiler: Distributor:	2 / 3 / 50 / 51 / 52 / 58		

Revision: 1

Ersatz für Ausgabe vom: Replacement for Version of: 23.05.2003

Inquiry/Order Form Spare Parts

NETZSCH

▶ Please copy before use

☐ Inquiry ☐ Order

Netzsch Pumps North America, LLC
119 Pickering Way
Exton, PA 19341-1393

Tel: 1-610-363-8010
npa@netzsch.com
www.netzsch.com

Company Address

Person in Charge

Tel:

Fax:

Delivery address

Billing address

Important: Please fill in		
Machine #	Pump Com #	Type
Quantity	Pos. No.	Description

Required delivery date_____

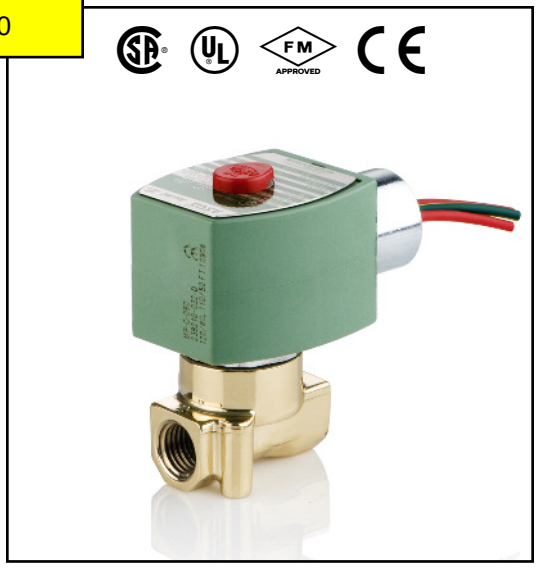
Address_____

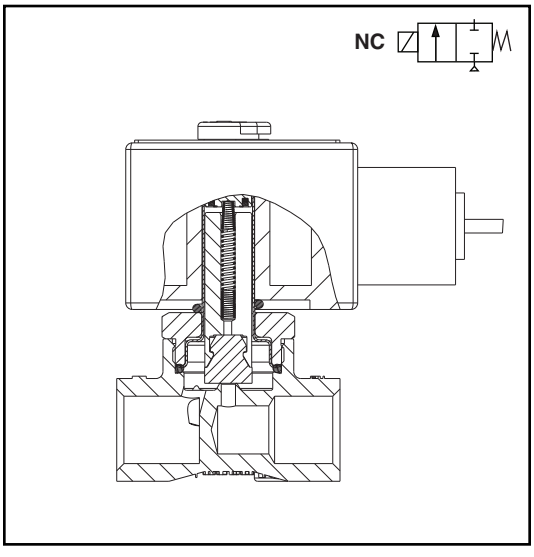
Date_____ Signature/co. stamp_____

TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
SCUM PUMP SEAL WATER
SOLENOID VALVE P/N: 8262H208MS-120/60

Features

- Welded core tube provides higher pressure ratings
- Reliable, proven design with high flows
- Small poppet valves for tight shutoff
- Wide range of elastomers for specialty service applications
- Mountable in any position
- Tapped mounting holes in body standard





Construction

Valve Parts in Contact with Fluids		
Body	Brass	Cast 304 Stainless Steel
Seals and Discs	NBR or Cast UR	
Core Tube	305 Stainless Steel	
Core and Plugnut	430F Stainless Steel	
Springs	302 Stainless Steel	
Shading Coil	Copper	Silver

Electrical

Watt Rating and Power Consumption				Spare Coil Part No.			
	AC			General Purpose		Explosionproof	
DC Watts	Watts	VA Holding	VA Inrush	AC	DC	AC	DC
10.6	6.1*	16	30	238210	238510	238214	238514
18.6	9.1*	20	45	238210	238510	238214	238514
11.6	10.1	25	50	238610	238910	238614	238914
22.6	17.1	40	70	238610	238910	238614	238914

Standard Voltages: 24, 120, 240, 480 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz). 6, 12, 24, 120, 240 volts DC. Must be specified when ordering.
Other voltages available when required.

*On 50 hertz service, the rating for the 6.1/F solenoid is 8.1 watts, and the rating for the 9.1/F solenoid is 11.1 watts.

Solenoid Enclosures

Standard: Watertight, Types 1, 2, 3, 3S, 4, and 4X.

Optional: Explosionproof and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9. (To order, add prefix "EF" to catalog number)

See Optional Features Section for other available options.

Options

Mounting bracket (suffix MB)
Quarter-turn manual operator with screw slot (suffix MS)
Panel mount (prefix GP for conduit; *consult ASCO for other electrical connections*)
Vacuum service (suffix VVM, VVH; *see Vacuum Section for more details.*)
Oxygen service (suffix N)
Silicone Free (suffix SF)

Elastomers: FKM (suffix V), Ethylene Propylene (suffix E), CR (suffix J), PTFE* (suffix T), Low Temp NBR** (suffix A)

Note: *PTFE reduces pressure rating by 25% (i.e. 750 psi reduced to 560 psi)
** For Low Temp. NBR, fluid temperature range is -40˚F to 167˚F (only for valves with 10.1, 17.1, 11.6, and 22.6 watt coils).

Refer to Engineering Section for fluid and temperature compatibility.

Nominal Ambient Temp. Ranges

The nominal limitation of 32°F (0°C) is advisable for any valve that might contain moisture (water vapor).

AC: -13˚F to 131˚F (-25˚C to 55˚C)

DC: -13˚F to 104˚F (-25˚C to 40˚C)
-13˚F to 131˚F (-25˚C to 55˚C)

Note: Max ambient for explosionproof (EF) is 125˚F (52˚C) for AC, 131˚F (55˚C) for DC.

Optional: For AC, the max. ambient temperature is 140˚F (60˚C) with Class H coil (with or without prefix EF)

Refer to Engineering Section for details.

Approvals

CSA certified. UL listed, as indicated. Safety Shutoff Valves FM approved. Meets applicable CE directives. *Refer to Engineering Section for details.*

ATEX/IECEx certified with prefix "EV" as listed. *Refer to Optional Features Electrical Section for details.*

2/2 SERIES 8262 8263

ASCO®

Specifications (English units)

Pipe Size (in)	Orifice size (in)	Cv Flow Factor	Operating Pressure Differential (psi)									Max. Fluid Temp. °F		Catalog Number		Const. Ref.	UL Listing	Watt Rating/ Class of Coil Insulation	
			Max. AC@131°F			Max. DC@104°F			Max. DC@131°F										
			Air-Inert Gas	Water ¶	Lt. Oil @ 300ssu	Air-Inert Gas	Water ¶	Lt. Oil @ 300ssu	Air-Inert Gas	Water ¶	Lt. Oil 300ssu	AC	DC	Brass	Stainless Steel			AC	DC
NORMALLY CLOSED (Closed when de-energized), NBR Disc																			
1/8	3/64	0.06	2200	2200	1700	-	-	-	-	-	-	140	-	-	8262H175 ♣	1	●	10.1/F	-
1/8	3/64	0.06	-	-	-	2000	2000	1725	1900	1900	1700	-	140	-	8262H176 ♣	1	●	-	22.6/H
1/8	3/64	0.06	-	-	-	1500	1500	1500	1500	1500	1500	-	140	8262H089 ♣	-	1	●	-	22.6/H
1/8	3/64	0.06	2025	1710	825	965	745	720	920	700	675	140	140	-	8262H079 ♣	2	●	9.1/F	18.6/H
1/8	3/64	0.06	1500	1350	825	750	620	565	700	565	530	140	140	8262H096 ♣	-	2	●	6.1/F	10.6/H
1/8	3/64	0.06	1500	1350	825	-	-	-	-	-	-	140	-	-	8262H173 ♣	2	●	6.1/F	-
1/8	3/64	0.06	1500	1500	1500	1170	1145	945	1000	965	855	140	140	8262H099 ♣	-	1	●	10.1/F	11.6/H
1/8	3/64	0.06	750	750	725	750	640	550	750	600	500	180	180	8262H001	8262H012	2	❍	6.1/F	10.6/H
1/8	3/32	0.21	720	410	410	610	410	410	600	410	400	180	180	8262H277	8262H178	1	❍	17.1/F	22.6/H
1/8	3/32	0.21	-	-	-	290	290	270	240	240	255	180	180	-	8262H177 ③	1	❍	-	11.6/H
1/8	3/32	0.21	500	350	325	295	210	205	285	200	195	180	180	8262H011	-	2	❍	9.1/F	18.6/H
1/8	3/32	0.21	370	330	190	235	160	160	215	150	145	180	180	8262H014	8262H015	2	❍	6.1/F	10.6/H
1/8	1/8	0.35	500	380	355	275	275	235	250	250	225	180	180	8262H105	8262H174	1	❍	17.1/F	22.6/H
1/8	1/8	0.35	340	300	215	-	-	-	-	-	-	-	180	-	8262H179	1	❍	10.1/F	-
1/8	1/8	0.35	275	260	195	165	130	130	155	120	120	180	180	8262H016	-	2	❍	9.1/F	18.6/H
1/8	1/8	0.35	185	180	120	130	110	95	120	100	90	180	180	8262H002	8262H006	2	❍	6.1/F	10.6/H
1/4	3/64	0.06	2200	2200	1700	1170	1145	945	1000	965	855	140	140	-	8262H214 ♣	3	●	10.1/F	11.6/H
1/4	3/64	0.06	1500	1500	1500	1170	1145	945	1000	965	855	140	140	8262H200 ♣	-	3	●	10.1/F	11.6/H
1/4	3/64	0.06	1500	1500	1500	1500	1500	1500	1500	1500	1500	140	140	8262H107 ♣	-	3	●	17.1/F	22.6/H
1/4	3/64	0.06	-	-	-	2000	2000	1725	1900	1900	1700	-	140	-	8262H181 ♣	3	●	-	22.6/H
1/4	3/64	0.06	1500	1350	825	750	620	530	700	565	495	140	140	8262H106 ♣	8262H180 ♣	4	●	6.1/F	10.6/H
1/4	3/64	0.06	750	750	725	750	640	550	750	600	500	180	180	8262H019	8262H080	4	❍	6.1/F	10.6/H
1/4	3/32	0.21	720	410	410	610	410	410	600	410	400	180	180	8262H109	8262H183 ③	3	❍	17.1/F	22.6/H
1/4	3/32	0.21	590	410	410	290	290	270	240	240	225	180	180	8262H108	8262H182 ③	3	❍	10.1/F	11.6/H
1/4	3/32	0.21	500	350	270	295	210	205	285	200	195	180	180	8262H021	-	4	❍	9.1/F	18.6/H
1/4	3/32	0.21	370	330	160	235	160	160	215	150	145	180	180	8262H020	8262H086	4	❍	6.1/F	10.6/H
1/4	1/8	0.35	500	380	355	275	275	235	250	250	225	180	180	8262H110	8262H185 ③	3	❍	17.1/F	22.6/H
1/4	1/8	0.35	340	300	215	130	125	115	110	105	100	180	180	8262H232	-	3	❍	10.1/F	11.6/H
1/4	1/8	0.35	340	300	215	-	-	-	-	-	-	180	-	-	8262H184 ③	3	❍	10.1/F	-
1/4	1/8	0.35	275	260	150	165	130	120	155	120	115	180	180	8262H023	-	4	❍	9.1/F	18.6/H
1/4	1/8	0.35	185	180	90	130	110	90	120	100	85	180	180	8262H022	8262H007	4	❍	6.1/F	10.6/H
1/4	5/32	0.52	300	210	210	135	135	135	115	115	115	180	180	8262H112	8262H187 ③	3	❍	17.1/F	22.6/H
1/4	5/32	0.52	210	200	145	65	63	63	55	54	54	180	180	8262H202	-	3	❍	10.1/F	11.6/H
1/4	5/32	0.52	210	200	145	-	-	-	-	-	-	180	180	-	8262H220 ③	3	❍	10.1/F	-
1/4	5/32	0.52	150	140	100	95	75	75	85	72	70	180	180	8262H113	-	4	❍	9.1/F	18.6/H
1/4	5/32	0.52	100	100	55	72	60	55	67	53	52	180	180	8262H111	8262H186	4	❍	6.1/F	10.6/H
1/4	7/32	0.73	125	125	125	70	70	70	65	65	65	180	180	8262H114	8262H188	3	❍	17.1/F	22.6/H
1/4	7/32	0.73	100	100	100	35	35	35	30	30	30	180	180	8262H208	-	3	❍	10.1/F	11.6/H
1/4	7/32	0.73	100	100	100	-	-	-	-	-	-	180	-	-	8262H226	3	❍	10.1/F	-
1/4	7/32	0.73	55	54	40	38	33	31	35	30	28	180	180	8262H013	8262H036	4	❍	6.1/F	10.6/H
1/4	9/32	0.88	90	90	90	53	50	47	48	46	44	180	180	8262H212	8262H230	3	❍	17.1/F	22.6/H
1/4	9/32	0.88	65	75	60	25	25	22	22	22	20	180	180	8262H210	-	3	❍	10.1/F	11.6/H
1/4	9/32	0.88	65	75	60	-	-	-	-	-	-	180	-	-	8262H189	3	❍	10.1/F	-
1/4	9/32	0.88	36	36	33	27	23	21	24	22	20	180	180	8262H090	8262H038	4	❍	6.1/F	10.6/H
3/8	1/8	0.35	500	380	355	275	275	160	250	250	150	180	180	8263H115	8263H191	5	❍	17.1/F	22.6/H
3/8	1/8	0.35	340	300	215	130	125	85	110	105	75	180	180	8263H232	-	5	❍	10.1/F	11.6/H
3/8	1/8	0.35	340	300	215	-	-	-	-	-	-	180	-	-	8263H190	5	❍	10.1/F	-
3/8	1/8	0.35	275	260	140	165	130	110	155	120	105	180	180	8263H003	-	6	❍	9.1/F	18.6/H
3/8	1/8	0.35	185	180	90	130	110	80	120	100	75	180	180	8263H002	8263H330	6	❍	6.1/F	10.6/H
3/8	5/32	0.52	300	210	195	135	135	100	115	115	90	180	180	8263H118	8263H193	5	❍	17.1/F	22.6/H
3/8	5/32	0.52	210	185	100	65	63	50	55	54	44	180	180	8263H200	-	5	❍	10.1/F	11.6/H
3/8	5/32	0.52	210	185	100	-	-	-	-	-	-	180	-	-	8263H331 ③	5	❍	10.1/F	-
3/8	5/32	0.52	150	140	80	95	75	75	85	72	70	180	180	8263H117	-	6	❍	9.1/F	18.6/H
3/8	5/32	0.52	100	100	50	72	60	55	67	53	52	180	180	8263H116	8263H192	6	❍	6.1/F	10.6/H
3/8	7/32	0.73	125	100	100	70	70	70	65	65	65	180	180	8263H206 ③	8263H332	5	❍	17.1/F	22.6/H
3/8	7/32	0.73	100	86	70	35	35	35	30	30	30	180	180	8263H124	-	5	❍	10.1/F	11.6/H
3/8	7/32	0.73	100	86	70	-	-	-	-	-	-	180	-	-	8263H195	5	❍	10.1/F	-
3/8	7/32	0.73	55	54	29	38	33	31	35	30	28	180	180	8263H119	8263H194	6	❍	6.1/F	10.6/H
3/8	9/32	0.88	100	85	70	53	50	47	48	46	44	180	180	8263H210	8263H333	5	❍	17.1/F	22.6/H
3/8	9/32	0.88	65	63	47	-	-	-	-	-	-	180	180	8263H125	8263H197	5	❍	10.1/F	-
3/8	9/32	0.88	35	32	21	27	23	21	24	22	20	180	180	8263H054	8263H196	6	❍	6.1/F	10.6/H

♣ Only available with UR disc, limits min. ambient temp. to 32˚F (0˚C). ¶ Water rating, CSA certified up to 232 psi. ③ ATEX/IECEx certified with prefix "EV".
● = General Purpose Valve, ❍ = Safety Shutoff Valve

Specifications (Metric units)

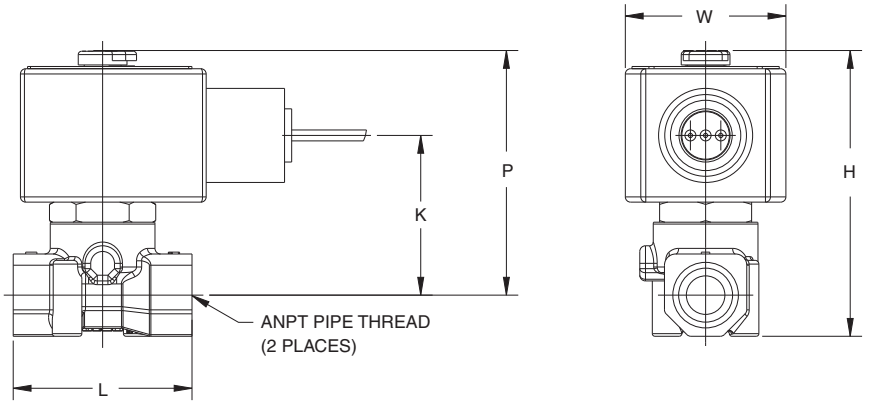
Pipe Size (in)	Orifice size (mm)	Kv Flow Factor (m^3/h)	Operating Pressure Differential (bar)									Max. Fluid Temp. °C		Catalog Number		Const. Ref.	UL Listing	Watt Rating/ Class of Coil Insulation	
			Max. AC@55°C			Max. DC@40°C			Max. DC@55°C										
			Air-Inert Gas	Water ¶	Lt. Oil @ 300ssu	Air-Inert Gas	Water ¶	Lt. Oil @ 300ssu	Air-Inert Gas	Water ¶	Lt. Oil 300ssu	AC	DC	Brass	Stainless Steel			AC	DC
NORMALLY CLOSED (Closed when de-energized), NBR Disc																			
1/8	1.2	0.05	152	152	117	-	-	-	-	-	-	60	-	-	8262H175 ♣	1	●	10.1/F	-
1/8	1.2	0.05	-	-	-	138	138	119	131	131	117	-	60	-	8262H176 ♣	1	●	-	22.6/H
1/8	1.2	0.05	-	-	-	103	103	103	103	103	103	-	60	8262H089 ♣	-	1	●	-	22.6/H
1/8	1.2	0.05	140	118	57	67	51	50	63	48	47	60	60	-	8262H079 ♣	2	●	9.1/F	18.6/H
1/8	1.2	0.05	103	93	57	52	43	39	48	39	37	60	60	8262H096 ♣	-	2	●	6.1/F	10.6/H
1/8	1.2	0.05	103	93	57	-	-	-	-	-	-	60	-	-	8262H173 ♣	2	●	6.1/F	-
1/8	1.2	0.05	103	103	103	81	79	65	69	67	59	60	60	8262H099 ♣	-	1	●	10.1/F	11.6/H
1/8	1.2	0.05	52	52	50	52	44	38	52	41	34	82	82	8262H001	8262H012	2	❍	6.1/F	10.6/H
1/8	2.4	0.18	50	28	28	42	28	28	41	28	28	82	82	8262H277	8262H178	1	❍	17.1/F	22.6/H
1/8	2.4	0.18	-	-	-	20	20	19	17	17	18	-	82	-	8262H177 ③	1	❍	-	11.6/H
1/8	2.4	0.18	34	24	22	20	14	14	20	14	13	82	82	8262H011	-	2	❍	9.1/F	18.6/H
1/8	2.4	0.18	26	23	13	16	11	11	15	10	10	82	82	8262H014	8262H015	2	❍	6.1/F	10.6/H
1/8	3.2	0.30	34	26	24	19	19	16	17	17	16	82	82	8262H105	8262H174	1	❍	17.1/F	22.6/H
1/8	3.2	0.30	23	21	15	-	-	-	-	-	-	82	-	-	8262H179	1	❍	10.1/F	-
1/8	3.2	0.30	19	18	13	11	9	9	11	8	8	82	82	8262H016	-	2	❍	9.1/F	18.6/H
1/8	3.2	0.30	13	12	8	9	8	7	8	7	6	82	82	8262H002	8262H006	2	❍	6.1/F	10.6/H
1/4	1.2	0.05	152	152	117	81	79	65	69	67	59	60	60	-	8262H214 ♣	3	●	10.1/F	11.6/H
1/4	1.2	0.05	103	103	103	81	79	65	69	67	59	60	60	8262H200 ♣	-	3	●	10.1/F	11.6/H
1/4	1.2	0.05	103	103	103	103	103	103	103	103	103	60	60	8262H107 ♣	-	3	●	17.1/F	22.6/H
1/4	1.2	0.05	-	-	-	138	138	119	131	131	117	-	60	-	8262H181 ♣	3	●	-	22.6/H
1/4	1.2	0.05	103	93	57	52	43	37	48	39	34	60	60	8262H106 ♣	8262H180 ♣	4	●	6.1/F	10.6/H
1/4	1.2	0.05	52	52	50	52	44	38	52	41	34	82	82	8262H019	8262H080	4	❍	6.1/F	10.6/H
1/4	2.4	0.18	50	28	28	42	28	28	41	28	28	82	82	8262H109	8262H183 ③	3	❍	17.1/F	22.6/H
1/4	2.4	0.18	41	28	28	20	20	19	17	17	16	82	82	8262H108	8262H182 ③	3	❍	10.1/F	11.6/H
1/4	2.4	0.18	34	24	19	20	14	14	20	14	13	82	82	8262H021	-	4	❍	9.1/F	18.6/H
1/4	2.4	0.18	26	23	11	16	11	11	15	10	10	82	82	8262H020	8262H086	4	❍	6.1/F	10.6/H
1/4	3.2	0.30	34	26	24	19	19	16	17	17	16	82	82	8262H110	8262H185 ③	3	❍	17.1/F	22.6/H
1/4	3.2	0.30	23	21	15	9	9	8	8	7	7	82	82	8262H232	-	3	❍	10.1/F	11.6/H
1/4	3.2	0.30	23	21	15	-	-	-	-	-	-	82	-	-	8262H184 ③	3	❍	10.1/F	-
1/4	3.2	0.30	19	18	10	11	9	8	11	8	8	82	82	8262H023	-	4	❍	9.1/F	18.6/H
1/4	3.2	0.30	13	12	6	9	8	6	8	7	6	82	82	8262H022	8262H007	4	❍	6.1/F	10.6/H
1/4	4.0	0.45	21	14	14	9	9	9	8	8	8	82	82	8262H112	8262H187 ③	3	❍	17.1/F	22.6/H
1/4	4.0	0.45	14	14	10	4	4	4	4	4	4	82	82	8262H202	-	3	❍	10.1/F	11.6/H
1/4	4.0	0.45	14	14	10	-	-	-	-	-	-	82	-	-	8262H220 ③	3	❍	10.1/F	-
1/4	4.0	0.45	10	10	7	7	5	5	6	5	5	82	82	8262H113	-	4	❍	9.1/F	18.6/H
1/4	4.0	0.45	7	7	4	5	4	4	5	4	4	82	82	8262H111	8262H186	4	❍	6.1/F	10.6/H
1/4	5.6	0.63	9	9	9	5	5	5	4	4	4	82	82	8262H114	8262H188	3	❍	17.1/F	22.6/H
1/4	5.6	0.63	7	7	7	2	2	2	2	2	2	82	82	8262H208	-	3	❍	10.1/F	11.6/H
1/4	5.6	0.63	7	7	7	-	-	-	-	-	-	82	-	-	8262H226	3	❍	10.1/F	-
1/4	5.6	0.63	4	4	3	3	2	2	2	2	2	82	82	8262H013	8262H036	4	❍	6.1/F	10.6/H
1/4	7.1	0.76	6	6	6	4	3	3	3	3	3	82	82	8262H212	8262H230	3	❍	17.1/F	22.6/H
1/4	7.1	0.76	4	5	4	2	2	2	2	2	1	82	82	8262H210	-	3	❍	10.1/F	11.6/H
1/4	7.1	0.76	4	5	4	-	-	-	-	-	-	82	-	-	8262H189	3	❍	10.1/F	-
1/4	7.1	0.76	2	2	2	2	2	1	2	2	1	82	82	8262H090	8262H038	4	❍	6.1/F	10.6/H
3/8	3.2	0.30	34	26	24	19	21	11	17	19	10	82	82	8263H115	8263H191	5	❍	17.1/F	22.6/H
3/8	3.2	0.30	23	21	15	9	9	6	8	7	5	82	82	8263H232	-	5	❍	10.1/F	11.6/H
3/8	3.2	0.30	23	21	15	-	-	-	-	-	-	82	82	-	8263H190	5	❍	10.1/F	-
3/8	3.2	0.30	19	18	10	11	9	8	11	8	7	82	82	8263H003	-	6	❍	9.1/F	18.6/H
3/8	3.2	0.30	13	12	6	9	8	6	8	7	5	82	82	8263H002	8263H330	6	❍	6.1/F	10.6/H
3/8	4.0	0.45	21	14	13	9	9	7	8	8	6	82	82	8263H118	8263H193	5	❍	17.1/F	22.6/H
3/8	4.0	0.45	14	13	7	4	4	3	4	4	3	82	82	8263H200	-	5	❍	10.1/F	11.6/H
3/8	4.0	0.45	14	13	7	-	-	-	-	-	-	82	-	-	8263H331 ③	5	❍	10.1/F	-
3/8	4.0	0.45	10	10	6	7	5	5	6	5	5	82	82	8263H117	-	6	❍	9.1/F	18.6/H
3/8	4.0	0.45	7	7	3	5	4	4	5	4	4	82	82	8263H116	8263H192	6	❍	6.1/F	10.6/H
3/8	5.6	0.63	9	7	7	5	5	5	4	4	4	82	82	8263H206 ③	8263H332	5	❍	17.1/F	22.6/H
3/8	5.6	0.63	7	6	5	2	2	2	2	2	2	82	82	8263H124	-	5	❍	10.1/F	11.6/H
3/8	5.6	0.63	7	6	5	-	-	-	-	-	-	82	-	-	8263H195	5	❍	10.1/F	-
3/8	5.6	0.63	4	4	2	3	2	2	2	2	2	82	82	8263H119	8263H194	6	❍	6.1/F	10.6/H
3/8	7.1	0.76	7	6	5	4	3	3	3	3	3	82	82	8263H210	8263H333	5	❍	17.1/F	22.6/H
3/8	7.1	0.76	4	4	3	-	-	-	-	-	-	82	-	8263H125	8263H197	5	❍	10.1/F	-
3/8	7.1	0.76	2	2	1	2	2	1	2	2	1	82	82	8263H054	8263H196	6	❍	6.1/F	10.6/H

♣ Only available with UR disc, limits min. ambient temp. to 32˚F (0˚C). ¶ Water rating, CSA certified up to 16 bar. ③ ATEX/IECEx certified with prefix "EV".
● = General Purpose Valve, ❍ = Safety Shutoff Valve

Dimensions: inches (mm)

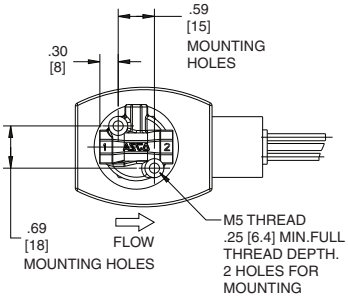
Const. Ref.		H	K	L	P	W
1	ins	3.05	1.71	1.19	2.69	1.95
	mm	77	43	30	68	50
2	ins	2.85	1.60	1.19	2.50	1.69
	mm	72	41	30	63	43
3	ins	3.12	1.79	1.56	2.76	1.95
	mm	79	45	40	70	50
4	ins	2.96	1.72	1.56	2.60	1.69
	mm	75	44	40	66	43
5	ins	3.20	1.79	1.88	2.77	1.95
	mm	81	45	48	70	50
6	ins	3.03	1.72	1.88	2.60	1.69
	mm	77	44	48	66	43

Const. Ref. 1-6

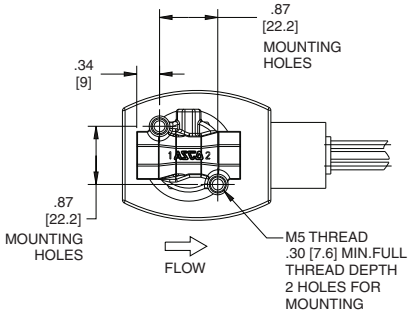


Mounting Dimensions

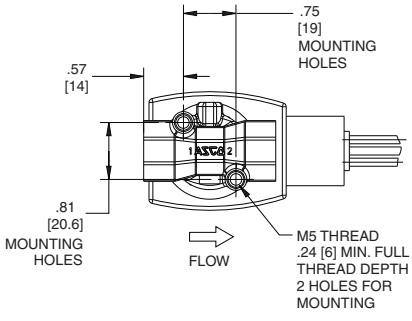
Const. Ref. 1, 2
(1/8" Pipe)



Const. Ref. 3, 4
(1/4" Pipe)



Const. Ref. 5, 6
(3/8" Pipe)



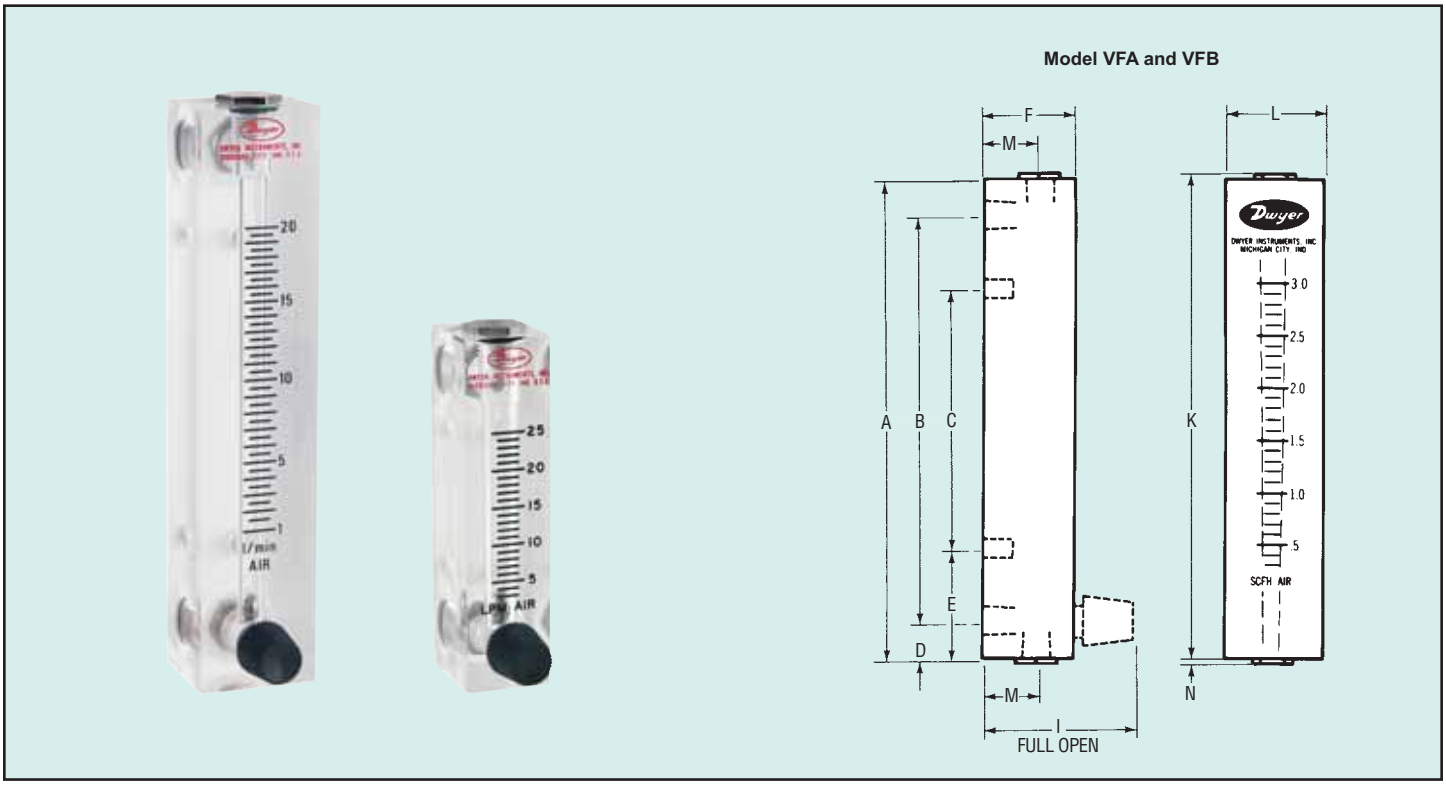
Note: Mounting holes will accept a standard #10-32 machine screw.

TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
SCUM PUMP SEAL WATER
FLOW INDICATOR P/N: VFB-85

Series VFA & VFB

Visi-Float® Flowmet

Used to Indicate or Manually Control Air or Water Flow



The Visi–Float® flowmeter bodies are cut and precision machined from solid, clear acrylic plastic blocks. This construction not only produces a handsome finished product, but permits complete visual inspection. As a result, the Visi-Float® flowmeters are especially popular for medical and laboratory equipment applications.

Scales are easy to read – The front scale location and white background provides excellent visibility. The direct reading scales are hot stamped into the plastic and will not wear off. Mid-range calibration is established with a master flowmeter. Accuracy is ±5% of full scale for VFA models, ±3% for VFB. Scales average 2" long on the VFA models, 4" long on VFB.

Durable and attractive construction – The machined acrylic bodies of the Visi-Float® flowmeters are practically unbreakable. Fabrication is backed by over 60 years of experience in acrylic instrument machining. The tapered bore is precision machined to a smooth surface that provides perfect visibility of the indicating float. The VFA and VFB models are available with either brass or stainless steel inlet and outlet connections and are tapped for 1/8˝ NPT thread. VFB models 85 and 86 have either 1/4˝ back or 3/8˝ end connections. All standard models employ Buna-N "O" rings for leak proof operation and are available with either back or end connections for horizontal or vertical piping. Precision metering valves in brass or stainless steel are available for most VFA and VFB models.

Easy installation – All Visi-Float® flowmeters have metal mounting inserts on rear for panel mounting. They can also be supported directly by system piping.

Dimension-In-Inches		
	Model VFA	**Model VFB**
A	4	6-1/2
B	3 (1/8 female NPT)	5-1/2 (1/8 female NPT)
C	1-5/8 (10-32 Thread)	3-1/2 (10-32 thread)
D	1/2	1/2
E	1-3/16	1-1/2
F	1-1/4	1-1/4
I	2-1/16 (BV or SSV)	2-1/16 (BV or SSV)
K	4-3/32	6-19/32
L	1	1-3/8
M	3/4 (EC)	3/4 (EC)
N	3/32 (EC)	3/32 (EC)

Special Multi-Column Visi-Float® Flowmeters
Perfect for OEM applications, Visi-Float® flowmeters can be custom made with up to 10 columns in a single block of acrylic plastic.
Available with or without valves. Consult factory for more information.

OEM Specials – Special flowmeter designs can be supplied to meet a wide range of requirements and specific applications. These include: on-off plunger and push-to-test valves, special gas or fluid calibration, special ranges, scales, name brand or other identification. Pointer flags can be furnished for instant visual reference. For specific information, please supply an outline of your requirements.

SPECIFICATIONS
Service: Compatible gases & liquids.
Wetted Materials:
Body: Acrylic plastic.
O-ring: Buna-N (Fluoroelastomer available).
Metal Parts: Brass standard, stainless steel optional.
Float: Stainless steel, black glass, aluminum, K Monel depending on range.
Temperature & Pressure Limits:
Without Valve: 100 psig (6.9 bar) @ 150°F (65°C);
150 psig (10 bar) @ 100°F (38°C).
With Valve: 100 psig (6.9 bar) @ 120°F (48°C).
Accuracy: VFA = 5% of full scale; VFB = 3% of full scale.
Process Connection: 1/8″ female NPT. VFB ranges 85 and 86 have 1/4″ NPT back connections or 3/8″ NPT end connections. These ranges not available with brass valves.
Scale Length: VFA 2″ typical length; VFB 4″ typical length.
Mounting Orientation: Mount in vertical position.
Weight: VFA: 4.0-4.8 oz (.11-.14 kg). VFB: 7.2-8.8 oz (.20-.25 kg).

How To Order
Series—Range No.—Valve—Option
Example: VFA-9-BV
Series VFA with 20-200 SCFH Air Range & Brass Valve

VFA Series

Model	Description
VFA-X	Standard VFA
VFA-X-SS	VFA with Stainless Metal Wetted Parts
VFA-X-BV	VFA with Brass Valve
VFA-X-SSV	VFA with Stainless Steel Valve
VFA-X-EC	VFA with End Connections
VFA-X-EC-SS	VFA with End Connections and Stainless Steel Metal Wetted Parts

OPTIONS & ACCESSORIES
-PF, Red ABS Plastic Pointer Flag
-VIT, Fluoroelatomer O-rings
RKA, Pressure Regulator

Popular Ranges

Model VFA — 2" Scale			
Range No.	**Range SCFH Air**	**Range No.**	**Range LPM Air**
1	.1-1	21	.06-0.5
2	.2-2	22	.15-1
3	.6-5	23	.6-5
4	1-10	24	1-10
5	2-20	25	3-25
6	4-30	26	6-50
7	5-50	27	10-100
8	10-100		
9	20-200		
	CC Water per min.		**Gal. Water per hour**
32	6-50	41	.6-5
33	10-100	42	2-10
34	20-200	43	3-20
		44	8-40

VFB Series

Model	Description
VFB-X	Standard VFB
VFB-X-SS	VFB with Stainless Metal Wetted Parts
VFB-X-BV	VFB with Brass Valve
VFB-X-SSV	VFB with Stainless Steel Valve
VFB-X-EC	VFB with End Connections
VFB-X-EC-SS	VFB with End Connections and Stainless Steel Metal Wetted Parts

OPTIONS & ACCESSORIES
-PF, Red ABS Plastic Pointer Flag
-VIT, Fluoroelastomer O-rings
RK-VFB, Pressure Regulator

Popular Ranges

Model VFB — 4" Scale			
Range No.	**Range SCFH Air**	**Range No.**	**LPM Air**
50	.3-3	65	.2-4
91⁺	1-10	66	1-10
51⁺	2-20	67	1-20
52	4-40	68	3-30
53⁺	10-100	69	4-40
54⁺	10-150		**CC/Min. Water**
55⁺	20-200	82	2-30
	SCFM Air		**GPH Water**
90	.3-3	80⁺	.5-12
	CC/Min. Air	83⁺	1-20
60	100-1000	84	6-40
		81	6-60
			GPM Water
		85*	.2-2
		86*	.6-5

⁺ For dual range models in English and Metric add "D" to end of Range No.
* Ranges 85 and 86 consult factory. Not available with brass valve.

Series V6 FLOTECT® Flow Switch

Specifications - Installation and Operating Instructions

TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
SCUM PUMP SEAL WATER
FLOW SWITCH P/N: V6EPB-B-S-LF-CSA

The Series V6 FLOTECT® Flow Switch is an inexpensive, explosion-proof flow switch for use on air, water or other compatible gases and liquids. Three configurations are available - 1. Factory installed in a tee. 2. With a trimmable vane for field adjustment and installation in a suitable tee. 3. Low flow models with an integral tee and adjustable valve. All are available with an optional enclosure which is UL and CSA listed, or Directive 94/9/EC (ATEX) compliant for
CE Ex II 2 G Ex d IIC T6 Gb
Process Temp≤75°C or IECEx compliant for Ex d IIC T6 Gb Process Temp ≤ 75°C.

INSTALLATION

Unpack and remove any packing material found inside lower housing or tee.

Switch can be installed in any position but the actuation/deactuation flow rates in the charts are based on horizontal pipe runs and are nominal values. For more precise settings, units can be factory calibrated to specific flow rates.

V6 Models with Tee are supplied in 1/2″ - 2″ NPT sizes. Install in piping with arrow pointing in direction of flow.

V6 Low Flow Models have 1/2″ NPT connections and are field adjustable. Install in piping with arrow pointing in direction of flow. To adjust, loosen the four socket head cap screws on bottom. The adjustment valve rotates 90° between “O” (open) and “C” (closed). See flow charts for approximate ranges. Tighten screws once the required flow rate has been set.

V6 with Field Trimmable Vane. These models enable the installer to choose approximate actuation/deactuation points by trimming the full size vane at appropriate letter-designated marks on a removable template. Flows are defined in the following charts. Note that the charts are based on either brass or cast iron reducing tees or stainless or forged steel straight tees with bushings where necessary. Install in piping with arrow pointing in direction of flow.

When bushings are used, they must be back drilled to allow proper clearance for unrestricted vane travel. Bore the I.D. to 13/16″ (20 mm) on 1/2″ x 3/4″ bushings or 1″ (25 mm) on larger bushings. The depth of the bore must leave internal threads 9/16″ (14 mm) high for proper engagement between the lower housing of the switch and the bushing. Check for proper vane travel and switch operation after installation.

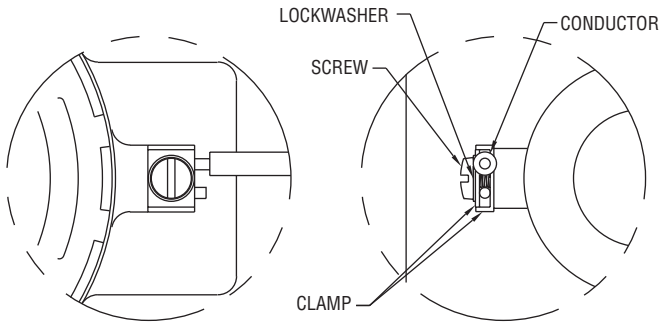
SPECIFICATIONS

Service: Gases or liquids compatible with wetted materials.
Wetted Materials: Standard V6 Models: Vane: 301 SS; Lower Body: brass or 303 SS; Magnet: ceramic; Other: 301, 302 SS; Tee: brass, iron, forged steel, or 304 SS. V6 Low Flow Models: Lower Body: brass or 303 SS; Tee: brass or 304 SS; Magnet: ceramic; O-ring: Buna-N standard, Fluoroelastomer optional; Other: 301, 302 SS.
Temperature Limits: -4 to 220°F (-20 to 105°C) Standard, MT high temperature option 400°F (205°C) (MT not UL, CSA, ATEX, IECEx or KC) ATEX Compliant AT, IECEx IEC Option and KC (KC Option), Ambient Temperature -4 to 167°F (-20 to 75°C) Process Temperature: -4 to 220°F (-20 to 105°C).
Pressure Limit: Brass lower body with no tee models 1000 psig (69 bar), 303 SS lower body with no tee models 2000 psig (138 bar). Brass tee models 250 psi (17.2 bar), iron tee models 1000 psi (69 bar), forged and stainless steel tee models 2000 psi (138 bar), low flow models 1450 psi (100 bar).
Enclosure Rating: Weatherproof and Explosion-proof. Listed with UL and CSA for Class I, Groups A, B, C and D; Class II, Groups E, F, and G. (Group A on stainless steel body models only).
CE 0344 Ex II 2 G Ex d IIC T6 Gb Process Temps≤75°C Alternate Temperature Class T5 Process Temps≤90°C, 115°C (T4) Process Temp ≤105°C consult factory. EC-type Certificate No.: KEMA 04ATEX2128.
ATEX Standards: EN 60079-0: 2009; EN 60079-1: 2007.
IECEx Certified: For Ex d IIC T6 Gb Process Temps≤75°C Alternate Temperature Class T5 Process Temps≤90°C, 115°C (T4) Process Temps≤105°C consult factory.
IECEx Certificate of Conformity: IECEx DEK 11.0039;
IECEx Standards: IEC 60079-0: 2007; IEC 60079-1: 2007;
Korean Certified (KC) for: Ex d IIC T6 Gb Process Temp≤75°C;
KTL Certificate Number: 2012-2454-75.
Switch Type: SPDT snap switch standard, DPDT snap switch optional.
Electrical Rating: UL models: 5A @125/250 VAC. CSA, ATEX and IECEx models: 5A @ 125/250 VAC (V~); 5A res., 3A ind. @ 30 VDC (V⎓). MV option: .1A @ 125 VAC (V~). MT option: 5A @125/250 VAC (V~). [MT option not UL, CSA, ATEX or IECEx].
Electrical Connections: UL models: 18 AWG, 18″ (460 mm) long. ATEX/CSA /IECEx models: terminal block.
Upper Body: Brass or 303 stainless steel.
Conduit Connections: 3/4″ male NPT standard, 3/4″ female NPT on junction box models.
Process Connection: 1/2″ male NPT on models without a tee.
Mounting Orientation: Switch can be installed in any position but the actuation/deactuation flow rates in the charts are based on horizontal pipe runs and are nominal values.
Set Point Adjustment: Standard V6 models none. Without tee models vane is trimmable. Low flow models are field adjustable in the range shown. See set point charts on opposite page.
Weight: 2 to 6 lb (.9 to 2.7 kg) depending on construction.
Options not Shown: Custom calibration, bushings, PVC tee, reinforced vane, DPDT relays.

ELECTRICAL CONNECTIONS

Connect wire leads in accordance with local electrical codes and switch action required. N.O. contacts will close and N.C. contacts will open when flow increases to the actuation point. They will return to “normal” condition when flow decreases to the deactuation point. Black = Common, Blue = Normally Open and Red = Normally Closed.

For units supplied with both internal ground and external bonding terminals, the ground screw inside the housing must be used to ground the control. The external bonding screw is for supplementary bonding when allowed or required by local code. When external bonding conductor is required, conductor must be wrapped a minimum of 180° about the external bonding screw. See below. Some CSA listed models are furnished with a separate green ground wire. Such units must be equipped with a junction box, not supplied but available on special order.



FRONT VIEW DETAIL SIDE VIEW DETAIL

W.E. ANDERSON DIV., DWYER INSTRUMENTS, INC.
P.O. BOX 358 • MICHIGAN CITY, INDIANA 46360 U.S.A.
Phone: 219/879-8000
Fax: 219/872-9057
www.dwyer-inst.com
e-mail: info@dwyer-inst.com

EC-Type Certificate, IECEx and KC Installation Instructions:

Cable Connection
The cable entry device shall be certified in type of explosion protection flameproof enclosure “d”, suitable for conditions of use and correctly installed. For Ta ≥ 65°C cable and cable gland rated ≥ 90°C shall be used.

Conduit Connection
An Ex d certified sealing device such as a conduit seal with setting compound shall be provided immediately to the entrance of the valve housing. For Ta ≥ 65°C wiring and setting compound, in the conduit seal, rated ≥ 90°C shall be used.

Note: ATEX, IECEx and KC units only: The temperature class is determined by the maximum ambient and or process temperature. Units are intended to be used in ambient of -20°C≤ Tamb ≤75°C. Units may be used in process temperatures up to 105°C providing the enclosure and switch body temperature do not exceed 75°C. The standard Temperature Class is T6 Process Temp ≤75°C. Alternate Temperature Class of T5 Process Temp ≤90°C and 115°C (T4) Process Temp ≤105°C are available consult factory.

Refer to Certificate No: IECEx DEK 11.0039 for conditions of safe use for IECEx compliant units.

All wiring, conduit and enclosures must meet applicable codes for hazardous areas. Conduits and enclosures must be properly sealed. For outdoor or other locations where temperatures vary widely, precautions should be taken to prevent condensation inside switch or enclosure. Electrical components must be kept dry at all times.

CAUTION: To prevent ignition of hazardous atmospheres, disconnect the device from the supply circuit before opening. Keep assembly tightly closed when in use.

MAINTENANCE
Inspect and clean wetted parts at regular intervals. The cover should be in place at all times to protect, the internal components from dirt, dust and weather and to maintain hazardous location ratings. Disconnect device from the supply circuit before opening to prevent ignition of hazardous atmosphere. Repairs to be conducted by Dwyer Instruments, Inc. Units in need of repair should be returned to the factory prepaid.

V6 With Tee

Cold Water - Factory Installed Tee
Approximate actuation/deactuation low Rates
GPM upper, **M³/HR** lower

1/2″ NPT		3/4″ NPT		1″ NPT		1-1/4″ NPT		1-1/2″ NPT		2″ NPT	
1.5	1.0	2.0	1.25	3.0	1.75	4.0	3.0	6.0	5.0	10.0	8.5
0.34	0.23	0.45	0.28	0.68	0.40	0.91	0.68	1.36	1.14	2.27	1.93

Air-Factory Installed Tee
Approximate actuation/deactuation flow rates
SCFM upper, **NM³/M** lower

1/2″ NPT		3/4″ NPT		1″ NPT		1-1/4″ NPT		1-1/2″ NPT		2″ NPT	
6.5	5.0	10.0	8.0	14	12	21	18	33	30	43	36
.18	.14	.28	.23	.40	.34	.59	.51	.93	.85	1.19	1.02

V6 Low Flow, Field Adjustable
Cold Water - Low Flow Models
Approximate actuation/deactuation flow rates
GPM upper, **M³/HR** lower

Minimum		Maximum	
.04	.03	.75	0.60
.009	.007	0.17	0.14

Air - Low Flow Models
Approximate actuation/deactuation flow rates
SCFM upper, NM³/M lower

Minimum		Maximum	
.18	.15	2.70	2.0
.005	.004	.08	.06

Example	V6	EP	B	B	S	2	B	MT		V6EPB-B-S-2-B-MT flow switch; brass upper housing, brass lower housing, brass tee with 3/4″ NPT connections, SPDT snap switch, and high temperature option
Series	V6									Series V6 flow switch
Construction		EP								Explosion Proof and Weatherproof
Upper Body Material			B S							Brass 303 Stainless Steel
Lower Body Material				B S						Brass 303 Stainless Steel
Circuit (Switch) Type					S D					SPDT DPDT
Process Connection Size						1 2 3 4 5 6 LF				1/2″ NPT 3/4″ NPT 1″ NPT 1-1/4″ NPT 1-1/2″ NPT 2″ NPT Low Flow Model (1/2″ NPT connections)
Process Connection Type							0 B FS MI PVC PVCSW S S150			No Tee, Male NPT Connection, Field Trimmable Vane Brass Tee Forged Steel Tee Iron Tee PVC Tee with NPT* PVC Tee with sweat joints* 304 Stainless Steel Tee 304 Stainless Steel 150# Tee (For LF Model no tee material chosen, tee material matches lower housing choice)
Switch Options								MV MT		Gold Contacts on snap switch for dry circuits (see specifications for ratings) High Temperature switch rated 400°F (205°C) (see specifications for ratings)*
Options									AT CSA IEC KC CV FTR GL ID JCTLH ORFB ORFS RV TBC VIT 018 020 022 022A 031	ATEX approved construction (weatherproof and explosion-proof junction box) CSA approved construction (weatherproof and explosion-proof junction box)* IECEx approved construction (weatherproof and explosion-proof junction box) Korean certified (KC) approved construction (with JCT option standard) Custom Vane Flow Test Report Ground Lead* Customer Information on standard nameplate Weatherproof and explosion-proof junction box, left side Orifice Brass Orifice Stainless Steel Reinforced Vane Terminal Block Connector* Viton® O-rings in place of Buna-N on low flow models .018 Spring .020 Spring .022 Spring .022 Spring with Alnico® magnet .031 Spring

* Options that do not have ATEX, IECEx or KC.
Attention: Units without the “AT” suffix are not Directive 94/9/EC (ATEX) compliant. These units are not intended for use in potentially hazardous atmospheres in the EU. These units may be CE marked for other Directives of the EU.

V6 With Field Trimmable Vane
Cold Water - Brass or Cast Iron Reducing Tee
Approximate actuation/deactuation flow rates
GPM upper, **M^3/HR** lower

Vane	1/2″ NPT		3/4″ NPT		1″ NPT		1-1/4″ NPT		1-1/2″ NPT		2″ NPT	
Full Size											9.0	8.5
											2.0	1.9
a											9.5	9.0
											2.2	2.0
b											10.0	9.3
											2.3	2.1
c											11.0	10.0
											2.5	2.3
d									6.2	5.5	12.0	10.0
									1.4	1.2	2.7	2.3
e									7.0	6.5	13.0	11.0
									1.6	1.5	3.0	2.5
f							4.3	3.9	7.6	7.1	14.0	12.0
							1.0	0.9	1.7	1.6	3.2	2.7
g							4.9	4.4	8.0	7.3		
							1.1	1.0	1.8	1.7		
h							5.5	5.0	9.0	8.2		
							1.2	1.1	2.0	1.9		
i					3.5	3.1	6.0	5.6	10.0	9.0		
					0.8	0.7	1.4	1.3	2.3	2.0		
j					4.0	3.5	7.0	6.6	13.0	11.0		
					0.9	0.8	1.6	1.5	3.0	2.5		
k					4.6	4.2	8.0	7.6	15.0	13.0		
					1.04	0.95	1.8	1.7	3.4	3.0		
l			2.6	2.3	5.6	5.2	10.0	9.0				
			0.6	0.5	1.3	1.2	2.3	2.0				
m	1.6	1.3	3.5	3.1	6.3	6.1	12.0	10.0				
	0.4	0.3	0.8	0.7	1.43	1.39	2.7	2.3				
n	2.2	1.8	4.3	3.8	8.0	7.5						
	0.5	0.4	1.0	0.9	1.8	1.7						
o	3.0	2.4										
	0.7	0.5										

Vane	1/2″ NPT		3/4″ NPT		1″ NPT		1-1/4″ NPT		1-1/2″ NPT		2″ NPT	
Full Size											39.0	37.0
											1.10	1.05
a											40.0	38.0
											1.13	1.08
b											42.0	40.0
											1.19	1.13
c											50.0	44.0
											1.42	1.25
d											27.0	25.0	55.0	46.0
											0.76	0.71	1.56	1.30
e											30.0	28.0		
											0.85	0.79		
f											20.0	18.0	32.0	30.0
											0.57	0.51	0.91	0.85
g											21.0	19.0	34.0	32.0
											0.59	0.54	0.96	0.91
h											23.0	21.0	37.0	34.0
											0.65	0.59	1.05	0.96
i									16.0	15.0	24.0	22.0	39.0	36.0
									0.45	0.42	0.68	0.62	1.10	1.02
j									18.0	16.0	28.0	25.0	51.0	45.0
									0.51	0.45	0.79	0.71	1.44	1.27
k									19.0	17.0	33.0	30.0	69.0	57.0
									0.54	0.48	0.93	0.85	1.95	1.61
l			13.0	12.0	22.0	20.0	38.0	35.0				
			0.37	0.34	0.62	0.57	1.08	0.99				
m	6.4	3.8	15.0	14.0	25.0	23.0	45.0	42.0				
	0.18	0.11	0.42	0.40	0.71	0.65	1.27	1.19				
n	10.0	7.0	20.0	16.0	32.0	28.0						
	0.28	0.20	0.57	0.45	0.91	0.79						
o	12.0	9.0										
	0.34	0.25										

Cold Water - Stainless or Forged Steel Straight Tee and Bushing
Approximate actuation/deactuation flow rates
GPM upper, **M^3/HR** lower

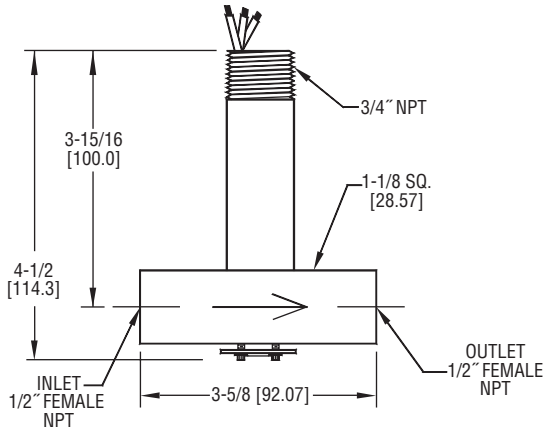
Vane	1/2″ NPT		3/4″ NPT		1″ NPT		1-1/4″ NPT		1-1/2″ NPT		2″ NPT	
Full Size							5.0	4.5	8.5	7.8		
							1.1	1.0	1.9	1.8		
a							5.5	5.0	9.2	8.6		
							1.2	1.1	2.1	2.0		
b							6.2	5.7	9.8	9.0		
							1.4	1.3	2.2	2.0		
c							6.8	6.3	12.0	10.0		
							1.5	1.4	2.7	2.3		
d					2.8	2.4	8.5	7.8	13.0	11.0		
					0.6	0.5	1.9	1.8	3.0	2.5		
e					3.4	3.0	10.0	9.2				
					0.8	0.7	2.3	2.1				
f					4.0	3.6	12.0	10.0				
					0.91	0.82	2.7	2.3				
g			2.0	1.5	5.0	4.5						
			0.5	0.3	1.1	1.0						
h			2.5	2.0	6.5	6.1						
			0.6	0.5	1.48	1.39						
i			3.5	3.0	9.0	8.2						
			0.8	0.7	2.0	1.9						
j			7.0	5.5								
			1.6	1.2								
k			10.0	8.0								
			2.3	1.8								

Vane	1/2″ NPT		3/4″ NPT		1″ NPT		1-1/4″ NPT		1-1/2″ NPT		2″ NPT	
Full Size											21.0	18.0	33.0	30.0		
											0.59	0.51	0.93	0.85		
a											22.0	20.0	39.0	36.0		
											0.62	0.57	1.10	1.02		
b											24.0	22.0	42.0	38.0		
											0.68	0.62	1.19	1.08		
c											28.0	26.0	51.0	46.0		
											0.79	0.74	1.44	1.30		
d									12.0	10.0	33.0	30.0	55.0	50.0		
									0.34	0.28	0.93	0.85	1.56	1.42		
e									14.0	12.0	37.0	34.0				
									0.40	0.34	1.05	0.96				
f									16.0	14.0	43.0	40.0				
									0.45	0.40	1.22	1.13				
g			8.0	6.5	19.0	17.0										
			0.23	0.18	0.54	0.48										
h			11.0	10.0	26.0	24.0										
			0.31	0.28	0.74	0.68										
i			14.0	13.0	32.0	30.0										
			0.40	0.37	0.91	0.85										
j			27.0	24.0												
			0.76	0.68												
k			39.0	36.0												
			1.10	1.02												

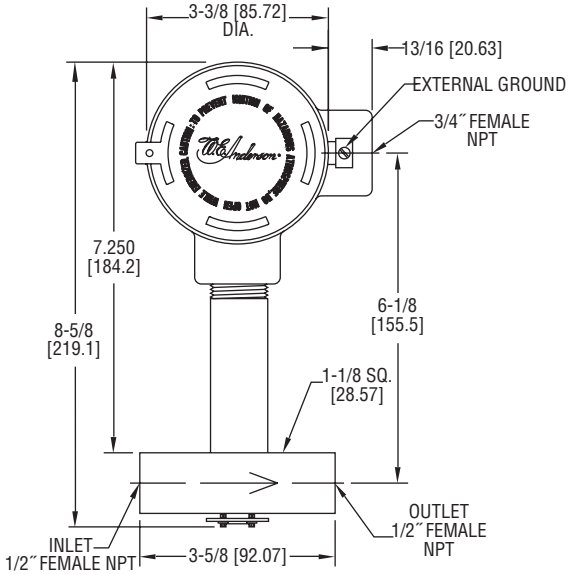
Air - Brass or Cast Iron Reducing Tee
Approximate actuation/deactuation flow rates
SCFM upper, **NM^3/M** lower

Air - Stainless or Forged Steel Straight Tee and Bushing
Approximate actuation/deactuation flow rates
SCFM upper, **NM^3/M** lower

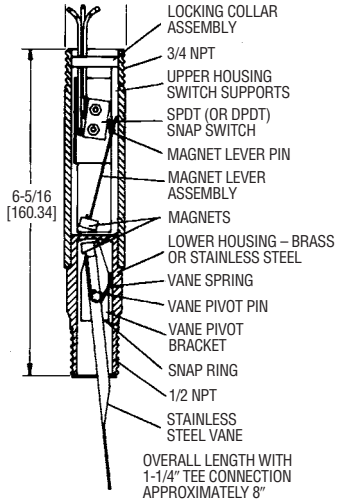
DIMENSIONS
Series V6 FLOTECT® Flow Switch



V6 Low Flow

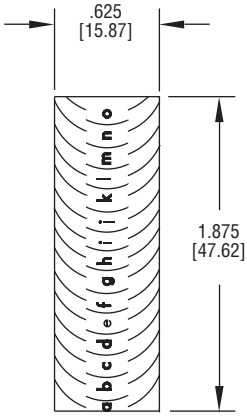


V6 Low Flow with CSA, ATEX Conduit Enclosure

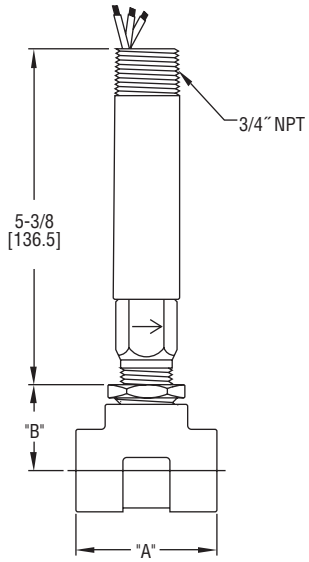


V6 with Field Trimmable Vane

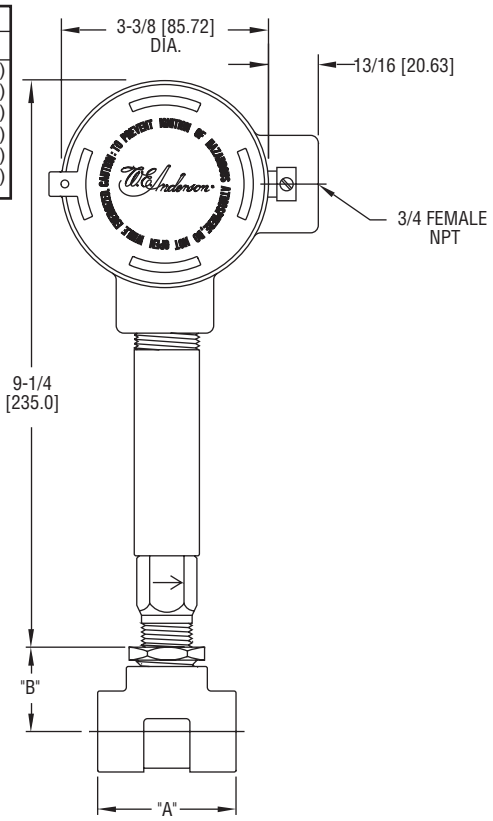
Pipe Size	Brass/Ductile Iron		Forged/Stainless Steel		Malleable Iron	
	Dim. A	Dim. B	Dim. A	Dim. B	Dim. A	Dim. B
1/2″	2-1/4 (57)	1-1/8 (29)	2-1/4 (57)	1-1/8 (29)	2-1/2 (64)	1-1/4 (32)
3/4″	2-3/8 (60)	1-1/4 (32)	2-5/8 (67)	1-7/8 (47)	2-5/8 (67)	1-3/8 (35)
1″	2-1/2 (64)	1-3/8 (35)	3 (76)	2-1/8 (54)	2-7/8 (73)	1-1/2 (38)
1-1/4″	2-5/8 (67)	1-1/2 (38)	3-1/2 (89)	2-1/2 (64)	3 (76)	1-3/4 (44)
1-1/2″	2-7/8 (73)	1-5/8 (41)	4 (102)	2-3/4 (70)	3-1/4 (83)	1-7/8 (48)
2″	3 (76)	1-7/8 (48)	4-3/4 (121)	3-1/8 (79)	3-1/2 (89)	2-1/8 (54)



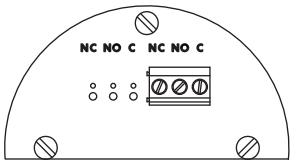
Trimmable Vane



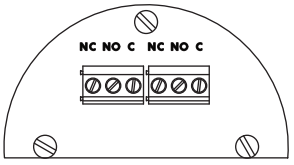
V6 with Tee



V6 with Tee and CSA, ATEX Conduit Enclosure



SPDT



DPDT

Terminal Connections CSA, ATEX Enclosures

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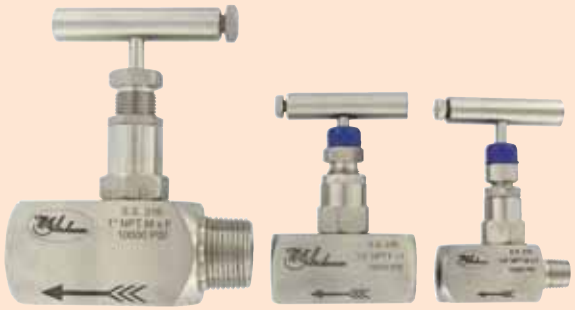
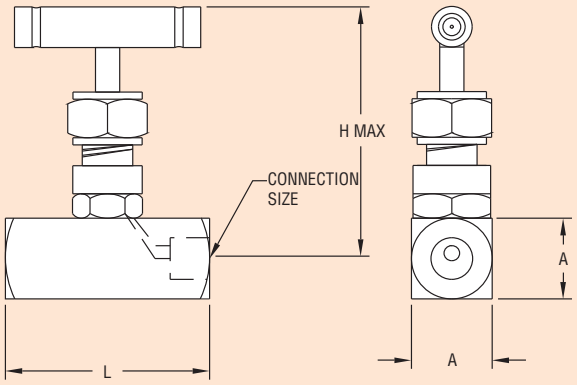
TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
SCUM PUMP SEAL WATER
NEEDLE VALVE P/N: HNV-SSS32B

Series HNV

Needle Valve

For Use with Gas and Liquids, Pressures Up to 6000 psi





DIMENSIONS in (mm)

CONNECTION	A	L	H	CONNECTION	A	L	H	CONNECTION	A	L	H
1/8˝ F x F	7/8 (22.3)	1-31/32 (50.01)	2-3/8 (60.33)	3/8˝ F x F	63/64 (25)	2-3/8 (60.33)	2-9/16 (65.09)	3/4˝ F x F	1-1/2 (38.10)	2-61/64 (59.13)	3-23/64 (85/33)
1/8˝ M x F		2-11/64 (55.17)		3/8˝ M x F		2-9/16 (65.09)		3/4˝ M x F		3-5/32 (80.17)	
1/8˝ M x M		2-3/8 (60.33)		3/8˝ M x M		2-49/64 (70.25)		3/4˝ M x M		3-23/64 (85.33)	
1/4˝ F x F	63/64 (25)	2-3/8 (60.33)	2-9/16 (65.09)	1/2˝ F x F	1-17/64 (32.15)	2-9/16 (65.09)	2-49/64 (70.25)	1˝ F x F	1-25/32 (45.24)	3-23/64 (85.33)	3-3/4 (95.25)
1/4˝ M x F		2-9/16 (65.09)		1/2˝ M x F		2-49/64 (70.25)		1˝ M x F		4-7/64 (104.38)	
1/4˝ M x M		2-49/16 (70.25)		1/2˝ M x M		2-61/64 (59.13)		1˝ M x M		4-9/64 (105.17)	

Series HNV Needle Valve is a barstock style needle valve that is designed for controlling low flow rates of liquids or gases. The valve series features fine threading and large seat area to ensure precise flow control. Wetted materials are 316 SS and PTFE making these ideal for use with corrosives. The HNV has been tested to assure vibration and thermal stability.

Body includes a lock pin to prevent accidental bonnet disengagement. The HNV is available in male x male, male x female, and female x female connections from 1/8˝ to 1˝. Tee handle is constructed of 316 SS and allows low torque operation.

FEATURES

- Solid Barstock Body
- 6000 psi (431 bar) Pressure Rating
- Panel Mountable
- Bubble Tight Shutoff
- Bonnet Lock Pin

APPLICATIONS

Test stands, laboratories, mobile equipment, hydraulic systems, sampling systems, metering service, and corrosives.

SPECIFICATIONS

Service: Gases and liquids compatible with wetted materials.
End Connections: NPT.
Wetted Materials: 316 SS and PTFE packing.
Pressure Limits: 6000 psi (431 bar) @ 200°F (93°C). 4000 psi (276 bar) @ 464°F (240°C).
Temperature Limits: 464°F (240°C).
Other Materials: Handle: 316 SS.
Options: Contact the factory for tube and BS connections, other materials of construction, NACE certified, and round handwheel handles.

HNV Needle Valve			
Pipe Size	Female X Female	Female X Male	Male X Male
	Model	Model	Model
1/8˝	HNV-SSS31B	HNV-SSS21B	HNV-SSS11B
1/4˝	HNV-SSS32B	HNV-SSS22B	HNV-SSS12B
3/8˝	HNV-SSS33B	HNV-SSS23B	HNV-SSS13B
1/2˝	HNV-SSS34B	HNV-SSS24B	HNV-SSS14B
3/4˝	HNV-SSS35B	HNV-SSS25B	HNV-SSS15B
1˝	HNV-SSS36B	HNV-SSS26B	HNV-SSS16B

Valves

TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317
SCUM PUMP SEAL WATER
Y-STRAINER P/N: 1/2" YS 52-BZ

TITAN FLOW CONTROL, INC.

INSTALLATION, OPERATION, AND MAINTENANCE

PREFACE:

This manual contains information concerning the installation, operation, and maintenance of Titan Flow Control (Titan FCI) WYE Type Strainers. To ensure efficient and safe operation of Titan FCI WYE Strainers, the instructions in this manual should be thoroughly read and understood. This manual is general in nature and is not meant to take the place of an on-site, process engineer or pipe fitter. As such, Titan FCI recommends that only experienced, skilled personnel be allowed to install and maintain Titan FCI WYE Strainers. Please retain this manual in a location where it is readily available for reference.

GENERAL INFORMATION:

A WYE Strainer is installed into a pipeline system to remove unwanted debris from the pipeline flow by utilizing a perforated or mesh lined straining element. This is illustrated in Figure 1. WYE Strainers remove only insoluble floating impurities with the most common range of particle retention ranging from 1 inch to 40 micron (.0015 inch).

Straining of the pipeline flow is accomplished via a perforated or mesh lined screen, internal to the strainer. In general, the size of the screen perforation should be slightly smaller than the smallest debris particle to be removed. If the screen perforation is undersized, the screen may require excessive cleaning. Consequently, if the screen perforation is oversized, unwanted debris may be permitted to flow through the pipeline; possibly damaging downstream equipment.

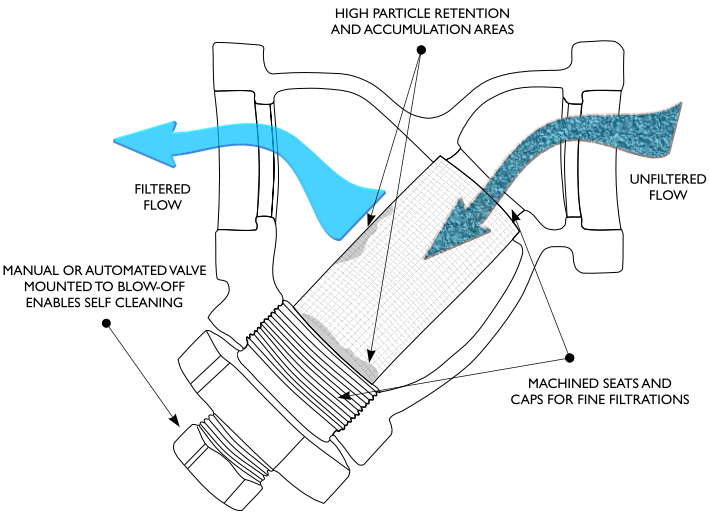


Figure 1: WYE Strainer Straining Illustration

GENERAL INFORMATION: continued...

Titan Flow Control offers a wide variety of WYE Strainer styles to meet all of your strainer requirements. Specific engineering design data, not contained in this manual, may be located within the Specification Sheets for each Strainer Model or within the certified engineering drawing.

Figure 2: WYE Strainer ~ Threaded Ends

Prior to selection of a Titan FCI WYE Strainer, the following factors must be determined:

- Material construction requirements of WYE Strainer.
- Design and working pressure/temperature requirements.
- Operating conditions (throttling, pressure drop, condensation, flow reversal, operation frequency, etc.).
- Pipeline service media type (liquid, gas, abrasive, corrosive, dirty, etc).
- The debris size to be removed.
- The debris loading of the pipeline.
- Pipeline media flow-rate and viscosity.
- Clean start-up pressure of the pipeline.
- Space availability for installation.

Please contact a Titan Design Engineer to assist in the determination of these requirements prior to selection and purchase.

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290 Corporate Drive ◇ PO Box 7408 ◇ Lumberton, NC 28358

UNPACKING AND INSPECTION:

Upon receipt of product, it is important to follow these unpacking and inspection procedures.

All Titan FCI WYE Strainers are shipped in specialized shipping containers designed to prevent damage during transportation. If external damage to the shipping container is evident upon receipt of product, please request that a representative of the shipping carrier be present before unpacking the product.

- Carefully open the shipping container, following any instructions that may be marked on the container. Remove all packing material surrounding the Strainer and carefully lift it from the container. It is recommend to keep the shipping container and all packing material for reuse in storage or reshipment.

CAUTION:

For large or heavy Strainers, the appropriate material handling equipment must be used to prevent injury and possible damage to the WYE Strainer.

- Visually inspect the WYE Strainer for any signs of damage including scratches, loose parts, broken parts or any other physical damage that may have occurred during shipment. If damage is observed, immediately file a claim with the shipping carrier. WYE Strainers that are damaged during transportation are the responsibility of the customer. For information regarding Titan FCI's warranty policy, please refer to the last page of this document.

- Before installation, the WYE Strainer's cover should be removed and inspected internally for any loose or foreign materials that may have become trapped in the screen during transportation. After inspection, ensure sealing surfaces are clean and replace the gasket and cover. Make sure the gasket is seated correctly before tightening the cover bolts.

- If the WYE Strainer is not required to be installed immediately, it should be stored indoors in a clean, dry, consistent temperature environment. It is also recommended to utilize the original shipping container and packing materials to properly store the WYE Strainer. If long term storage is required, a desiccant may be necessary. This would be based upon the local, environmental storage conditions. Please consult a Titan FCI Design Engineer to assist in this determination.

Figure 3: WYE Strainer ~ Flanged Ends

UNPACKING AND INSPECTION: continued...

- When ready to install, remove any preservatives with solvent dampened cloths. Remove any loose material and protective packing material.

INSTALLATION:

Pre-Installation Checklist

- Ensure Working conditions (pressure/temperature) are within the specified capacity of the product being installed. Please refer to the certified drawings to assist in determining these values.

- Make sure that the construction material of the Strainer is chemically compatible with the media flowing in the pipeline.

- Inspect all sealing surfaces to ensure gasket surfaces are free of defects (no nicks or cuts). The pipeline should also be checked for proper alignment. Titan FCI WYE Strainers should never be utilized to realign an existing piping system.

- Ensure that the pipeline's mating flanges are the same type as the WYE Strainer being installed. Raised face flange ends cannot be mated to flat face flange ends.

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Pre-Installation Checklist continued...

- For flanged units, ensure Strainer end-to-end length and installation gap are with in ¼ in gap for gasket, and have sufficient clearance for easy opening of cover and screen removal. Refer to the certified drawing for screen removal clearance requirements.

- If the WYE Strainer is to be located on the discharge side of a pump, then a safety release valve must be installed between the WYE Strainer and the pump.

PRECAUTION:

A Titan FCI WYE Stainer should always be installed ahead of pumps and other expensive, downstream equipment to help ensure proper protection and trouble-free operation. This even holds true for "clean lines" to protect against pipe scale and accidentally introduced items such as: gaskets or tools.

Installation Procedure

Step 1:
Install blow down valve (if provided) at blow-off connection. Also, for maximum efficiency, install a differential pressure gauge at inlet and outlet connections or at the Strainer gauge tap (if provided).

Step 2:
Titan WYE Strainers must be positioned in the pipeline ahead of the equipment requiring protection. If the equipment requiring protection is a pump, the WYE Strainer must be placed on the suction side of the pump.

Step 3:
To provide for easier maintenance, the WYE Strainer should be located where the drain plug can be removed. Additionally, ensure the drain or blow-off is located at the lowest position when installed. If installed in the vertical position, the WYE side of the strainer must be pointing downward.

Step 4:
Ensure there is ample space at the WYE side of the Strainer for screen removal. Refer to the certified engineering drawing to determine the screen clearance requirements.

Step 5:
Before placing the WYE Strainer into place, support the existing pipeline with pipe supports near the inlet and outlet connections.

Figure 4: WYE Strainer ~ Solder Ends

Installation Procedure continued...

Step 5:
Place the WYE Strainer into the pipeline, ensuring that the flow arrow on the body of the WYE Strainer is pointing in the direction of the pipeline flow. For large or heavy Strainers, appropriate material handling equipment must be used.

Step 5:
Install a standard, ANSI (1/8" thick) flange gasket between the WYE Strainer and pipeline flanges, on both sides. Install lubricated flange bolts and hand tighten. Flange bolts should then be tightened, using a star or crisscross pattern to evenly load the bolts, in accordance with established piping standards. This is illustrated in Figure 5.

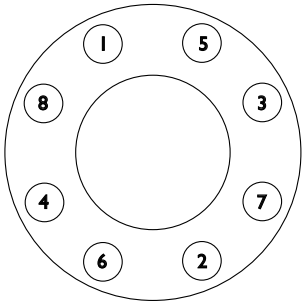

Figure 5: Bolting Sequence Pattern

CAUTION:

Excessive bolt torque may damage flanges. Please refer to established flange bolt torques for guidelines.

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OPERATION:

Once proper installation has been successfully completed, start the system gradually, at start up as well as after shut down. This eliminates sudden shock to the strainer and other equipment in the line. This is extremely important for steam service.

Start-up Procedure:

Step 1:
Open blow-down valve to remove air from the Strainer. To remove all fluid from the Strainer belly, a drip-leg can be installed or the piping can be placed at a 1/4" slope.

CAUTION:

With piping systems that contain fluids other than water or when the working temperature is above 120° F, fluid must be drained to safe area, away from the operator. Operators should always be fitted with appropriate protective equipment (goggles, gloves, vests, etc.) when venting or servicing is performed.

Step 2:
Start the piping system by opening the outlet valve nearest the WYE Strainer's outlet first. Then gradually open the inlet valve nearest the WYE Strainer's inlet, approximately 25% of normal operational flow. It is important to start the system gradually to avoid displacing or damaging the WYE Strainer.

Step 3:
Continue to open the inlet valve until the desired service flow has been reached.

Step 4:
Close the blow-down when air is removed and fluid begins to flow. The system is now ready to start.

MAINTENANCE:

Titan Flow Control WYE Strainers require little monitoring once they are properly installed. The pressure differential across the strainer should be check periodically to determine if the screen needs to be cleaned or replaced. If the pressure differential goes unchecked and the screen becomes completely clogged, the screen will break and require replacing.

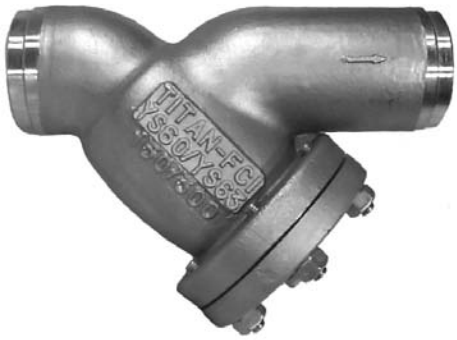

Figure 6: WYE Strainer ~ Butt-Weld Ends

CAUTION:

Strainer screens are not designed to withstand the same pressure ratings as the housings. If the screen becomes completely clogged, it will be exposed to the same pressure as the housing. In most cases, this will cause the screen to fail and potentially damage downstream equipment.

Titan FCI WYE Strainers are designed to require very little maintenance. Regular maintenance involves:

- Blow-down cleaning.
- Timely cleaning or replacement of screen.
- Periodically checking for leaks.

During normal use, the screen will become clogged with foreign matter, causing the differential pressure to increase. Once the differential pressure has increased to an unacceptable value, typically by 5 psi to 10 psi, it is time to clean or replace the screen. It is not advisable to let the differential pressure increase by 20 psi. This may cause the screen to fail and possibly damage downstream equipment.

A convenient and safe way to determine when the screen needs to be replaced is to install pressure gauges on the inlet and outlet sides of the Strainer. The maximum acceptable pressure drop across the Strainer will indicate when the screen needs to be replaced. Screen size and construction determine the maximum pressure drop a Strainer screen can withstand. Please consult factory for exact pressure ratings.

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Blow-Down Cleaning:

To avoid shutting down the system, when possible, clean the screen when pressure differential is 7 to 10 PSI. Clean the screen of debris by opening the blow-down valve. Keep valve open until all debris has been removed and pressure differential returns to normal range. Close the valve and resume normal operation. If pressure differential does not return to an acceptable level after blow-down cleaning then the screen needs to be removed and cleaned or replaced.

CAUTION:

Before removing the cover of the WYE Strainer, the pressure inside the vessel must be reduced to atmospheric via suction or venting. Failure to do so may result in serious bodily injury.

CAUTION:

Before removing the WYE Strainer's cover, ensure that the media that is flowing in the pipeline is known and any special handling precautions are understood. Please review the Material Safety Data Sheet (MSDS) for that specific fluid.

Screen Removal/Cleaning/Replacement:

Step 1:
Isolate the Strainer by closing the inlet and outlet valve connections on either side of the WYE Strainer. Make sure valves are bubble tight.

Step 2:
Open blow-down valve or other vent to relieve pressure inside and drain fluid from the Strainer.

Step 3:
Once pressure is relieved, remove the WYE side cap or cover.

Step 4:
Remove screen and clean. Do not permit screen to dry as it will be difficult to remove debris after it has hardened. Avoid banging or hitting the screen to remove stubborn debris. For perforated screens, it is recommended to use high pressure water or air stream to clean the screen. This is not recommended for mesh or mesh-lined screens as this may cause the mesh to tear. Solvent may be required if service is fuel, oil, or chemicals. Follow manufacturer's instructions when using solvent to clean the screen.

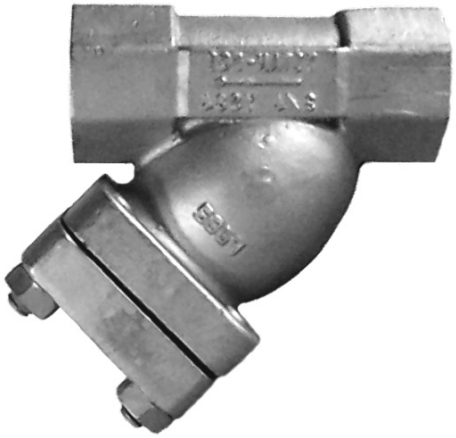

Figure 7: WYE Strainer ~ Socket-Weld Ends

Screen Removal/Cleaning/Replacement: continued...

Step 5:
Inspect screen and cover gasket for damage. If either is damaged, replace. Always ensure there is a spare gasket and screen on hand prior to maintenance.

Step 6:
Remove any debris or sludge from within the Strainer.

Step 7:
Replace cleaned or new screen into its original position, ensuring it is squarely positioned on the screen seat.

Step 8:
Replace cover gasket and cap or cover. Tighten cap or cover to specified torque rating.

Step 9:
Close blow-down valve.

Follow the Start-up procedure outlined within the OPERATION section of this manual.

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SPARE PARTS LIST:

For the bill of materials and spare parts listing of each WYE Strainer model, please refer to the corresponding Engineering Specification Sheet. For special or fabricated units, please refer to the certified engineering drawing for that unit.

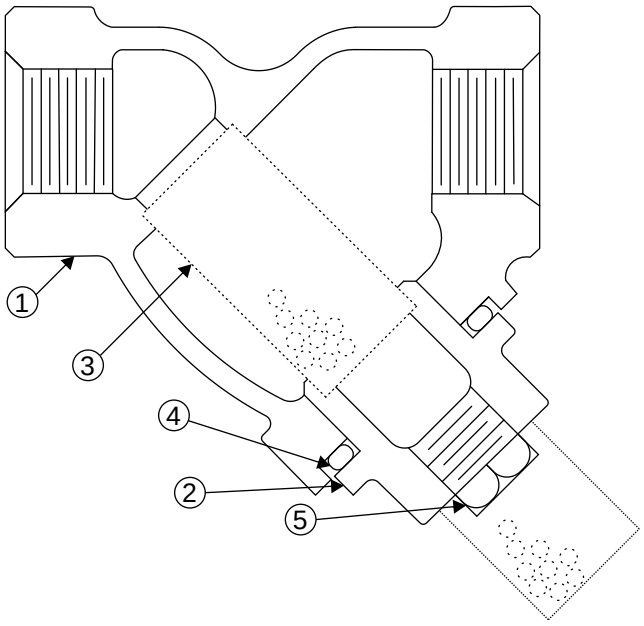

Figure 8: CAD Illustration

PARTS LIST	
No.	**WYE Strainer**
1	BODY
2	COVER/CAP
3*	SCREEN
4*	GASKET
5	PLUG

* Denotes recommended spare parts

WARRANTY:

Seller warrants each of the products and parts sold hereunder, under normal use of service, and subject to user's compliance with any operating instructions and other directions given by seller, to be free from defects in materials or workmanship for a period of one year from date of shipment from seller's plant. Seller's liability, under this warranty, shall be limited to, at the seller's option, to repairing or replacing any such defective product FOB seller's plant in Lumberton, NC, and reimbursing purchaser for shipping costs, subject to the following: (1) Timely receipt of purchaser's written notice that such products are defective. (2) Seller's written authorization to purchaser for the return of such products, (3) the return of such products to seller with shipping charges prepaid and (4) seller's inspection of and confirmation that such products are defective in materials or workmanship. If seller's inspection shows that the products returned are defective due to dirt, rust or any foreign material not attributable to seller: improper usage, over tightening on threads, abuse or incorrect assembly in the field, or other cause not due to seller's improper manufacture, seller will, subject to purchaser's written authorization, repair or replace such products at cost. Seller's factory inspection and testing reports will be made available to purchaser upon request.

THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF FITNESS OR MERCHANTABILITY. SELLER SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES. NO REPRESENTATIVE OR SELLER HAS AUTHORITY TO MAKE ANY REPRESENTATIONS OR WARRANTIES, EXCEPT AS STATED HEREIN.

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TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317, 13321
SHOCK RELAY
TSUBAKI - TSBSS05

SHOCK RELAY
TSBSS Series
INSTRUCTION MANUAL

WARNING

1. Make sure you read this instruction manual thoroughly before installing, wiring, operation and inspecting this SHOCK RELAY.
2. Please make sure that this instruction manual accompanies the SHOCK RELAY to the end user.
3. Product specification are subject to change for improvement without notice.
4. Disconnect power. Always lock out power switch before installing, removing, or servicing unit. Comply with Occupational Safety and Health Standards 1910. 147 “The Control of Hazardous Energy (Lock Out/Tag Out).”
5. Install in proper enclosure in accordance with NEMA 250-1991 “Enclosures for Electrical Equipment (1000Volts Maximum)” and NFPA496 1993 edition “Purged and Pressurized Enclosures for Electrical Equipment, 1993 Edition.” When revisions of these standards are published, the updated edition shall apply.
6. Guards must be provided on all power transmission and conveyor applications in accordance with provisions of ASME B15.1-1996 “Safety Standards for Conveyors and Related Equipment, or other applicable standards. When revision of these standards are published, the updated edition shall apply.

CAUTION

- If danger is expected from your application, take the necessary steps to ensure that it operates safely.
- If your Tsubaki Emerson product does not operate normally, take care to ensure that dangerous operating conditions do not occur.
- Wear suitable clothing and protective equipment (safety glasses, gloves, safety shoes, etc.)
- Keep your work place tidy and safe to prevent accidents.

TSUBAKI EMERSON CO.

2006. 8. 1

1. Preface

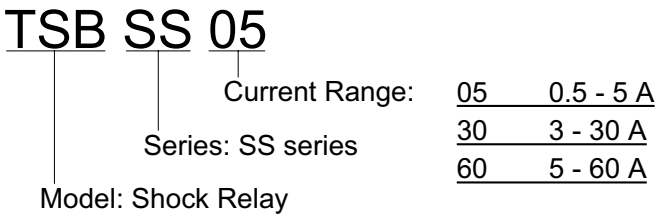
Thank you for purchasing the Shock Relay TSBSS series.

This instruction manual describes everything from installation to adjustment.

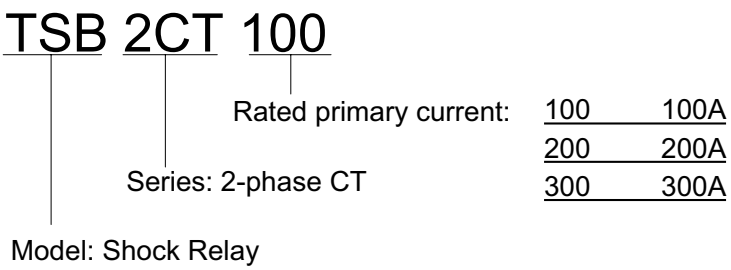
Be sure to read this manual carefully before using your Shock Relay.
When delivering a device containing the Shock Relay, be sure that this instruction manual is included.

2. TSBSS and TSB2CT Model identification

・Shock relay



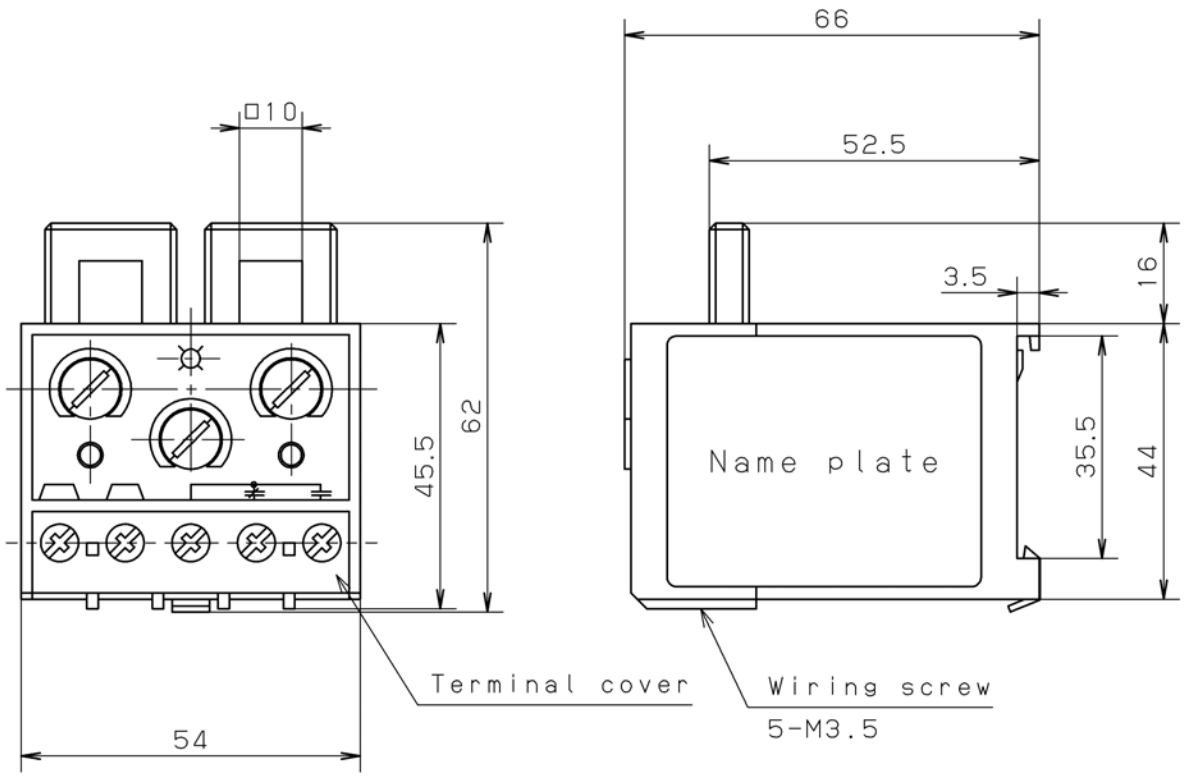
・External 2-phase CT



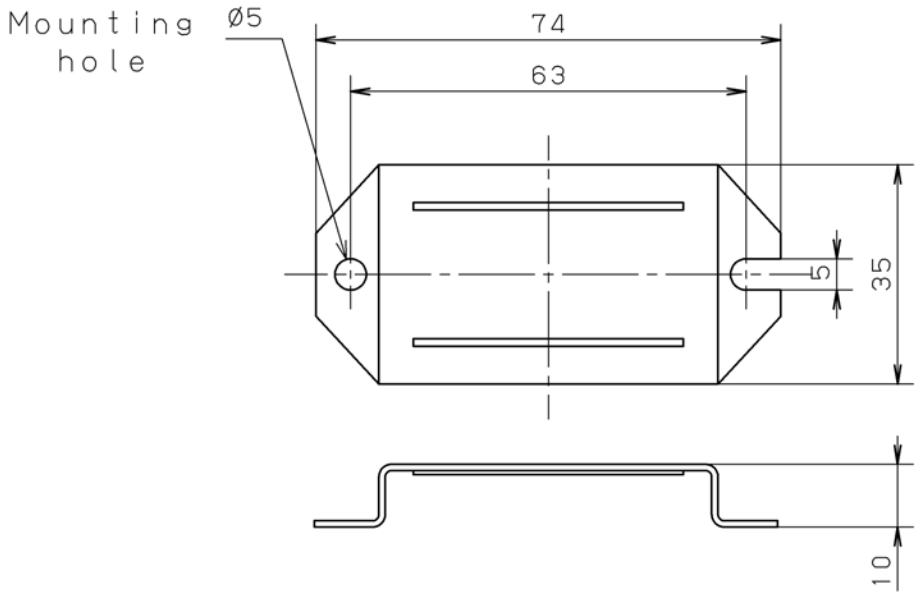
3. Dimensions

(Unit mm 1inch=25.4 mm)

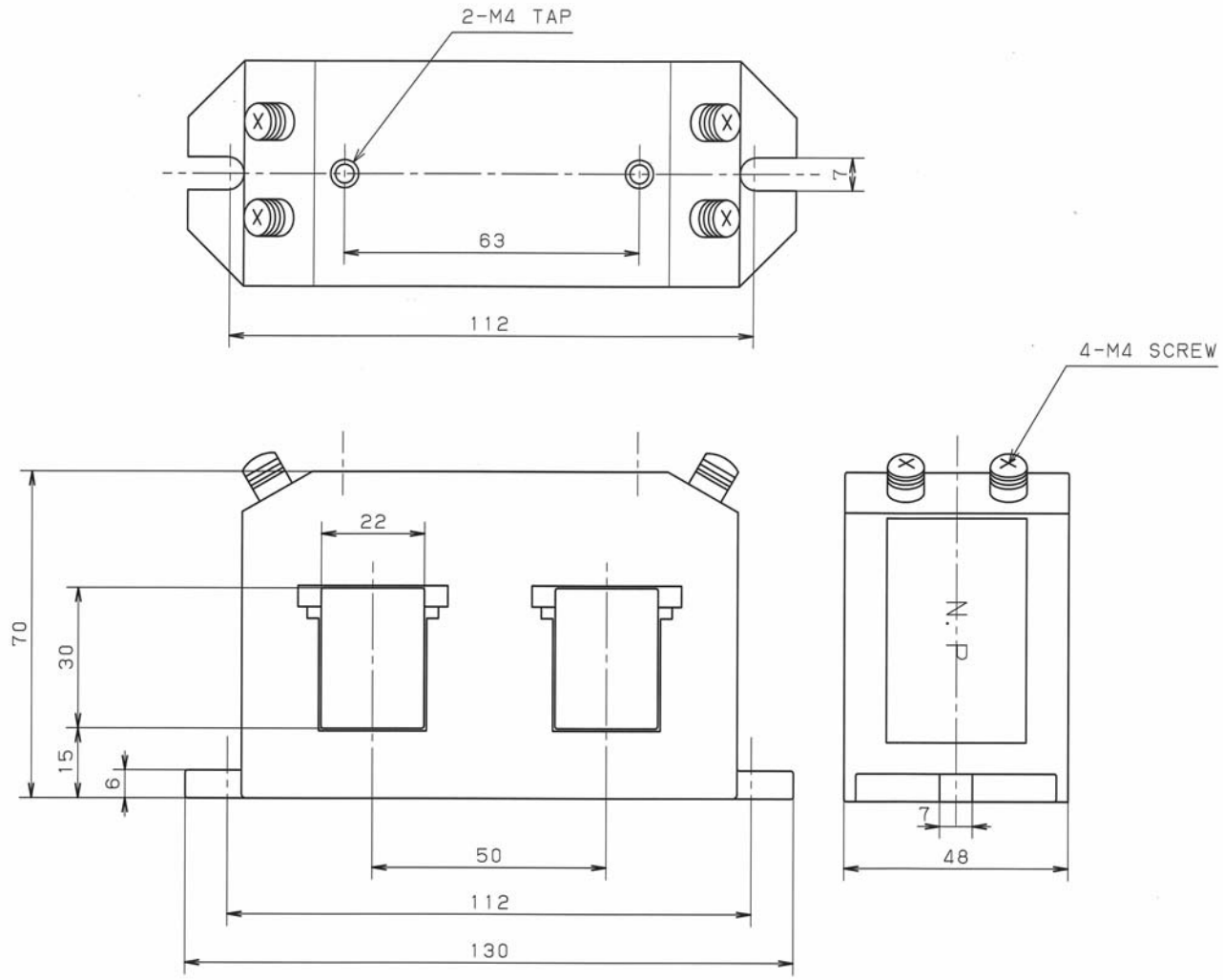
・Shock relay



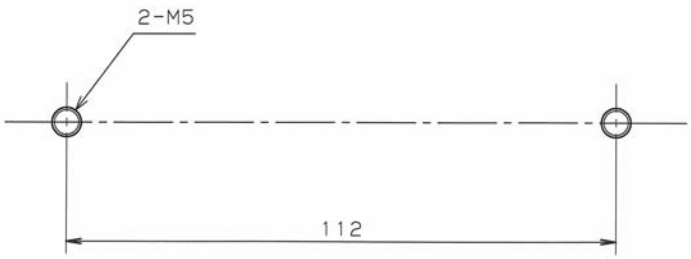
Bracket



・External 2-phase CT



Details for installation holes



4. Specifications

Series			TSB SS
Current Setting ( ): Max Limit		Model	Range
		05	0.5-5A(6.5A)
		30	3-30A(35A)
		60	5-60A(70A)
Time Setting	Starting Trip Delay	Start Time	0.2-30s
	Trip Time	Shock Time	0.2-10s
Accuracy		Current	±10% (Full scale)
Control Power Supply			90～250VAC, 50/60Hz *1 (UC : 110～240VAC, 50/60Hz)
Maximum motor voltage			600VAC, 50/60Hz
Current Sensing method			2 Integral Current Transformer
Output Relay	Mode		1-SPDT(1c)
	Contact Rating (max.)		3A / 250VAC cos ϕ =1
	Contact Rating (min.)		10VDC 10mA
	Operation		Fail safe operation,Normally energized
	Reset		Manual or Electrical (Interrupt power supply)
	Expected Life		100,000 operations
Ambient Environment	Temperature	Operating	-20 - +60℃ (-4 - +158 F)
		Storage	-30 - +70℃ (-22 - +176 F)
	Humidity		45 – 85% RH without Condensation
	Altitude		2,000m max.
	Pollution degree		Class 3 To be free from dust and corrosive gas
	Vibration		5.9 m/s^2 or less.
Insulation	Between casing and circuit		Over 10MΩwith 500 VDC Megger
Dielectric Strength	Between casing and circuit		AC 2000V, 60Hz, 1min
	Between contacts		AC 1000V, 60Hz, 1min
	Between circuits and contacts		AC 2000V, 60Hz, 1min
Protection Structure			IP20
Power Consumption		115VAC	2.7 VA(0.35W)
		230VAC	11.0 VA(1.2W)
Material	Case		Polycarbonate UL94V0
	Terminal cover		Nylon 6
Mounting			35mm DIN rail or Panel
Dimension(W x H x D /Including Integral CT Windows)			54 x 62 x 66 mm
Weight			Less than 160g (0.35LBS) without External CT

*1 CE marking

*2 When Shock Relay is used with Inverter, the output frequency of Inverter should be from 30Hz to 60Hz.

5. Installation

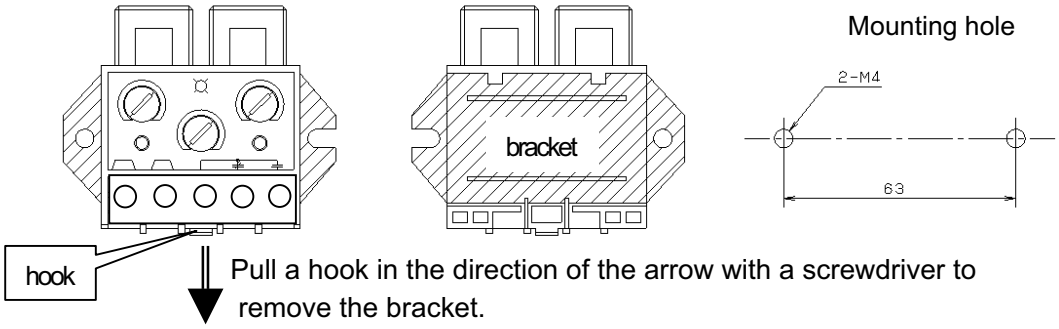
1. Environmental specifications

Install the Shock Relay in the following environment.

- Temperature: －20 to ＋60℃ not in direct sunlight.
- Humidity：45～85% relative humidity without condensation and freezing.
- Place：Indoors, no water splash.
- Atmosphere：Free from dust, corrosion gas, and oil mist.
- Height: 2000m or less above sea level.
- Vibration: 5.9m/s^2 and under.

2. Installation to the panel

(1) Pull the hook on the Shock Relay in the direction of the arrow to remove the mounting bracket.
(2) Fit the mounting bracket to the board.
(3) Fit the Shock Relay to the fixed mounting bracket.



3. Installation to the DIN rail

(1) Pull the hook on the Shock Relay in the direction of the arrow to remove the mounting bracket.
(2) Install the Shock Relay to the DIN rail.

6. Wiring

(1) Connect 90－250VAC power source to the terminal L1- L2.

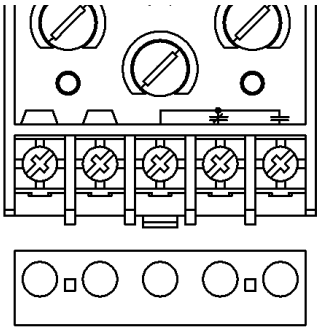
Never connect the output of an inverter or a servo driver to terminals L1-L2.
Install an insulation transformer between the power line and terminals L1-L2 of the SHOCK RELAY when harmonic noise is included in the power line.

(2) Check and correct the following items before turning the power on.

a. Is there any misconnection?
b. Have you forgotten to complete any connections?
c. Are there any abnormal conditions such as a short-circuit or ground fault?

WARNING	**ELECTRICAL SHOCK AND BURN** Do not operate without the ground wire connected.

7. Terminal Function



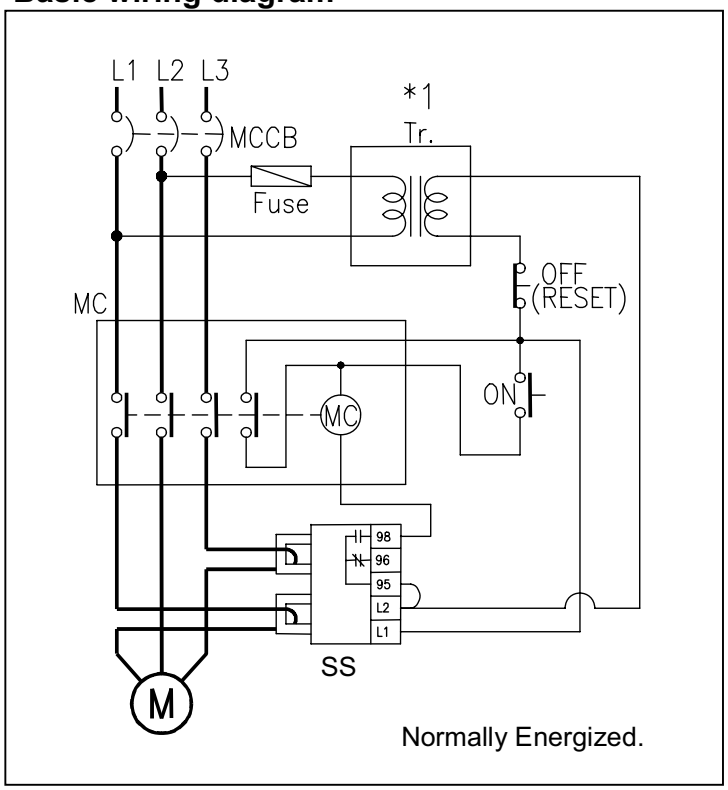
Terminal	Function.	Contents.
L1	Power Supply	90 – 250VAC commercial power supply is wired
L2		
95	Output Relay	Common
96		Normally close (Power on : open Power off or tripped: close)
98		Normally open (Power on : close Power off or tripped: open)

8. Current Transformer

Select the number of wires passing through the CT (Current Transformer) by using the following table for best performance. When two motor leads pass through the CT, the current sensed by the CT is twice the motor current flowing through the motor lead.

AC 200 ~ 230 Volt Motor				AC 400 ~ 460 Volt Motor			
Motor Capacity (kW)	Motor Capacity (Hp)	TSBSS TYPE	Wires passing through CT	Motor Capacity (kW)	Motor Capacity (Hp)	TSBSS TYPE	Wires passing through CT
0.1	1/8	TSBSS05	4				
0.2	1/4	TSBSS05	3	0.2	1/4	TSBSS05	4
0.4	1/2	TSBSS05	2	0.4	1/2	TSBSS05	3
0.75	1	TSBSS05	1	0.75	1	TSBSS05	2
1.5	2	TSBSS30	3	1.5	2	TSBSS05	1
2.2	3	TSBSS30	2	2.2	3	TSBSS05	1
3.7	5	TSBSS30		3.7	5	TSBSS30	3
5.5	7-1/2	TSBSS30	1	5.5	7-1/2	TSBSS30	2
7.5	10	TSBSS60	1	7.5	10	TSBSS30	
11	15	TSBSS60	1	11	15	TSBSS30	1
				15	20	TSBSS60	1
				18.5	25	TSBSS60	1
				22	30	TSBSS60	1

Basic wiring diagram



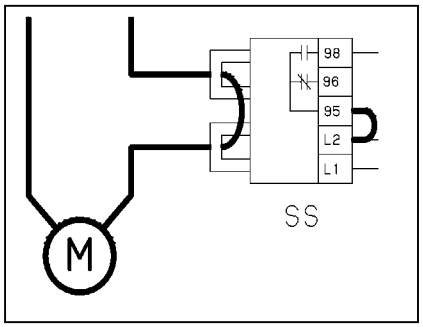
M : THREE-PHASE MOTOR

MC : Magnetic contactor
ON : Start switch
OFF : Stop switch
Fuse : Fuse
Tr : Transformer

1. A transformer may be required, depending on the voltage of Motor (i.e. over 250VAC)

2. Output relay is normally energized when there is power to the Shock Relay. When Shock Relay trips, the contacts change state.

3. Two of three phases of the motor are passed through the Shock Relay's CT in the same direction.



M: SINGLE-PHASE MOTOR

9. TSB2CT（External 2-phase CT）

・Specifications

Model No.	TSB2CT100	TSB2CT200	TSB2CT300
Class	3		
Rated primary current	100A	200A	300A
Rated secondary current	5A		
Rated burden	5VA		
Rated frequency	50/60Hz		
Approximately weight	0.5kg		

・Installation

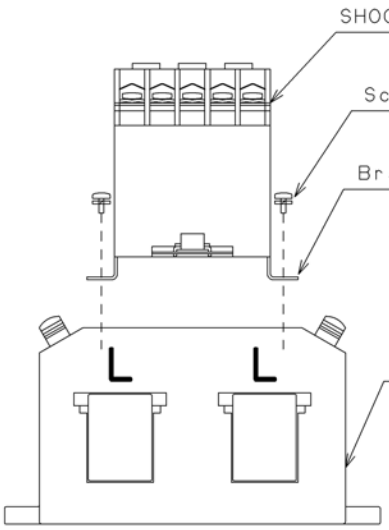


Figure 1

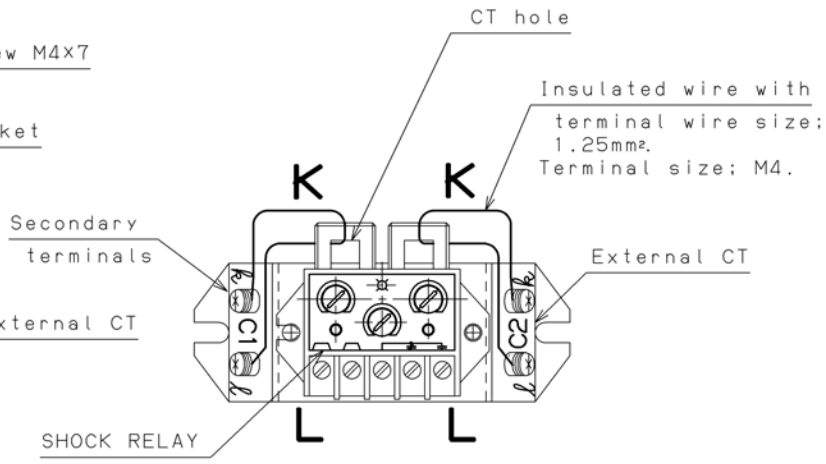
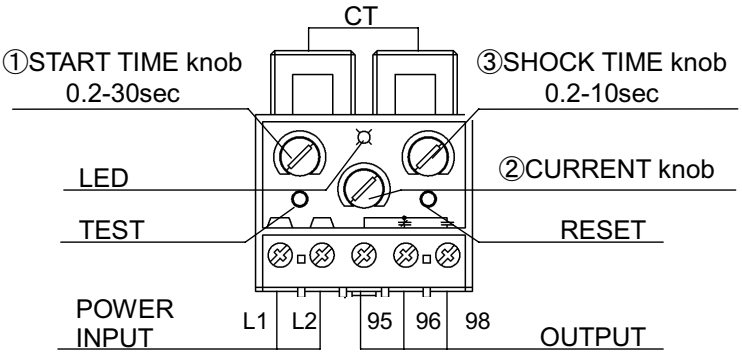


Figure 2

Procedure

1. Install the SHOCK RELAY on the External CT with screws according to Figure 1.
2. Connect the wire between "ℓ" and "ℓ" after passing the wire through CT hole According to Figure 2.

10. Construction



Description

Shock Relay senses the motor current passing through the two CTs and automatically detects the starting of the motor.

Shock Relay filters out the large starting current during the start-up delay preset with the START TIME knob.

Shock Relay detects an overload by comparing the CT-sensed motor current with the trip current that is preset with the CURRENT knob.

When the motor current exceeds the preset trip current level, the Shock Relay trips after the trip delay that is preset with the SHOCK TIME knob.

Shock Relay can be used as an electronic shear-pin for a motor-driven machine.

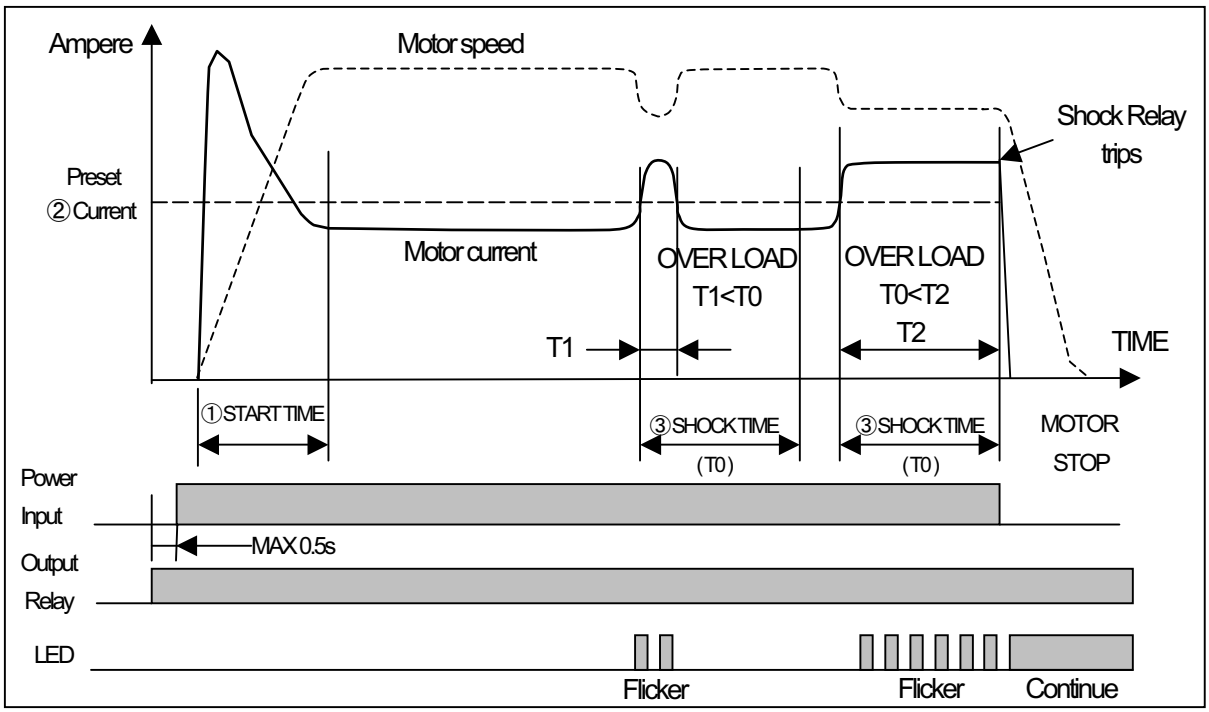
Every time that the Shock Relay trips, always investigate the cause of the overload and correct the cause.

Release the tripped Shock Relay by pressing the RESET button or by shutting power down before restarting the equipment.

As a fail-safe, the Shock Relay keeps the built-in output relay operating except when trips occur, provided that power is applied to the Shock Relay.

Shock Relay lights the LED when sensing a greater current than preset with the CURRENT knob and remains lit after the relay trips.

Shock Relay provides a TEST button to confirm the operation of the output relay and the two timers －START TIME and SHOCK TIME. The Shock Relay trips after the total of the START TIME and the SHOCK TIME when the TEST button is pressed and held.



11. Set up

1. Set START TIME knob (start-up delay) at the start-up time if the start-up time is known. Set START TIME knob (start-up delay) at the maximum if the start-up time is unknown.
2. Set SHOCK TIME knob (trip delay timer) at the desired trip time.
3. Set CURRENT knob (trip current) at the rated current of the motor.
4. Supply control voltage to the Shock Relay. Then confirm that the SHOCK TIME activates its built-in output relay – the contacts will change state.
5. Press and hold the TEST button. Confirm that the Shock Relay lights its LED and trips after total of the START TIME and SHOCK TIME. Confirm that this also deactivates the built-in output relay.
6. Press the RESET button. Confirm that the LED turns off and that the built-in output relay activates.
7. Start the motor and check that the start-up time was correctly set. Then slowly turn the CURRENT knob counter clockwise until the Shock Relay flashes its LED. At this point, the CURRENT knob indicates 100% of the motor running current.
8. Set the CURRENT knob at the proper trip current, this is commonly at 110% of the actual motor running current.
9. Recheck and adjust the START TIME knob so that it is a little longer than the normal start-up time.

12. Troubleshooting

Trouble	Check	Result	Solution
Even when the Shock Relay trips, the 95-98 contacts do not shut down the attached motor.	Wiring of the power source (L1-L2)	Not attached correctly	Wire properly.
	Power source voltage (L1-L2) by voltage tester	Under 90V AC	Supply 90-250V AC voltage
The Shock Relay does not trip even with the CURRENT knob set to the minimum	Model no. of the SHOCK RELAY See the nameplate	Incorrect size Shock Relay	Switch to the correct Shock Relay
	Number of wires passing through the CT	Improper	Rewire properly
	Press and hold TEST button	It does not trip	Exchange SHOCK RELAY for a new one
During start-up, an overload trip occurs.	CURRENT knob setting	Set too low	Turn CURRENT knob CW and set it properly
	START TIME knob setting	Set too short.	Turn START TIME knob CW and set it properly
During operation, overload trip occurs.	CURRENT knob setting	Set too low	Turn CURRENT knob CW and set it properly
	SHOCK TIME knob setting	Set too short.	Turn SHOCK TIME knob CW and set it properly
Shock Relay does not trip with an overload occurs	CURRENT knob setting	Set too high	Turn CURRENT knob CCW and set it properly
	SHOCK TIME knob setting	Set too long	Turn SHOCK TIME knob CCW and set it properly
	Press and hold TEST button	It does not trip	Exchange SHOCK RELAY for new one

If replacement of the shock Relay is necessary, please make contact with our company office.

13. Maintenance

(1) To prevent an accident, keep the surrounding area clean and create a safe environment.

(2) Before checking the installation and connection of the Shock Relay, turn off the power source. Be sure that the equipment is completely stopped and the LED of the Shock Relay is off. Make sure that the power source is locked out and cannot be accidentally turned on.

14. Daily check and periodic check

(1) Confirm that there is no looseness in the installation of the Shock Relay and current transformer. Check the wiring connections every six months.

(2) Regularly check the function of the output relay, terminal 95-96, terminal 97-98, by pressing the TEST button.

(3) A typical life time of electrolytic capacitor mounted in the SHOCK RELAY is about 10 years at an average ambient temperature of 30℃, but this lifetime may vary with a different ambient environment and with the operating period when power is supplied. We recommend you to exchange the Shock Relay for a new one before trouble occurs.

15. Point for safe use

(1) Take measures beforehand to prevent danger when using a TSUBAKI EMERSON product.

(2) If our product begins to operate improperly, be sure to take measures to prevent a dangerous situation from arising.

16. Guarantee.

1. Range of guarantee

With regard to any troubles happened to our products, replacement or repair of such troubled parts will be provided for free of charge during the effective period of guarantee, provided that installation and maintenance/management of said products have been performed properly pursuant to the description of this instruction manual and said products have been used under the condition described in the brochures or agreed separately through mutual consultations. The content of guarantee is limited only to the Shock Relay itself delivered to you and the judgment thereof will be made by our selection because such judgment pertaining to the range of guarantee is often complex.

2. Guarantee period

The guarantee period shall be either 18 months after shipment from our factory or 12 months after starting operation, whichever is shorter. Any and all inspection/repair undertaken by us after the above guarantee period has passed will be charged. Should questions arise, please do not hesitate to contact us or the dealer from whom you purchased.

3. Miscellaneous

(1) Any matters described in this instruction manual are subject to change without notice.

(2) We have tried our best in preparing the contents of this instruction manual. Should any mistake or oversight be found, we will be more than happy if you would advice us of them.

NEWPORT I SERIES TEMPERATURE CONTROLLER CONFIGURATION PARAMETERS

POST POINT SCUM CONCENTRATOR - CONCENTRATOR TANK TEMPERATURE CONTROLLER

MENU: SP1 - Set point 1		
		40
MENU: SP2- Set point 2		
		Not used
MENU: CNFG - Configuration		
	MENU: INPt - Input	
Parameter	**Description**	**Value**
INPt	Input type selection -t.c., Rtd, or PROC	t.c
t.c	Thermocouple type	k
	MENU: RdG - Reading Configuration	
Parameter	**Description**	**Value**
dEC	Decimal location selection	FFF.F
tEMP	Temperature unit selection	°F
FLtR	Signal filter constant	0004
	MENU: ALR1 - Alarm 1	
Parameter	**Description**	**Value**
ALR1	Alarm 1 configuration	dSbl
	MENU: ALR2 - Alarm 2	
Parameter	**Description**	**Value**
ALR2	Alarm 2 configuration	dSbL
	MENU: LOOP - Loop Break Time/Field Calibration	
Parameter	**Description**	**Value**
LOOP	Loop break time -monitors rate of change of the process val.	dSbL
b.tIM	Defines time unit to alarm a loop break	00.00
R.AdJ	Compensation unit for error in transducer	000.0
SP.dV	Defines deviation for set point 1 / 2	dSbL
	MENU: OUt1 - Ouput 1	
Parameter	**Description**	**Value**
SELF	Auto defines output 1 configuration	dSbL
CtRL	Control Type - On/Off or PID	ON.OF
ActN	Direct or reverse acting (dRct or RVRS)	RVRS
dEAd	Dead band - span near setpoint with no control action - deg.	10
	MENU: OUt1 - Ouput 2	
Parameter	**Description**	**Value**
CtRL	Control Type - On/Off or PID	ON.OF
ActN	Direct or reverse acting (dRct or RVRS)	RVRS

dEAd	Dead band - span near setpoint with no control action - deg.	10
	MENU: RAMP - Ramp and Soak	
Parameter	**Description**	**Value**
RAMP	Allows for and sets ramp function	dSbL
SOAk	Allows for and sets soak functions	dSbL
	MENU: id - ID code	
Parameter	**Description**	**Value**
Id	Defines security ID for controller	0000
CH.Id	Four digit ID code	0000
	MENU: FULL - Security configuration	
Parameter	**Description**	**Value**
FULL	Appoints ID code to access the configuration menus	dSbL
SP.Id	Appoints ID code to access the setpoints	dSbL
	MENU: COMM - Communication Options	
Parameter	**Description**	**Value**
COMM	Permits communication with controller via PC	dSbL
	MENU: COLR -Display color selection	
Parameter	**Description**	**Value**
N.CLR	Normal display color	GRN
1.CLR	Display color when in alarm 1 condition	REd
2.CLR	Display color when in alarm 2 condition	AMbR

Scum Concentrator
Concentrator Tank Temperature

NEWPORT iSERIES TEMPERATURE CONTROLLER CONFIGURATION PARAMETERS POST POINT SCUM CONCENTRATOR - SCUM TANK TEMPERATURE CONTROLLER		
MENU: SP1 - Set point 1		
		95
MENU: SP2- Set point 2		
		Not used
MENU: CNFG - Configuration		
	MENU: INPt - Input	
Parameter	**Description**	**Value**
INPt	Input type selection -t.c., Rtd, or PROC	t.c
t.c	Thermocouple type	k
	MENU: RdG - Reading Configuration	
Parameter	**Description**	**Value**
dEC	Decimal location selection	FFF.F
tEMP	Temperature unit selection	°F
FLtR	Signal filter constant	0004
	MENU: ALR1 - Alarm 1	
Parameter	**Description**	**Value**
ALR1	Alarm 1 configuration	dSbL
	MENU: ANGLE - Analog Output (Retransmission)	
Parameter	**Description**	**Value**
ANLG	Analog Output configuration	dSbL
	MENU: ALR2 - Alarm 2	
Parameter	**Description**	**Value**
ALR2	Alarm 2 configuration	ENbL
AbSo	Defines Alarm 2 link to set point 2	AbSo
LtcH	Defines Alarm 2 relay action	UNLt
Ct.CL	Defines Alarm 2 contact state	N.o.
ActV	Defines alarm condition in relation to alarm setpoint	AboV
A.P.oN	Defines how alarm will be treated when unit is powered on/off	dSbL
ALR.L	Low alarm set point	70
ALR.H	High alarm set point	120
	MENU: LOOP - Loop Break Time/Field Calibration	
Parameter	**Description**	**Value**
LOOP	Loop break time -monitors rate of change of the process val.	dSbL
b.tIM	Defines time unit to alarm a loop break	00.00
R.AdJ	Compensation unit for error in transducer	000.0
SP.dV	Defines deviation for set point 1 / 2	dSbL

	MENU: INPt - Input MENU: OUt1 - Ouput 1	
Parameter	**Description**	**Value**
SELF	Auto defines output 1 configuration	dSbL
CtRL	Control Type - On/Off or PID	PId
ActN	Direct or reverse acting (dRct or RVRS)	RVRS
AUto	Automaticly deterimine PID values	dSbL
ANtL	Anti integral - calculate integral outside of prop. band	dSbL
PRoP	Proportional band - deg. of change in temp for 100% output	10
RESt	Reset value - 0-3999 seconds (integral)	1800
RAtE	Rate value - 000.0-399.9 seconds (derivative)	0
CyCL	Cycle time - total on/off time per proportional cycle 1-199 sec	5
dPNG	Damping factor - speed, overshoot, & undershot for response	003
	MENU: RAMP - Ramp and Soak	
Parameter	**Description**	**Value**
RAMP	Allows for and sets ramp function	dSbL
SOAk	Allows for and sets soak functions	dSbL
	MENU: id - ID code	
Parameter	**Description**	**Value**
Id	Defines security ID for controller	0000
CH.Id	Four digit ID code	0000
	MENU: FULL - Security configuration	
Parameter	**Description**	**Value**
FULL	Appoints ID code to access the configuration menus	dSbL
SP.Id	Appoints ID code to access the setpoints	dSbL
	MENU: COMM - Communication Options	
Parameter	**Description**	**Value**
COMM	Permits communication with controller via PC	dSbL
	MENU: COLR -Display color selection	
Parameter	**Description**	**Value**
N.CLR	Normal display color	GRN
1.CLR	Display color when in alarm 1 condition	REd
2.CLR	Display color when in alarm 2 condition	AMbR

iSeries

Temperature & Process Controller

TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317, 13321
SCUM TEMPERATURE CONTROLLER
NEWPORT - I853
CONCENTRATOR
TEMPERATURE CONTROLLER
NEWPORT - I833

Operator's Manual

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Recorders	pH pens
Relative Humidity	pH Controllers
Transmitters	pH Electrodes
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Wire	Flow Sensors

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www.newportUS.com	info@newportUS.com

TABLE OF CONTENTS

LIST OF FIGURES:

LIST OF TABLES:

NOTES, WARNINGS and CAUTIONS

Information that is especially important to note is identified by following labels:

- **NOTE**
- **WARNING or CAUTION**
- **IMPORTANT**
- **TIP**

NOTE: Provides you with information that is important to successfully setup and use the Programmable Digital Meter.

CAUTION or WARNING: Tells you about the risk of electrical shock.

CAUTION, WARNING or IMPORTANT: Tells you of circumstances or practices that can effect the instrument's functionality and must refer to accompanying documents.

TIP: Provides you helpful hints.

PART 1
INTRODUCTION
1.1 Description

Note ☞ This device can be purchased as monitor (read process value only) or as a controller.

- The iSeries controller offers unparalleled flexibility in process measurement. Each unit allows the user to select the input type, from 10 thermocouple types (J, K, T, E, R, S, B, C, N and J DIN), Pt RTDs (100, 500 or 1000 Ω, with either 385 or 392 curve), DC voltage, or DC current. The voltage/current inputs are fully scalable to virtually all engineering units, with selectable decimal point, perfect for use with pressure, flow or other process input.

- The temperature control can be achieved by using on/off or PID heat/cool control strategy. Control can be optimized with an auto tune feature. The instrument offers a ramp to setpoint with timed soak period before switching off the output.

- The iSeries device features a large, three color programmable display with capability to change a color every time the Alarm is triggered. The standard features include dual outputs with relay, SSR, dc pulse, analog voltage or current. Options include programmable RS-232 or RS-485 serial communication and excitation. Analog Output is fully scalable and may be configured as a proportional controller or retransmission to follow your display. Universal power supply accepts 90 to 240 Vac. Low voltage power option accepts 24 Vac or 12 to 36 Vdc.

1.2 Safety Considerations

This device is marked with the international caution symbol. It is important to read this manual before installing or commissioning this device as it contains important information relating to Safety and EMC (Electromagnetic Compatibility).

This instrument is a panel mount device protected in accordance with EN 61010-1:2001, electrical safety requirements for electrical equipment for measurement, control and laboratory. Installation of this instrument should be done by qualified personnel. In order to ensure safe operation, the following instructions should be followed.

This instrument has no power-on switch. An external switch or circuit-breaker shall be included in the building installation as a disconnecting device. It shall be marked to indicate this function, and it shall be in close proximity to the equipment within easy reach of the operator. The switch or circuit-breaker shall meet the relevant requirements of IEC 947–1 and IEC 947-3 (International Electrotechnical Commission). The switch shall not be incorporated in the main supply cord.

Furthermore, to provide protection against excessive energy being drawn from the main supply in case of a fault in the equipment, an overcurrent protection device shall be installed.

Note ☞

- Do not exceed voltage rating on the label located on the top of the instrument housing.
- Always disconnect power before changing signal and power connections.
- Do not use this instrument on a work bench without its case for safety reasons.
- Do not operate this instrument in flammable or explosive atmospheres.
- Do not expose this instrument to rain or moisture.
- Unit mounting should allow for adequate ventilation to ensure instrument does not exceed operating temperature rating.
- Use electrical wires with adequate size to handle mechanical strain and power requirements. Install without exposing bare wire outside the connector to minimize electrical shock hazards.

EMC Considerations

- Whenever EMC is an issue, always use shielded cables.
- Never run signal and power wires in the same conduit.
- Use signal wire connections with twisted-pair cables.
- Install Ferrite Bead(s) on signal wires close to the instrument if EMC problems persist.

Failure to follow all instructions and warnings may result in injury!

1.3 Before You Begin

Inspecting Your Shipment:

Remove the packing slip and verify that you have received everything listed. Inspect the container and equipment for signs of damage as soon as you receive the shipment. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent. The carrier will not honor damage claims unless all shipping material is saved for inspection. After examining and removing the contents, save the packing material and carton in the event reshipment is necessary.

Customer Service:

If you need assistance, please call the nearest Customer Service Department, listed in this manual.

Manuals, Software:

The latest Operation and Communication Manual as well as free configuration software and ActiveX controls are available from **the website listed in this manual or on the CD-ROM enclosed with your shipment**.

Tip ☞ For first-time users: Refer to the QuickStart Manual for basic operation and set-up instructions.

Tip ☞ If you have the Serial Communications/Ethernet Option you can easily configure the controller on your computer or on-line.

To Disable Outputs:

To ensure that menu changes are properly stored, Standby Mode should be used during setup of the instrument. During Standby Mode, the instrument remains in a ready condition, but all outputs are disabled. Standby Mode is useful when maintenence of the system is necessary.

When the instrument is in "RUN" Mode, **push ◴ twice** to disable all outputs and alarms. It is now in "STANDBY" Mode. **Push ◴ once** more to resume "RUN" Mode.

Tip ☞ **PUSH ◴ TWICE** to disable the system during an **EMERGENCY**.

To Reset the Meter:

When the controller is in the "MENU" Mode, **push ▼ once** to direct controller one step backward of the top menu item.

Push ▼ twice to reset controller, prior to resuming "Run" Mode except after "Alarms", that will go to the "Run" Mode without resetting the controller.

PART 2
SETUP
2.1 Front Panel

Note Refer to the Quick Start Guide for assembly and disassembly instructions.

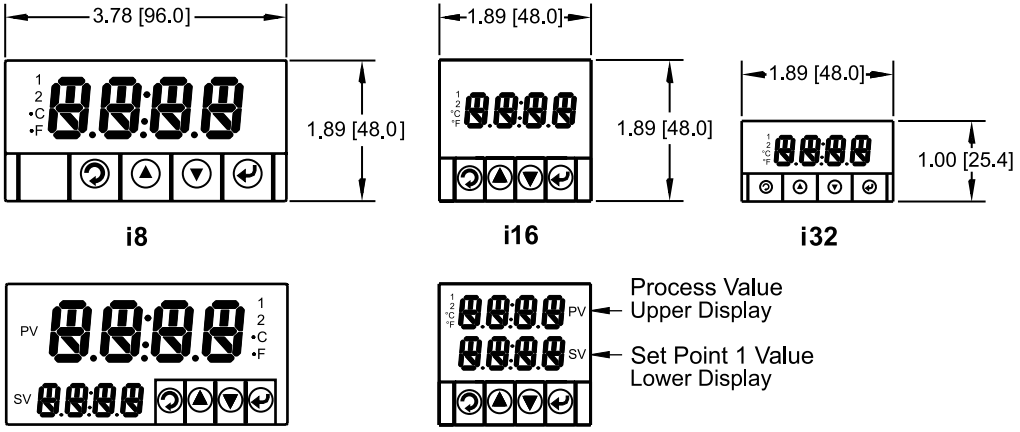
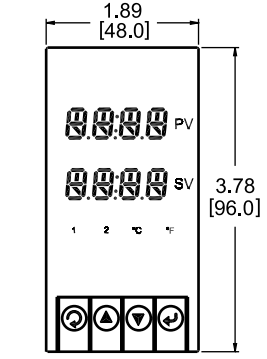


Figure 2.1 Front Panel Display



i8DV DUAL VERTICAL DISPLAY

Table 2.1 Front Panel Annunciators

1	Output 1/Setpoint 1/ Alarm 1 indicator
2	Output 2/Setpoint 2/ Alarm 2 indicator
°C	°C unit indicator
°F	°F unit indicator
PV	Upper Display shows the Process Value
SV	Lower Display shows the Setpoint 1 Value
↺	Changes display to Configuration Mode and advances through menu items*
▲	Used in Program Mode and Peak Recall*
▼	Used in Program Mode and Valley Recall*
↵	Accesses submenus in Configuration Mode and stores selected values*

* See Part 3 Operation: Configuration Mode

The Dual Display model allows the user to observe the Process Value (upper display) and Setpoint 1 Value (lower display) at the same time.

2.2 Rear Panel Connections

The rear panel connections are shown in Figures 2.2 and 2.3.

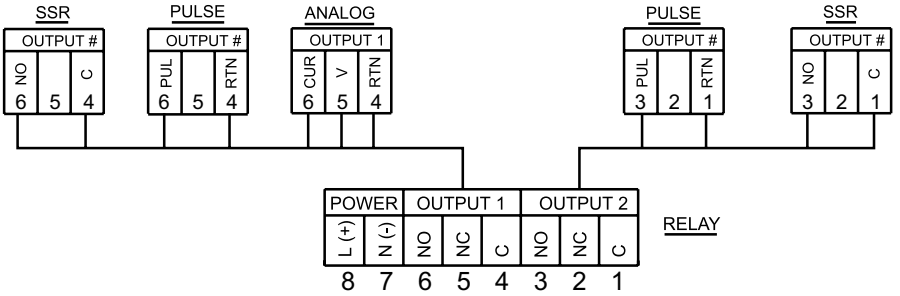


Figure 2.2 Rear Panel Power and Output Connections

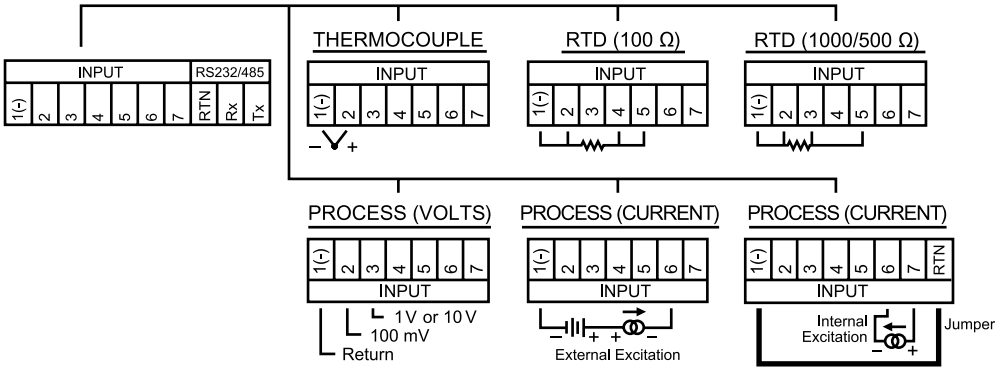


Figure 2.3 Rear Panel Input Connections

Table 2.2 Rear Panel Connector

POWER	AC/DC Power Connector: All models
INPUT	Input Connector: All models TC, PR (Process), RTD
OUTPUT 1	Based on one of the following models: Relay SPDT Solid State Relay Pulse Analog Output (Voltage and Current)
OUTPUT 2	Based on one of the following models: Relay SPDT Solid State Relay Pulse
OPTION	Based on one of the following models: RS-232C or RS-485 programmable Excitation

2.3 Electrical Installation

2.3.1 Power Connections

Caution: Do not connect power to your device until you have completed all input and output connections. Failure to do so may result in injury!

Connect the main power connections as shown in Figure 2.4.

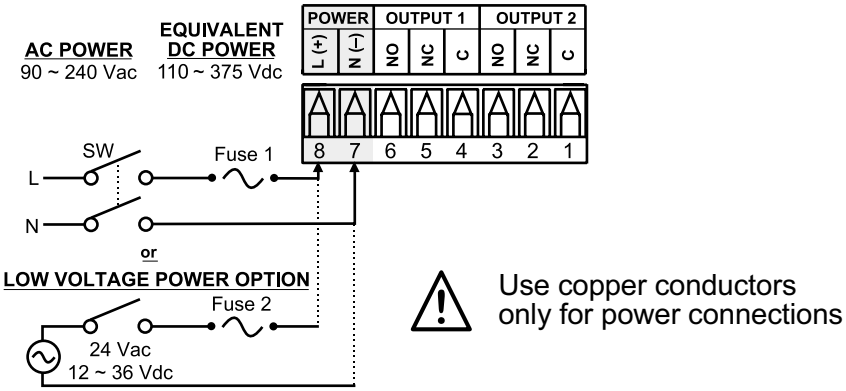


Figure 2.4 Main Power Connections

Table 2.3 Fuse Requirement (see specifications)

FUSE	Connector	Output Type	For 115Vac	For 230Vac	DC
FUSE 1	Power	N/A	100 mA(T)	100 mA(T)	100 mA(T)
FUSE 2	Power	N/A	N/A	N/A	400 mA(T)

For the low voltage power option, in order to maintain the same degree of protection as the standard high voltage input power units (90 - 240 Vac), always use a Safety Agency Approved DC or AC source with the same Overvoltage Category and pollution degree as the standard AC unit (90 - 240 Vac).

Note

The Safety European Standard EN61010-1 for measurement, control, and laboratory equipment requires that fuses must be specified based on IEC127. This standard specifies for a Time-lag fuse, the letter code “T”. The above recommended fuses are of the type IEC127-2-sheet III. Be aware that there are significant differences between the requirements listed in the UL 248-14/CSA 248.14 and the IEC 127 fuse standards. As a result, no single fuse can carry all approval listings. A 1.0 Amp IEC fuse is approximately equivalent to a 1.4 Amp UL/CSA fuse. It is advised to consult the manufacturer’s data sheets for a cross-reference.

2.3.2 Thermocouple

The figure below shows the wiring hookup for any thermocouple type. For example, for Type K hookup, connect the yellow wire to the "2" terminal and the red wire to the "1(-)" terminal.

When configuring your controller, select Thermocouple and Thermocouple Type in the Input Type menu (see Part 3).

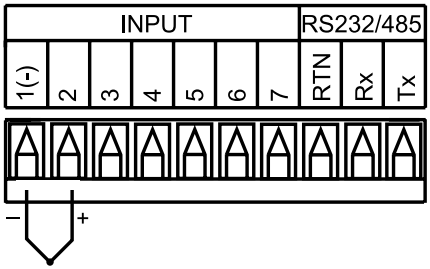


Figure 2.5 Thermocouple Wiring Hookup

Table 2.4 TC Wire Color Chart

TYPE	Input Connector		Jacket (external insulation)	
	Terminal 1 (-)	Terminal 2 (+)	Extension	Grade
J	Red	White	dark-Brown	Black
K	Red	Yellow	dark-Brown	Yellow
T	Red	Blue	dark-Brown	Blue
E	Red	Purple	dark-Brown	Purple
N	Red	Orange	dark-Brown	Brown
R	Red	Black	-	Green
S	Red	Black	-	Green
B	Red	Gray	-	Black

2.3.3 Two/Three/Four-Wire RTD

The figures below show the input connections and input connector jumpers (shown in bold lines) required to hookup a 2-, 3- or 4-wire RTD.

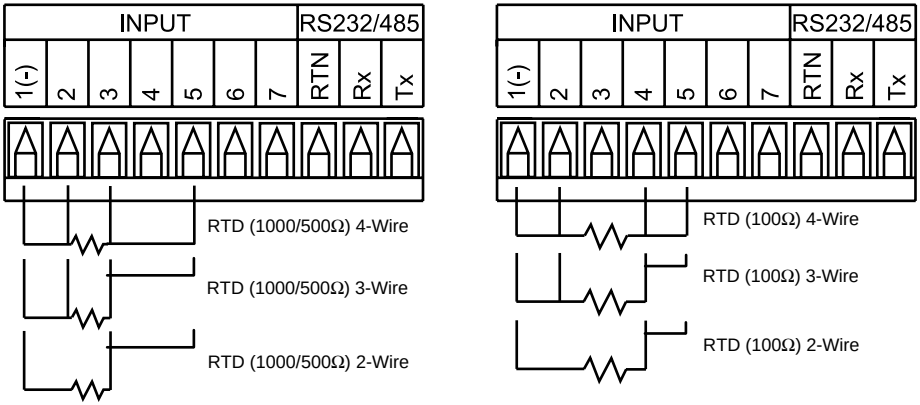


Figure 2.6 a) RTD-1000 ohm and 500 ohm Wiring Hookup **b) RTD-100 ohm Wiring Hookup**

The **two-wire** connection is simplest method, but does not compensate for lead-wire temperature change and often requires calibration to cancel lead-wire resistance offset.

The **three-wire** connection works best with RTD leads closely equal in resistance. The device measures the RTD, plus upper and lower lead drop voltage and the subtracts twice the measured drop in the lower supply current lead producing excellent lead-resistance cancellation for balanced measurements.

The **four-wire** RTD hookup is applicable to unbalanced lead resistance and enables the device to measure and subtract the lead voltage, which produces the best lead-resistance cancellation.

When configuring your controller, select RTD type and RTD value in the Input Type menu (see Part 3).

Note ☞ If the input wires of the meter get disconnected or broken, it will display `+OPN` "Input (+) Open" message except in case of 500/1000 Ω 2-wire RTD. In this case the display shows `-OPN` "Input (-) Open" message. For safety purpose you may want to set up your alarm to be triggered when input is open. See Alarm 1 & 2 chapters for details.

2.3.4 Process Current

The figure below shows the wiring hookup for Process Current 0 – 20 mA.

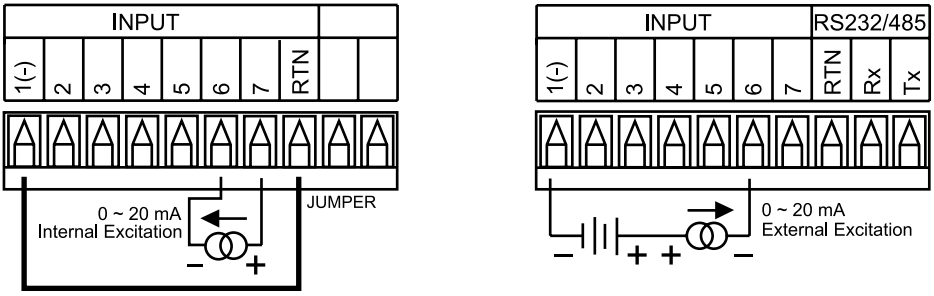


Figure 2.7 Process Current Wiring Hookup (Internal and External Excitation)

When configuring your instrument, select Process Type in the Input Type Menu (see Part 3).

2.3.5 Process Voltage

The figure below shows the wiring hookup for Process Voltage 0 – 100 mV, 0 – 1 V, 0 – 10 V.

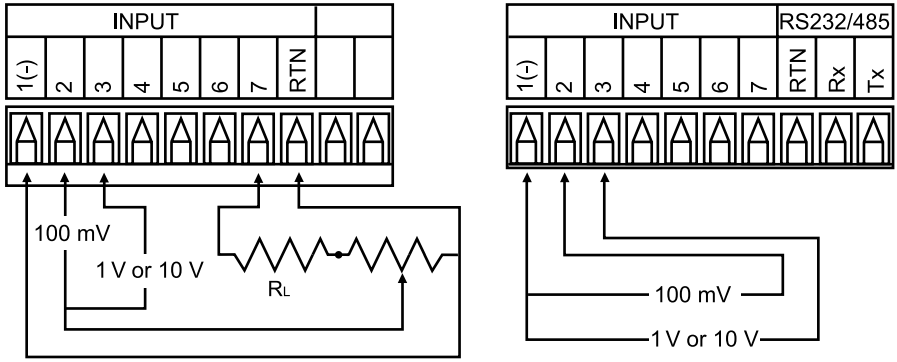


Figure 2.8
a) Process Voltage Wiring Hookup with Sensor Excitation
b) Process Voltage Wiring Hookup without Sensor Excitation

R_L - Voltage limited resistor, which allows to convert 24 Vdc internal excitation voltage to the appropriate process input value. For instance: if the potentiometer value is equal to 10 kΩ, the minimum R_L is 14 kΩ for 10 V process input.

When configuring your instrument, select Process Type in the Input Type Menu (see Part 3).

2.3.6 Wiring Outputs

This meter has two factory installed outputs. The SPDT Mechanical Relay, SPST Solid State Relay, Pulse and Analog Output Connection are shown below.

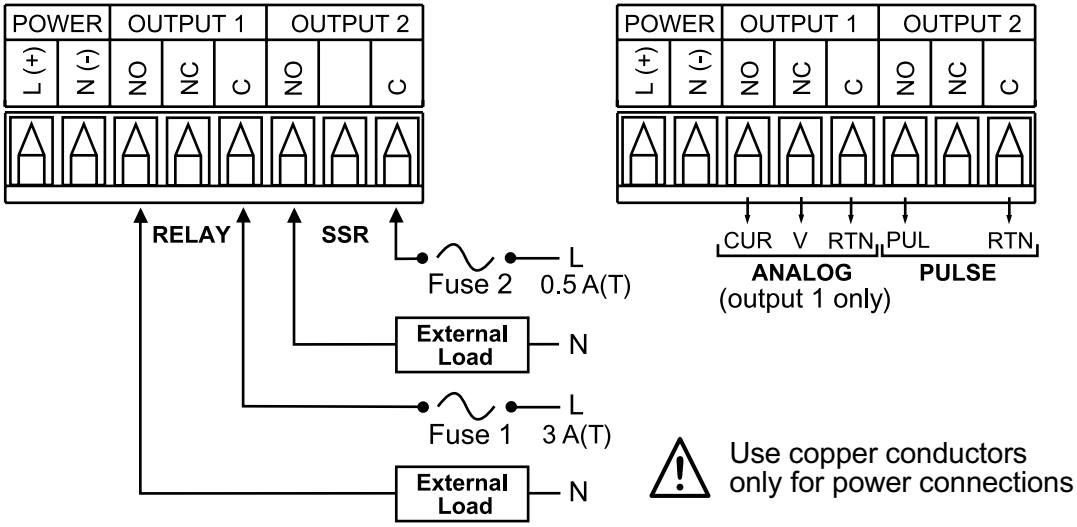


Figure 2.9
a) Mechanical Relay and SSR Outputs Wiring Hookup
b) Pulse and Analog Outputs Wiring Hookup

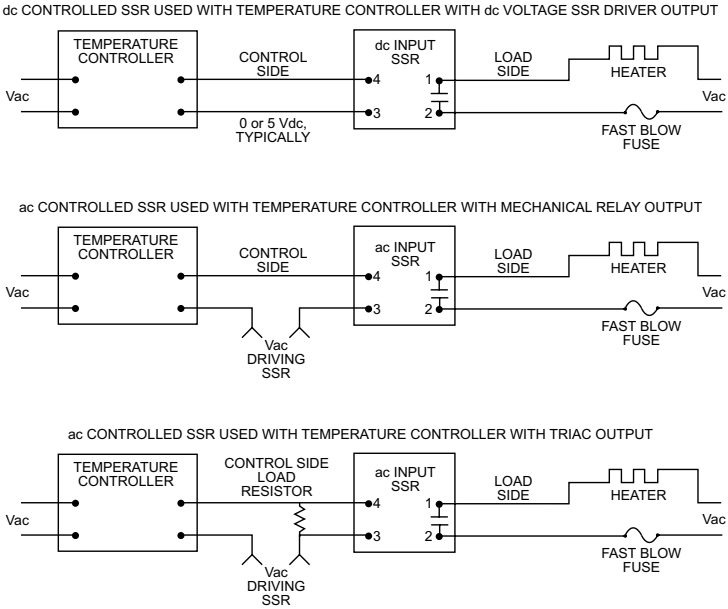
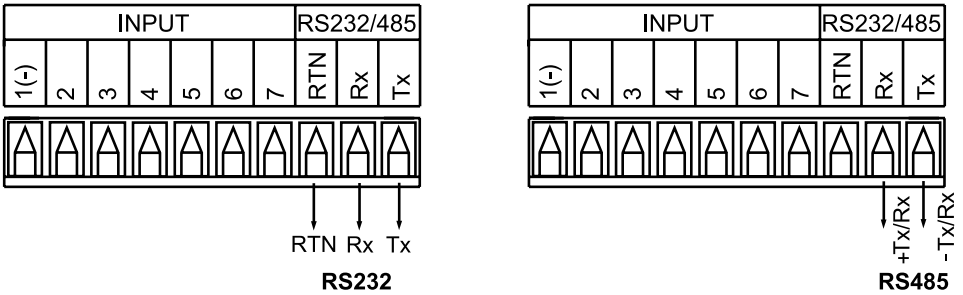


Figure 2.10 Typical Applications

This device may have a programmable communication output. The RS-232 and RS-485 Output Connection are shown below.



Note ☞ External RS-232 connections are not available with -EI or C4EI options.

Figure 2.11
a) RS-232 Output Wiring Hookup b) RS-485 Output Wiring Hookup

This device may also have an excitation output.

Note ☞ If the Dual Display model has a Low Voltage power supply option, then excitation is not available.

Note ☞ Excitation is not available if communication option is installed.

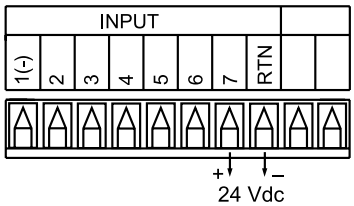


Figure 2.12 Excitation Output

This device has snubber circuits designed to protect the contacts of the mechanical relays when it switches to inductive loads (i.e. solenoids, relays). These snubbers are internally connected between the Common (C) and Normally Open (NO) relay contacts of Output 1 and Output 2.

Note ☞ If you have an inductive load connected between Common (C) and Normally Closed (NC) contacts of the mechanical relays and you want to protect them from the rush current during the switching period, you have to connect an external snubber circuit between Common (C) and Normally Closed (NC) contacts as indicated in Figure 2.13.

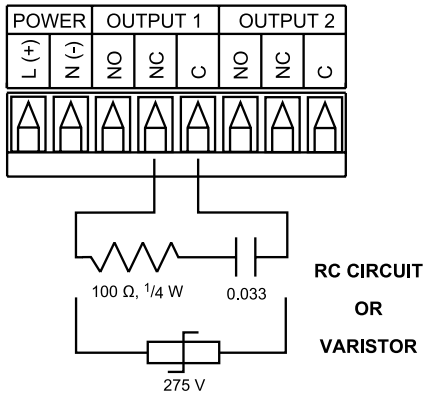


Figure 2.13 Snubber Circuits Wiring Hookup

2.3.7 Dual Display Color Setup

The dual display option allows the user to change the color of the upper and lower displays.

Note ☞ To change the color of the upper display, see **Section 3.2.15** (Display Color section).

To change the color of the lower display follow the instructions below:
The unit should be removed from the panel and opened.

Note ☞ Refer to the Quick Start Guide for assembly and disassembly instructions.

The S1 jumper is located on the back side of the display board.
The location of S1 and pin selection jumpers are shown below.

Use a jumper for GREEN or RED, never leave S1 open.

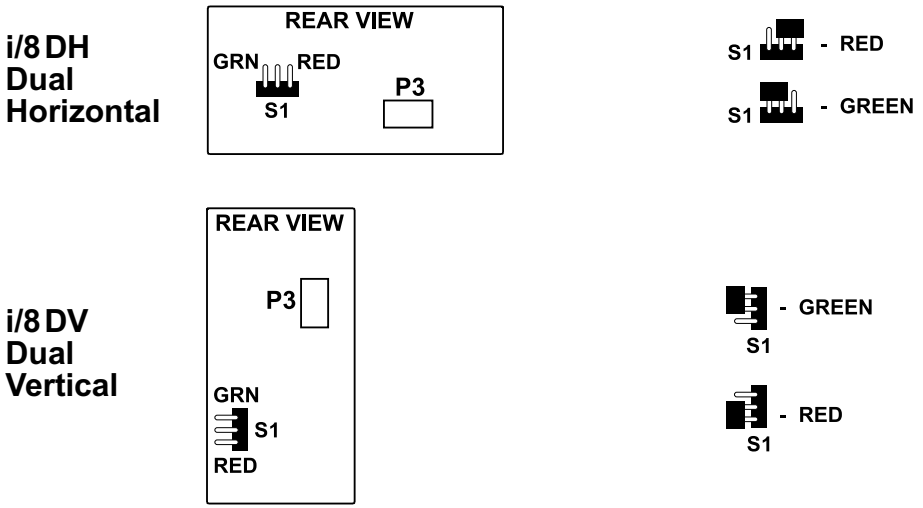


Figure 2.14 i/8D Location of S1 and Selectable Jumper Positions

Figure 2.15 i/16D Location of S1 and Selectable Jumper Positions

PART 3
OPERATION: Configuration Mode
3.1 Introduction

The instrument has two different modes of operation. The first, Run Mode, is used to display values for the Process Variable, and to display or clear Peak and Valley values. The other mode, Menu Configuration Mode, is used to navigate through the menu options and configure the controller. Part 3 of this manual will explain the Menu Configuration Mode. For your instrument to operate properly, the user must first "program" or configure the menu options.

Turning your Controller On for the First Time

The device becomes active as soon as it is connected to a power source. It has no On or Off switch. The device at first momentarily shows the software version number, followed by reset RSt, and then proceeds to the Run Mode.

Tip For first-time users: Refer to the QuickStart Manual for basic operation and set-up instructions.

Tip If you have the Serial Communications/Ethernet Option you can easily configure the controller on your computer or on-line.

Table 3.1 Button Function in Configuration Mode

MENU	• To enter the Menu, the user must first press button. • Use this button to advance/navigate to the next menu item. The user can navigate through all the top level menus by pressing . • While a parameter is being modified, press to escape without saving the parameter.
(UP)	• Press the up button to scroll through “flashing” selections. When a numerical value is displayed press this key to increase value of a parameter that is currently being modified. • Holding the button down for approximately 3 seconds will speed up the rate at which the set point value increments. • In the Run Mode press causes the display to flash the PEAK value – press again to return to the Run Mode.
(DOWN)	• Press the down button to go back to a previous Top Level Menu item. • Press this button twice to reset the controller to the Run Mode. • When a numerical value is flashing (except set point value) press to scroll digits from left to right allowing the user to select the desired digit to modify. • When a setpoint value is displayed press to decrease value of a setpoint that is currently being modified. Holding the button down for approximately 3 seconds will speed up the rate at which the setpoint value is decremented. • In the Run Mode press causes the display to flash the VALLEY value – press again to return to the Run Mode.
ENTER	• Press the enter button to access the submenus from a Top Level Menu item. • Press to store a submenu selection or after entering a value — the display will flash a StRd message to confirm your selection. • To reset flashing Peak or Valley press . • In the Run Mode, press twice to enable Standby Mode with flashing Stby.

Note **Reset:** Except for Alarms, modifying any settings of the menu configuration will reset the instrument prior to resuming Run Mode.

3.2 Menu Configuration

Note ☞ It is required that you put the controller in the Standby Mode for any configuration change other than Setpoints & Alarms.

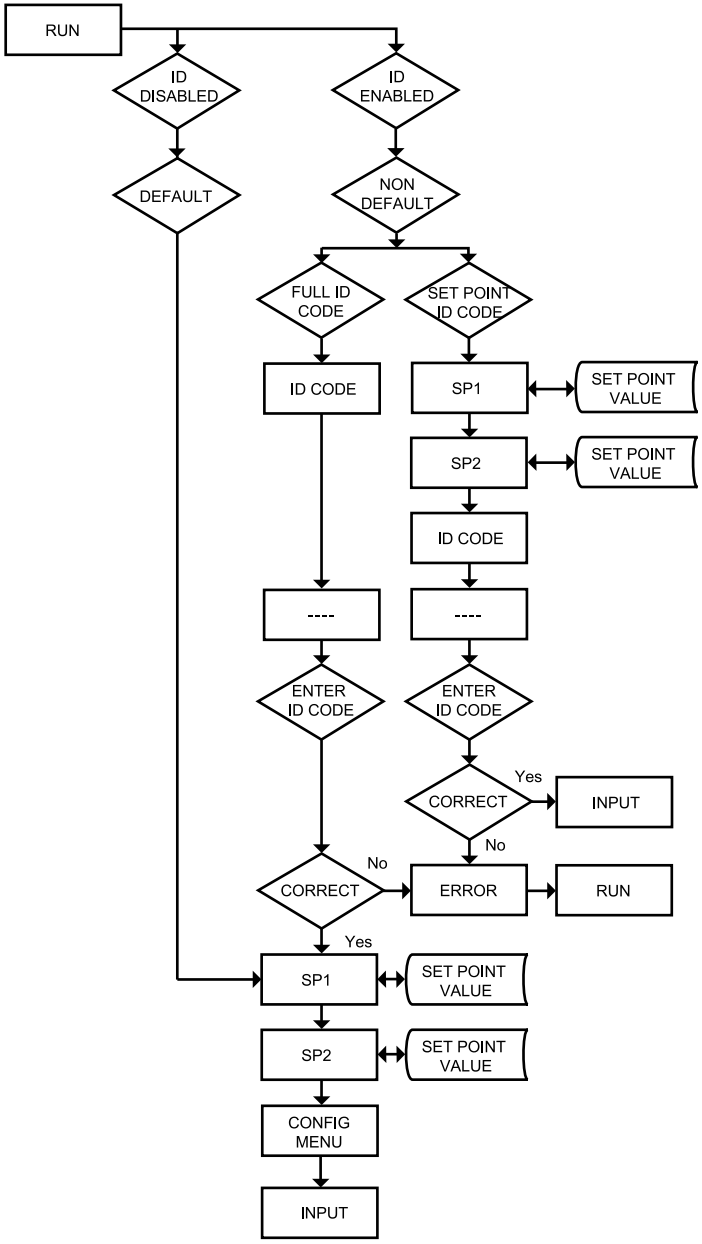


Figure 3.1 Flow Chart for ID and Setpoints

3.2.1 ID Number

SEE ID MENU SELECTION IN CONFIGURATION SECTION FOR ENABLE/DISABLE OR CHANGE ID CODE.

Note ☞ If ID Code is **Disabled** or set as **Default** (0000) the menu will skip ID step to Setpoint Menu.

If ID Code is set to **Full** Security Level and user attempts to enter the Main Menu, they will be prompted for an ID Code.

If ID Code is set to **Setpoint/ID** Security Level and user attempts to enter the Configuration Menu, they will be prompted for an ID Code.

ENTERING YOUR NON-DEFAULT FULL SECURITY ID NUMBER.

Press ➋	**1)** Display shows Id.
Press ➍	**2)** Display advances to ----.
Press ▲ & ▼	**3)** Press ▲ to increase digit 0-9. Press ▼ to activate next digit (flashing). Continue to use ▲ and ▼ to enter your 4-digit ID code.
Press ➍	**4)** If the correct ID code is entered, the menu will advance to the Setpoint 1 Menu, otherwise an error message ERRo will be displayed and the instrument will return to the Run Mode.

Note ☞ To change ID Code, see ID Menu in the Configuration section.

ENTERING YOUR NON-DEFAULT SETPOINT/ID SECURITY ID NUMBER.

Press ➋	**5)** Display shows SP1 Setpoint 1 Menu.
Press ➋	**6)** Display shows SP2 Setpoint 2 Menu.
Press ➋	**7)** Display shows Id ID Code Menu.
Press ➍	**8)** Display advances to ----.
Press ▲ & ▼	**9)** Use ▲ and ▼ to change your ID Code.
Press ➍	**10)** If correct ID Code is entered, the display will advance to the INPt Input Menu, otherwise the error message ERRo will be displayed and the controller will return to the Run Mode.

Note ☞ To prevent unauthorized tampering with the setup parameters, the instrument provides protection by requiring the user to enter the ID Code before allowing access to subsequent menus. If the ID Code entered does not match the ID Code stored, the controller responds with an error message and access to subsequent menus will be denied.

Tip ☞ Use numbers that are easy for you to remember. If the ID Code is forgotten or lost, call customer service with your serial number to access and reset the default to 0000.

3.2.2 Set Points

SETPOINT 1:

Press ⊙ **1)** Press ⊙, if necessary until SP 1 prompt appears.
Press ⊙ **2)** Display shows previous value of “Setpoint 1”.
Press ▲ & ▼ **3)** Press ▲ and ▼ to increase or decrease Setpoint 1 respectively.

Note ☞ Holding ▲ & ▼ buttons down for approximately 3 seconds will speed up the rate at which the Setpoint value increments or decrements.

Press ▲ & ▼ **4)** Continue to use ▲ and ▼ to enter your 4-digit Setpoint 1 value.
Press ⊙ **5)** Display shows StRd stored message momentarily and then advances to SP2 only, if a change was made, otherwise press ⊙ to advance to SP2 Setpoint 2 Menu.

SETPOINT 2:

Press ⊙ **6)** Display shows previous value of “Setpoint 2”.
Press ▲ & ▼ **7)** Press ▲ and ▼ to increase or decrease Setpoint 2 respectively.

Note ☞ Holding ▲ & ▼ buttons down for approximately 3 seconds will speed up the rate at which the setpoint value increments or decrements.

Press ⊙ **8)** Display shows StRd stored message momentarily and then advances to CNFG only, if a change was made, otherwise press ⊙ to advance to CNFG Configuration Menu.

3.2.3 Configuration Menu

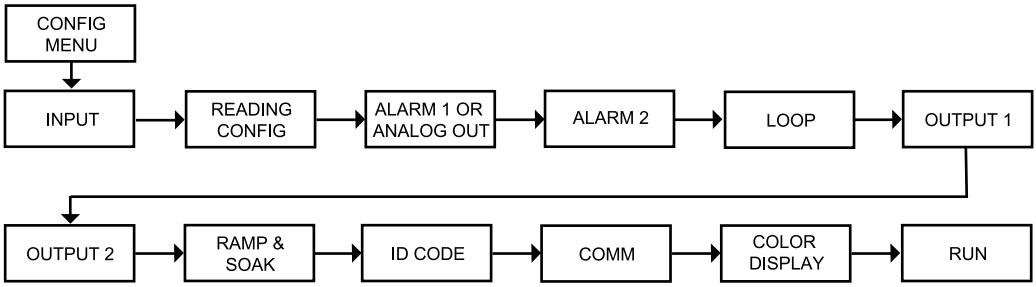


Figure 3.2 Flow Chart for Configuration Menu

Enter Configuration Menu:

Press ⊙ **1)** Press ⊙, if necessary, until CNFG prompt appear.
Press ⊙ **2)** Display advances to INPt Input Menu.
Press ⊙ **3)** Pressing and releasing ⊙ to scroll through all available menus of Configuration section.

3.2.4 Input Type Menu

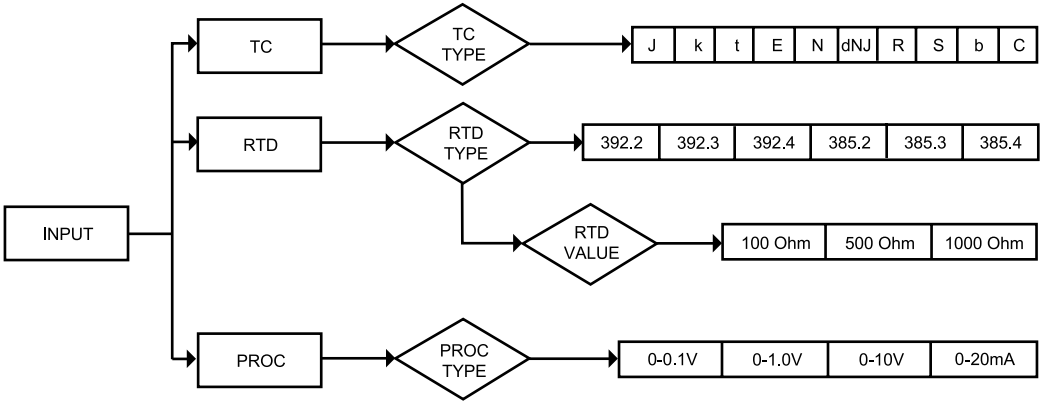


Figure 3.3 Flow Chart for Input Type Menu

Input Type (Thermocouple)

ENTER INPUT TYPE MENU:

Press ⟲ **1)** Press ⟲, if necessary, until CNFG prompt appears.
Press ⟳ **2)** Display advances to INPt Input Menu.
Press ⟳ **3)** Display flashes t.c, rtd or PROC (Thermocouple, RTD or Process). If the displayed input type is t.c, press ⟲ to skip to step 6 (t.c stops flashing).

THERMOCOUPLE SUBMENU:

Press ⟰ **4)** Scroll through the available selection to t.c (flashing).
Press ⟳ **5)** Display shows StRd stored message momentarily and then t.c (not flashing).
Press ⟳ **6)** Display flashes previous thermocouple type selection. i.e. J (see below for types).
Press ⟰ **7)** Scroll through the available thermocouple types to the selection of your choice.
Press ⟳ **8)** Display shows StRd stored message momentarily and then advances to the RdG Reading Configuration Menu.

Note ☞ Use the Input Type (Thermocouple) (RTD) or (Process) and verify your Electrical Installation (see section 2.3).

Thermocouple Types: J, K, T, E, N, DIN J, R, S, B, C
Display: J K t E n dnJ r S b C

Input Type (RTD)

ENTER INPUT TYPE MENU:

Press ⊙ **1)** Press ⊙, if necessary, until CNFG prompt appears.
Press ⊙ **2)** Display advances to INPt Input Menu.
Press ⊙ **3)** Display flashes t.c, Rtd or PROC (Thermocouple, RTD or Process). If the displayed input type is Rtd, press ⊙ to skip to step 6 (Rtd stops flashing).

RTD SUBMENU:

Press ▲ **4)** Scroll through the available selection to Rtd (flashing).
Press ⊙ **5)** Display shows StRd stored message momentarily and then Rtd (not flashing).
Press ⊙ **6)** Display flashes previous RTD type selection i.e. 392.2 (see below for RTD types selection).
Press ▲ **7)** Scroll through the available RTD types to the selection of your choice.
Press ⊙ **8)** Display shows StRd stored message momentarily and then advances to Rtd RTD value.

RTD Types: 392 385 Two, Three or Four-wire
Display: 392.2, 392.3, 392.4, 385.2, 385.3, 385.4

Note ☞ Last digit indicates: 2-, 3- or 4-wire input.

RTD VALUE SUBMENU:

Press ⊙ **9)** Display flashes previous RTD value selection i.e. 100_ (see below for RTD value selection).
Press ▲ **10)** Scroll through the available RTD values to the selection of your choice.
Press ⊙ **11)** Display shows StRd stored message momentarily and then advances to RdG Reading Configuration Menu.

RTD Values: 100 ohm 500 ohm 1000 ohm
Display: 100_ 500_ 1000

Input Type (Process)

ENTER INPUT TYPE MENU:

Press ⊙ **1)** Press ⊙, if necessary, until CNFG prompt appears.
Press ⊙ **2)** Display advances to INPt Input Menu.
Press ⊙ **3)** Display flashes t.c, Rtd or PROC (Thermocouple, RTD or Process). If the displayed input type is PROC, press ⊙ to skip to step 6 (PROC stops flashing).

PROCESS SUBMENU:

Press ▲ **4)** Scroll through the available selection to PROC (flashing).
Press ⊙ **5)** Display shows StRd stored message momentarily and then PROC (not flashing).
Press ⊙ **6)** Display flashes previous Process type selection. i.e. 0-10 (see below for Process types selection).
Press ▲ **7)** Scroll through the available Process types to the selection of your choice.
Press ⊙ **8)** Display shows StRd stored message and then advances to rdG Reading Configuration Menu.

Process Types:	100 mV	1 V	10 V	0 – 20 mA
Display:	0-0.1	0-1.0	0-10	0-20

For 4-20 mA Input select 0-20 mA then adjust the Input/Reading accordingly. To adjust 4-20 mA input, see example under INPUT/READING submenu. The factory preset value is 4-20 mA.

3.2.5 Reading Configuration

Note ☞ It is required that you put the controller in the Standby Mode for any configuration change other than Set Points & Alarms.

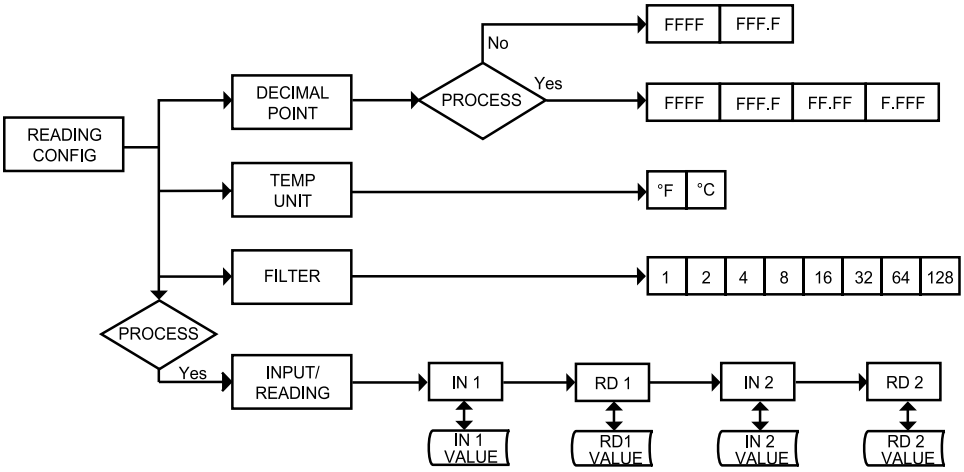


Figure 3.4 Flow Chart for Reading Configuration Menu

ENTER READING CONFIGURATION MENU:

Press ↵ **1)** Press ↵, if necessary, until CNFG prompt appears.
Press ↵ **2)** Display advances to INPt Input Menu.
Press ↵ **3)** Display advances to RdG Reading Configuration Menu.
Press ↵ **4)** Display advances to dEC Decimal Point.

DECIMAL POINT SUBMENU:

Press ↵ **5)** Display flashes previous selection for Decimal location.
Press ▲ **6)** Scroll though the available selections and choose Decimal location: FFFF or FFF.F (also FF.FF and F.FFF — if PROC Process type was selected in the Input Type Menu).
Press ↵ **7)** Display shows StRd stored message momentarily and then advances to tEMP Temperature Unit.

