WCRF-400-001 - REACTION TANK
WIPC-4-1320-001 WITH ACCESSORIES
WCNT-400-001 – NEUTRAILIATION TANK

INSTALLATION & OPERATION MANUAL

FOR:

OMNI WATER SOLUTIONS
4007 Commercial Center Drive, Suite 700
AUSTIN, TEXAS 78744

PROJECT NAME: OMNI, Texas

EQUIPMENT TAG NUMBER: - CRF-400, IPC-4-1320 & CNT-400
SHIPMENT DATE: February 2015

ELLIS PROJECT NUMBER: C06112-00

1400 W. Bryn Mawr Ave.
Itasca, IL 60143
(630) 250-9222

ELLIS CORPORATION RETURN OF GOODS POLICY

If for any reason you need to return any items to the Ellis Corporation, please follow the procedure below.

1. Obtain a return goods authorization number from the Ellis Corporation's parts Dept.

2. Place the return goods authorization number on the packing slip and also on the outside of the package.

3. Return only the items authorized. Send items freight prepaid by the most economical means available.

4. Return within 30 days of authorized date.

5. If it is determined by the Ellis Corporation that freight charges are the responsibility of Ellis, your company will be issued a credit for the freight charges.

6. If you have any questions, please contact the Ellis Corporation's customer service Department at (800) 611-6806.

7. Send all shipments to the following address:

Ellis Corporation
1400 West Bryn Mawr Avenue
Itasca, IL 60143

Items returned without an authorization number, freight collect or beyond 30 days of Authorization cannot be processed for credit.

ELLIS CORPORATION
REACTION TANK, IPC CLAIRIFIER & NEUTRIALIATION TANK
INSTRUCTION AND OPERATION MANUAL

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WARRANTY

The company warrants the equipment manufactured by it to be free from defects in material and workmanship for a period of 1 (one) year from the date of shipment, provided the machine is operated normally at its rated capacity and is lubricated at proper intervals with the specified types of oil and grease. Parts in the supply system subject to the corrosive action of solutions are not covered by this warranty. When defective parts show deliberate abuse this warranty will be subject to cancellation at the option of the company. This express warranty is in lieu of and excludes all other warranties of merchantability or of fitness for a particular purpose. Any articles not of the company's manufacture are sold only under such warranty as maker gives the company and which the company is able to extend to its customer, but such articles are not warranted in any way by the company.

All machines and parts claimed to be defective must be returned during the warranty period to the company, transportation prepaid of examination. Those determined by the company to be defective in material in workmanship will be repaired or replaced at the company's option, (F.O.B.) the company's factory. In no event shall the company be liable for claims (whether based upon breach of contract, breach of express or implied warranty, negligence or any other grounds) for any other damages, whether direct, immediate, foreseeable, consequential, incidental or special, or any expenses incurred by reason of the use of misuse or sale of any machines or parts which do or do not conform to the terms and conditions of the contract.

Where the original equipment warranty has expired, the company does not warrant replacement parts as the condition of the equipment may affect the life of the part. Modifications of the equipment or the use of repair parts not approved by the company will subject this warranty to cancellation.

Ellis will not accept any backcharge for modifying, adjusting, servicing or any other work that has not received advanced written authorization. Authorization will only be granted when satisfactory proof is submitted, and then only in the event that a price has been agreed upon. Any backcharge submitted without authorization by Ellis Corporation will be rejected in full.

ELLIS CORPORATION
1400 W. Bryn Mawr
Itasca, IL 60143
(630) 250-9222

TANK COATINGS

PRIOR TO FILLING ANY TANK, THOROUGHLY INSPECT THE INTERIOR AND EXTERIOR COATING SYSTEMS. PROPERLY TOUCH UP ANY NICKS, SCRATCHES AND SUSPECT AREAS IMMEDIATELY. IF INTERIOR COATING IS DAMAGED IN ANY WAY, PROMPTLY REPAIR THE COATING BEFORE FILLING THE TANK. SEE THE GENERAL ARRANGEMENT DRAWINGS LOCATED IN THE BACK OF THIS MANUAL FOR PAINT SPECIFICATIONS. ELLIS CORPORATION WILL NOT MAINTAIN WARRANTY COVERAGE ON TANK LININGS DAMAGED DURING INSTALLATION AND SHIPMENT.

Maintenance of the coatings is the single most important step in preventing deterioration of the equipment. If left unattended, an uncoated area will rust, and in due time may effect the structural integrity of the tank. Please consult the paint manufacturer for proper instructions on maintenance, handling and application of the coating systems.

SECTION 1 - INTRODUCTION

GENERAL

The information provided in this manual is intended a guide to the installer and end user. Installation areas and availability of equipment may dictate the installation procedure. Ellis Corporation does not hold the final responsibility for installation of this equipment.

INSPECTION

Inspect all equipment upon arrival. If any items are found to be damaged or missing, be sure to note the shipping papers as such. Notify Ellis Corporation immediately.

STORAGE

Equipment that is not to be installed immediately should be stored in an area with low traffic. All factory packing should remain on the unit until installation. The unit should be stored and leveled on timbers. If the unit is placed directly on the floor general housekeeping is necessary to ensure the floor is free of debris. (These items may damage coatings.) If possible, equipment should be stored indoors. Covering is required for out door installation.

COATINGS

All damage to coatings should be touched up immediately. See general arrangement drawings for paint specifications. See operational maintenance section for proper upkeep.