Note ☞ Decimal Point for Process Input Type is passive.

TEMPERATURE UNIT SUBMENU:

Press ↵ **8)** Display flashes previous Temperature Unit selection.
Press ▲ **9)** Scroll though the available selections to the Temperature Unit of your choice: °F or °C.
Press ↵ **10)** Display shows StRd stored message momentarily and then advances to FLtR Filter Constant.

FILTER CONSTANT SUBMENU:

Press ↵ **11)** Display flashes previous selection for Filter Constant.
Press ▲ **12)** Scroll though the available selections:
0001, 0002, 0004, 0008, 0016, 0032, 0064, 0128
Press ↵ **13)** Display shows StRd stored message momentarily only, if change was made, otherwise press ↵ to advance to the next menu.

Note ☞ If Process was selected in the Input Type Menu the display will advance to IN.Rd Input/Reading Submenu, otherwise the display advances to the ALR1 Alarm 1 Menu.

The Filter Constant Submenu allows the user to specify the number of readings stored in the Digital Averaging Filter.

Tip ☞ For PID control select filter value 0001-0004. A filter value of 2 is approximately equal to 1 second RC low pass time constant.

Reading Configuration (If Process was selected)

INPUT/READING (SCALE AND OFFSET) SUBMENU:

Input Voltage or Current can be converted or scaled into values appropriate for the process or signal being measured. So, a reading may be displayed, for example, in units of weight or velocity instead of in amperes or volts.

The instrument determines Scale and Offset values based on two user-provided input values entered with the corresponding readings. Note that “In1” Input 1 and “In2” Input 2 are represented and entered as a product of the input voltage/current and the conversion number from the Table 3.1.

Note ☞ The following instructions include details for a specific scenario in which a 4-20 mA input (in the 20 mA Process Mode) is to be represented as a measurement of 0-100 percent.

Press ⏎ **14)** Press ⏎ at the IN.Rd prompt. Display shows IN 1 Input 1 submenu.

Press ⏎ **15)** Display shows Input 1 value with 1st digit flashing.

Press ▲ & ▼ **16)** Use ▲ and ▼ buttons to enter IN 1 value.
The IN 1 value = min. input value * conversion number.

Note ☞ Disregard the position of the decimal point (2000 counts may actually appear as “200.0”, “20.00”, or “2.000”).

Example: 4 mA as 4(mA) x 500 = 2000.

Press ⏎ **17)** Display advances to Rd 1 Reading 1 Submenu.

Press ▲ & ▼ **18)** Use ▲ and ▼ buttons to enter Rd 1 value.
This value represents IN 1 in terms of some meaningful engineering units. To show the 4 mA as zero percent enter Rd 1 value = 0000.
Example: Rd 1 value = 0000.

Press ⏎ **19)** Display IN 2 Input 2 Submenu.

Press ⏎ **20)** Display shows Input 2 value with 1st digit flashing.
The IN 2 value = max. input value * conversion number.
Example: 20(mA) x 500 = 10000 (9999).

Press ▲ & ▼ **21)** Use ▲ and ▼ buttons to enter IN 2 value.

Press ⏎ **22)** Display advances to Rd 2 Reading 2 Submenu.

Press ▲ & ▼ **23)** Use ▲ and ▼ buttons to enter Rd 2 value.
Example: Rd 2 value = 0100.

Press ⏎ **24)** Display flashes StRd stored message momentarily and then advances to ALR 1 only, if change was made, otherwise press ⏎ to advance to ALR 1 Alarm 1 Menu.

Tip ☞ Conversion number is a coefficient of conversion between input values and real full display range (10000 counts shown as 9999). See Table 3.2 below for proper conversion number.

Table 3.2 Conversion Table

RANGE	CONVERSION NUMBER
100 mV	10000 / (100 x 1) = 100
1 V	10000 / (1000 x 1) = 10
10 V	10000 / (1000 x 10) = 1
0 -20 mA	10000 / (20 x 1) = 500

Example =
0 - 1 V = 0 - 100.0
In 1 = 0
Rd 1 = 0
Inp 2 = 9999
Rd 2 = 100.0

3.2.6 Alarm 1

This unit is equipped with two physical outputs that can only be configured as follows: **Alarm 1 & Alarm 2, Alarm 1 & Output 2, Output 1 & Alarm 2, Output 1 & Output 2, Analog Out 1 & Alarm 2, Analog Out 1 & Output 2**. Analog Out available only if Analog Output Option board is factory installed.

Note If Analog Output Option is installed, the controller will skip Alarm 1 Menu item to Analog Output.

Note Alarm must be DISABLED if Ramp is ENABLED.

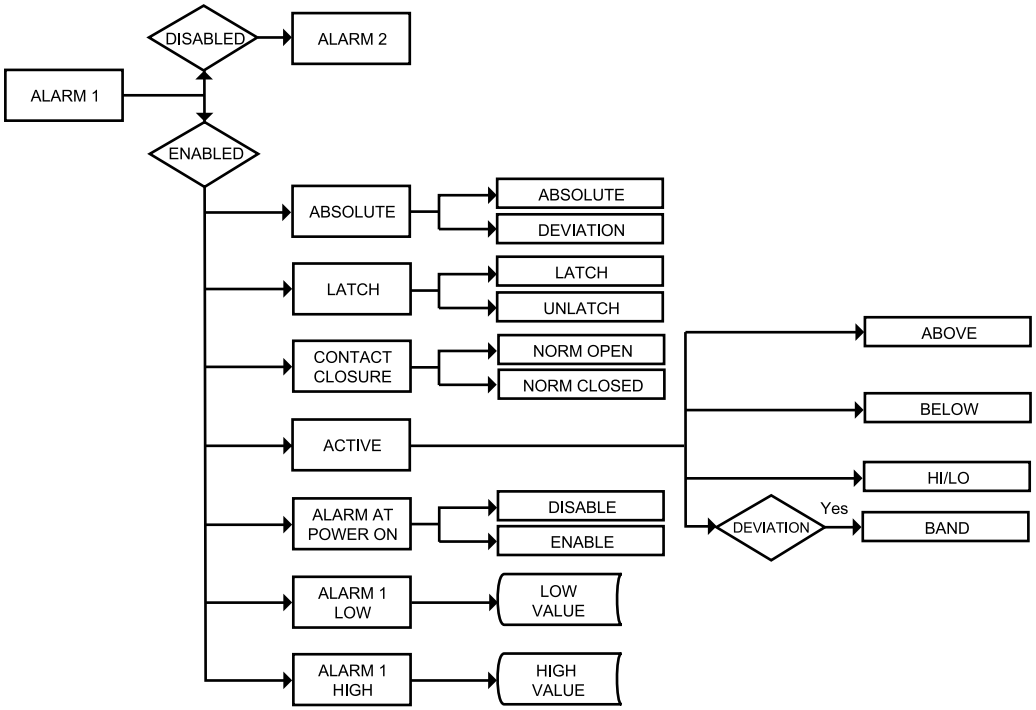


Figure 3.5 Flow Chart for Alarm 1

ENTER ALARM 1 MENU:

Press ⊙ **1)** Press ⊙, if necessary, until CNFG prompt appears.
Press ⊙ **2)** Display advances to INPt Input Menu.
Press ⊙ **3)** Press ⊙, if necessary, until Display advances to ALR1 Alarm 1 Menu.
Press ⊙ **4)** Display advances to Alarm 1 ENbL Enable or dSbL Disable Submenu and flashes the previous selection.

ALARM 1 ENABLE/DISABLE SUBMENU:

Press ▲ **5)** Scroll though the available selection until ENbL displays to use Alarm 1.

Press ➲ **6)** Display shows StRd stored message momentarily and then advances to AbSo only if it was changed, otherwise press ➲ to advance to AbSo Alarm 1 Absolute/Deviation Submenu.

Note If dSbL Alarm 1 **Disabled** was selected, all submenus of Alarm 1 Menu will be skipped and meter advances to ALR2 Alarm 2 Menu. If ENbL Alarm 1 **Enabled** was selected, Output 1 would be automatically Disabled, and reassigned as Alarm 1.

ALARM 1 ABSOLUTE/DEVIATION SUBMENU:

Press ➲ **7)** Display flashes previous selection. Press ▲ to AbSo Absolute or dEv Deviation.

Press ➲ **8)** Display shows StRd stored message momentarily and then advances to LtcH only if it was changed, otherwise press ➲ to advance to LtcH Alarm 1 Latch/Unlatch Submenu.

Absolute Mode allows Alarm 1 to function independently from Setpoint 1. If the process being monitored does not change often, then "Absolute" Mode is recommended.

Deviation Mode allows changes to Setpoint 1 to be made automatically to Alarm 1. Deviation mode is typically the ideal mode if the process temperature changes often. In Deviation Mode, set Alarm 1 a certain number of degrees or counts away from Setpoint 1 — this relation remains fixed even if Setpoint 1 is changed.

ALARM 1 LATCH/UNLATCH SUBMENU:

Press ➲ **9)** Display flashes previous selection. Press ▲ to LtcH Latched or UnLt Unlatched.

Press ➲ **10)** Display shows StRd stored message momentarily and then advances to Ct.CL only, if it was changed, otherwise press ➲ to advance to Ct.CL Contact Closure Submenu.

Latched Mode: Relay remains "latched" until reset. To reset already latched alarm, select Alarm Latch and press Max twice (i.e. Unlatch and then back to Latch) or from a Run Mode, push ➲ twice to put the controller in Standby Mode and then push ➲ one more time to return to the Run Mode.

Unlatched Mode: Relay remains latched only as long as the alarm condition is true.

CONTACT CLOSURE SUBMENU:

Press ⏲ **11)** Display flashes previous selection. Press ▲ to n.c. Normally Closed or n.o. Normally Open.

Press ⏲ **12)** Display shows StRd stored message momentarily and then advances to ActN only if it was changed, otherwise press ⏲ to advance to ActN Active Submenu.

Normally Open: If this feature is selected, then the relay is "energized" only when an alarm condition occurs.

Normally Closed: "Fail Safe" Mode. Relay is energized under "normal" conditions and becomes de-energized during alarm or power failure.

ACTIVE SUBMENU:

Press ⏲ **13)** Display flashes previous selection. Press ▲ to scroll through the available selections: AboV Above, bELo Below, HI.Lo HI/Low and bAnd Band. (Band is active if dEV Deviation was selected).

Press ⏲ **14)** Display shows StRd stored message momentarily and then advances to A.P.oN only if it was changed, otherwise press ⏲ to advance to A.P.oN Alarm Enable/Disable at Power On Submenu.

Above: Alarm 1 condition triggered when the process variable is greater than the Alarm Hi Value (Low value ignored).

Below: Alarm 1 condition triggered when the process variable is less than the Alarm Low Value (Hi value ignored).

Hi/Low: Alarm 1 condition triggered when the process variable is less than the Alarm Low Value or above the Hi Value.

Band: Alarm 1 condition triggered when the process variable is above or below the "band" set around Setpoint 1. Band equals Hi Value (Low Value ignored). A "band" is set around the Setpoint by the instrument only in the "Deviation" Mode.

The Band for the AL 1 would be following the Setpoint 1 value

The Band for the AL 2 would be following the Setpoint 2 value.

The Band or the Deviation Value should be entered under:

AL1 High (if they want Alarm 1)

AL2 High (if they want Alarm 2)

AL Low value is ignored in the Band mode.

Example: if customer requires a Deviation Value of ±10 degrees around a setpoint (using Output 2 as alarm)

Output 2: disabled (this enables the Alarm 2)

Alarm 2: - Deviation

Contact Closure type: Deviation---Band

AL2 High: 10 (Band they want around Setpoint 2)

Then the Band Value is to be entered under AL2 HI: 10 not 80+10 = 90

ALARM ENABLE/DISABLE AT POWER ON:

Press ⏲ **15)** Display flashes previous selection. Press ▲ to ENbL enable or dSbL disable.

Press ⏲ **16)** Display shows StRd stored message. momentarily and then advances to ALR.L only if it was changed, otherwise press ⏲ to advance to the ALR.L Alarm 1 Low Value Submenu.

Note ☞ If the alarm is enabled at Power On, the alarm will be active right after reset. If the alarm is disabled at Power On, the alarm will become enabled when the process value enters the non alarm area. The alarm is not active while the process value is approaching Setpoint 1.

ALARM 1 LOW VALUE SUBMENU:

Press ⏲ **17)** Display flashes 1st digit of previous value. Use ▲ and ▼ to enter new value.

Press ▲ & ▼ **18)** Use ▲ and ▼ to enter Alarm 1 Low Value.

Press ⏲ **19)** Display shows StRd storage message momentarily and then advances to ALR.H only, if it was changed, otherwise press ⏲ to advance to ALR.H Alarm 1 Hi Value Submenu.

ALARM 1 HI VALUE SUBMENU:

Press ⏲ **20)** Display flashes 1st digit of previous value. Use ▲ and ▼ to enter new value.

Press ▲ & ▼ **21)** Use ▲ and ▼ to enter Alarm1 Hi Value.

Press ⏲ **22)** Display shows StRd stored message momentarily and then advances to the next menu only, if it was changed, otherwise press ⏲ to advance to the next menu.

3.2.7 Analog Output (Retransmission)

Note ☞ Analog Output can be configured as Retransmission or Control outputs. In this section we will discuss Retransmission Output.

This unit is equipped with two physical outputs that can only be configured as follows: **Alarm 1 & Alarm 2, Alarm 1 & Output 2, Output 1 & Alarm 2, Output 1 & Output 2, Analog Out 1 & Alarm 2, Analog Out 1 & Output 2**. Analog Output is available only, if Analog Output Option board is factory installed.

Note ☞ If Analog Output Option is not installed, the instrument will skip to Alarm 2 Menu.

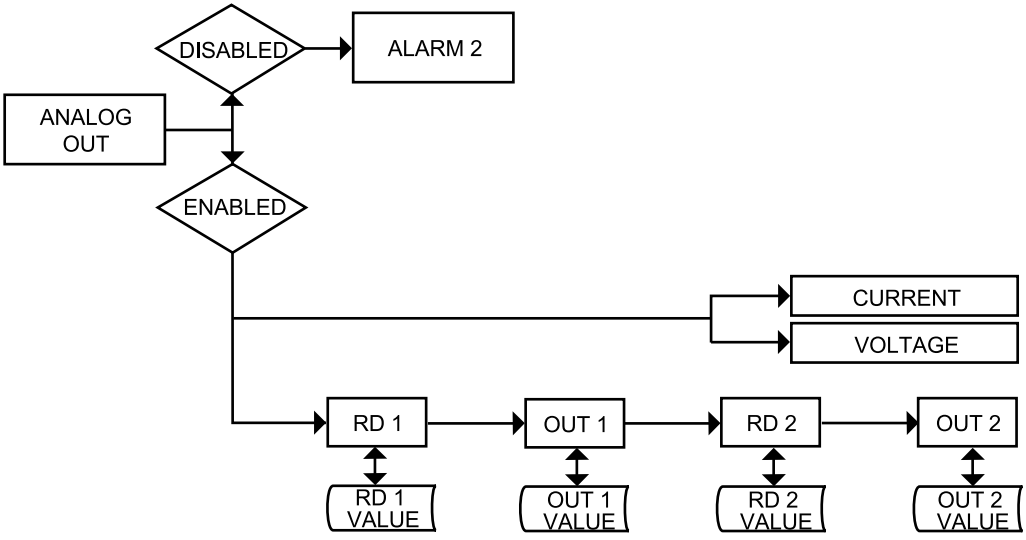


Figure 3.6 Flow Chart for Analog Output (Retransmission)

ENTER ANALOG OUTPUT MENU:

Press ⊙ **1)** Press ⊙, if necessary, until CNFG prompt appears.
Press ⊙ **2)** Display advances to INPt Input Menu.
Press ⊙ **3)** Press ⊙, if necessary, until Display advances to ANLG Analog Output Menu.
Press ⊙ **4)** Display advances to Analog Output ENbL Enable or dSbL Disable Submenu and flashes the previous selection.

ANALOG OUTPUT ENABLE/DISABLE SUBMENU:

Press ▲ **5)** Scroll though the available selection until ENbL displays to use Analog Output Retransmission (output proportional to the input signal).

Press ↵ **6)** Display shows StRd stored message momentarily and then advances to CURR or VoLt Submenu only if it was changed, otherwise press ↵ to advance to CURR or VoLt Current/Voltage Submenu.

Note ☞ If dSbL Analog Output **Disabled** was selected, all submenus of Analog Output Menu will be skipped and the meter will advance to ALR2 Alarm 2 Menu. If ENbL Analog Output **Enabled** was selected, Output 1 would be automatically **Disabled**, and reassigned as Analog Output.

CURRENT/VOLTAGE SUBMENU:

Press ↵ **7)** Display flashes CURR Current or VoLt Voltage.

Press ▲ **8)** Scroll through the available selection: Current or Voltage (Example VoLt).

Press ↵ **9)** Display shows StRd stored message momentarily and then advances to Rd 1 Submenu only if it was changed, otherwise press ↵ to advance to Rd 1 Reading 1 Submenu.

READING 1:

Press ↵ **10)** Display flashes 1st digit of previous “Reading 1” value.
Press ▲ & ▼ **11)** Enter “Reading 1” value. (Example 0000)
Press ↵ **12)** Display advances to Out.1 Out 1 Submenu.

OUT 1:

Press ↵ **13)** Display flashes 1st digit of previous “Out 1” value.
Press ▲ & ▼ **14)** Enter “Out 1” value. (Example 00.00)
Press ↵ **15)** Display advances to Rd 2 Reading 2 Submenu.

READING 2:

Press ↵ **16)** Display flashes 1st digit of previous “Reading 2” value.
Press ▲ & ▼ **17)** Enter “Reading 2” value. (Example 9999)
Press ↵ **18)** Display advances to Out.2 Out 2 Submenu.

OUT 2:

Press ↵ **19)** Display flashes 1st digit of previous “Out 2” value.
Press ▲ & ▼ **20)** Enter “Out 2” value. (Example 10.00)
Press ↵ **21)** Display advances to the ALR2 Alarm 2 Menu.

Note ☞ The above example is for 0-10 V of the entire range of the Process Input and Analog Output. For 0-20 mA output you need to set “Analog Type” to Current and OUT 2 to 20.00.

Accuracy of Analog Output board is +/-1% of FS (Full Scale) when following conditions are satisfied:

1. The input is not scaled below 1% of Input FS (10 mV @ 1 V or 0.2 mA @ 20 mA input ranges).
2. Analog Output is not scaled below 3% of Output FS (300 mV @ 10 V or 0.6 mA @ 20 mA output ranges).

Otherwise certain corrections need to be applied.

For example:

For entire range of process input, the Analog Output on 10 V FS scaled for **300 mV** output range:

Rd1 = 0000, Out1 = 00.00
RD2 = 9999, Out2 = 00.30

The **measured output** will be as follows:

Rd1 = 0000, Out1 = -0.07 V
Rd2 = 9999, Out2 = 0.23 V

This means that for 300 mV output range we have -70 mV offset at zero and at full scale. In order to compensate this 70 mV offset the **correct scaling** will be as follows:

Rd1 = 0000, Out1 = 00.07
Rd2 = 9999, Out2 = 00.37

The above corrections need to be applied only for **Input scaled below 1% of FS** and **Output scaled below 3% of FS** or if you need the **Analog Output accuracy to be better than 1% of FS.**

3.2.8 Alarm 2

This unit is equipped with two physical outputs that can only be configured as follows: **Alarm 1 & Alarm 2, Alarm 1 & Output 2, Output 1 & Alarm 2, Output 1 & Output 2, Analog Out 1 & Alarm 2, Analog Out 1 & Output 2**. Analog Out available only if Analog Output Option board is factory installed.

Note ☞ Alarm must be DISABLED if Ramp is ENABLED.

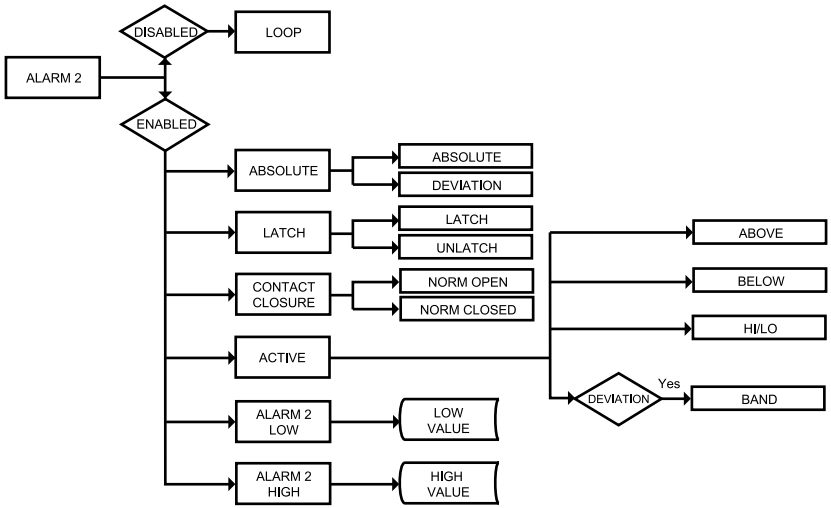


Figure 3.7 Flow Chart for Alarm 2

ENTER ALARM 2 MENU:

Press ⊙ **1)** Press ⊙, if necessary, until CNFG prompt appears.
Press ⊙ **2)** Display advances to INPt Input Menu.
Press ⊙ **3)** Press ⊙, if necessary, until Display advances to AlR2 Alarm 2 Menu.
Press ⊙ **4)** Display advances to Alarm 2 EnbL Enable or dSbL Disable Submenu.

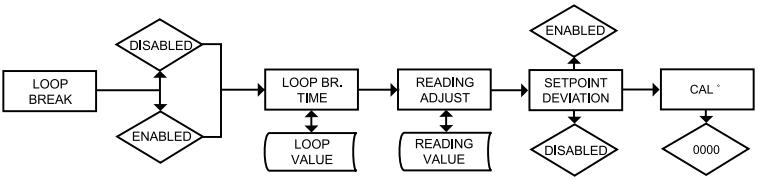
ALARM 2 ENABLE/DISABLE SUBMENU:

Press ⊙ **5)** Display flashes previous selection. Press ▲ until EnbL displays to use Alarm 2.
Press ⊙ **6)** Display shows StRd stored message momentarily and then advances to AbSo only if it was changed, otherwise press ⊙ to advance to AbSo Absolute/Deviation Submenu.

If dSbL Alarm 2 **Disabled** was selected, all submenus of Alarm 2 will be skipped and meter advances to LOOP Loop Break Time Menu. If EnbL Alarm 2 **Enabled** was selected, Output 2 will automatically **Disabled**, and reassigned as Alarm 2.

Note ☞ The remaining Alarm 2 menu items are identical to Alarm 1 Menu. Modifying Alarm Settings will not reset the instrument.

3.2.9 Loop Break Time/Field Calibration



Note It is required that you put the controller in the Standby Mode for any configuration change other than Set Points & Alarms.

Figure 3.8 Flow Chart for Loop Break Time/Field Calibration

ENTER LOOP BREAK TIME MENU:

Press ⊙ **1)** Press ⊙, if necessary, until CNFG prompt appears.
Press ⊙ **2)** Display advances to INPt Input Menu.
Press ⊙ **3)** Press ⊙, if necessary, until Display advances to LOOP Loop Break Time Menu.
Press ⊙ **4)** Display advances to Loop Break Time EnbL Enable or dSbL Disable Submenu and flashes the previous selection.

LOOP BREAK ENABLE/DISABLE SUBMENU:

Press ▲ **5)** Scroll through the available selections: EnbL or dSbL.
Press ⊙ **6)** Display shows StRd stored message momentarily and then advances to b.t 1M Loop Break Time Value Submenu.

Loop Break is an additional safety feature intended to monitor the rate of change of the process value, while approaching the SP1. It is strictly intended as an additional warning system, therefore its use is entirely optional. An active Loop Break will cause the Process Value digits to blink in a rotating pattern. If the process value reaches the set point the blinking will stop and b.t 1M is completed successfully, otherwise bR.AL Break Alarm warning will flash, and Output 1 will be turned off.

LOOP BREAK TIME VALUE SUBMENU:

Press ⊙ **7)** Display flashes 1st digit of previous Loop Value.
Press ▲ & ▼ **8)** Press ▲ and ▼ buttons to enter a new Loop Value (0 to 99.59).
Press ⊙ **9)** Display shows StRd stored message momentarily and then advances to R.Adj Reading Adjust Submenu.

Loop Break Time Value allows the user to determine the time interval in MM:SS (from zero to 99 minutes and 59 seconds) that the Process Value changes at least 10 counts or if the Input Type is either RTD or Thermocouple, the value changes 4° Fahrenheit or 2° Celsius. At the specified time interval, if the process value change is less than the stated rate, flashing b.t 1M will be displayed, the output 1 will be de-energized, and Alarm 1 energized. Loop break time will be disabled when the Process Value (PV) enters the control band.

READING ADJUST SUBMENU:

Press ⊙ **10)** Display flashes 1st digit of previous Reading Adjust value.
Press ▲ & ▼ **11)** Press ▲ and ▼ buttons to enter a new Reading Adjust value (-1999 to 9999).
Press ⊙ **12)** Display shows StRd stored message momentarily and then advances to SP.dV Setpoint Deviation Menu.

3.2.9 Loop Break Time/Field Calibration (continued)

Reading Offset Adjust allows the user to fine tune a minor error of the transducer, however some applications may require a large offset adjust.
(Displayed Process Value = Measured Process Value ± R.ADJ).
Reading Adjust is adjustable between -1999 to 9999. For Temperature Reading only, not Process

SETPOINT DEVIATION ENABLE/DISABLE SUBMENU:

Press ⏎ **13)** Display advances to Setpoint Deviation ENbL Enable or dSbL Disable Submenu and flashes the previous selection.
Press ⏶ **14)** Scroll through the available selections: ENbL or dSbL.
Press ⏎ **15)** Display shows StRd stored message momentarily and then advances to CAL° Menu.

Setpoint Deviation Submenu, if "enabled", allows changes to Setpoint 1 to be made automatically to Setpoint 2. This mode is very helpful if the Process Value changes often. In Setpoint Deviation Mode, set SP2 a certain number of degrees or counts away from SP1 - this relation remains fixed when SP1 is changed. For instance: Setting SP1=200 and SP2=20 and enabling SP.dY means that the absolute value of SP2=220. Moving SP1 to 300, the absolute value of SP2 becomes 320.

THERMOCOUPLE FIELD CALIBRATION SUBMENU:

> ⚠ **CAUTION:** Do not perform the following steps until you fully understand this entire section.

Note ☞ RTD and Process are perfectly calibrated. This section is applicable to Thermocouple (TC) calibration *only*.

Be sure that the TC being used to calibrate the meter is of the type selected in the TC submenu. Place the TC in an ice-bath (or other **0°C / 32°F** environment). In ambient temperature conditions: connect the TC to the meter, apply power to the meter.

⚠ **CAUTION:** Do not proceed with TC calibration unless the above conditions have been in effect for at least one hour.

Press ⏎ **7)** Display shows CAL° .
Press ⏎ **8)** Display shows flashing 0000.
Press ⏎ * **9)** Display will still show flashing 0000.
Press ⏎ * **10)** Display shows OUt 1 (meaning Calibration is complete)

* If you accidently engage the flashing 0000 (CAL° alert) simply re-press the last button you pressed, to avoid unintentionally mis-calibrating your meter.

3.2.10 Output 1

Alarm 1 and Output 1 or Analog Output (Retransmission) share the same contacts on the rear panel connector. If Alarm 1 or Analog Output (Retransmission) is **Enabled**, Output 1 is automatically **Disabled**.

Note ☞ It is required that you put the controller in the Standby Mode for any configuration change other than Set Points & Alarms.

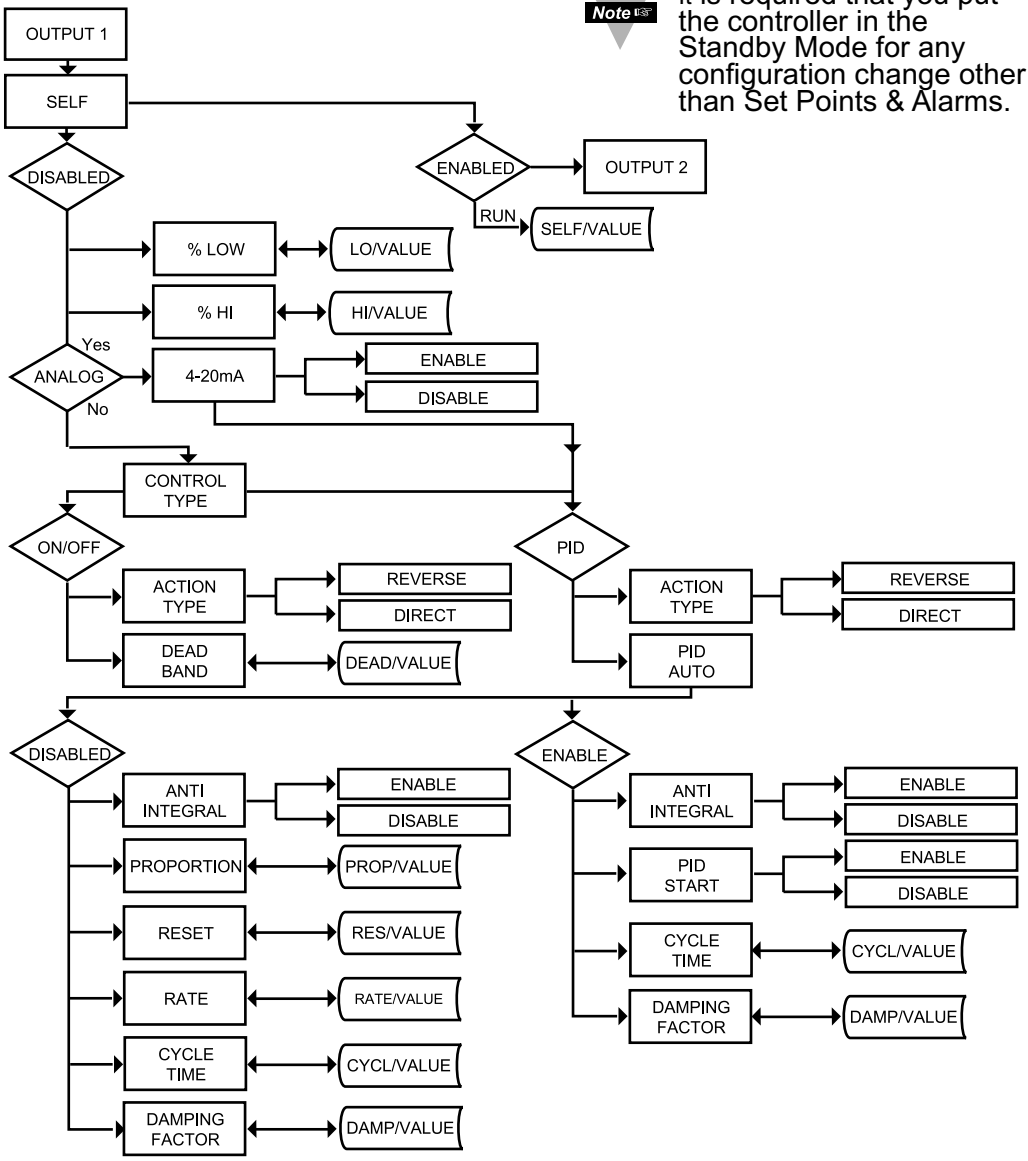


Figure 3.9 Flow Chart for Output 1

ENTER OUTPUT 1 MENU:

Press ⊙ **1)** Press ⊙, if necessary, until CNFG prompt appears.
Press ⊙ **2)** Display advances to INPt Input Menu.
Press ⊙ **3)** Press ⊙, if necessary, until Display advances to Out 1 Output 1 Menu.
Press ⊙ **4)** Display advances to SELF Self Submenu.

SELF SUBMENU:

The Self Option allows the output of the instrument to be controlled manually from the front panel.

Press ⊙ **5)** Display flashes the current setting of Self, EnbL Enabled or dSbL Disabled.
Press ▲ **6)** Press the ▲ button to select between Enable and Disable.
Press ⊙ **7)** If Self EnbL Enabled was selected, display shows StRd stored message momentarily and then advances to the next menu (Output 1 setting is completed).

The output is now under the direct control of the operator and can be adjusted in the Run Mode (M00.0 to M99.9), by pressing the ▲ and ▼ buttons, where M calls for the Manual (Self) Control. For example, setting of M50.0 of an Analog Output of 0 to 10 Vdc would produce roughly 5 Vdc at the output.

8) If Self dSbL Disabled was selected, display shows StRd stored message momentarily and then advances to oPLO Minimum/Percent Low Submenu of Output 1 Menu.

Note ☞ There is a shorter way to Enable or Disable Self Mode. From a Run Mode, press ⊙ and then press ⊙. Self Mode is Enabled now. Press ▲ or ▼ to display **MXX.X**. To disable Self, press ⊙ and then press ⊙. Display goes to the Run Mode. Self Mode is Disabled now.

MINIMUM/PERCENT LOW SUBMENU:

Specify in percent, the minimum value (0000) for control output. If the output is analog proportional (Current or Voltage), then the minimum voltage or current, in percent, is specified. If the output is time proportional (Relay, SSR or Pulse), then the minimum duty-cycle, in percent, is specified.

Press ⊙ **9)** Display flashes 1st digit of previous “Percent Low” setting.
Press ▲ & ▼ **10)** Use ▲ and ▼ buttons to enter a new value for “Percent Low”.
Press ⊙ **11)** Display shows StRd stored message momentarily and then advances to oPHI Maximum/Percent High Submenu.

MAXIMUM/PERCENT HIGH SUBMENU:

Specify in percent, the maximum value (99) for control output. If the output is analog proportional (Current or Voltage), then the maximum voltage or current, in percent, is specified. If the output is time proportional (Relay, SSR, or Pulse), then the maximum duty-cycle, in percent, is specified.

Press ⏎ **12)** Display flashes 1st digit of previous "Percent High" setting.
Press ▲ & ▼ **13)** Use ▲ and ▼ buttons to enter a new value for "Percent High".
Press ⏎ **14)** Display shows StRd stored message momentarily and then advances to CtRL Control Type Submenu.

Example: On an Analog Output of 0~10 Vdc, a setting of %LO = 10 and %HI = 90, cause the minimum on the control output to be 1 V and the maximum on the control output to be 9 V. The same setting on a time proportional output, will cause 10% duty cycle for the minimum control output and 90% duty cycle for maximum control output. To disable %LO/HI, set LO to 00 and HI to 99. If %LO/HI is at other values than the default (%LO = 00, %HI = 99), SOAK is disabled.

***CONTROL TYPE OUTPUT:**

(Relay, SSR, Pulse or Analog)
Press ⏎ **15)** Display flashes ON.OF On/Off or P Id Proportional, Integral, Derivative.
Press ▲ **16)** Scroll through the available selections: "ON/OFF" or "PID".
Press ⏎ **17)** Display flashes StRd stored message momentarily and then advances to ActN only, if it was changed, otherwise press ⏎ to advance to ActN Action Type Submenu.

The **ON/OFF** control is a coarse way of controlling the process. The "Dead Band" improves the cycling associated with the On/Off control. The **PID** control is best for processes where the Setpoint is continuously changing and/or a tight control of the process variable is required. PID control requires tuning and adjustment of the "Proportional", "Integral or Reset" and "Derivative or Rate" terms by a trial-and-error method. The instrument provides an "Auto Tuning" feature making the tuning process automatic, possibly optimum.

* If Analog Output (Current/Voltage) is your control Output 1, this menu i.e. CtRL type will not appear, instead 4-20 Current will be displayed. Select EnbL for a 4-20 mA current (2-10 V Voltage) outputs or dSbL for a 0-20 mA current (0-10 V Voltage) outputs. If 4-20 mA is enabled, %HI/LO setting will have no effect.

Note ☞ Both Current and Voltage control outputs are active simultaneously.

ACTION TYPE SUBMENU:

The error that results from the measurement of the Process Variable may be positive or negative since it may be greater or smaller than the Setpoint. If a positive error should cause the instrument output to increase (i.e. cooling), it would be called **Direct Acting**. If a negative error should cause the output to increase (i.e. heating), it would be called **Reverse Acting**.

Press ⊙ **18)** Display flashes dRct Direct or rVRS Reverse.
Press ⊙ **19)** Scroll through the available selections: “Direct” or “Reverse”.
Press ⊙ **20)** Display shows StRd stored message momentarily and then advances to AUto only, if it was changed, otherwise press ⊙ to advance to AUto Auto PID Submenu (if PID Control Type was selected).

Note ☞ If **“ON/OFF”** was selected in the Control Type, the display skips to the Dead Band Submenu.

AUTO PID SUBMENU:

Press ⊙ **21)** Display flashes EnbL or dSbL.
Press ⊙ **22)** Scroll through the available selections: “Enable” or “Disable”.
Press ⊙ **23)** Display shows StRd stored message momentarily and then advances to AntL only, if it was changed, otherwise press ⊙ to advance to AntL Anti Integral Submenu.

Note ☞ If **“Enabled”**, the controller can determine, by enabling Start PID, the optimum values for the three adjustments — Proportional, Reset and Rate corresponding to P, I, and D. These values may be changed once the auto tuning is complete.

If **“Disabled”** is selected, the user will manually enter these three adjustment values. If you want the instrument to do the auto PID and the P , PI or PID, first select auto disable and enter 0000 for unwanted parameter. i.e. for PI enter 0000 for the rate.

ANTI INTEGRAL SUBMENU:

Press ⊙ **24)** Display flashes EnbL or dSbL.
Press ⊙ **25)** Scroll through the available selections: “Enable” or “Disable”.
Press ⊙ **26)** Display shows StRd stored message momentarily and then advances to StRt only, if it was changed, otherwise press ⊙ to advance to StRt to Start Auto Tune PID Submenu (If auto PID was Enabled).

Note ☞ If Auto PID was disabled display advances to PRoP Proportional Band Submenu.

Note ☞ If Anti Integral (Anti Windup) Submenu **"Enabled"**, this feature allows the error term outside the proportional band to be calculated and accumulated for integration. This may be an important feature in applications where fast response time is desirable.

START AUTO TUNE PID:

Press ◕ **27)** Display flashes ENbL or dSbL.
Press ▲ **28)** Scroll through the available selections: "Enable" or "Disable".
Press ◕ **29)** Display shows StRd stored message momentarily and then advances to CYCL only, if it was changed, otherwise press ◕ to advance to CYCL Cycle Time Submenu.

Note ☞ If **"Enabled"**, the controller is ready to calculate P, PI or PID parameters. The instrument performs this by activating the output and observing the delay and rate at which the Process Value changes. The setpoints must be at least 18°F or 10°C above the (PV) Process Value in order to perform Auto Tune, otherwise an error message will be displayed.

To start Auto Tune PID select PID, enable Auto PID and enable Start PID. Sometimes Auto PID parameter needs fine tuning i.e. for each 5°F over shoot increase the Proportional Band (PB) by 15% and for each ±1°F fluctuation at the Setpoint (SP) increase reset by 20%.

Once started, display shows A.tUN with letters blinking in the rotating pattern. When auto tune stops, display will show process value. Do not perform any operations or settings before first stopping Auto Tune. Any alarms or other output is disabled during Auto Tune.

Note ☞ If **"AUTO PID"** was **"DISABLED"**, the display will show the following three submenus. This allows the user to manually enter values for Proportional, Reset and Rate terms corresponding to P, I, and D. It also can be used for auto PID for disabling unwanted parameter i.e. PI enter 0000 for rate.

PROPORTIONAL BAND SUBMENU:

Press ◕ **30)** Display flashes 1st digit of the previous **P** PRoP Proportional band value.
Press ▲ & ▼ **31)** Press ▲ and ▼ buttons to enter a new "Proportional Band" value.
Press ◕ **32)** Display shows StRd stored message momentarily and then advances to RESt only, if it was changed, otherwise press ◕ to advance to RESt Reset Setup Submenu.

Proportional band is in degrees of temperature or counts of process. Proportional band is defined, as the change in the instrument input to cause a 100% change in the controller output.

RESET SETUP SUBMENU:

Press ⊙ **33)** Display flashes 1st digit of the previous **I** RESt Reset value.
Press ▲ & ▼ **34)** Press ▲ and ▼ buttons to enter a new "Reset" value.
Press ⊙ **35)** Display shows StRd stored message momentarily and then advances to RATE only, if it was changed, otherwise press ⊙ to advance to RATE Rate Setup Submenu.

Reset unit is in seconds 0-3999.

RATE SETUP SUBMENU:

Press ⊙ **36)** Display flashes 1st digit of previous **D** RATE Rate value.
Press ▲ & ▼ **37)** Press ▲ and ▼ buttons to enter a new RATE value.
Press ⊙ **38)** Display shows StRd stored message momentarily and then advances to the CYCL only, if it was changed, otherwise press ⊙ to advance to CYCL Cycle Time submenu for RTD and Thermocouple types.

Rate unit is in seconds 000.0-399.9.

Note If the Output 1 is Analog Option the display skips to Damping Factor.

CYCLE TIME SUBMENU:

Press ⊙ **39)** Display flashes 1st digit of the previous CYCL Cycle Time value.
Press ▲ & ▼ **40)** Press ▲ and ▼ buttons to enter a new "Cycle Time" value. (1 to 199 seconds)
Press ⊙ **41)** Display shows StRd stored message momentarily and then advances to dPNG only, if it was changed, otherwise press ⊙ to advance to dPNG Damping Factor Submenu.

A Cycle Time selected between 1 and 199 seconds determines the total On/Off time of each proportional cycle. For example, a 15 second cycle time means that every 15 seconds the output will turn on for part or all of the cycle. For Relay control outputs, do not select a cycle time of less than 7 seconds or the relays' lifetime will be shortened. For a cycle time of less than 7 seconds select SSR or DC pulse. Use an external SSR with the DC pulse option for higher currents (higher than 1 Amp).

DAMPING FACTOR SUBMENU:

Press ◕ **42)** Display flashes the previous “Damping Factor” selection.
Press ▲ **43)** Scroll through the available selections: 0000, 0001, 0002, 0003, 0004, 0005, 0006, 0007.
Press ◕ **44)** Display flashes StRd stored message and then advances to Out2 only, if it was changed, otherwise press ◕ to advance to Out2 Output 2 Menu.

Damping Factor is a measure of speed, overshoot, and undershoot in which the process variable responds to the output changes of the instrument, which were used during the Auto Tune. This value is typically set to the ratio of Rate to Reset. This Default value is (0003). For fast response time, this value should be decreased while for slow response time it should be increased.

The "DEADBAND" Submenu will only appear if "ON/OFF" was selected from the "Control Type" Menu.

DEADBAND SUBMENU:

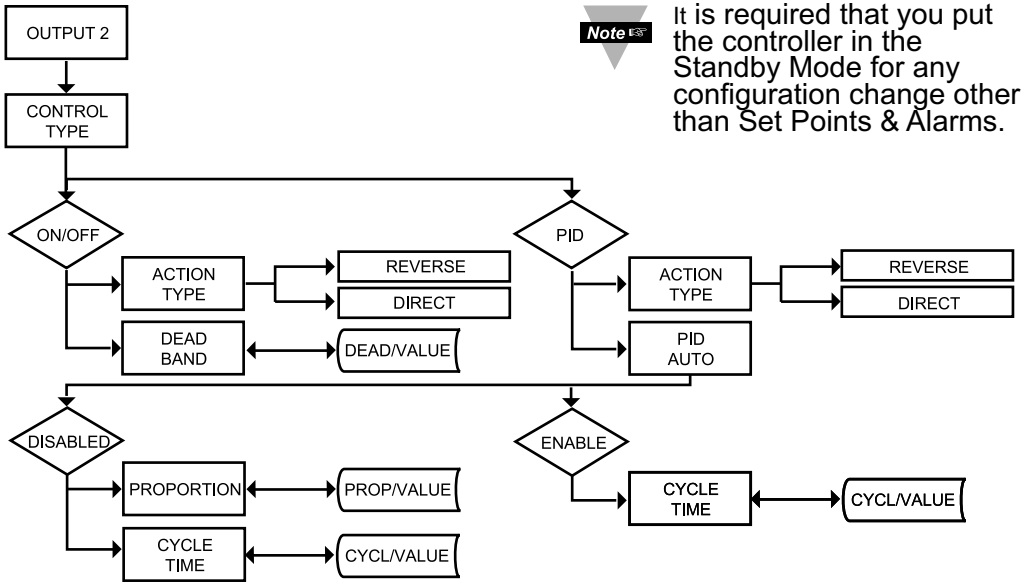
Press ◕ **45)** Display flashes 1st digit of the previous dEAd Deadband value.
Press ▲ & ▼ **46)** Press ▲ and ▼ buttons to enter a new “Deadband” value.
Press ◕ **47)** Display shows StRd stored message and then advances to Out2 only, if it was changed, otherwise press ◕ to advance to Out2 Output 2 Menu.

Dead Band units are the same as Proportional Band units.

The Dead Band or neutral zone is the number of degrees or counts (if Input Type is Process) around the Setpoint which the Process Variable must pass above or below the Setpoint, before the output changes state.

3.2.11 Output 2

Output 2 and Alarm 2 share the same contacts on the rear panel connector. If Alarm 2 is **Enabled**, Output 2 is automatically **Disabled**.



Note ☞ It is required that you put the controller in the Standby Mode for any configuration change other than Set Points & Alarms.

Figure 3.10 Flow Chart for Output 2

ENTER OUTPUT 2 MENU:

Press ⟲ **1)** Press ⟲, if necessary, until CNFG prompt appears.
Press ⟳ **2)** Display advances to INPt Input Menu.
Press ⟲ **3)** Press ⟲, if necessary, until Display advances to Out2 Output 2 Menu.
Press ⟳ **4)** Display advances to CtRL Control Type Submenu.

CONTROL TYPE SUBMENU:

Press ⟳ **3)** Display flashes On.OF ON/OFF, or PId PID.
Press ▲ **4)** Scroll through the available selections: “ON/OFF” or “PID”.
Press ⟳ **5)** Display shows StRd stored message momentarily and then advances to ActN only, if it was changed, otherwise press ⟲ to advance to ActN Action Type Submenu.

The ON/OFF control is a coarse way of controlling the Process. The “Dead Band” improves the cycling associated with the ON/Off control. The PID control is best for processes where the Setpoint is continuously changing and/or tight control of the Process Variable is required.

ACTION TYPE SUBMENU:

The error that results from the measurement of the Process Variable may be positive or negative since it may be greater or smaller than the Setpoint. If a positive error should cause the instrument output to increase (i.e. cooling), it would be called **Direct Acting**. If a negative error should cause the output to decrease (i.e. heating), it would be called **Reverse Acting**.

Press ⏎ **6)** Display flashes dRct Direct or rVRS Reverse.
Press ▲ **7)** Scroll through the available selections: “Direct” or “Reverse”.
Press ⏎ **8)** Display shows StRd stored message momentarily and then advances to Auto only, if it was changed, otherwise press ⏎ to advance to Auto Auto PID Submenu (If PID Control type was selected).

Note ☞ If ON/OFF was selected in the Control Type, the display skips to the Dead Band Submenu.

AUTO PID SUBMENU:

Press ⏎ **9)** Display flashes EnbL Enable or dSbL Disable.
Press ▲ **10)** Scroll through the available selections: “Enable” or “Disable”.

Note ☞ If "Enabled", the PID parameter of Output 1 will be copied to Output 2.

Press ⏎ **11)** Display shows StRd stored message momentarily and then advances to the next submenu only, if it was changed, otherwise press ⏎ to advance to the next submenu.

Note ☞ If AUTO PID was ENABLED", the display skips to the CYCL CYCLE TIME submenu. If "AUTO PID" was "DISABLED", the display will show ProP PROPORTIONAL BAND Submenu allowing the user to manually enter the Proportional Band value.

The Reset and Rate value are the same as Output 1.

PROPORTIONAL BAND SUBMENU:

Press ⏎ **12)** Display flashes 1st digit of the previous Proportional Band value.
Press ▲ & ▼ **13)** Press ▲ and ▼ buttons to enter a new Proportional Band value.
Press ⏎ **14)** Display shows StRd stored message momentarily and then advances to CYCL only, if it was changed, otherwise press ⏎ to advance to the CYCL Cycle Time Submenu.

Note ☞ Refer to “Proportional Band” Submenu of “Output 1” Menu.

CYCLE TIME SUBMENU:

Press ◕ **15)** Display flashes 1st digit of the previous “Cycle Time” value.
Press ▲ & ▼ **16)** Press ▲ and ▼ buttons to enter a new “Cycle Time” value (1 to 199 seconds).
Press ◕ **17)** Display shows StRd stored message momentarily and then advances to RAMP only, if it was changed, otherwise press ◕ to advance to RAMP Ramp Value Submenu.

A cycle time selected between 1 to 199 seconds indicates the total On/Off time of each proportional cycle. For example, a 15 second cycle time means that every 15 seconds the output will turn on for part or all of the cycle. For Relays' Control Outputs, do not select a cycle time of less than 7 seconds or the relays' lifetime will be shortened. For a cycle time of less than 7 seconds select SSR or DC pulse. Use an external SSR with the DC pulse option for higher current (higher than 1 Amp).

The DEADBAND Submenu will only appear if the ON/OFF was selected from the "Control Type" Submenu.

DEADBAND SUBMENU:

Press ◕ **18)** Display flashes 1st digit of the previous “Dead Band” value.
Press ▲ & ▼ **19)** Press ▲ and ▼ buttons to enter a new “Dead Band” value.
Press ◕ **20)** Display shows StRd stored message momentarily and then advances to RAMP only, if it was changed, otherwise press ◕ to advance to RAMP Ramp Value Menu.

Dead Band units are the same as Proportional Band units.

The Dead Band or neutral zone is the number of degrees or counts (if Input Type is Process) around the Setpoint which the Process Variable must pass above or below the Setpoint, before the output changes state.

3.2.12 Ramp & Soak

Note ☞ Alarm must be DISABLED if Ramp is ENABLED.

Note ☞ It is required that you put the controller in the Standby Mode for any configuration change other than Set Points & Alarms.

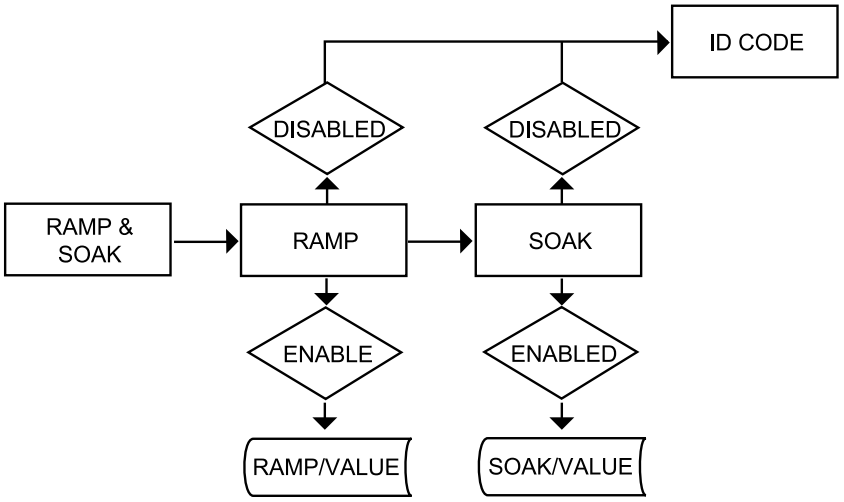


Figure 3.11 Flow Chart for Ramp and Soak

ENTER RAMP AND SOAK MENU:

Press ⊙ **1)** Press ⊙, if necessary, until CNFG prompt appears.
Press ⊙ **2)** Display advances to INPt Input Menu.
Press ⊙ **3)** Press ⊙, if necessary, until Display advances to RAMP Ramp and SOAK Soak Menu.

RAMP ENABLE/DISABLE SUBMENU:

Press ⊙ **4)** Display advances to "Ramp Enable/Disable" Submenu and flashes EnbL or dSbL.
Press ⊙ **5)** Scroll through the available selections: "Enable" or "Disable".
Press ⊙ **6)** Display shows StRd stored message momentarily and then advances to SOAK Soak Enable/Disable Menu.

Note ☞ If RAMP **Disable** was selected, display skips to the next menu item (ID Code).

SOAK ENABLE/DISABLE SUBMENU:

Press ⏲ **7)** Display flashes EnbL or dSbL.
Press ▲ **8)** Scroll through the available selections: “Enable” or “Disable”.
Press ⏲ **9)** Display shows StRd stored message momentarily and then advances to “Ramp Value” Submenu.

Ramp & Soak provides users with the flexibility to slowly bring the Process Variable (PV) to the desired setpoint. Ramp & Soak values are specified in HH.MM format. The Ramp value indicates the time specified to bring the process variable to Setpoint 1 (SP1). Once the set point is reached, the PID takes over and the Process Variable will be controlled at the desired set point indefinitely. If Soak is enabled, PID will control the Process Variable at the specified Setpoint for the duration of Soak time and then will turn off Output 1. To start a new Ramp/Soak cycle, reset the instrument by pressing ⏲ and then ▼ button.

An active Ramp/Soak will change SP1 one degree above the PV and will cause the most significant digit to blink. The SP1 will be incremented by one degree until it reaches the original SP1. The minimum Ramp time must be at least twice the time that it will take the PV to reach the Setpoint Value (SV) with OUT 1 fully ON.

RAMP VALUE SUBMENU:

Press ⏲ **10)** Display flashes 1st digit of previous stored “Ramp Value”.
Press ▲ & ▼ **11)** Press ▲ and ▼ buttons to enter a new “Ramp Value”.
Press ⏲ **12)** Display shows StRd stored message momentarily and then advances to “Soak Value” Submenu.

SOAK VALUE SUBMENU:

Press ⏲ **13)** Display flashes 1st digit of previous stored “Soak Value”.
Press ▲ & ▼ **14)** Press ▲ and ▼ buttons to enter a new “Soak Value”.
Press ⏲ **15)** Display shows StRd stored message and advances to the Id ID Code Menu.

The Ramp and Soak time is 00:00 to 99:59 i.e. HH.MM. (from zero to 99 hours and 59 minutes) During Ramp & Soak do not perform any operations or settings before first stopping it. Any alarms or other output are disabled during this time. To stop Ramp & Soak first put instrument into Standby Mode, then go to Ramp & Soak Menu and disable it.

3.2.13 ID CODE

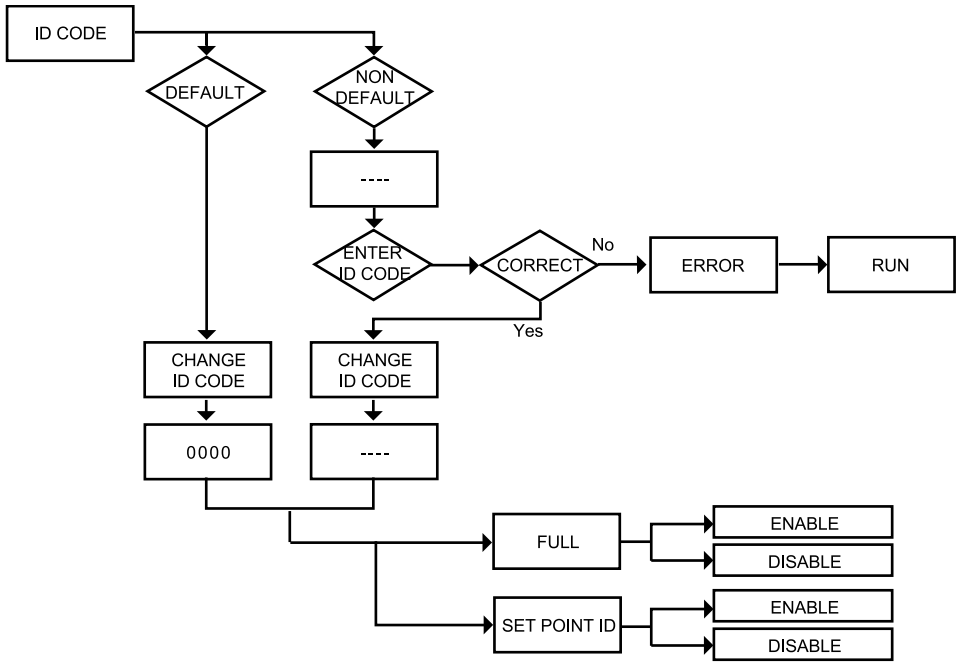


Figure 3.12 Flow Chart for ID Code

ENTER ID CODE MENU:

Press ⊙ **1)** Press ⊙, if necessary, until CNFG prompt appears.
Press ⊙ **2)** Display advances to INPt Input Menu.
Press ⊙ **3)** Press ⊙, if necessary, until Display advances to Id ID Code Menu.

ENTERING OR CHANGING YOUR (NON-DEFAULT) ID CODE:

Press ⊙ **4)** Display advances to ____ with 1st under score flashing.
Press ▲ & ▼ **5)** Press ▲ and ▼ to enter your 4-digit "ID Code" number.
Press ⊙ **6)** Display advances to CH.Id Change ID Code Submenu.

Note If entered "ID Code" is incorrect display shows ERRo Error message momentarily and then skips to the Run Mode.

Press ⊙ **7)** Display flashes the first digit of previous entered "ID Code" number.
Press ▲ & ▼ **8)** Press ▲ and ▼ buttons to enter your new "ID Code" number.
Press ⊙ **9)** Display shows StRd stored message momentarily and then advances to the FULL Full Security Submenu.

ENTERING OR CHANGING YOUR (DEFAULT) ID CODE:

Enter Id menu (Repeat steps from 1 to 3).

Press ⊙ **10)** Display advances to CH.Id Change ID Code Submenu.
Press ⊙ **11)** Display shows 0000 message with flashing 1st digit.

Note ☞ If you want to change your default “ID Code” you can do it now, otherwise press ⊙ and menu will skip to FULL Full Security Submenu.

Press ▲ & ▼ **12)** Press ▲ and ▼ buttons to enter your new “ID Code” number.
Press ⊙ **13)** Display shows StRd stored message momentarily and then advances to the FULL Full Security Submenu.

FULL SECURITY LEVEL SUBMENU:

Press ⊙ **14)** Display flashes ENbL Enable or dSbL Disable.
Press ▲ **15)** Scroll through the available selections: “Enable” or “Disable”.
Press ⊙ **16)** Display shows StRd stored message momentarily and then advances to SP.Id Setpoint/ID Submenu.

Note ☞ If "Full" Security Level is "Enabled" and the user attempts to enter the Main Menu, they will be prompted for an ID Code. The ID Code should be correct to enter the instrument Menu item.

SETPOINT/ID SECURITY LEVEL SUBMENU:

Note ☞ This Security Level can be functional only if FULL Security Level is Disabled.

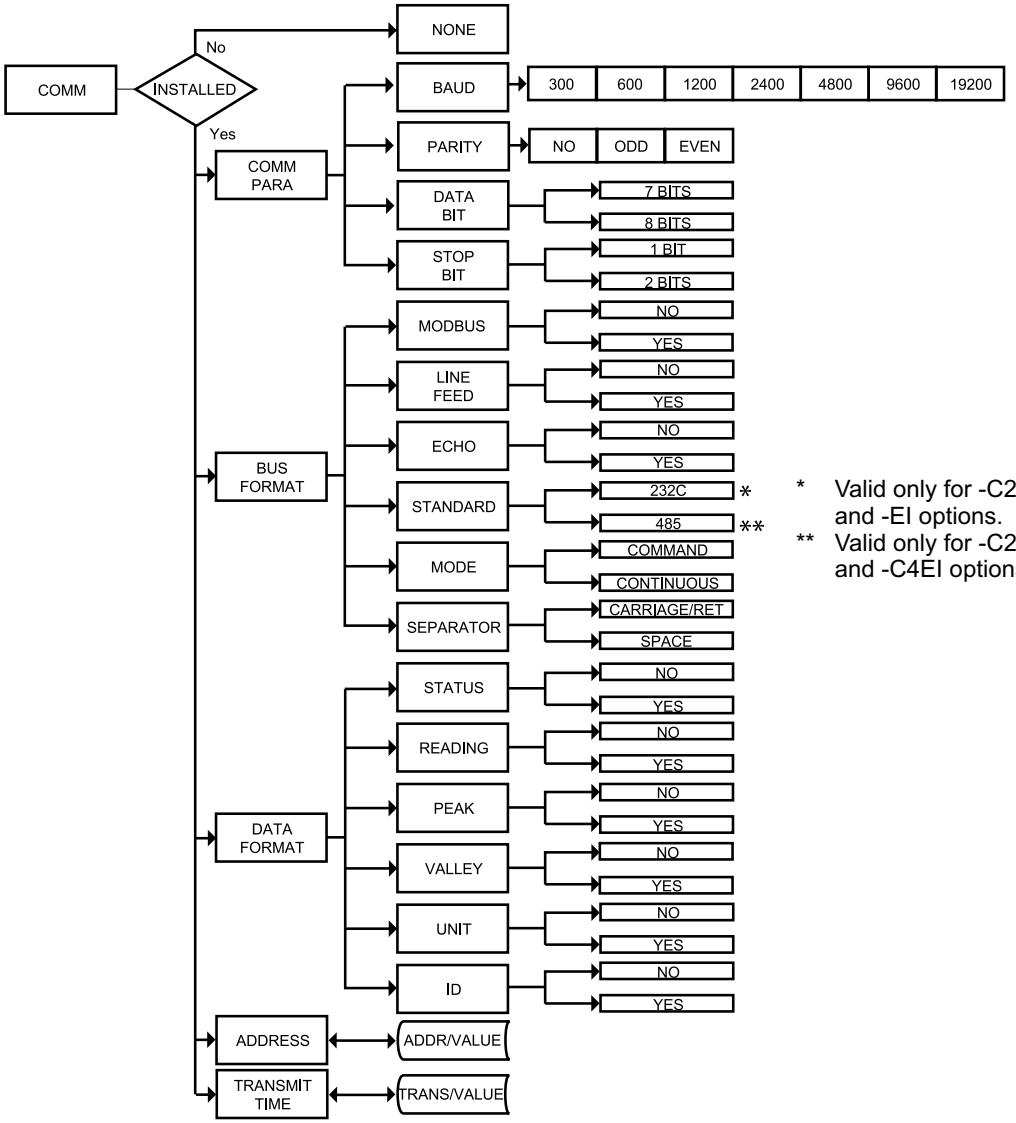
Press ⊙ **17)** Display flashes ENbL Enable or dSbL Disable.
Press ▲ **18)** Scroll through the available selections: “Enable” or “Disable”.
Press ⊙ **19)** Display shows StRd stored message momentarily and then advances to COMM Communication Submenu.

Note ☞ If **"Setpoint/ID"** Security Level is **"Enabled"** and the user attempts to advance into the CNFG Configuration Menu, he will be prompted for ID Code number. The ID Code should be correct to proceed into the Configuration Menu, otherwise display will show an Error and skip to the Run Mode.

Note ☞ If **“Full”** and **“Setpoint/ID”** Security Levels are "**Disabled**", the ID code will be “Disabled” and user will not be asked for ID Code to enter the Menu items (“ID” Submenu will not show up in “ID/Setpoint” Menu).

3.2.14 COMMUNICATION OPTION

Purchasing the controller with Serial Communications permits an instrument to be configured or monitored from an IBM PC compatible computer using software available from **the website or on the CD-ROM enclosed with your shipment**. For complete instructions on the use of the Serial Comm.Option, refer to the Serial Comm. Reference Manual.



Note ☞ External RS-232 connections are not available with -EI or -C4EI options.

Figure 3.13 Flow Chart for Communication Option

ENTER COMMUNICATION OPTION MENU:

Press ⊙ **1)** Press ⊙, if necessary, until CNFG prompt appears.
Press ⊙ **2)** Display advances to INPt Input Menu.
Press ⊙ **3)** Press ⊙, if necessary, until Display advances to COMM Communication Options Menu.
Press ⊙ **4)** Display advances to C.PAR Communication Parameters Submenu.

Note If Communication Option is not installed, the display shows NONE and skips to the Color Display Menu.

COMMUNICATION PARAMETERS SUBMENU:

Allows the user to adjust Serial Communications Settings of the instrument. When connecting an instrument to a computer or other device, the Communications Parameters must match. Generally the default settings (as shown in Section 5) should be utilized.

Press ⊙ **5)** Display advances to bAUd Baud Submenu.

BAUD SUBMENU:

Press ⊙ **6)** Display flashes previous selection for bAUd value.
Press ⊙ **7)** Scroll through the available selections: 300, 600, 1200, 2400, 4800, 9600, 19.2K.
Press ⊙ **8)** Display shows StRd stored message momentarily and then advances to PrtY only, if it was changed, otherwise press ⊙ to advance to PrtY Parity Submenu.

PARITY SUBMENU:

Press ⊙ **9)** Display flashes previous selection for “Parity”.
Press ⊙ **10)** Scroll through the available selections: NO, ODD, EVEN.
Press ⊙ **11)** Display shows StRd stored message momentarily and then advances to dAtA only, if it was changed, otherwise press ⊙ to advance to dAtA Data Bit Submenu.

DATA BIT SUBMENU:

Press ⊙ **12)** Display flashes previous selection for “Data Bit”.
Press ⊙ **13)** Scroll through the available selections: 7-BIT, 8-BIT.
Press ⊙ **14)** Display shows StRd stored message and then advances to StOP only, if it was changed, otherwise press ⊙ to advance to StOP Stop Bit Submenu.

STOP BIT SUBMENU:

Press ◉ **15)** Display flashes previous selection for “Stop Bit”.
Press ▲ **16)** Scroll through the available selections: 1-BIT, 2-BIT.
Press ◉ **17)** Display shows StRd stored message momentarily and then advances to bUS.F only, if it was changed, otherwise press ◉ to advance to bUS.F Bus Format Submenu.

BUS FORMAT SUBMENU:

Determines Communications Standards and Command/Data Formats for transferring information into and out of the controller via the Serial Communications Bus. Bus Format submenus essentially determine how and when data can be accessed via the Serial Communications of the device.

Press ◉ **18)** Display advances to M.bUS Modbus Submenu.

MODBUS PROTOCOL SUBMENU:

Press ◉ **19)** Display flashes previous selection for M.bUS.
Press ▲ **20)** Scroll through the available selections: NO, YES.
Press ◉ **21)** Display shows StRd stored message momentarily and then advances to _LF_ only, if it was changed, otherwise press ◉ to advance to _LF_ Line Feed submenu.

Note ☞ To select iSeries Protocol, set Modbus submenu to “No”.
To select Modbus Protocol, set Modbus submenu to “Yes”.

Note ☞ If Modbus Protocol was selected, the following Communications Parameters must be set as: No Parity, 8-bit Data Bit, 1-Stop Bit. Do not attempt to change these parameters.

LINE FEED SUBMENU:

Determines if data sent from the instrument will have a Line Feed appended to the end - useful for viewing or logging results on separate lines when displayed on communications software at a computer.

Press ◉ **22)** Display flashes previous selection for “Line Feed”.
Press ▲ **23)** Scroll through the available selections: NO, YES.
Press ◉ **24)** Display shows StRd stored message momentarily and then advances to ECHO only, if it was changed, otherwise press ◉ to advance to ECHO Echo Submenu.

ECHO SUBMENU:

When valid commands are sent to the instrument, this determines whether the command will be echoed to the Serial Bus. Use of echo is recommended in most situations, especially to help verify that data was received and recognized by the controller.

Press ↵ **25)** Display flashes previous selection for “Echo”.
Press ▲ **26)** Scroll through the available selections: NO, YES.
Press ↵ **27)** Display flashes StRd stored message momentarily and then advances to StNd only if it was changed, otherwise press ↵ to advance to StNd Communication Standard Submenu.

COMMUNICATION INTERFACE STANDARD SUBMENU:

Determines whether device should be connected to an RS-232C serial port (as is commonly used on IBM PC-compatible computers) or via an RS-485 bus connected through appropriate RS-232/485 converter. When used in RS-485 Mode, the device must be accessed with an appropriate Address Value as selected in the Address Submenu described later.

Press ↵ **28)** Display flashes previous selection for “Standard”.
Press ▲ **29)** Scroll through the available selections: 232C, 485.
Press ↵ **30)** Display shows StRd stored message momentarily and then advances to ModE only, if it was changed, otherwise press ↵ to advance to ModE Data Flow Mode Submenu.

DATA FLOW MODE SUBMENU:

Determines whether the instrument will wait for commands and data requests from the Serial Bus or whether the instrument will send data automatically and continuously to the Serial Bus. Devices configured for the RS-485 Communications Standard operate properly only under Command Mode.

Press ↵ **31)** Display flashes previous selection for “Mode”.
Press ▲ **32)** Scroll through the available selections: CMd_ “Command”, CoNt “Continuous”.
Press ↵ **33)** Display shows StRd stored message momentarily and then advances to SEPR only, if it was changed, otherwise press ↵ to advance to SEPR Data Separation Submenu.

DATA SEPARATION CHARACTER SUBMENU:

Determines whether data sent from the device in Continuous Data Flow Mode will be separated by spaces or by Carriage Returns.

Press ↵ **34)** Display flashes previous selection for “Separation” Submenu.
Press ▲ **35)** Scroll through the available selections: SPCE “Space” or _cR_ “Carriage Return”.
Press ↵ **36)** Display shows StRd stored message momentarily and then advances to dAt.F only, if it was changed, otherwise press ↵ to advance to dAt.F Data Format Submenu.

DATA FORMAT SUBMENU:

Preformatted data can be sent automatically or upon request from the controller. Use the Data Format Submenus to determine what data will be sent in this preformatted data string. Refer to the iSeries Communications Manual for more information about the data format. At least one of the following suboptions must be enabled and hence output data to the Serial Bus.

Note ☞ This menu is applicable for Continuous Mode of RS-232 communication.

Press ◎ **37)** Display advances to StAt Alarm Status Submenu.

ALARM STATUS SUBMENU:

Includes Alarm Status bytes in the data string.

Press ◎ **38)** Display flashes previous selection for “Status” (alarm status).
Press ▲ **39)** Scroll through the available selections: NO, YES.
Press ◎ **40)** Display shows StRd stored message momentarily and then advances to RdNG only, if it was changed, otherwise press ◎ to advance to RdNG Reading Submenu.

MAIN READING SUBMENU:

Includes Main Reading in the data string.

Press ◎ **41)** Display flashes previous selection for “Reading”.
Press ▲ **42)** Scroll through the available selections: NO, YES.
Press ◎ **43)** Display shows StRd stored message momentarily and then advances to PEAK only, if it was changed, otherwise press ◎ to advance to PEAK Peak Submenu.

PEAK VALUE SUBMENU:

Includes Peak Value in the data string.

Press ◎ **44)** Display flashes previous selection for PEAK Submenu.
Press ▲ **45)** Scroll through the available selections: NO, YES.
Press ◎ **46)** Display shows StRd stored message momentarily and then advances to VALY only, it was changed, otherwise press ◎ to advance to VALY Valley Submenu.

VALLEY VALUE SUBMENU:

Includes Valley Value in the data string.

Press ◎ **47)** Display flashes previous selection for “Valley”.
Press ▲ **48)** Scroll through the available selections: NO, YES.
Press ◎ **49)** Display shows StRd stored message momentarily and then advances to UNIt only, if it was changed, otherwise press ◎ to advance to UNIt Temperature Unit Submenu.

TEMPERATURE UNIT SUBMENU:

Includes a byte in the data string to indicate whether reading is in Celsius or Fahrenheit.

Press ⊙ **50)** Display flashes previous selection for UNIT.
Press ▲ **51)** Scroll through the available selections: NO, YES.
Press ⊙ **52)** Display shows STRD stored message momentarily and then advances to ADDR only, if it was changed, otherwise press ⊙ to advance to ADDR Address Setup Submenu.

ADDRESS SETUP SUBMENU:

Note ☞ This menu is applicable to the RS-485 Option only.

Press ⊙ **53)** Display advances to “Address Value” (0000 to 0199) Submenu.

ADDRESS VALUE SUBMENU:

Press ⊙ **54)** Display flashes 1st digit of previously stored Address Value.
Press ▲ & ▼ **55)** Press ▲ and ▼ to enter new “Address Value”.
Press ⊙ **56)** Display shows STRD stored message momentarily and then advances to TR.TM only, if it was changed, otherwise press ⊙ to advance to TR.TM Transmit Time Interval Submenu.

TRANSMIT TIME INTERVAL SUBMENU:

Note ☞ This menu is applicable if “Continuous” Mode was selected in the “Data Flow Mode” Submenu and the device is configured as an RS-232C Standard device. Also, one or more options under the Data Format Submenu must be enabled.

Press ⊙ **57)** Display advances to “Transmit Time Value” Submenu.

TRANSMIT TIME INTERVAL VALUE SUBMENU:

Determines the interval at which data will be emitted to the RS-232 Serial Bus when the instrument is in Continuous Data Flow Mode.

Press ⊙ **58)** Display flashes 1st digit of previous “Transmit Time Value” in seconds.
Press ▲ & ▼ **59)** Press ▲ and ▼ to enter new “Transmit Time Value”, e.g. 0030 will send the data every 30 seconds in Continuous Mode.
Press ⊙ **60)** Display shows STRD stored message momentarily and then advances to COLR only, if it was changed, otherwise press ⊙ to advance to COLR Color Display Selection Menu.

Note ☞ **For more details, refer to the Communication Manual available at the website listed in the cover page of this manual.**

3.2.15 DISPLAY COLOR SELECTION

This submenu allows the user to select the color of the display.

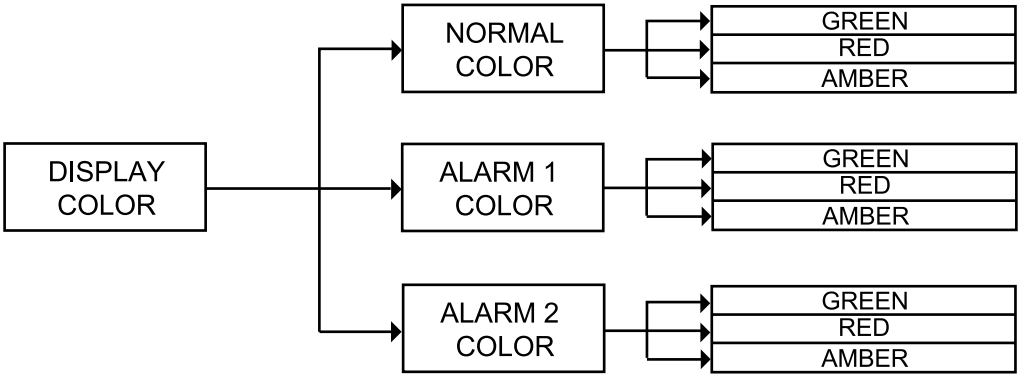


Figure 3.14 Flow Chart for Display Color Selection

ENTER DISPLAY COLOR SELECTION MENU:

Press ⊙ **1)** Press ⊙, if necessary, until CNFG prompt appears.
Press ⊙ **2)** Display advances to INPt Input Menu.
Press ⊙ **3)** Press ⊙, if necessary, until Display advances to COLR Display Color Selection Menu.
Press ⊙ **4)** Display advances to N.CLR Normal Color Submenu.

NORMAL COLOR DISPLAY SUBMENU:

Press ⊙ **5)** Display flashes the previous selection for "Normal Color".
Press ▲ **6)** Scroll through the available selections: GRN, REd or AMbR.
Press ⊙ **7)** Display shows StRd stored message momentarily and then advances to 1.CLR only, if it was changed, otherwise press ⊙ to advance to 1.CLR Alarm 1 Display Color Submenu.

The menu below allows the user to change the color of display when alarm is triggered.

ALARM 1 DISPLAY COLOR SUBMENU:

Press ⊙ **8)** Display flashes previous selection for "Alarm 1 Color Display".
Press ▲ **9)** Scroll through the available selections: GRN, REd or AMbR.
Press ⊙ **10)** Display shows StRd stored message momentarily and then advances to 2.CLR only, if it was changed, otherwise press ⊙ to advance to 2.CLR Alarm 2 Display Color Submenu.

ALARM 2 DISPLAY COLOR SUBMENU:

Press ◕ **11)** Display flashes previous selection for “Alarm 2 Color Display”.
Press ▲ **12)** Scroll through the available selections: GRN, REd or AMbR.
Press ◕ **13)** Display shows StRd stored message momentarily and then momentarily shows the software version number, followed by RSt Reset, and then proceeds to the Run Mode.

Tip ☞ IN ORDER TO DISPLAY ONE COLOR, SET THE SAME DISPLAY COLOR ON ALL THREE SUBMENUS ABOVE.

Note ☞ If user wants the Display to change color every time when both Alarm 1 and Alarm 2 are triggered, the Alarm values should be set in such a way that Alarm 1 value is always on the top of Alarm 2 value, otherwise value of Alarm 1 will overwrite value of Alarm 2 and Display Color would not change when Alarm 2 is triggered.

Example 1:
Output 1 & Output 2 = SSR
Alarm Setup: Absolute, Above, Alarm 2 HI Value “ALR.H” = 200, Alarm 1 HI Value “ALR.H” = 400
"Color Display" Setup: Normal Color “N.CLR” = Green, Alarm 1 Color “1.CLR” = Amber, Alarm 2 Color “2.CLR” = Red

Display Colors change sequences:

Example 2:
Output 1 & Output 2 = Pulse
Alarm Setup: Absolute, Below, Alarm 2 Low Value “ALR.L” = 300, Alarm 1 Low Value “ALR.L” = 100
Color Display Setup: "N.CLR" = Green, "1.CLR" = Amber, "2.CLR" = Red

Display Colors change sequences:

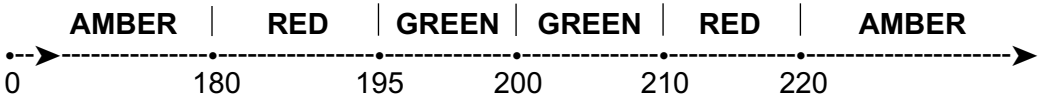
Example 3:
Output 1 = Analog Output (Alarm 1 disabled), Setpoint 1 = 300,
Output 2 = Relay, Setpoint 2 = 200
Alarm 1 & 2 Setup: Deviation, Band, “ALR.H” = 10
Color Display Setup: “N.CLR” = Green, “1.CLR” = Amber, “2.CLR” = Red

Display Colors change sequences:

Tip ☞ Alarm 1 is designed to monitor the Process Value around the Setpoint 1. Alarm 2 is designed to monitor the Process Value around the Setpoint 2. If Analog Output Option board is installed (Alarm 1 is disabled), only Alarm 2 is active and only two colors are available.

Example 4:
Output 1 = Relay, Setpoint 1 = 200
Output 2 = Relay, Setpoint 2 = 200
Alarm 1 Setup: Deviation, Band, “ALR.H” = 20
Alarm 2 Setup: Deviation, Hi/Low, “ALR.H” = 10, “ALR.L” = 5
Color Display Setup: “N.CLR” = Green, “1.CLR” = Amber, “2.CLR” = Red

Display colors change sequences:



Note ☞ **Reset:** The instrument automatically resets after the last menu of the Configuration Mode has been entered. After the instrument resets, it advances to the Run Mode.

PART 4
SPECIFICATIONS

Accuracy
±0.5°C temp; 0.03% reading process

Resolution
1°/0.1°; 10 µV process

Temperature Stability
1) RTD: 0.04°C/°C
2) TC @ 25°C (77°F): 0.05°C/°C
- Cold Junction Compensation
3) Process: 50 ppm/°C

NMRR
60 dB

CMRR
120 dB

A/D Conversion
Dual slope

Reading Rate
3 samples per second

Digital Filter
Programmable

Display
4-digit, 9-segment LED
- 10.2 mm (0.40"): i32, i16, i16D (Dual Display), i8DV (Dual Vertical)
- 21 mm (0.83"): i8
- 10.2 mm (0.40") and 21 mm (0.83"): i8DH (Dual Horizontal)
  red, green and amber programmable colors for process variable, set point and temperature units

Warm up to Rated Accuracy
30 min.

INPUT
Input Types
Thermocouple, RTD, Analog Voltage, Analog Current

Thermocouple Type (ITS 90)
J, K, T, E, R, S, B, C, N, L

Thermocouple Lead Resistance
100 ohm max

RTD Input (ITS 68)
100/500/1000 Ω Pt sensor, 2-, 3- or 4-wire; 0.00385 or 0.00392 curve

Voltage Input
0 to 100 mV, 0 to 1 V, 0 to 10 Vdc

Input Impedance
10 MΩ for 100 mV
1 MΩ for 1 or 10 Vdc

Current Input
0 to 20 mA (5 ohm load)

Configuration
Single-ended

Polarity
Unipolar

Step Response
0.7 sec for 99.9%

Decimal Selection
None, 0.1 for temperature
None, 0.1, 0.01 or 0.001 for process

Setpoint Adjustment
-1999 to +9999 counts

Span Adjustment
0.001 to 9999 counts

Offset Adjustment
-1999 to +9999

CONTROL
Action
Reverse (heat) or direct (cool)

Modes
Time and Amplitude Proportional Control Modes; selectable Manual or Auto PID, Proportional, Proportional with Integral, Proportional with Derivative with Anti-reset Windup and ON/OFF

Rate
0 to 399.9 seconds

Reset
0 to 3999 seconds

Cycle Time
1 to 199 seconds; set to 0 for ON/OFF operation

Gain
0.5 to 100% of span; Setpoints 1 or 2

Damping
0000 to 0008

Soak
00.00 to 99.59 (HH:MM), or OFF

Ramp to Setpoint
00.00 to 99.59 (HH:MM), or OFF

Auto Tune
Operator initiated from front panel

CONTROL OUTPUT 1 & 2
Relay
250 Vac or 30 Vdc @ 3 A (Resistive Load); configurable for on/off, PID and Ramp and Soak

Output 1: SPDT type, can be configured as Alarm 1 output

Output 2: SPDT type, can be configured as Alarm 2 output

SSR
20-265 Vac @ 0.05-0.5 A (Resistive Load); continuous

DC Pulse
Non-Isolated; 10 Vdc @ 20 mA

Analog Output (Output 1 only)
Non-Isolated, Proportional 0 to 10 Vdc or 0 to 20 mA; 500 Ω max

NETWORK AND COMMUNICATIONS (Optional -C24, -C4EI, -EI)
Ethernet: Standards Compliance IEEE 802.3 10Base-T
Supported Protocols: TCP/IP, ARP, HTTPGET

RS-232/RS-422/RS-485/MODBUS:
Selectable from menu; both ASCII and modbus protocol selectable from menu. Programmable 300 to 19.2 K baud; complete programmable setup capability; program to transmit current display, alarm status, min/max, actual measured input value and status.

RS-485
Addressable from 0 to 199

Connection
Screw terminals

ALARM 1 & 2 (programmable):
Type
Same as Output 1 & 2

Operation
High/low, above/below, band, latch/unlatch, normally open/normally closed and process/deviation; front panel configurations

ANALOG OUTPUT (programmable)
Non-Isolated, Retransmission 0 to 10 Vdc or 0 to 20 mA, 500 Ω max (Output 1 only). Accuracy is ± 1% of FS when following conditions are satisfied.
1) Input is not scaled below 1% of Input FS.
2) Analog Output is not scaled below 3% of Output FS.

EXCITATION
(optional in place of Communication)
24 Vdc @ 25 mA
Not available for Low Power Option

INSULATION
Power to Input/Output
2300 Vac per 1 min. test
1500 Vac per 1 min. test
(Low Voltage/Power Option)
Power to Relays/SSR Outputs
2300 Vac per 1 min. test
Relays/SSR to Relay/SSR Outputs
2300 Vac per 1 min. test
RS-232/485 to Inputs/Outputs
500 Vac per 1 min. test

Approvals
FM, UL, C-UL, and
see CE Approval Section

GENERAL

Line Voltage/Power
90-240 Vac +/-10%, 50-400 Hz*****
110-375 Vdc, equivalent voltage
4 W, power for i8, i8C, i16, i32 Models
5 W, power for i8DV, i8DH, i16D Models
***** *No CE compliance above 60 Hz*

Low Voltage/Power Option
12-36 Vdc, **3 W**, power for i8, i16, i32
20-36 Vdc, **4 W**, power for i8DV, i8DH, i16D
External power source must meet Safety Agency Approvals.
***** *Units can be powered safely with 24 Vac power but, no Certification for CE/UL are claimed.*

External Fuse Required
Time-Delay, UL 248-14 listed:
100 mA/250 V
400 mA/250 V (Low Voltage/Power Option)
Time-Lag, IEC 127-3 recognized:
100 mA/250 V
400 mA/250 V (Low Voltage/Power Option)

Environmental Conditions
- All models: 0 to 55°C (32 to 131°F), 90% RH non-condensing
- i8DV, i8DH, i8C, i16D: 0 to 50°C (32 to122°F) for UL only. 90% RH non-condensing

Protection
NEMA-4x/Type 4x/IP65 front bezel: i32, i16D, i8C
NEMA-1/Type 1 front bezel: i8, i8DH, i8DV

Dimensions
i/8 Series:
48 H x 96 W x 127 mm D
(1.89 x 3.78 x 5")

i/8 Compact Series:
48 H x 96 W x 74 mm D
(1.89 x 3.78 x 2.91")

i/16 Series:
48 H x 48 W x 127 mm D
(1.89 x 1.89 x 5")

i/32 Series:
25.4 H x 48 W x 127 mm D
(1.0 x 1.89 x 5")

Panel Cutout
i/8 Series: 45 H x 92 mm W
(1.772" x 3.622 "), 1/8 DIN

i/16 Series:
45 mm (1.772") square, 1/16 DIN

i/32 Series:
22.5 H x 45 mm W
(0.886" x 1.772"), 1/32 DIN

Weight
i/8 Series: 295 g (0.65 lb)
i/16 Series: 159 g (0.35 lb)
i/32 Series: 127 g (0.28 lb)

Table 4.1 Input Properties

TC	Input Type	Range	Accuracy*
J	Iron-Constantan	-210 to 760°C -346 to 1400°F	0.4°C 0.7°F
K	CHROMEGA®-ALOMEGA®	-270 to -160°C -160 to 1372°C -454 to -256°F -256 to 2502°F	1.0°C 0.4°C 1.8°F 0.7°F
T	Copper-Constantan	-270 to -190°C -190 to 400°C -454 to -310°F -310 to 752°F	1.0°C 0.4°C 1.8°F 0.7°F
E	CHROMEGA-Constantan	-270 to -220°C -220 to 1000°C -454 to -364°F -364 to 1832°F	1.0°C 0.4°C 1.8°F 0.7°F
R	Pt/13%Rh-Pt	-50 to 40°C 40 to 1788°C -58 to 104°F 104 to 3250°F	1.0°C 0.5°C 1.8°F 0.9°F
S	Pt/10%Rh-Pt	-50 to 100°C 100 to 1768°C -58 to 212°F 212 to 3214°F	1.0°C 0.5°C 1.8°F 0.9°F
B	30%Rh-Pt/6%Rh-Pt	200 to 640°C 640 to 1820°C 212 to 1184°F 1184 to 3308°F	1.0°C 0.5°C 1.8°F 0.9°F
C	5%Re-W/26%Re-W	0 to 2354°C 32 to 4253°F	0.4°C 0.7°F
N	Nicrosil-Nisil	-250 to -100°C -100 to 1300°C -418 to -148°F -148 to 2372°F	1.0°C 0.4°C 1.8°F 0.7°F
L	J DIN	-200 to 900°C -328 to 1652°F	0.4°C 0.7°F
RTD	Pt, 0.00385, 100 Ω, 500 Ω, 1000 Ω	200 to 900°C -328 to 1652°F	0.4°C 0.7°F
RTD	Pt, 0.00392, 100 Ω, 500 Ω, 1000 Ω	-200 to 850°C -328 to 1562°F	0.4°C 0.7°F
PROCESS	Voltage	0 to 100 mV, 0 to 1 V, 0 to 10 Vdc	0.03% rdg 0.03% rdg
PROCESS	Current	0 to 20 mA, 4 to 20 mA	0.03% rdg

PART 5
FACTORY PRESET VALUES

Table 5.1 Factory preset value

MENU ITEMS	FACTORY PRESET VALUES	NOTES
Set Point 1 (SP1)	000.0	
Set Point 2 (SP2)	000.0	
Input:		
Input Type (INPT)	TC, type K	
Reading Configuration (RDG):		
Decimal Point (DEC.P)	FFF.F	
Temperature unit (TEMP)	°F	
Filter value (FLTR)	0004	
Alarm 1 & 2:		
Alarm 1 (ALR1), Alarm 2 (ALR2)	Disable (DSBL)	
Absolute/Deviation (ABSO/DEV)	Absolute (ABSO)	
Latch/Unlatch (LTCH/UNLT)	Unlatch (UNLT)	
Contact Closure (CT.CL)	Normally Open (N.O.)	
Active (ACTV)	Above (ABOV)	
Alarm At Power On (A.P.ON)	Disable (DSBL)	Alarm 1 only
Alarm Low (ALR.L)	-100.0	
Alarm High (ALR.H)	400.0	
LOOP:		
Loop Break Time (LOOP)	Disable (DSBL)	
Loop Value (B.TIM)	00:59	
Reading Adjust Value (R.ADJ)	000.0	
Setpoint Deviation (SP.dV)	Disable (DSBL)	
ANALOG OUTPUT (Retransmission):		
Analog Output (ANLG)	Enabled (ENBL)	
Current/Voltage (CURR/VOLT)	Voltage (VOLT)	
Scale and Offset	Reading: 0 - 999.9 cts, Output: 0 - 10 V	
OUTPUT 1 & 2:		
Self (SELF)	Disabled (DSBL)	Output 1 only
% Low Value (%LO)	0000	Output 1 only
% High Value (%HI)	0099	Output 1 only
Control Type (CTRL)	On/Off	
Action Type (ACTN)	Reverse (RVRS)	
Dead Band (DEAD)	020.0	
PID Auto (AUTO)	Disable (DSBL)	
Anti Integral (ANTI)	Disable (DSBL)	Output 1 only
Proportion Value (PROP)	020.0	
Reset Value (REST)	0180	Output 1 only
Rate Value (RATE)	0000	Output 1 only
Cycle Value (CYCL)	0007	
Damping Factor (DPNG)	0003	

MENU ITEMS	FACTORY PRESET VALUES	NOTES
Ramp & Soak (RAMP):		
Ramp (RAMP)	Disable (DSBL)	
Soak (SOAK)	Disable (DSBL)	
Ramp Value (RAMP)	00:00	
Soak Value (SOAK)	00:00	
ID:		
ID Value	0000	
Full ID (FULL)	Disable (DSBL)	
Set Point ID (ID.SP)	Disable (DSBL)	
Communication Parameters:		
Baud Rate (BAUD)	9600	
Parity (PRTY)	Odd	
Data bit (DATA)	7 bit	
Stop Bit	1 bit	
Modbus Protocol (M.BUS)	No	
Line Feed (LF)	No	
Echo (ECHO)	Yes	
Standard Interface (STND)	RS-232 (232C)	
Command Mode (MODE)	Command (CMD)	
Separation (SEPR)	Space (SPCE)	
Alarm Status (STAT)	No	
Reading (RDNG)	Yes	
Peak	No	
Valley (VALY)	No	
Units (UNIT)	No	
Multipoint Address (ADDR)	0001	
Transmit Time (TR.TM)	0016	
Display Color (COLR):		
Normal Color (N.CLR)	Green (GRN)	
Alarm 1 Color (1.CLR)	Red (RED)	
Alarm 2 Color (2.CLR)	Amber (AMBR)	

PART 6
CE APPROVALS INFORMATION

CE This product conforms to the EMC directive 89/336/EEC amended by 93/68/EEC, and with the European Low Voltage Directive 72/23/EEC.

Electrical Safety EN61010-1:2001

Safety requirements for electrical equipment for measurement, control and laboratory.

Double Insulation

Pollution Degree 2

Dielectric withstand Test per 1 min

- Power to Input/Output: 2300Vac (3250Vdc)
- Power to Input/Output: 1500Vac (2120Vdc)
  (Low Voltage dc Power Option*)
- Power to Relays/SSR Output: 2300Vac (3250Vdc)
- Ethernet to Inputs: 1500Vac (2120Vdc)
- Isolated RS232 to Inputs: 500Vac (720Vdc)
- Isolated Analog to Inputs: 500Vac (720Vdc)
- Analog/Pulse to Inputs: No Isolation

Measurement Category I

Category I are measurements performed on circuits not directly connected to the Mains Supply (power). Maximum Line-to-Neutral working voltage is 50Vac/dc. This unit should not be used in Measurement Categories II, III, IV.

Transients Overvoltage Surge (1.2 / 50uS pulse)

- Input Power: 2500V
- Input Power: 1500V
  (Low Voltage dc Power Option*)
- Ethernet: 1500V
- Input/Output Signals: 500V

Note: **Units configured for external low power dc voltage, 12-36Vdc*

EMC EN61326:1997 + and A1:1998 + A2:2001

Immunity and Emissions requirements for electrical equipment for measurement, control and laboratory.

- EMC Emissions Table 4, Class B of EN61326
- EMC Immunity** Table 1 of EN61326

Note: ***I/O signal and control lines require shielded cables and these cables must be located on conductive cable trays or in conduits. Furthermore, the length of these cables should not exceed 30 meters*

⚠ Refer to the EMC and Safety installation considerations (Guidelines) of this manual for additional information.

NOTES

NOTES

Warranty/Disclaimer

NEWPORT Electronics, Inc. warrants this unit to be free of defects in materials and workmanship for a period of **one (1) year** from the date of purchase. In addition to NEWPORT's standard warranty period, NEWPORT Electronics will extend the warranty period for **four (4) additional years** if the warranty card enclosed with each instrument is returned to NEWPORT.

If the unit should malfunction, it must be returned to the factory for evaluation. NEWPORT's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by NEWPORT, if the unit is found to be defective it will be repaired or replaced at no charge. NEWPORT's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of NEWPORT's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

NEWPORT is pleased to offer suggestions on the use of its various products. However, NEWPORT neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by NEWPORT, either verbal or written. NEWPORT warrants only that the parts manufactured by it will be as specified and free of defects. NEWPORT MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive and the total liability of NEWPORT with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall NEWPORT be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by NEWPORT is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, or used on humans, or misused in any way, NEWPORT assumes no responsibility as set forth in our basic WARRANTY / DISCLAIMER language, and additionally purchaser will indemnify NEWPORT and hold NEWPORT harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

Return Requests/Inquiries

Direct all warranty and repair requests/inquiries to the NEWPORT Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO NEWPORT, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM NEWPORT'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting NEWPORT:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult NEWPORT for current repair charges. Have the following information available BEFORE contacting NEWPORT:

1. P.O. number to cover the COST of the repair,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

NEWPORT's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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NEWPORT Electronics, Inc.

M3355/N/0906

NEWPORT INFINITY PROCESS PANEL METER CONFIGURATION PARAMETERS
POST POINT SCUM CONCENTRATOR - SCUM TANK LEVEL CONTROL

MENU: SP1 - Set point 1			
			20
MENU: SP2- Set point 2			
			40
MENU: SP3 - Set point 3			
			60
MENU: SP4 - Set point 4			
			80
JUMPER POSITIONS			
CURRENT		**S1: NONE; S2: A, F, M, N, T, U; S3: A, C; S4: B**	
VOLTAGE		**N/A**	
POTENTIOMETER		**N/A**	
LOCKOUT CONFIGURATIONS			
Parameter		**Description**	**Value**
L1 CNF		Lockout Configuration #1	
	L1C.1	Setpoint 1 change = 0 unlocked, 1 locked out	0
	L1C.2	Setpoint 2 change = 0 unlocked, 1 locked out	0
	L1C.3	Setpoint 3 (Alarm 1) change = 0 unlocked, 1 locked out	0
	L1C.4	Setpoint 4 (Alarm 2) change = 0 unlocked, 1 locked out	0
	L1C.5	Valley-value (LO RDG) displayed = 0, Microprocessor version displayed = 1	0
	L1C.6	Peak-value (HI RDG) display = 0 permitterd, 1 not permitted	0
	L1C.7	INPUT CLASS (CURRENT VOLTAGE OR POT) = 0 selectable, 1 locked out	0
	L1C.8	INPUT TYPE (4-20mA, 0-20mA, 0-100mV, etc.) = 0 selectable, 1 locked out	0
L2 CNF		Lockout Configuration #2	
	L2C.1	RDG.CNF (scale/offset method and display features) 0 may be chosen, 1 locked out	0
	L2C.2	0 RDG SC (computed input-to-display scale factor or 1 RD.SC.OF (two data points, which determine the reading scale/offset) may be entered.	0
	L2C.3	RDG OF (offset computed in display digits) 0 may be entered, 1 locked out.	0
	L2C.4	INP.CNF (meter rates, front-end features, prelinearizing scale/offset) 0 may be chosen, 1 locked out	0
	L2C.5	IN.SC.OF (two data points for additional scale/offset) 0 may be entered, 1 may not be entered	0
	L2C.6	DEC PT (decimal-point location) 0 may be chosen, 1 may not be chosen	0
	L2C.7	CNT BY (round off of display) 0 can be specified, 1 cannot be specified	0
	L2C.8	FIL CNF (adaptive/fixed filtering and for which output(s)) 0 can be chosen, 1 cannot be chosen	0
L3 CNF		Lockout Configuration #3	
	L3C.1	FIL TI (# of samples in average) 0 can be chosen, 1 locked out	0
	L3C.2	SP CNF (mode of action of setpoints 1 & 2 LEDs, transistors and relays) 0 can be selected, 1 locked out	0
	L3C.3	AL CNF (mode of action of Setpoints 3 & 4, often used as alarms) 0 can be locked out, 1 cannot be locked out.	0
	L3C.4	AL FNC (Setpoints 3 & 4 independent or ganged with Setpoints 1 and 2) 0 can be selected, 1cannot be accessed	0
	L3C.5	AL RDG (# of out-of-range readings before trip of setpoints 3 & 4) 0 can be selected, 1 cannot be accessed	0
	L3C.6	SP DB (hysteresis or deadband of Setpoints and Alarms) 0 can be specified, 1 cannot be accessed	0
	L3C.7	OUT.CNF (analog & BCD outputs, setpoint display flashing) 0 can be specified, 1 cannot be specified	0
	L3C.8	OT.SC.OF (2-data-point method for independent analog-output scale/offset) 0 can be entered, 1 cannot be accessed	0
L4 CNF		Lockout Configuration #4	
	L4C.1	BAUD (communication rate) 0 can be chosen, 1 cannot be accessed	0

	L4C.2	SER.CNF (parity/stop-bit length) 0 is selectable, 1 not selectable	0
	L4C.3	ADDRES (meter address # on a multipoint bus) 0 can be changed, 1 cannot be accessed	0
	L4C.4	SERCNT (interval # of readings for the automatic digital output of meter) 0 can be changed, 1 cannot be accessed	0
	L4C.5	Analog output trim input 0 can be entered, 1 cannot be entered	0
	L4C.6	Analog output trim input 0 can be entered, 1 cannot be entered	0
MENU: INPUT			
Parameter		**Description**	**Value**
INPUT CLASS		Current, Volt, or Pot	CURRENT
INPUT TYPE		0-20mA, 4-20mA, 0-100mV, 0-10Vdc, -50-50mV, etc.	4-20
MENU: RDG.CFG - Reading Configuration			
Parameter		**Description**	**Value**
RDG.CNF		Reading Configuration	
	RDG.1	Reading Scale & Offset = 0 Direct Format, = 1 2-Coordinate format	0
	RDG.2	Decimal point effect = 0 Active, = 1 Independent	1
	RDG.3	Display Brightness = 0 Normal, 1 50% of Normal	0
	RDG.4	Leading Zeros on Display = 0 Displayed, 1 Not Displayed	0
	RDG.5	Unit of Temperature = 0 Not used with, = 1 Process	1
	RDG.6	Reading Scale & Offset Functions = 0 Disables Reading Scale and Offset (RDG SC=1.0, RDG OF=0.0), 1 Enables Reading Scale and Offset (Uses scale and offset values entered by user)	0
	RDG.7	Resetting Mode = 0 Grounding P2-5 causes Hard Reset (RESET 2), =1 Grounding P2-5 causes Peak/Valley (HI/LO) Reset	0
MENU: RDG SC (Reading Scale) RDG OF (Reading Offset)			
Parameter		**Description**	**Value**
RDG.SC.OF		Reading scale and offset	
	RDG SC	Reading scale	4999975
	RDG OF	Reading offest	-000005
MENU: IN CNF (input Configuration)			
Parameter		**Description**	**Value**
IN CNF		Input Configuration	
	INP.1	Line Frequency = 0 60HZ, = 1 50 HZ	0
	INP.2	Read Rate = 0 Slow, = 1 Fast	0
	INP.3	Input Voltage = 0 Unipolar, = 1 Bipolar	0
	INP.4	Transmitter Type = 0 No Transmitter, = 1 Not Used, = 2 Not Used	0
	INP.5	Process Mode = 0 Must be set to this bit, = 1 Not Used	0
	INP.6	IN.SC.OF = 0 Disabled, = 1 Enabled	1
	INP.7	0 Non Ratiomatic, =1 Not Used	0
MENU: IN.SC.OF (Input Scale and Offset)			
Parameter		**Description**	**Value**
IN.SC.OF		Input Scale and Offset	
	INPUT 1	Enter the first value displayed by the meter	-999999
	READ 1	Enter first desired value	-999999
	INPUT 2	Enter the second value displayed by the meter	-999999
	READ 2	Enter second desired value	-999999
MENU: DEC PT (Decimal Point)			
Parameter		**Description**	**Value**
DEC PT		Decimal point posistion	
	DEC PT	Decimal point posistion	FFF.FFF
MENU: CNT BY (Count By)			
Parameter		**Description**	**Value**
CNT BY		Count By	
	CNT BY	001, 002, 005, 010, 020, 050, 100	001
MENU: FIL.CNF Filter n)			

Parameter		Description	Value
FIL.CNF		Filter Configuration	
	FIL.1	Filter ttype = 0 ABC Filter, = 1 Moving Average Filter	0
	FIL.2	Value to be Displayed = 0 Unfiltered, = 1 Filtered	1
	FIL.3	Value to be Transmitter = 0 Unfiltered, = 1 Filtered, = 2 Peak Value, = 3 Valey Value	1
MENU: FIL TI (Filter Time Constant)			
Parameter		**Description**	**Value**
FIL IT		Filter Time Constant	
	CNT BY	001, 002, 004, 008, 016, 032, 064, 128	064
MENU: SP CNF (Setpoints 1 & 2 Configuration)			
Parameter		**Description**	**Value**
SP CNF		Setpoint 1 and 2 Configuration	
	SPC.1	Setpoint 1 active zone = 0 Above, = 1 Below	0
	SPC.2	Setpoint 1 open-collector or relay output Active ON or OFF = 0 On, = 1 Off	0
	SPC.3	Filtered/unfiltered reading compared with Setpoint 1 value = 0 Unfiltered, = 1 Filtered	1
	SPC.4	Setpoint 2 active zone = 0 Above, = 1 Below	0
	SPC.5	Setpoint 2 open-collector or relay output Active ON or OFF = 0 On, = 1 Off	0
	SPC.6	Filtered/unfiltered reading compared with Setpoint 2 value = 0 Unfiltered, = 1 Filtered	1
	SPC.7	Setpoint 1 & 2 Action = 0 Enabled, = 1 Disabled	0
	SPC.8	Setpoint 1 & 2 LED Action = 0 Enabled, = 1 Disabled	0
MENU: AL CNF (Alarm Configuration)			
Parameter		**Description**	**Value**
AL CNF		Alarm 1 & 2 (Setpoints 3 & 4) Configuration	
	ALC.1	Alarm 1 active zone (Setpoint 3) = 0 Above, = 1 Below	0
	ALC.2	Alarm 1 open-collector or relay output Active ON or OFF = 0 On, = 1 Off	0
	ALC.3	Filtered/unfiltered reading compared with Alarm 1 (Setpoint 3) value = 0 Unfiltered, = 1 Filtered	1
	ALC.4	Alarm 2 active zone (Setpoint 4) = 0 Above, = 1 Below	0
	ALC.5	Alarm 2 open-collector or relay output Active ON or OFF = 0 On, = 1 Off	0
	ALC.6	Filtered/unfiltered reading compared with Alarm 2 (Setpoint 4) value = 0 Unfiltered, = 1 Filtered	1
	ALC.7	Alarm 1 & 2 (Setpoints 3 & 4) Action and LED = 0 Enabled, = 1 Disabled	0
	ALC.8	Alarm reset at P2-11 connector = 0 Enabled, = 1 Disabled	0
MENU: AL FNC (Alarm Function)			
Parameter		**Description**	**Value**
AL FNC		Alarm 1 & 2 Function	
	ALF.1	Alarm 1 State = 0 Process Mode, = 1 High Deviation Mode, = 2 Low Deviation Mode, = 3 Band Deviation Mode	0
	ALF.2	Alarm 1 Latch Action = 0 Unlatched, = 1 Latched	0
	ALF.3	Alarm 2 State = 0 Process Mode, = 1 High Deviation Mode, = 2 Low Deviation Mode, = 3 Band Deviation Mode	0
	ALF.4	Alarm 2 Latch Action = 0 Unlatched, = 1 Latched	0
MENU: AL RDG (Alarm Readings)			
Parameter		**Description**	**Value**
AL RDG		Alarm number of readings	
	AL RDG	Number of readings to delay activation of Alarms 1 & 2, 01 to 15, (AL1) (AL2)	03 03
MENU: SP DB (Setpoint Deadband)			
Parameter		**Description**	**Value**
SP DB		Setpoint deadband	
	SP DB	Hysteresis for Setipints 1 & 2, 0000 to 9999	0020
MENU: AL DB Alarm Deadband)			
Parameter		**Description**	**Value**
AL DB		Alarm deadband	
	AL DB	Hysteresis for alarm 1 & 2, 0000 to 9999	0020

MENU: OUT.CNF (Output Configuration)			
Parameter		**Description**	**Value**
OUT.CNF		Output Configuration	
	OUT.1	Data on the Analog output board = 0 Disabled, = 1 Enabled	0
	OUT.2	Analog output mode = 0 0-1V, 0-5V, 1-5V, 0-10V, = 1 0-20mA, 4-20mA	1
	OUT.3	Data out on parallel BCD board = 0 Disabled, = 1 Enabled	0
	OUT.4	Type of data on BCD board = 0 Display, = 1 Peak	0
	OUT.5	BCD output = 0 used for standard parallel printers, = 1 used for specialty printers	1
	OUT.6	Type of display flashing = 0 disabled - display flashing, = 1 SP1 active - display flashing, = 2 SP2 active - display flashing, = 3 SP3 active - display flashing, = 4 SP4 active - display flashing, = 5 any SP active - display flashing	0

MENU: OT.SC.OF (Output Scale and Offset)			
Parameter		**Description**	**Value**
OT.SC.OF		Input Scale and Offset	
	READ 1	Enter the first value displayed by the meter	-99999
	OUTPT 1	Enter first desired output value	039840
	READ 2	Enter the second value displayed by the meter	-99999
	OUTPT 2	Enter second desired output value	039848

NEWPORT INFINITY PROCESS PANEL METER CONFIGURATION PARAMETERS
POST POINT SCUM CONCENTRATOR - SCUM OUTLET PRESSURE CONTROL

MENU: SP1 - Set point 1			
			NOT USED
MENU: SP2- Set point 2			
			NOT USED
MENU: SP3 - Set point 3			
			NOT USED
MENU: SP4 - Set point 4			
			NOT USED
JUMPER POSITIONS			
CURRENT		**S1: NONE; S2: A, F, M, N, T, U; S3: A, C; S4: B**	
VOLTAGE		**N/A**	
POTENTIOMETER		**N/A**	
LOCKOUT CONFIGURATIONS			
Parameter		**Description**	**Value**
L1 CNF		Lockout Configuration #1	
	L1C.1	Setpoint 1 change = 0 unlocked, 1 locked out	0
	L1C.2	Setpoint 2 change = 0 unlocked, 1 locked out	0
	L1C.3	Setpoint 3 (Alarm 1) change = 0 unlocked, 1 locked out	0
	L1C.4	Setpoint 4 (Alarm 2) change = 0 unlocked, 1 locked out	0
	L1C.5	Valley-value (LO RDG) displayed = 0, Microprocessor version displayed = 1	0
	L1C.6	Peak-value (HI RDG) display = 0 permitterd, 1 not permitted	0
	L1C.7	INPUT CLASS (CURRENT VOLTAGE OR POT) = 0 selectable, 1 locked out	0
	L1C.8	INPUT TYPE (4-20mA, 0-20mA, 0-100mV, etc.) = 0 selectable, 1 locked out	0
L2 CNF		Lockout Configuration #2	
	L2C.1	RDG.CNF (scale/offset method and display features) 0 may be chosen, 1 locked out	0
	L2C.2	0 RDG SC (computed input-to-display scale factor or 1 RD.SC.OF (two data points, which determine the reading scale/offset) may be entered.	0
	L2C.3	RDG OF (offset computed in display digits) 0 may be entered, 1 locked out.	0
	L2C.4	INP.CNF (meter rates, front-end features, prelinearizing scale/offset) 0 may be chosen, 1 locked out	0
	L2C.5	IN.SC.OF (two data points for additional scale/offset) 0 may be entered, 1 may not be entered	0
	L2C.6	DEC PT (decimal-point location) 0 may be chosen, 1 may not be chosen	0
	L2C.7	CNT BY (round off of display) 0 can be specified, 1 cannot be specified	0
	L2C.8	FIL CNF (adaptive/fixed filtering and for which output(s)) 0 can be chosen, 1 cannot be chosen	0
L3 CNF		Lockout Configuration #3	
	L3C.1	FIL TI (# of samples in average) 0 can be chosen, 1 locked out	0
	L3C.2	SP CNF (mode of action of setpoints 1 & 2 LEDs, transistors and relays) 0 can be selected, 1 locked out	0
	L3C.3	AL CNF (mode of action of Setpoints 3 & 4, often used as alarms) 0 can be locked out, 1 cannot be locked out.	0
	L3C.4	AL FNC (Setpoints 3 & 4 independent or ganged with Setpoints 1 and 2) 0 can be selected, 1cannot be accessed	0
	L3C.5	AL RDG (# of out-of-range readings before trip of setpoints 3 & 4) 0 can be selected, 1 cannot be accessed	0
	L3C.6	SP DB (hysteresis or deadband of Setpoints and Alarms) 0 can be specified, 1 cannot be accessed	0
	L3C.7	OUT.CNF (analog & BCD outputs, setpoint display flashing) 0 can be specified, 1 cannot be specified	0
	L3C.8	OT.SC.OF (2-data-point method for independent analog-output scale/offset) 0 can be entered, 1 cannot be accessed	0
L4 CNF		Lockout Configuration #4	
	L4C.1	BAUD (communication rate) 0 can be chosen, 1 cannot be accessed	0

	L4C.2	SER.CNF (parity/stop-bit length) 0 is selectable, 1 not selectable	0
	L4C.3	ADDRES (meter address # on a multipoint bus) 0 can be changed, 1 cannot be accessed	0
	L4C.4	SERCNT (interval # of readings for the automatic digital output of meter) 0 can be changed, 1 cannot be accessed	0
	L4C.5	Analog output trim input 0 can be entered, 1 cannot be entered	0
	L4C.6	Analog output trim input 0 can be entered, 1 cannot be entered	1
MENU: INPUT			
Parameter		**Description**	**Value**
INPUT CLASS		Current, Volt, or Pot	CURRENT
INPUT TYPE		0-20mA, 4-20mA, 0-100mV, 0-10Vdc, -50-50mV, etc.	4-20
MENU: RDG.CFG - Reading Configuration			
Parameter		**Description**	**Value**
RDG.CNF		Reading Configuration	
	RDG.1	Reading Scale & Offset = 0 Direct Format, = 1 2-Coordinate format	0
	RDG.2	Decimal point effect = 0 Active, = 1 Independent	1
	RDG.3	Display Brightness = 0 Normal, 1 50% of Normal	0
	RDG.4	Leading Zeros on Display = 0 Displayed, 1 Not Displayed	1
	RDG.5	Unit of Temperature = 0 Not used with, = 1 Process	0
	RDG.6	Reading Scale & Offset Functions = 0 Disables Reading Scale and Offset (RDG SC=1.0, RDG OF=0.0), 1 Enables Reading Scale and Offset (Uses scale and offset values entered by user)	0
	RDG.7	Resetting Mode = 0 Grounding P2-5 causes Hard Reset (RESET 2), =1 Grounding P2-5 causes Peak/Valley (HI/LO) Reset	0
MENU: RDG SC (Reading Scale) RDG OF (Reading Offset)			
Parameter		**Description**	**Value**
RDG.SC.OF		Reading scale and offset	
	RDG SC	Reading scale	100000
	RDG OF	Reading offest	000000
MENU: IN CNF (input Configuration)			
Parameter		**Description**	**Value**
IN CNF		Input Configuration	
	INP.1	Line Frequency = 0 60HZ, = 1 50 HZ	0
	INP.2	Read Rate = 0 Slow, = 1 Fast	0
	INP.3	Input Voltage = 0 Unipolar, = 1 Bipolar	0
	INP.4	Transmitter Type = 0 No Transmitter, = 1 Not Used, = 2 Not Used	0
	INP.5	Process Mode = 0 Must be set to this bit, = 1 Not Used	0
	INP.6	IN.SC.OF = 0 Disabled, = 1 Enabled	1
	INP.7	0 Non Ratiomatic, =1 Not Used	0
MENU: IN.SC.OF (Input Scale and Offset)			
Parameter		**Description**	**Value**
IN.SC.OF		Input Scale and Offset	
	INPUT 1	Enter the first value displayed by the meter	4
	READ 1	Enter first desired value	-00001
	INPUT 2	Enter the second value displayed by the meter	20032
	READ 2	Enter second desired value	200174
MENU: DEC PT (Decimal Point)			
Parameter		**Description**	**Value**
DEC PT		Decimal point posistion	
	DEC PT	Decimal point posistion	FFFF.FF
MENU: CNT BY (Count By)			
Parameter		**Description**	**Value**
CNT BY		Count By	
	CNT BY	001, 002, 005, 010, 020, 050, 100	001
MENU: FIL.CNF Filter n)			

Parameter		Description	Value
FIL.CNF		Filter Configuration	
	FIL.1	Filter ttype = 0 ABC Filter, = 1 Moving Average Filter	0
	FIL.2	Value to be Displayed = 0 Unfiltered, = 1 Filtered	1
	FIL.3	Value to be Transmitter = 0 Unfiltered, = 1 Filtered, = 2 Peak Value, = 3 Valey Value	1
MENU: FIL TI (Filter Time Constant)			
Parameter		**Description**	**Value**
FIL IT		Filter Time Constant	
	CNT BY	001, 002, 004, 008, 016, 032, 064, 128	064
MENU: SP CNF (Setpoints 1 & 2 Configuration)			
Parameter		**Description**	**Value**
SP CNF		Setpoint 1 and 2 Configuration	
	SPC.1	Setpoint 1 active zone = 0 Above, = 1 Below	0
	SPC.2	Setpoint 1 open-collector or relay output Active ON or OFF = 0 On, = 1 Off	0
	SPC.3	Filtered/unfiltered reading compared with Setpoint 1 value = 0 Unfiltered, = 1 Filtered	1
	SPC.4	Setpoint 2 active zone = 0 Above, = 1 Below	0
	SPC.5	Setpoint 2 open-collector or relay output Active ON or OFF = 0 On, = 1 Off	0
	SPC.6	Filtered/unfiltered reading compared with Setpoint 2 value = 0 Unfiltered, = 1 Filtered	1
	SPC.7	Setpoint 1 & 2 Action = 0 Enabled, = 1 Disabled	0
	SPC.8	Setpoint 1 & 2 LED Action = 0 Enabled, = 1 Disabled	0
MENU: AL CNF (Alarm Configuration)			
Parameter		**Description**	**Value**
AL CNF		Alarm 1 & 2 (Setpoints 3 & 4) Configuration	
	ALC.1	Alarm 1 active zone (Setpoint 3) = 0 Above, = 1 Below	0
	ALC.2	Alarm 1 open-collector or relay output Active ON or OFF = 0 On, = 1 Off	0
	ALC.3	Filtered/unfiltered reading compared with Alarm 1 (Setpoint 3) value = 0 Unfiltered, = 1 Filtered	0
	ALC.4	Alarm 2 active zone (Setpoint 4) = 0 Above, = 1 Below	0
	ALC.5	Alarm 2 open-collector or relay output Active ON or OFF = 0 On, = 1 Off	0
	ALC.6	Filtered/unfiltered reading compared with Alarm 2 (Setpoint 4) value = 0 Unfiltered, = 1 Filtered	0
	ALC.7	Alarm 1 & 2 (Setpoints 3 & 4) Action and LED = 0 Enabled, = 1 Disabled	0
	ALC.8	Alarm reset at P2-11 connector = 0 Enabled, = 1 Disabled	0
MENU: AL FNC (Alarm Function)			
Parameter		**Description**	**Value**
AL FNC		Alarm 1 & 2 Function	
	ALF.1	Alarm 1 State = 0 Process Mode, = 1 High Deviation Mode, = 2 Low Deviation Mode, = 3 Band Deviation Mode	0
	ALF.2	Alarm 1 Latch Action = 0 Unlatched, = 1 Latched	0
	ALF.3	Alarm 2 State = 0 Process Mode, = 1 High Deviation Mode, = 2 Low Deviation Mode, = 3 Band Deviation Mode	0
	ALF.4	Alarm 2 Latch Action = 0 Unlatched, = 1 Latched	0
MENU: AL RDG (Alarm Readings)			
Parameter		**Description**	**Value**
AL RDG		Alarm number of readings	
	AL RDG	Number of readings to delay activation of Alarms 1 & 2, 01 to 15, (AL1) (AL2)	03 03
MENU: SP DB (Setpoint Deadband)			
Parameter		**Description**	**Value**
SP DB		Setpoint deadband	
	SP DB	Hysteresis for Setipints 1 & 2, 0000 to 9999	0020
MENU: AL DB Alarm Deadband)			
Parameter		**Description**	**Value**
AL DB		Alarm deadband	
	AL DB	Hysteresis for alarm 1 & 2, 0000 to 9999	0020

Scum Concentrator
Scum Outlet Pressure

MENU: OUT.CNF (Output Configuration)			
Parameter		**Description**	**Value**
OUT.CNF		Output Configuration	
	OUT.1	Data on the Analog output board = 0 Disabled, = 1 Enabled	1
	OUT.2	Analog output mode = 0 0-1V, 0-5V, 1-5V, 0-10V, = 1 0-20mA, 4-20mA	1
	OUT.3	Data out on parallel BCD board = 0 Disabled, = 1 Enabled	0
	OUT.4	Type of data on BCD board = 0 Display, = 1 Peak	0
	OUT.5	BCD output = 0 used for standard parallel printers, = 1 used for specialty printers	0
	OUT.6	Type of display flashing = 0 disabled - display flashing, = 1 SP1 active - display flashing, = 2 SP2 active - display flashing, = 3 SP3 active - display flashing, = 4 SP4 active - display flashing, = 5 any SP active - display flashing	0

MENU: OT.SC.OF (Output Scale and Offset)			
Parameter		**Description**	**Value**
OT.SC.OF		Input Scale and Offset	
	READ 1	Enter the first value displayed by the meter	000000
	OUTPT 1	Enter first desired output value	04.0000
	READ 2	Enter the second value displayed by the meter	000000
	OUTPT 2	Enter second desired output value	20.0000

TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317, 13321
DISPLAY & LIMIT METERS
NEWPORT - INFP0200-C2 & INFP0300-C2

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It is the policy of NEWPORT to comply with all worldwide safety and EMC/EMI regulations that apply. NEWPORT is constantly pursuing certification of its products to the European New Approach Directives. NEWPORT will add the CE mark to every appropriate device upon certification.

WARNING: These products are not designed for use in, and should not be used for, patient connected applications.

This device is marked with the international hazard symbol. It is important to read the Setup Guide before installing or commissioning this device as it contains important information relating to safety and EMC.

Table of Contents

Table of Contents

Table of Contents

Figures

Figures

Notes, Warnings, and Cautions

Information that is especially important to note is identified by these labels:

- **NOTE**
- **WARNING**
- **CAUTION**
- **IMPORTANT**

NOTE: provides you with information that is important to successfully setup and use the Programmable Digital Meter.

CAUTION or WARNING: tells you about the risk of electric shock.

CAUTION, WARNING or IMPORTANT: tells you of circumstances or practices that can effect the meter's functionality and must refer to accompanying documents.

1.1 DESCRIPTION

This Process meter is part of a complete line of process indicators/ controllers, offering exceptional performance.

The process meter is front panel programmable to accept 0-20 and 4-20 mAdc current inputs, unipolar and bipolar DC voltage inputs and potentiometer inputs. The meter will accept inputs from most of the process sensors in use today such as transmitters, pressure transducers, and potentiometers.

Configuring the meter is accomplished through the 5 front panel buttons. If the RS-232 or RS-485 communication option is installed, the user may remotely set the display parameters.

Options for the meter include analog and BCD outputs, relay outputs, and RS-232 or RS-485 communications.

1.2 FEATURES

The following is a list of features of the meter.

- 6-digit LED display in red or green
- 0.005% accuracy of reading
- 12 DC input ranges: 0-100 mV, 0-1 V, 0-5 V, 1-5 V, 0-10 V, 0-100 V, ±50 mV, ±500 mV, ±5 V, ±50 V, 0-20 mA, or 4-20 mA
- 10 or 24 V dc sensor excitation
- Peak & Valley detection and memory
- External Tare
- Up to 13 readings per second
- 4 isolated open collector outputs(standard) and optional isolated relay or isolated BCD and isolated analog outputs
- Optional isolated RS-232 or RS-485 communications
- NEMA 4 Front Panel/IP65
- Non-volatile memory without battery back-up
- 115 Vac, 50/60 Hz, 230 Vac, 50/60 Hz power supply
- Optional 10-32 Vdc power supply

1.3 AVAILABLE MODELS

The following models and options are available. Optional boards are either installed at the time of purchase, or available as separate items and installed by the user after purchase.

MAIN ASSEMBLIES

MODEL NUMBER	DESCRIPTION
INFP0	Red LEDs, 115 V ac, 50/60Hz
INFP1	Red LEDs, 230 V ac, 50/60Hz
INFP2	Green LED's, 115 V ac, 50/60 Hz
INFP3	Green LED's, 230 V ac, 50/60Hz
INFP4	Red LEDs, 10-32 V dc
INFP5	Green LED's, 10-32 V dc

Note ☞

NOTE: The following options are available installed at the time of purchase or as separate items installed by the user after purchase:

Analog Output Board, BCD Output Board, Relay Output Board, RS-232 Communications Board, and RS-485 Communications Board.

CONTROL/BCD OUTPUT OPTIONS

MODEL NUMBER	DESCRIPTION
"0"	Standard four open-collector outputs are standard
"1" (BCD1)	Isolated BCD Output Board
"2" (REL1)	Dual 7A Form-C Relays
"4" (REL4)	Dual 7A & Dual 1A Form-C Relays (not available with dc unit).

Note ☞

NOTE: Choose only one Control/BCD output option per meter. A 40-pin mating connector is included with the BCD option.

ANALOG OUTPUT

MODEL NUMBER	DESCRIPTION
"0"	None
"1" (ANO2)	Isolated configurable analog (4-20 mA, 0-1, 0-5, 1-5, 0-10 V dc, 0-20 mA) output

SERIAL COMMUNICATIONS OPTION

MODEL NUMBER	DESCRIPTION
“1” (RS20)*	Isolated RS-232 Communications
“2” (RS40)**	Isolated RS-485 Communications

Note ☞

NOTE: Choose only one option per meter. Both computer communications comes with 6 ft. communications cable with phone plug termination.

Free configuration software is available from ***www.newportUS.com/software*** **or on the CD-ROM enclosed with your shipment**.

* Recommend purchase of 9SC2 or 25SC2 (see OPTIONS below)

** Recommend purchase of 9SC4 or 25SC4 (see OPTIONS below)

OPTIONS

MODEL NUMBER	DESCRIPTION
FS	Custom Calibration/configuration
H5	50 Hz line frequency (Requires”FS”)
H6	60 Hz line frequency (Requires”FS”)
BL	Blank lens
9SC2	9-pin Serial Connector for RS-232
9SC4	9-pin Serial Connector for RS-485
25SC2	25-pin Serial Connector for RS-232
25SC4	25-pin Serial Connector for RS-485
RP18	19” Rack panel for one (1) meter
RP28	19” Rack panel for two (2) meters
RP38	19” Rack panel for three (3) meters
SP1	Split connector for RS-485 network
SPC4	1/8 DIN NEMA 4 heavy duty cover with thumb screws
SPC18	1/8 DIN NEMA 4 Splash Proof lens cover with spring clip
TP1	Trimplate adapter

2 Unpacking

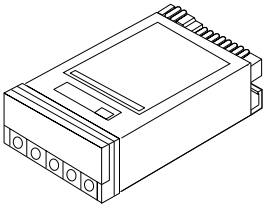
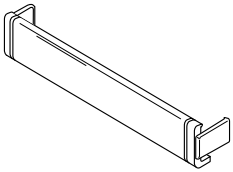
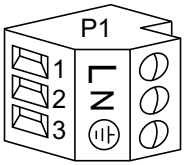
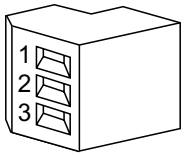
Unpack all items and make sure that every item on the packing list is present. The items you should receive are listed below. If something is missing, use the phone number for the Customer Service Department nearest you.

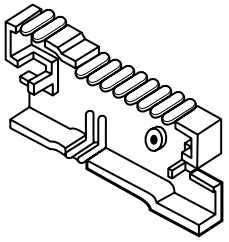
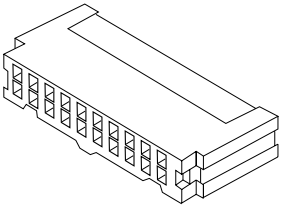
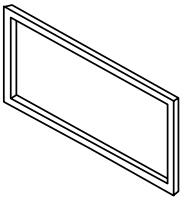
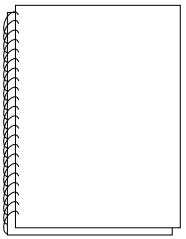
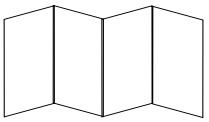
Also, inspect the shipping container and enclosed equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

Note ☞

NOTE: The shipping agent will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save all packing material and containers in the event that reshipment is required.

When you ordered your process meter, you will receive the following items in the shipping box:

QTY	DESCRIPTION	ILLUSTRATION
1	Basic Meter in a Mounting Sleeve with Gasket	
1	Front-Panel Button Cover	
	AC Power Connector (orange - P1)	
2	Input Connectors (gray - P3 and P9)	

1	Rear Protective Cover with Screw	
1	20-Socket Ribbon Connector (P2 Connector)	
2	Panel-Mounting Gaskets (1 Spare)	
1	Process Owner's Guide	
1	Quick Start Manual	

Other items may also be in the box depending on the options ordered. Refer to specific options described previously.

3 Safety Considerations

3.1 SAFETY CONSIDERATIONS

This device is marked with the **international caution symbol**. It is **important to read** this manual before installing or commissioning this device as it contains important information relating to **Safety and EMC** (Electromagnetic Compatibility).

Unpacking & Inspection

Unpack the instrument and inspect for obvious shipping damage. Do not attempt to operate the unit if damage is found.

This instrument is a **panel mount device** protected in accordance with **Class I** of EN 61010 (115/230 AC power connections), **Class III** for the DC power option (10-32Vdc). Installation of this instrument should be done by Qualified personnel. In order to ensure safe operation, the following instructions should be followed.

This instrument has **no power-on switch**. An external **switch or circuit-breaker** shall be included in the building installation as a disconnecting device. It shall be marked to indicate this function, and it shall be in close proximity to the equipment within easy reach of the operator. The switch or circuit-breaker shall not interrupt the Protective Conductor (Earth wire), and it shall meet the relevant requirements of IEC 947–1 and IEC 947-3 (International Electrotechnical Commission). The switch shall not be incorporated in the mains supply cord.

Furthermore, to provide protection against **excessive energy** being drawn from the mains supply in case of a fault in the equipment, an **overcurrent** protection device shall be installed.

- The Protective Conductor must be connected for safety reasons. Check that the power cable has the proper Earth wire, and it is properly connected. It is not safe to operate this unit without the Protective Conductor Terminal connected. Conductor Terminal connected.

- Do not exceed voltage rating on the label located on the top of the instrument housing.
- Always disconnect power before changing signal and power connections.
- Do not use this instrument on a work bench without its case for safety reasons.
- Do not operate this instrument in flammable or explosive atmospheres.
- Do not expose this instrument to rain or moisture.
- Unit mounting should allow for adequate ventilation to ensure instrument does not exceed operating temperature rating.
- Use electrical wires with adequate size to handle mechanical strain and power requirements. Install without exposing bare wire outside the connector to minimize electrical shock hazards.

EMC Considerations

- Whenever EMC is an issue, always use shielded cables.
- Never run signal and power wires in the same conduit.
- Use signal wire connections with twisted-pair cables.
- Install Ferrite Bead(s) on signal wires close to the instrument if EMC problems persist.

Failure to follow all instructions and warnings may result in injury!

4.1 FRONT OF THE METER

The following is a brief description of each part of the front of the meter.

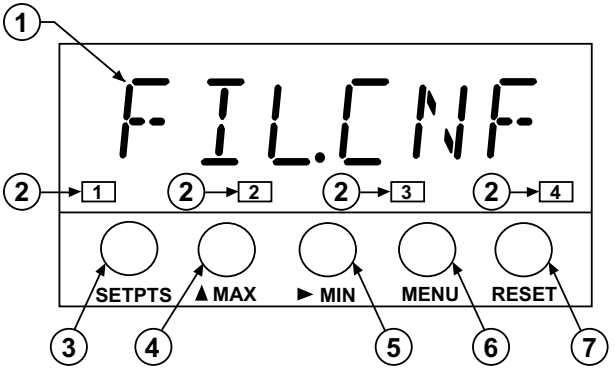


Figure 4-1. Front Detail

ITEM	DESCRIPTION
1	–.8.8.8.8.8. or 8.8.8.8.8.8. 6-digit, 14 segment, alphanumeric 0.54” high LED display with programmable decimal point.
2	SETPOINT LED These LEDs, labeled 1 through 4, display the status of setpoints 1, 2, 3 (Alarm 1), and 4 (Alarm 2).
3	**SETPTS** BUTTON This button functions only in the run mode. When the Setpoint/Alarm features are unlocked, pressing this button sequentially recalls the previous setpoint settings to the display. After the **‘MIN’** and **‘MAX’** buttons are used to alter those values as desired, pressing the ‘SETPTS’ button, again, stores these new values. Unless the ‘SETPTS’ button is pressed, each of the four setpoint values is displayed for approximately 10 seconds after the last press of the ‘SETPTS’ button. Holding the ‘SETPTS’ button depressed stalls this automatic sequence, retaining the most recent setpoint number on the display.

ITEM	DESCRIPTION
4	▲ /**MAX** BUTTON During run mode, pressing this button displays the “HI RDG” (peak reading) value that has occurred up to the moment the **‘MAX’** button is pressed. This peak reading flashes, to distinguish its value from the current readings. Since this is a dynamic peak reading, the value will change if the value increases while reviewing it. To return to display of the current readings without resetting the peak-value memory to zero (0), press the **‘MAX’** button once again. To reset the peak-value memory (start a new peak determining period), press the **‘RESET’** button once. During the configuration mode, the **‘MAX’** button is used to change the numerical value of the flashing digit displayed. For submenu items, such as “L1C.1=0”, pressing the **‘MAX’** button toggles the choice from “0” to “1”. The meter allows rapid changes of a displayed numerical value by making “0” the first value to occur when the **‘MAX’** button is pressed. After that, the numbers increase to “9” and then roll over to “0” again. A negative (“–”) symbol may be displayed in the most significant digit (i.e. the digit at the far left such as shown here “–.8.8.8.8.8.”) In the **SETPT** (SETPOINT) mode (SP1, SP2, etc), pressing the **‘MAX’** button causes the flashing digit to increment by 1 from 0 to 9.
5	▶ /**MIN** BUTTON During run mode, pressing the **‘MIN’** button recalls the “LO RDG” (valley reading) measured since the last press of the **‘RESET’** button. This lowest value flashes, to distinguish it from the current process display. Since this is a dynamic valley reading, the value will change if the value decreases while reviewing it.

ITEM	DESCRIPTION
	To return to the actual process display, without resetting the low-value memory, press the **'MIN'** button once again. To reset the memory for current-value readings (start a new observation period), press the **'RESET'** button once and the meter will return to the run mode. In the configuration mode, once in a submenu (like input type) the **'MIN'** button allows you scroll through the available choices such as, 0-20 mA or 4-20 mA, etc. In the **SETPT** mode, the **'MIN'** button advances the flashing digit to the right.
6	**MENU** BUTTON In the run mode, this button terminates the measurement process and allows you to enter the configuration mode, advancing through the configuration menus. In the configuration mode, this button will store changes in the non-volatile memory at the same time advancing the display to the next menu item.
7	**RESET** BUTTON In the run mode, pressing the **'RESET'** button once erases the memories of peak ("HI RDG"), valley ("LO RDG"), and ALARM latches. The display then returns to the run mode. **WARNING:** Pressing the **'RESET'** button two (2) times will result in a hard reset of the meter. This will clear the Peak & Valley, Alarm latches and meter reading and immediately begin a new measurement. In the configuration mode, pressing the **'RESET'** button once, displays the previous selection. For example, if you were in "IN CNF" then pressed the **'RESET'** button once, the display will then show "RD.SC.OF". Press the **'RESET'** button two times to return to the run mode.

4.2 REAR OF THE METER

The following is a brief description of each part of the rear of the meter. The label on the top of the mounting sleeve (not the case) identifies the location of the connectors found at the rear of the meter. Figure 4-2A & figure 4-2B shows this label.

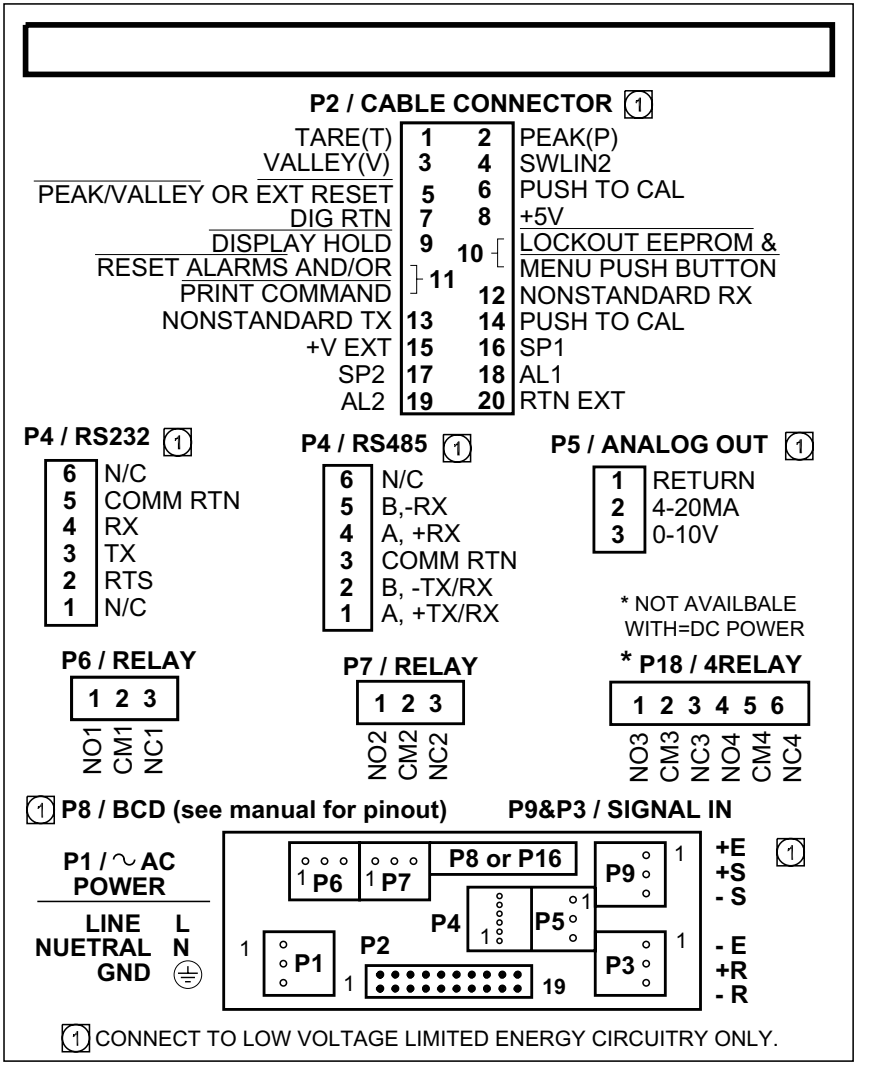


Figure 4-2A. AC Power - Connector Label for Rear Connectors

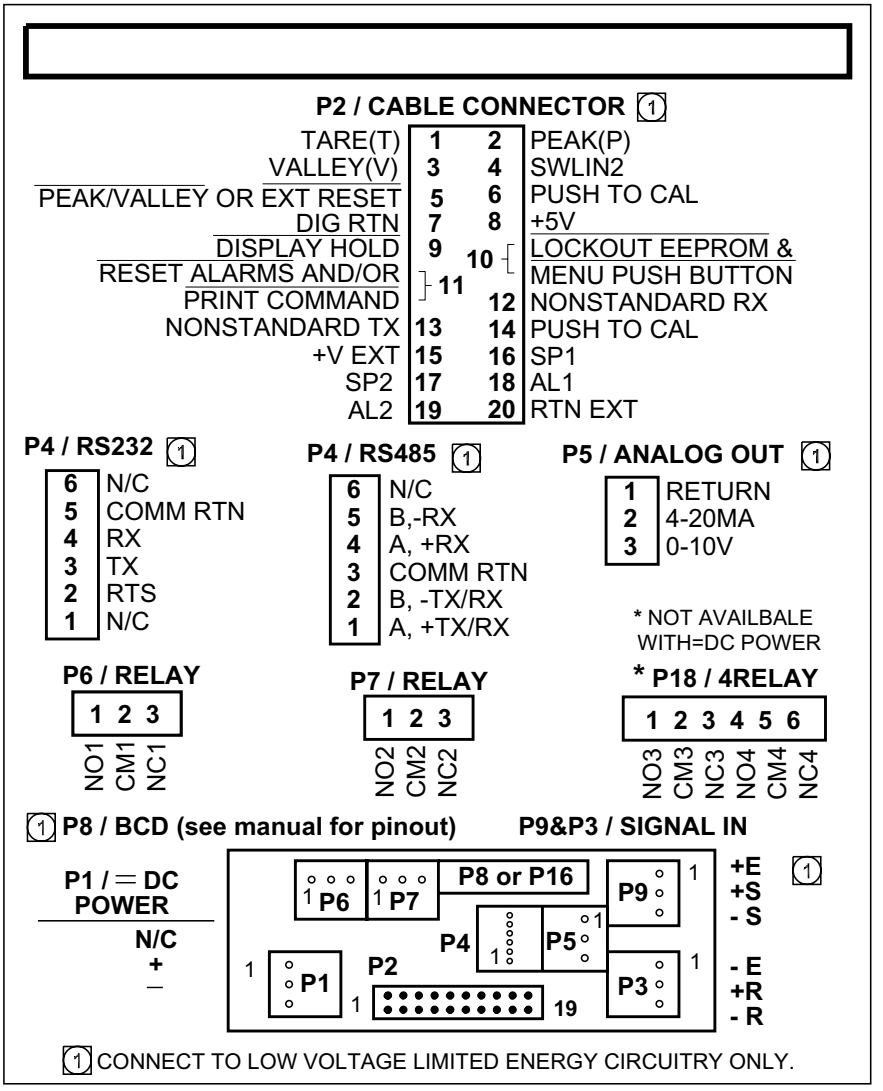


Figure 4-2B. DC Power - Connector Label for Rear Connectors

4 Parts of the Meter

Figure 4-3 shows the rear of the meter with the optional 4-relay output board and a serial communications board installed.

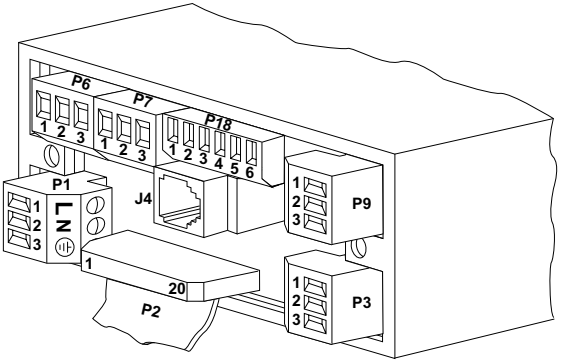


Figure 4-3. Rear View

Figure 4-4 shows the rear of the meter with the optional BCD output board and a serial communications output board installed.

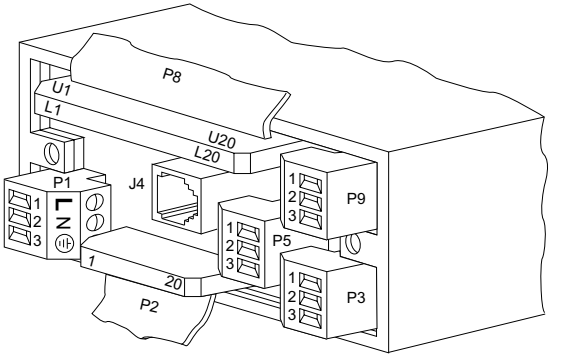


Figure 4-4. Rear View

CONNECTOR #	DESCRIPTION
P1	AC Power Connector
P2	External I/O Connector
P3	Input Connector, –E, +R, –R
J4	Optional RS-232 or RS-485 Phone Jack Connector
P5	Optional Analog Out Connector
P6	Optional Form-C Relay #1 Connector
P7	Optional Form-C Relay #2 Connector
P8	Optional BCD Connector
P9	Input Connector, +E, +S, –S
P18	Optional Form-C Relay #3 and #4 Connector

TABLE 4-1 Rear Connector Descriptions

5.1 CONDITIONS REQUIRING DISASSEMBLY

You may need to remove the sleeve or open the meter for several reasons:

1. To inspect the rating label on the case (not the same label as on the sleeve) (Section 5.2.1).
2. To check or change the 115 V ac or 230 V ac or main board jumpers (Sections 5.2.2 and 5.2.4).
3. To install optional output board(s) (Section 5.2.3).
4. To mount the meter in a panel (Section 5.2.5).

5.2 ASSEMBLY/DISASSEMBLY OPENING

OPENING THE METER

Your meter is fully assembled, but not wired. See Section 7 for wiring connection for power and sensor inputs. In most cases, if you have ordered optional boards with the meter, these boards will already be installed.

You will need to remove only the rear cover to complete wiring, but you will have to open the meter to do one or more of the following:

WARNING!: You must disconnect and turn-off the power and connector signals before accessing the unit and installing optional boards. Failure to do so may result in injury!

a. Check or reconfigure the Transformer Jumpers on the Main Board so that they correspond to your line voltage (W1 and W2 for 115 V ac, or W3 for 230 V ac). See Section 5.2.2.

b. Install optional boards. See Section 5.2.3.

c. Access jumpers on the Main and optional boards. See Section 5.2.4.

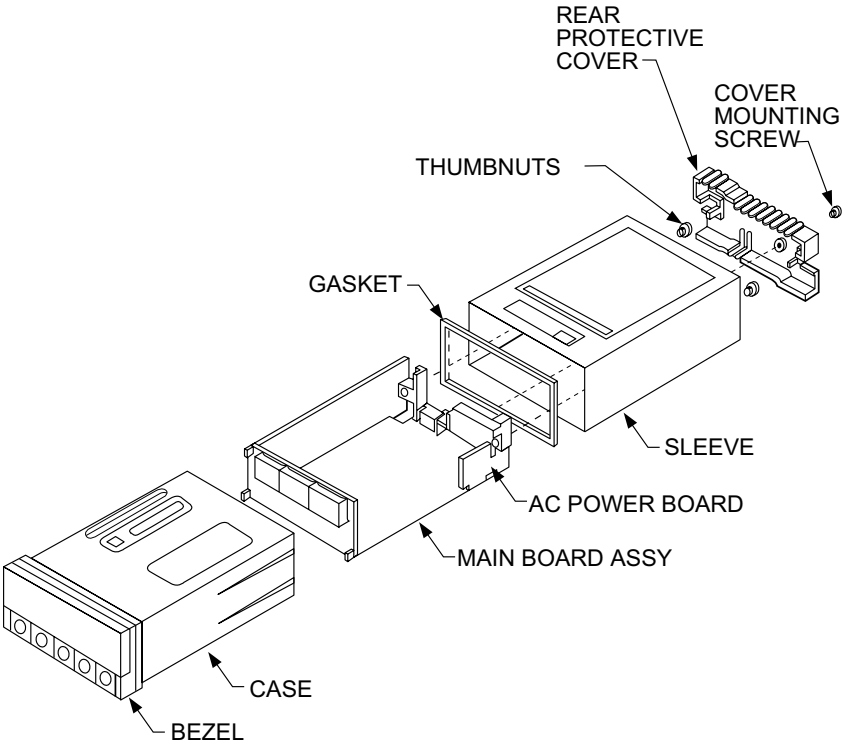


Figure 5-1. Meter Exploded View

Using Figures 5-1 as a guide, follow these simple instructions to open the meter:

IMPORTANT: Turn-off the power and input signals from the unit before proceeding. Failure to do so may result in injury!

1. Remove the cover mounting screw that secures the rear protective cover to the meter, and remove the Rear Protective Cover.

   If you are simply wiring the meter–but not checking jumpers or installing or removing boards–this is as far as the meter needs to be disassembled. Go to Section 5.2.1.

2. Remove all wiring connectors from the rear of the meter.
3. Remove the two thumbnuts that secure the case to the sleeve.
4. Remove the sleeve completely by sliding it back from the front bezel.

5. Using Figure 5-2 as a guide, bend the side-panel detents on the case outward and pull the board assembly out of the case by the mounting screw stem.

Note ☞

NOTE: From this point forward, these 5 steps are referred to as “Reveal the main board”.

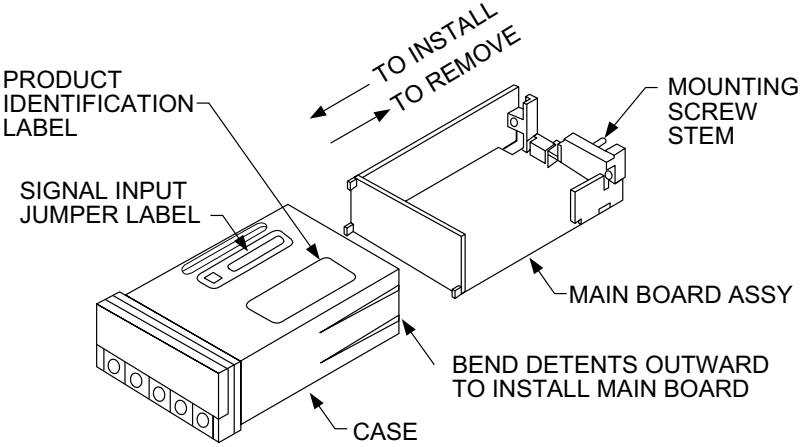


Figure 5-2. Board Assembly Removing/Installing Detail

The meter is now disassembled to the point where you can check and configure jumpers and install boards.

REINSERTING THE MAIN BOARD ASSEMBLY INTO THE CASE

Reinsert the Main Board into the case once jumpers and optional boards have been configured and installed.

Spread the side-panel detents of the case, and carefully slide the main board all the way in.

5.2.1 Safety Precaution/Product ID Label

To look at the Rating/Product ID label on the case, you must follow the first step as described in Section 5-2. Refer to Figure 5-2 for the location of the Product Identification label.

The meter is protected in accordance with Class I of EN61010. Refer to Safety Considerations page.

WARNING: If your meter is to be wired to sensors to control inputs that could be hazardous potentials, these potentials will be carried to the 20-pin output connector (P2) at the rear. They will also be present on the meter's circuit boards. Follow all instructions carefully BEFORE connecting the meter to any source of power.

DO NOT contact any exposed metal parts, install optional board(s), change jumpers, or in any way disassemble or assemble the meter while it is connected to AC voltage.

Note the following information and guidelines for safe operation of your meter:

Power Voltage

Your power source voltage rating should agree with the voltage under which the meter has been configured to operate. The first thing you should do is verify this.

The meter's operating voltage is shown in the VOLTS: entry of the Product Identification and Serial Number Label. It is located on the case, as shown in Figure 5-2, and is clearly visible on the meter packing box.

5.2.2 Main Board Power Jumpers

To check voltage jumpers or to change from 115 V ac to 230 V ac:

CAUTION: The meter has no power-on switch; it will be in operation as soon as you apply power. To change the factory preset jumpers, disconnect the power from the unit. Failure to do so may result in injury! The jumpers must be changed by specifically trained personnel.

1. "Reveal the Main Board" (refer to Section 5.2, Disassembly).
2. Locate the main board assembly and position it in front of you the same way as shown in Figure 5-3.
3. On the main board, locate the transformer jumpers W1, W2, and W3 near the transformer T1.
   If your power requirement is 115 V ac, jumpers W1 and W2 should be installed. (DO NOT INSTALL W3)

   If your power requirement is 230 V ac, jumper W3 should be installed. (DO NOT INSTALL W1 OR W2)

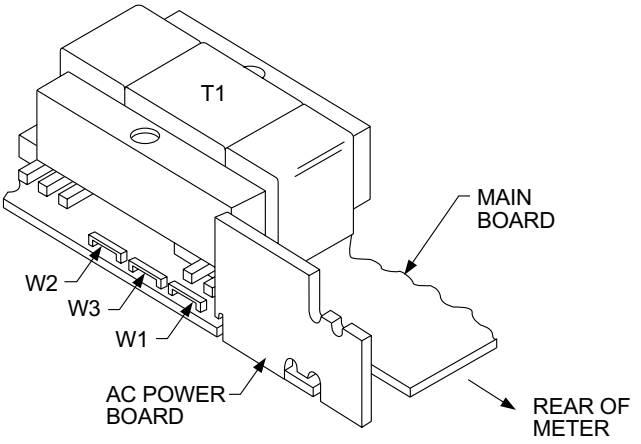


Figure 5-3. Transformer Jumpers

5.2.3 Printed Circuit Board(s) Installation

To install optional printed circuit board(s):

1. "Reveal the Main Board" (refer to Section 5.2, Disassembly).
2. Using Figure 5-4 as a reference, insert option board(s) into the corresponding slot(s) on the main board. Each circuit board is keyed to fit in it's own position.

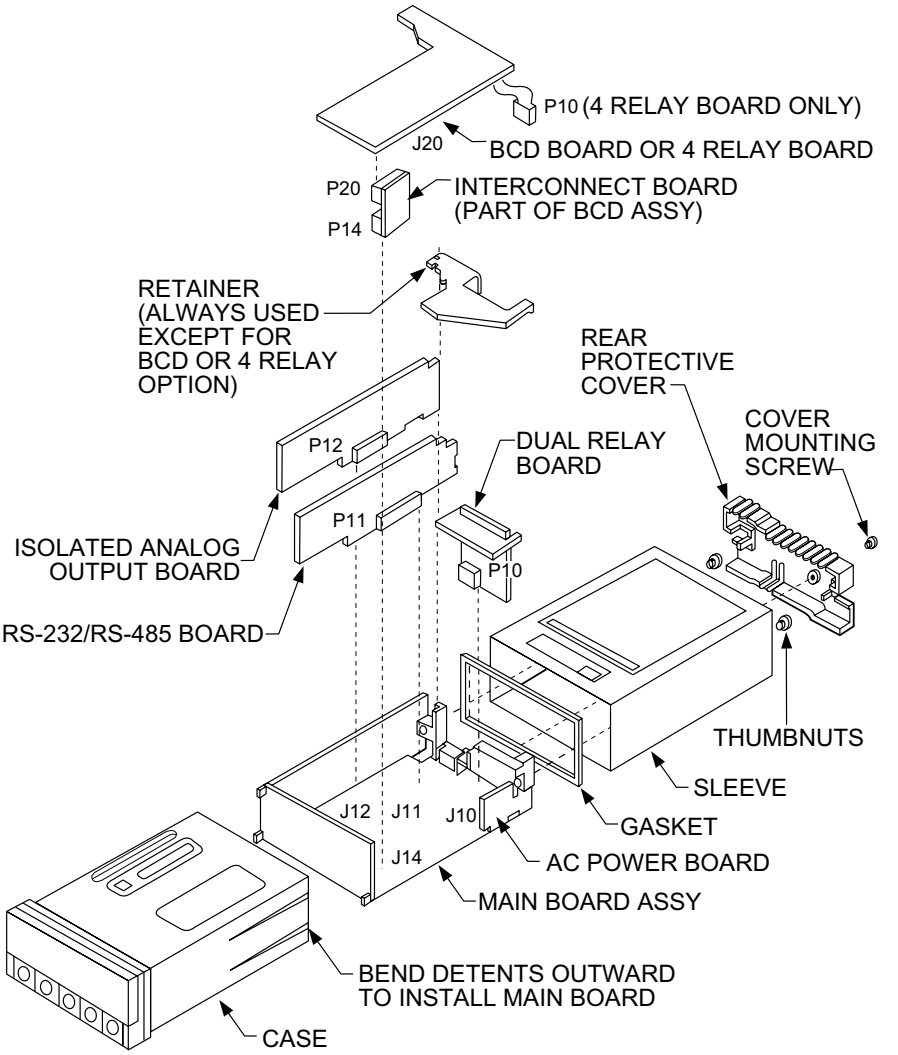


Figure 5-4. Optional Printed Circuit Board Locations

5.2.4 How to Access Jumpers

To gain access to jumper S1 and S2 used to configure input type remove the mounting sleeve. The jumpers may be accessed through the slot in the case.

To gain access to jumpers on the main board for power, excitation and lockout selection:

1. “Reveal the main board” (refer to Section 5.2, Disassembly).

Note ☞

NOTE: To access the S1 and S2 jumpers on the Signal Input Board, you only need to remove the mounting sleeve.

2. To re-assemble the meter, follow the steps in reverse order.

Figures 5-5 through 5-13 show the layout of the seven (7) printed circuit boards with respective jumper blocks, where applicable, used in the meter. Figures 5-7 through 5-13 show the optional boards.

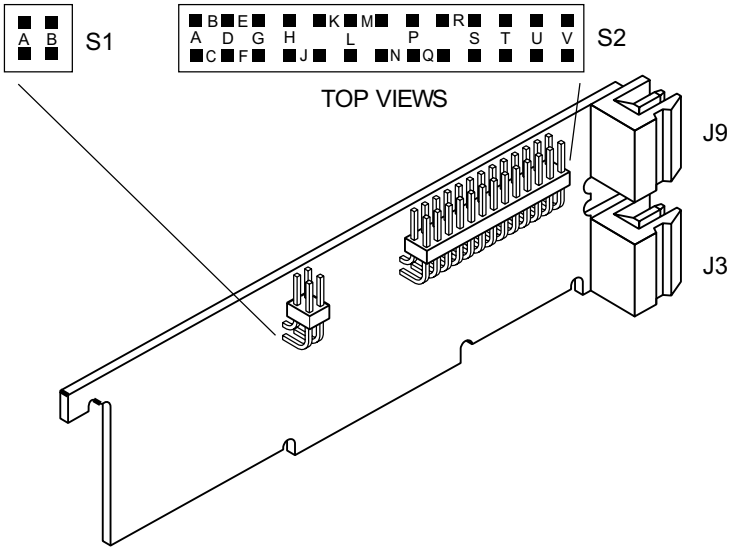


Figure 5-5. Signal Input Board

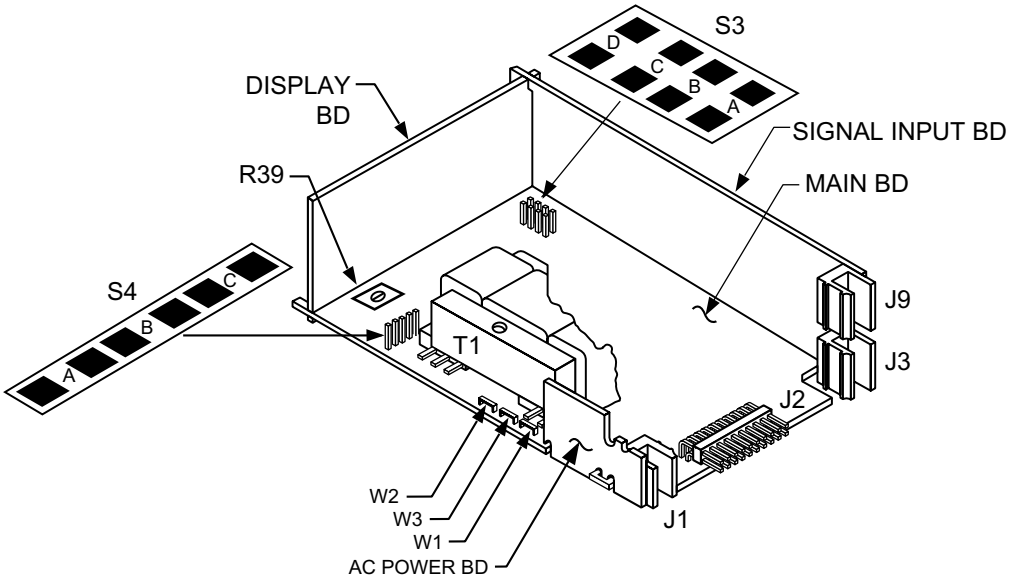


Figure 5-6. ac-Powered Main Board

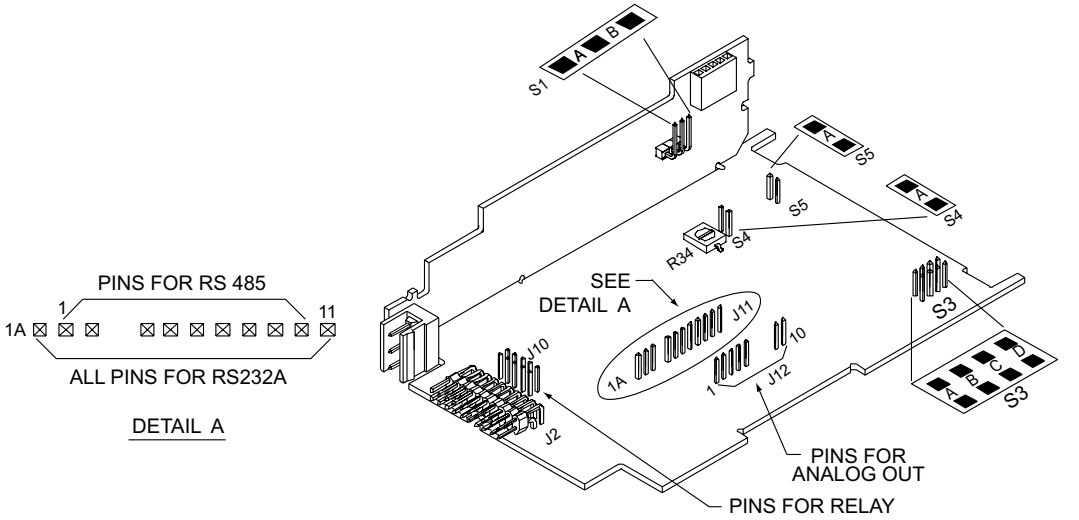


Figure 5-7. dc-Powered Main Board

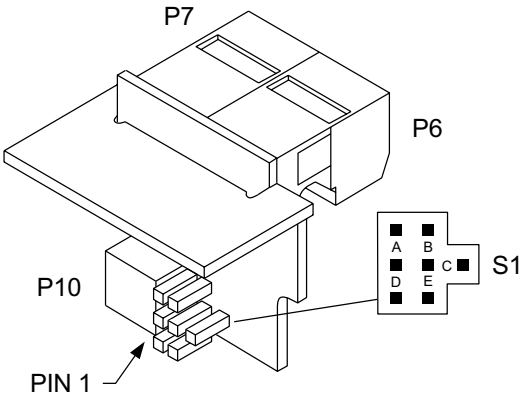


Figure 5-8. Relay Option Board

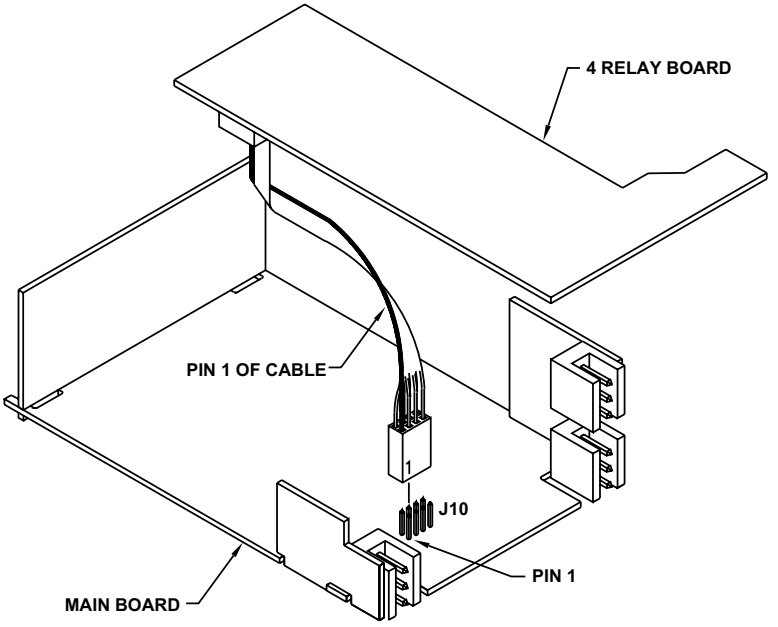
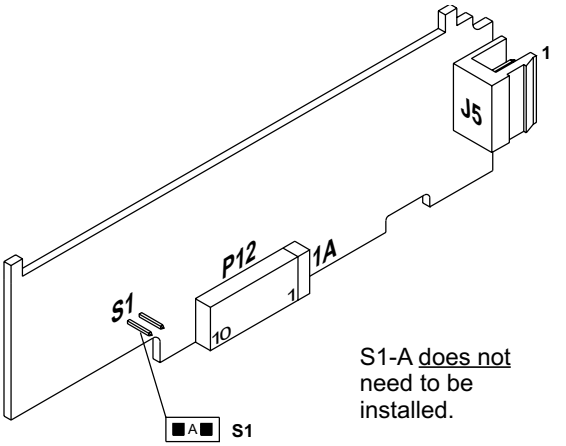


Figure 5-9. 4-Relay Option Board

Note

NOTE: Both the Dual Relay Output Board and the 4 Relay Output Board can be installed at J10. However, only one option board can be installed at a time.



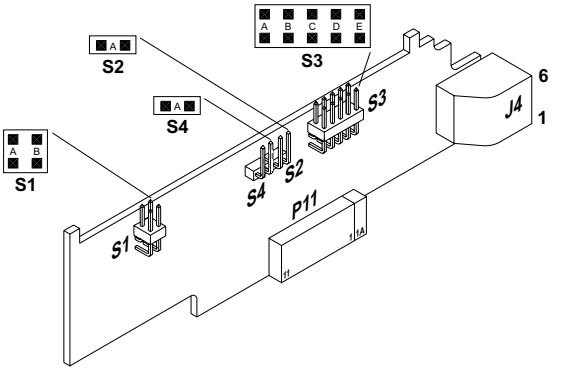
S1-A does not need to be installed.

The Analog option board has been updated. The figure shown is the latest version.

Some older versions of the analog output cards are not compatible with dc-powered meters.

Check the J12 connector on the main board to ensure it has a 10 position connector.

Figure 5-10. Analog Output Option Board

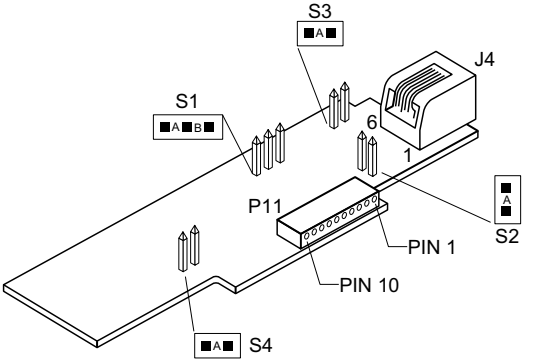


The RS-232 option board has been updated. The figure shown is the latest version.

Some older versions of the RS-232 cards are not compatible with dc-powered meters.

Check the J11 connector on the main board to ensure it has a 12 position connector.

Figure 5-11. RS-232 Option Board



The RS-485 option board has been updated. The figure shown is an older version, the newer version is the same figure as the RS-232 option card shown above.

Figure 5-12. RS-485 Option Board

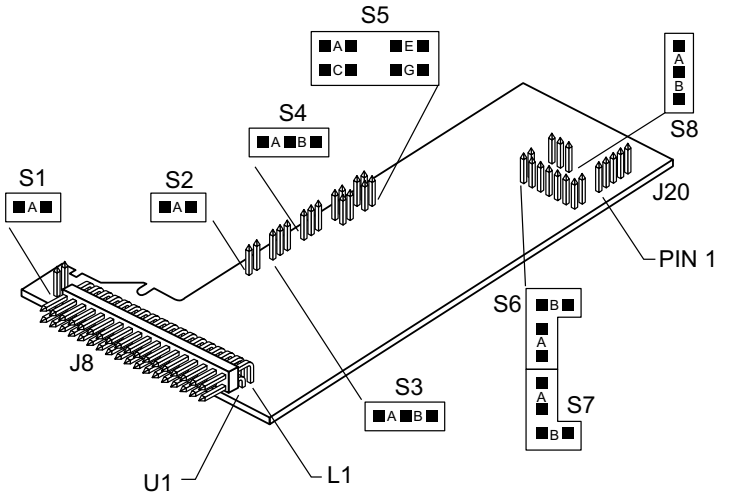


Figure 5-13. BCD Option Board

5.2.5 PANEL-MOUNT ASSEMBLY

The meter can be mounted in a panel so that the front of the meter is flush with the vertical panel surface. Panel mounting can be seen as simply "sandwiching" the panel between the inner case and the outer sleeve in the last phases of assembly. **Figure 5-14** shows the panel cutout dimensions, and the dimensions for the panel thickness. It requires that the following already be done:

1. Your line voltage rating has been checked against the meter rating on the Product ID and serial number label on the meter case. See Section 5.2.1.
2. You have configured all jumpers–those on the main board as well as those on any optional boards. See Section 5.2.2 for main board jumper configuration and the appropriate sections for optional board jumper configuration.
3. You have installed all optional boards and inserted the main board assembly back into the case. See Section 5.2.3.
4. You have wired P1, the AC power connector, and P2 the input output control connector; connectors are not installed in the meter, but are ready to be installed. See Section 7.
5. You have wired all connectors for optional boards; connectors are not connected to the meter, but are ready to be installed.

If all of these steps are done, use **Figure 5-14** as a guide:

CAUTION: Connectors with the wiring connections will be installed after mounting the unit.

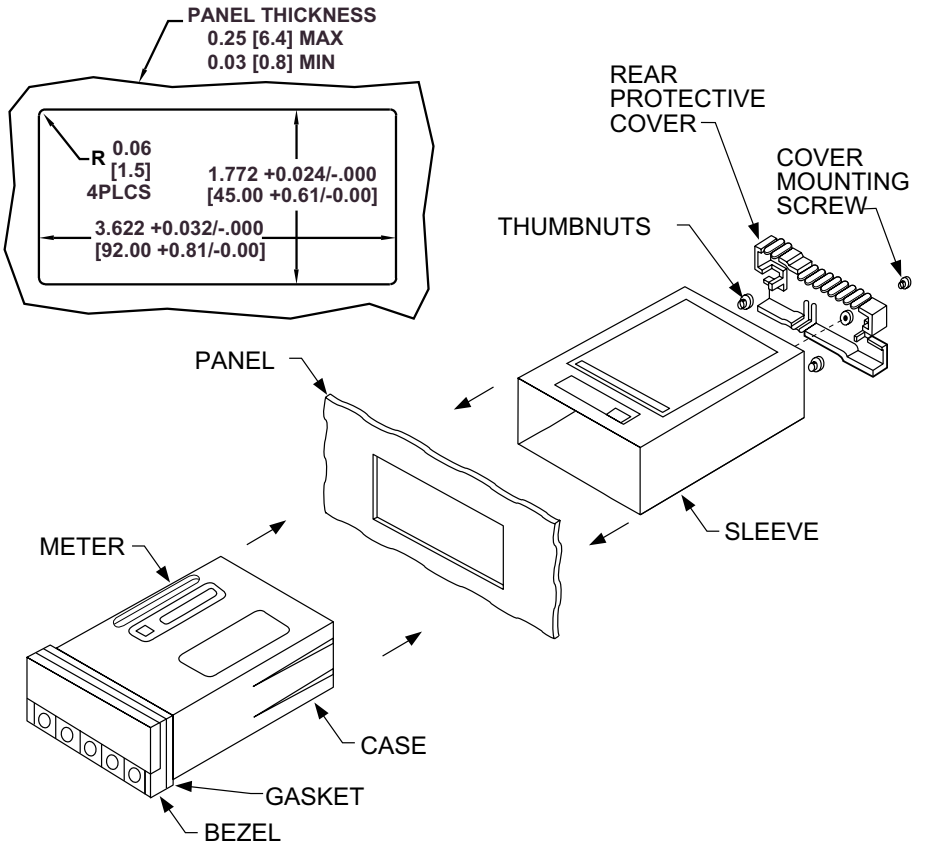


Figure 5-14. Panel Mounting Assembly

6. Punch or cut a hole in the panel using the panel cutout dimensions in **Figure 5-14**. Remove burrs and paint the panel as required.
7. Insert the panel-mount gasket around the rear of the case and slide it forward to the bezel (if it's not already in place).
8. Working from the front of the panel, insert the case assembly, rear end first, all the way into the panel cutout such that the gasket firmly backs the panel surface.
9. Working from the rear of the panel, slide the sleeve forward over the case and up to the panel surface.

The panel should now be sandwiched between the bezel-backed gasket in front and the sleeve in back.

10. Replace the thumbnuts that secure the sleeve tabs to the case.

WARNING: Do not “turn-on” the ac power and input signals until all connections are connected to the meter.