BACKCHARGES

Ellis Corporation will not accept any back charge for modifying, adjusting, servicing or any other work that has not received advanced written authorization. Authorization will only be granted when satisfactory proof is submitted, and then a specific price will be agreed upon.

IPC PRINCIPALS OF OPERATION

The Ellis Corporation Inclined Plate Clarifier (IPC) is designed for the removal of settle able suspended solids. The flow enters the inlet chamber where it is dispersed through a non-clogging diffuser across the width of the clarifier. Larger solids settle into the sludge chamber while the water and fine particles flow upward between slick surfaced plates that are inclined 55 degrees. The solids settle onto the surface of the plates, slide to the bottom and fall into the sludge chamber while the clean water continues up and over an adjustable clean water weir. The sludge chamber contains a mechanical sludge thickener that conveys the sludge to a central discharge point for sludge removal. Clarified water overflows the clean water weir and is discharged by gravity through an effluent nozzle.

SECTION 2 - SAFETY

It is extremely important that the following safety cautions and warnings be adhered to. Violation of these or general safety precautions could result in serious injury or loss of life.

These safety considerations are not, nor are they intended to be, complete or all inclusive of the safety rules and regulations that may apply to this system. Operators must familiarize themselves with all general and specific safety rules, regulations and considerations set forth by governmental regulation or by other applicable sources. The following are some basic safety rules for the equipment.

- Nothing in this manual shall take precedence over safety rules and considerations set forth in the manuals for the individual equipment items that make up this system.

- All safety rules and considerations established by governmental regulations shall take precedence over any operation or procedure set forth in this manual.

- Any safety rule or consideration set forth by governmental regulations shall take precedence over any less stringent safety rule or consideration set forth in this manual.

- Only properly trained and/or qualified adult personnel should operate, maintain or be in the vicinity of this equipment.

- Before operating or maintaining this machine, all operating and maintenance personnel must read the applicable sections and be familiar with the Operating and Maintenance Manual furnished by Ellis Corporation.

- Do not perform any maintenance on this equipment without locking out all electrical, air, water or other feeds to the machine.

- Never operate this equipment without all guards in place.

- All placards and signs on the equipment and safety notes in the Operating and Maintenance Manual have been pointed out and discussed with operating and maintenance personnel.

- Do not disable, bypass or otherwise interfere with any limit switches, clutches, torque limiters, speed limiters, safety stops, interlocks or other safety devices.

- Do not disable, bypass, wire around components, change the size of or otherwise interferes with electrical interlocks, electrical disconnects grounds, current limiters, or other electrical safety devices.

- Properly secure all chemical piping, tubing, hoses, etc. so that splashing and/or spraying of personnel or equipment will not occur. Routinely inspect all fastenings and repair or replace them as necessary.

- Install all acid or other caustic chemical piping, tubing or hoses with double containment so that leakage will be conducted to a safe place. Any leakage must be controlled so that it is immediately evident.

- Whenever in the vicinity of chemical storage, pumping or addition points, personnel MUST wear chemical goggles, face shields, protective gloves, acid proof apron and acid proof overshoes.

- If acid dilution is ever required, **ALWAYS** add acid to water; never add water to acid. This does not apply to safety shower or eyewash use when acid contact has occurred.

- Install a safety shower and eyewash station and test them on a routine basis.

- Never handle chemicals without at least two people present. Both persons should be trained in chemical safety and first aid.

- If polymer is spilled, immediately apply an adsorbent and wash down the area. Polymer is extremely slippery and can cause bad falls.

- A water source with hose should be installed in the immediate vicinity of chemical storage, pumping and addition areas.

SECTION 3 - LEVELING

1) Prepare the tank site by installing the anchor bolts (if cast in place anchor bolts are used) or drilling the anchor bolts (if expansion type, field installed anchor bolts are used). Refer to the general arrangement drawing for anchor bolt locations. Make sure the site is level and free of sharp objects that may damage the tank. Shim or grout in areas where necessary. **Note: The leveling of a tank is extremely important to function.**

2) Remove all lids, if there are any. The tank should now be leveled. The absolute minimum requirements being: within +/- 3/8" total from inlet end to outlet end of tank and +/- 1/64" per foot from side to side, maximum of 1/8" total. Shim the tank until these parameters are met. Take extra precaution to make sure the adjustable weir is made as level as possible. Stainless steel shims are recommended. The shims should be installed at intersections of the base and vertical members.

SECTION 4 - ANCHORING

There are many methods of anchoring the equipment to the ground, any of which are acceptable for a particular installation. Please choose the method most suitable for your application.
Listed below are the most common methods for anchoring equipment:

1) If this equipment is to be installed in a new facility, cast-in place anchor bolts may be used. This method is acceptable for most applications, however offers the least amount of flexibility. If anchor bolts are off even by the slightest margins, equipment will require rework to accept the existing bolt pattern.

2) If the equipment is to be installed in an existing facility or new facility, expansion type anchor bolts are the best choice. They are the easiest to install and offer the most flexibility. It is extremely important to follow anchor manufacturers recommendations for bolt size and tightening.

3) Use pressure plates. If anchor bolts are to be located outside of equipment base, this method can be utilized.

Regardless of which anchoring method, the bolts should be grouted in place following a proper start-up. **Do NOT apply any grout until equipment is operational!**

SECTION 5 - PLUMBING

When making any connections to the Ellis equipment DO **NOT** use the equipment as a pipe support. All plumbing should be self-supporting following disconnection from the unit. Ellis cannot be held responsible for damage caused by using the equipment to support any piping before or after it.

The following guidelines should be observed during pipe installation (order not important):

1) Connect the outlet plumbing. For gravity flow, the effluent plumbing must be the same or larger than that of the nozzle size of the equipment. Reducing the size of the effluent piping may cause hydraulic overloading of the unit. If an outlet pump is utilized use pipe sizing in conjunction with manufacturer's recommendations. It is recommended to minimize the number of bends and turns on piping and minimize the length of runs. The pipe pitch should not exceed 1/16" per foot.

2) Connect the inlet plumbing. For gravity flow, the influent plumbing must be the same or smaller than that of the nozzle size of the equipment. Increasing the size of the influent piping may cause hydraulic overloading of the unit. If an inlet pump is utilized use pipe sizing in conjunction with manufacturer's recommendations. It is recommended to minimize the number of bends and turns on piping and minimize the length of runs. The pipe pitch should not exceed 1/16" per foot.

3) Connect the sludge and float outlets. Isolation valves are required at each outlet.

4) For totally enclosed tanks, vents are provided to prevent air locks during surge conditions. The vent should terminate in an area where noxious and/or volatile gas will not pose any hazard. For indoor installations, run the vent to the outside of the building. If hazardous gases are involved in the process, consult your local authority on the proper handling and disposal.

SECTION 6 – PRE-START UP

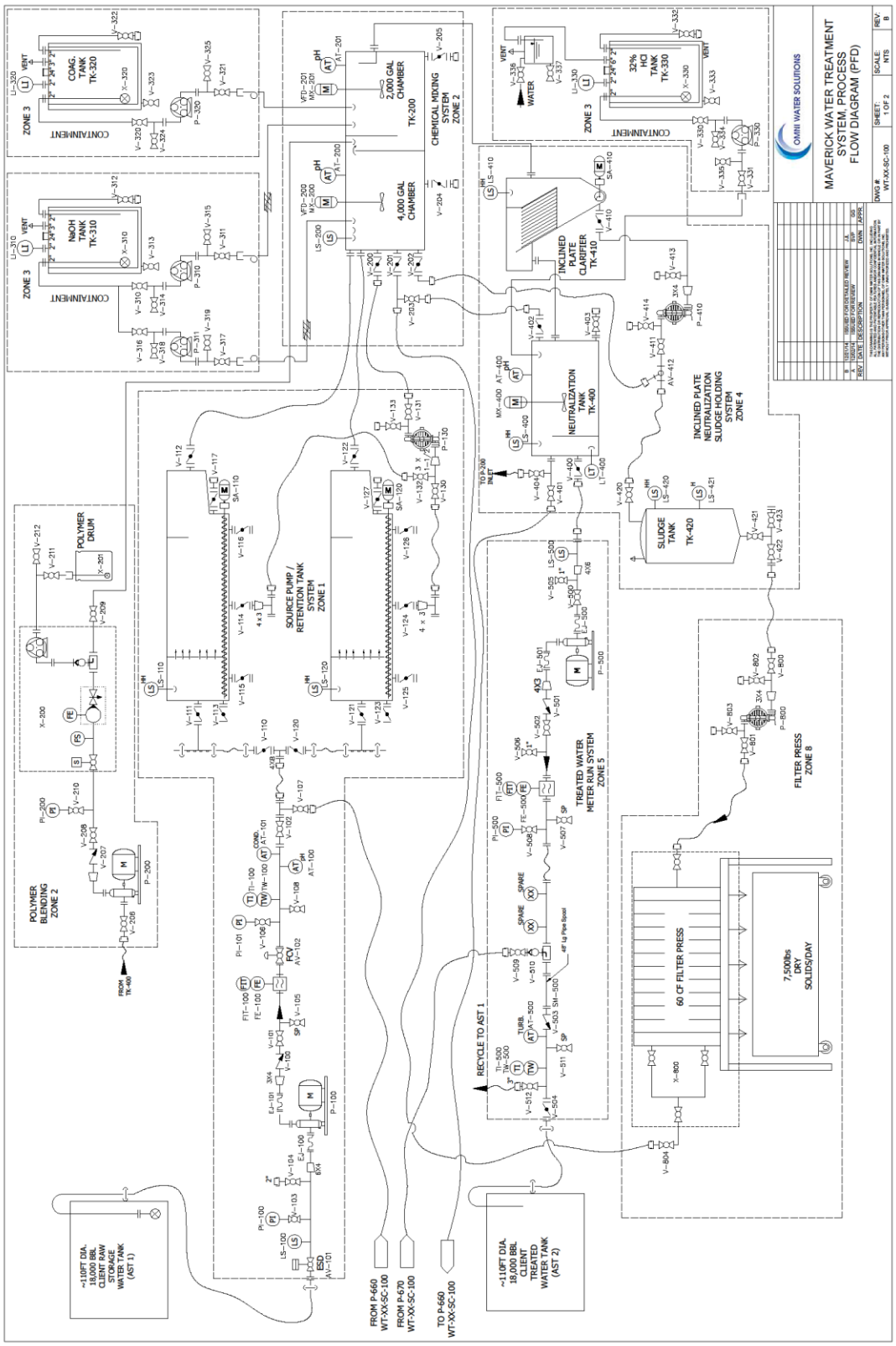
BEFORE placing the system in operation the following items **MUST** be inspected:

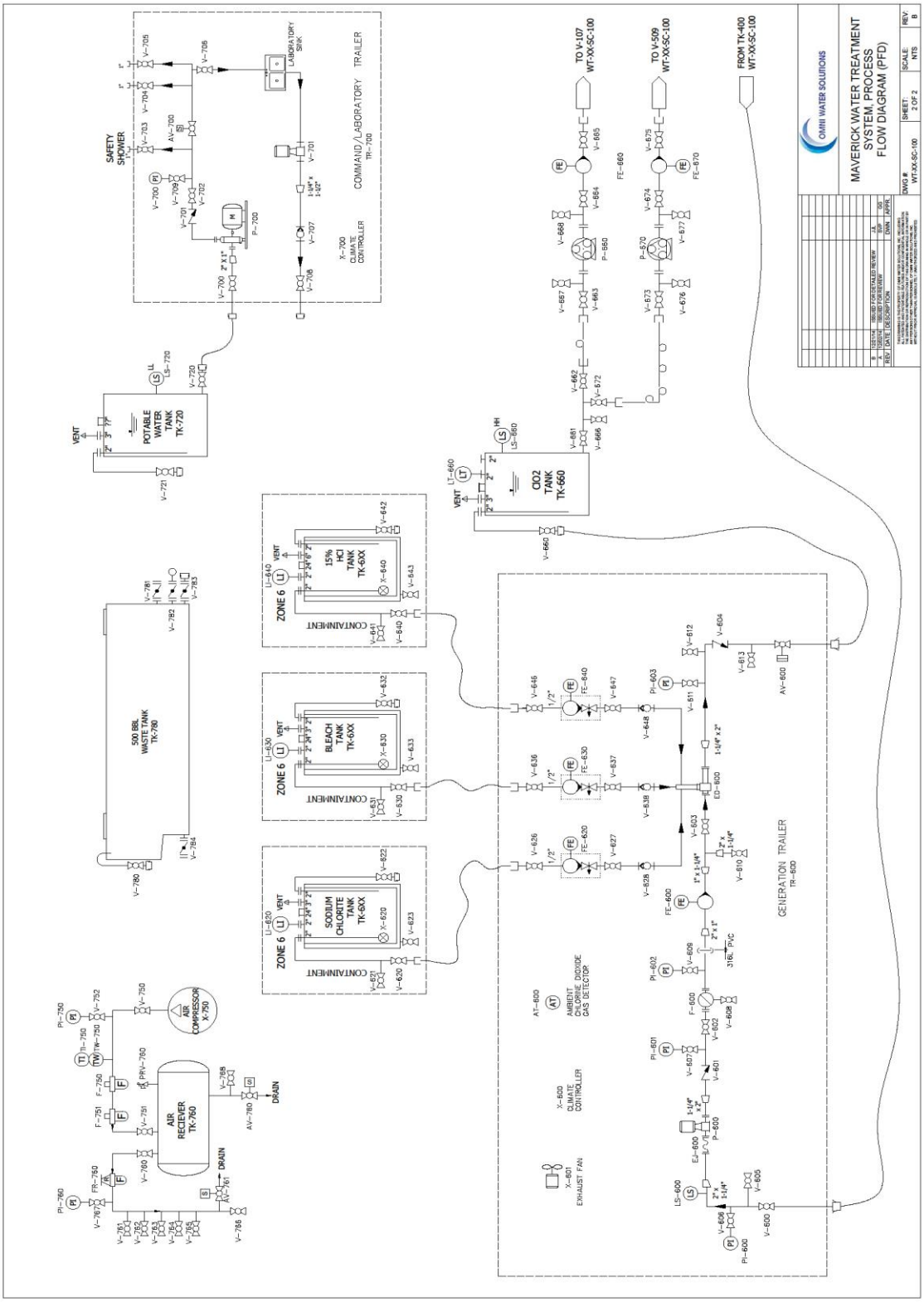
1. Check the chemical storage tanks for an adequate supply of treatment chemicals. (If applicable).
2. Check that CRF tank has chemical pump hose connections properly connected at allocated points per General Arrangement drawing. Anti-siphon valves are to be located in line between the chemical pumps and connection points on the CRF system. Open ball valves only where chemicals will be injected. Valves that are not being used should remain closed. If unused valves are left open water will leak from the CRF system.
    a. Clean the pH probes (if applicable) wipe off accumulated oil, grease and other deposits.
    b. If particularly fouled, use a mild detergent.
    c.
3. Check the feed tank level.
    a. Water level above the low level limit.
    b. Check that feed tank switches or electrodes are free and unobstructed.
4. If IPC is empty.
    a. Check that there are no solids buildups or foreign objects in the clarifier.
    b. Check that all drain valves are closed.
5. Check that all pump inlet and discharge valves are open.
6. Check that no maintenance is being performed on the system. Do visual checks, **DO NOT** assume that lockouts are being used?
7. Check that utilities are on:
    a. Check that electrical power is on.
8. Check that air to the sludge pumps is on.
9. Check rotation of auger. Solids should be carried to sludge outlet connection.
10. Close all tank drain valves, confirm that plugs or access covers are in place.
11. Fill IPC tank with clean water until water begins to flow out of the effluent pipe.
12. Check the effluent weir, making sure that it is level within 1/8". The effluent weir can be reset by loosening the bolts, moving it carefully up or down and tightening bolts. The weir may need to be worked loose in order to break free the factory installed silicon sealant. After repositioning the weir new sealant should be applied.
13. Tighten all the anchor bolts.