11. Set P1, the AC power connector, aside and connect or reconnect all other connectors to the back of the meter using Figures 4-3 and 4-4 in Section 4.2 as guides.

    Connect P1 last.

NOTE: The P1 connector is “keyed”; it is shaped in such a way that it fits only the J1 male pins.

12. Replace the rear protective cover and secure it with the cover mounting screw.

Your meter is now ready for operation and you can turn-on the power.

The meter display should light, and pass through “RESET 2” to run or display mode. If the meter flashes an overscale or overload message, press the **‘MENU’** button to advance to the configuration mode. Do not be concerned about overloads (the +S input can stand 120 V continuously and current inputs can handle ten times rated current).

6 Jumper Positions

6.1 INTRODUCTION

This section is for the configuration and setup of your jumper positions for readrate, unipolar or bipolar signal input, sensor input signal jumpers, sensor excitation jumpers, pushbutton lockouts and lockout of lockout configuration menus.

6.2 S1 JUMPER POSITIONS FOR READRATE AND UNIPOLAR OR BIPOLAR INPUT(S)

The typical readrate for your meter is 3/per second. This requires that no jumper has been installed in the S1A position and Input Configuration ("IN CNF") bit "INP.2" has been set to equal "0". Your meter is capable of a fast readrate of 13/per second. This requires that you install a jumper in the S1A position and the Input Configuration ("IN CNF") bit "INP.2" has been set to equal "1". Refer to Figure 6-1 for the location of the S1 jumpers.

The typical setting for your meter is unipolar. For unipolar input, no jumper is installed in the S1B position and Input Configuration ("IN CNF") bit "INP.3" must be set to equal "0". For bipolar inputs, install a jumper in S1B and set Input Configuration ("IN CNF") bit "INP.3" to equal "1".

6.3 S2 JUMPER POSITIONS FOR INPUT RANGES

The following are the input signal jumper positions required to be installed in the "S2" position on your meter for the CURRENT or VOLTAGE input ranges you require. These jumper positions include those that are required for sensor excitation. Jumpers S2-N & S2-T are for either 10 Vdc or 24 Vdc sensor excitation. To select desired excitation see Section 6.4. Refer to Figure 6-1 for the location of the S2 jumpers.

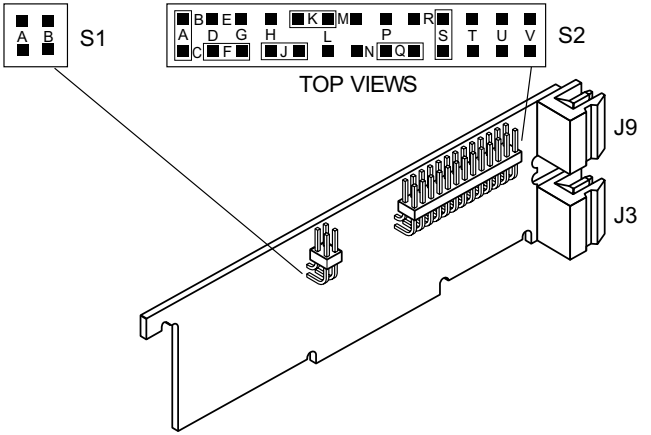
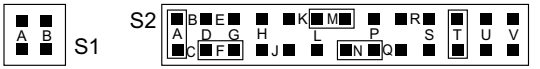


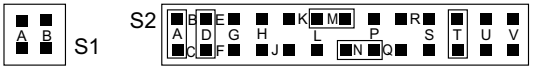
Figure 6-1. S1 and S2 Jumper Locations on Signal Input Board

VOLTAGE - UNIPOLAR

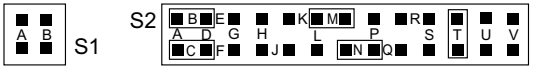
Jumpers for 0 to 100 mV range: (meter supplied excitation)



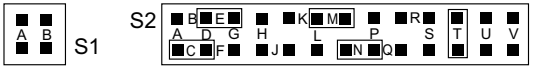
Jumpers for 0 to 1 V range: (meter supplied excitation)



Jumpers for 0 to 10 V range: (meter supplied excitation)

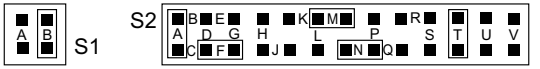


Jumpers for 0 to 100 V range: (meter supplied excitation)

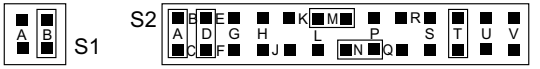


VOLTAGE - BIPOLAR

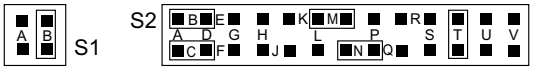
Jumpers for -50 to +50 mV range: (meter supplied excitation)



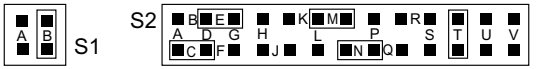
Jumpers for -500 to +500 mV range: (meter supplied excitation)



Jumpers for -5 to +5 V range: (meter supplied excitation)

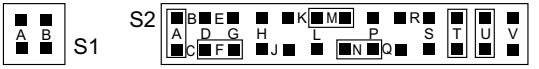


Jumpers for -50 to +50 V range: (meter supplied excitation)



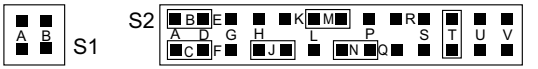
CURRENT

Jumpers for 0-20 mA or 4-20 mA: (Factory preset value) (meter supplied excitation)



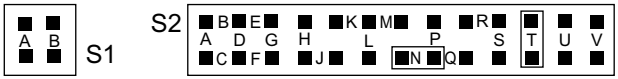
POTENTIOMETER

Jumpers for 0 to 10 V range: (using 10 Vdc drive)

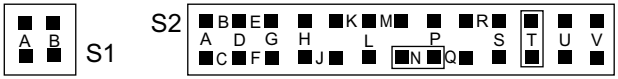


6.4 JUMPER SETTING(S) FOR SENSOR EXCITATION

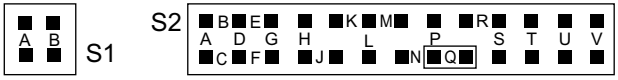
24 Vdc meter excitation (S2N, S2T, omit S4A)



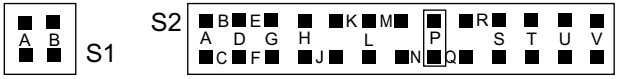
10 Vdc meter excitation (S2N, S2T, & S4A)



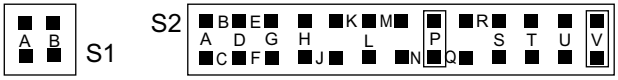
1.25 Vdc meter excitation (S2Q)



160 µA meter excitation (S2P)



1.6 mA meter excitation (S2P, S2V)



6.4.1 JUMPER SETTING(S) FOR SENSOR EXCITATION- ac Powered Unit

Your ac-powered meter is capable of supplying either 1.5 to 11Vdc or 24 Vdc sensor excitation. (refer to Figure 6-2.).

- For 1.5 to 11Vdc excitation, install S4A and C jumpers, then adjust the potentiometer (R39) for proper voltage.
- For 24Vdc excitation, remove S4A and C jumpers and install S4B.

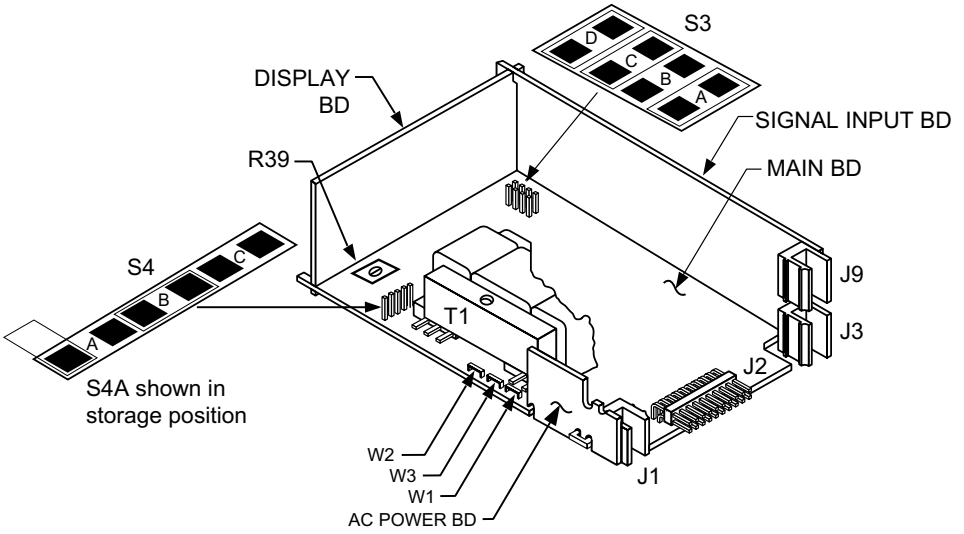


Figure 6-2. ac-Powered Main Board Jumper Positions S3 and S4

S4 On ac-powered units, main board		
S4B	Installed	For 24 Vdc excitation. (S4A located in storage position).
S4A ,S4C	Installed	For 10 Vdc excitation.
S3 On ac-powered units, main board		
S3A	Installed	Unlocks "**MENU**" button for programming.
S3B	Omit	See note below.
S3C	Installed	Unlocks lockout menu (L1 through L4).
S3D	Installed	Unlocks Front pushbuttons.

Note ☞

NOTE: S3B should **NOT** be installed. This jumper is only used when recalibrating the meter (e.g. an annual, careful performance by the calibration lab). When this jumper is installed, calibration coefficients can be changed via digital communications.

6.4.2 JUMPER SETTING(S) FOR SENSOR EXCITATION - dc Powered Unit

Your dc-powered meter is capable of supplying either 1.25 to 12Vdc or 24 Vdc sensor excitation. (refer to Figure 6-3).

- For 1.25 to 12Vdc excitation, install S1A and S4A jumpers, then adjust the potentiometer (R34) for proper voltage.
- For 24Vdc excitation, remove S4A jumpers and install S1B.

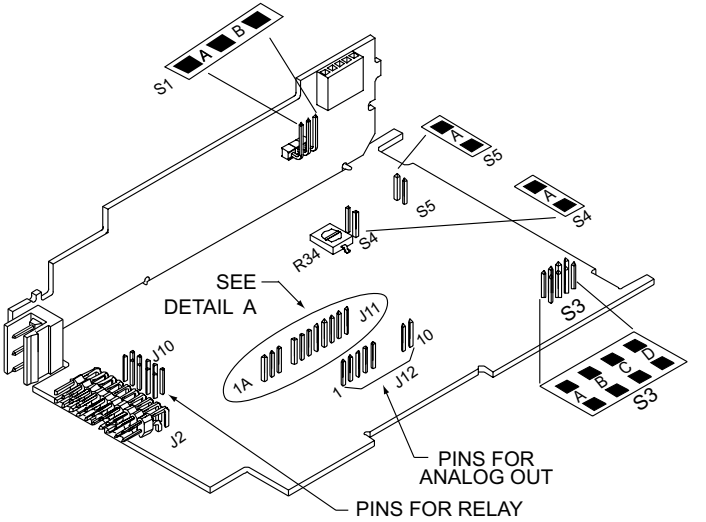


Figure 6-3. dc-Powered Main Board Jumper Positions S3 and S4

S1 On dc-powered unit, side power board		
S1A	Installed	For 1.25 to 12 Vdc excitation at 120 mA.
S1B	Installed	For 24 Vdc excitation at 35 mA.
S3, S4, S5 On dc-powered unit, main board		
S3A	Installed	To store data and setup parameters in nonvolatile memory.
S3B	Omit	See note in previous Section 6.4.1.
S3C	Installed	Unlocks lockout menu (L1 through L4).
S3D	Installed	Unlocks Front pushbuttons.
S4A	Installed	Along with the S1 jumper to program the excitation output. Adjust excitation with R34 surface mount pot from 1.25 to 12 volts, with an output current up to 120mA.
S4A	Removed	For 24 Vdc excitation. (S4A located in storage position).
S5A	Installed	To enable the RESET front panel pushbutton.
S5A	Removed	To secure against unauthorized meter reset.

7.1 INTRODUCTION

The following describes how to connect your sensors to your meter with and without sensor excitation and how to connect the AC power to your meter. Prior to wiring the sensor to the meter, check with a multimeter that a proper excitation exists.

WARNING: Do not connect ac power to your meter until you have completed all input and output connections. Failure to do so may result in injury! This device must only be installed electrically by specially trained electrician with corresponding qualifications.

7.2 SIGNAL INPUT CONNECTIONS

The following figures (7-1 through 7-5) show the connections for voltage, current and potentiometer inputs:

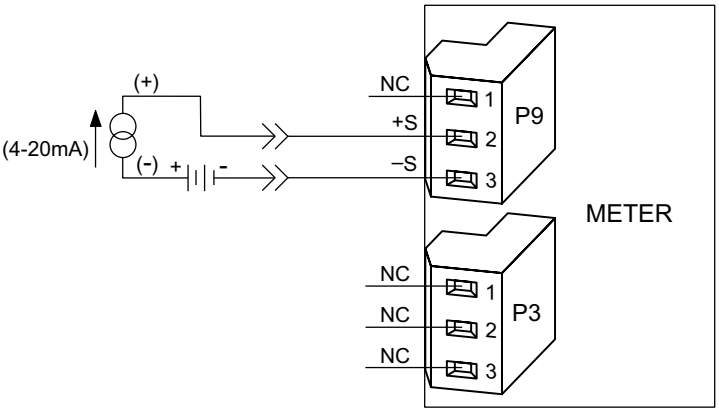


Figure 7-1. Current Input Without Sensor Excitation

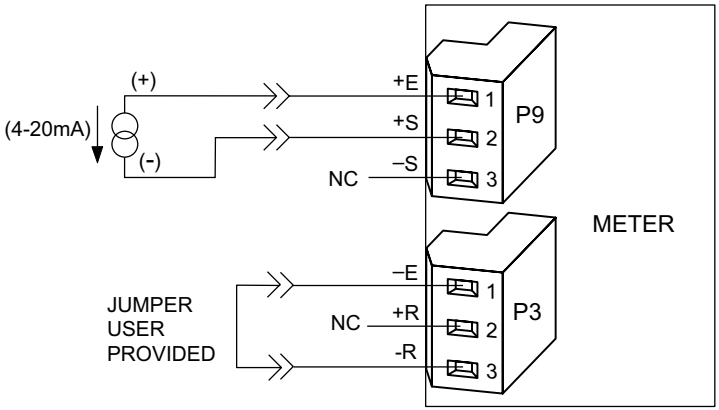


Figure 7-2. Current Input With Sensor Excitation

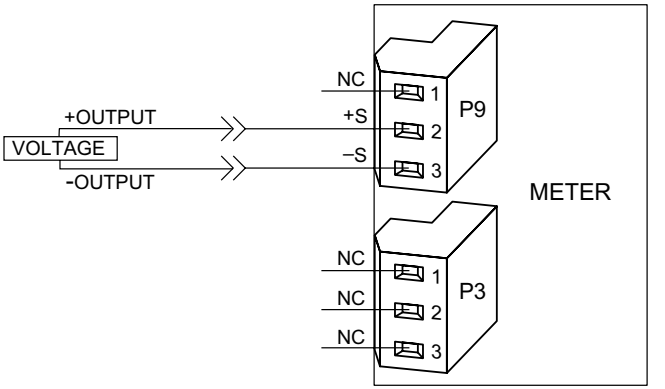


Figure 7-3. Voltage Input Without Sensor Excitation

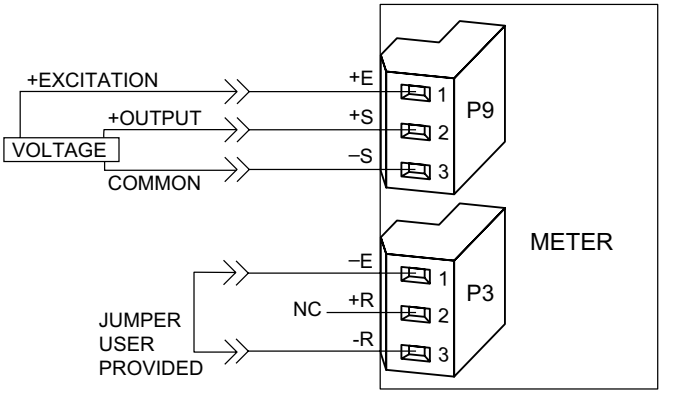


Figure 7-4. 3-Wire Voltage Input With Sensor Excitation

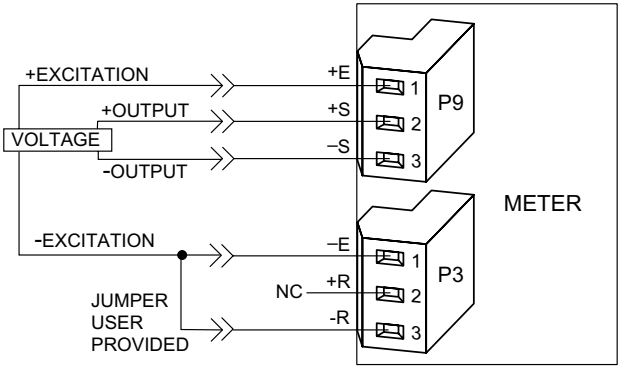


Figure 7-5 4-Wire Voltage Input With Sensor Excitation

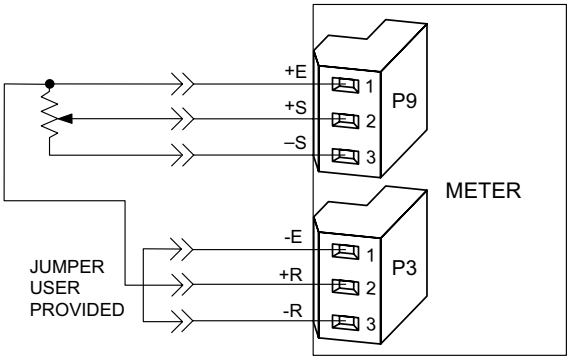


Figure 7-6. Potentiometer Connections with Internal Power Supply and Ratio Measurement.

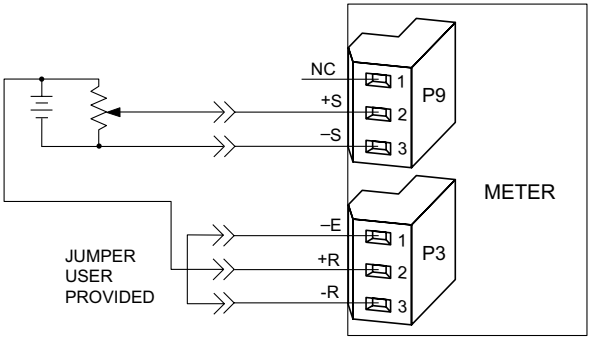


Figure 7-7 Potentiometer Connections With External Power Supply and Ratio Measurement (Remove jumper S2-T)

7.3 CONNECTING MAIN POWER

Wire your power (from a wall socket or other source) to P1, the orange, 3-socket connector that plugs into the 3 pins on the left side as you view the meter from the rear. The orange (power) connector must be wired according to the following table (also refer to Figure 7-8):

USA WIRING CODE	EUROPE WIRING CODE	CONNECTION	PIN # ON ORANGE CONNECTOR
Black	Brown	~ AC Line (L)	1
White	Blue	~ AC Neutral (N)	2
Green	Green/Yellow	~ AC Protective Earth Ground ⏚	3

7 Signal and Power Input Connections

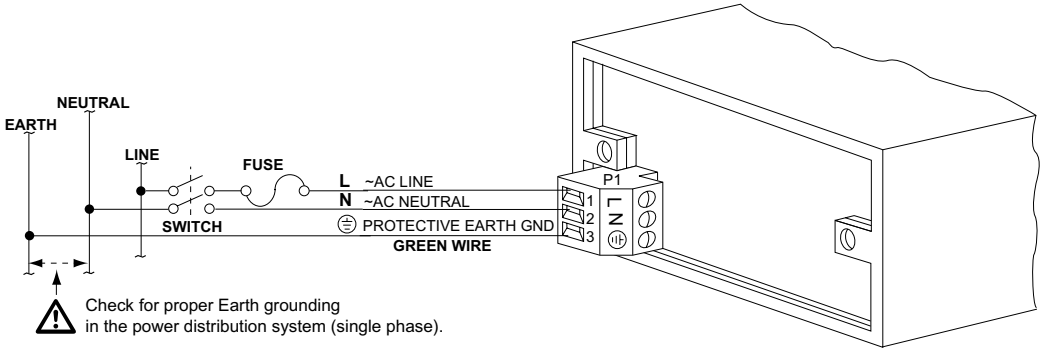


Figure 7-8. AC Connector Wiring at P1

Connect your AC meter power as described above and as shown in Figure 7-8:

CAUTION: As mentioned in Section 5.2.2, the meter has no power ON/OFF switch. The meter will be ON when power is applied.

WARNING: Do not connect ac power to your meter until you have completed all input and output connections. Failure to do so may result in injury! This device must only be installed electrically by specially trained electrician with corresponding qualifications. The main power input to the unit as well as the AC input signal to be measured must agree with the wiring instruction. The meter is factory set to the power specified by the customer at the time of ordering. The voltage is printed on the Product ID Label.

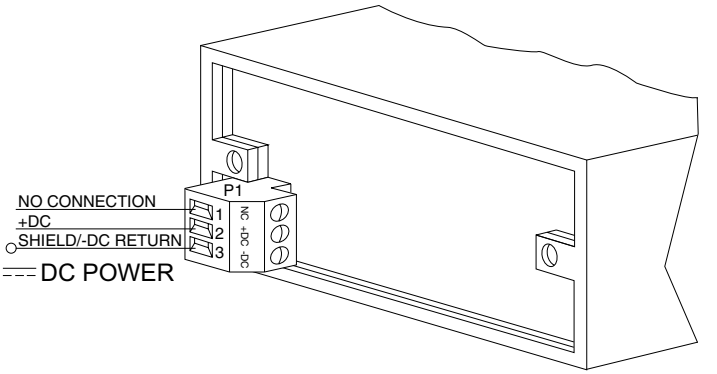


Figure 7-9. DC Connector Wiring at P1

You are now ready to proceed with scaling your meter to display in engineering units as described in Section 8.

METHOD FOR SCALING THE METER TO DISPLAY IN ENGINEERING UNITS

8.1 INTRODUCTION

There are two basic methods for scaling your meter to display engineering units; scaling by using measured input values or scaling without connecting a sensor using assumed input values. Both methods use the Input Scale and Offset (“IN.SC.OF”) method.

8.2 SETUP METER INPUT TYPE AND RANGE

If you have received your meter setup for your required input and do not require changes or rescaling, skip this section entirely and proceed with the normal use of your meter.

If you received your meter and you only require a scaling change, proceed with the steps in Section 8.3.

If you received your meter and it has been configured for input other than what you require, you must proceed with the following steps before rescaling the display:

WARNING: You must set your jumper positions at the S1 and S2 positions BEFORE proceeding. Refer to Section 6 for jumper positions.

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
'MENU'		"INPUT"	Press the **'MENU'** button until the display shows "INPUT".
'MIN'		"VOLT"	Press the **'MIN'** button and the display will show some type of input such as "VOLT".
'MAX'		"CURRNT" or "VOLT" or "POT"	Press the **'MAX'** button until the display shows a flashing input type that you want such as "CURRNT", "VOLT" or "POT".
'MENU'		"CURRNT"	Press the **'MENU'** button to store you selection. The display will momentarily show "STORED" only if a change has been made and then will display your selection such as "CURRNT".
For Current Inputs:			
'MAX'		"4-20 mA" or "0-20 mA"	Press the **'MAX'** button and the display shows a flashing input range of 4-20 mA, or "0-20 mA." Press the **'MAX'** button to select the 4-20 mA input range.
For Voltage Inputs:			
'MAX'		Unipolar "100 mV", "1 V", "10 V", "100 V" Bipolar "50 mV", "500 mV", "5 V", "50 V"	Press the **'MAX'** button and the display will show a flashing input voltage range
For Potentiometer Input: No input range is selected.			
'MENU'		"STORED" then "RDG.CNF"	Press the **'MENU'** button to store your selection. The display will momentarily show "STORED" only if a change has been made and then "RDG.CNF"

You are now ready to proceed with Input Scale and Offset ("IN.SC.OF")

8.3 SCALING YOUR METER USING 2-COORDINATE INPUT SCALE AND OFFSET (IN.SC.OF) WITH SENSOR CONNECTED TO YOUR METER

The most accurate method for scaling your meter to display engineering units is by connecting your sensor to your meter, apply two known loads, record them as INPUT1 and INPUT2 respectively and use these numbers for entry into 2-coordinate Input Scale and Offset (“IN.SC.OF”).

The typical factory calibration and configuration is for the meter to accept a 4-20 mA dc and scaled to display 0 to 020000.

An example would be a 2-wire transmitter that sends a signal of 4-20 mAdc. With a signal input of 4 mA the display will show “000000” and with a signal input of 20 mA this display will show “02000”. However, the output signal from your transmitter may be something like 3.98 mA and 19.99 mA. Using Input Scale and Offset (“IN.SC.OF”) you can configure your meter to accurately display your required engineering units.

Note ☞

NOTE: Although the full span input of your sensor signal is preferred for maximum resolution, you may record any two points within the signal span for scaling accurately into engineering units.

The following will walk you step by step in configuring your meter for scaling your meter using the Input Scale and Offset (“IN.SC.OF”) procedure.

8.3.1 SETTING INPUT CONFIGURATION (“IN CNF”)

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
‘MENU’		“IN CNF”	Press the **‘MENU’** button until the display shows “IN CNF”.
‘MIN’		“INP.3=0”	Press the **‘MIN’** button until the display shows “INP.3=0” or “INP.3=1”.
‘MAX’		“INP.3=0”	Press the **‘MAX’** button to select “INP.3=0”- Unipolar input for current, voltage and potentiometer inputs.
or			
‘MAX’		“INP.3=1”	Press the **‘MAX’** button to select “INP.3=1”- Bipolar input for voltage or potentiometer inputs.
‘MIN’		“INP.6=0” or “INP.6=1”	Press the **‘MIN’** button until the display “INP.6=0” or “INP.6=1”.
‘MAX’		“INP.6=1”	Press the **‘MAX’** button until the display shows “INP.6=1” to enable Input Scale and Offset (“IN.SC.OF”).
‘MENU’		“IN.SC.OF”	Press the **‘MENU’** button to store your selection and the display will momentarily show “STORED” then “IN.SC.OF”.

If you need to re-scale your meter, you must proceed with the following steps:

8.3.2 SCALING YOUR METER WITH YOUR SENSOR CONNECTED

Before proceeding, you must first apply a low input ("INPUT1") and a high input ("INPUT 2") into your meter and record the exact display shown. As explained in Section 8.3, the display you will be recording will be 0 and 100000 if your meter has not been changed from the typical factory setup and calibration. The following is an example using the numbers below as the recorded input displayed on the meter. You should use the numbers you have recorded:

Low input:	4 milliamps
Meter display ("INPUT 1"):	000000.
High input:	20 milliamps
Meter display ("INPUT 2"):	020000.

Note ☞

Note: If you are using an input signal that is reverse acting (e.g. 20-4 mA), then the 20 mA reading would be "INPUT1" and the 4 mA reading would be "INPUT 2".

In addition to recording your display readings for your two inputs, you must also decide what you want these inputs to display on your meter.

In order to simplify this (especially if you want to display numbers to the right of the decimal point position), you should think of your meter as a process indicator and your decimal point as being passive or cosmetic.

As an example, if you wanted your display to read 0.000 to 68.000, you would record and enter your "READ 1" number as 000000. and your "READ 2" number as 068000. Then after storing these numbers, you would then place your decimal point position (refer to Section 8.3.4) so that your display would show 0.000 to 68.000.

Record your "INPUT1" and "READ 1" numbers, and your "INPUT2" and "READ 2" numbers, record them below and proceed as follows:

INPUT1 = _____ 000003.

READ 1 = _____ 000000.

INPUT2 = _____ 020018.

READ 2 = _____ 068000.

For the purpose of this example, we will use the numbers described above for the following procedure:

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
'MENU'		"IN.SC.OF"	Press the **'MENU'** button until the display shows "IN.SC.OF" Input Scale and Offset.
'MIN'		"INPUT1"	Press the **'MIN'** button and the display will show "INPUT1".
'MIN'		"XXXXXX"	Press the **'MIN'** button and the display will show some 6 digit number.
'MAX'	**'MIN'**	"000003."	Using the **'MAX'** button to change the value of the flashing digit and the **'MIN'** button to scroll to the next digit to the right, enter your "INPUT1" number on the display.
'MENU'		"READ 1"	Press the **'MENU'** button and the display will show "READ 1".
'MIN'		"XXXXXX"	Press the **'MIN'** button and the display will show some 6-digit number.
'MAX'	**'MIN'**	"000000."	Using the **'MAX'** button to change the value of the flashing digit and the **'MIN'** button to scroll to the next digit to the light, enter the engineering value that you want your "INPUT1" number to display on the meter.
'MENU'		"INPUT2"	Press the **'MENU'** button and the display will show "INPUT2".
'MIN'		"XXXXXX"	Press the **'MIN'** button and the display will show some 6-digit number,
'MAX'	**'MIN'**	"100018."	Using the **'MAX'** button to change the value of the flashing digit and the **'MIN'** button to scroll to the next digit to the right, enter your "INPUT 2" number on the display.

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
'MENU'		"READ 2"	Press the **'MENU'** button and the display will show "READ 2".
'MIN'		"XXXXXX"	Press the **'MIN'** button and the display will show some 6-digit number.
'MAX'	**'MIN'**	"068000."	Using the **'MAX'** button to change the value of the flashing digit and the **'MIN'** button to scroll to the next digit to the right, enter the engineering value you want your "INPUT 2" to display.
'MENU'		"STORED"	Press the **'MENU'** button to store your selection and the display will momentarily show "STORED" then "DEC PT".

Now you are ready to position your decimal point position by completing the following steps:

8.3.3 TO SELECT DECIMAL POINT POSITION (DEC PT)

The following is the procedure for selecting your decimal point position.

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
'MENU'		"DEC PT"	Press the **'MENU'** button until the display shows "DEC PT".
'MIN'	**'MAX'**	"FFF.FFF"	Press the **'MIN'** button and the display will show "FFFFFF." or the previously selected position. Press the **'MAX'** button to select the decimal point position you require, the meter displays the previously selected decimal point location within the "F's"
'MENU'		"CNT BY"	Press the **'MENU'** button to store your decimal point selection and the meter will momentarily display "STORED" only if you have made a change, and then "CNT BY".
'RESET'	**'RESET'**	"RESET2" then the Measured Value	Press the **'RESET'** button two times. The display will momentarily show "RESET2" and then will display the currently measured values,

Your meter is now calibrated. If you need to offset your zero reading on your meter after calibration, you must proceed with the following steps:

8.3.4 ENTERING ZERO OFFSET NUMBERS

The RDG OF (Reading Offset) menu item should be used if the meter shows a nonzero reading with zero input. The offset value zeroes the display by canceling out the nonzero reading.

If your meter displays a positive reading at zero input, you must enter a negative offset value. If your meter displays a negative reading at zero input, you must enter a positive offset value.

If you are using an active decimal point (RDG.2=0), your offset value will be the negative of the display reading at zero point.

If you are using the more common independent decimal point (the factory setting, RDG.2=1), follow these instructions display reading to the appropriate offset value:

1. Note the display reading at zero input, ignoring the decimal point. This reading represents the count value - the number of whole counts that need to be offset,

2. Shift the count value to the left side of the decimal point.

3. If the count value is positive, make it negative by replacing the leading digit (the left-most digit) with a minus sign. If the count value is negative, make it positive by replacing the negative sign with a zero.

Example 1: Your meter displays 000.003 when the input is zero. The count value is 000003. Shift this value to the left side of the decimal point: 003.000. Change the leading zero to a minus sign: -03.000. This is the “converted offset value” you will use for configuring RDG OF.

Example 2: Your meter displays -00.003 when the input is zero. The count value is -00003. Shift this value to the left side of the decimal point: -03.000. Change the leading minus sign to a zero: 003.000. This is the “converted offset value” you will use for configuring RDG OF.

If the nonzero reading is fluctuating between two numbers, convert the smaller count value to the offset value, then add a 5 just right of the decimal point. This adds half a count to the offset. For example, the display is fluctuating between 00.0001 and 00.0002. Calculate the offset using the 000001 count value. The converted offset value is -1.0000. Add a 5 to the right of the decimal point: -the final offset value is -1.5000.

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
'MENU'		"RDG OF"	Press the **'MENU'** button until the display shows "RDG OF".
'MIN'		"000000."	Press the **'MIN'** button and the display will show the last offset entered.
'MIN'	**'MAX'**	"XXXXXX"	Use the **'MIN'** to move to each digit and the **'MAX'** button to change the flashing digits value and enter your zero offset number.
'MENU'		"STORED" then "IN CNF"	Press the **'MENU'** button to store your selection. The display will momentarily show "STORED" then "IN CNF".
'RESET'	**'RESET'**	"RESET2" the then Measured Value	Press the **'RESET'** button two times. The display will momentarily show "RESET2" and you will display the currently measured values.

Note ☞

NOTE: If after zeroing the display with RDG OF, the reading again drifts from zero, the required offset value is the sum of the current RDG OF value and the current converted offset value. The examples below illustrate the calculation of required offset values when using an independent decimal. If you are using an active decimal point, the current converted offset value is simply the negative value of the display reading.

Example 1: You use a RDG OF value of -1.0000 to zero the meter. The next morning, the meter displays 00.0008 at zero input; you need to rezero. The current count value is 000008; shifting this value to the left of the decimal makes it 08.0000, and making the value negative makes it -8.0000. The required RDG OF value is the sum of the current RDG OF value (-1.0000) and the current converted offset value (-8.0000):

-1.0000 + -8.0000 = -9.0000

Example: You use a RDG OF value of -1.0000 to zero the meter. The next morning, the meter displays -0.0008 at zero input; you need to rezero. The current count value is -00008; shifting this value to the left of the decimal makes it -8.0000, and making the value positive makes it 08.0000. The required RDG OF value is sum of the current RDG OF value (-1.0000) and the current converted offset value (08.0000):

-1.0000 + 08.0000 = 07.0000

If you require further configuration(s) for your specific application, refer to sections 9 through 21.

Note ☞

NOTE: Should you receive an error code of any kind while configuring your meter, refer to Section 17 - Troubleshooting - Display Messages and Troubleshooting Guide.

8.4 SCALING YOUR METER WITHOUT CONNECTING A SENSOR USING CALCULATED VALUES

Your meter can be scaled without connecting a sensor and taking measured values rising Input Scale and Offset (“IN.SC.OF”).

The typical configuration and scaling of your meter is 4-20 mAdc input with a display equal to 0 to 100000. If your meter has not been rescaled and your input is 4-20 mAdc, you can use the factory scaling “0” as your “INPUT1” and “100000” as your “INPUT2” and proceed with the step by step procedure in Section 8.4.1.

If you need to change your input signal, you must rescale your meter as described in the following steps:

8.4.1 PREPARING YOUR METER FOR SCALING WITH INPUT SCALE AND OFFSET

If you are changing your input signal you must follow the instruction for installing the correct jumper positions as described in Section 6 and the sensor connections as described in Section 7.

WARNING: Do not connect your AC meter power until all input jumpers and sensor input connections are completed. Failure to do so could result in damage to your sensor and/or the meter.

The following procedure will direct you step by step in preparing your meter for rescaling using Input Scale and Offset (“IN.SC.OF”)

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
'MENU'		"IN.SC.OF"	Press the **'MENU'** button until the display shows "IN.SC.OF" Input Scale and Offset.
'MIN'		"INPUT1"	Press the **'MIN'** button and the display will show "INPUT1".
'MIN'		"XXXXXX"	Press the **'MIN'** button and the display will show some 6 digit number.
'MAX'	**'MIN'**	"000000."	Using the **'MAX'** button to change the value of the flashing digit and the **'MIN'** button to scroll to the next digit to the right, enter "000000." on the display.
'MENU'		"READ 1"	Press the **'MENU'** button and the display will show "READ 1".
'MIN'		"XXXXXX"	Press the **'MIN'** button and the display will show some 6-digit number.
'MAX'	**'MIN'**	"000000."	Using the **'MAX'** button to change the value of the flashing digit and the **'MIN'** button to scroll to the next digit to the right, enter "000000" on the meter.
'MENU'		"INPUT2"	Press the **'MENU'** button and the display will show "INPUT2".
'MIN'		"XXXXXX"	Press the **'MIN'** button and the display will show some 6-digit number.

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
'MAX'	**'MIN'**	"020000."	Using the **'MAX'** button to change the value of the flashing digit and the **'MIN'** button to scroll to the next digit to the right, enter "020000." on the display.
'MENU'		"READ 2"	Press the **'MENU'** button and the display will show "READ 2".
'MIN'		"XXXXXX"	Press the **'MIN'** button and the display will show some 6-digit number.
'MAX'	**'MIN'**	"100000."	Using the **'MAX'** button to change the value of the flashing digit and the **'MIN'** button to scroll to the next digit to the right, enter "100000." on the display.
'MENU'		"STORED"	Press the **'MENU'** button to store your selection and the display will momentarily show "STORED" then "DEC PT".

Proceed with the following steps for positioning your decimal point position:

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
'MENU'		"DEC PT"	Press the **'MENU'** button until the display shows "DEC PT".
'MIN'	**'MAX'**	"FFF.FFF"	Press the **'MIN'** button and the display will show "FFFFFF." or the previously selected position. Press the **'MAX'** button to select the decimal point position you require, the meter displays the previously selected decimal Point location within the "F's".
'MENU'		"CNT BY"	Press the **'MENU'** button to store your decimal point selection and the meter will momentarily display "STORED" only if you have made a change and then "CNT BY".

You are now ready to scale your meter rising Input Scale and Offset ("IN.SC.OF") without connecting a sensor or signal source to your meter.

8.4.2 SCALING YOUR METER

Scaling your Meter without a sensor or a signal source connected is easily accomplished by using one of the calculated scale factors as shown in Figure 8-1.

These calculated scale factors are the numbers that your meter would display if you connected a signal source.

You must complete the procedure for preparing your meter for scaling as described in Section 8.4.1. Failure to complete this procedure will result in erroneous readings.

INPUT SIGNAL	LOW VALUE	HIGH VALUE
0-20 mA	000000	020000
4-20 mA	000000	020000
± 50 mV	-50000	050000
± 500 mV	-50000	050000
0-20 mV	000000	020000
0-30 mV	000000	030000
0-50 mV	000000	050000
0-100 mV	000000	100000
0-1 V	000000	100000
0-5 V	000000	050000
1-5 V	010000	050000
1-6 V	010000	060000
0-10 V	000000	100000
0-50 V	000000	050000
0-100 V	000000	100000
+/-5 V	-50000	050000
+/-50 V	-50000	050000

Figure 8-1 . Factory Calculated Scale Factors

For the purpose of this procedure, we will use an input of 1-5 Vdc and scale the meter to display 0 to 2500.0.

The calculated scale factors can now be used to scale your meter to display in engineering units using Input Scale and Offset (“IN.SC.OF”) as follows:

Record your “INPUT1” and “READ 1” numbers, and your “INPUT2” and “READ 2” numbers, record them below and proceed as follows:

	Example
INPUT1 = _____	010000.
READ 1 = _____	000000.
INPUT2 = _____	050000.
READ 2 = _____	025000.

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
'MENU'		"IN.SC.OF"	Press the **'MENU'** button until the display shows "IN.SC.OF" Input Scale and Offset.
'MIN'		"INPUT1"	Press the **'MIN'** button and the display will show "INPUT1",
'MIN'		"XXXXXX"	Press the **'MIN'** button and the display will show some 6-digit number.
'MAX'	**'MIN'**	"010000."	Using the **'MAX'** button to change the value of the flashing digit and the **'MIN'** button to scroll to the next digit to the right, enter your "INPUT1" number on the display.
'MENU'		"READ 1"	Press the **'MENU'** button on the display will show 'READ 1".
'MIN'		"XXXXXX"	Press the **'MIN'** button and the display will show some 6-digit number.
'MAX'	**'MIN'**	"000000."	Using the **'MAX'** button to change the value of the flashing digit and the **'MIN'** button to scroll to the next digit to the right, enter the engineering value that you want your "INPUT1" number to display on the meter.
'MENU'		"INPUT2"	Press the **'MENU'** button and the display will show "INPUT2".
'MIN'		"XXXXXX"	Press the **'MIN'** button and the display will show some 6-digit number.
'MAX'	**'MIN'**	"050000."	Using the **'MAX'** button to change the value of the flashing digit and the **'MIN'** button to scroll to the next digit to the right, enter your "INPUT 2" number on the display.

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
'MENU'		"READ 2"	Press the **'MENU'** button and the display will show 'READ 2".
'MIN'		"XXXXXX"	Press the **'MIN'** button and the display will show some 6-digit number.
'MAX'	**'MIN'**	"025000."	Using the **'MAX'** button to change the value of the flashing digit and the **'MIN'** button to scroll to the next digit to the right, enter the engineering value, you want your "INPUT 2" to display.
'MENU'		"STORED"	Press the **'MENU'** button to store your selection and the display will momentarily show "STORED" then "DEC PT".

Now you are ready to position your decimal point position by completing the following steps:

8.4.3 TO SELECT DECIMAL POINT POSITION

The following is the procedure for selecting your decimal point position.

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
'MENU'		"DEC PT"	Press the **'MENU'** button until the display shows "DEC PT".
'MIN'	**'MAX'**	"FFFFF.F"	Press the **'MIN'** button and the display will show "FFFFFF." or the previously selected position, Press the **'MAX'** Button to select the decimal point position you require, the meter displays the previously selected decimal point location within the "F's".
'MENU'		"CNT BY"	Press the **'MENU'** button to store your decimal point selection and the meter will momentarily display "STORED" only if you have made a change and then "CNT BY".
'RESET'	**'RESET'**	"RESET2" then the Measured Value	Press the **'RESET'** button two times. The display will momentarily show "RESET2" then will display the currently measured values.

Your meter is now calibrated. If you need to offset your zero reading on your meter after calibration, you must proceed with the following steps:

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
'MENU'		"RDG OF"	Press the **'MENU'** button until the display shows "RDG OF".
'MIN'		"000000."	Press the **'MIN'** button and the display will show the last offset entered.

If your meter displays an offset, which is a positive number, you must enter a negative "-" offset number into Reading Offset ("RDG OF"). An example would be if your zero input shows "20" on your meter display, you would enter "-00020" in Reading Offset ("RDG OF") and if your zero input shows a negative "-20" you would enter a positive 000020 in Reading Offset ("RDG OF").

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
'MIN'	**'MAX'**	"XXXXXX"	Use the **'MIN'** button to move to each digit and the **'MAX'** button to change the flashing digits value and enter your zero offset number.
'MENU'		"STORED" then "IN CNF"	Press the **'MENU'** button to store your selection. The display will momentarily show "STORED" then "IN CNF".
'RESET'	**'RESET'**	"RESET2" then the Measured Value	Press the **'RESET'** button two times. The display will momentarily show "RESET2" and then will display the currently measured values.

8.4.4 ENTERING ZERO OFFSET NUMBERS

The RDG OF (Reading Offset) menu item should be used if the meter shows a nonzero reading with zero input. The offset value zeroes the display by canceling out the nonzero reading.

If your meter displays a positive reading at zero input, you must enter a negative offset value. If your meter displays a negative reading at zero input, you must enter a positive offset value.

If you are using an active decimal point (RDG.2=0), your offset value will be the negative of the display reading at zero point.

If you are using the more common independent decimal point (the -factory setting, RDG.2=1), follow these instructions to convert the display reading to the appropriate offset value:

1. Note the display reading at zero input, ignoring the decimal point. This reading represents the count value - the number of whole counts that need to be Offset.
2. Shift the count value to the left side of the decimal point.
3. If the count value is positive, make it negative by replacing the leading digit (the left-most digit) with a minus sign. If the count value is negative, make it positive by replacing the negative sign with a zero.

Example 1: Your meter displays, 000.003 when the input is zero. The count value is 000003. Shift this value to the left side of the decimal point: 003.000. Change the leading zero to a minus sign: -03.000. This is the “converted offset value” you will use for configuring RDG OF.

Example 2: Your meter displays -00.003 when the input is zero. The count value is -00003. Shift this value to the left side of the decimal point: -03.000. Change the leading minus sign to a zero: 003.000. This is the “converted offset value” you will use for configuring RDG OF.

If the nonzero reading is fluctuating between two numbers, convert the smaller count value to the offset value, then add a 5 just right of the decimal point. This adds half a count to the offset. For example, the display is fluctuating between 00.0001 and 00.0002.

Calculate the offset using the 000001 count value. The converted offset value is -1.0000. Add a 5 to the right of the decimal point: the final offset value is -1.5000.

PRESS	THEN PRESS (TO CHANGE IF REQUIRED)	UNTIL DISPLAY SHOWS	COMMENTS
'MENU'		"RDG OF"	Press the **'MENU'** button until the display shows "RDG OF".
'MIN'		"000000."	Press the **'MIN'** button and the display will show the last offset entered.
'MIN'	**'MAX'**	"XXXXXX"	Use the **'MIN'** to move to each digit and the **'MAX'** button to change the flashing digits value and enter your zero offset number.
'MENU'		"STORED" then "IN CNF"	Press the **'MENU'** button to store your selection. The display will momentarily show "STORED" then "IN CNF".
'RESET'	**'RESET'**	"RESET2" then the Measured Value	Press the **'RESET'** button two times. The display will momentarily show "RESET2" and then will display the currently measured values.

Note ☞

NOTE: If after zeroing the display with RDG OF, the reading again drifts from zero, the required offset value is the **sum** of the current RDG OF value and the current converted offset value. The examples below illustrate the calculation of required offset values when using an independent decimal. If you are using an active decimal point, the current converted offset value is simply the negative value of the display reading.

Example 1: You use a RDG OF value of -1.0000 to zero the meter. The next morning, the meter displays 00.0008 at zero input; you need to rezero. The current count value is 000008; shifting this value to the left of the decimal makes it 08.0000, and making the value negative makes it -8.0000. The required RDG OF value is the **sum** of the current RDG OF value (-1.0000) and the current converted offset value (-8.0000):

-1.0000 + -8,0000 = -9,0000

Example 2: You use a RDG OF value of -1.0000 to zero the meter. The next morning, the meter displays -0.0008 at zero input; you need to rezero. The current count value is -00008; shifting this value to the left of the decimal makes it -8.0000, and making the value positive makes it 08.0000. The required RDG OF value is **sum** of the current RDG OF value (-1.0000) and the current converted offset value (08.0000):

-1.0000 + 08.0000 = 07.0000

If you require further configuration(s) for your specific application, refer to Sections 9 through 21.

Note ☞

NOTE: Should you receive an error code of any kind while configuring your meter, refer to Section 17 - Troubleshooting - Display Messages and Troubleshooting Guide.

EXPLANATION OF LOCKOUT CONFIGURATIONS AND METER FUNCTION MENUS

HOW TO USE THE TABLES IN SECTION 9	
MIN/MAX/MENU	These are the buttons on the meter you are to press to access the parameters given in the same column.
MAIN MENU/ SUBMENU:	These are headings for the table columns.
DISPLAYED INFORMATION:	These are parameters seen on the display after pressing either **'MIN'**, **'MAX'**, or **'MENU'** button(s).

Note ☞

NOTE: If you press the **'RESET'** button two times while the meter is in the run mode, all Setpoints, Alarms, Peak & Valley will be reset and the meter will begin new measurements.

If you press the **'RESET'** button one time while in the configuration mode, you will move one MAIN MENU backwards and any selection will not be saved. If you press the **'RESET'** button two times while in the configuration mode, you will reset the meter and only those menu items saved by pressing the **'MENU'** button will be saved.

9.1 Individual Lockout Information

To restrict access to different parameters of the program in the meter, you may want to lockout parts of the meter. When you lock out a parameter, it will no longer appear when you scroll through the menu. To lock out specific parameters of the meter (setpoint, scaling), refer to the following tables.

Once set (to unlock useful features for a given application and to lock out any features), these four "L1C", "L2C", "L3C", and "L4C" can be rapidly skipped over by pressing the **'MENU'** button four times.

MENU BUTTON MAIN MENU	MIN/MAX* BUTTON SUB MENU	CONDITION
"L1 CNF":		LOCKOUT CONFIGURATION #1
	"L1C.1=0"	Setpoint 1 change unlocked.
	"L1C.1=1"	Setpoint 1 change locked out.
	"L1C.2=0"	Setpoint 2 change unlocked.
	"L1C.2=1"	Setpoint 2 change locked out.
	"L1C.3=0"	Setpoint 3 (Alarm 1) change unlocked.
	"L1C.3=1"	Setpoint 3 (Alarm 1) change locked out.
	"L1C.4=0"	Setpoint #4 (Alarm 2) change unlocked.
	"L1C.4=1"	Setpoint #4 (Alarm 2) change locked out.
	"L1C.5=0"	Valley-value (LO RDG) display is permitted.
	"L1C.5=1"	Displays microprocessor revision.
	"L1C.6=0"	Peak-value (HI RDG) display is permitted.
	"L1C.6=1"	Peak-value (HI RDG) display is not permitted.
	"L1C.7=0"	INPUT CLASS (CURRENT VOLTAGE or POT) can be selected.
	"L1C.7=1"	INPUT CLASS is locked out.
	"L1C.8=0"	INPUT TYPE (such as 0-20 mA, 4-20 mA, 0-100 mV, 0-10 Vdc, etc.) can be selected.
	"L1C.8=1"	INPUT TYPE is locked out.

*The **'MIN'** button allows you to sequence through L1C.1, L1C.2, L1C.3, L1C.4, L1C.5, L1C.6, L1C.7 and L1C.8.

The **'MAX'** button allows you to select the "0" or "1" state for each "L1C" condition.

The **'MENU'** button stores the selected values for all "L1C" condition(s) changed and advances the meter to "L2 CNF". Do not press the **'MENU'** button after each change within the submenu or the meter will advance to the next menu item.

Every underlined "0" or "1" state is the factory preset value.

MENU BUTTON MAIN MENU	MIN/MAX* BUTTON SUB MENU	CONDITION
"L2 CNF":		LOCKOUT CONFIGURATION #2
	"L2C.1=0"	RDG.CNF (scale/offset method and display features) may be chosen.
	"L2C.1=1"	RDG.CNF (scale/offset method and display features) is locked out.
	"L2C.2=0"	Either RDG SC (computed input-to-display scale factor) or RD.SC.OF (two data points, which determine the reading scale/offset) may be entered.
	"L2C.2=1"	Either RDG SC (computed input-to-display scale factor) or RD.SC.OF (two data points, which determine the reading scale/offset) is locked out.
	"L2C.3=0"	RDG OF (offset computed in display digits) may be entered.
	"L2C.3=1"	RDG OF (offset computed in display digits) is locked out.
	"L2C.4=0"	INP.CNF (meter rates, front-end features, prelinearizing scale/offset) may be chosen.
	"L2C.4=1"	INP.CNF (meter rates, front-end features, prelinearizing scale/offset) may not be locked out.
	"L2C.5=0"	IN.SC.OF (two data points for additional scale/offset) may be entered.
	"L2C.5=1"	IN.SC.OF (two data points for additional scale/offset) may not be entered.
	"L2C.6=0"	DEC PT (decimal-point location) may be chosen
	"L2C.6=1"	DEC PT (decimal-point location) may not be chosen.

continued next page

MENU BUTTON MAIN MENU	MIN/MAX* BUTTON SUB MENU	CONDITION
"L2 CNF"		
	"L2C.7=0"	CNT BY (round off of display) can be specified.
	"L2C.7=1"	CNT BY (round off of display) cannot be specified.
	"L2C.8=0"	FIL CNF (adaptive/fixed filtering and for which output(s)) can be chosen.
	"L2C.8=1"	FIL CNF (adaptive/fixed filtering and for which output(s)) cannot be chosen.

* The **'MIN'** button allows you to sequence through L2C.1, L2C.2, L2C.3, L2C.4, L2C.5, L2C.6, L2C.7, and L2C.8.

The **'MAX'** button allows you to select the "0" or "1" state for each "L2C" condition.

The **'MENU'** button stores the selected values for all "L2C" condition(s) changed and advances the meter to "L3 CNF". Do not press the **'MENU'** button after each change within the submenu or the meter will advance to the next menu item.

Every underlined "0" or "1" state is the factory preset value.

MENU BUTTON MAIN MENU	MIN/MAX* BUTTON SUB MENU	CONDITION
"L3 CNF":		LOCKOUT CONFIGURATION#3
	"L3C.1=0"	FIL TI (# of samples in average) can be chosen.
	"L3C.1=1"	FIL TI (# of samples in average) cannot be locked out.
	"L3C.2=0"	SP CNF (mode of action of setpoints 1 & 2 LEDs, transistors and relays) can be selected.
	"L3C.2=1"	SP CNF (mode of action of setpoints 1 & 2 LEDs, transistors and relays) cannot be locked out.
	"L3C.3=0"	AL CNF (mode of action of Setpoints 3 & 4, often used as alarms) can be locked out.

MENU BUTTON MAIN MENU	MIN/MAX* BUTTON SUB MENU	CONDITION
"L3 CNF"	"L3C.3=1"	AL CNF (mode of action of setpoints 3 & 4, often used as alarms) cannot be locked out.
	"L3C.4=0"	AL FNC (Setpoints 3 & 4 independent or ganged with Setpoints 1 and 2) can be selected.
	"L3C.4=1"	AL FNC (Setpoints 3 & 4 independent or ganged with Setpoints 1 and 2) cannot be accessed.
	"L3C.5=0"	AL RDG (# of out-of-range readings before trip of setpoints 3 & 4) can be selected.
	"L3C.5=1"	AL RDG (# of out-of-range readings before trip of setpoints 3 & 4) cannot be accessed.
	"L3C.6=0"	SP DB (hysteresis or deadband of Setpoints and Alarms) can be specified.
	"L3C.6=1"	SP DB (hysteresis (deadband) of Setpoints and Alarms) cannot be accessed.
	"L3C.7=0"	OUT.CNF (analog & BCD outputs, setpoint display flashing) can be specified.
	"L3C.7=1"	OUT.CNF (analog & BCD outputs, setpoint display flashing) cannot be accessed.
	"L3C.8=0"	OT.SC.OF (2-data-point method for independent analog-output scale/offset) can be entered.
	"L3C.8=1"	OT.SC.OF (2-data-point method for independent analog-output scale/offset) cannot be accessed.

* The **'MIN'** button allows you to sequence through L3C.1, L3C.2, L3C.3, L3C.4, L3C.5, L3C.6, L3C.7, and L3C.8.

The **'MAX'** button allows you to select the "0" or "1" state for each "L3C" condition.

The **'MENU'** button stores the selected values for all "L3C" condition(s) changed and advances the meter to "L4 CNF". Do not press the **'MENU'** button after each change within the submenu or the meter will advance to the next menu item.

Every underlined "0" or "1" state is the factory preset value.

MENU BUTTON MAIN MENU	MIN/MAX* BUTTON SUB MENU	CONDITION
"L4 CNF":		LOCKOUT CONFIGURATION #4
	"L4C.1=0"	BAUD (communication rate) can be chosen.
	"L4C.1=1"	BAUD (communication rate) cannot be accessed.
	"L4C.2=0"	SER.CNF (parity/stop-bit length) is selectable.
	"L4C.2=1"	SER.CNF (parity/stop-bit length) is not selectable.
	"L4C.3=0"	ADDRES (meter address # on a multipoint bus) can be changed.
	"L4C.3=1"	ADDRES (meter address # on a multipoint bus) cannot be accessed.
	"L4C.4=0"	DAT FT & BUS FT (format of datA stream and bus interaction for digital communications) can be altered.
	"L4C.4=1"	DAT FT & BUS FT (format of data stream and bus interaction for digital communications) cannot be accessed.
	"L4C.5=0"	SERCNT (interval # of readings for the automatic digital output of meter) can be changed.
	"L4C.5=1"	SERCNT (interval # of readings for the automatic digital output of meter) cannot be accessed.
	"L4C.6=0"	Analog output trim input can be entered.
	"L4C.6=1"	Analog output trim input cannot be entered.

* The **'MIN'** button allows you to sequence through L4C.1, L4C.2, L4C.3, L4C.4, L4C.5 and L4C.6.

The **'MAX'** button allows you to select the "0" or "1" state for each "L4C" condition.

The **'MENU'** button stores the selected values for all "L4C" condition(s) changed and advances the meter to "INPUT". Do not press the **'MENU'** button after each change within the submenu or the meter will advance to the next menu item.

Every underlined "0" or "1" state is the factory preset value.

9.2 METER FUNCTION MENUS

9.2.1 Input

By pressing the **'MAX'** and **'MENU'** buttons you can select and then store respectively either "CURRNT", "VOLTAGE" or "POT" (input type). Refer to the chart below to go the next level of programming of the meter.

MENU BUTTON MAIN MENU	MIN/MAX* BUTTON SUB MENU	DESCRIPTION
		SIGNAL TYPE
"CURRNT"	"0-20 mA"	DC current
	"4-20 mA"	
"VOLT"	"100 mV"	Unipolar DC voltage
	"1 V"	
	"10 V"	
	"100 V"	
		Bipolar DC voltage
	"50 mV"	
	"500 mV"	
	"5 V"	
	"50 V"	
"POT"		No input selection is made.

9.2.2 RDG.CNF (Reading Configuration)

Reading configuration is used to select:

- reading scale and offset (direct vs 2-point) [RDG.1]
- active or independent decimal point [RDG.2]
- display brightness [RDG.3]
- leading zero suppression on your meter display [RDG.4]

Direct scale and Offset: these two values are used in the straight line equation, y = mx + b. (RD.SC.OF)

Display = m times input plus b or [m (input) + b] (where m is the RDG SC and b is the RDG OF).

RDG.6 enables or disables (RD.SC.OF), (RDG,SC), (RDG.OF).

The 2-data-point method allows the user to use two known points to convert from one scale to another. For example, to convert from degrees Fahrenheit to degrees Celsius, enter two (2) known points, such as 32°F = 0°C and 0°F = 17.77°C. The meter will automatically compute scale and offset and display the correct value.

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
"RDG.CNF":		READING CONFIGURATION
		Reading Scale & Offset:
	"RDG.1=0"	Direct Format
	"RDG.1=1"	2-Coordinate format
		Decimal point effect:
	"RDG.2=0"	Active
	"RDG.2=1"	Independent
		Display Brightness:
	"RDG.3=0"	Normal
	"RDG.3=1"	50% of Normal
		Leading Zeros on Display:
	"RDG.4=0"	Displayed
	"RDG.4=1"	Not Displayed
	"RDG.5=0"	Unit of Temperature:
	"RDG.5=1"	NOT USED WITH
	"RDG.5=2"	PROCESS
		Reading Scale & Offset Functions:
	"RDG.6=0"	Disables Reading Scale and Offset (RDG SC=1.0, RDG OF=0.0)
	"RDG.6=1"	Enables Reading Scale and Offset (Uses scale and offset values entered by user)
		Resetting Mode:
	"RDG.7=0"	Grounding P2-5 causes Hard Reset (RESET 2)
	"RDG.7=1"	Grounding P2-5 causes Peak/Valley (HI/LO) Reset

* The **'MIN'** button allows you to sequence through RDG.1, RDG.2, RDG.3, RDG.4, RDG.5, RDG.6, and RDG.7.

The **'MAX'** button allows you to select the "0" or "1" state for each "RDG" condition.

The **'MENU'** button stores the selected values for all "RDG.CNF" condition(s) changed and advances the meter to "RD SC". Do not press the **'MENU'** button after each change within the submenu or the meter will advance to the next menu item.

Every underlined "0" or "1" state is the factory preset value.

9.2.3 RDG SC (Reading Scale) And RDG OF (Reading Offset)

Typically, this would be used only when you cannot connect a known load to your meter, you require a display with 3 or more positions to the right of the decimal point position, you have scaled your meter using Input Scale and Offset (“IN.SC.OF”) and want to enter a constant multiplying factor, or you have an extremely large offset.

If “RDG.1=0” were chosen, then you go automatically into “RDG SC” and “RDG OF” where:

“RDG SC” is reading scale from -99999 to +499999 where you set the display to “1.00000” and “RDG OF” is reading offset from -99999 to 999999 when you set the display to “000000”.

When “RDG SC” is displayed, press the **‘MIN’** button to see the previously-set value. Process measurement scale is set to “1.00000” using the ‘**MIN**/**MAX**’ buttons. Store by pressing the **‘MENU’** button.

For “RDG OF”, you may choose to enter a reference temperature offset here (e.g., “-100.00”) so that the display will read deviation of the input from the boiling point (or some other temperature).

If “RDG.1 = 1” were chosen, then you go automatically into “RD.SC.OF”.

Note ☞

Direct reading offset “RDG OF” now has programmable decimal point position. This makes the decimal point independent of the display decimal point and allows larger offset values.

MENU BUTTON MAIN MENU	MIN/MAX* BUTTON SUB MENU 1	MIN/MAX /MENU** BUTTON SUB MENU 2	DESCRIPTION
"RD.SC.OF":			READING SCALE & OFFSET
	INPUT 1		Item #1 of Coordinate #1
		000000. ("00000.0")	Enter the first value displayed by the meter.
	READ 1		Item #2 of Coordinate #1.
		000000. ("00000.0")	Enter first desired value.
	INPUT 2		Item #1 of Coordinate #2.
		000000. ("10000.0")	Enter the second value displayed by the meter.
	READ 2		Item #2 of Coordinate #2.
		000000. ("10000.0")	Enter second desired value.

* The **'MIN'** button allows you to sequence through "INPUT 1", "READ 1", "INPUT 2", and "READ 2" headings.

The **'MAX'** button sends you to the value corresponding to "INPUT 1", "READ 1", "INPUT 2", or "READ 2" so you can change it (go to the SUB MENU 2 item).

** The **'MIN'** button allows you to step through the digits of the applicable number being changed.

The **'MAX'** button changes the value of the digit to be displayed.

The **'MENU'** button stores the selected values for each input required in "RD.SC.OF". After the last value ("READ 2") has been entered and the **'MENU'** button is pressed, the meter display will advance to "IN CNF".

Every underlined item is the factory preset value.

Note ☞

Meter now stores all scale and offset values for "IN.SC.OF", "RD.SC.OF", and "OT.SC.OF".

The meter will display previously input values when entering these menus. If system decimal point changes, all values will be modified accordingly; if overflow occurs meter will flash that parameter with 999999.

9.2.4 IN CNF (Input Configuration)

Input configuration is used to select:

- 50 or 60 Hz line frequency [INP.1]
- slow or fast read rate [INP.2]
- unipolar or bipolar inputs
- cold junction compensation [INP.5]

INP.1 and INP.2 are related to each other. If your power requirements require 50 Hz, you can have optimum integration in FAST read mode (12/sec). In the FAST mode, you need a jumper in the S1A position on the vertical Signal Input Board. If you set the SLOW read rate, this jumper should be removed to avoid overloading the integrator. SLOW read rate produces less noise.

MENU BUTTON MAIN MENU	MIN/MAX /MENU * BUTTON SUB MENU	DESCRIPTION
"IN CNF":		INPUT CONFIGURATIONS
		Line Frequency:
	"INP.1=0"	60 Hz
	"INP.1=1"	50 Hz
		Read Rate:
	"INP.2=0"	Slow
	"INP.2=1"	Fast
		Input Voltage:
	"INP.3=0"	Unipolar
	"INP.3=1"	Bipolar
		Transmitter Type:
	"INP.4=0"	No Transmitter
	"INP.4=1"	Not used
	"INP.4=2"	Not used
		Process Mode:
	"INP.5=0"	Must be set to this bit
	"INP.5=1"	Not Used
		IN.SC.OF:
	"INP.6=0"	Disabled
	"INP.6=1"	Enabled
		Type of Reading: (not used for Temperature, set "INP.7 = 0")
	"INP.7=0"	Non Ratiometric
	"INP.7=1"	Not used

* The **'MIN'** button allows you to sequence through INP.1, INP.2, INP.3, INP.4, INP.5, INP.6, and INP.7.

The **'MAX'** button allows you to select the "0" or "1" state for each "INP" condition.

The **'MENU'** button stores the selected values for all "IN CNF" condition(s) changed and advances the meter to "IN.SC.OF". Do not press the **'MENU'** button after each change within the submenu or the meter will advance to the next menu item.

Every underlined "0" or "1" state is the factory preset value.

9.2.5 IN.SC.OF (Input Scale and Offset)

Refer to Section 8 for a detailed discussion of this feature.

Input scale and offset is typically used when you want to scale your meter (using two input data points):

MENU BUTTON MAIN MENU	MIN/MAX * BUTTON SUB MENU 1	MIN/MAX/ MENU ** BUTTON SUB MENU 2	DESCRIPTION
"IN.SC.OF":			INPUT SCALE OFFSET
			Input scale and offset in
			2-Coordinate Format
	INPUT 1		Item #1 of Coordinate #1.
		000000. ("000000.")	Enter the first value displayed by the meter.
	READ 1		Item #2 of Coordinate #1.
		000000. ("000000.")	Enter first desired value.
	INPUT 2		Item #1 of Coordinate #2.
		000000. ("100000.")	Enter the second value displayed by the meter.
	READ 2		Item #2 of Coordinate #2.
		000000. ("100000.")	Enter second desired value.

* The **'MIN'** button allows you to sequence through "INPUT 1", "READ 1", "INPUT 2", and "READ 2" headings.

The **'MAX'** button sends you to the value that corresponds to "INPUT 1", "READ 1", "INPUT 2", or "READ 2" so you can change it (go to the SUB MENU 2 item).

** The **‘MIN’** button allows you to sequence through the digits of the applicable number being changed.

The **‘MAX’** button changes the value of the digit to be displayed.

The **‘MENU’** button stores the selected values for each input required in “IN.SC.OF”. After the last value (“READ 2”) has been entered and the **‘MENU’** button is pressed, the meter display will advance to “DEC PT”.

Pressing the **‘MENU’** button allows you go to the next SUB MENU 1 item automatically.

After changing the last value at the bottom of the chart, pressing the **‘MENU’** button once more stores everything that was changed and advances the meter to the next configuration (“DEC PT”).

Every underlined item is the factory preset value.

9.2.6 DEC PT (Decimal Point)

Refer to Section 8 for a detailed discussion of this feature.

Decimal point is used to select the resolution of your meter display such as in one degree, tenths of a degree, hundredths of a degree or more.

If “ERR 01” is displayed, check that “RDG OF” is within the display range.

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON CONDITION	DESCRIPTION
“DEC PT”:		DECIMAL POINT POSITION
	“FFFFFF.”	Position 1
	“FFFFF.F”	Position 2
	“FFFF.FF”	Position 3
	“FFF.FFF”	Position 4
	“FF.FFFF”	Position 5
	“F.FFFFF”	Position 6

* Press the **‘MIN’** button to show all “F’s” on the display.

Press the **‘MAX’** button to move the decimal point.

Press the **‘MENU’** button to store the decimal point location and the meter will advance to “CNT BY”.

The underlined item is the factory preset value.

9.2.7 CNT BY (Count By)

Count by is used to round off the meter values by 1's, 2's, 5's, 10's, 20's, 50's, or 100's. This feature is normally set to "001" so that the display shows all possible values for the least-significant digit.

If the combination of input-signal noise and selected resolution is high, however, your meter can round off the display to the nearest 2, 5, 10, 20, 50 or even 100 digits. This can eliminate annoying display jitter without introducing any filter time delays.

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
"CNT BY":		COUNT BY ROUNDING OFF THE VALUE
	"<u>001</u>"	
	"002"	(the decimal point
	"005"	position is ignored)
	"010"	
	"020"	
	"050"	
	"100"	

* Press the **'MIN'** button to show "001", "002", "005", "010", "020", "050", or "100".

Press the **'MAX'** button to select one of the above.

Press the **'MENU'** button to store the Count By number and the meter will advance to "FIL.CNF".

The underlined item is the factory preset value.

9.2.8 FIL.CNF (Filter Configuration)

Filter configuration is used to select:

- Adaptive Bandwidth Control (ABC) filtering or moving average filter [FIL.1]
- whether the value displayed on the meter is filtered or unfiltered [FIL.2]
- whether the value sent to the optional analog output is filtered or unfiltered [FIL.3]

"FIL.1=0" for Adaptive Bandwidth Control (ABC filtering, which averages over a larger number of samples when the input is not moving, but drops down to no averaging for systematic input changes). "FIL.1=1" is for averaging over a fixed number of samples. The number of samples to be used is selected in "FIL TI".

"FIL.3=0" removes the selected filtering from the analog output (if that option is installed in your meter). "FIL.3=1" puts the selected filtering on that output. Usually you choose "FIL.3=0", relying on the signal conditioning available at the device receiving the analog output data.

MENU BUTTON MAIN MENU	MIN/MAX/ MENU * BUTTON SUB MENU	DESCRIPTION
"FIL.CNF":		FILTER CONFIGURATION
		Filter Type:
	"FIL.1=0"	ABC Filter
	"FIL.1=1"	Moving Average Filter
		Value to be displayed:
	"FIL.2=0"	Unfiltered
	"FIL.2=1"	Filtered
		Value to be transmitted on Analog Output:
	"FIL.3=0"	Unfiltered
	"FIL.3=1"	Filtered
	"FIL.3=2"	Peak value
	"FIL.3=3"	Valley value

The **'MIN'** button allows you to sequence through FIL.1, FIL.2, and FIL.3.

The **'MAX'** button allows you to select the "0", "1", "2", or "3" state for each "FIL" condition.

The **'MENU'** button stores the selected values for all "FIL.CNF" condition(s) changed and advances the meter to "FIL TI". Do not press the **'MENU'** button after each change within the submenu or the meter will advance to the next menu item.

Adaptive Bandwidth Control takes the average of the samples except when the input is rapidly changing. Patent applied for.

Every underlined "0", "1", "2", or "3" is the factory preset value.

9.2.9 FIL TI (Filter Time Constant)

Filter time constant is used to determine the number of readings the meter will average before displaying an input value. The choices are 001, 002, 004, 008, 016, 032, 064, or 128.

For fixed filtering, the averaged number of samples is fixed; for Automatic Bandwidth Control, the chosen value is the maximum number of samples in the average computed by ABC when the input is not changing significantly (ABC, for slowly-moving signals, filters by averaging the "TI" number of samples, but follows signal changes rapidly by decreasing that averaging number).

Pressing the **'MENU'** button stores your selection and moves on to "RESET 1" and then to "RUN" (unless setpoints, outputs, or communications have been unlocked for programming change)

MENU BUTTON MAIN MENU	**MIN/MAX/MENU * BUTTON SUB MENU**	**DESCRIPTION**
"FIL TI":		FILTER TIME CONSTANT
	"001" "002" "004" "008" "016" "032" "<u>064</u>" "128"	Number of readings used in averaging.

* Press the **'MIN'** button to show "001", "002", "004", "008", "016", "032", "064" or "128".
Press the **'MAX'** button to select one of the above.
Press the **'MENU'** button to store the selection made and to advance the meter to the next menu ("SP CNF").

The underlined item is the factory preset value.

9.2.10 SP CNF (Setpoints 1 & 2 Configuration)

Refer to Section 10 for an in-depth discussion of these features.

Setpoint configuration is used to select:

- the active zone of each setpoint to above and below the setting [SPC.1 & SPC.4]
- whether the open-collector output is on or off [SPC.2 & SPC.5]
- whether the reading compared with the setpoints is filtered or unfiltered [SPC.3 & SPC.6]
- enabled or disabled setpoints [SPC.7]
- enabled or disabled setpoint LED displays [SPC.8]

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
"SP CNF":		SETPOINTS 1 & 2 CONFIGURATIONS
		Setpoint 1 Active Zone:
	"SPC.1=0"	Above
	"SPC.1=1"	Below
		Setpoint 1 open-collector or relay output Active ON or OFF:
	"SPC.2=0"	On
	"SPC.2=1"	Off
		Filtered/unfiltered reading compared with Setpoint 1 value:
	"SPC.3=0"	Unfiltered
	"SPC.3=1"	Filtered
		Setpoint 2 Active zone:
	"SPC.4=0"	Above
	"SPC.4=1"	Below
		Setpoint 2 open-collector or relay output Active ON or OFF:
	"SPC.5=0"	On
	"SPC.5=1"	Off
		Filtered/unfiltered reading compared with Setpoint 2 value:
	"SPC.6=0"	Unfiltered
	"SPC.6=1"	Filtered
		Setpoints 1 & 2 action:
	"SPC.7=0"	Enabled
	"SPC.7=1"	Disabled
		Setpoint 1 & 2 LEDs action:
	"SPC.8=0"	Enabled
	"SPC.8=1"	Disabled

* The **'MIN'** button allows you to sequence through SPC.1, SPC.2, SPC.3, SPC.4, SPC.5, SPC.6, SPC.7 and SPC.8.

The **'MAX'** button allows you to select the "0" or "1" state for each "SPC" condition.

The **'MENU'** button stores the selected values for each "SPC" condition changed and advances the meter to the next configuration ("AL CNF").

Every underlined "0" or "1" is the factory preset value.

9.2.11 AL CNF (Alarm Configuration)

Refer to Section 10 for an in-depth discussion of these features.

Alarm configuration is used to select:

- the active zone for each alarm point to above or below the setting [ALC.1 & ALC.4]
- whether the open-collector output is on or off [ALC.2 & ALC.5]
- whether the readings compared with the alarm points are filtered or unfiltered [ALC.3 & ALC.6]
- enabled or disabled alarm points [ALC.7]

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
"AL CNF":		ALARMS 1 & 2 (SETPOINTS 3 & 4) CONFIGURATIONS
		Alarm 1 Active zone (Setpoint 3):
	"ALC.1=0"	Above
	"ALC.1=1"	Below
		Alarm 1 open-collector or relay output Active ON or OFF:
	"ALC.2=0"	On
	"ALC.2=1"	Off
		Filtered/unfiltered reading compared with Alarm 1 (Setpoint 3) value:
	"ALC.3=0"	Unfiltered
	"ALC.3=1"	Filtered
		Alarm 2 Active zone (Setpoint 4):
	"ALC.4=0"	Above
	"ALC.4=1"	Below

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MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
		Alarm 2 open-collector or relay output Active ON or OFF:
	"ALC.5=0"	On
	"ALC.5=1"	Off
		Filtered/unfiltered reading compared with Alarm 2 (Setpoint 4) value:
	"ALC.6=0"	Unfiltered
	"ALC.6=1"	Filtered
		Alarms 1 & 2 (Setpoints 3 & 4) action and LEDs:
	"ALC.7=0"	Enabled
	"ALC.7=1"	Disabled
		Alarm reset at P2-11 connector:
	"ALC.8=0"	Disabled
	"ALC.8=1"	Enabled

* The **'MIN'** button allows you to sequence through ALC.1, ALC.2, ALC.3, ALC.4, ALC.5, ALC.6, ALC.7 and ALC.8.

The **'MAX'** button allows you to select the "0" or "1" state for each "ALC" condition.The **'MENU'** button stores the selected values for each "ALC" condition changed and advances the meter to the next configuration ("AL FNC").

Every underlined "0" or "1" is the factory preset value.

9.2.12 AL FNC (Alarm Function)

Refer to Section 10 for an in-depth discussion of these features.

Alarm function is used to select:

- whether the alarms are used in the process, high-deviation, low-deviation or band deviation modes [ALF.1 & ALF.3]
- whether or not to latch the alarms [ALF.2 & ALF.4]

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
"AL FNC":		ALARMS 1 & 2 FUNCTION
		Alarm 1 State:
	"ALF.1=0"	Process Mode
	"ALF.1=1"	High Deviation Mode
	"ALF.1=2"	Low Deviation Mode
	"ALF.1=3"	Band Deviation Mode
		Alarm 1 Latch Action:
	"ALF.2=0"	Unlatched
	"ALF.2=1"	Latched
		Alarm 2 State:
	"ALF.3=0"	Process Mode. Process Mode means the deadband is equally above and below the setpoint.
	"ALF.3=1"	High Deviation Mode
	"ALF.3=2"	Low Deviation Mode
	"ALF.3=3"	Band Deviation Mode
		Alarm 2 Latch Action:
	"ALF.4=0"	Unlatched
	"ALF.4=1"	Latched

* The **'MIN'** button allows you to sequence through ALF.1, ALF.2, ALF.3 and ALF.4.

The **'MAX'** button allows you to select the "0", "1", "2", or "3" state for each "ALF" condition.

The **'MENU'** button stores the selected values for each "ALF" condition changed and advances the meter to the next configuration ("AL RDG").

Every underlined item is the factory preset value.

9.2.13 AL RDG (Alarm Readings)

Refer to Section 10 for an in-depth discussion of these features.

Alarm reading is used to select the number of readings (from 01 to 15) the meter must make prior to activating the alarms.

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
"AL RDG":		ALARM NUMBER OF READINGS
	"00 00" ("03 03")	Number of readings to delay activation of Alarms 1 & 2 (from "01" to "15") (AL1), (AL2)

* Press the **'MIN'** button to show the current number of readings on the display (left pair of digits are flashing).

The **'MAX'** button is used to change the value of the flashing digits (from 01 to 15).

Pressing the **'MIN'** button allows you go to the second set of digits.

The **'MAX'** button is used to change the value of the flashing digits.

After changing the last number, if necessary, pressing the **'MENU'** button stores everything that was changed and advances the meter to the next configuration ("SP DB").

The underlined item is the factory preset value.

9.2.14 SP DB (Setpoint Deadband)

Refer to Section 10 for an in-depth discussion of these features.

Setpoint deadband is used to select the amount of hysteresis for the setpoints (programmable from “0000” to “9999”).

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
“SP DB”:		SETPOINTS 1 & 2 DEADBAND
	“0000” (“0020”)	Hysteresis for (w/system decimal points) Setpoints1 and 2 (Programmable from”0000” to “9999”)

* Press the **‘MIN’** button to show the value on the display.

The **‘MIN’** button also allows you to sequence through the digits of the number being changed.

The **‘MAX’** button changes the value of the digit to be displayed.

The **‘MENU’** button stores the selected values for each “SP DB” condition changed and advances the meter to the next configuration (“AL DB”):

The underlined item is the factory preset value.

9.2.15 AL DB (Alarm Deadband)

Refer to Section 10 for an in-depth discussion of these features.

Alarm deadband is used to select the amount of hysteresis for the alarms (programmable from “0000” to “9999”).

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
“AL DB”:		ALARMS 1 & 2 DEADBAND
	“0000” (“0020”)	Hysteresis for (w/System decimal points) Alarms 1 & 2 (Programmable from “0000” to “9999”)

* Press the **‘MIN’** button to show the value on the display.

The **‘MIN’** button also allows you to sequence through the digits of the number being changed.

The **‘MAX’** button changes the value of the digit to be displayed.

Press the **‘MENU’** button to store the changes and advances the meter to the next configuration (“OUT.CNF”).

The underlined item is the factory preset value.

9.2.16 OUT.CNF (Output Configuration)

Output configuration is used to select:
- whether or not to send data to the optional analog output board [OUT.1]
- the analog output signal of 0-10 V dc or 4-20 mA DC [OUT.2]
- whether or not to send data to the optional BCD output board [OUT.3]
- to send peak value via the optional BCD output board [OUT.4]
- to select type of BCD output [OUT.5]
- enable or disable the flashing display [OUT.6]

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
"OUT.CNF":		OUTPUT CONFIGURATION
		Data on the Analog Output Board:
	"OUT.1=0"	Disabled
	"OUT.1=1"	Enabled
		Analog Output Mode:
	"OUT.2=0"	0-1 V, 0-5 V, 1-5 V, 0-10 V
	"OUT.2=1"	0-20 mA or 4-20 mA
		Data out on Parallel BCD Board:
	"OUT.3=0"	Disabled
	"OUT.3=1"	Enabled
		Type of data out on BCD Board:
	"OUT.4=0"	Display
	"OUT.4=1"	Peak
		BCD Output:
	"OUT.5=0"	Used for standard parallel printers.
	"OUT.5=1"	Used for Specialty printers.
		Type of Display Flashing:
	"OUT.6=0"	Disabled - display flashing.
	"OUT.6=1"	SP1 active - display flashing.
	"OUT.6=2"	SP2 active - display flashing.
	"OUT.6=3"	SP3 active - display flashing.
	"OUT.6=4"	SP4 active - display flashing.
	"OUT.6=5"	any SP active - display flashing.

* The **'MIN'** button allows you to sequence through OUT.1, OUT.2, OUT.3, OUT.4, OUT.5, and OUT.6.

The **'MAX'** button allows you to select the "0", "1", "2", "3", "4" or "5" state for each "OUT" condition.

The **'MENU'** button stores the selected values for each "OUT" condition changed and advances the meter to the next configuration ("OT.SC.OF").

Every underlined item is the factory preset value.

9.2.17 OT.SC.OF (Output Scale and Offset)

Output scale and offset is used to calibrate your optional analog output to correspond to the engineering units you desire.

MENU BUTTON MAIN MENU	MIN/MAX * BUTTON SUB MENU 1	MIN/MAX/ MENU ** BUTTON SUB MENU 2	DESCRIPTION
"OT.SC.OF":			OUTPUT SCALE & OFFSET
	READ 1		Item #1 of Coordinate #1.
		000000. ("000000.")	Enter the first value displayed by the meter.
	OUTPT1		Item #2 of Coordinate #1.
		00.0000 ("04.0000")	Enter first desired output value.
	READ 2		Item #1 of Coordinate #2.
		000000. ("100000.")	Enter the second value displayed by the meter.
	OUTPT2		Item #2 of Coordinate #2.
		00.0000 ("20.0000")	Enter second desired output value.

* The **'MIN'** button allows you to sequence through "READ 1", "OUTPT1", "READ 2", and "OUTPT2" headings.

The **'MAX'** button sends you to the value corresponding to "READ 1", "OUTPT1", "READ 2", and "OUTPT2" so you can change it (go to the SUB MENU 2 item).

** The **'MIN'** button allows you to step through the digits of the applicable number being changed.

The **'MAX'** button changes the value of the digit to be displayed.

The **'MENU'** button stores the selected values for each input required in "OT.SC.OF". After the last value ("READ 2") has been entered and the **'MENU'** button is pressed, the meter display will advance to "BAUD".

Every underlined item is the factory preset value.

9.2.18 BAUD (Baud Rate)

Baud is used to select the baud rate for communication via the optional RS-232 or RS-485 communications boards. The choices are 300, 600, 1200, 2400, 4800, 9600, and 19200.

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
"BAUD":		BAUD RATE
	"00300"	
	"00600"	
	"01200"	Select baud rate for
	"02400"	communications via
	"04800"	RS-232 or RS-485
	"09600"	
	"19200"	

* Press the **'MIN'** button to show "00300", "00600", "01200", "02400", "04800", "09600", or "19200".

Press the **'MAX'** button to select one of the above.

Press the **'MENU'** button to store the changes and the meter advances to the next configuration ("SERCNF").

The underlined item is the factory preset value.

9.2.19 SERCNF (Serial Communication Configuration)

Serial communication configuration is used to select:

- no parity, odd parity, or even parity for communications [SER.1]
- 1 stop bit or 2 stop bits [SER.2]
- No parity, 1 stop is not allowed

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
"SERCNF":		SERIAL COMMUNICATION CONFIGURATION
		Select parity for communications via RS-232 or RS-485:
	"SER.1=0"	No parity
	"SER.1=1"	Odd parity
	"SER.1=2"	Even parity
		Select stop bits for communications via RS-232 or RS-485:
	"SER.2=0"	1 Stop Bit
	"SER.2=1"	2 Stop Bits

* The **'MIN'** button allows you to toggle between SER.1 and SER.2.

The **'MAX'** button allows you to select the "0", "1", or "2" state for each "SER" condition.

The **'MENU'** button stores the selected values for each "SER" condition changed and advances the meter to the next configuration ("ADDRES").

Every underlined "0", "1" or "2" is the factory preset value.

Note ☞

NOTE: Only 7 data bit communication is supported

9.2.20 ADDRESS (Multipoint Communications Device Address)

Address is used to give each meter a unique address while on a local area network using the optional RS-485 board.

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
"ADDRES":		MULTIPOINT COMMUNICATIONS DEVICE ADDRESS
	"000" ("001")	Enter address as an integer value: "000" to "199"

* Press the **'MIN'** button to show the value on the display.

The **'MIN'** button also allows you to change the position of the digit being changed.

The **'MAX'** button changes the value of the digit to be displayed.

Press the **'MENU'** button to store the changes and advances the meter to the next configuration ("DAT FT").

The underlined item is the factory preset value.