14. Perform a leak test on all interconnecting piping and joints, tighten or seal as necessary.

15. An initial inspection of the sludge auger should have been performed prior to start-up. Check the packing gland for excessive leakage. The gland should not be so tight as to score or damage the drive shaft. To check to see if the gland needs adjustment turn on the auger gear motor and observe the water dripping from the packing gland. If no water drips the gland is too tight. Water should drip approximately once every ten to fifteen seconds. Make necessary adjustments to achieve this.

1


MAVERICK WATER TREATMENT SYSTEM, PROCESS FLOW DIAGRAM (PFD)
OMNI WATER SOLUTIONS
COAG. TANK TK-320
NaOH TANK TK-310
32% HCl TANK TK-330
CHEMICAL MIXING SYSTEM ZONE 2
2,000 GAL CHAMBER TK-200
4,000 GAL CHAMBER
INCLINED PLATE CLARIFIER TK-410
NEUTRALIZATION TANK TK-400
INCLINED PLATE NEUTRALIZATION SLUDGE HOLDING SYSTEM ZONE 4
SLUDGE TANK TK-420
SOURCE PUMP / RETENTION TANK SYSTEM ZONE 1
POLYMER DRUM
POLYMER BLENDING ZONE 2
TREATED WATER METER RUN SYSTEM ZONE 5
FILTER PRESS ZONE 8
60 CF FILTER PRESS
7,500lbs DRY SOLIDS/DAY
~110FT DIA. 18,000 BBL CLIENT RAW STORAGE WATER TANK (AST 1)
~110FT DIA. 18,000 BBL CLIENT TREATED WATER TANK (AST 2)
RECYCLE TO AST 1
FROM P-660 WT-XX-SC-100
FROM P-670 WT-XX-SC-100
TO P-660 WT-XX-SC-100
ZONE 3
CONTAINMENT


OMNI WATER SOLUTIONS
MAVERICK WATER TREATMENT SYSTEM, PROCESS FLOW DIAGRAM (PFD)
DWG #: WT-XX-SC-100
SHEET: 2 OF 2
SCALE: NTS
REV: B
COMMAND/LABORATORY TRAILER TR-700
SAFETY SHOWER
LABORATORY SINK
X-700 CLIMATE CONTROLLER
P-700
POTABLE WATER TANK TK-720
VENT
ClO2 TANK TK-660
TO V-107 WT-XX-SC-100
TO V-509 WT-XX-SC-100
FROM TK-400 WT-XX-SC-100
FE-660
P-670
P-680
500 BBL WASTE TANK TK-780
15% HCl TANK TK-6XX
BLEACH TANK TK-6XX
SODIUM CHLORITE TANK TK-6XX
ZONE 6
CONTAINMENT
AIR COMPRESSOR X-750
AIR RECIEVER TK-760
DRAIN
GENERATION TRAILER TR-600
AMBIENT CHLORINE DIOXIDE GAS DETECTOR
AT-600
X-600 CLIMATE CONTROLLER
X-601 EXHAUST FAN
EJ-600
P-600
AV-600

SECTION 7 –

PROCEED FROM THIS POINT FOR DAILY START UP

1. If a pH controller is used, clean and, if necessary, calibrate the pH electrodes.

- PH controllers should be checked against an indicator paper on a daily basis. A weekly check should be made with a buffer.
- Most process problems result from improper chemical feed. It is **EXTREMELY IMPORTANT** that the pH controllers are operating correctly for the proper chemical reactions to take place.
- Even if the chemical process is not pH dependent, there are probably pH limitations on your wastewater discharge.

2. If mixers are used turn mixers **ON** and set flocculation mixer for proper rotational speed. Do not set the speed on the flocculation mixer too high. It is for gentle to medium mixing.

3. Turn **ON** chemical pumps. Pumps are to dose only when the system feed pump is feeding the reaction tank system.

4. Start the system feed pump(s) to the system.

5. The clarifier is ready for operation. Start flow to inlet of IPC.

6. The owner/operator will need to adjust chemical pre-treatment in order to have proper sludge settling. In addition, based on the solids loading, a sludge removal schedule will need to be developed.

7. Regardless if sludge pump is supplied by Ellis Corp. or customer, proper and frequent removal of the sludge from the sludge chamber is critical to proper system operation. Sludge should be drawn off regularly and not allowed to accumulate. If left unattended, the sludge level will rise to a point where it disrupts the proper function of the unit.

CAUTION: If suction valves to sludge pump(s) are left open, water may gravity flow through pumps even when they are turned off.

Method to determine a schedule for sludge removal:

1. Have an area which you can store the accumulated sludge. An open top tank with volume markings is ideal as the user will need to witness when the sludge concentration declines and a higher ratio of water is being discharged.

2. Arrange for the proper disposal of the sludge, either by further treatment or by having a service dispose of the waste.

3. Begin by decanting the sludge after the unit has been in operation for about a day. Time how long it takes for the high concentration of sludge to decline resulting in a higher ratio of water. You should keep a chart of when you decant the sludge and how much was removed from the separator. By maintaining an accurate chart, you will have an idea of how often and how long to decant the sludge.

   Close sludge chamber valve after sludge removal is complete. If sludge chamber valve is left open, water may gravity flow and drain tank.

SECTION 8 - NORMAL SHUTDOWN

This routine should be used for routine shutdown at the end of the operating period or for routine maintenance.