9.2.21 DAT FT (Data Format)

Data format is used to set all the parameters to be transmitted via the optional RS-232 or RS-485 serial communications board.
Data format allows you to select:

- whether to transmit Alarm 1 or 2 status character [DAT.1]
- whether to transmit peak and valley status character [DAT.2]
- whether or not the data transmitted is filtered or unfiltered [DAT.3 & DAT.4]
- whether or not to transmit the peak and valley readings [DAT.5 & DAT.6]
- the type of separator [DAT.7]
- whether or not to transmit the unit of measure [DAT.8]

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
"DAT FT":		DATA FORMAT
		Alarms 1 & 2 Status Character:
	"DAT.1=0"	Excluded
	"DAT.1=1"	Included
		HI/LO (Peak/Valley) Status Character:
	"DAT.2=0"	Excluded
	"DAT.2=1"	Included
		Filtered Value to be transmitted:
	"DAT.3=0"	No
	"DAT.3=1"	Yes
		Filtered value to be transmitted:
	"DAT.4=0"	No
	"DAT.4=1"	Yes
		Peak value to be transmitted:
	"DAT.5=0"	No
	"DAT.5=1"	Yes
		Valley value to be transmitted:
	"DAT.6=0"	No
	"DAT.6=1"	Yes
		Separator for above items:
	"DAT.7=0"	Space
	"DAT.7=1"	<CR>
		Unit of measurement to be transmitted:
	"DAT.8=0"	No
	"DAT.8=1"	Yes

* The **'MIN'** button allows you to sequence through DAT.1, DAT.2, DAT.3, DAT.4, DAT.5, DAT.6, DAT.7, and DAT.8.

The **'MAX'** button allows you to select the "0" or "1" state for each "DAT" condition.

The **'MENU'** button stores the selected values for each "DAT" condition changed and advances the meter to the next configuration ("BUS FT").

Every underlined "0" or "1" is the factory preset value.

9.2.22 BUS FT (Bus Format)

Bus format is to select:

- whether or not to include check sum with reading [BUS.1]
- whether or not to include line feeds [BUS.2]
- whether or not to have the meter respond in echo mode [BUS.3]
- multipoint or point-to-point mode [BUS.4]
- (if in point-to-point mode) select whether to communicate continuously or on command [BUS.5]
- whether a message character is used in handshake or continuous mode [BUS.6]
- whether or not you have installed the RS-485 board [BUS.7]
- whether or not to enable the external print command at P2-11.

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
"BUS FT":		BUS FORMAT
		Check sum with reading:
	"BUS.1=0"	Excluded
	"BUS.1=1"	Included
		Line feed following all <CR>'s:
	"BUS.2=0"	Excluded
	"BUS.2=1"	Included
		Response from the meter (echo):
	"BUS.3=0"	No
	"BUS.3=1"	Yes
		Point to Point mode or Multipoint mode:
	"BUS.4=0"	Pt-Pt
	"BUS.4=1"	Multi-Pt
		Point-to-Point mode only:
	"BUS.5=0"	Continuous
	"BUS.5=1"	On Command
		Handshake if continuous mode:
	"BUS.6=0"	Message
	"BUS.6=1"	Character
		RS-485 Board installed?:
	"BUS.7=0"	Not installed
	"BUS.7=1"	Installed
		Print Command at P2-11:
	"BUS.8=0"	Disabled
	"BUS.8=1"	Enabled

* The **‘MIN’** button allows you to sequence through BUS.1, BUS.2, BUS.3, BUS.4, BUS.5, BUS.6, BUS.7 and BUS.8.

The **‘MAX’** button allows you to select the “0” or “1” state for each “BUS” condition.

The **‘MENU’** button stores the selected values for each “BUS” condition changed and advances the meter to the next configuration (“SERCNT”).

Every underlined “0” or “1” state is the factory preset value.

9.2.23 SERCNT (Serial Count)

Serial count is used to program the number of readings the meter must take (programmable from “00001” to “59,999”) between transmissions of data via the optional RS-232 or RS-485 serial communications board.

Once you are done with the changes, press the **‘MENU’** button to display the normal operating display. The meter advances to run mode showing the currently measured values. Pressing the **‘RESET’** button two times allows you to return to the run mode.

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
“SERCNT”:		SERIAL COUNT
		This specifies the number of readings between data transmissions:
	“00000” (“<u>00001</u>”)	“00001” to “59999”

* Press the **‘MIN’** button to show the value on the display.

The **‘MIN’** button also allows you to change the position of the digit being changed.

The **‘MAX’** button changes the value of the digit to be displayed.

Press the **‘MENU’** button to store the changes and advances the meter to “RESET 2” and returns to the run mode.

The underlined item is the factory preset value.

Note ☞

NOTE: After you complete your programming you may want to go back and remove the jumper in S3A position on the main board to insure against any unauthorized changes.

9.2.24 ANALOG OUTPUT CALIBRATION NUMBERS

The analog output calibration numbers (see Figure 12-1) are printed on the optional analog output board. These four numbers (CAL VZ, CAL VS, CAL mAS), must be entered into the meter to ensure that the analog output board is calibrated with the microprocessor.

MENU BUTTON MAIN MENU	MIN/MAX/MENU * BUTTON SUB MENU	DESCRIPTION
“CAL VZ”	0 to 59999	Calibration number marked on the analog output board must be entered for voltage zero.
“CAL VS”	0 to 59999	Calibration number marked on the analog output board must be entered for voltage span.
“CAL mAZ”	0 to 59999	Calibration number marked on the analog output board must be entered for current zero.
“CAL mAs”	0 to 59999	Calibration number marked on the analog output board must be entered for current span.

Note ☞

NOTE: After you complete your programming you may want to go back and remove the jumper in S3A position on the main board to insure against any unauthorized changes.

Once you are done with the changes, press the **‘MENU’** button to display. The meter advances to run mode showing the currently measured values.

SETPOINTS/ALARMS

Setpoints 1 through 4 can be configured for a very large variety of zone and level signalling.

SP1 and SP2 have balanced configurable hysteresis and are non-latching, suitable for control-level signalling. SP3 and SP4 are often used as ALarm 1 and ALarm 2, because they have single-sided hysteresis and can be configured for latching action.

The levels of these setpoints are entered during run mode via the front-panel pushbuttons (refer to Section 10.11). Many performance options are entered during the configuration mode (refer to Sections 10.2 through 10.10).

10.1 FEATURES OVERVIEW

1. Four full-range levels with many menu programmable features.
2. Independent operation or ganged action (including guard-band assignments).
3. Active above or below level, outside or inside band.
4. SP1 and SP2 have configurable hysteresis, 50% on either side of setpoint.
5. SP3 and SP4 have configurable hysteresis, 100% on inactive side.
6. SP3 and SP4 is configurable for latching action.
7. Setpoint levels can be compared to the unfiltered or filtered input signal measurements.
8. Configurable delays in alarm action.
9. Individual front-panel LED indicators.
10. Four (4) open-collector transistor outputs with clamping diodes, are isolated from signal input.
11. Setpoints can be displayed and reset as desired without interrupting measurements.

Setpoints 1 and 2 have selectable hysteresis, allocated 50% on either side of the setpoint level. A single setpoint can now generate on/off control signals for an operating region defined by the hysteresis. Refer to Figures 10-1 and 10-2 to understand how hysteresis works:

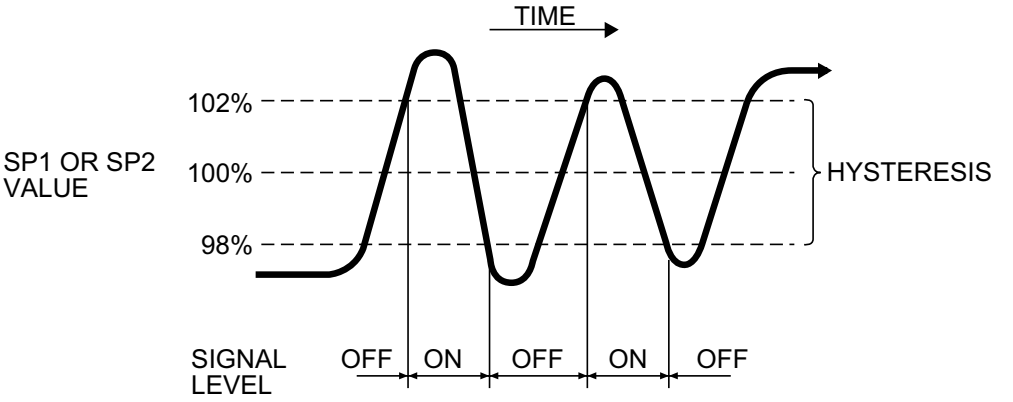


Figure 10-1. Setpoints 1 & 2 Action (Setpoint at 100 with 4% hysteresis)

These two setpoints have selectable single-sided hysteresis. When used as alarms, the action is immediate (unless a delay is programmed) going into the alarm zone but turning off is deferred (if latching is not programmed) by the hysteresis amount.

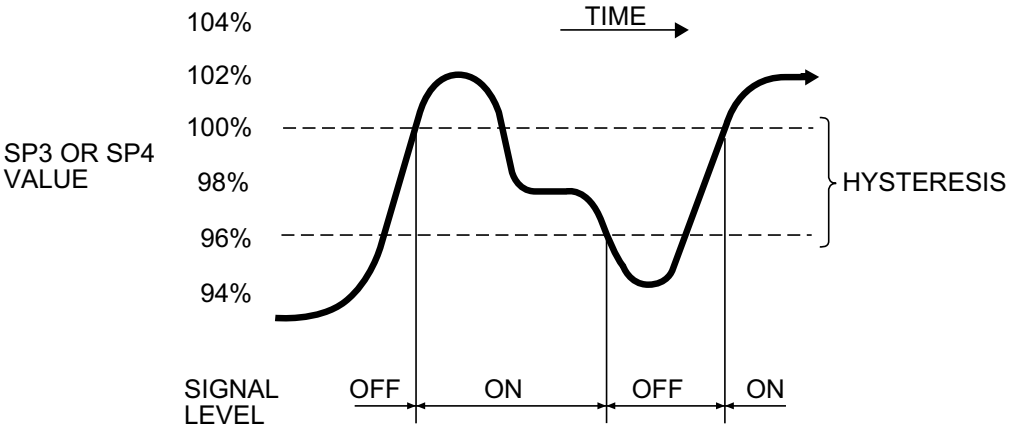


Figure 10-2. Setpoints 3 & 4 Action
(for Low Alarm with Relay on at -100, relay off at -96 with a hysteresis of 4)

You are now able to program the setpoint features (as described in the following sections).

10.2 UNLOCKING THE FEATURES

All setpoint values and features can be set via the front-panel buttons or the optional serial communications boards (RS-232 or RS-422/485). Control from the front-panel buttons can be locked out by jumpers on S3A and S3C on the main board or by setting lockout bits “L3C.2”, and “L3C.6” in Lockout configuration “L3 CNF”.

1. Check that main board jumpers S3A and S3C are installed (to permit memory storage of program and data along with button controls).

Note ☞

NOTE: Jumper S3B should NOT be installed. This jumper is reserved for factory recalibration!

2. Press the **‘MENU’** button to see “L1 CNF” and then press the **‘MIN’** button to view “L1C.1=0” if “SP 1” is unlocked. If “L1C.1=1”, change to equal “0” by pressing the **‘MAX’** button.
3. Press the **‘MIN’** button again to advance to “L1C.2” and set equal to “0” to unlock “SP 2”.
4. Repeat for “L1C.3=0” and “L1C.4=0” to access “SP 3” and “SP 4”.
5. Press the **‘MENU’** button to save these choices and advance to “L2 CNF”. Skip over “L2 CNF” by pressing the **‘MENU’** button and advance to “L3 CNF”.
6. Press the **‘MIN’** and **‘MAX’** buttons to set “L3C.2=0”, “L3C.3=0”, “L3C.4=0”, “L3C.5=0”, “L3C.6=0”, “L3C.7=0” to gain access to the programming for the setpoints. All changes are then saved by pressing the **‘MENU’** button.

10.3 SELECTING “SP CNF” SETPOINT CONFIGURATION FEATURES

These eight bits select the modes for “SP 1” and “SP 2” (see Section 10.5 for “SP 3” and “SP 4”).

1. Press the **‘MENU’** button until “SP CNF” is displayed, then press the **‘MIN’** button to sequence through the selections. Use the **‘MAX’** button to choose alternate choice.
2. “SPC.1=0” makes “SP 1” active ABOVE its level;
   “SPC.1=1” sets “SP 1” active BELOW.
3. “SPC.2=0” turns “SP 1” transistor ON when “SP 1” is active.
   “SPC.2=1” turns it OFF.
4. “SPC.3=0” compares the “SP 1” level to the UNFILTERED measurements.
   “SPC.3=1” compares “SP 1” to the FILTERED measurements.
5. “SPC.4=0” makes “SP 2” active ABOVE setpoint.

   “SPC.4=1” makes “SP 2” active BELOW setpoint.
6. “SPC.5=0” turns “SP 2” transistor ON when “SP 2” is active.
   “SPC.5=1” turns it OFF.

7. “SPC.6=0” compares the “SP 2” level to the UNFILTERED measurements.
   “SPC.6=1” compares “SP 2” to the FILTERED measurements.
8. “SPC.7=0” Enables both setpoints 1 and 2.

   “SPC.7=1” Disables both setpoints 1 and 2.
9. “SPC.8=0” ENABLES the two front-panel LED indicators for setpoints 1 and 2 when you have chosen “SPC.7=0”.

   “SPC.8=1” DISABLES the two front-panel LED indicators for setpoints 1 and 2. (use with caution; recommended only when other external over-range indicators are present).
10. Press the **‘MENU’** button to store your selections and advance to “AL CNF” (Alarm Configuration).

10.4 DEVIATION FUNCTION FOR ALARMS

Deviation functions apply to Alarms 1 and 2 (Setpoints 3 and 4) and act as buffer zones to control setpoint action. The Alarm 1 deviation is the sum of the Alarm 1 value plus the Setpoint 1 value; the Alarm 2 deviation is the Alarm 2 value plus the Setpoint 2 value. The four types of deviation functions are Process (no deviation), High, Low, and Deadband. The following illustrate the ways in which the deviation function alters the alarm response.

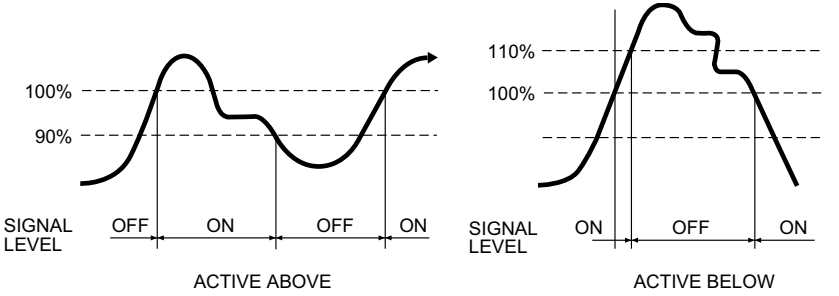


Figure 10-3. Process Deviation

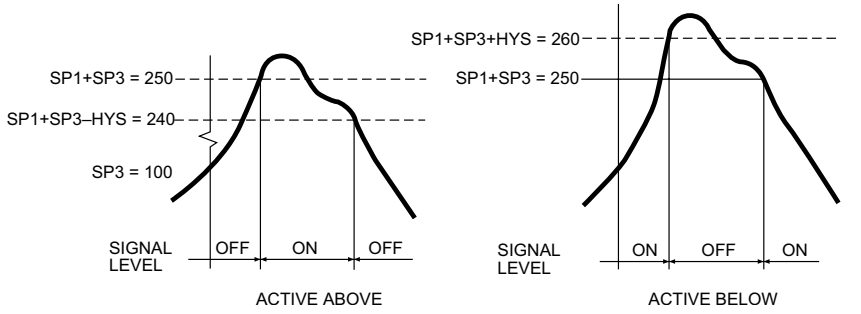


Figure 10-4. High Deviation for both Active Above and Active Below

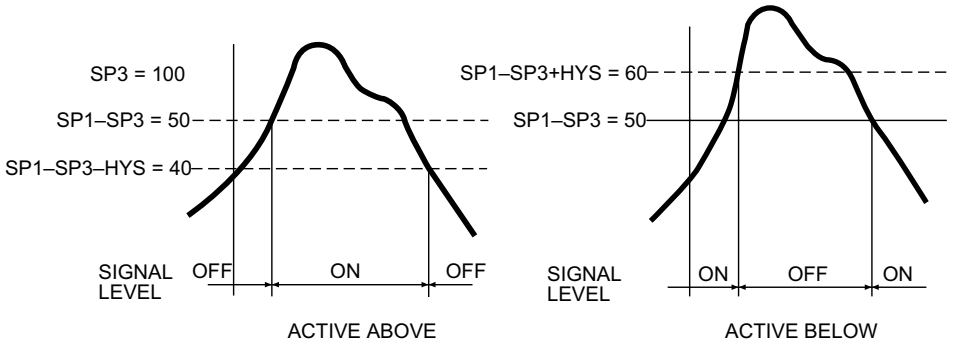


Figure 10-5. Low Deviation for both Active Above and Active Below

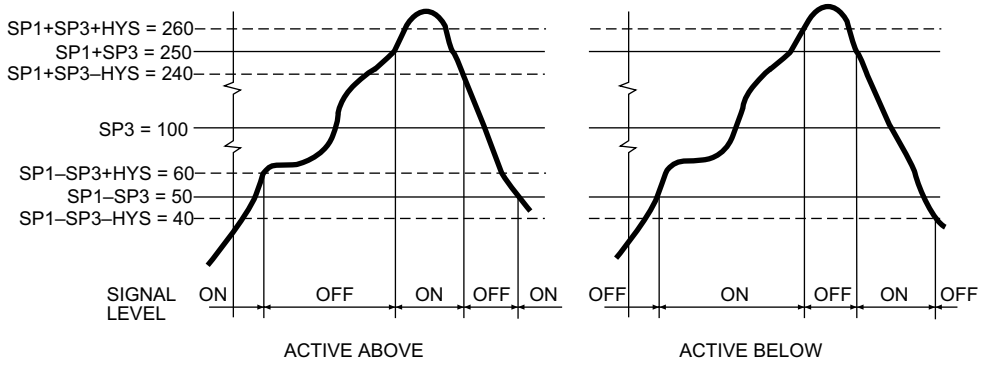


Figure 10-6. Band Deviation for both Active Above and Active Below

10.5 SELECTING "AL CNF" ALARM CONFIGURATION FEATURES

These bits offer the same selections for "SP 3" and "SP 4" as "SP CNF" did for "SP 1" and "SP 2", except for the last bit, which controls "SP 3" and "SP 4" LATCH reset.

1. "ALC.1=0" makes Alarm 1 (Setpoint 3) active above the Setpoint value.

   "ALC.1=1" makes Alarm 1 (Setpoint 3) active below the Setpoint value.

When Alarm 1 (Setpoint 3) is assigned to place a band about the Setpoint 1 level (by setting "ALF.1=3", described in Section 10.6), "ALC.1=0" makes Alarm 1 (Setpoint 3) active ABOVE and BELOW the band (OUTSIDE the band), with the chosen hysteresis for Alarm 1 (Setpoint 3) now inside the band. If "ALC.1=1", Alarm 1 (Setpoint 3) is active INSIDE the band, with the chosen hysteresis for Alarm 1 (Setpoint 3) now outside the band.

Figure 10-7 Illustrates the Alarm configuration for hysteresis.

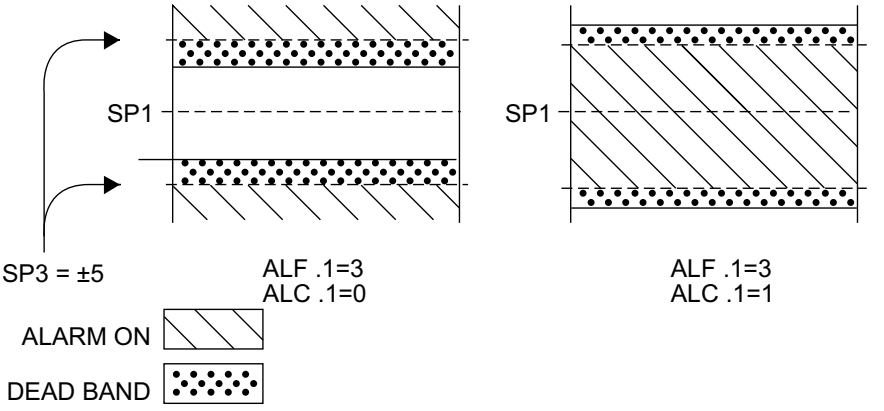


Figure 10-7. AL CNF Hysteresis

2. "ALC.2=0" turns the Alarm 1 (Setpoint 3) open-collector output ON when Setpoint 3 is active.

   "ALC.2=1" turns it OFF.

3. "ALC.3=0" compares the Alarm 1 (Setpoint 3) level to the UNFILTERED measurements.

   "ALC.3=1" compares the Alarm 1 (Setpoint 3) level to the FILTERED measurements.

4. "ALC.4=0" makes Alarm 2 (Setpoint 4) active ABOVE the Setpoint value.

   "ALC.4=1" makes Alarm 2 (Setpoint 4) active BELOW the Setpoint value.

When Alarm 2 (Setpoint 4) is assigned to place a band about the Setpoint 4 level (by setting "ALF.1=3", described in Section 10.6), "ALC.4=0" makes Alarm 2 (Setpoint 4) active ABOVE and BELOW the band (OUTSIDE the band), with the chosen hysteresis for Alarm 2 (Setpoint 4) now inside the band. If "ALC.4=1", Alarm 2 (Setpoint 4) is active INSIDE the band, with the chosen hysteresis for Alarm 2 (Setpoint 4) now outside the band.

5. "ALC.5=0" turns the Alarm 2 (Setpoint 4) open-collector output ON when Setpoint 1 is active.

   "ALC.5=1" turns it OFF.

6. "ALC.6=0" compares the Alarm 2 (Setpoint 4) level to the UNFILTERED measurements.

   "ALC.6=1" compares the Alarm 2 (Setpoint 4) level to the FILTERED measurements.

7. “ALC.7=0” ENABLES both Alarms 1 and 2 (Setpoints 3 and 4) action and LEDs.

   “ALC.7=1” DISABLES both Alarms 1 and 2 (Setpoints 3 and 4) action and LEDs.

8. “ALC.8=0” DISABLES Alarm reset at the P2-11 connector.

   “ALC.8=1” ENABLES Alarm reset at the P2-11 connector.

Press the **‘MENU’** button to store any changes and advance to “AL FNC” (Alarm Function).

10.6 SELECTING “AL FNC” ALARM FUNCTION FEATURES

This byte allows you to select independent or ganged operation for “SP 3” and “SP 4”, and whether or not they should latch once triggered.

1. “ALF.1=0” makes Alarm 1 (Setpoint 3) INDEPENDENT, with a level equal to the value inserted for Setpoint 3.

   “ALF.1=1” assigns Setpoint 3 (“SP 3”) to Setpoint 1 (“SP 1”), placing it ABOVE Setpoint 1 (“SP 1”) by the amount entered for Setpoint 3 (“SP 3”).

   “ALF.1=2” places “SP 3” BELOW “SP 1” by the amount entered for “SP 3”.

   “ALF.1=3” places “SP 3” ON BOTH SIDES OF “SP 1” by the amount entered for “SP 3”.

2. “ALF.2=0” makes Alarm 1 (Setpoint 3) a NON-LATCHING Alarm.

   “ALF.2=1” makes Alarm 1 (Setpoint 3) LATCHING. This means that once Alarm 1 (Setpoint 3) is triggered it will remain active until it is reset by pressing the **‘RESET’** button one time or by grounding P2-11 when configuration bit “ALC.8=1” is set. Reset can also be accomplished via the optional RS-232 or RS-485 serial communication board.

3. “ALF.3=0” makes “SP 4” INDEPENDENT, with a level equal to the value inserted for “SP 4”.

   “ALF.3=1” assigns “SP 4” to “SP 2”, placing it ABOVE “SP 2” by the amount entered for “SP 4”.

   “ALF.3=2” places “SP 4” BELOW “SP 2” by the amount entered for “SP 4”.

   “ALF.3=3” places “SP 4” ON BOTH SIDES OF “SP 2” by the amount entered for “SP 4”.

4. “ALF.4=0” makes Alarm 2 (Setpoint 4) a NON-LATCHING Alarm.

   “ALF.4=1” makes Alarm 2 (Setpoint 4) LATCHING. This means that once Alarm 2 (Setpoint 4) is triggered it will remain active until it is reset by pressing the **‘RESET’** button one time or by grounding P2-11 when configuration bit “ALC.8=1” is set. Reset can also be accomplished via the optional RS-232 or RS-485 serial communication board.

Press the **‘MENU’** button to store any changes and advance to “AL RDG” (Alarm Reading).

10.7 “AL RDG”: ALARM READINGS-SELECT DELAY IN ALARM ACTION

This byte allows you to select the number of input readings required to trigger Alarm 1 (Setpoint 3) and Alarm 2 (Setpoint 4) action.

When “AL RDG” is displayed, press the **‘MIN’** button to see two

2-digit numbers, with the first one flashing, indicating that you can reset the delay for SP3 by pressing the **‘MAX’** button.

After choosing “SP 3” delay, press the **‘MIN’** button and select the delay for “SP 4” by pressing the **‘MAX’** button.

Store your selections or changes by pressing the **‘MENU’** button and advance to “SP DB” (Setpoint Deadband).

10.8 “SP DB”: SELECT “SP 1” AND “SP 2” DEADBAND (HYSTERESIS)

The deadband (hysteresis) for Setpoint 1 (“SP 1”) and Setpoint 2 (“SP 2”) is displayed with the same decimal point location as chosen for run mode.

This selected hysteresis value is EVENLY SPLIT on both sides of the levels chosen for “SP 1” and “SP 2”.

View the value by pressing the **‘MIN’** button, reset by pressing the **‘MAX’** button, and store by pressing the **‘MENU’** button. Advance to “AL DB” (Alarm Deadband).

10.9 “AL DB”: SELECT ALARM 1 (“SP 3”) AND ALARM 2 (“SP 4”) DEADBAND (HYSTERESIS)

This selected deadband (hysteresis) for Alarm 1 (“SP 3”) and Alarm 2 (“SP 4”) is placed on the INACTIVE side of the selected levels. This results in immediate action (if zero (0) delay is selected in “AL RDG”) when an alarm limit is exceeded, but defers recovery when the input returns to pre-alarm levels.

Press the **‘MIN’** button to view the values, change the values of each flashing digit by pressing the **‘MAX’** button, store any changes by pressing the **‘MENU’** button. Advance to “OUT.CNF” (Output Configuration).

10.10 "OUT.CNF": CONTROL FLASHING OF THE DISPLAY

You may wish to bring abnormal conditions to immediate attention by causing the display to flash.
Press the **'MIN'** button to see "OUT.6".
Press the **'MAX'** button to select "0", "1", "2", "3", "4", or "5".

"OUT.6=0" disables display flashing.
"OUT.6=1" flashes the display if SP1 is active.
"OUT.6=2" flashes the display if SP2 is active.
"OUT.6=3" flashes the display if SP3 is active.
"OUT.6=4" flashes the display if SP4 is active.
"OUT.6=5" flashes the display if any SP is active.

Save your choice or changes by pressing the **'MENU'** button and the meter will momentarily display "STORED", then "RUN" and proceed with normal operation (go into run mode).

10.11 ENTERING SETPOINT LEVELS (IN RUN MODE)

When you have completed selecting the setpoint(s) (and other features), the last press of the **'MENU'** button stores any changes and the meter will automatically return to the run mode (the display will momentarily display "RESET2"). The stored values are placed into operation, and the meter proceeds with normal measurements.

Now you can view and reset all four setpoint levels.

1. Press the 'SETPTS' button. The meter now starts its setpoint display cycle; every 15 seconds, the display flashes the SP number, and then displays the value of that setpoint, with a flashing left-hand digit.
2. You can restart the time-out of any of these display intervals by pressing the **'MIN'** button (to shift the flashing [alterable] digit position), or by pressing the **'MAX'** button (to increment the value of that digit).
3. When you change the value of any setpoint and then decide to revert to the original value instead, just press the **'RESET'** button or allow the display to return to "RUN" at the end of its cycle. The meter does not store a new value for the setpoint in either case.
4. To save a newly-entered setpoint value, press the 'SETPTS' button again.
5. You may return to viewing the measurements by pressing the **'RESET'** button or repeatedly pressing the 'SETPTS' button (or by letting the meter complete its setpoint display cycle).

PEAK AND VALLEY READINGS

The meter examines every new reading to see if it is greater than the stored PEAK or less than the stored VALLEY readings.

If you have unlocked access to these values with “L1C.5=0” and “L1C.6=0” (part of the first lockout byte “L1 CNF”), you can view the PEAK (“HI RDG”) by pressing the **‘MAX’** button, or the VALLEY (“LO RDG”) by pressing the **‘MIN’** button while in the run mode.

Selection of either PEAK or VALLEY causes the display to flash giving the indication that it is NOT the current measurement value. If the meter measures a more extreme value while displaying the PEAK or VALLEY measurement, the new value will immediately replace the old.

Unlike the setpoint display, there is no time out period. Press the ‘SETPTS’ button or **‘MENU’** button to return to current-value display WITHOUT resetting the PEAK or VALLEY memory.

Press the **‘RESET’** button to return to run mode and start a new PEAK/VALLEY measurement period.

The BCD option can be programmed to read the PEAK (but not the VALLEY) instead of the current measurement (refer to Section 13).

Both PEAK and VALLEY readings (and/or a PEAK/VALLEY status summary character) can be transmitted by the RS-232 or RS-422/485 digital communications (refer to Section 15).

The PEAK or VALLEY value can be transmitted via the optional analog output board (refer to Section 12).

ANALOG OUTPUT OPTION

If you received your meter with the optional analog board installed, you should not have to enter the trim data as described in Section 12.5.

Your meter converts display readings into an independently-scaled-and-offset isolated voltage and/or current analog output. Isolation is accomplished via opto-isolators on the board. Your meter has the capability of transmitting SIMULTANEOUS voltage and current outputs although when this is done, the current analog output is not as accurate.

12.1 FEATURES OVERVIEW

1. Precise analog levels are generated from digital code using a proprietary ASIC chip.
2. Voltage (to 10 V) is available at the same time as current (to 22 mA), but the total current drawn should not exceed 24 mA.
3. Load resistance for the voltage output can be as low as 500 ohms (20 mA at 10 V out) when current output is not used.
4. Loop resistance for the current output can be as high as 600 ohms (12 volts compliance) with negligible current from the voltage output.
5. Both outputs are galvanically isolated from both power and measurement circuits of the meter: 354 V per IEC spacing, 500 V test.
6. Precision calibration is applied by the meter to either the voltage output or the current output (but not to both simultaneously). When both outputs are used simultaneously, the non-calibrated output is stable but does require external adjustment if fine-trimming is required.
7. Independent, 15-bit resolution OuTput SCale and OFfset (OT.SC.OF) can convert a wide range of meter readings to the desired current or voltage output span.
8. The output resolution permits good accuracy for turndown ratios (offset/span) as high as 100:1.
9. 50° to 104°F (10° to 40°C) accuracy within 0.1% after installation calibration.
10. 10% to 90% step response time is 50 milliseconds (plus filter delay, if any, programmed for the analog output).
11. Configurable so that output will track the PEAK or VALLEY measurement.

12.2 UNLOCKING

1. Press the **'MENU'** button until "L3 CNF" is displayed, then press the **'MIN'** button until "L3C.7" is displayed.
2. Press the **'MAX'** button (if required) to set "L3C.7=0", unlocking the choice of current or voltage as the calibrated output.
3. Press the **'MIN'** button (and the **'MAX'** button if required) to set "L3C.8=0", unlocking OT.SC.OF.
4. Press the **'MENU'** button to store these choices.
5. If your analog board is NEWLY INSTALLED, you will need to enter the four trimming constants (refer to the one-time only procedure in Section 12.5). To unlock this feature, press the **'MIN'** button and then the **'MAX'** button to set "L4C.6=0" and store by pressing the **'MENU'** button.

12.3 "OUT.CNF": CONFIGURING THE OUTPUT

1. Press the **'MENU'** button until "OUT.CNF" is displayed, then press the **'MIN'** button to display "OUT.1=0" or "OUT.1=1".
2. Press the **'MAX'** button to set "OUT.1=1" if you wish the analog output to be driven at once when you return to run mode. (You can leave this as "OUT.1=0" and complete all the other programming if you wish to activate the analog output at a later time by returning to this configuration bit).
3. Press the **'MIN'** button (and the **'MAX'** button if required) and set "OUT.2=0" for calibrated VOLT output (0-1 V, 0-5 V, 1-5 V, or 0-10 V) or "OUT.2=1" for calibrated CURRENT (0-20 mA or 4-20 mA) output.
4. Press the **'MENU'** button to store these choices (the rest of the "OUT.CNF" byte controls BCD and display-flashing features).

   After pressing the **'MENU'** button again, you advance to "OT.SC.OF" (Output Scale and Offset).

12.4 "OT.SC.OF": SETTING OUTPUT SCALE AND OFFSET

Any two data points can be used here: a data point is specified by a value of the display ("READ") and the desired output ("OUTPT") for that display.

1. Press the **'MIN'** button to see "READ1" and then use the **'MIN'** and **'MAX'** buttons to enter a small display value, for example, "000.000", where the center decimal point position is used as an example.
2. Store this value by pressing the **'MENU'** button and then you see "OUTPT1". Use the **'MIN'** and **'MAX'** buttons to specify the desired output value, for example, "04.0000" if current calibration had been selected ("OUT.2=1"), or "00.0000" for voltage.
3. Store this value by pressing the **'MENU'** button and then advance to "READ2". Use the **'MIN'** and **'MAX'** buttons to enter a large display value, for example, "123.456", for the display that you want the analog output at full scale.

4. Store this value by pressing the **'MENU'** button and then advance to "OUTPT2". Use the **'MIN'** and **'MAX'** buttons to enter the desired output for the display value in step 3. For example, enter "20.0000" for calibrated current or "10.0000" for calibrated voltage.
5. Press the **'MENU'** button to store. Press the **'RESET'** button two times to return to run mode and check calibration points, unless your analog output board is newly installed; in this case, follow Section 12.5.

12.5 BOARD INSTALLATION; ENTERING THE TRIM DATA

To precisely calibrate your analog output board with your meter, each analog output board has been supplied with voltage and current zero trim values printed on the board. "CAL VZ" is for the voltage output and "CALmAZ" is for the current output.

Similarly, the fine trim for output gain is "CAL VS" for the voltage output and "CALmAS" for the current output.

These 4 data points are obtained from the factory calibration of each analog output board and are inscribed on the top edge of each board, as shown in Figure 12-1.

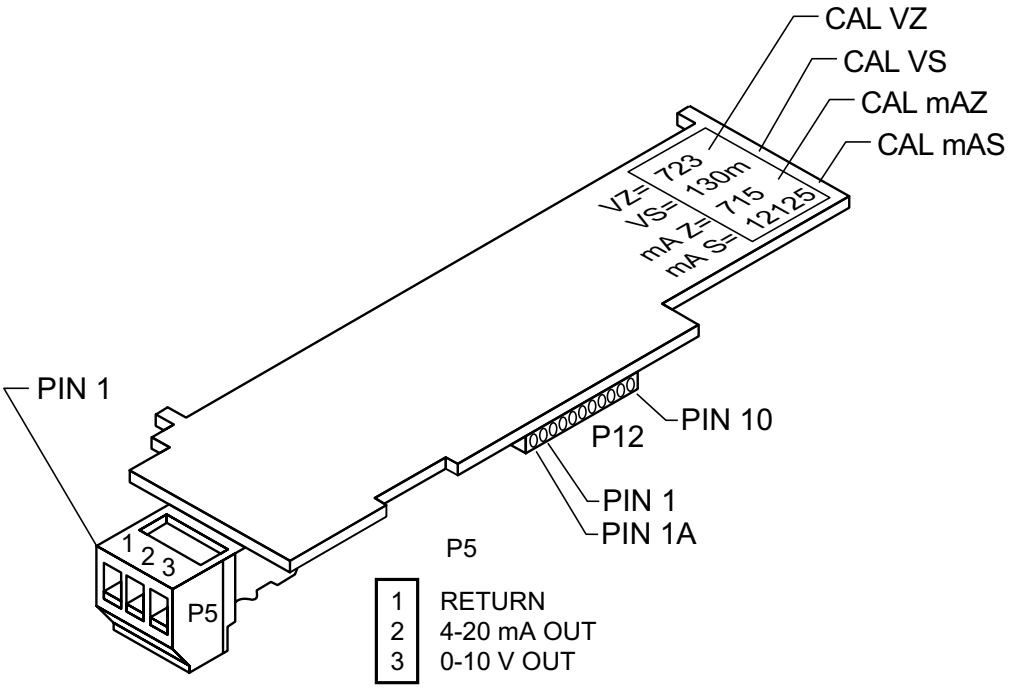


Figure 12-1. Analog Option Board and Connection Diagram at P5.

12 Analog Output Options

If you are installing an analog output board, follow this “one time only” procedure:

1. Write down the four (4) numbers inscribed on the top edge of your analog output board below:

   CAL VZ = _____

   CAL VS = _____

   CALmAZ = _____

   CALmAS = _____

2. “Reveal the main board” and install the analog output board using the procedures outlined in Section 5.2.
3. Attach connector wires, insert connectors, and apply power to the meter as described in Section 5.3.
4. If not already unlocked, press the **‘MENU’** button until “L4 CNF” is displayed and press the **‘MIN’** button six times. Now press the **‘MAX’** button to set “L4C.6=0”.
5. Press the **‘MENU’** button to store and advance to “CAL VZ”. Use the **‘MIN’** and **‘MAX’** buttons to enter the value (recorded from the edge of the board).
6. Press the **‘MENU’** button to store and advance to “CAL VS”. Use the **‘MIN’** and **‘MAX’** buttons to enter the value.
7. Repeat for “CALmAZ”.
8. Repeat for “CALmAS”.
9. Press the **‘MENU’** button to store your entries and then you will see “C.JUN.OF”. Press the **‘RESET’** button two times and you will see “RESET2”, followed by “RUN”. Verify your calibration points for the analog output.

12.6 FILTER CONFIGURATION "FIL.CNF" VALUE TO BE TRANSMITTED ON ANALOG OUTPUT

1. Press the **'MENU'** button until the display shows "FIL.CNF".
2. Press the **'MAX'** button until the display shows "FIL.3=0", "FIL.3=1", "FIL.3=2", or "FIL.3=3".
3. "FIL.3=0" Transmits the unfiltered value of your signal input.
   "FIL.3=1" Transmits the filtered value of your signal input.
   "FIL.3=2" Transmits the recorded PEAK ("HI RDG") value(s).
   "FIL.3=3" Transmits the recorded VALLEY ("LO RDG") value(s).
4. Press the **'MENU'** button to store your selection or changes and the meter will advance to "FIL TI" (Filter Time Constant). Press the **'RESET'** button two times to return to the run mode.

12.7 WIRING/CONNECTIONS

WARNING: Do not connect ac power to your meter until you have completed all input and output connections. Failure to do so may result in injury! This device must only be installed electrically by specially trained electrician with corresponding qualifications.

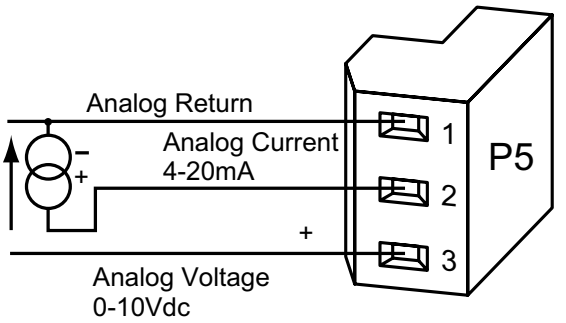


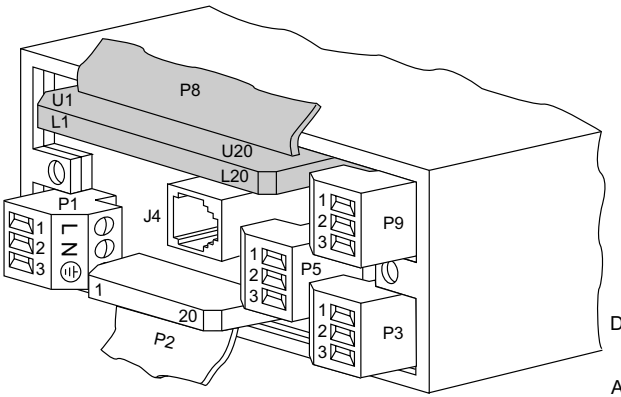
Figure 12-2. Isolated Analog Output Board Wiring Connections.

13 BCD Option

13.1 FEATURES OVERVIEW

1. 6 BCD digits (24 lines plus 1 polarity, 3 decimal-point location code, 1 overflow, 1 timing, 1 control, 4 card address, and 3 isolation power lines).
2. Furnished 40-line mass-terminated connector: pin compatibility with 50-pin BCD cable assignments.
3. Can be jumpered for internal, non-isolated drive or external power with isolation (354 V per IEC spacing, 500 V test).
4. Upper 3 BCD digits can be multiplexed onto lower 3 BCD lines for 3 digits at a time readout.
5. All outputs tri-state, TTL/CMOS compatible, 10 LSTTL loads.
6. Data always valid (stored, buffered).
7. Selectable 4-line card address (with internal pull-ups) or single-line activation.

Figure 13-1 shows the rear of the meter case with the 40-line edge connector highlighted and the upper and lower pin assignments.



	P8		
BCD 400K	L1	U1	BCD 800K
BCD 100K	L2	U2	BCD 200K
ISO RTN	L3	U3	SPARE
BCD 40K	L4	U4	BCD 80K
BCD 10K	L5	U5	BCD 20K
BCD 4K	L6	U6	BCD 8K
BCD 1K	L7	U7	BCD 2K
D.P. 2	L8	U8	D.P. 4
BCD 400	L9	U9	BCD 800
BCD 100	L10	U10	BCD 200
BCD 40	L11	U11	BCD 80
BCD 10	L12	U12	BCD 20
BCD 4	L13	U13	BCD 8
BCD 1	L14	U14	BCD 2
ISO RTN	L15	U15	D. P. 1
DATA READY	L16	U16	POLARITY
ISO V+	L17	U17	HOLD
SPARE	L18	U18	OVERFLOW
ADDRESS B4	L19	U19	ADDRESS B8
ADDRESS B1	L20	U20	ADDRESS B2

Figure 13-1. BCD 40-Pin Cable Connector (P8)

Figure 13-2 shows the board connections and pin designators. The locations of the jumpers are also shown.

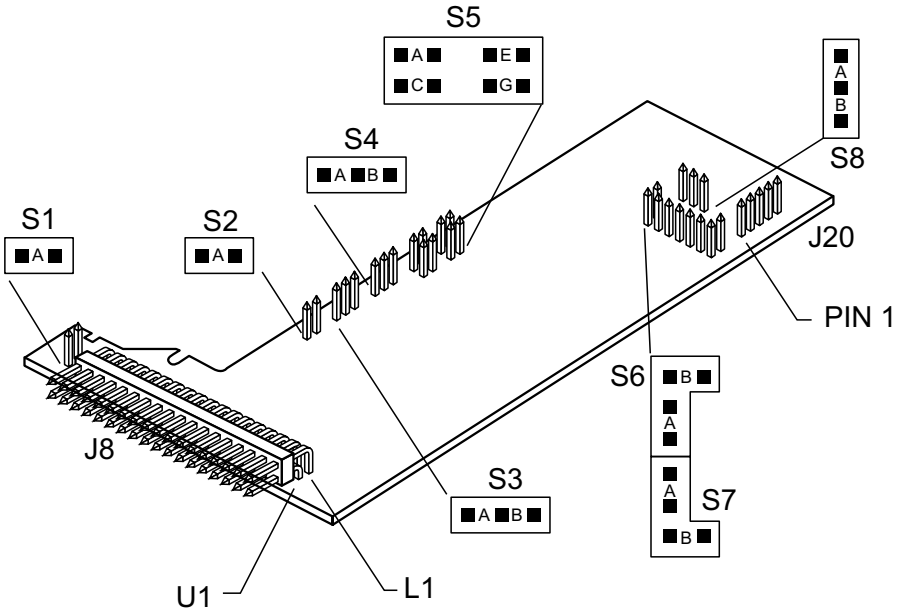


Figure 13-2. BCD Option Board

13.2 BCD CARD JUMPER TABLE

JUMPER	WHEN USED
S1A	Brings OVERFLOW signal to P8-U18
S2A	Insert for 3-digit multiplex
	Remove for 6-digit readout
S3A	Insert for 3-digit multiplex or one-line card-address enable
	OR
S3B	4-line card-address enable
S4A	Insert for 3-digit multiplex
	OR
S4B	Insert for 6-digit readout
S5A	P8-U20 must be low to enable card
	Remove for high or open enable
S5C	P8-L20 must be low to enable card
	Remove for high or open enable
S5E	P8-U19 must be low to enable card
	Remove for high or open enable
S5G	P8-L19 must be low to enable card
	Remove for high or open enable
S6A, S6B,	Install for internal power
S7A, S7B	Remove for isolated power
S8A	Output data is negative-true
	OR
S8B	Output data is positive-true

13.3 INTERCONNECT BOARD

For mechanical support and electrical interconnection, each BCD board is shipped with a small 5-pin INTERCONNECT board. Insert onto the main board pins immediately behind the right-hand side of the display board. The BCD board itself (component side down) is then plugged into the interconnect board at J20, with the PCB connection fingers protruding from the case rear. For assembly detail, refer to Figure 5-4 (in Section 5).

13.4 50-LINE CABLE COMPATIBILITY

The 40 lines of the BCD connector are compatible with lines 9 through 48 of some 50-line busses (left-most 8 and right-most 2 are not used by this BCD option).

13.5 SELECTING THE SOURCE OF BCD DATA: "OUT.CNF"

If "L3C.7=0" has been selected to unlock the OUTput CoNFiguration byte, set "OUT.3=1" to send data to this BCD board. "OUT.4=0" selects that data as the DISPLAYED (current) measurement value. "OUT.4=1" sends the PEAK (HI) value to the BCD. Save your selection by pressing the **'MENU'** button.

13.6 $\overline{\text{HOLD}}$ CONTROL

P8-U17 is the $\overline{\text{HOLD}}$ line, referenced to the same ground as the BCD outputs (on P8-L15 and P8-L3). Pulling this line low freezes the BCD outputs (useful for a slow reading device or asymmetric cable delays).

When released, all 6 digits of the BCD data are updated together.

13.7 $\overline{\text{DATA READY}}$ TIMING PULSES

The tri-state BCD outputs are always valid (to within a few nanoseconds; a single update pulse controls all the digits).

To generate a timing marker, P8-L16, $\overline{\text{DATA READY}}$, goes active low for approximately 200 microseconds at the time of each BCD update. The polarity of this line is NOT CHANGED by S8, the data polarity control jumper.

13.8 BRINGING OUT THE BCD OVERFLOW LINE

P8-U18 can be used for BCD OVERFLOW by inserting jumper S1A. If this line is used for another purpose by some other equipment on the BCD bus, remove this jumper.

13.9 3 DIGIT AT A TIME MULTIPLEX

When jumpers S2A, S3A, and S4A are used, P8-L20 and S5C control when the upper 3 digits of the 6-digit BCD value appear on the output line (P8-U9 through P8-L14).

With jumper S5C, a LOW level on P8-L20 activates those upper 3 digit outputs; a high or open level disables those digits.

With jumper S5C removed, a high or open level on P8-L20 enables those upper 3 digits and a low level disables them.

When the upper 3 digits are NOT enabled, the lower 3 digits can be enabled in just the same way by jumper S5A and P8-U20, and they now appear on the same 12 lines.

13.10 6 DIGIT AT A TIME CARD ADDRESS

Jumpers S2A and S4A are removed for full parallel (6-digit output).

If jumper S3A is installed, the outputs are enabled by line P8-L20 ALONE: a low level enables the outputs when jumper S5C is installed, and a high or open level does the job if S5C is removed.

When jumper S3A is removed, the outputs are enabled only when the selected 4-line address is applied to P8-U19, L19, U20 and L20. Each of these four is exclusive-OR'd with its jumper, and the following four outputs are AND'd to create a 1 of 16 enable code.

If jumper S5A is installed, P8-U20 must be LOW to enable the card (BIT 2).

If jumper S5C is installed, P8-L20 must be LOW to enable the card (BIT 1).

If jumper S5E is installed, P8-U19 must be LOW to enable the card (BIT 8).

If jumper S5G is installed, P8-L19 must be LOW to complete enabling the card outputs (BIT 4).

BINARY BIT	1	2	4	8		1	2	4	8
JUMPER S5–	C	A	G	E		C	A	G	E
00	X	X	X	X	08	X	X	X	
01		X	X	X	09		X	X	
02	X		X	X	10	X		X	
03			X	X	11			X	
04	X	X		X	12	X	X		
05		X		X	13		X		
06	X			X	14	X			
07				X	15				

Figure 13-3. Address Programming Chart for 4 -line Address

Note ☞

NOTE: "X" in chart indicates jumper that must be installed.

EXAMPLE: For a positive true address of 03, install jumpers S5-G and S5-E.

If any of these jumpers are removed, the corresponding line must go HIGH or OPEN to assist the card enable; if all four jumpers are missing, for example, the card outputs are enabled ONLY when all four lines are HIGH or OPEN, a ground on any of the four input lines causes the outputs to go the high impedance state.

13.11 SELECT DATA POLARITY: JUMPER S8

Inserting the jumper in S8B (the usual shipping position) makes the output data (including decimal point code) positive-true. Placing the jumper in S8A converts the data to negative-true.

13.12 DECIMAL POINT ADDRESS CODE

P8-U15, P8-L8 and P8-U8 output a 3-bit positive-true binary code for the location of the decimal point: “001” for the extreme right position and “110” for the extreme left position (just to the right of the left-hand digit).

Panel-mounted printers, however, may require an inverted/shifted decimal point code. You can create this by setting “OUT.5=1” in the “OUT.CNF” byte (unlocked by setting “L1C.7=0”), rather than the normal “OUT.5=0”.

13.13 APPLYING NON-ISOLATED/ISOLATED POWER

Non-isolated power from the meter is connected to this board by inserting jumpers S6A, S6B, S7A, and S7B (bridging the isolation separation distance on the board). Current drawn is less than 10 mA.

To isolate these outputs from the other meter circuits, remove the four jumpers described earlier, and connect an external, nominal 5 V supply to P8-L17, with its ground return connected to P8-L15.

13.14 DRIVING A PRINTER

Direct connection of the 24 BCD lines and the 3 decimal point address lines is all that is needed for positive-true printers that accept a binary-coded decimal point address (which do not print the decimal point).

If your printer has more than 6 digits, tie the unused inputs to ground or V+ or leave open (whichever produces blanks in those locations).

For negative-true decimal point addresses, found in some panel-mounted printers, set “OUT.5=1” (part of menu item “OUT.CNF”, unlocked by “L1C.7=0”).

14 Relay Options

14.1 FEATURES OVERVIEW

The Dual Relay Output Board and 4 Relay Output Board provides two isolated (354 V per IEC spacing, 500 test), 7-ampere Form-C electro-mechanical relays that enable setpoint-triggered switching to an external device (plus two 1-ampere Form-C electro-mechanical relays for 4 Relay Option). Each relay can accommodate a single setpoint. 200 W, 2500pf snubbers are provided for each normally open contact.

These options may not be used with parallel BCD Board Option. Figure 14-1 and 14-2 shows the board connections and jumper locations.

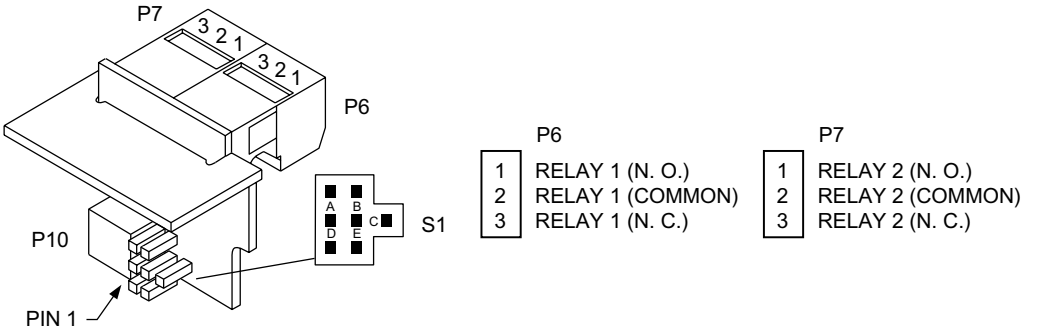


Figure 14-1 Dual Relay

TABLE 14.1 Dual Relay Board Jumpers

JUMPER	FUNCTION
S1A*	Drives Relay 1 from SP3 (P6)
S1B	not used
S1C	Drives Relay 2 from SP2 (P7)
S1D	Drives Relay 1 from SP1 (P6)
S1E*	Drives Relay 2 from SP4 (P7)

* Factory preset jumper locations

Figure 14-2 below show the locations of the 4 Relay Output Board jumpers, the P10 plug connecting the board to the Main Board, and the positions of P6, P7 and P18, the output plugs.

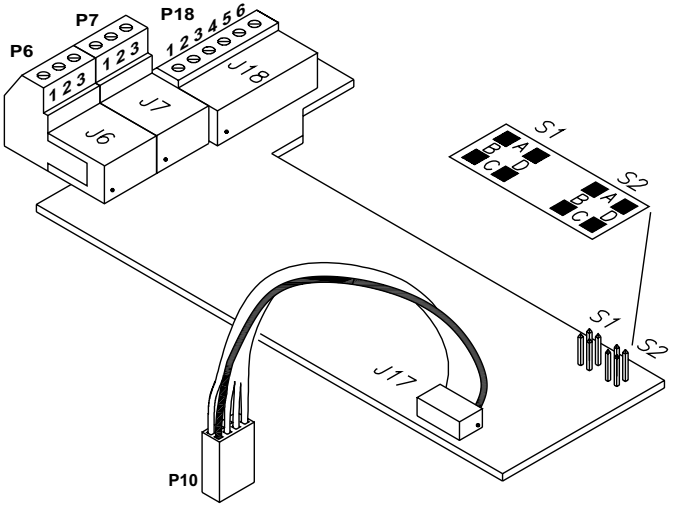


Figure 14-2. 4 Relay Board Jumpers and Plugs.

Table 14-2 shows which jumpers are assigned to each relay. Defaults have asterisks.

Table 14-2. 4 Relay Board Jumpers.

S1	S2	FUNCTION
A, C*	A, C*	Assigns SP1 to Relay 1 (P6) Assigns SP2 to Relay 2 (P7) Assigns SP3 to Relay 3 (P18) Assigns SP4 to Relay 4 (P18)
B, D	A, C	Assigns SP1 to Relay 3 (P18) Assigns SP2 to Relay 2 (P7) Assigns SP3 to Relay 1 (P6) Assigns SP4 to Relay 4 (P18)
B, D	B, D	Assigns SP1 to Relay 3 (P18) Assigns SP2 to Relay 4 (P18) Assigns SP3 to Relay 1 (P6) Assigns SP4 to Relay 2 (P7)
A, C	B, D	Assigns SP1 to Relay 1 (P6) Assigns SP2 to Relay 4 (P18) Assigns SP3 to Relay 3 (P18) Assigns SP4 to Relay 2 (P7)

14.2 WIRING/CONNECTIONS

WARNING: Do not connect ac power meter until you have completed all input and output connections. Failure to do so may result in injury! This device must only be installed electrically by specially trained electrician with corresponding qualifications.

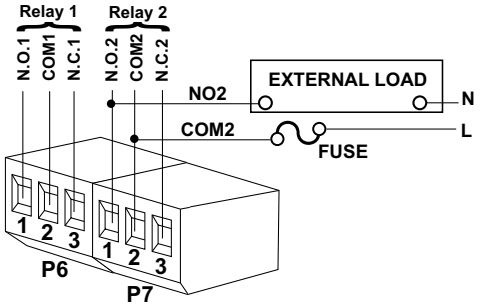


Figure 14-3. Dual Relay Output Board Wiring Connections

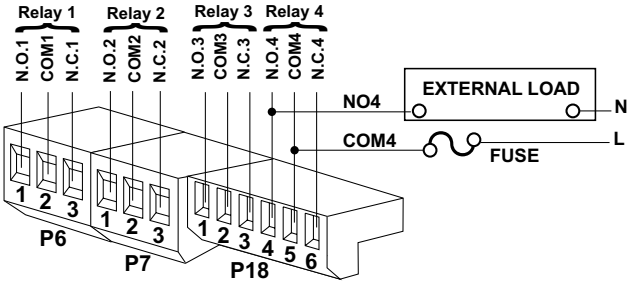


Figure 14-4. 4 Relay Output Board Wiring Connections

CONNECTOR	PIN	FUNCTION
P-6	1	NO1 (Normally Open)
(Relay 1 Connection)	2	Common 1
	3	NC1 (Normally Closed)
P-7	1	NO2 (Normally Open)
(Relay 2 Connection)	2	Common 2
	3	NC2 (Normally Closed)
P-18	1	NO3 (Normally Open)
(Relay 3 & 4	2	Common 3
Connection	3	NC3 (Normally Closed)
for 4 Relay Option only.)	4	NO4 (Normally Open)
	5	Common 4
	6	NC4 (Normally Closed)

Table 14-3 Pin Assignments for the P6, P7 and P18 plugs

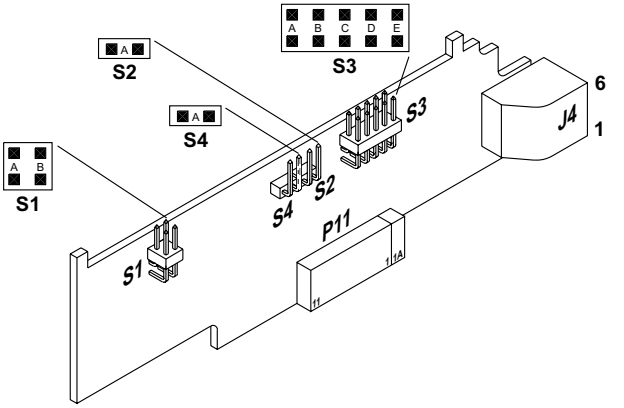
15.1 FEATURES OVERVIEW

The Isolated Serial RS-232 Communications Board provides an isolated digital communications channel between a single meter and another meter or device, or between a single meter and a computer. The Isolated Serial RS-485 Communications Board adheres to the IEC standard, providing an isolated channel between up to 32 meters and a single computer or intelligent device–but can actually address up to 199 devices.

1. When you order either option board, you will also receive a six foot communications cable that plugs into J4. Optional female 9-pin and 25-pin “D” computer connector-adapters are offered for either RS-232 or RS-422/485 hookup.
2. The latest Operation and Communication Manual as well as free configuration software and ActiveX controls are available from **the website listed in this manual or on the CD-ROM enclosed with your shipment**.
3. The communications board you ordered, plugs into the main board socket (P11 connects into J11 next to the transformer) with the 6-pin telephone socket. J4 is then protruding out of the rear of the case.
4. Choose baud rate from 300 to 19200. Standard factory setting is 9600.
5. Wide choice of commands and message formats available.

15 RS-232 or RS-485 Option Board

Figure 15-1 gives the board connections and pin designators for RS-232/RS-485.



METER RJ-12 PIN (J4)	RS232	RS485 HALF DUPLEX	RS485 FULL DUPLEX
6			
5	GND		
4	RX		RX-
3	TX	RX-TX-	TX-
2	RTS	RX+/TX+	RX+
1			TX+

Figure 15-1. RS-232/RS-485 Option Board and Pin Designations

Figure 15-2 shows board connections and pin designators for older RS-232 and RS-485 option cards.

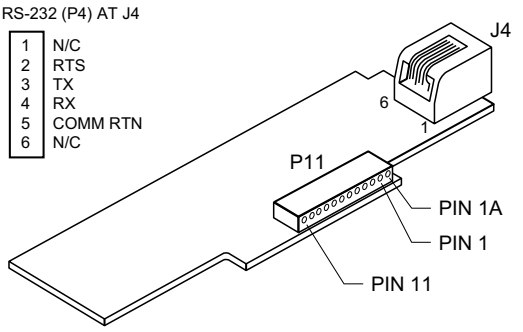


Figure 15-2a. Older RS-232 Option Board and Pin Designations

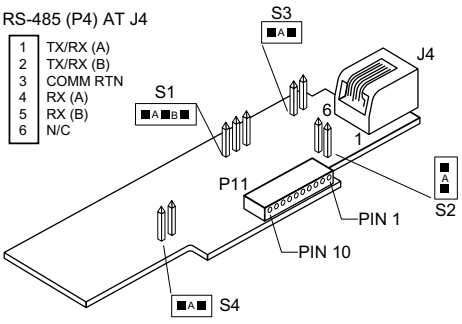


Figure 15-2b. Older RS-485 Option Board and Pin Designations

15.2 FRONT-PANEL PUSHBUTTON CONFIGURATION

Setup configuration can be accomplished via the front panel buttons or via your computer if you use the configuration setup program. If you are going to use a computer, your choices include “AUTO SET” or “MANUAL SET” for establishing communication with your meter. “AUTO SET” cycles through the possible combinations of baud rate, parity and stop bits to find a match for your meter settings. For faster action, you may enter the values for your meter via “MANUAL SET”.

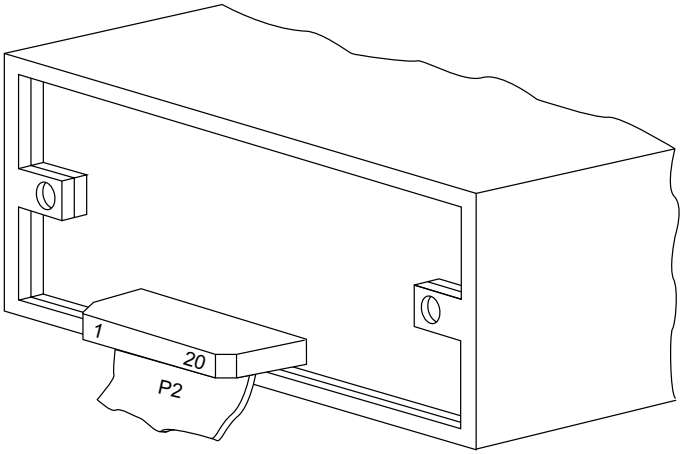
If your meter communications settings are unknown or need changing, you can insert the factory-set values with the front panel buttons (or, after communications has been established, from your keyboard).

1. Unlock the communications bits by setting “L4C.1=0”, “L4C.2=0”, “L4C.3=0”, “L4C.4=0” and “L4C.5=0”.
2. Press the **‘MENU’** button until “BAUD” is displayed, then press the **‘MAX’** button until the baud rate you require is displayed. Press the **‘MENU’** button to store this choice and your meter will display “SERCNF”.
3. Press the **‘MIN’** button until you see the display show “SER.1=0” for no parity, “SER.1=1” for odd parity, or “SER.1=2” for even parity. Press the **‘MAX’** button to select the parity required for your system. Once you have done that, press the **‘MIN’** button and advance to “SER.2=0” or “SER.2=1”.
4. By pressing the **‘MAX’** button you can select the “SER.2” value. Setting “SER.2=0” picks the value to one stop bit; “SER.2=1” selects two stop bits. Select “SER.2=0”.
5. Pressing the **‘MENU’** button stores these choices and then the meter advances to “ADDRES”. Use the **‘MAX’** button to set to “001” (unless your meter is one of several on an RS-485 bus, in which case you must give a different address to each device and use those addresses when communicating from your computer).
6. Press the **‘MENU’** button again and press the **‘RESET’** button two times to return to the run mode. The remaining communications format and options are set from your keyboard.

EXTERNAL CONTROL LINES

P2, the 20-pin connector at the rear of the main board, connects to the setpoint transistor collectors and permits remote control of significant meter features.

The meter case label gives the names (abbreviated functions) of each of the twenty pins of P2, the center-bottom connector. Refer to Figure 16-1.



P2

TARE(T)	1	2	PEAK (P)
VALLEY (V)	3	4	SWLIN2
PEAK/VALLEY OR EXT. RESET	5	6	PUSH TO CAL
DIG RTN	7	8	+5V
DISPLAY HOLD	9	10	LOCKOUT EEPROM &
RESET ALARMS AND/OR	11		MENU PUSH BUTTON
PRINT COMMAND		12	NONSTANDARD RX
NONSTANDARD TX	13	14	PUSH TO CAL
+V EXT	15	16	SP1
SP2	17	18	AL1
AL2	19	20	RTN EXT

Figure 16-1. Connector Label Detail

16.1 TARE (PIN 1)

Tare is available when P2-1 and P2-4 are connected to a momentary contact switch. This feature allows you to automatically zero your meter when the switch is activated.

16.2 PEAK (PIN 2)

When this is connected to P2-4 by an external switch, the meter displays the stored PEAK (“HI RDG”) value rather than the current reading. The display flashes to distinguish this value.

16.3 VALLEY (PIN 3)

When this is connected to P2-4 by an external switch, the meter displays the stored valley ("LO RDG") value rather than the current reading. The display flashes to distinguish this value.

16.4 SWLIN2 (PIN 4)

Completes the circuit for any of the above three signals.

16.5 PEAK & VALLEY OR EXTERNAL RESET (PIN 5)

Connecting this to ground (P2-7) when "RDG.7=0" has been programmed causes a "HARD" **RESET** (when you see "RESET2" on the display). If you set "RDG.7=1", grounding causes only a PEAK/VALLEY **RESET**.

16.6 PUSH TO CAL (PIN 6)

Not applicable for process meters.

16.7 DIGITAL RETURN (PIN 7)

This is a non-isolated return to be used for the digital controls provided on this P2 connector.

WARNING: THIS METER RETURN IS NOT ISOLATED FROM THE SIGNAL INPUT AND SHOULD NOT BE CONNECTED TO EXTERNALLY-GROUNDED DEVICES UNLESS ISOLATION IS PROVIDED EITHER AT THE SIGNAL INPUT OR AT THIS EXTERNAL-LOGIC CONNECTION.

16.8 +5 V (PIN 8)

Up to 20 mA is available for driving external devices, but isolation should be provided if there is a possibility of common mode (ground) currents, since this supply is NOT isolated from the signal input.

16.9 DISPLAY HOLD (PIN 9)

Grounding this pin to P2-7 freezes the display value. However, the meter continues to take new samples and update the other outputs, such as Analog Output, BCD, Setpoints/Alarms, and Peak/Valley.

16.10 LOCKOUT EEPROM (AND 'MENU' BUTTON) (PIN 10)

Grounding this pin to P2-7 stops any configuration changes and new storage into the non-volatile memory, and when in run mode does not allow entry into the setup mode when the **'MENU'** button is pressed.

16.11 PRINT COMMAND AND/OR RESET OF ALARMS (PIN 11)

Grounding this pin to P2-7 when "BUS.8=1" has been programmed will initiate a meter printout via serial communications in the format previously selected. If "ALC.8=1" it causes the alarm latches to reset.

16.12 NONSTANDARD RX (PIN 12) AND NONSTANDARD TX (PIN 13)

These two pins allow digital communications with the meter using 5 V CMOS logic levels and RS-232 protocols and format. This access is normally reserved for specialized equipment communication in a calibration lab or at the factory.

16.13 PUSH TO CAL (PIN 14)

NOT USED

16.14 +V EXT (PIN 15)

This is the pin on which to bring in isolated external 5 to 30 V to power the snubbing diodes of the four setpoint/alarm open-collector transistors.

16.15 SP1 (PIN 16)

The open-collector of the first setpoint transistor (can carry 150 mA).

16.16 SP2 (PIN 17)

The open-collector of the second setpoint transistor (can carry 150 mA).

16.17 AL1 (PIN 18)

The open-collector of the third setpoint (first alarm) transistor (can carry 150 mA).

16.18 AL2 (PIN 19)

The open-collector of the fourth setpoint (second alarm) transistor (can carry 150 mA).

16.19 RTN EXT (PIN 20)

This is the return to the external ground (P2-20) of the external power for the setpoint transistors and snubbing diodes brought in on P2-15, 16, 17, 18 and 19. Figure 16-2 shows an example of a circuit using an external relay with SP1 (Setpoint 1). If a solid state relay is used, delete connection to Pin 15.

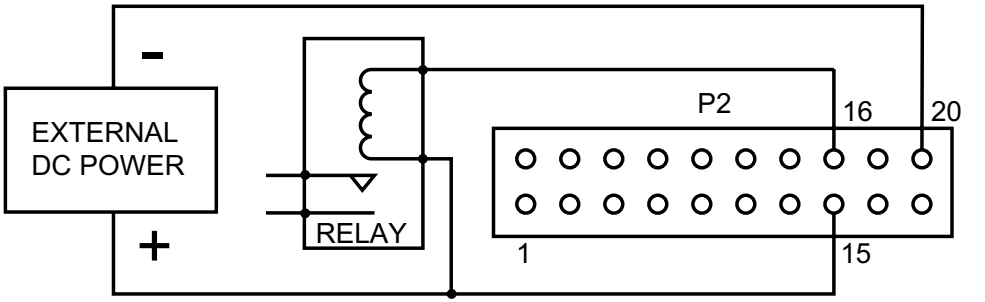


Figure 16-2. Connection of External Power for Setpoint Transistors

TROUBLESHOOTING - DISPLAY MESSAGES AND TROUBLESHOOTING GUIDE

A flashing alpha-numeric message in the display generally indicates an incorrect combination of jumpers and/or configuration values.

17.1 ERROR MODE MESSAGES

17.1.1 Flashing “999999” (Numerical Overflow)

The maximum number of counts in the display cannot exceed –99999 or 999999. If, by moving the ACTIVE decimal point one or more places to the left, you cause the display to move beyond the maximum number of counts it is capable of showing (for example, 12345.0 to 12345.00), the display will indicate the overflow by flashing “999999”.

17.1.2 Flashing “ERR O1” (Offset Overflow)

When an offset value has been entered and then the ACTIVE decimal point has been moved one or more places to the left, causing the offset display reading to move beyond the maximum number of counts it is capable of showing (for example, 1000.00 to 1000.000), the display will go into offset overflow.

Note ☞

NOTE: The meter will only display 6 digits (999999) maximum.

17.1.3 Flashing “ERR O2” (Setpoint Overflow)

After a Setpoint (or Alarm) value has been entered and then the ACTIVE decimal point has been moved one or more places to the left, causing the setpoint display reading to move beyond the number of counts it is capable of showing (for example, setpoint at 100.00 and then a decimal point change to 100.0000), the display will indicate the SETPOINT OVERFLOW by momentarily flashing “ERR 02” before returning to the run mode.

Note ☞

NOTE: The meter will only display 6 digits (999999) maximum.

17.1.4 “NOSTOR” & “STORED” (Programming Entries In EEPROM)

If you are in the configuration mode and you make a CHANGE to any setup parameter (for example, changing “RDG.1 = 1” to “RDG.1 = 0”) and press the **‘MENU’** button, the display will MOMENTARILY flash either “STORED” or “NOSTOR” and then go to the next menu item. If you are in a submenu, this will only occur when you press the **‘MENU’** button to go to the next menu item.

17.1.5 Flashing “+OVLD” (Positive Input Overload)

If the input signal exceeds the range selected (for example, 0-100 mV range selected and greater than 200 mV is applied to the input), the display will flash a “+OVLD”.

17.1.6 Flashing “+OPEN” (Open Sensor Indication)

Coupled with the proper jumper selection, the display will indicate an open sensor.

17.1.7 Flashing “-OPEN” (Open Sensor Indication)

Coupled with the proper jumper selection, a “-OPEN” indicates the input is below the bottom limit of the range selected.

17.1.8 Flashing “I OVSC” (Input Overscale)

This display occurs when the input scale and/or offset applied to the input signal causes the display to go into a numerical overflow.

17.1.9 Flashing “R OVSC” (Reading Overscale)

This display occurs when the reading scale and/or offset applied to the input signal causes the display to go into a numerical overflow.

17.1.10 Flashing “CB OVF” (Count By Overflow)

When a display value near the maximum display capability is forced into a numerical overflow by changing the CNT BY menu (for example, the display reads 999997 and the count by is changed from 001 to 005 and rounds the display up to 1000000).

17.1.11 Flashing “UOM.OVF” (Unit Of Measure Overflow)

If a unit of measure is selected and you are near the full scale capability of the display and in the ACTIVE decimal mode, the display will shift one digit to the left (for example, to a display of 1065.33 you add a unit of measure such as “F” for a display of 1065.33F), the display will flash “UOM.OVF”.

17.2 TROUBLESHOOTING GUIDE

“99999”	
POSSIBLE CAUSE:	Active decimal point change driving the display into numerical overload.
TO CORRECT:	Press the **‘MAX’** button to reset the entire display to all zeros, then enter a revised number into the submenu item that caused the overflow.
“ERR 01”	
POSSIBLE CAUSE:	Active decimal (“RDG.2=0”) has been selected and/or DEC PT (decimal point) position has been moved one or more places to the left driving the programmed offset value into numerical overflow.
TO CORRECT:	Press the **‘MENU’** button and the meter will show the left most decimal point position possible for the chosen offset: by pressing the **‘MENU’** button again this revised entry is stored. Alternately, the amount of RDG.OF may be reduced to get the decimal point further to the left.

continued next page

“ERR 02”

POSSIBLE CAUSE:	Active decimal (RDG.2) has been selected and/or DEC PT (decimal point) position has been moved one or more places to the left driving the programmed Setpoint value into numerical overflow.
TO CORRECT:	Display will flash “ERR 02” message for a short period of time, then automatically correct the setpoint’s decimal point position and move to the next menu item. Press the ‘**SETPT**’ button until the meter displays flashing “999999”. Then press the **‘MAX’** button to reset the display to “000000” and enter a new valid setpoint value.

“+OVLD”

POSSIBLE CAUSE:	The positive input CURRENT & VOLTAGE exceeds the input range selected.
TO CORRECT:	Check both the input range and the actual input to find the error condition and either reduce the input or change jumpers to a higher input range for more input attenuation.

“-OVLD”

POSSIBLE CAUSE:	The negative input voltage exceeds the input range selected.
TO CORRECT:	Check both the input range and the actual input to find the error condition and either reduce the input or change jumpers to a higher input range for more input attenuation.

“+OPEN”

POSSIBLE CAUSE:	Input sensor is open or broken, or the connection to the meter is open or broken. Input sensor is not wired to the proper input terminals.
TO CORRECT:	Check thermocouple or RTD wiring.

“-OPEN”

POSSIBLE CAUSE:	The input sensor is open or broken, or the connection to the meter is open or broken. The input sensor is not wired to the proper input terminals. The input signal is below the minimum specified (refer to Section 18, Specifications).
TO CORRECT:	When jumper S2R on the signal input board is used, this will be indicated if a sensor lead is broken or otherwise opened. Check thermocouple or RTD wiring.

“I OVSC”

POSSIBLE CAUSE:	The input scale and/or offset values chosen are large enough to drive the display into numerical overflow.
TO CORRECT:	Reduce the input and/or the input scaling/offset. Refer to “IN.SC.OF” in Section 9.2.5.

“R OVSC”

POSSIBLE CAUSE:	The reading scale and/or offset values chosen are large enough to drive the display into numerical overflow.
TO CORRECT:	Reduce the reading scale/offset and/or move the active decimal point to the right. Reducing input scale/offset is not required, because the input overscale message has higher priority than this message and would be displayed if there were an input overscale.

“CB OVF”

POSSIBLE CAUSE:	CNT BY (count by value) has been changed causing the display to round up to a numerical overflow.
TO CORRECT:	Reduce the “CNT BY” count by value to 001. If you have an active decimal point selected, move the decimal point one or more positions to the right.

“UOM.OVF”

POSSIBLE CAUSE:	Selection of unit of measure displayed (“RDG.6=0”) moves the display reading one place to the left causing a numerical overflow.
TO CORRECT:	If you have an active decimal point, move the decimal point position one or more positions to the right.

“SERIAL”

POSSIBLE CAUSE:	A configuring change has been attempted via the front panel buttons while the serial communications port is actively communicating with the meter.
TO CORRECT:	Either lockout the front panel buttons by removing the jumpers S3A & S3C or disconnect the serial communications option.

18.1 CURRENT INPUT

INPUT RANGES(+10%):	0-20 mA and 4-20 mA
RESOLUTION:	1µA
MAXIMUM INPUT:	200 mA
INPUT OHMS:	5

18.2 VOLTAGE INPUT

INPUT RANGES:				
UNIPOLAR:	100 mV	1 V	10 V	100 V
BIPOLAR:	±50 mV	±0.5 V	±5 V	±50 V
RESOLUTION:	1 µV	10 µV	100 µV	1 mV
MAX INPUT:	70 Vp	350 Vp	350 Vp	300 Vp
INPUT OHMS:	1G	1M	1M	1M
BIAS AMPS:	50 pA	5 pA	1 pA	1 pA

18.3 POTENTIOMETER INPUT

INPUT RANGES:	1 V or 10 V
RESOLUTION:	programmed to 0.001%

18.4 GENERAL

SCALE:	+0.000001 to +500000 or –0.0001 to –99999.
OFFSET:	Zero to +999999
POLARITY:	Automatic

NOISE REJECTION

NMR:	60 dB, 50 or 60 Hz, + selected filter
CMR:	120 dB
CMV:	Dielectric strength to 1500 V transient per 260 VRMS or DC working voltage.

ACCURACY at 25 ºC:	
MAX ERROR:	±0.005% of reading
SPAN TEMPCO:	less than 20 ppm/ºC
STEP RESPONSE:	1 second to 99.9%

WARMUP:	55 minutes to rated accuracy. It is recommended that the unit be continuously running to insure its accuracy.	
CONVERSION TECHNIQUE:	Dual-slope	
	READRATE and DISPLAY UPDATE/Programmable	
INTEGRATION TIME:	3 samples/sec:	100 msec
	13 samples/sec, 60 Hz:	16.7 msec
	12 samples/sec, 50 Hz:	20 msec
DISPLAY LEDs:	6, 0.54” (13.8mm)h, red, 14-segment 4, 0.12” x 0.24” (3 x 6mm), red lamp	
SYMBOLS:	–.8.8.8.8.8. or 8.8.8.8.8.8.	
DECIMAL POINT POSITION:	Programmable	

SENSOR EXCITATION

AC-POWERED:	1.5 to 11 Vdc, up to 60 mA max. 24 Vdc at 25 mA max.
DC-POWERED:	10 Vdc at 120 mA 24 Vdc at 35 mA Can power up to 4 load cells.

OUTPUTS

(STANDARD):	4, isolated open collector; 150 mA at 1 V sink; 30 V open
BCD OUTPUT:	Tri-state, TTL/CMOS compatible; internal 5 V supply for non-isolated, external 5 V supply for isolated.
ANALOG OUTPUT:	0-5 V, 1-5 V, 0-10 V, 0-20 mA, 4-20 mA level; compliance, 12 V at 20 mA; 15-bit resolution; 0.1% accuracy; programmable zero and span.
RELAY OUTPUT:	Dual Form-C relays or 4 Form-C relay

POWER RATING FOR RESISTIVE LOADS:	
DUAL AND 4 RELAY:	Two relays at P6 and P7 Normally open contact, 7 amp; 30Vdc or 230Vac Normally closed contact, 7 amp; 30Vdc or 230Vac
4 RELAY ONLY:	Two relays at P18 Normally open contact, 1 amp; 24Vdc or 30Vac Normally closed contact, 1 amp; 24Vdc or 30Vac

TURNDOWN RATIO

(MAX OFFSET-MIN SPAN):	1000 with 0.1% or 100 with 0.01% resolution

COMMUNICATIONS INFORMATION

RS-232 COMMUNICATIONS:	RJ11 4-wire connection; complete program setup and message display capability; programmable to transmit current display, alarm status, MIN/MAX, and status
BAUD RATES:	300, 600, 1200, 2400, 4800, 9600, 19200
RS-485 COMMUNICATIONS:	RJ12 6-wire connection; addressable from “000” to “199”.
BAUD RATES:	300, 1200, 2400, 4800, 9600, 19200

POWER

~ AC UNITS:	115/230 Vac ±10%, 50/60 Hz 12 W max power consumption
= DC UNITS:	10-32 Vdc, 3 to 9 W consumption 0.001% of span/volt power supply rejection
EXTERNAL FUSE REQUIRED:	
115 Vac	IEC127-2/III, 125mA, 250V (Time-Leg) or UL Slow-Blow, 125mA, 250V
230 Vac	IEC127-2/III, 63mA, 250V (Time-Leg) or UL Slow-Blow, 63mA, 250V

18 Specifications

ENVIRONMENTAL

OPERATING TEMP RANGE:	0 to 50 ºC (32 to 140°F)
STORAGE TEMP RANGE:	–40 to 85 ºC (–40 to 202°F)
HUMIDITY:	up to 95% non-condensing at 40°C (104°F)
FRONT PANEL:	NEMA-4 rated

MECHANICAL

DIMENSIONS (H x W x D):	1.89 x 3.78 x 5.86in. (48 x 96 x 145mm)
PANEL CUTOUT (H x W):	1/8 DIN 1.772 X 3.622in. (45 x 92mm)
WEIGHT:	1.316 pounds (600 g)
MATERIAL:	94V-0 UL-rated Polycarbonate

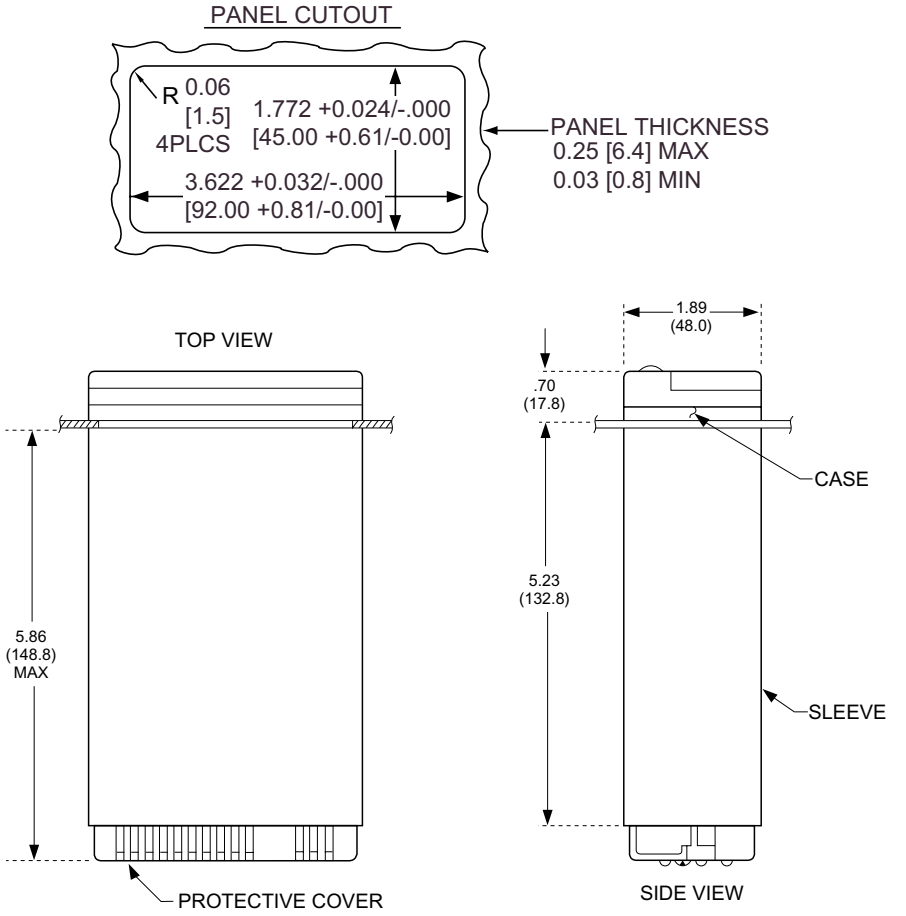


Figure 18-1. Meter Housing and Panel Cutout.

FLASHING MESSAGES

DURING PROGRAMMING (configuration mode)

NUMERICAL OVERFLOW:	“999999”
OFFSET OVERFLOW:	“ERR 01”
SETPOINT OVERFLOW:	“ERR 02”
NOT STORED IN EEPROM:	“NOSTOR”
VALUE PUT IN EEPROM:	“STORED”

DURING MEASUREMENT (RUN MODE)

INPUT TOO LARGE, POSITIVE:	“+ OVLD”
INPUT TOO LARGE, NEGATIVE:	“– OVLD”
INPUT OUT OF RANGE, POSITIVE:	“+ OPEN”
INPUT OUT OF RANGE, NEGATIVE:	“– OPEN”
EXCESS INPUT SCALE/OFFSET:	“I OVSC”
EXCESS DISPLAY SCALE/OFFSET:	“R OVSC”
COUNT-BY DISPLAY OVERFLOW:	“999999”

DURING SETPOINT ADJUST (RUN MODE)

OUT OF SELECTED DIGIT RANGE:	“999999”
NOT STORED IN EEPROM:	“NOSTOR”
VALUE PUT IN EEPROM:	“STORED”

19 Factory Preset Values

JUMPER POSITIONS:

ac Powered unit

S1: NONE S2: A, F, M, N, T, U
S3: A, C S4: B

dc Powered unit

S1 (dc power board): A
S1: NONE S2: A, F, M, N, T, U
S3: A, C, D S4: A S5: A

LOCKOUT CONFIGURATION(S)

L1 CNF	L2 CNF	L3 CNF	L4 CNF
L1C.1=0	L2C.1=0	L3C.1=0	L4C.1=0
L1C.2=0	L2C.2=0	L3C.2=0	L4C.2=0
L1C.3=0	L2C.3=0	L3C.3=0	L4C.3=0
L1C.4=0	L2C.4=0	L3C.4=0	L4C.4=0
L1C.5=0	L2C.5=0	L3C.5=0	L4C.5=0
L1C.6=0	L2C.6=0	L3C.6=0	L4C.6=1
L1C.7=0	L2C.7=0	L3C.7=0	
L1C.8=0	L2C.8=0	L3C.8=0	

Input Class: Current: “CURRNT”
Input Type: 4-20 mA

Reading Configuration “RDG.CNF”:

RDG.1=0 RDG.2=0 RDG.3=0 RDG.4=0
RDG.5=0 RDG.6=0 RDG.7=0

Reading Scale

(“RDG SC”): 1.00000

Reading Offset

(RDG OF”): -00000

Input Configuration “IN CNF”:

INP.1=0 INP.2=0 INP.3=0 INP.4=0
INP.5=0 INP.6=0 INP.7=0

Input Scale and Offset “IN.SC.OF”:

INPUT 1: 000000. READ 1: 000000.
INPUT 2: 100000. READ 2: 100000.