1. Turn **OFF** system feed pump(s).

2. Turn **OFF** chemical pumps.

3. Turn **OFF** mixers. (If applicable)

4. Turn **OFF** auger. Auger should run primarily when removing sludge from the system. If the system is going to be shut down for an extended period of time, the auger should be turned on periodically to prevent the formation of tunnels in the accumulated solids.

SECTION 9 – ROUTINE INSPECTION

During routine operation the Reaction tank, IPC and Neutralization tank should be observed at set intervals. The time between inspections can only be determined by operating experience. Some of the items mentioned, such as chemical supplies, may be observed at longer intervals. The below items are for all tanks.

1. Check that there is an adequate chemical supply.

2. Check that the chemicals are actually being supplied to the injection points.

    - Check chemical pump operation.

3. Check that the pH reading is within limits (If applicable)

4. Sample and visually inspect the final mixing chamber and observe the quality of the floc. This step does not pertain to systems with an SMS system.

5. Sample and visually inspect the final effluent and test the quality as required.

6. Check for proper sludge removal through sludge pump (if applicable).

SECTION 10 – OPERATIONAL MAINTENANCE

There are several maintenance items that are concerned with maintaining operational efficiency rather than with mechanical problems. These must be checked at time intervals varying from daily to several months.

1. Check for solids buildup in the equalization tank or pit. Drain and clean as necessary.

    - Heavier solids will settle in the equalization tank causing decrease in tank volume or excessive solids in the IPC if the solids level rises to the feed pump inlet.
    - Indications of this problem are excessive solids buildup in the IPC, erratic clarifier operation and feed pump problems.
    - If the equalization tank is agitated, increase agitator speed if deposition occurs.

2. Check the equalization pit for excessive free oil. Skim as necessary.

    - If the equalization tank is agitated, free oil may not be visible.
    - Indications of this problem are varied. Generally they involve excessive oil and grease in the clarifier and in the sludge holding tank.
    - Often the first indication of excessive free oil is seen in the sludge. When, after dewatering, the sludge still has a "wet" appearance.

The standard Ellis Corporation IPC is supplied with UHMW bearings, which require no lubrication. The Varvel gearbox motor is factory sealed and requires no lubrication during the life of the unit. If additional accessories have been supplied beyond the Ellis standard IPC, some lubrication may be necessary. Please refer to the enclosed individual item catalogs for more detail.

Description	**Recommended Frequency**
Empty and flush tank	Semi-annually
Rinse off entire Skid	Daily
Touch-up rust, scratches	As required
Inspect Packing Gland For excessive leakage	Monthly
Clean Plate Pack	Semi-annually

Cleaning the plate packs can be accomplished by removing them via the lifting lugs, and rinsing plates down with a hose (some pressure may be needed). When cleaning the plate packs, be sure to contain the water run-off so that it can be put back into the system line for cleaning. When plates are clean, place them back into the tank. Use care not to scratch the tank when replacing plate packs.

SECTION 11 – TROUBLESHOOTING

Poor effluent quality can result from several causes. Some of them are outlined below.

I. EXCESSIVE FLOC CARRYOVER

Sample a portion of the effluent in a glass container and check the appearance of the floc.

1) Flock carry-over into the clear well

   a) Chemicals need to be adjusted.
   b) Screw auger is not operating correctly. (Rotation, shut-down)
   c) Increase sludge removal frequency.
   d) Adjust speed of flock mixer.
   e) Drain the unit and inspect for solids bridging.

2) Packing gland has excessive leakage.

   a) Tighten in accordance with section VII
   b) Replace rope packing.

3) Unit is overflowing.

   a) Verify supply is at rated flowrate
   b) Check upstream piping for obstructions, or closed valves.
   c) Drain unit and inspect for bridging or obstructions clean as necessary.

4) Screw auger will not operate.

   a) Verify power supply.
   b) Verify wiring for proper voltage.
   c) Check motor overloads.
   d) Inspect auger assembly.

ELLIS PART NUMBERS:
5913000187 - 1st Chamber
Mixer CRF tank

ELLIS PART NUMBERS:
5913000187 - 1st Chamber
Mixer CRF tank

SECTION C

E - SERIES GEARBOX LUBRICATION

C1.1 **E-SERIES WORM GEAR GEARBOXES:** See data sheet and/or assembly drawing at the front of this manual to find the case size of gearbox supplied. See table C1.3 for cross reference.

C1.2 **Models E05 through E55 (without optional drywell).** Your gearbox has been lubricated at the factory with the proper type and amount of lubrication for an ambient temperature range of 51° - 110°F; for different ambient conditions, change to appropriate oil shown in Table C.2.1

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. Replenish if necessary. To prevent leakage during handling the gearbox vent has been replaced with a temporary plug for shipment.

WARNING: VENT MUST BE REINSTALLED PRIOR TO START-UP OR DAMAGE TO GEARBOX WILL OCCUR.

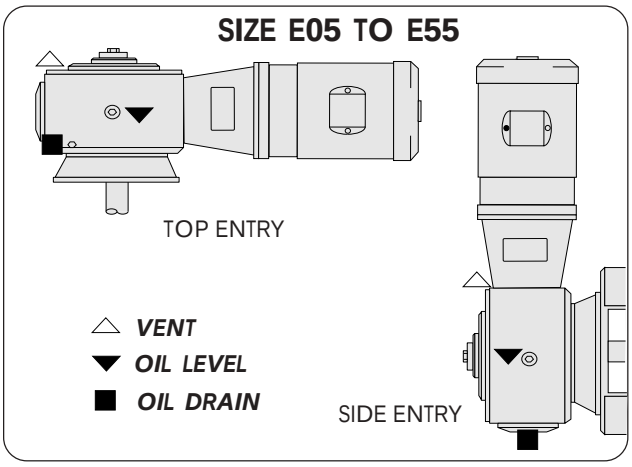


FIGURE C1.1

C1.3 **MODELS E6 THROUGH E9 (SHIPPED WITHOUT OIL).** See table C1.3 for oil quantities and table C2.1 for the appropriate types of oil. Oil levels shown are approximate and all top entry units should be filled to the levels marked on the dipstick provided before start-up. Note the dipstick on these units is also the vent.

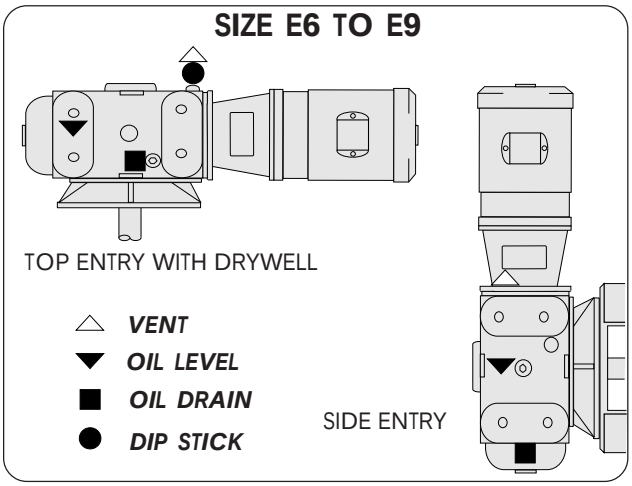


FIGURE C1.2

CAUTION: CONFIRM PROPER OIL LEVEL BEFORE START-UP. USE WORM GEAR (CYLINDER) OILS ONLY. STANDARD GEAR OILS OR OIL WITH EP ADDITIVES WILL CAUSE PREMATURE FAILURE!

C1.4 The lubricant needs to be changed under normal conditions after 150 hours of service. Subsequently, change the oil every 2,500 hours or 6 months, whichever occurs first. Under extreme conditions it is recommended that the lubricant in the gearbox be changed more frequently. Refer to the worm gear chart for the lubricant recommended for temperatures in your area (see Table C2.1). Drain oil when gearbox is still warm. Remove vent to facilitate draining. The oil quantities shown in Table C1.3 are approximate. The exact quantity will be determined when filled to the oil level position on your gearbox. When changing to a different lubricant, clean and flush the gearbox with a light flushing oil before refilling.

Regrease grease lubricated bearings once a month with two shots of grease (when zirc fittings are present).

RECOMMENDED E-SERIES LUBRICATION VOLUMES *(PINTS)*

SIZE	CASE SIZE	SIDE ENTRY	TOP ENTRY STANDARD	TOP ENTRY W/ DRYWELL
E05	917CDSF	0.5	0.5	N/A
E1	920CDSF	0.5	0.5	N/A
E2	924CDSF	0.9	0.9	N/A
E3	926CDSF	1.2	1.2	N/A
E4	930CDSF	1.6	1.6	N/A
E5	935CDSF	2.1	2.1	N/A
E55	943CDSF	2.8	2.8	N/A
E6	A1002*	§	N/A	1.8
E7	A1252*	§	N/A	3.8
E8	A1602*	§	N/A	6.8
E9	A2002*	§	N/A	10.4

§ Consult factory

TABLE C1.3

***CAUTION: WHEN DRYWELL OPTION IS INCLUDED ON LARGER GEARBOX MODELS, THE EQUIPMENT WILL SHIP DRY (WITHOUT LUBRICANT) FROM THE FACTORY. GEARBOX MUST BE FILLED TO THE PROPER LEVEL WITH THE CORRECT TYPE OF LUBRICANT PRIOR TO START-UP. DO NOT OVERFILL GEARBOX AS EXCESS MAY CAUSE OVERHEATING.**

NOTE: OIL CAPACITIES SHOWN ON TOP ENTRY CHART ARE FOR VERTICAL MOUNTING ONLY. ANGLE MOUNTING REQUIRES LESS LUBRICANT (CONTACT FACTORY FOR VOLUMES)

GEARBOX MAINTENANCE

CAUTION: ANY DISSASSEMBLY OF THE GEARBOX MUST BE PRE-AUTHORIZED BY SHARPE MIXERS WHEN WITHIN WARRANTY PERIOD.

C2.1 If disassembling gearbox, contact factory for complete instructions.

C2.2 Gearboxes can generate temperatures up to 200°F depending on the application and the ambient temperature. When oil temperature exceeds this, refer to the troubleshooting guide in Section B of this manual. Viton lip seals can be substituted to handle higher temperatures.

C2.3 When installing a new lip seal, cover the shaft keyway with smooth tape to protect the seal from damage during installation.

C2.4 Use a sealant between the seal O.D. and the bore into which the seal is installed. Be sure the bore is free from nicks, scratches, and burrs.

C2.5 Do not cock the seal in the bore. The seal must be flush with the surface into which it is mounted.

C2.6 Check vent plug periodically to insure it has not become clogged.

C2.7 Shimming is required to properly set tapered roller bearings. When replacing bearings, shim to allow 0.001" - 0.002" total end play. Contact factory for complete instructions.

NOTE: E05 - E55 worm gear speed reducers are factory filled with Mobil Glygoyle 460 (PAG) lubricant. The use of other lubricants may result in substantially lower torque capacity and is not recommended. If other lubricants are used, a thorough flushing procedure is required.