Decimal Point “DEC PT” Position: FFFFFF.
Count By “CNT BY”: 001
Filter Configuration “FIL.CNF”: FIL.1=0 FIL.2=1 FIL.3=1
Filter Time Constant “FIL TI”: 064

Setpoint Configuration “SP CNF”:

SPC.1=0	SPC.2=0	SPC.3=1	SPC.4=0
SPC.5=0	SPC.6=1	SPC.7=0	SPC.8=0

Alarm Configuration “AL CNF”:

ALC.1=0	ALC.2=0	ALC.3=1	ALC.4=0
ALC.5=0	ALC.6=1	ALC.7=0	ALC.8=0

Alarm Function “AL FNC”:

ALF.1=0	ALF.2=0	ALF.3=0	ALF.4=0

Alarm Number of Readings “AL RDG”: 03 03 for (AL1) (AL2)
Setpoints 1 & 2 Deadband “SP DB”: 0020
Alarms 1 & 2 Deadband “AL DB”: 0020

Output Configuration “OUT.CNF”:

OUT.1=0	OUT.2=1	OUT.3=0	OUT.4=0
OUT.5=1	OUT.6=0		

Output Scale and Offset “OT.SC.OF”:

READ 1: 000000.	OUTPT 1: 04.0000
READ 2: 100000.	OUTPT 2: 20.0000

Baud Rate “BAUD”: 09600

Serial Communication Configuration “SERCNF”:

SER.1=1	SER.2=0

Address “ADDRES” (for RS-485): 001

Data Format “DAT FT”:

DAT.1=0	DAT.2=0	DAT.3=1	DAT.4=0
DAT.5=0	DAT.6=0	DAT.7=0	DAT.8=0

Bus Format “BUS FT”:

BUS.1=0	BUS.2=0	BUS.3=1	BUS.4=0
BUS.5=1	BUS.6=0	BUS.7=0	BUS.8=1

Serial Count “SERCNT”: 00001

ANALOG OUTPUT

CAL VZ:
CAL VS:
CAL mAZ:
CAL mAS:

JUMPER POSITIONS:

Current

S1: _____ S2: _____

S3: _____ S4: Not used

Voltage

S1: _____ S2: _____

S3: _____ S4: Not used

Potentiometer

S1: _____ S2: _____

S3: _____ S4: Not used

LOCKOUT CONFIGURATION(S)

L1 CNF	L2 CNF	L3 CNF	L4 CNF
L1C.1=___	L2C.1=___	L3C.1=___	L4C.1=___
L1C.2=___	L2C.2=___	L3C.2=___	L4C.2=___
L1C.3=___	L2C.3=___	L3C.3=___	L4C.3=___
L1C.4=___	L2C.4=___	L3C.4=___	L4C.4=___
L1C.5=___	L2C.5=___	L3C.5=___	L4C.5=___
L1C.6=___	L2C.6=___	L3C.6=___	L4C.6=___
L1C.7=___	L2C.7=___	L3C.7=___	L4C.7=___
L1C.8=___	L2C.8=___	L3C.8=___	

Input Class: (check one)

"CURRNT": _____

"VOLT": _____

"POT": _____

Input Type:

For Current: _____

For Volt: _____

For Pot: _____

Reading Configuration "RDG.CNF":

RDG.1=__ RDG.2=__ RDG.3=__ RDG.4=__ RDG.5=__
RDG.6=__ RDG.7=__

Reading Scale and Reading Offset "RDG SC" and "RDG OF" (Direct Format):

Reading Scale "RDG SC": _____

Reading Offset "RDG OF": _____

20 Record your Setup Values

Reading Scale & Offset
(2-coordinate Format):

INPUT 1= _____ READ 1= _____
INPUT 2= _____ READ 2= _____

Input Configuration “IN CNF”:

INP.1=__ INP.2=__ INP.3=__ INP.4=__
INP.5=__ INP.6=__ INP.7=__

Input Scale and Offset “IN.SC.OF”:

INPUT 1: _____ READ 1: _____
INPUT 2: _____ READ 2: _____

Decimal Point “DEC PT” Position: F__F__F__F__F__F__
Count By “CNT BY”: _____
Filter Configuration “FIL.CNF”: FIL.1=__ FIL.2=__ FIL.3=__
Filter Time Constant “FIL TI”: _____

Setpoint Configuration “SP CNF”:

SPC.1=__ SPC.2=__ SPC.3=__ SPC.4=__
SPC.5=__ SPC.6=__ SPC.7=__ SPC.8=__

Alarm Configuration “AL CNF”:

ALC.1=__ ALC.2=__ ALC.3=__ ALC.4=__
ALC.5=__ ALC.6=__ ALC.7=__ ALC.8=__

Alarm Function “AL FNC”:

ALF.1=__ ALF.2=__ ALF.3=__ ALF.4=__

Alarm Number of Readings “AL RDG”: ____ ____
Setpoints Deadband “SP DB”: _____
Alarms 1 & 2 Deadband “AL DB”: _____

Output Configuration “OUT.CNF”:

OUT.1=__ OUT.2=__ OUT.3=__ OUT.4=__
OUT.5=__ OUT.6=__ OUT.7=__ OUT.8=__

Output Scale and Offset “OT.SC.OF”:

READ 1: _____ OUTPT 1: _____

READ 2: _____ OUTPT 2: _____

Baud Rate “BAUD”: _____

Serial Communication Configuration “SERCNF”:

SER.1=__ SER.2=__

Address “ADDRES” (for RS-485): _____

Data Format “DAT FT”:

DAT.1=__ DAT.2=__ DAT.3=__ DAT.4=__

DAT.5=__ DAT.6=__ DAT.7=__ DAT.8=__

Bus Format “BUS FT”:

BUS.1=__ BUS.2=__ BUS.3=__ BUS.4=__

BUS.5=__ BUS.6=__ BUS.7=__ BUS.8=__

Serial Count “SERCNT”: _____

ANALOG OUTPUT

CAL VZ: _____

CAL VS: _____

CAL mAZ: _____

CAL mAS: _____

Warranty/Disclaimer

NEWPORT Electronics, Inc. warrants this unit to be free of defects in materials and workmanship for a period of one (1) year from the date of purchase. In addition to NEWPORT's standard warranty period, NEWPORT Electronics will extend the warranty period for four (4) additional years if the warranty card enclosed with each instrument is returned to NEWPORT.

If the unit should malfunction, it must be returned to the factory for evaluation. NEWPORT's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by NEWPORT, if the unit is found to be defective it will be repaired or replaced at no charge. NEWPORT's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of NEWPORT's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

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Return Requests/Inquiries

Direct all warranty and repair requests/inquiries to the NEWPORT Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO NEWPORT, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM NEWPORT'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting NEWPORT:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult NEWPORT for current repair charges. Have the following information available BEFORE contacting NEWPORT:

1. P.O. number to cover the COST of the repair,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

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NEWPORT Electronics, Inc.

TAUNTON, MA
SCUM CONCENTRATOR
SPEC SECTION #11317, 13321
AIR CONDITIONER
PENTAIR - T200216G100

PROAIR
AIR CONDITIONER
CR23 MODEL

INSTRUCTION MANUAL

DESIGN WITH CONFIDENCE™

Rev. A

P/N 89112522

TABLE OF CONTENTS

RECEIVING THE AIR CONDITIONER

Inspect the air conditioner. Check for concealed damage that may have occurred during shipment. Look for dents, scratches, loose assemblies, evidence of oil, etc. Damage evident upon receipt should be noted on the freight bill. Damage should be brought to the attention of the delivering carrier -- NOT to Pentair Equipment Protection -- within 15 days of delivery. Save the carton and packing material and request an inspection. Then file a claim with the delivering carrier.

Pentair Equipment Protection cannot accept responsibility for freight damages; however, we will assist you in any way possible.

HANDLING AND TESTING THE AIR CONDITIONER

If the air conditioner has been in a horizontal position, be certain it is placed in an upright, vertical or mounting position for a minimum of five (5) minutes before operating.

⚠ CAUTION

Do not attempt to operate the air conditioner while it is horizontal or on its side, back or front. The refrigeration compressor is filled with lubricating oil. This will cause permanent damage to the air conditioner and also voids the warranty.

TEST FOR FUNCTIONALITY BEFORE MOUNTING THE AIR CONDITIONER TO THE ENCLOSURE.

Refer to the nameplate for proper electrical current requirements, and then connect the power cord to a properly grounded power supply. Minimum circuit ampacity should be at least 125% of the amperage shown in the design data section for the appropriate model. No other equipment should be connected to this circuit to prevent overloading.

Operate the air conditioner for five (5) to ten (10) minutes. No excessive noise or vibration should be evident during this run period. The condenser blower (ambient air), the evaporator blower (enclosure air), and the compressor should be running.

Condenser air temperatures should be warmer than normal room temperatures within a few minutes.

The compressor is provided with automatic reset thermal overload protection. This thermo-switch is located and mounted inside the plastic enclosure clipped to the compressor. The switch operates when the compressor overheats due to clogged or dirty inlet air filter or if ambient air temperatures exceed nameplate rating or if enclosure dissipated heat loads exceed the rated capacity of the air conditioner. The thermal overload switch will actuate and stop compressor operation. The blowers will continue to operate and the compressor will restart after it has cooled to within the thermal overload cut-in temperature setting.

INSTALLATION INSTRUCTIONS

1. Inspect air conditioner and verify functionality before mounting the air conditioner, see HANDLING AND TESTING THE AIR CONDITIONER on page 3.
2. Using the cutout dimensions shown in this manual, prepare the air "IN" and air "OUT" openings, and mounting bolt hole pattern for the enclosure.
3. Using the gasket kit provided, install gaskets to air conditioner. See Mounting Gasket Kit on page 6 for proper location.
4. Mount air conditioner on enclosure using mounting bolts and washers provided to secure unit to enclosure. Allow unit to remain upright for a minimum of five (5) minutes before starting. Caution! Air conditioner must be in upright position during operation.
5. Refer to the top of the nameplate for electrical requirements. Connect the power cord to a properly grounded power supply. Use of an extension cord is not recommended. Electrical circuit should be fused with slow blow or HACR circuit breaker.
6. When the unit is equipped with an automatic temperature controller, the controller is preset at the factory for your convenience and should not require adjustment.

SYSTEM CONTROLS

LEVEL I TEMPERATURE CONTROLLER

The Level I controller is located inside the air conditioner. To adjust, disconnect power to the air conditioner. Open the front panel by loosening the front panel screw. Refer to Figure 2 on page 7 to locate the controller. Turn the controller adjustment screw slot counter-clockwise to increase and clockwise to decrease the temperature set point, see Figure 1. The thermostat cooling setpoint is indicated by the alignment of the adjustment screw slot with the dial decal. After completing adjustment, close the front panel and tighten the front panel screw. Restore power to the air conditioner for operation.

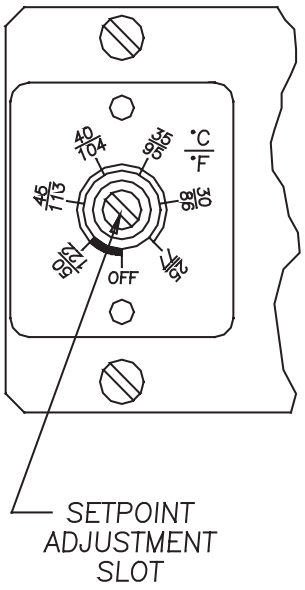


Figure 1

LEVEL II AND III TEMPERATURE CONTROLLER

The Level II and III controller is mounted on the air conditioner front panel and is factory set for standard operation. All operating parameters are programmable for custom applications. Refer to the Level II and III programming and Operating Instruction Manual, 10-1008-161.

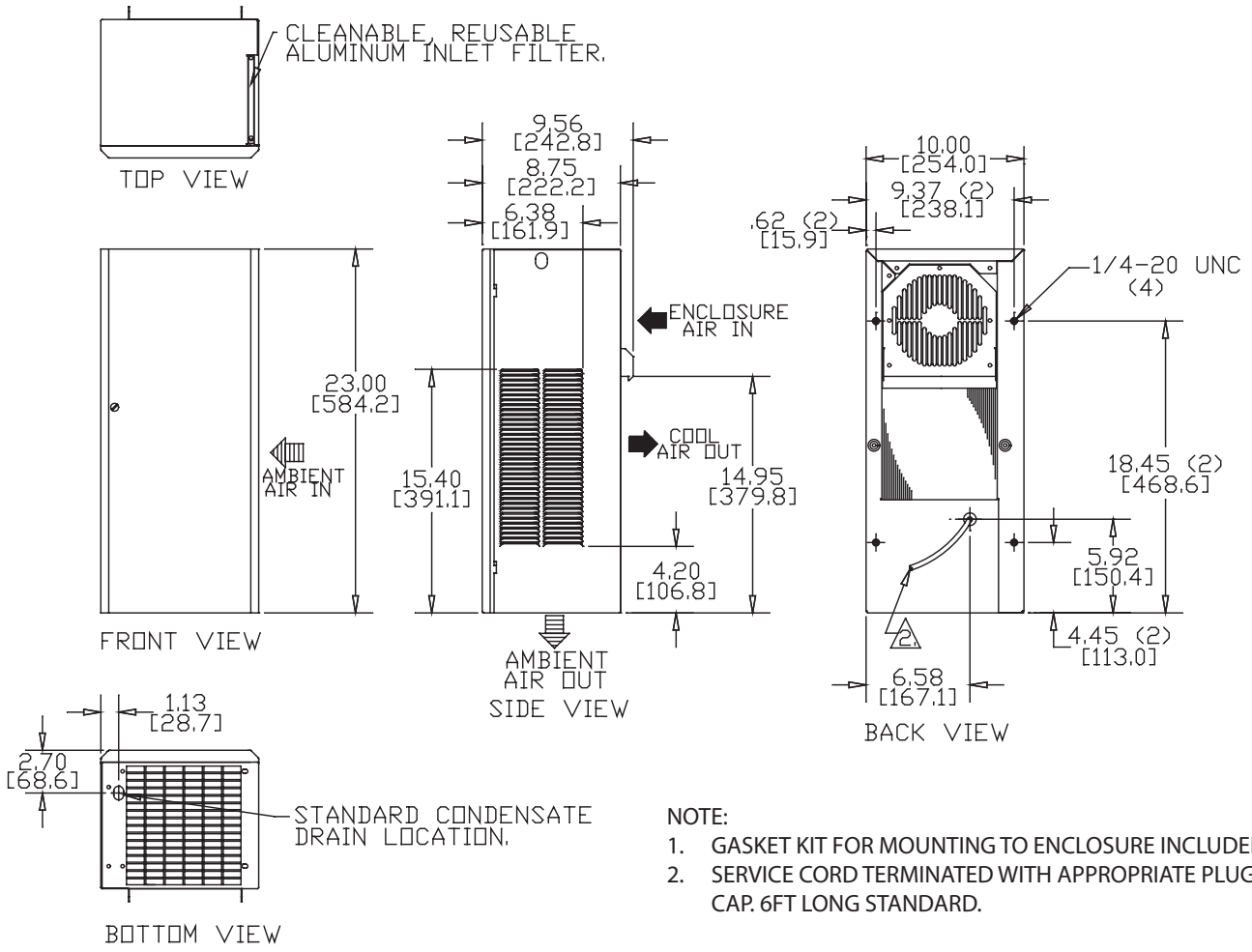
TECHNICAL INFORMATION

DESIGN DATA

Model	Voltage	Hz	Phase	BTU/Hr @ 131 F/131 F	Amps @ 131 F/131 F	BTU/Hr @ 95 F/95 F	Amps @ 95 F/95 F	Max Amb Temp °F/°C	Shipping Weight lb./kg
CR230216GXXX	115	50/60	1	1600/1600	4.1/4.0	1400/1500	3.7/3.1	131/55	57/26
CR230226GXXX	230	50/60	1	1500/1600	2.7/2.5	1400/1400	2.0/2.0	131/55	57/26

-XXX will be replaced with a three-digit number designating all desired options. Consult the factory for specific model numbers.

DIMENSION DRAWING



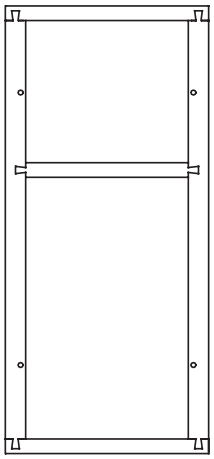
NOTE:
1. GASKET KIT FOR MOUNTING TO ENCLOSURE INCLUDED.
2. SERVICE CORD TERMINATED WITH APPROPRIATE PLUG CAP. 6FT LONG STANDARD.

MOUNTING GASKET KIT

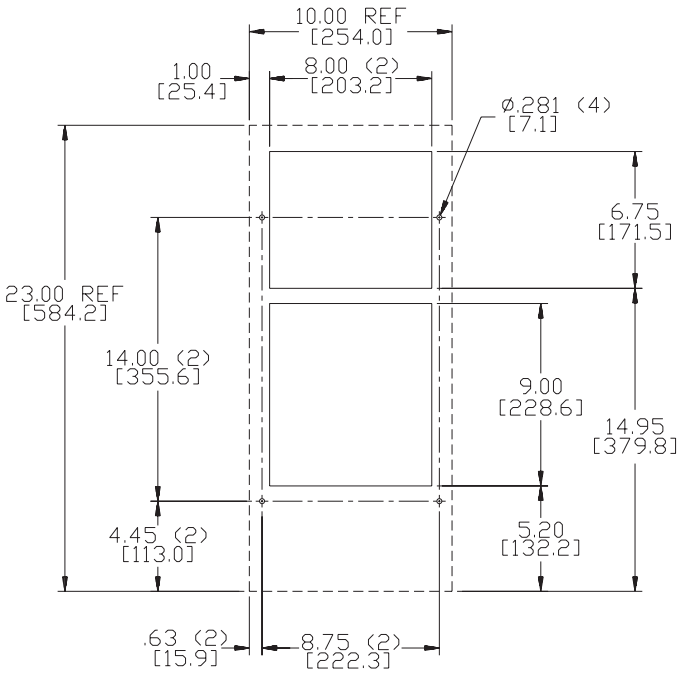
DESIGN NOTES

1. Gasket kit included. Apply gasket to rear of air conditioner before mounting on enclosure.
2. Service cord terminated with appropriate plug cap.
3. Millimeter dimensions [ ] are for reference only; do not convert to inch dimensions.
4. Allow at least 4 inch inlet and 6 inch outlet clearance for proper ambient air flow. Allow 20 inch above filter for removal.

Mounting gasket kit part no. 23-2000-00 as applied to rear of CR23.



MOUNTING CUTOUT DIMENSIONS



NOTE:

1. DASHED LINES REPRESENT OUTSIDE OF AIR CONDITIONER.

COMPONENTS LIST

Part Description	115 Volt	230 Volt
Blower, Condenser	12-1012-01	12-1012-02
Blower, Evaporator	12-1012-01	12-1012-02
Capacitor, Compressor, Start/Run	N/A	N/A
Compressor	89109065	89109066
Thermal Overload, Compressor	10-1007-19	10-1007-58
Filter, Air, Reusable	23-2004-00	23-2004-00
Thermostat, SPST, 55-100F	10-1061-16	10-1061-16
Mounting Gasket Kit	23-2000-00	23-2000-00
Relay, Compressor	N/A	N/A
Power Cord	52-6035-15	52-6035-74

OPTIONAL PARTS

Part Description	115 Volt	230 Volt
Electric Heat Element	10-1038-40	10-1038-43
Electric Heat Limit Switch	10-1033-01	10-1033-01
Level II/III Transformer	10-1006-94	10-1006-93

PARTS LIST

Part	Description	Part No.
1	Condenser Coil	23-2001-00
2	Fan Pan	23-2003-00
3	Condenser Blower	See Components List
4	Evaporator Coil	23-2002-00
5	Air Filter	23-2004-00
6	Compressor	See Components List
7	Cool Relay (Lev. II/III only)	10-1005-21
8	Transformer (Lev. II/III only)	See Optional Parts
9	Heat Relay (Lev. II/III with Electric Heat only)	10-1005-21
10	Temperature Controller	Consult Factory
11	Electric Heat Element and Limit Switch	See Optional Parts
12	Terminal Block	10-1003-03
13	Expansion Valve	Consult Factory
14	Evaporator Blower	See Components List
15	Filter Drier	52-6028-03
16	Compressor Thermal Overload	See Components List
17	Mounting Gasket Kit	23-2000-00
18	Power Cord	See Components List
19	Capillary Tube	99-0360-60

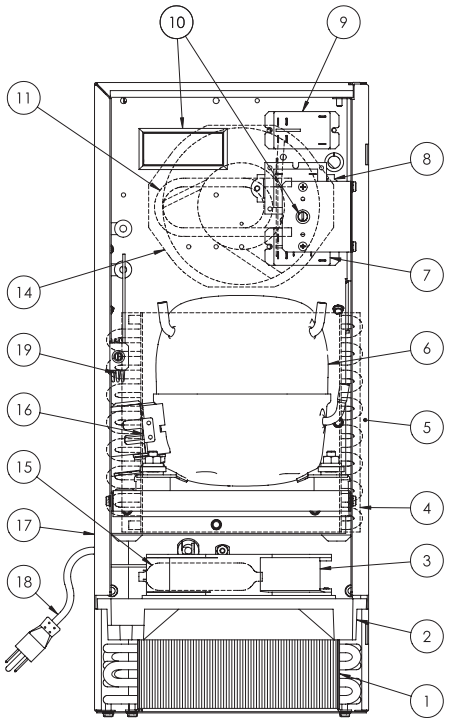
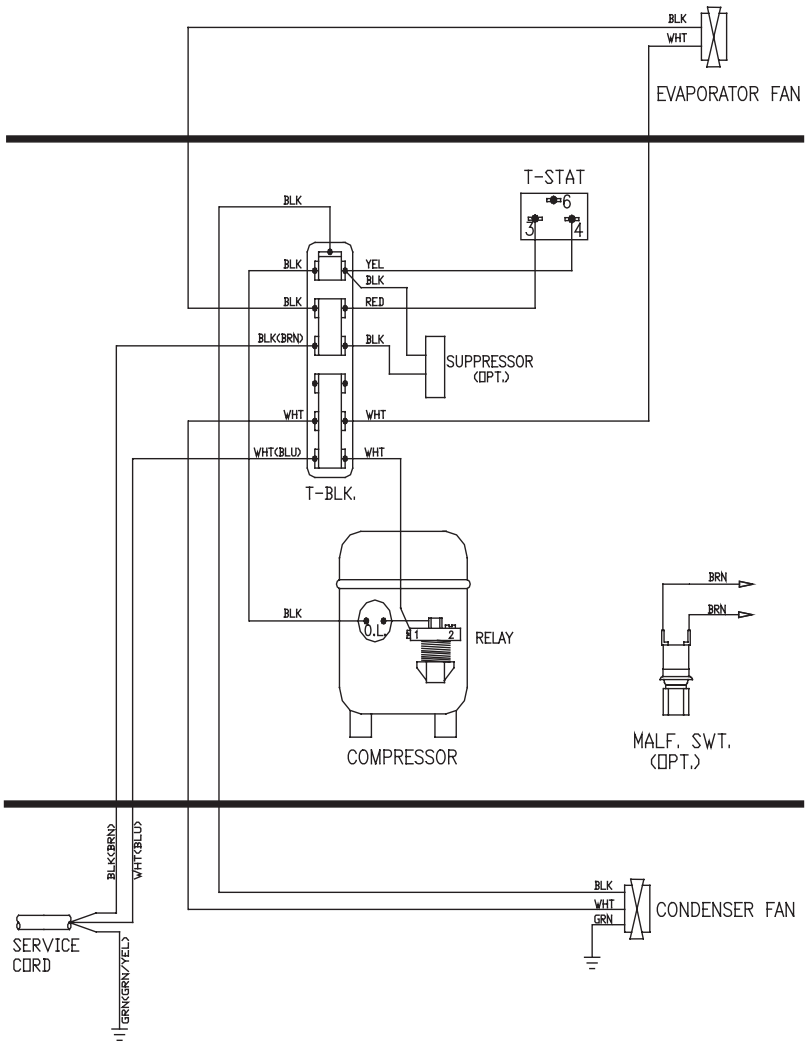
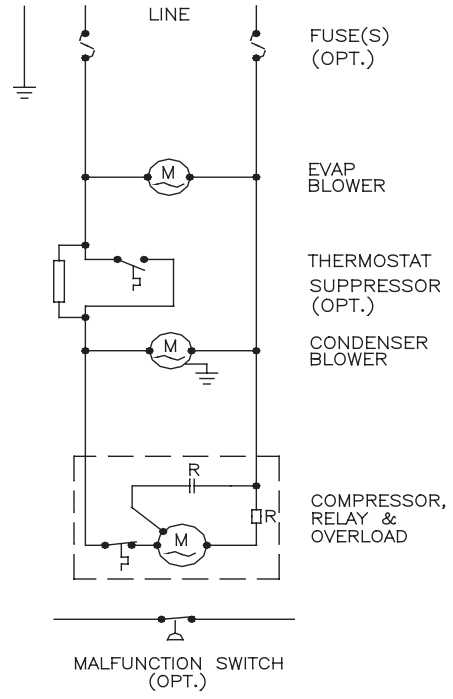


Figure 2

WIRE DIAGRAMS AND SCHEMATICS

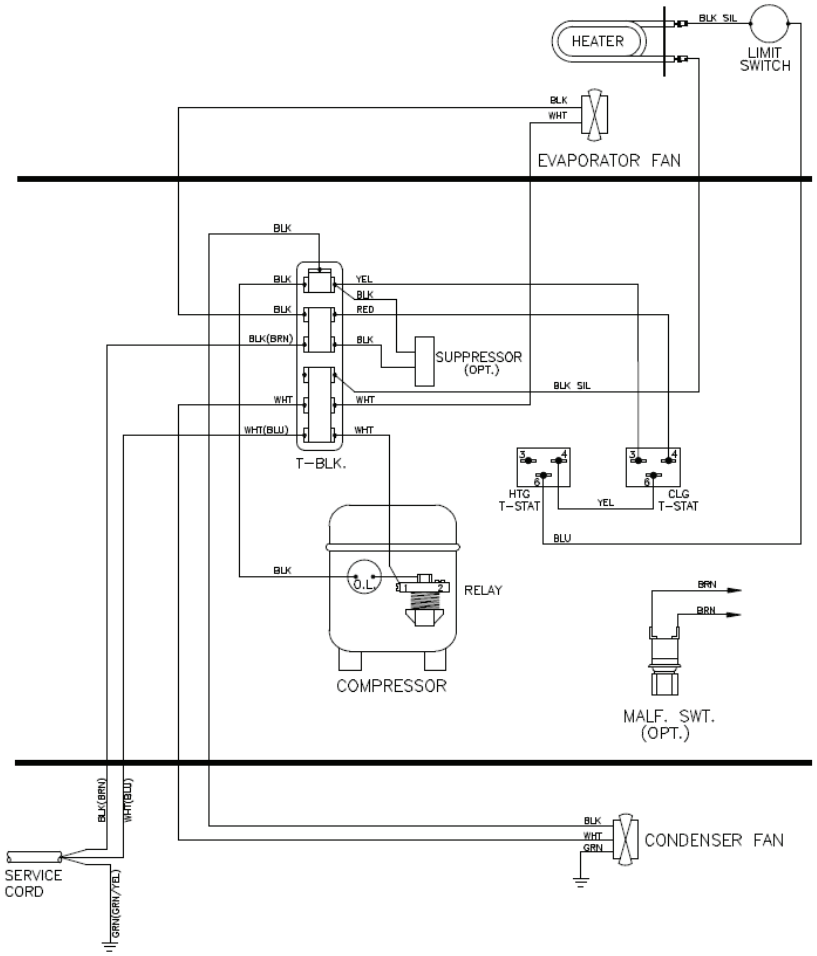
WIRE DIAGRAM, LEVEL I

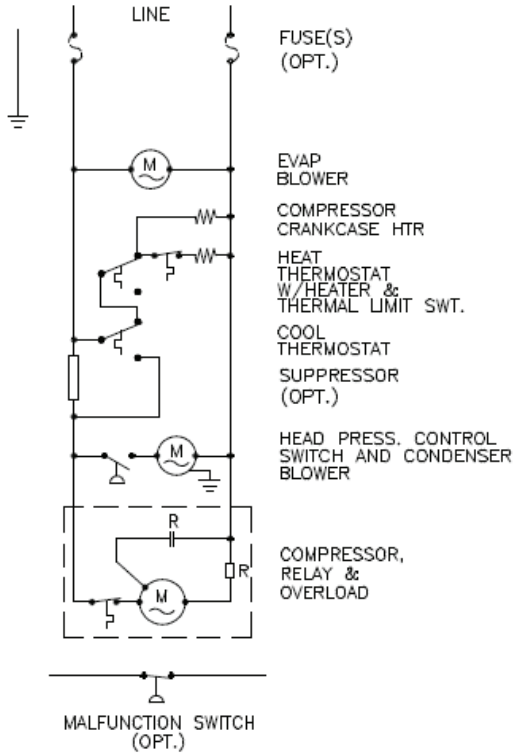




ELECTRICAL SCHEMATIC

WIRE DIAGRAM, LEVEL I WITH ELECTRIC HEATER

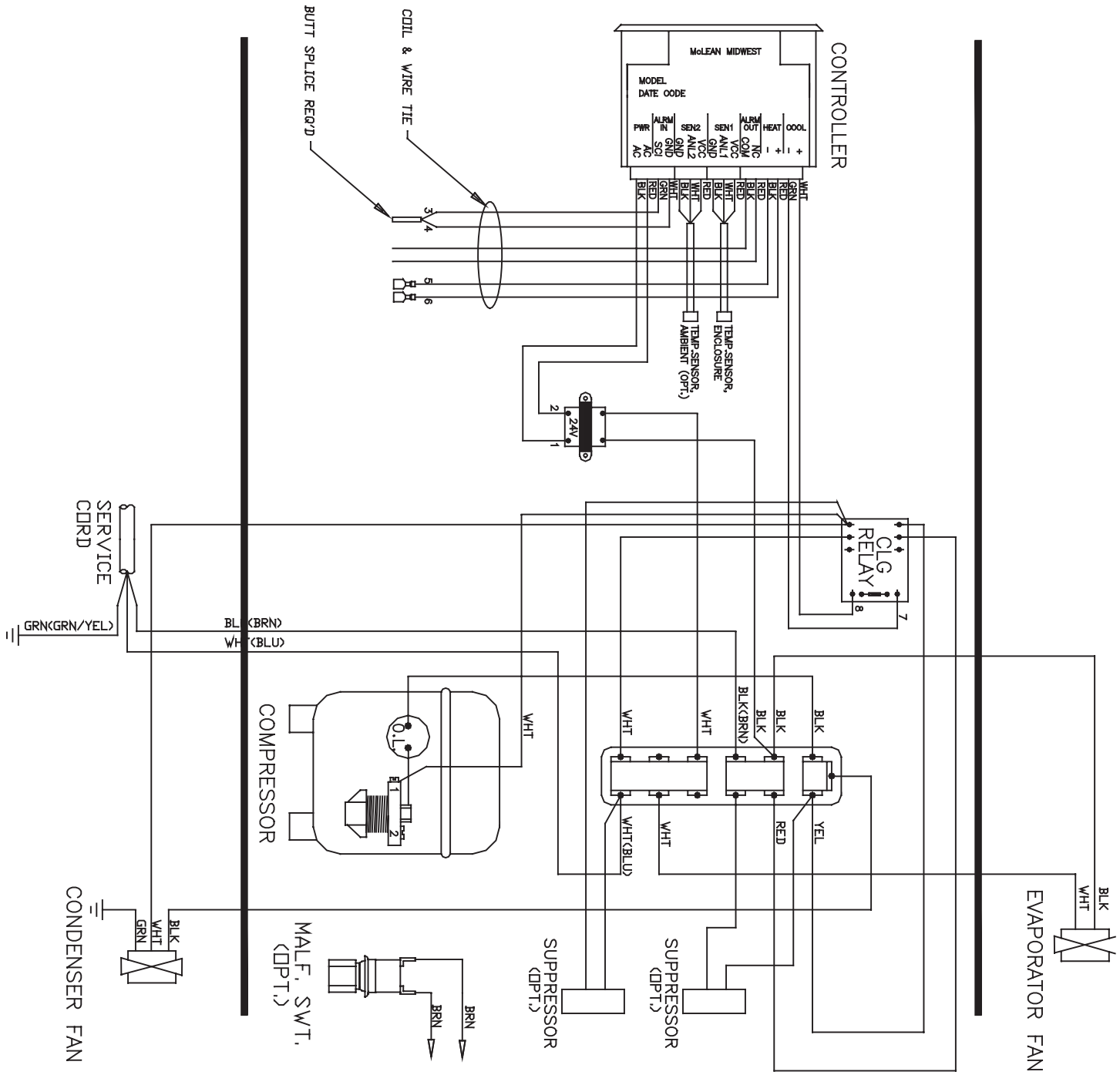


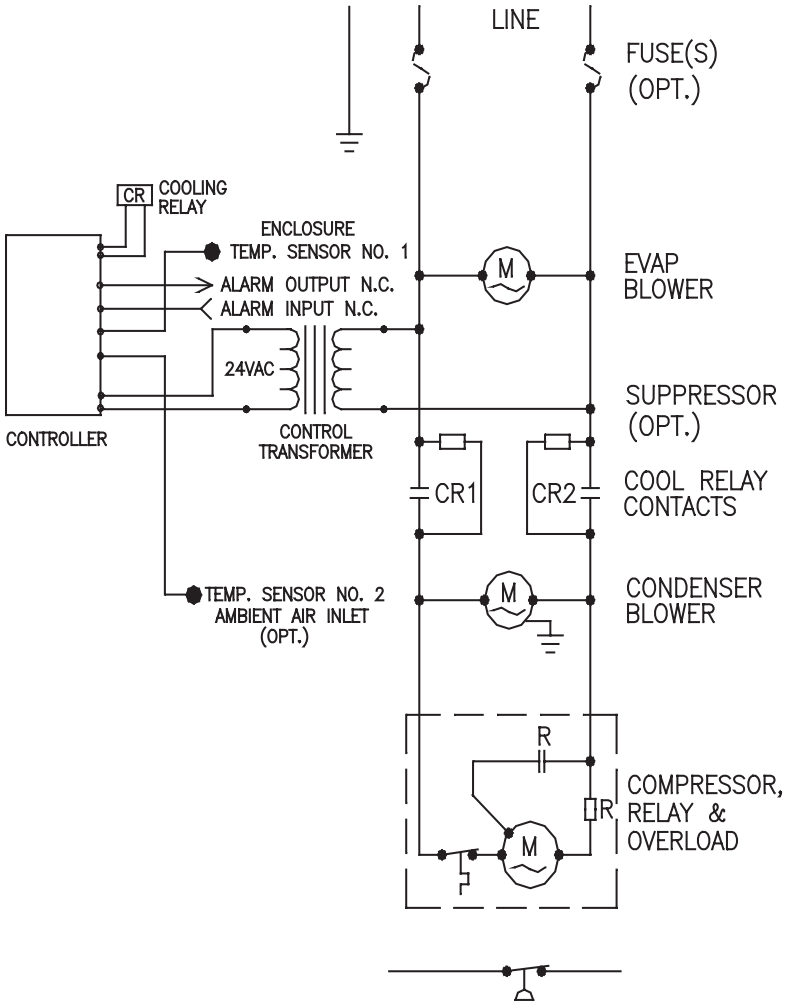


ELECTRICAL SCHEMATIC

NOTE: For voltage, hertz, and options not shown in this manual, refer to the wiring diagram attached to the unit.

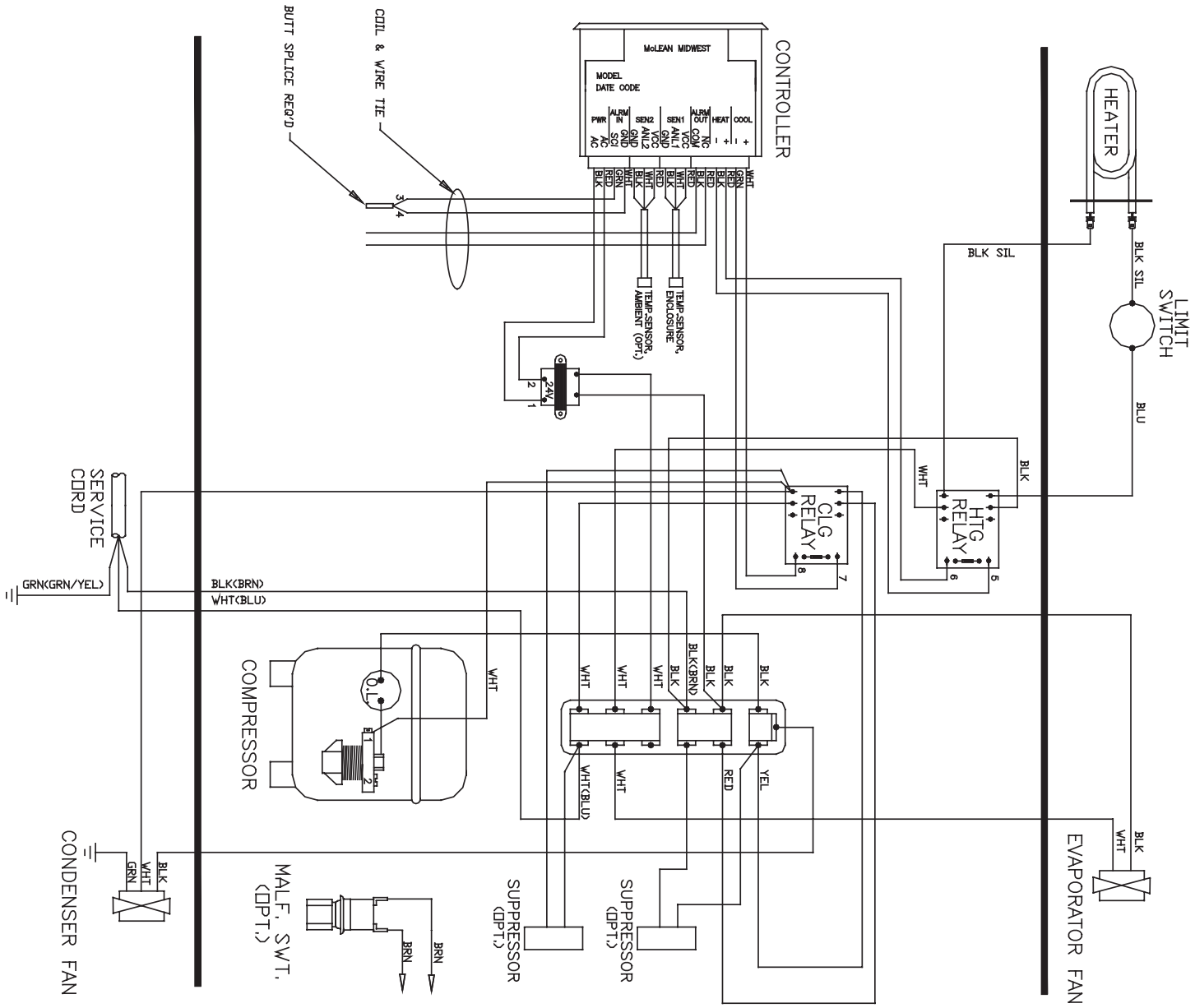
WIRE DIAGRAM, LEVEL II AND III



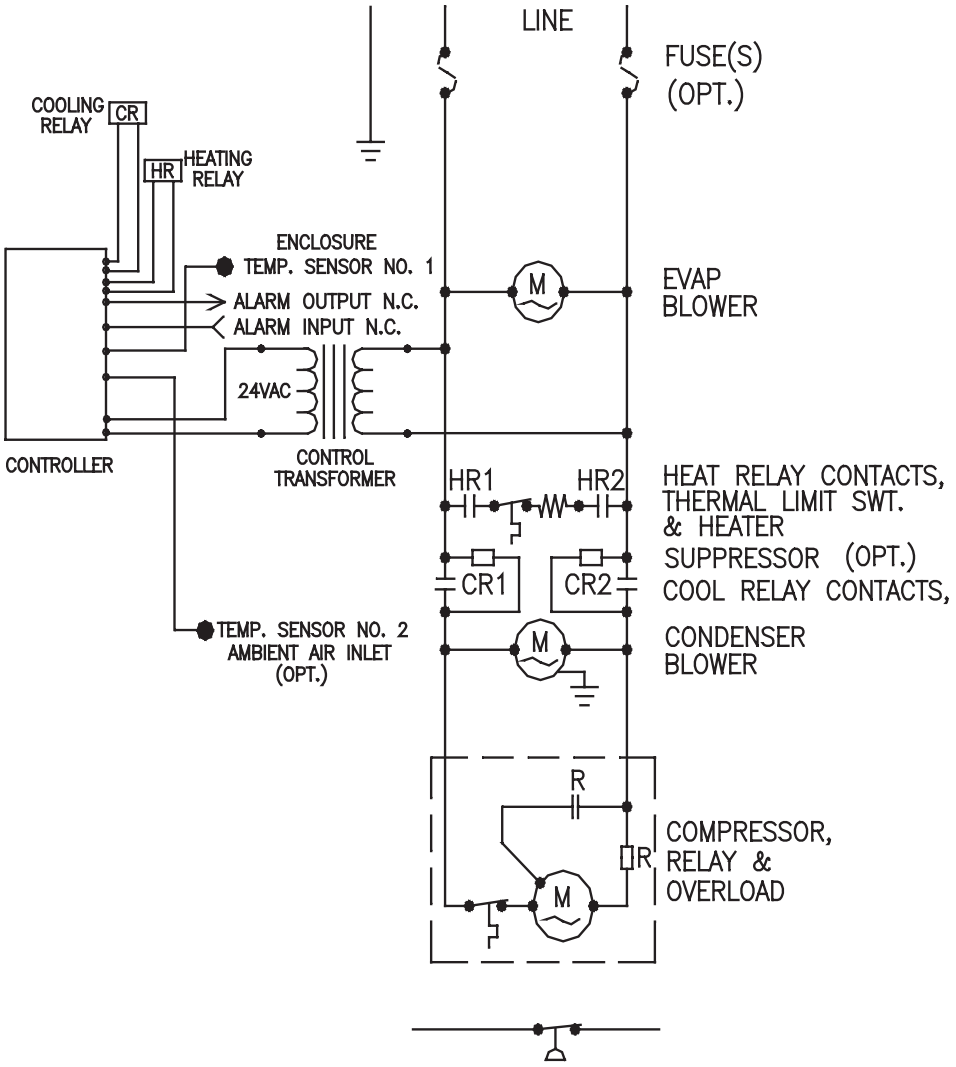


ELECTRICAL SCHEMATIC

WIRE DIAGRAM, LEVEL II AND III WITH ELECTRIC HEATER



NOTE: For voltage, hertz, and options not shown in this manual, refer to the wiring diagram attached to the unit.



ELECTRICAL SCHEMATIC

TEMPERATURE CONTROL

The electromechanical thermostat is factory preset to 75 F/23 C. To change the temperature setting, remove the nylon plug from the back face of the unit. Use a standard screwdriver to adjust thermostat. For cooler temperatures turn clockwise, for warmer temperatures turn counterclockwise.

PRINCIPLES OF OPERATION

If electrical power to the air conditioner is interrupted and reapplied immediately (within 3 to 5 seconds), the compressor may not restart due to the high back pressure of the compressor. It takes a minimum of one (1) minute after shut-down for the compressor suction and discharge pressures to equalize in order for the air conditioner to restart.

Operating the air conditioner below the minimum ambient temperature or above the maximum ambient temperatures indicated on the nameplate voids all warranties.

It is recommended that the warranty section of this manual be read in order to familiarize yourself with parameters of restricted operation.

The moisture that the enclosure air can contain is limited. If moisture flows from the drain tube continuously this can only mean that ambient air is entering the enclosure. Be aware that frequent opening of the enclosure's door admits humid air which the air conditioner must then dehumidify.

MAINTENANCE

COMPRESSOR

The compressor requires no maintenance. It is hermetically sealed, properly lubricated at the factory and should provide years of satisfactory operating service.

Should the refrigerant charge be lost, recharging ports (access fittings) on the suction and discharge sides of the compressor are provided for recharging and/or checking suction and discharge pressures.

Under no circumstances should the access fitting covers be loosened, removed or tampered with.

Breaking of seals on compressor access fittings during warranty period will void warranty on hermetic system.

Recharging ports are provided for the ease and convenience of reputable refrigeration repair service personnel for recharging the air conditioner.

INLET AIR FILTER

Proper maintenance of the inlet air filter, located behind the front cover, will assure normal operation of the air conditioner. If filter maintenance is delayed or ignored, the maximum ambient temperatures under which the unit is designed to operate will be decreased.

If the compressor's operating temperature increases above designed conditions due to a dirty or clogged filter (or plugged condenser coil), the air conditioner's compressor will stop operating due to actuation of the thermal overload cut-out switch located on the compressor housing. As soon as the compressor temperature has dropped to within the switch's cut-in setting, the compressor will restart automatically. However the above condition will continue to take place until the filter or coil has been cleaned. It is recommended that power to the air conditioner be interrupted intentionally when abnormally high compressor operating temperature causes automatic shut-down of the unit.

The above described shut-down is symptomatic of a clogged or dirty filter, thus causing a reduction in cooling air flow across the surface of the compressor and condenser coil.

Do not run the air conditioner for extended periods of time with the filter removed. Particles of dust, lint, etc., can plug the fins of the condenser coil which will give the same reaction as a plugged filter. The condenser coil is not visible through the filter opening, so protect it with a filter.

Continued operation under the above conditions can and will damage and shorten compressor life. The air conditioner is available with an easily removable inlet filter to facilitate necessary cleaning. There should be no reason to neglect this necessary maintenance.

HOW TO REMOVE, CLEAN OR INSTALL A NEW INLET AIR FILTER

RP aluminum washable air filters are designed to provide excellent filtering efficiency with a high dust holding capacity and a minimum amount of resistance to air flow. Since they are constructed entirely of aluminum, they are lightweight and easy to service. Optimum filter performance is maintained by recoating the filters after washing with RP Super Filter Coat adhesive. To achieve maximum performance from your air handling equipment, air filters should be cleaned on a regular basis.

The inlet air filter is located behind the right side panel. To access the filter, pull from slot on top cover. The filter may now be cleaned or a new filter installed.

Cleaning Instructions:

1. Flush the filter with warm water from the exhaust side to the intake side. DO NOT USE CAUSTICS.
2. After flushing, allow filter to drain. Placing it with a corner down will assure complete drainage.
3. Recoat the filters with RP Super Filter Coat adhesive. When spraying filter do so from both sides for maximum concentration of adhesive.

CONDENSER AND EVAPORATOR AIR MOVERS

Fan motor requires no maintenance. All bearings, shafts, etc. are lubricated for the life of the motor during manufacturing.

If the condenser fan motor (ambient fan) should fail, it is not necessary to remove the air conditioner from the cabinet or enclosure to replace the fan. The condenser fan is mounted on its own bulkhead and is easily accessible by opening the front cover.

⚠ CAUTION

Operation of the air conditioner in areas containing airborne caustics or chemicals can rapidly deteriorate filters, condenser coils, blowers and motors, etc. Contact Pentair Equipment Protection for special recommendations.

REFRIGERANT LOSS

Each air conditioner is thoroughly tested prior to leaving the factory to insure against refrigeration leaks. Shipping damage or microscopic leaks not found with sensitive electronic refrigerant leak detection equipment during manufacture may require repair or recharging of the system. This work should only be performed by qualified professionals, generally available through a local, reputable air conditioning repair or service company.

Refer to the data on the nameplate which specifies the type of refrigerant and the charge size in ounces.

Before recharging, make sure there are no leaks and that the system has been properly evacuated into a deep vacuum.

TROUBLE SHOOTING

BASIC AIR CONDITIONING TROUBLE SHOOTING CHECK LIST

1. Check manufacturer's nameplate located on the unit for correct power supply.
2. Turn on power to the unit. The evaporator (Enclosure or "COLD" air) fan should come on. Is there airflow?

YES, proceed to step 3.	
NO, possible problem: • Open motor winding • Stuck fan motor • Obstructed blades	→ **Repair or Replace defective part**

3. Check thermostat setting and adjust thermostat to the lowest setting. This should turn on the condenser fan and compressor. Did condenser fan and compressor come on when the thermostat was turned on?

YES, proceed to step 4.	
NO, possible problem: • Defective thermostat	→ **Replace part**

4. Are both fans and the compressor running? If not, the unit will not cool properly.
5. Check condenser (Ambient or "HOT" air) fan for airflow. Is there airflow?

YES, proceed to step 6.	
NO, possible problem: • Defective thermostat • Open motor winding • Stuck fan motor • Obstructed blades	→ **Repair or Replace defective part**

6. Carefully check the compressor for operation - motor should cause slight vibration, and the outer case of the compressor should be warm. Is the compressor showing signs of this?

YES, wait 5 minutes, then proceed to step 7.	
NO, possible problem: • Defective thermostat • Defective capacitor • Defective overload • Defective relay	→ **Repair or Replace defective part**

7. Make sure the coils are clean. Then check evaporator "air in" and "air out" temperatures. If the temperatures are the same:

• Possible loss of refrigerant • Possible bad valves in the compressor	→ **Repair or Replace defective part**

8. To check for a bad thermostat, turn power off to the unit. Remove control box cover and place both thermostat wires onto one terminal (replace control box cover for safety). This will bypass the switch in the thermostat. Turn on the power. If both fans and the compressor come on, the thermostat needs to be replaced.

SYMPTOMS AND POSSIBLE CAUSES:

SYMPTOM	POSSIBLE CAUSE
Unit won't cool	Fans not running
	Compressor not running
	Compressor runs, but has bad valves
	Loss of refrigerant
Compressor tries to start but won't run	Low line voltage at start. Should be +/-10% rated voltage.
	Compressor motor stuck
	Bad relay
	Bad overload switch
	Bad run/start capacitor
Unit blows breakers	Undersized breaker/fuse or not time delayed
	Short in system
Getting water in enclosure	Drain plugged
	Drain tube kinked
	Enclosure not sealed (allowing humidity in)

For additional technical support (amp draw, pressures, temperatures), contact Pentair Equipment Protection at 800-896-2665.

WARRANTY

Pentair Equipment Protection warrants that the Goods manufactured by Pentair Equipment Protection will be free from defects in material and workmanship for a period of one (1) year from the date of shipment by Pentair Equipment Protection, subject to the following conditions and exclusions:

A. Conditions. All Goods must be installed and operated according to the following specifications:

1. Maximum voltage variation no greater than plus or minus 10% of nameplate nominal rating;
2. Maximum frequency variation no greater than plus or minus 3 Hz of nameplate nominal rating;
3. Must not exceed minimum and maximum stated temperatures on the nameplate;
4. Must not exceed (BTU/Hr) rating, including any heat sink as indicated on the nameplate;
5. Refrigerant bearing Goods must not be restarted for a period of one (1) minute after intentional or accidental shut-off;
6. The filters (if applicable) must be cleaned regularly;
7. The Goods and any parts thereof must not be modified, unless prior written authorization is received from Pentair Equipment Protection; and
8. All Goods must be installed and grounded in accordance with all relevant electrical and safety codes, as well as the National Electric Code and OSHA rules and regulations.
9. All Goods must be installed in a stationery application, free of vibration.

A violation of any one of these conditions shall render the warranty hereunder void and of no effect.

B. Exclusions. This warranty shall be void if product is misapplied in any way or:

1. Buyer specified product is inappropriate for system or environment in which it is operating.
2. Goods are not installed in accordance with Pentair Equipment Protection specifications.
3. Removal or modification of Pentair Equipment Protection label affixed to product without written Pentair Equipment Protection approval.

Pentair Equipment Protection must be notified of a claim in writing not later than fourteen (14) days from the date when Buyer has become aware of such occurrence, or where the defect is such that it may cause damage, immediately, such notice containing a description of how the defect manifests itself. Failure to provide such prompt notice to Pentair Equipment Protection shall result in forfeiture of Buyer's rights under this warranty.

In the event of a warranty claim, Buyer is to return defective goods to Pentair Equipment Protection in accordance with Pentair Equipment Protection Return Policy. Warranty period for repaired goods remains at 1 year from shipment of original goods. Pentair Equipment Protection sole obligation to Buyer under this warranty will be, at Pentair Equipment Protection option:

A. Repair or replace Pentair Equipment Protection products or parts found to be defective in material or workmanship.

B. Issue credit for the purchase price paid by Buyer relating to such defective Goods or part.

THIS WARRANTY CONSTITUTES THE ENTIRE WARRANTY WITH RESPECT TO THE GOODS AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY AND IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

RETURN AND REPAIR POLICY

Pentair Equipment Protection products that: (i) are made to order, (ii) have been modified by Buyer, (ii) have special finishes, or (iv) are determined by Pentair Equipment Protection to constitute "custom" products that cannot be returned to stock or resold to other Buyers, will not be accepted for return by Pentair Equipment Protection.

All returns require a Return Material Authorization number (RMA #), regardless of reason for return, whether it be for warranty or out of warranty repair. Returns without an RMA # will be refused by our Receiving Department. An RMA # is valid for 30 days.

A. An RMA # will be issued by our Product Return Department in Anoka, MN at 763-422-2211. Buyer should have following information available at time of RMA request:
   1. Complete Model Number, Serial Number and description of damaged unit being returned.
   2. Original Buyer Purchase Order number and date product was received by Buyer.
   3. Quantity to be returned and a brief description of failure for each unit, if different.
   4. Contact information of Buyer that must include: name of company, billing and shipping address, phone, number, fax number, freight carrier and the name and phone number of a Buyer contact who can elaborate on the claimed defect in detail.
   5. Buyer must provide a Repair Purchase Order number for both warranty and out of warranty repairs. The PO will not exceed 50% of a new unit. Buyer will be notified of repair charges that exceed approved PO amount.

B. All returns to Pentair Equipment Protection must be securely packed, using original cartons if possible. All returns must have the RMA number visible on the outside of the carton. Pentair Equipment Protection is not responsible for material damaged in transit. Any refrigerant-bearing Goods must be shipped upright for return.

C. Shipping cost for all non-warranty repairs is the responsibility of the sender and must be shipped prepaid. Shipping costs for all warranty related repairs will be covered by Pentair Equipment Protection provided the goods are returned using a Pentair Equipment Protection approved carrier. If after diagnoses the product is determined by Pentair Equipment Protection not be covered under warranty, Buyer will be responsible for all shipping charges and will be billed accordingly.

D. Non-warranty repairs are subject to a $105 minimum analysis fee. If approval is not received within 30 days, material will be scrapped and all shipping expenses and corresponding analysis fees will be billed to Buyer.

E. At Buyer's request, Failure Analysis can be provided by Pentair Equipment Protection for warrantable goods at no charge. Failure analysis for non-warranty repairs are subject to a $150 per hour Engineering charge plus any other incurred testing costs.

F. All returned merchandise must be sent to the following address: Pentair Equipment Protection, 2100 Hoffman Way, Anoka, MN 55303-1745.

G. Credit for accepted returns shall be at the original selling price or the current selling price, whichever is lower, less the restocking charge indicated as follows:
   1. Within 60 days of invoice date - 20% of applicable selling price.
   2. Within 61-120 days of invoice date - 30% of applicable selling price.
   3. Within 121-180 days of invoice date - 40% of applicable selling price.
   4. Beyond 180 days - subject to individual review by Pentair Equipment Protection.

   If product being returned for credit requires repair or modification, the cost of any labor or material necessary to bring product into saleable condition will be deducted from credit. Buyer may not take credit against returns without prior written Pentair Equipment Protection approval.

LIMITATION OF LIABILITY

PENTAIR EQUIPMENT PROTECTION WILL NOT BE LIABLE UNDER ANY CIRCUMSTANCES FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES, INCLUDING WITHOUT LIMITATION ANY LOST PROFITS OR LABOR COSTS, ARISING FROM THE SALE, USE OR INSTALLATION OF THE GOODS, FROM THE GOODS BEING INCORPORATED INTO OR BECOMING A COMPONENT OF ANOTHER PRODUCT, FROM ANY BREACH OF THIS AGREEMENT OR FROM ANY OTHER CAUSE WHATSOEVER, WHETHER BASED ON WARRANTY (EXPRESSED OR IMPLIED) OR OTHERWISE BASED ON CONTRACT, OR ON TORT OR OTHER THEORY OF LIABILITY, AND REGARDLESS OF ANY ADVICE OR REPRESENTATIONS THAT MAY HAVE BEEN RENDERED BY PENTAIR EQUIPMENT PROTECTION CONCERNING THE SALE, USE OR INSTALLATION OF THE GOODS.

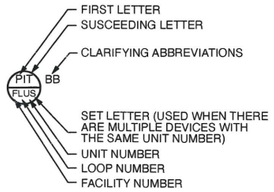
Pentair Equipment Protection
2100 Hoffman Way
Minneapolis, MN 55303 USA
☎ +1.763.422.2211
+1.763.576.3200

PentairProtect.com

P/N 89112522

9.0 EnviroCare Shop Drawings

INSTRUMENT IDENTIFICATION EXAMPLE SYMBOLS



INSTRUMENT SOCIETY OF AMERICA TABLE

FIRST LETTER			SUCCEEDING LETTERS		
LETTER	PROCESS OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		USERS CHOICE	USERS CHOICE	USERS CHOICE
C	USERS CHOICE			CONTROL	
D	DENSITY	DIFFERENTIAL			
E	VOLTAGE		PRELIMINARY ELEMENT (SENSOR)		
F	FLOW RATE	RATIO (FRACTION)			
G	USERS CHOICE		GLASS, GAUGE VIEWING DEVICE	GATE	
H	HAND (MANUAL)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN		CONTROL STATION	
K	TIME, SCHEDULE	TIME RATE OF CHANGE			
L	LEVEL		LIGHT (PILOT)		LOW
M	MOTION	MOMENTARY			MIDDLE
N	TORQUE		USERS CHOICE	USERS CHOICE	USERS CHOICE
O	USERS CHOICE		ORIFICE, RESTRICTION		
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD OR PRINT		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED	X-AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESCENCE	Y-AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z-AXIS		DRIVE ACTUATOR UNCLASSIFIED	
				FINAL CONTROL ELEMENT	

EXAMPLE: PDIT = DIFFERENTIAL PRESSURE INDICATING TRANSMITTER, TDRC = DIFFERENTIAL TEMPERATURE RECORDING CONTROLLER

ABBREVIATIONS TABLE

A/I	ANALOG INPUT SIGNAL	LSLL	LEVEL SWITCH LOW LOW	TI	TEMPERATURE INDICATOR
A/O	ANALOG OUTPUT SIGNAL	M	MOTOR	TIC	TEMPERATURE INDICATING CONTROLLER
AH	AIR HEADER	MA	MANUAL / AUTO	TJR	TEMPERATURE RECORDER
AI	AIR INLET	MCC	MOTOR CONTROL CENTER	TSH	TEMPERATURE SWITCH, HIGH
BO	BY OTHERS	MH	MANHOLE / ACCESS DOOR	TT	TEMPERATURE TRANSMITTER
D/I	DIGITAL INPUT SIGNAL	MS	MOTOR STARTER	UC	TORQUE CLUTCH
D/O	DIGITAL OUTPUT SIGNAL	O/O	ON/OFF	USH	HIGH TORQUE SWITCH
DCS	DISTRIBUTIVE CONTROL SYSTEM	OF	OVERFLOW	WBV	WATER BLOCK VALVE
DISC	DISCONNECT	OF	OVERFLOW DRAIN	WH	WATER HEADER
DN	DRAIN	PAH	PRESSURE ALARM HIGH	WI	WATER INLET
ECI	ENVIROCARE INTERNATIONAL, INC.	PB	PUSH BUTTON	YL	INDICATOR LIGHT
EV	ELECTRIC VALVE	PCV	PRESSURE CONTROL VALVE, AIR	ZSC	LIMIT SWITCH CLOSED
F	FLOW TUBE	PDI	PRESSURE DIFFERENTIAL INDICATOR	ZSO	LIMIT SWITCH OPEN
FA	FOUL AIR DUCT	PDIT	dP INDICATING TRANSMITTER		
FCV	FLOW CONTROL VALVE	PDT	PRESSURE DIFFERENTIAL TRANSMITTER		
FE	FLOW ELEMENT	PE	PRESSURE ELEMENT		
FI	FLOW INDICATOR	PI	PRES. INDICATOR		
FIT	FLOW INDICATING TRANSMITTER	PIT	PRES. INDICATING TRANSMITTER		
FLT	FAULT	PRV	PRESSURE REDUCING VALVE		
FSL	FLOW SWITCH, LOW	PSC	PUMP SPEED CONTROL		
HE	HEATING ELEMENT	PSH	PRESSURE SWITCH, HIGH ALARM		
HOA	HAND/OFF/AUTO SELECTOR SWITCH	PSL	PRESSURE SWITCH, LOW ALARM		
HS	HAND SWITCH	RST	RESET		
HV	HAND VALVE	S	STARTER		
IE	CURRENT MEASUREMENT	S/S	START/STOP		
LCP	LOCAL CONTROL PANEL	SC	SPEED CONTROL		
LH	LIME HEADER	SCR	SILICON CONTROL RECTIFIER		
LS	LEVEL SWITCH	SI	SPEED INDICATION		
LSH	LEVEL SWITCH HIGH	SV	SOLENOID VALVE		
LSHH	LEVEL SWITCH HIGH HIGH	TCV	TEMPERATURE CONTROL VALVE		
LSL	LEVEL SWITCH LOW	TE	TEMPERATURE ELEMENT		

GENERAL INSTRUMENT SYMBOLS

- ICP 1 — INCINERATOR CONTROL PANEL
- LCP xxx — FIELD MOUNTED
- DCS xxx — PANEL MOUNTED OPERATOR ACCESSIBLE
- MCC xxx — MCC MOUNTED
- JUNCTION BOX

PROCESS SYMBOLS

- WATER FLOW — xxx GPM
- GAS FLOW — xxx ACFM
- TEMP — xxx °F
- PRESSURE — xxx PSI
- PRESSURE — xxx "WC

VALVE SYMBOLS

- BACK FLOW PREVENTER
- BACK PRESSURE RELIEF
- BALL, NO, NC
- BALL CHECK
- BUTTERFLY
- DIAPHRAGM
- FLOAT
- GATE
- GLOBE
- KNIFE
- MOTORIZED
- MULTIPORT
- NEEDLE
- PINCH
- PLUG
- PRESSURE CONTROL (CONTROLLED SIDE)
- PRESSURE REGULATING (REGULATED SIDE)
- PRESSURE RELIEF
- SOLENOID, 2-WAY
- SOLENOID, 3-WAY
- SWING CHECK
- VACUUM RELEASE
- BLOCK & BLEED

APPURTENANCE SYMBOLS

- DRAIN
- DRAIN FILTER
- DUPLEX STRAINER
- FLANGED CONNECTION (###)
- FLEX HOSE
- FLOAT TRAP (T)
- ORIFICE PLATE
- PIPE REDUCER
- PIPE PLUG
- QUICK DISCONNECT
- SIMPLEX STRAINER
- UNION
- Y-STRAINER

DEVICE & INSTRUMENT SYMBOLS

- ACTUATOR, ELECTRIC (M)
- ACTUATOR, PNEUMATIC
- POSITIONER, I/P
- ANALYZING INSTRUMENT
- DIAPHRAGM ISOLATOR
- FLOAT SWITCH
- MAGNETIC FLOWMETER (F)
- ORIFICE FLOWMETER
- THERMOCOUPLE
- PRESSURE SWITCH

EQUIPMENT SYMBOLS

- BLOWER
- COMPRESSOR
- FAN
- HEATER
- MIST ELIMINATOR, CHEVRON
- MIST ELIMINATOR, MESH
- MIXER
- MOTOR (M)
- PUMP, DIAPHRAGM
- PUMP, HORIZONTAL
- PUMP, PERISTALTIC
- PUMP, PISTON
- PUMP, POSITIVE DISPLACEMENT
- PUMP, VERTICAL CENTRIFUGAL
- SPRAY LANCE
- VENTURI TUBE

OTHER SYMBOLS

- ## / ## — LINE SIZE
- MW — MANWAY
- ### — REFERENCE, PAGE/SHEET
- SW — SEAL WATER
- TEST — TEST PORT
- TIE IN — TIE IN POINT

LINE LEGEND

- PRIMARY PROCESS / PIPING
- PNEUMATIC SIGNAL
- SENSING LINE SIGNAL
- ELECTRICAL SIGNAL
- NETWORK SIGNAL
- SCOPE BY ECI
- EXISTING / BY OTHERS
- BOUNDARY LIMIT
- INSULATED LINE / BY OTHERS
- HEAT TRACING

DOCUMENT RELEASE

☐ Preliminary issue ☐ For Customer Approval ☒ Certified for Construction ☐ As Built

BY R.A.M. DATE 5/11/22

SYM	REVISION DESCRIPTION	BY	APP	DATE
1	CERTIFIED FOR CONSTRUCTION	JTP	RAY	4.22.22

EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

TITLE: **INSTRUMENT AND CONTROL LEGEND**

DRAWN	DCH	DATE	10.26.21
DESIGN	JTP	DATE	10.26.21
CHECK	JTP	DATE	10.26.21
APPR.	RAY	DATE	10.26.21
SCALE	NONE		

CLIENT: **TOTAL MECHANICAL SERVICE CORPORATION**

PROJECT: **TAUNTON WASTEWATER TREATMENT FACILITY IMPROVEMENTS 1 - MODEL 60-500 SCUM CONCENTRATOR**

CONTRACT NO. 1194 — ISO E

DRAWING NO. C100-1194 — SHEET 1 OF 1 — REV 1

PLANT CONTROL SYSTEM (120VAC DRY CONTACTS)
SCADA RTU-7

SCUM CONCENTRATOR RUN STATUS (YI-7401B) — PCS
SCUM CONCENTRATOR ALARM (YA-7401) — PCS

SCUM CONCENTRATOR CONTROL PANEL, LCP-7401
SEE DWG. C700-1194

SKIMMER CONTROL: MA HS SS11 | START GPB PB11 | STOP RPB PB12 | RUN GL PL12 | OVL FLT AL PL13 | TRQ FLT AL PL14 | FLT RST BPB PB13

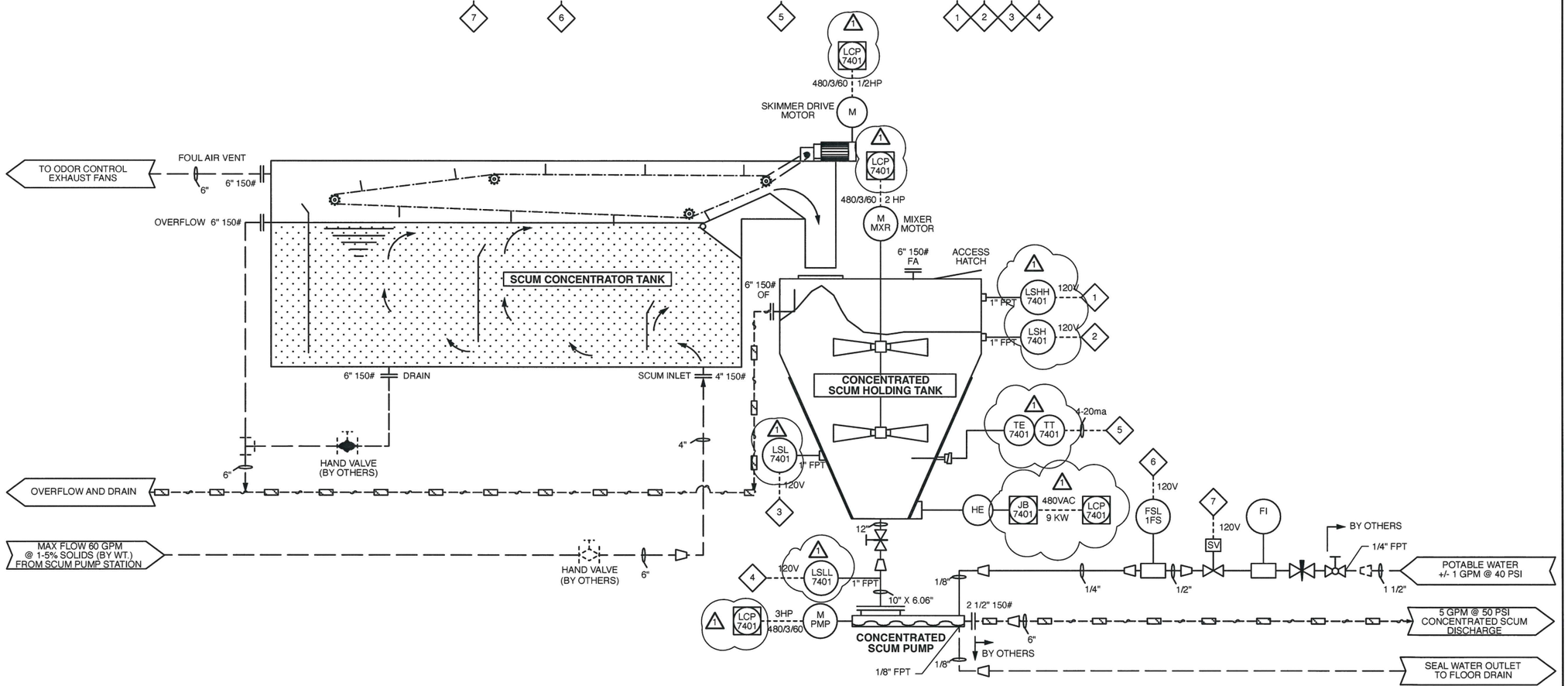
MIXER CONTROL: MA HS SS21 | START GPB PB21 | STOP RPB PB22 | RUN GL PL22 | OVL FLT AL PL23 | FLT RST BPB PB23

SCUM PUMP CONTROL: MA HS SS31 | START GPB PB31 | STOP RPB PB32 | RUN GL PL32 | OVL FLT AL PL23 | SEAL FLT AL PL34 | FLT RST BPB PB33

SCUM HEATER CONTROL: RUN GL PL42 | OVL FLT AL PL43 | TEMP CONTROL TIC 01 | TEMP FLT AL PL44 | FLT RST BPB PB43

HOLDING TANK LEVEL: HIGH/HIGH FLT AL PL81 | HIGH FLT AL PL82 | LOW FLT AL PL83 | LOW/LOW FLT AL PL84

SYSTEM CONTROL: POWER WL PL1 | MCC RESET BPB PBR | MCC POWER GL PL2 | E-STOP RPB ES1



TOTAL MECHANICAL SERVICE CORPORATION PO NO. 2021-26, SPECIFICATION SECTION: 11317

NOTES:

1. ONE (1) MODEL 60-500 SCUM CONCENTRATOR BY ENVIROCARE TO REPLACE EXISTING SCUM CONCENTRATOR. INSTALLATION BY OTHERS. SEE DWG. C300-1194 FOR GENERAL ARRANGEMENT.
2. ALL WIRING TO/FROM ELECTRICAL COMPONENTS AND LCP SUPPLIED AND INSTALLED BY OTHERS.
3. MOTOR STARTER FOR SKIMMER DRIVE, MIXER, SCUM PUMP, AND CONTACTOR FOR HEATERS SUPPLIED AND INSTALLED IN CONTROL PANEL LCP-700 AND WIRED BY OTHERS TO MOTORS AND HEATER JUNCTION BOX.
4. ALL FIELD DEVICES WITH DISSIMILAR SIGNAL POWER SHOULD BE RUN IN SEPARATE CONDUIT:
   A. 480VAC CONDUIT
   B. 120VAC CONDUIT
   C. 4-20 mA CONDUIT

DOCUMENT RELEASE

☐ Preliminary Issue ☒ Certified For Construction
☐ For Customer Approval ☐ As Built
BY R.M. DATE 5/11/22

SYM	REVISION DESCRIPTION	BY	APP	DATE
1	ADD TAG NUMBERS PER BETA DRAWING SKE-3 DATED 3/10/22, CERTIFIED FOR CONSTRUCTION	JTP	RAY	4.22.22

EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

TITLE: **PROCESS & INSTRUMENTATION DIAGRAM**

DRAWN	DCH	DATE 10.26.21
DESIGN	JTP	DATE 10.26.21
CHECK	JTP	DATE 10.26.21
APPR	RAY	DATE 10.26.21
SCALE	NONE	

CLIENT: **TOTAL MECHANICAL SERVICE CORPORATION**
PROJECT: **TAUNTON WASTEWATER TREATMENT FACILITY IMPROVEMENTS 1 - MODEL 60-500 SCUM CONCENTRATOR**
CONTRACT NO. 1194 | ISO E
DRAWING NO. C100-1194 | SHEET 1 OF 1 | REV 1

MATERIALS OF CONSTRUCTION

CONC. TANKAGE	1/4" THK, 304L-SS
HOLDING TANKAGE	3/16" THK, 304L-SS
CONC. TANK STRUCTURAL	A36-CS
HOLDING TANK STRUCTURAL	A36-CS
STAINLESS STEEL FINISH	SANDBLAST SSPC-SP6
CONC. TANK COVER	FRP
SKIMMER SHAFT	C-1018 CS
SPROCKETS	H-78 NYLON, 2.609" PITCH
CHAIN	PC-78 ACETAL, MODEL 78 2.609" PITCH
BLADE	NEOPRENE, DURO. 50
BLADE SUPPORT	304-SS
DRIVE SPROCKET	STEEL WITH FLAME HARDENED TEETH
DRIVE CHAIN	STEEL, ASA NO. 80 ROLLER CHAIN
CHAIN GUARD	304L-SS, 14GA FRONT, 12GA BACK
WEIR ASSEMBLY	304L-SS
WEIR CHAIN	STAINLESS STEEL, ASA NO.80 ROLLER CHAIN
HEAT SHIELD	14GA 304L-SS
INSULATION	2" THK. FIBERGLASS
KNIFE GATE VALVE	316-SS BODY & GATE
PLATFORM	**BY OTHERS**
GRATING	**BY OTHERS**
STAIRCASE / LADDER	**BY OTHERS**

DESIGN PARAMETERS

INFLUENT	PRIMARY CLARIFIER SCUM
CONCENTRATION	1-5% SOLIDS
RETENTION TIME	33.3 MINUTES
RATE	60 GPM
SEPARATION AREA	41 SQ.FT
SOLIDS LOADING RATE	1.46 GPM/SQ.FT @ DESIGN
CONC. TANK VOLUME	2000 GALLONS
SKIMMER SPEED	2.5 - 11.5 FPM (VARIABLE)
EFFLUENT	50% SOLIDS / 50% WATER
SCUM TANK VOLUME	500 GALLONS
HEATER CAPACITY	9 KW
SCUM TANK HEATED AREA	(12) STRIP HEATERS IN CONICAL SECTION

SHIPPING SUB-ASSEMBLIES:

THE FOLLOWING IS A SUMMARY OF THE MAJOR SYSTEM COMPONENTS AND HOW THEY WILL SHIP:

A. ONE (1) MODEL 60 CONCENTRATOR TANK, SKIMMER, WEIR, ECT FACTORY ASSEMBLED

B. ONE (1) MODEL 60 CONCENTRATOR TANK FRAME

C. LOT CONC. TANK FRP ODOR CONTAINMENT COVERS

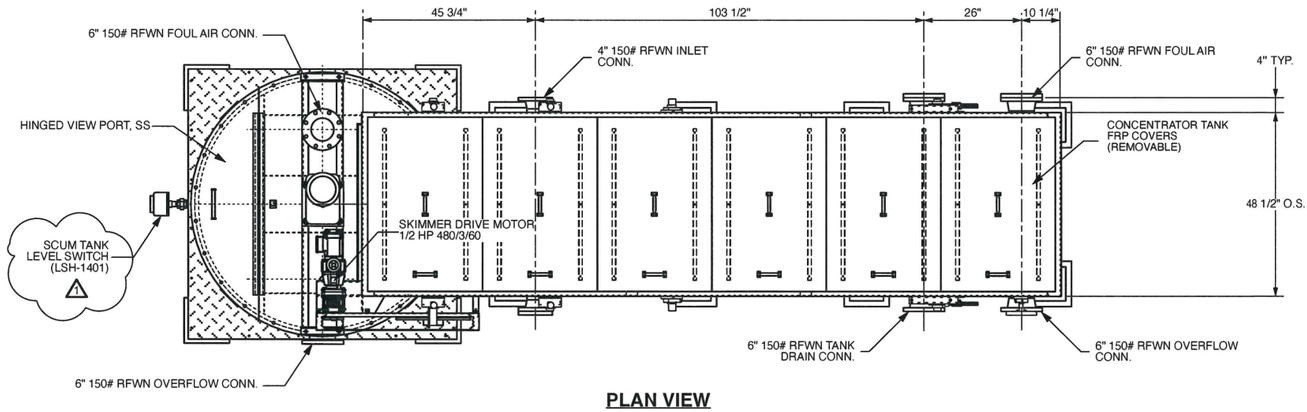
D. ONE (1) HOLDING TANK WITH FRAME AND COVER HEATING ELEMENTS, HEAT SHIELD, KNIFEGATE FACTORY ASSEMBLED.

E. ONE (1) SCUM PUMP

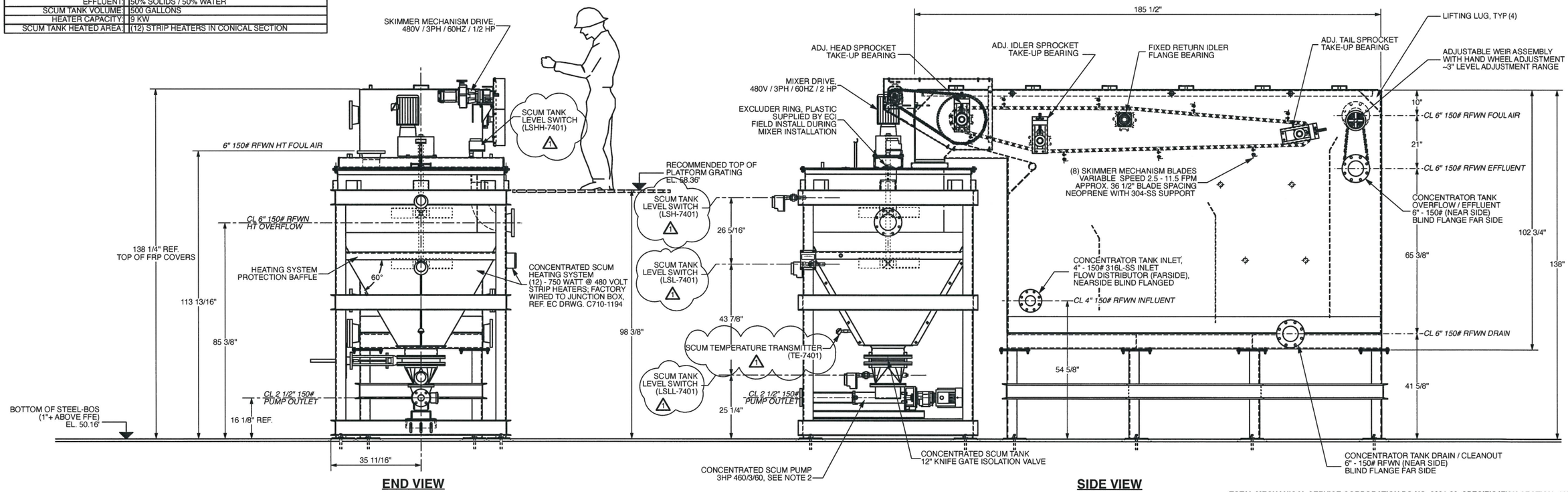
F. LOT HOLDING TANK INSTRUMENTATION AND SCUM PUMP SEAL WATER INSTRUMENTATION AND ACCESSORIES.

G. SPARE PARTS: TWO (2) BEARING ASSEMBLIES FOR SKIMMER TAKE-UPS, TWO (2) COLLECTOR CHAIN SPROCKETS, ONE (1) SKIMMER DRIVE CHAIN, AND ONE (1) SET REPLACEMENT WIPER BLADES

H. ONE (1) SCUM CONCENTRATOR CONTROL PANEL (LCP-7401) ⚠1



PLAN VIEW



END VIEW

SIDE VIEW

TOTAL MECHANICAL SERVICE CORPORATION PO NO. 2021-26, SPECIFICATION SECTION: 11317

NOTES:

1. ONE (1) MODEL 60-500 SCUM CONCENTRATOR ASSEMBLY SUPPLIED BY ENVIROCARE AND INSTALLED BY OTHERS.
2. PROGRESSIVE CAVITY PUMP SUPPLIED BY ENVIROCARE AND INSTALLED BY OTHERS.
3. ACCESS PLATFORM SUPPLIED AND INSTALLED BY OTHERS.
4. SEE DRAWING C100-1194 FOR PROCESS & INSTUMENTAION DETAILS.
5. SEE DRAWING C350-1194 FOR ASSEMBLY LAYOUT AND ANCHOR BOLT / LOADING DETAILS.
6. SEE DRAWING C700-1194 FOR SCUM CONCENTRATOR CONTROL PANEL DETAILS.

DOCUMENT RELEASE

☐ Preliminary Issue ☒ Certified for Construction
☐ For Customer Approval ☐ As Built
BY R.M. DATE 5/11/22

SYM	REVISION DESCRIPTION	BY	APP	DATE
1	ADDED TAG NUMBERS PER BETA DRAWING SKE-3 DATED 3/10/22, CERTIFIED FOR CONSTRUCTION	JTP	RAY	4.22.22

EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

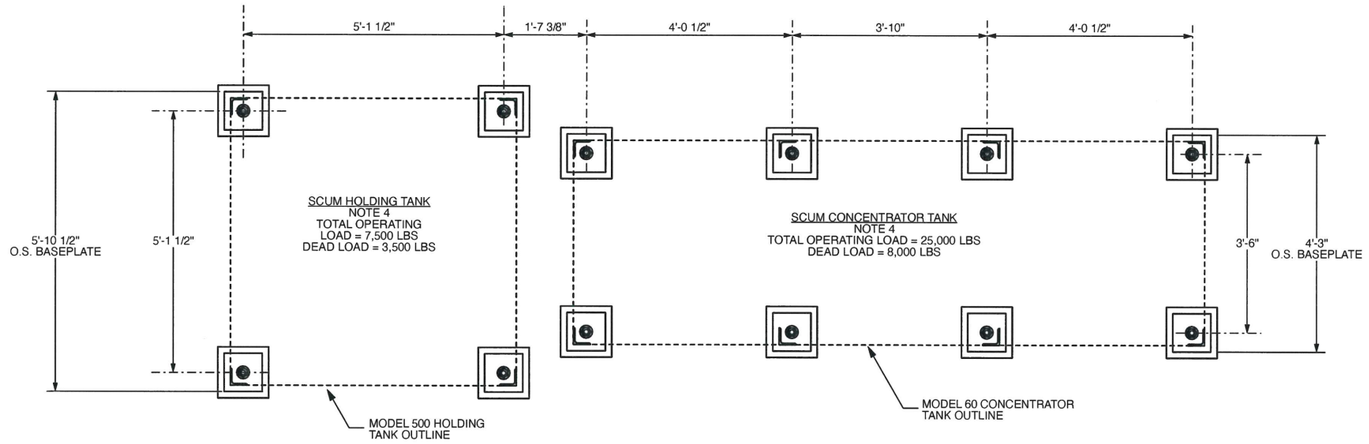
TITLE: **MODEL 60-500 SCUM CONCENTRATOR GENERAL ARRANGEMENT**

DRAWN	DCH	10.26.21
DESIGN	JTP	10.26.21
CHECK	JTP	10.26.21
APPR	RAY	10.26.21

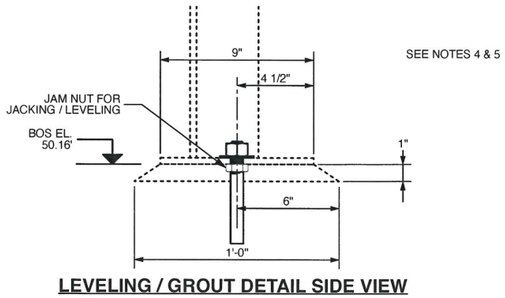
CLIENT: **TOTAL MECHANICAL SERVICE CORPORATION**

PROJECT: **TAUNTON WASTEWATER TREATMENT FACILITY IMPROVEMENTS 1 - MODEL 60-500 SCUM CONCENTRATOR**

SCALE: NONE | CONTRACT NO.: 1194 | ISO-A | DRAWING NO.: C300-1194 | SHEET 1 OF 1 | REV ⚠1

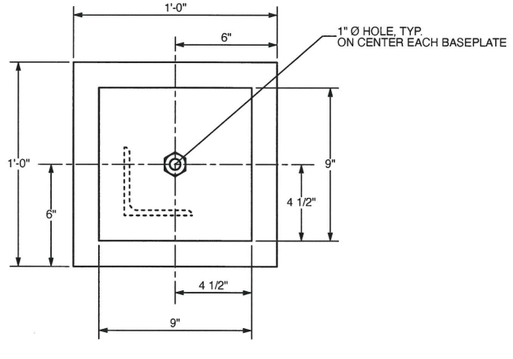


SCUM CONCENTRATOR ANCHOR BOLT LAYOUT PLAN VIEW



SEE NOTES 4 & 5

LEVELING / GROUT DETAIL SIDE VIEW



LEVELING / GROUT DETAIL PLAN VIEW

TOTAL MECHANICAL SERVICE CORPORATION PO NO. 2021-26, SPECIFICATION SECTION: 11317

NOTES:

1. SEE DRAWING C100-1194 FOR SCUM CONCENTRATOR PROCESS & INSTRUMENTATION DIAGRAM.
2. SEE DRAWING C300-1194 FOR SCUM CONCENTRATOR GENERAL ARRANGEMENT DETAILS.
3. 12 - 3/4" X 8"L EXPANSIONS ANCHORS SUPPLIED BY CONTRACTOR. RECOMMENDED BOLTS ARE HILTI KWIK BOLT EXPANSION ANCHOR 3/4" X 8" EMBEDMENT, 316-SS.
4. CONCRETE PIERS & PAD IS AS SUGGESTED DESIGN. FINAL DESIGN TO BE DETERMINED AND EXECUTED BY CONTRACTOR.

DOCUMENT RELEASE

☐ Preliminary issue ☒ Certified for Construction
☐ For Customer Approval ☐ As Built
BY: DATE 5/11/22

SYM	REVISION DESCRIPTION	BY	APP	DATE
1	CERTIFIED FOR CONSTRUCTION	JTP	RAY	4.22.22

EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

TITLE: **MODEL 60-500 SCUM CONCENTRATOR CONTACT SURFACE LAYOUT**

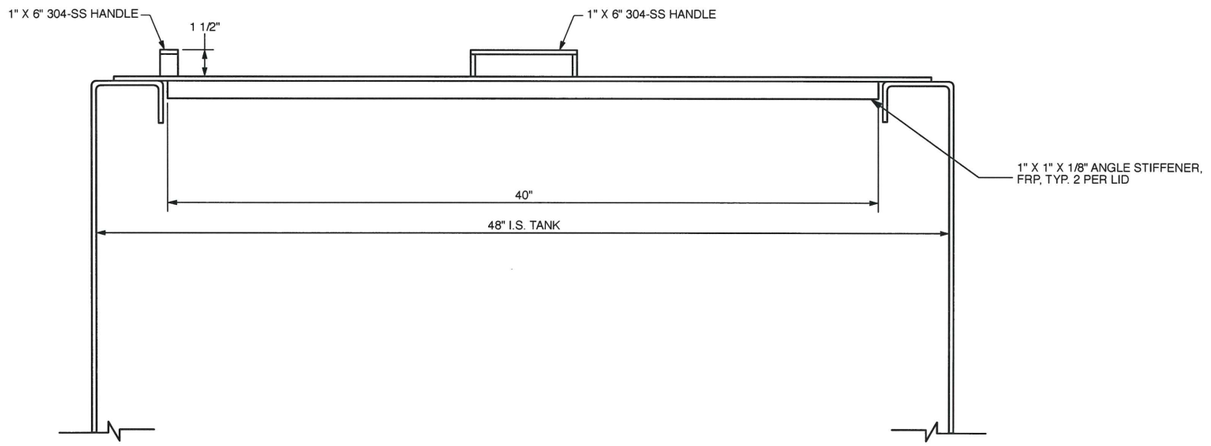
DRAWN	DCH	10.26.21
DESIGN	JTP	10.26.21
CHECK	JTP	10.26.21
APPR	RAY	10.26.21
SCALE	NONE	

CLIENT: **TOTAL MECHANICAL SERVICE CORPORATION**

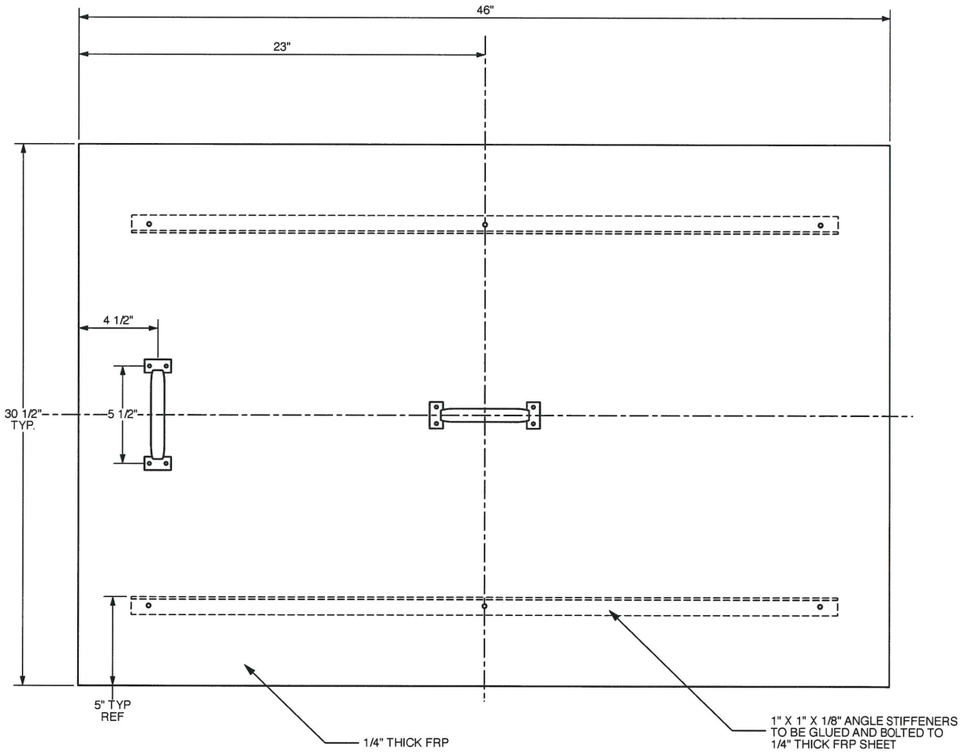
PROJECT: **TAUNTON WASTEWATER TREATMENT FACILITY IMPROVEMENTS 1 - MODEL 60-500 SCUM CONCENTRATOR**

CONTRACT NO. 1194 | ISO A

DRAWING NO. C350-1194 | SHEET 1 OF 1 | REV 1



ODOR CONTAINMENT COVER ELEVATION VIEW



ODOR CONTAINMENT COVER PLAN VIEW

TOTAL MECHANICAL SERVICE CORPORATION PO NO. 2021-26, SPECIFICATION SECTION: 11317

NOTES:

1. QTY. SIX (6) FRP ODOR CONTAINMENT COVERS, SUPPLIED BY ENVIROCARE AND INSTALLED BY OTHERS.

   ESTIMATED WEIGHT EA. : 20 LBS.
2. THE LIDS ARE CUSTOM MANUFACTURED USING 1/4" THICK FRP SKIN AND AND ANGLE STIFFENER WITH PREMIUM GRADE VINYL ESTER RESIN.
3. THE COVERS ARE DESIGNED TO BE INDIVIDUALLY REMOVED EASILY FOR MONITORING THE PROCESS AND MAINTENANCE.
4. WORK WITH DRAWING C300-1194.

DOCUMENT RELEASE

☐ Preliminary issue ☒ Certified for Construction

☐ For Customer Approval ☐ As Built

BY RJH DATE 5/11/22

SYM	REVISION DESCRIPTION	BY	APP	DATE
1	CERTIFIED FOR CONSTRUCTION	JTP	RAY	4.22.22

EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

TITLE: **CONCENTRATOR TANK FRP ODOR CONTAINMENT COVERS**

DRAWN	DCH	DATE	10.29.21
DESIGN	JTP	DATE	10.29.21
CHECK	JTP	DATE	10.29.21
APPR	RAY		10.29.21
SCALE	NOTED		

CLIENT: **TOTAL MECHANICAL SERVICE CORPORATION**

PROJECT: **TAUNTON WASTEWATER TREATMENT FACILITY IMPROVEMENTS 1 - MODEL 60-500 SCUM CONCENTRATOR**

CONTRACT NO. 1194

DRAWING NO. C550-1194

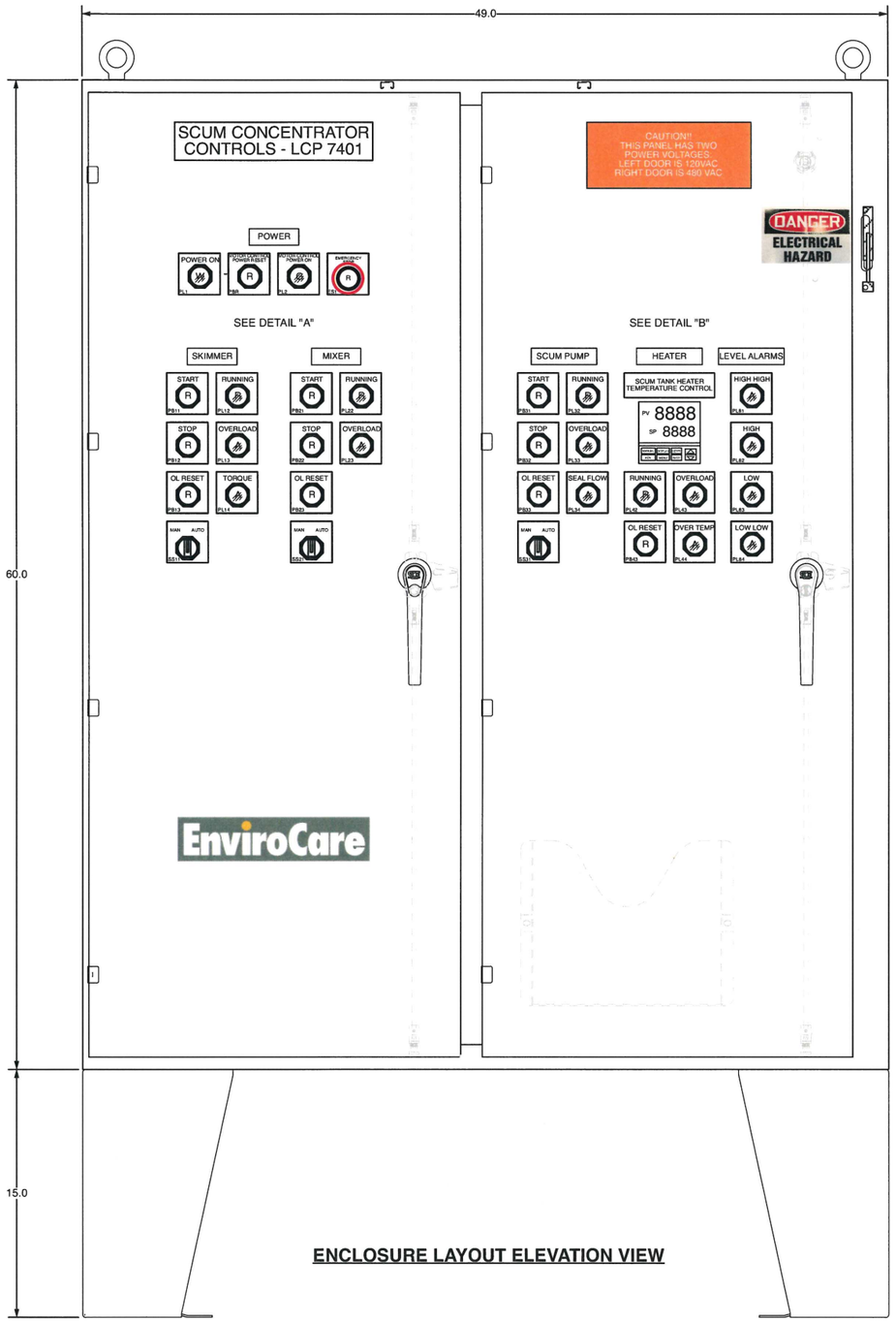
ISO A

SHEET 1 OF 1

REV 1

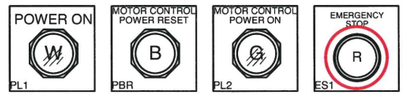
SCUM CONCENTRATOR CONTROLS - LCP 7401

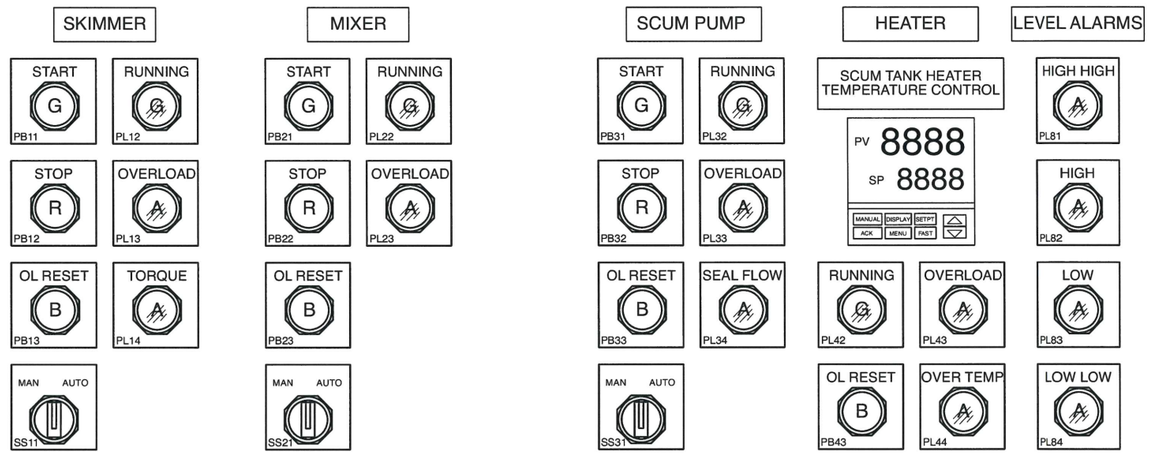
CAUTION!!
THIS PANEL HAS TWO POWER VOLTAGES:
LEFT DOOR IS 120VAC
RIGHT DOOR IS 480 VAC



ENCLOSURE LAYOUT ELEVATION VIEW

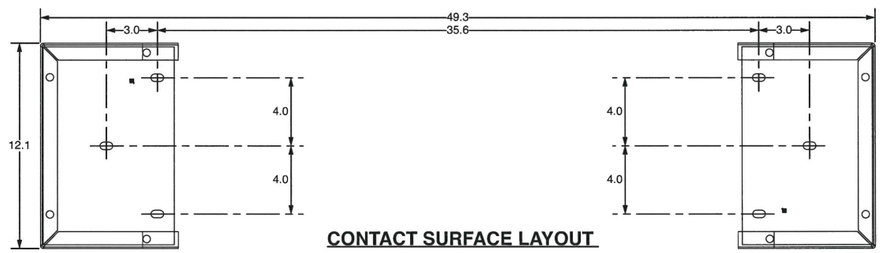
POWER





DETAIL A

DETAIL B



CONTACT SURFACE LAYOUT

TOTAL MECHANICAL SERVICE CORPORATION PO NO. 2021-26,
SPECIFICATION SECTION: 11317

U.S. PATENT NO.: 4,194,888
U.S. PATENT NO.: 6,719,829
U.S. PATENT NO.: 5,759,233
U.S. PATENT NO.: 5,279,646
OTHER U.S. PATENTS PENDING

NOTES:

1. THIS DRAWING IS REPRESENTATIVE OF ONE (1) LOCAL CONTROL PANEL. ONE (1) TOTAL PANEL IS SUPPLIED BY ENVIROCARE.
2. THE LOCAL CONTROL PANEL IS STANDALONE AND COMES WITH FLOORSTAND. MOUNT SHADED FROM DIRECT HEAT RADIATION.
3. ENCLOSURE IS NEMA 4X AND 304 SS. SAGINAW PN# SCE-60XEL4912SSLP. APPROX. WEIGHT 650 LBS.
4. CONTROL PANEL IS LABELLED UL 508A.
5. ALL ASSOCIATED FIELD INSTRUMENTS WILL BE INSTALLED AND WIRED TO THE LOCAL CONTROL PANEL BY OTHERS.
6. ALL SHOWN MOTORS ARE FACTORY INSTALLED BUT WIRED TO LOCAL CONTROL PANEL BY OTHERS.
7. SEE DRAWING C701-1194 FOR BACK PANEL LAYOUT.

DOCUMENT RELEASE

☐ Preliminary Issue ☒ Certified for Construction
☐ For Customer Approval ☐ As Built
BY R.Ray DATE 5/11/22

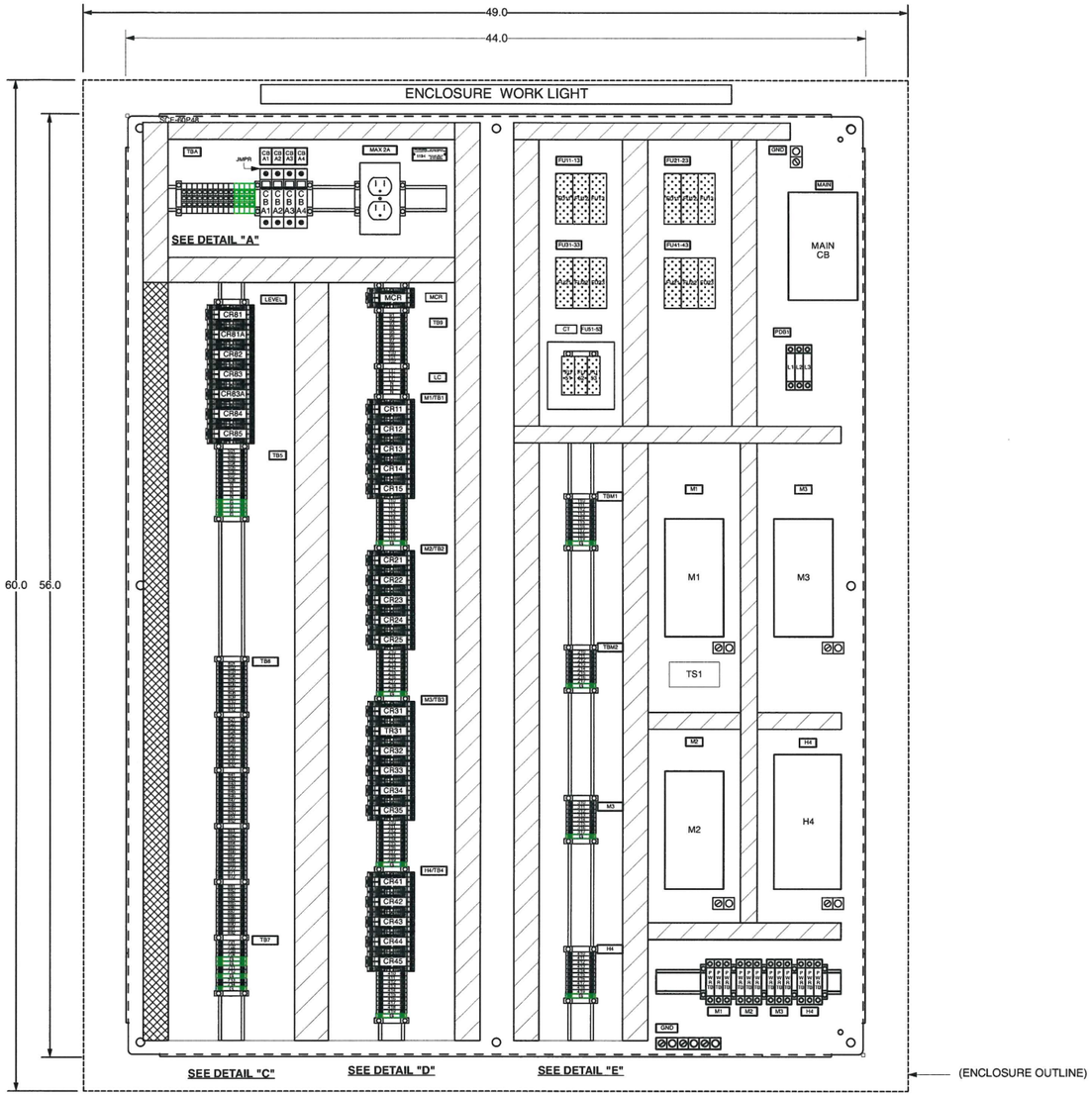
SYM	REVISION DESCRIPTION	BY	APP	DATE
1	UPDATE TO SAGINAW, PANEL NO. PER BETA DWG. SKE-3 DATED 3/10/22, CERT. FOR CONSTRUCTION.	MP	RAY	5.5.22

EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

TITLE: SCUM CONCENTRATOR LCP-7401 ENCLOSURE FRONT ELEVATION

DRAWN	MP	11.04.21
DESIGN	MP	11.04.21
CHECK	JTP	11.04.21
APPR	RAY	11.04.21
SCALE	NONE	

CLIENT: TOTAL MECHANICAL SERVICE CORPORATION
PROJECT: CITY OF TAUNTON WWTP, MA SCUM CONCENTRATOR CONTROL PANEL
CONTRACT NO.: 1194
SIZE: E
DRAWING NO.: C700-1194
SHEET: 1 OF 1
REV: 1



BACK PANEL LAYOUT

TOTAL MECHANICAL SERVICE CORPORATION PO NO. 2021-26,
SPECIFICATION SECTION: 11317

U.S. PATENT NO.: 4,194,888
U.S. PATENT NO.: 6,719,829
U.S. PATENT NO.: 5,759,233
U.S. PATENT NO.: 5,279,646
OTHER U.S. PATENTS PENDING

NOTES:

= FIELD WIRING
= INTERNAL WIRING
= PANEL WIRING
= SKID WIRING
= FIELD WIRING
- REPRESENTS PANEL TERMINAL
- REPRESENTS LINE REFERENCE
- REPRESENTS DEVICE TERMINAL

DOCUMENT RELEASE

☐ Preliminary Issue ☒ Certified for Construction
☐ For Customer Approval ☐ As Built
BY R. Ryan DATE 5/6/22

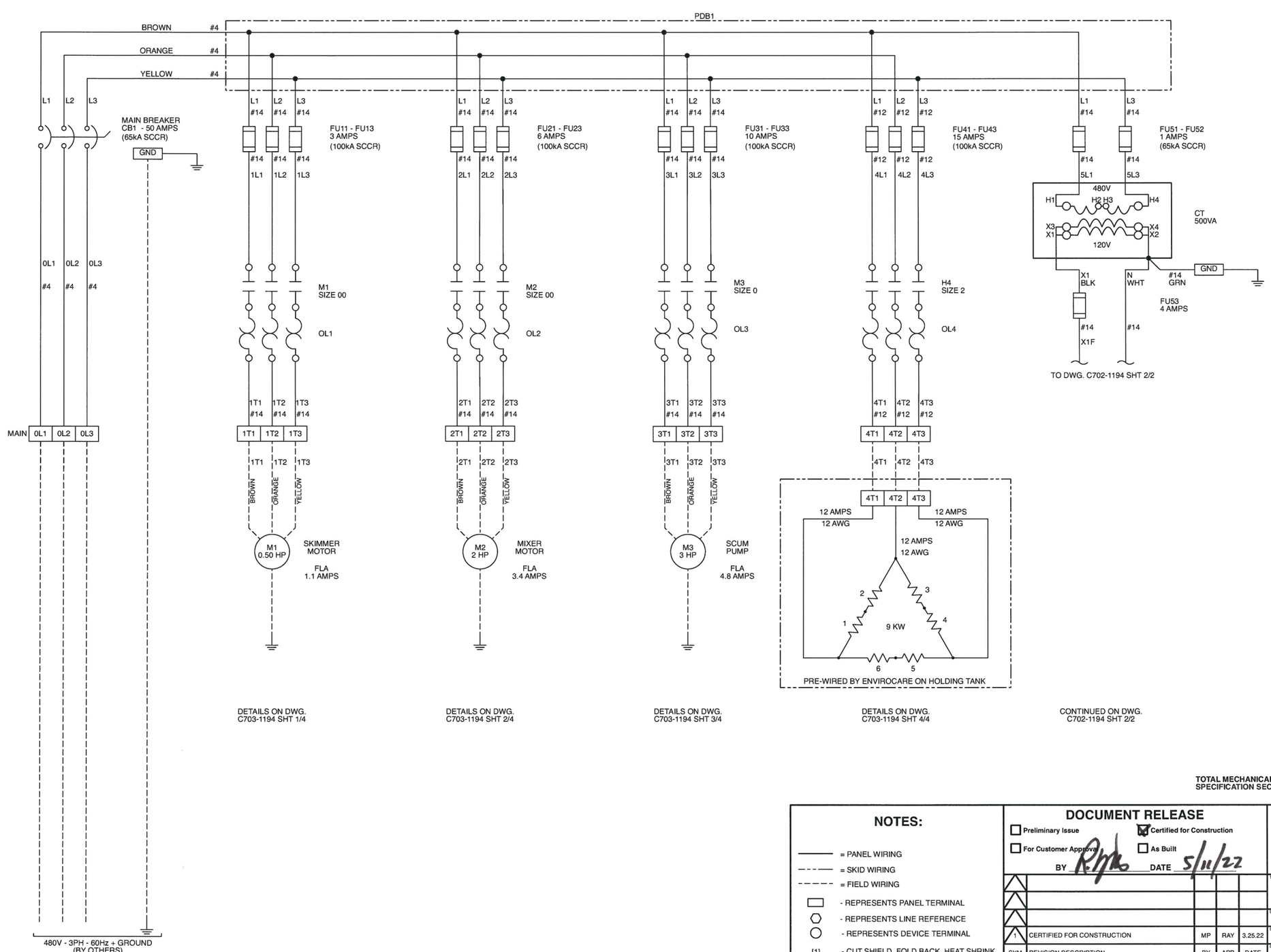
SYM	REVISION DESCRIPTION	BY	APP	DATE
1	CERTIFIED FOR CONSTRUCTION	MP	RAY	3.25.22

EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

TITLE: SCUM CONCENTRATOR LCP-7401
ENCLOSURE BACK PANEL LAYOUT

DRAWN	MP	11.04.21
DESIGN	MP	11.04.21
CHECK	JTP	11.04.21
APPR	RAY	11.04.21
SCALE	NONE	

CLIENT: TOTAL MECHANICAL SERVICE CORPORATION
PROJECT: CITY OF TAUNTON WWTP, MA
SCUM CONCENTRATOR CONTROL PANEL
CONTRACT NO.: 1194
SIZE: D
DRAWING NO.: C701-1194
SHEET 1 OF 1
REV: 1



TOTAL MECHANICAL SERVICE CORPORATION PO NO. 2021-26,
SPECIFICATION SECTION: 11317

U.S. PATENT NO.: 6,719,829
U.S. PATENT NO.: 5,759,233
U.S. PATENT NO.: 5,279,646
OTHER U.S. PATENTS PENDING

NOTES:

- ——— = PANEL WIRING
- - - - — = SKID WIRING
- - - - - = FIELD WIRING
- ▭ - REPRESENTS PANEL TERMINAL
- ⬡ - REPRESENTS LINE REFERENCE
- ○ - REPRESENTS DEVICE TERMINAL
- [1] - CUT SHIELD, FOLD BACK, HEAT SHRINK
- [2] - MOUNT IN FRONT DOOR

DOCUMENT RELEASE

☐ Preliminary Issue ☑ Certified for Construction
☐ For Customer Approval ☐ As Built
BY RJM DATE 5/11/22

SYM	REVISION DESCRIPTION	BY	APP	DATE
1	CERTIFIED FOR CONSTRUCTION	MP	RAY	3.25.22

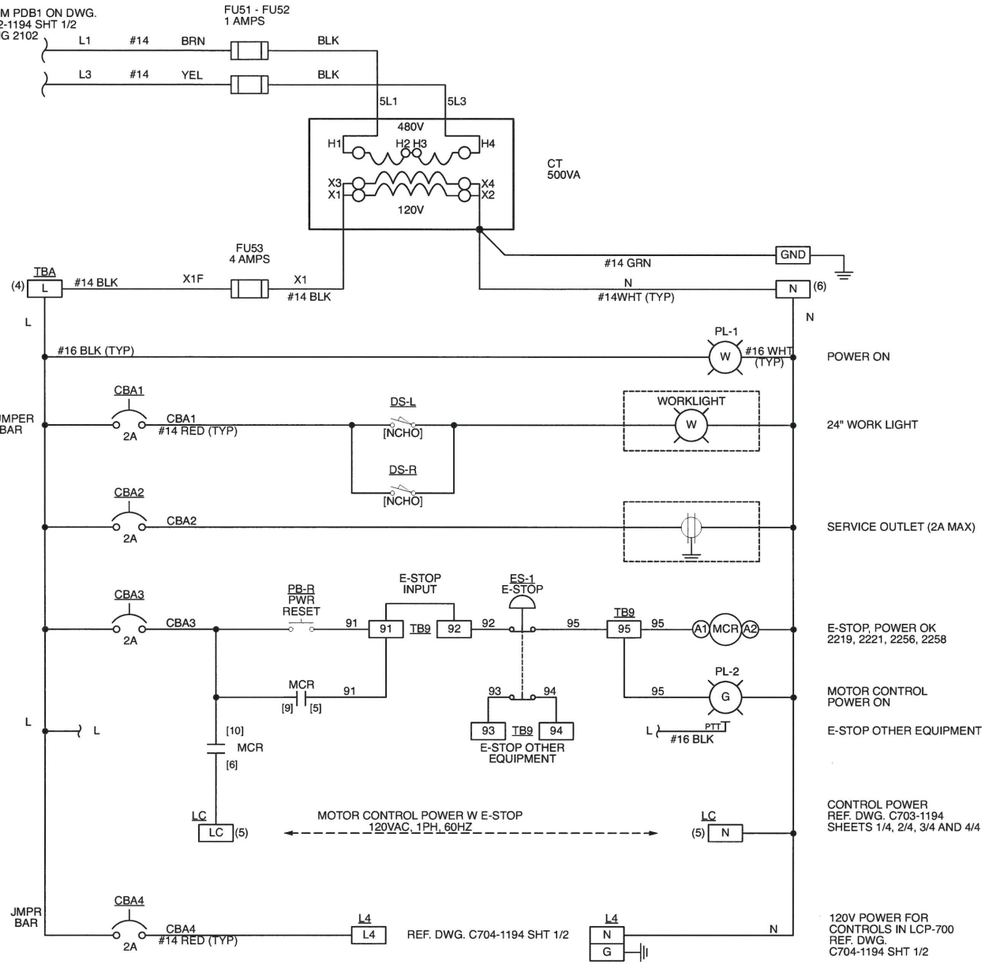
EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

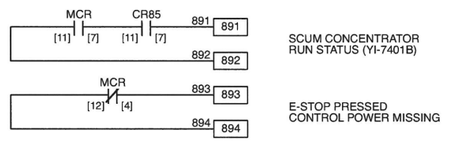
TITLE: CONTROL PANEL POWER DISTRIBUTION 480VAC THREE LINE

DRAWN	MP	DATE	11.04.21
DESIGN	MP	DATE	11.04.21
CHECK	JTP	DATE	11.04.21
APPR	RAY	DATE	11.04.21
SCALE	NONE		

CLIENT: TOTAL MECHANICAL SERVICE CORPORATION
PROJECT: CITY OF TAUNTON WWTP, MA
SCUM CONCENTRATOR CONTROL PANEL
CONTRACT NO. 1194
DRAWING NO. C702-1194
SIZE E
SHEET 1 OF 2
REV 1

MOTOR CONTROL IN 480 V SECTION (RIGHT DOOR) LCP-4100A





TOTAL MECHANICAL SERVICE CORPORATION PO NO. 2021-26,
SPECIFICATION SECTION: 11317

U.S. PATENT NO.: 6,719,829
U.S. PATENT NO.: 5,759,233
U.S. PATENT NO.: 5,279,646
OTHER U.S. PATENTS PENDING

NOTES:

- ——— = PANEL WIRING
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- ▭ - REPRESENTS PANEL TERMINAL
- ⬡ - REPRESENTS LINE REFERENCE
- ○ - REPRESENTS DEVICE TERMINAL
- [1] - CUT SHIELD, FOLD BACK, HEAT SHRINK
- [2] - MOUNT IN FRONT DOOR

DOCUMENT RELEASE

☐ Preliminary Issue ☒ Certified for Construction
☐ For Customer Approval ☐ As Built
BY R.Ray DATE 5/11/22

SYM	REVISION DESCRIPTION	BY	APP	DATE
1	CERTIFIED FOR CONSTRUCTION	MP	RAY	3.25.22

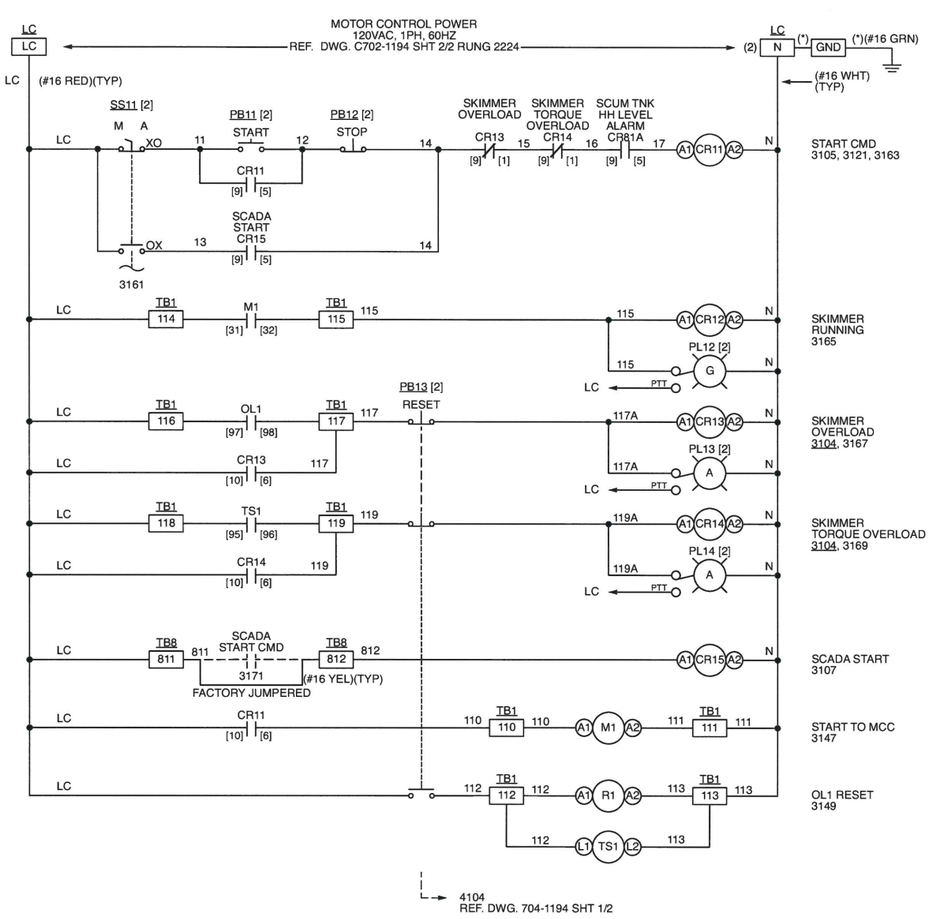
EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

TITLE: CONTROL PANEL POWER DISTRIBUTION TRANSFORMER 480/120 & E-STOP

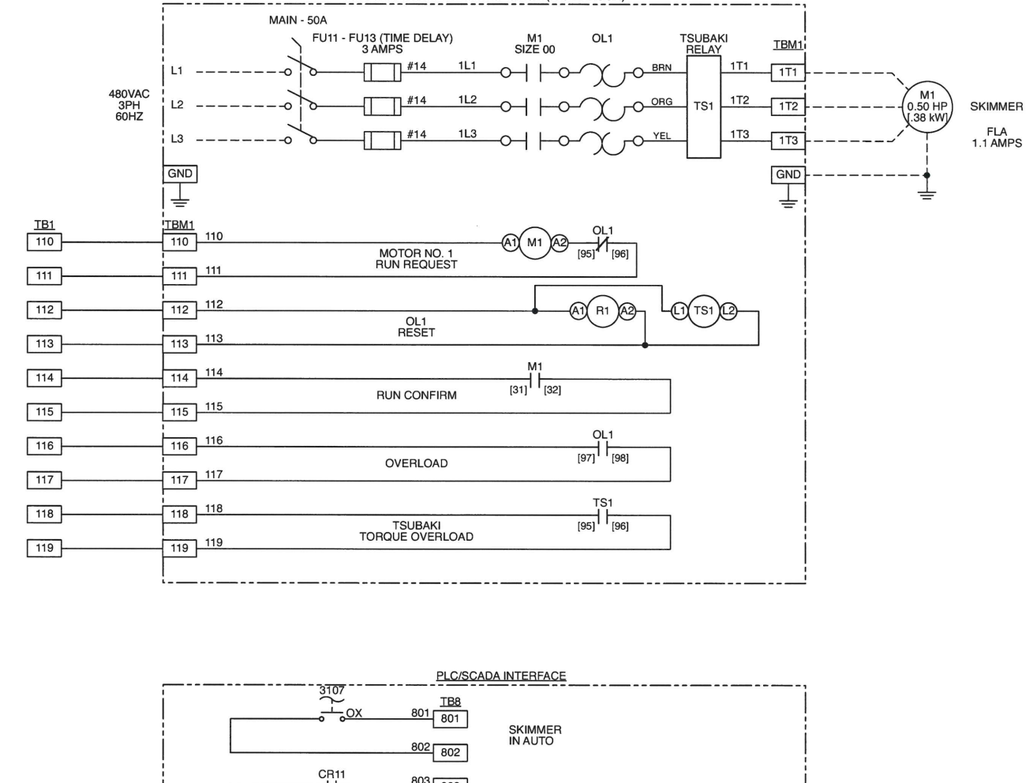
DRAWN MP	DATE 11.04.21
DESIGN MP	DATE 11.04.21
CHECK JTP	DATE 11.04.21
APPR RAY	DATE 11.04.21
SCALE NONE	

CLIENT: TOTAL MECHANICAL SERVICE CORPORATION
PROJECT: CITY OF TAUNTON WWTP, MA SCUM CONCENTRATOR CONTROL PANEL
CONTRACT NO. 1194
DWG NO. C702-1194
SHEET 2 OF 2
REV 1

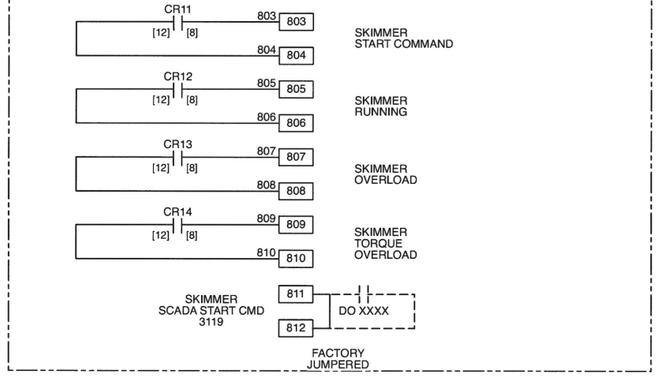
MOTOR CONTROL IN 120 V SECTION (LEFT DOOR)



MOTOR CONTROL IN 480 V SECTION (RIGHT DOOR)



PLC/SCADA INTERFACE



TOTAL MECHANICAL SERVICE CORPORATION PO NO. 2021-26,
SPECIFICATION SECTION: 11317

U.S. PATENT NO.: 6,719,829
U.S. PATENT NO.: 5,759,233
U.S. PATENT NO.: 5,279,646
OTHER U.S. PATENTS PENDING

NOTES:

- ——— = PANEL WIRING
- - - - = SKID WIRING
- – – – = FIELD WIRING
- ▭ - REPRESENTS PANEL TERMINAL
- ⬡ - REPRESENTS LINE REFERENCE
- ○ - REPRESENTS DEVICE TERMINAL
- [1] - CUT SHIELD, FOLD BACK, HEAT SHRINK
- [2] - MOUNT IN FRONT DOOR

DOCUMENT RELEASE

☐ Preliminary Issue ☒ Certified for Construction
☐ For Customer Approval ☐ As Built
BY RJH DATE 5/11/22

SYM	REVISION DESCRIPTION	BY	APP	DATE
1	CERTIFIED FOR CONSTRUCTION	MP	RAY	3.25.22

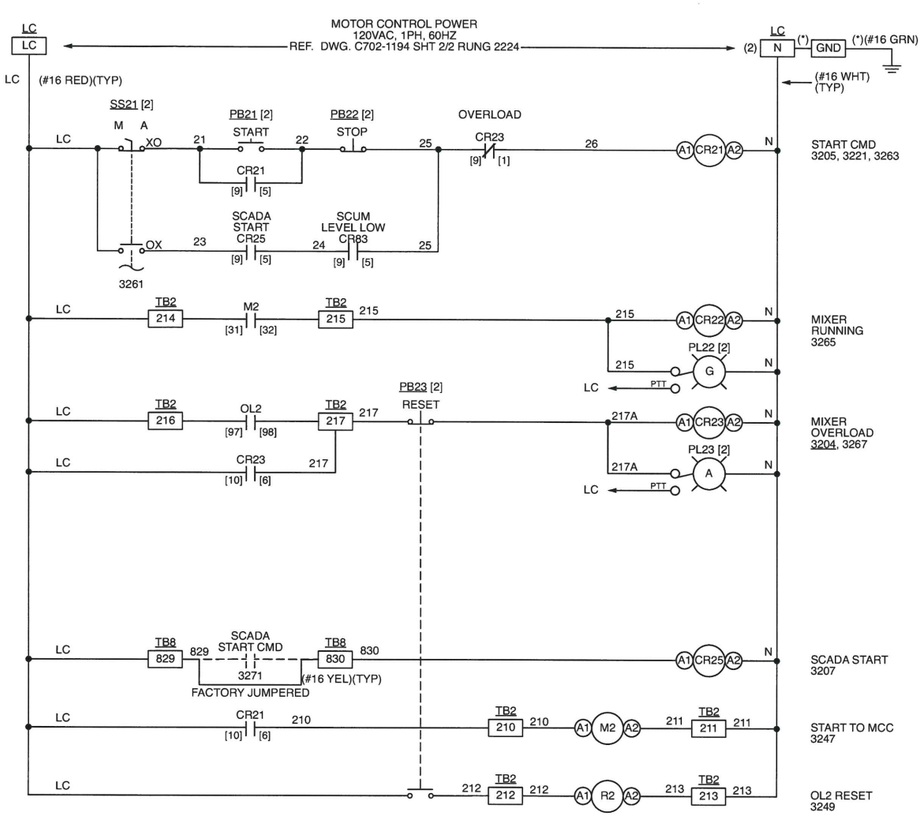
EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

TITLE: **WIRING DIAGRAM MOTOR CONTROL - SKIMMER**

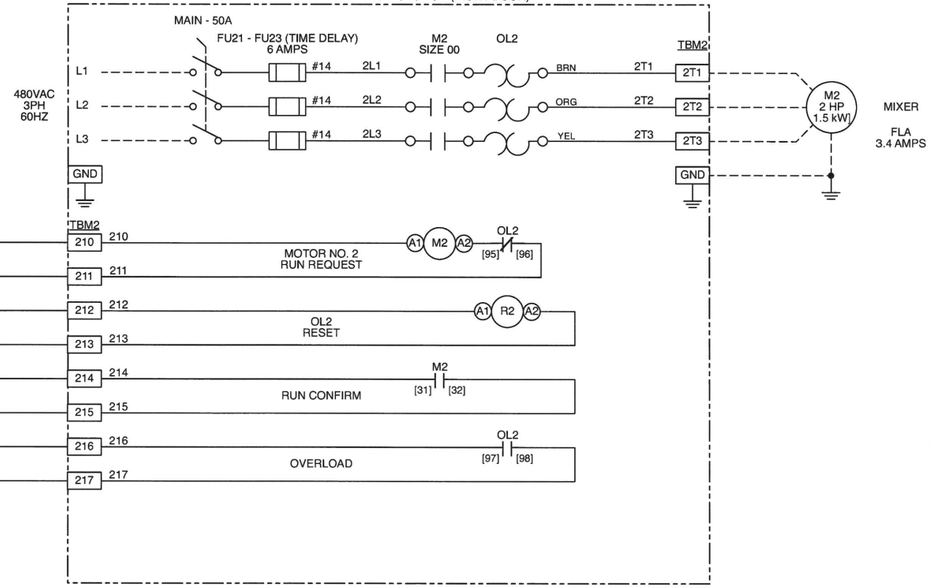
DRAWN: MP	DATE: 11.04.21	CLIENT: TOTAL MECHANICAL SERVICE CORPORATION
DESIGN: MP	DATE: 11.04.21	
CHECK: JTP	DATE: 11.04.21	PROJECT: CITY OF TAUNTON WWTP, MA SCUM CONCENTRATOR CONTROL PANEL
APPR: RAY	DATE: 11.04.21	CONTRACT NO: 1194
SCALE: NONE		DRAWING NO: C703-1194

SHEET 1 OF 4 REV 1

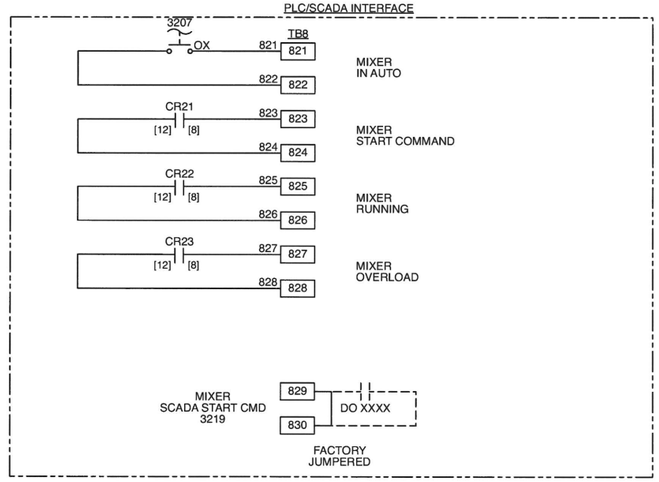
MOTOR CONTROL IN 120 V SECTION (LEFT DOOR)



MOTOR CONTROL IN 480 V SECTION (RIGHT DOOR)



PLC/SCADA INTERFACE



TOTAL MECHANICAL SERVICE CORPORATION PO NO. 2021-26,
SPECIFICATION SECTION: 11317

U.S. PATENT NO.: 6,719,829
U.S. PATENT NO.: 5,759,233
U.S. PATENT NO.: 5,279,646
OTHER U.S. PATENTS PENDING

NOTES:

- ——— = PANEL WIRING
- - - - - = SKID WIRING
- – – – – = FIELD WIRING
- ▭ - REPRESENTS PANEL TERMINAL
- ⬡ - REPRESENTS LINE REFERENCE
- ○ - REPRESENTS DEVICE TERMINAL
- [1] - CUT SHIELD, FOLD BACK, HEAT SHRINK
- [2] - MOUNT IN FRONT DOOR

DOCUMENT RELEASE

☐ Preliminary Issue ☒ Certified for Construction
☐ For Customer Approval ☐ As Built
BY RJL DATE 5/11/22

SYM	REVISION DESCRIPTION	BY	APP	DATE
1	CERTIFIED FOR CONSTRUCTION	MP	RAY	3.25.22

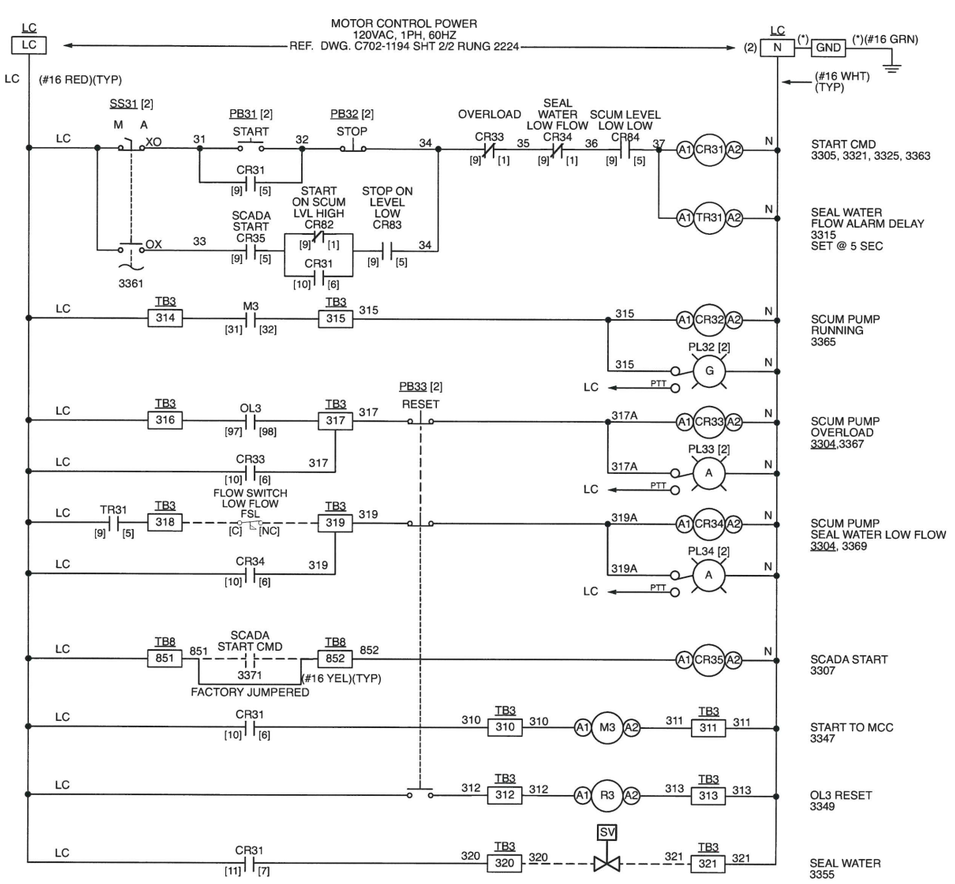
EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

TITLE: WIRING DIAGRAM
MOTOR CONTROL - MIXER

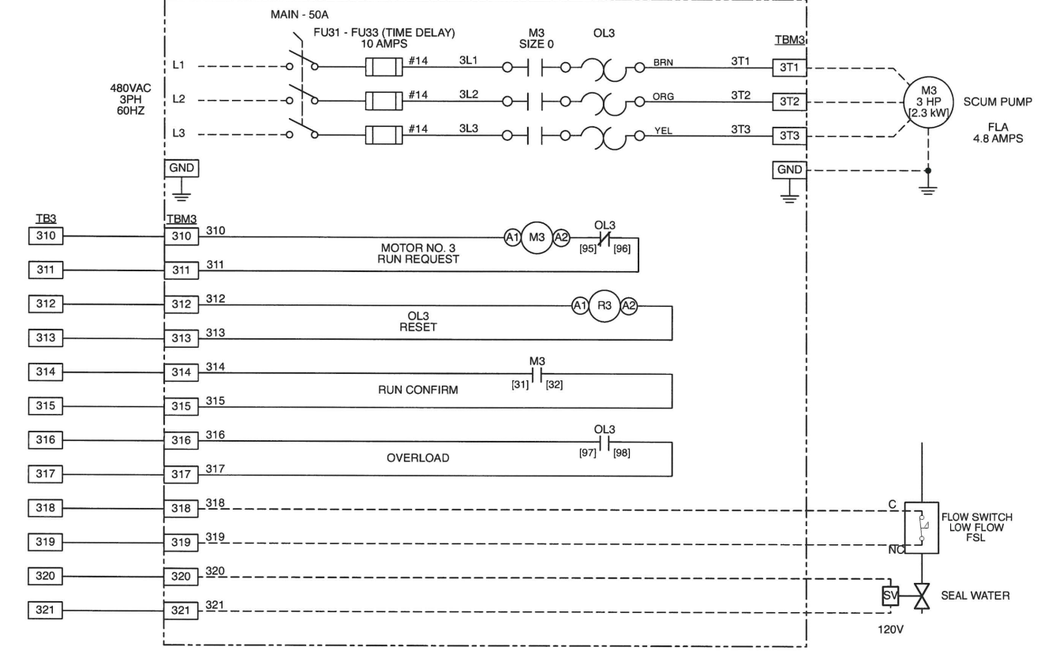
DRAWN	MP	DATE	11.04.21
DESIGN	MP	DATE	11.04.21
CHECK	JTP	DATE	11.04.21
APPR	RAY	DATE	11.04.21
SCALE	NONE		

CLIENT: TOTAL MECHANICAL SERVICE CORPORATION
PROJECT: CITY OF TAUNTON WWTP, MA
SCUM CONCENTRATOR CONTROL PANEL
CONTRACT NO. 1194
DRAWING NO. C703-1194
SHEET 2 OF 4
REV 1

MOTOR CONTROL IN 120 V SECTION (LEFT DOOR)



MOTOR CONTROL IN 480 V SECTION (RIGHT DOOR)



PLC/SCADA INTERFACE

TOTAL MECHANICAL SERVICE CORPORATION PO NO. 2021-26,
SPECIFICATION SECTION: 11317

U.S. PATENT NO.: 6,719,829
U.S. PATENT NO.: 5,759,233
U.S. PATENT NO.: 5,279,646
OTHER U.S. PATENTS PENDING

NOTES:

- ——— = PANEL WIRING
- - - - - = SKID WIRING
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- [1] - CUT SHIELD, FOLD BACK, HEAT SHRINK
- [2] - MOUNT IN FRONT DOOR

DOCUMENT RELEASE

☐ Preliminary Issue ☒ Certified for Construction
☐ For Customer Approval ☐ As Built
BY RMA DATE 5/11/22

SYM	REVISION DESCRIPTION	BY	APP	DATE
1	CERTIFIED FOR CONSTRUCTION	MP	RAY	3.25.22

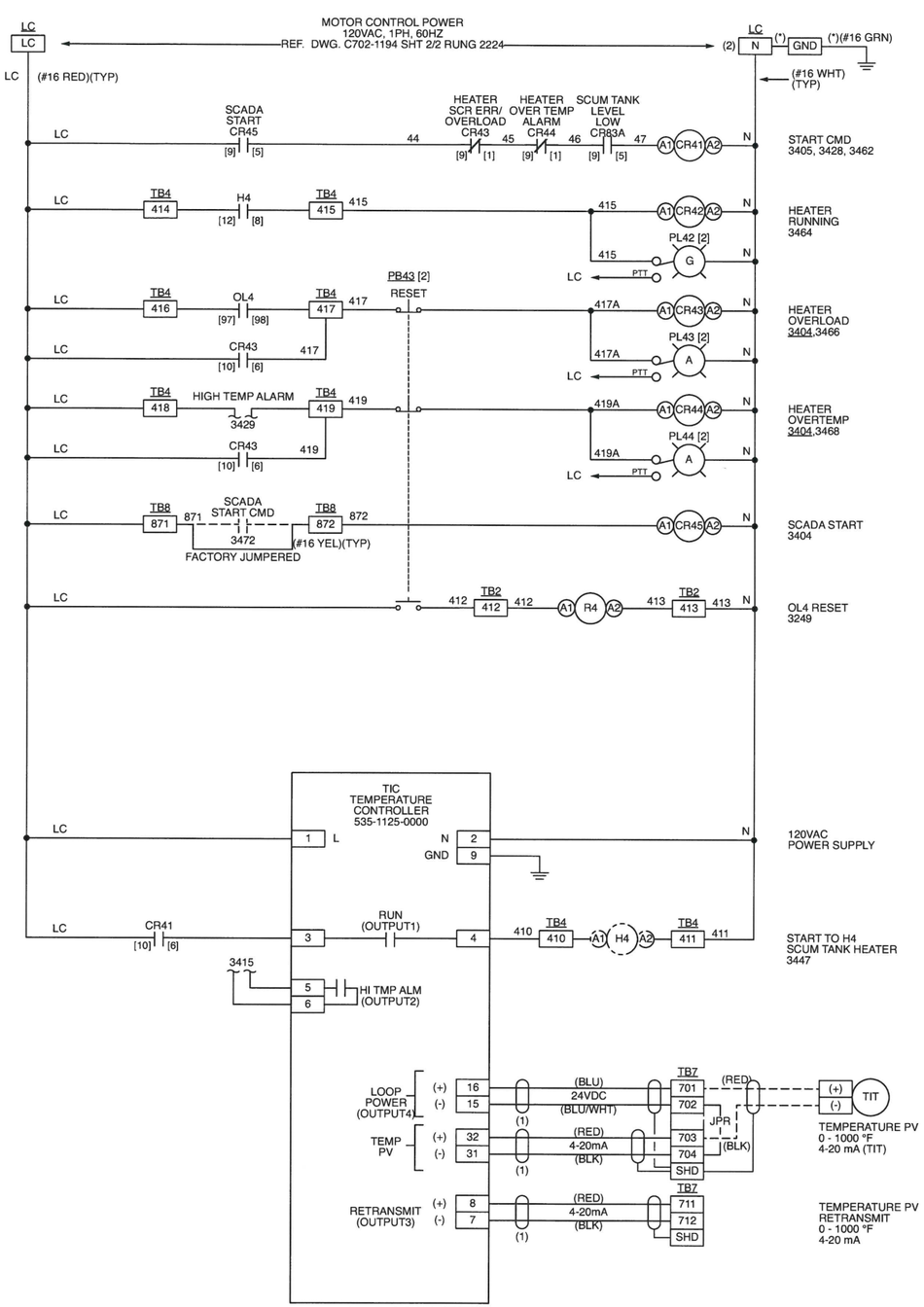
EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

TITLE: **WIRING DIAGRAM MOTOR CONTROL - SCUM PUMP**

DRAWN	MP	DATE	11.04.21
DESIGN	MP	DATE	11.04.21
CHECK	JTP	DATE	11.04.21
APPR	RAY	DATE	11.04.21
SCALE	NONE		

CLIENT: TOTAL MECHANICAL SERVICE CORPORATION
PROJECT: CITY OF TAUNTON WWTP, MA
SCUM CONCENTRATOR CONTROL PANEL
CONTRACT NO: 1194
DRAWING NO: C703-1194
SHEET 3 OF 4
REV 1

MOTOR CONTROL IN 120 V SECTION (LEFT DOOR)



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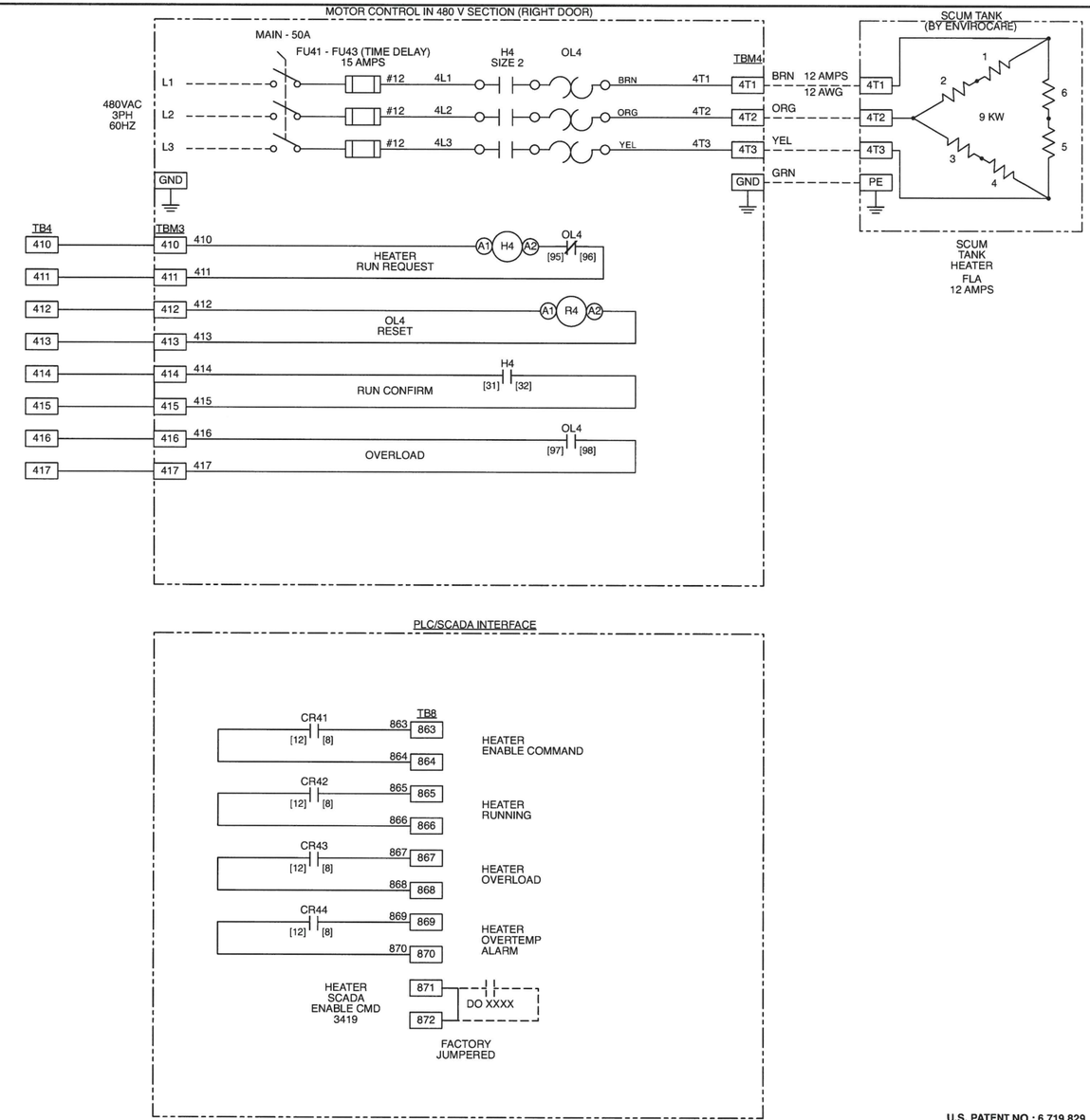

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SYM	REVISION DESCRIPTION	BY	APP	DATE
1	CERTIFIED FOR CONSTRUCTION	MP	RAY	3.25.22

EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

TITLE
WIRING DIAGRAM HEATER CONTROL - SCUM HEATER

DRAWN	MP	DATE	11.04.21
DESIGN	MP	DATE	11.04.21
CHECK	JTP	DATE	11.04.21
APPR	RAY	DATE	11.04.21
SCALE	NONE		

CLIENT: TOTAL MECHANICAL SERVICE CORPORATION
PROJECT: CITY OF TAUNTON WWTP, MA
SCUM CONCENTRATOR CONTROL PANEL
CONTRACT NO.: 1194
DRAWING NO.: C703-1194
SIZE: D
SHEET 4 OF 4
REV 1

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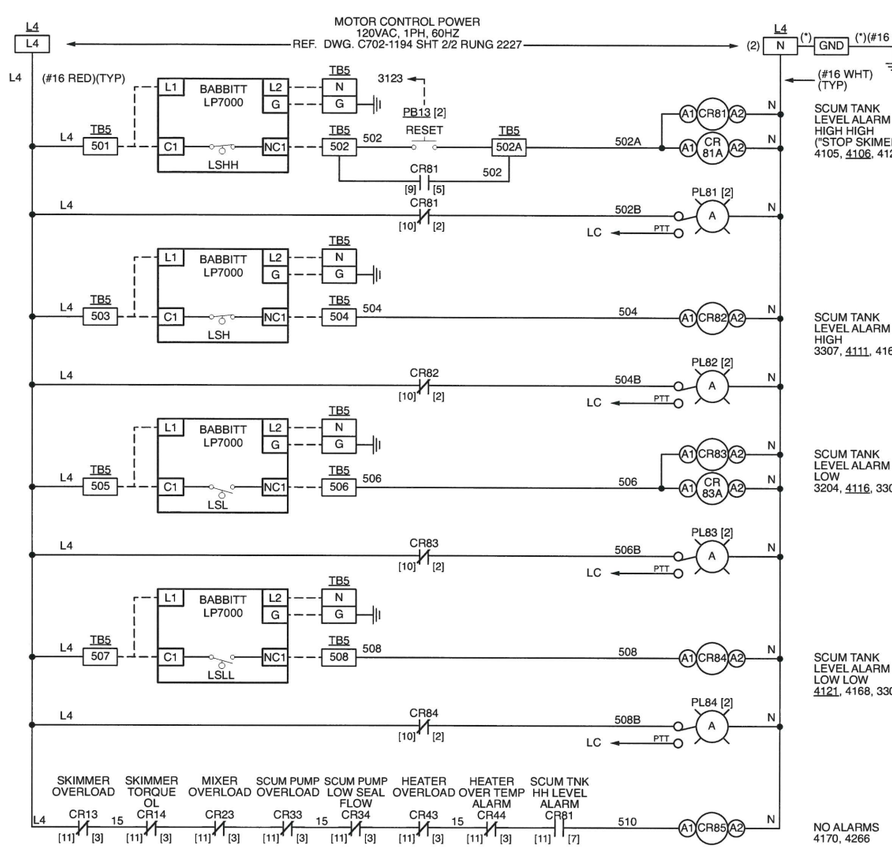
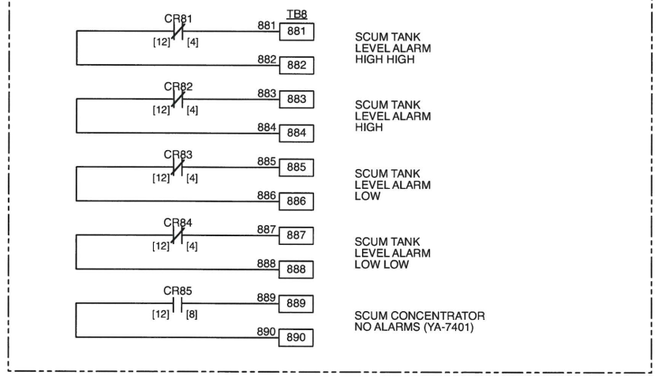


PLC/SCADA INTERFACE



TOTAL MECHANICAL SERVICE CORPORATION PO NO. 2021-26,
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BY R.Ray DATE 5/11/22

SYM	REVISION DESCRIPTION	BY	APP	DATE
1	CERTIFIED FOR CONSTRUCTION	MP	RAY	3.25.22

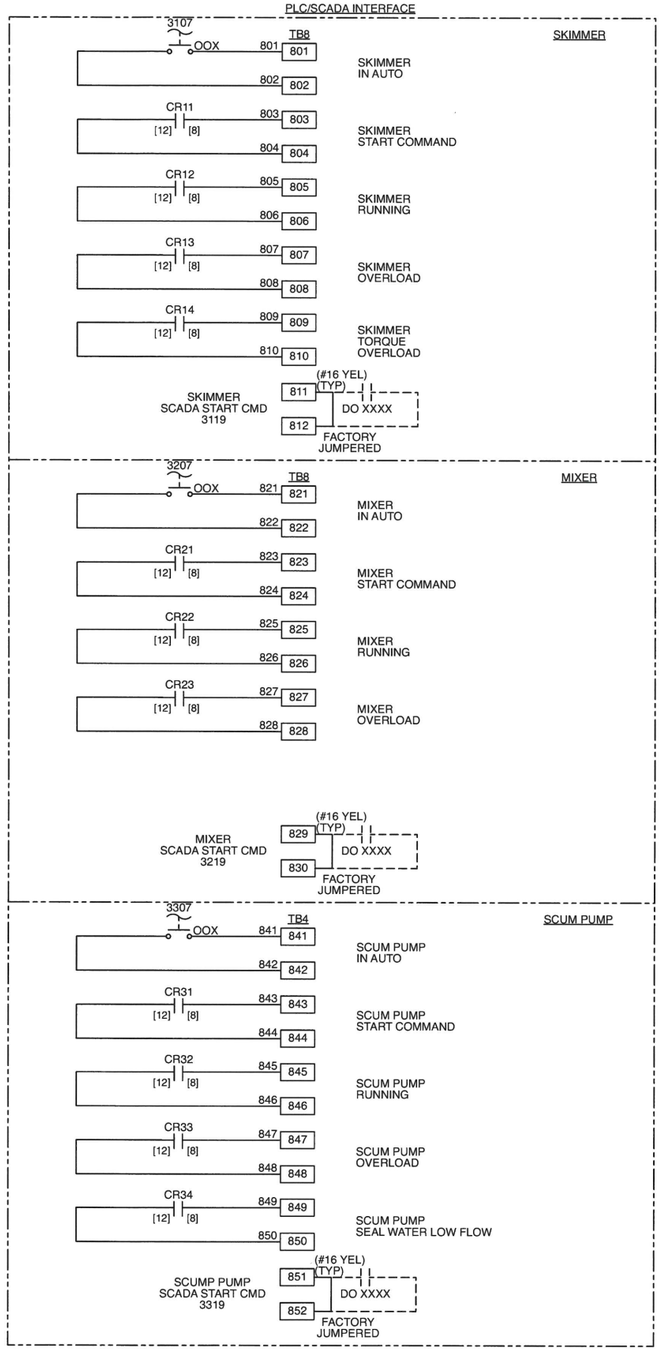
EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

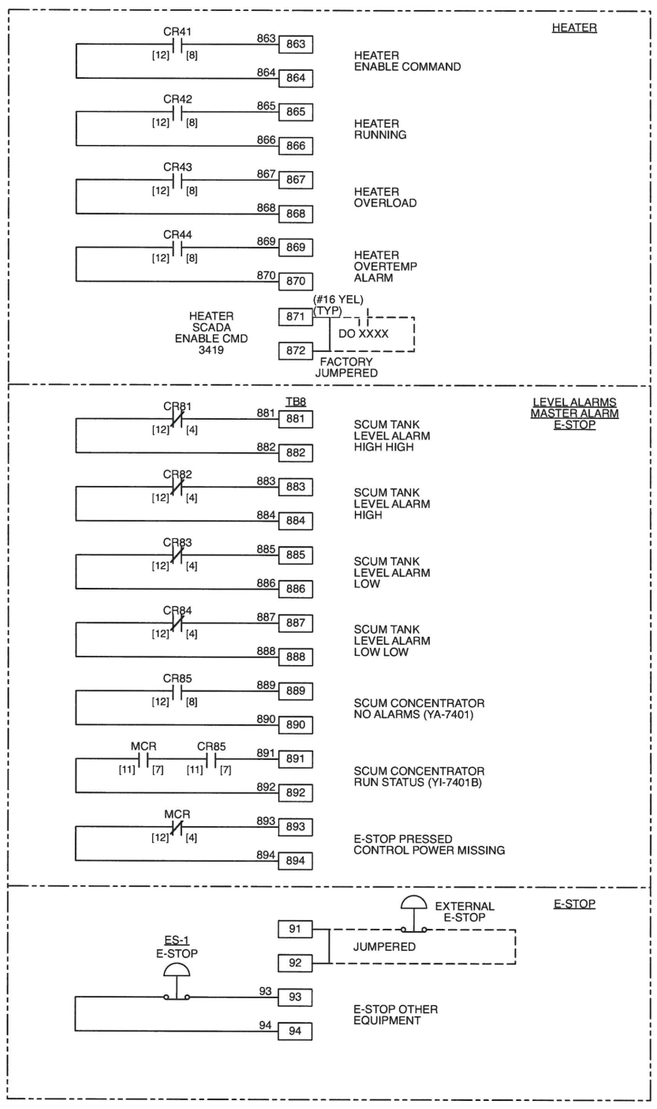
TITLE: **WIRING DIAGRAM LEVELS & ALARMS**

DRAWN	MP	11.04.21
DESIGN	MP	11.04.21
CHECK	JTP	11.04.21
APPR	RAY	11.04.21
SCALE	NONE	

CLIENT: **TOTAL MECHANICAL SERVICE CORPORATION**
PROJECT: CITY OF TAUNTON WWTP, MA
SCUM CONCENTRATOR CONTROL PANEL
CONTRACT NO: 1194
DRAWING NO: C704-1194
SHEET 1 OF 2
REV 1

PLC/SCADA INTERFACE





TOTAL MECHANICAL SERVICE CORPORATION PO NO. 2021-26,
SPECIFICATION SECTION: 11317

U.S. PATENT NO.: 6,719,829
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BY R.A. DATE 5/11/22

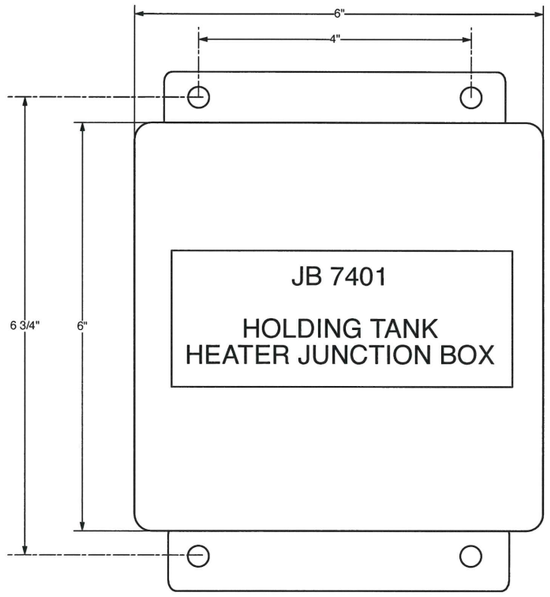
SYM	REVISION DESCRIPTION	BY	APP	DATE
1	CERTIFIED FOR CONSTRUCTION	MP	RAY	3.25.22

EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

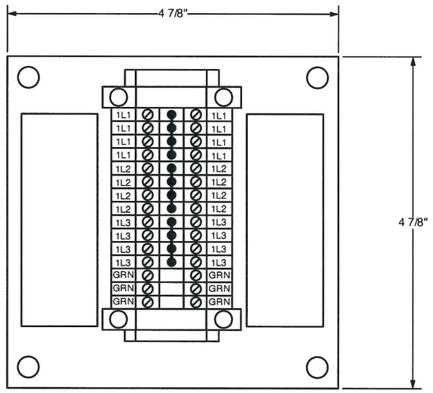
TITLE: **WIRING DIAGRAM PLC SCADA INTERFACE**

DRAWN	MP	DATE	11.04.21
DESIGN	MP	DATE	11.04.21
CHECK	JTP	DATE	11.04.21
APPR	RAY	DATE	11.04.21
SCALE	NONE		

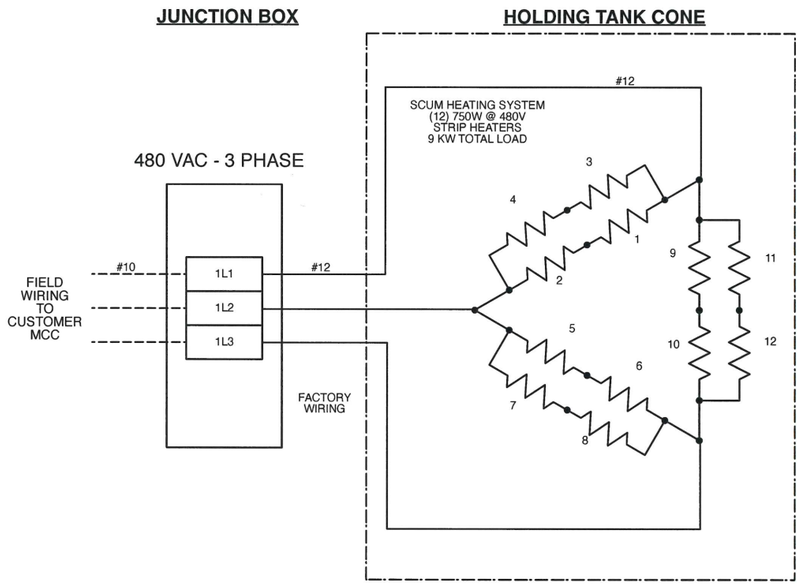
CLIENT: **TOTAL MECHANICAL SERVICE CORPORATION**
PROJECT: CITY OF TAUNTON WWTP, MA
SCUM CONCENTRATOR CONTROL PANEL
CONTRACT NO: 1194
DRAWING NO: C704-1194
SIZE: D
SHEET 2 OF 2
REV: 1



ENCLOSURE
HOFFMAN - A-606CHNF



BACK PANEL



SCHEMATIC

TOTAL MECHANICAL SERVICE CORPORATION PO NO. 2021-26,
SPECIFICATION SECTION: 11317

U.S. PATENT NO.: 6,719,829
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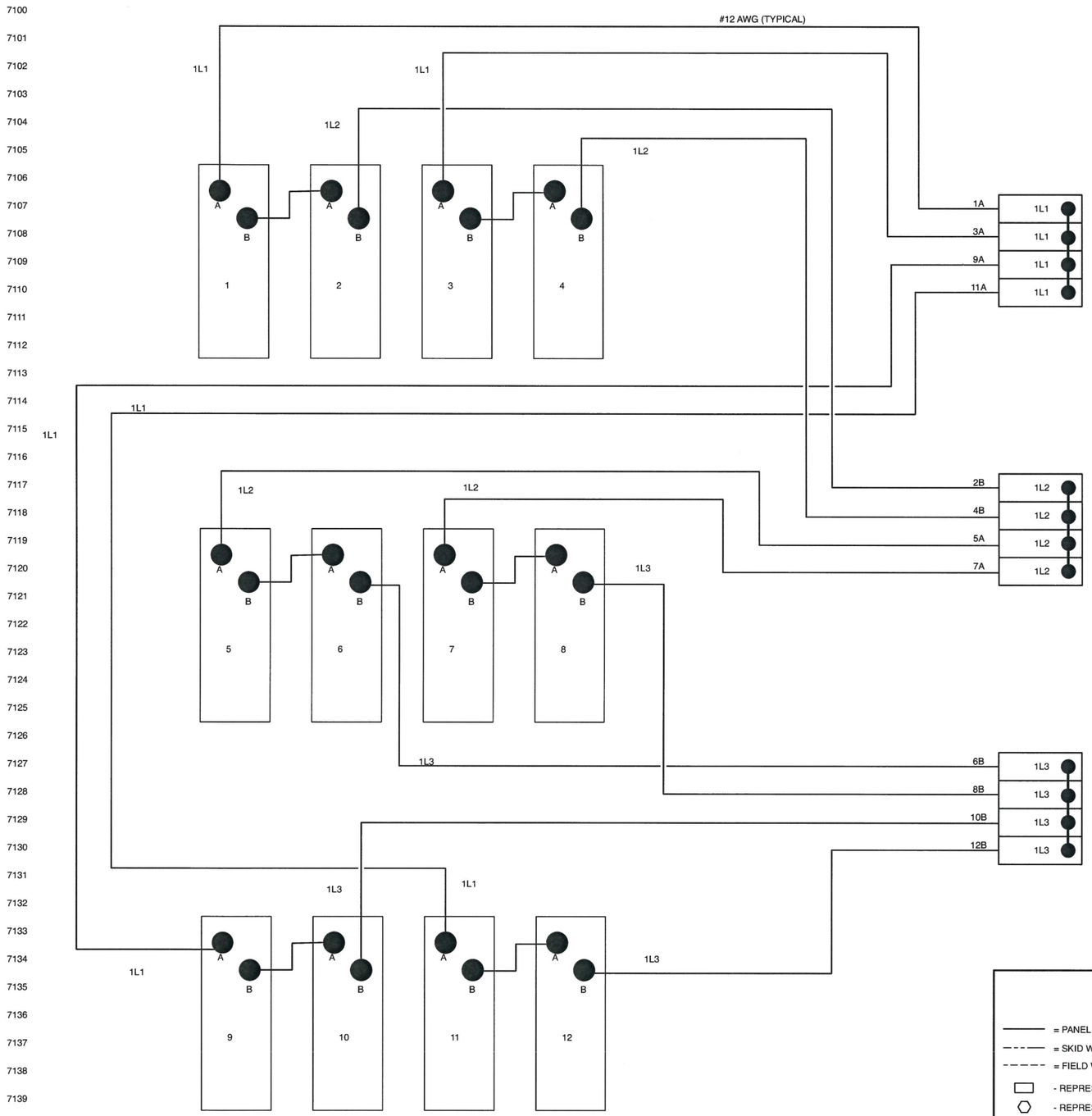
SYM	REVISION DESCRIPTION	BY	APP	DATE
1	CERTIFIED FOR CONSTRUCTION	MP	RAY	3.25.22

EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

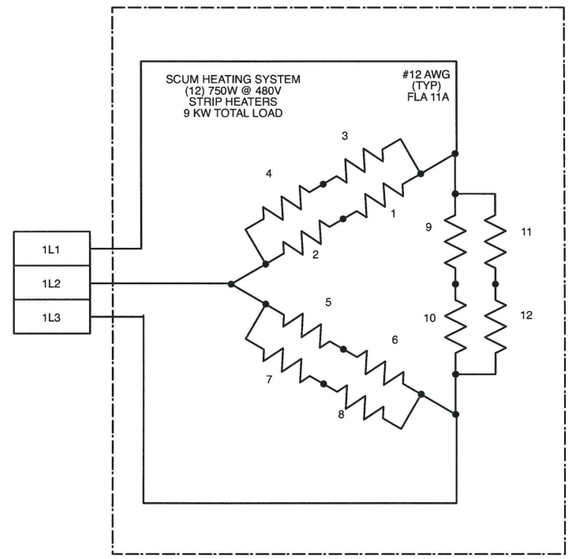
TITLE: **HOLDING TANK HEATER JUNCTION BOX & TERMINAL LAYOUT**

DRAWN	MP	DATE	11.04.21
DESIGN	MP	DATE	11.04.21
CHECK	JTP	DATE	11.04.21
APPR	RAY	DATE	11.04.21
SCALE	NONE		

CLIENT: **TOTAL MECHANICAL SERVICE CORPORATION**
PROJECT: CITY OF TAUNTON WWTP, MA
SCUM CONCENTRATOR CONTROL PANEL
CONTRACT NO: 1194
DRAWING NO: C710-1194
SHEET 1 OF 1
REV 1



HOLDING TANK CONE
STRIP HEATER WIRING DIAGRAM



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BY RAY DATE 5/4/22

SYM	REVISION DESCRIPTION	BY	APP	DATE
1	CERTIFIED FOR CONSTRUCTION	MP	RAY	3.25.22

EnviroCare International
507 Green Island Road, American Canyon, CA 94503
Tel: 707/638.6800 Fax: 707/638.6898

TITLE: HOLDING TANK STRIP HEATER WIRING

DRAWN	MP	11.04.21
DESIGN	MP	11.04.21
CHECK	JTP	11.04.21
APPR	RAY	11.04.21
SCALE	NONE	

CLIENT: TOTAL MECHANICAL SERVICE CORPORATION
PROJECT: CITY OF TAUNTON WWTP, MA
SCUM CONCENTRATOR CONTROL PANEL
CONTRACT NO: 1194
DRAWING NO: C711-1194
SIZE: D
SHEET 1 OF 1
REV 1

10.0 Maintenance Log

The following checklist documents the supplied equipment for the Scum Concentrator supplied by EnviroCare International for Total Mechanical Service Corporation, PO 2021-26. Please inspect the status of the field installation, and initial each corresponding line item if installation has been completed. Use EnviroCare O&M manual, drawing C100-1194 and noted drawings below as a reference. The following list should be completed and returned to EnviroCare before the scheduled commissioning.

Equipment Field Installation Checklist

Item No.:	Equipment Description:	CHECKED BY:	DATE
1	Concentrator Tank and Holding Tank anchored per EnviroCare drwg. C350-1194.		
2	Scum 4”-150# influent piping and related components complete to scum concentrator.		
3	Scum concentrator 6”-150# drain piping complete		
4	Scum concentrator 6”-150# overflow piping complete		
5	Scum concentrator 6”-150# foul air piping complete to the odor control system.		
6	The Holding Tank mixer is installed per Sharpe IOM in EnviroCare O&M manual.		
7	Concentrated Scum Pump mounted to platform and leveled. Pump inlet coupled to the tank discharge with 12” knifegate, transition piece and gaskets.		
8	Concentrated Scum Pump discharge piping and related components complete.		
9	Field Instrumentation mechanically installed on holding tank including: -LSHH (holding tank lid), LSH, LSL, & TE -LSLL in tank to pump transition piece		

Item No.:	Equipment Description:	CHECKED BY:	DATE
10	Scum Concentrator Control Panel LCP-7401 electrical installation complete including: -Connect 480V power distribution per drwgs. C702-1194 sheet 1 & 2 -480VAC skimmer motor wired per drwg. C703-1194 sheet 1 -480VAC scum mixer wired per drwg. C703-1194 sheet 2 -480VAC scum pump wired per drwg. C703-1194 sheet 3 -24VDC loop powered scum temperature TIT wired per drwg. C703-1194 sheet 4 Note: use Type-K thermocouple wire -120VAC scum level switches LSHH, LSH, LSL, & LSLL wired per drwg. C704-1194 sheet 1 -digital interface signals wired per drwg. C704-1194 sheet 2		
11	Bump skimmer, mixer, and scum pump motors per rotation as marked on the respective motor nameplate.		
12	480V Scum Concentrator Holding Tank heaters wired to LCP-7401 per junction box JB-7401 drawings C710-1194 & C711-1194.		
13	All plumbing appropriately heat traced and insulated.		
14	Verify that all field installed and factory installed hardware is tight as some joints may have loosened during shipment.		