RECOMMENDED LUBRICANTS FOR WORM GEAR REDUCERS

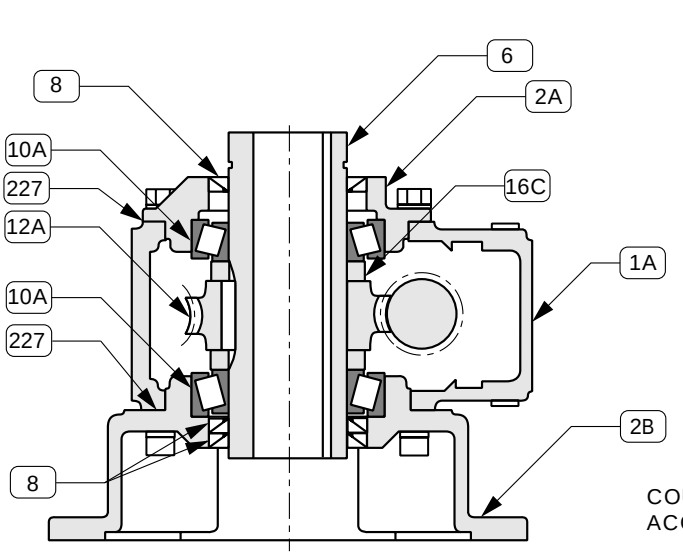
LUBRICANT CHARACTERISTIC						
AMBIENT TEMP. RANGE	-30 to 15° F (-34 to -9° C)	16° to 50° F (-9° Tto 10° C)	51° to 95° F (11° to 35° C) *(FACTORY FILLED)*	96° to 131° F (36° to 55° C)	-40° to 175° F (synthetic oils)	5° - 120° F Fluid Grease
SSU VISCOSITY at 104° F (40° C)	284 to 347	1919 to 2346	2837 to 3467	4171 to 5198	130 to 1112	...
AGMA LUBRICANT NO.	#6S	#7 Comp.	#8 Comp.	#8A Comp.	#5S	...
ISO GRADE	320	460	680	1000	...	SEE BELOW
LUBRICANT MANUFACTURURES						
CHEVRON	Tegra 220	Cylinder Oil W460	Cylinder Oil W680	Tegra 680	...	...
EXXON/ESSO	Teresstic SHP 220	Spartan EP 460	Spartan EP 680	Teresstic SHP 680	...	...
MOBIL	SHC630	600W Super or SHC 634	Glygoyle 460	Extra Hecla Super Cyl. Oil mineral or SHC 636	SHC 630	Mobilith SHC 007 (ISO 460)
SHELL	Omala RL 220	Valvata J-460	Valvata J-680	...	Omala RL 680	...
TEXACO	Pinnacle 220	Vanguard cyl. oil 460	Vanguard Cyl. oil 680	Pinnacle 680	...	Multifak HD00 (ISO 680)
FOOD GRADE		Chevron FM ISO-460	Chevron FM ISO-460			

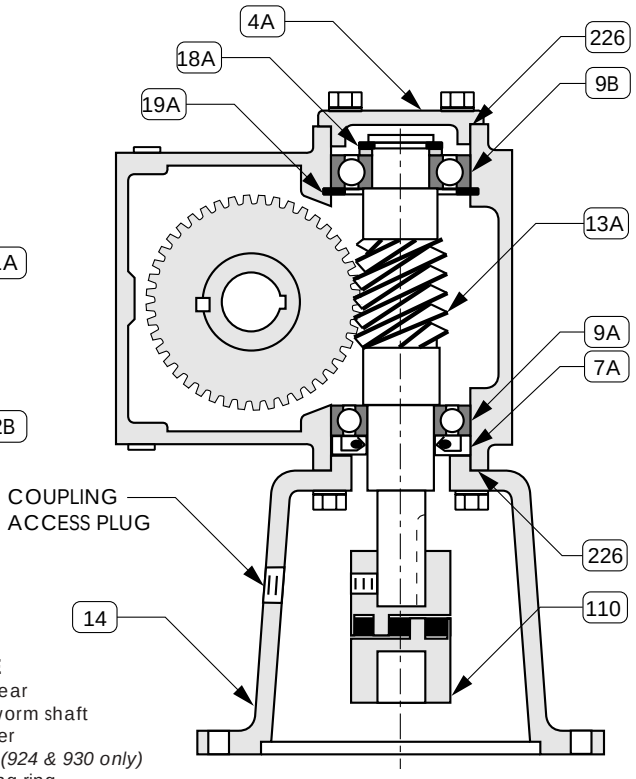
TABLE C2.1

GEARBOX PARTS FOR E05 (917CDSF) TO E55 (943CDSF)

C3.1 See data sheet and/or assembly drawing to find the model number of gearbox supplied. The following drawing (Figure C3.1) shows standard parts for the E-Series gearboxes listed above. Refer to page C4 for models E6 through E9. Your model may vary slightly due to size and ratio. Bearing and seal part numbers are shown on Table C3.2. and C3.4. Seal number prefixes indicate seal manufacturers: 'CR' for Chicago Rawhide and 'JM' for John Manville.

C3.2 When requesting parts, pricing or other service assistance, have serial number and model number off mixer nameplate readily available. Before disassembling gearbox, contact factory for complete instructions on replacing shims, bearings and seals. Note: Drywell option not shown in figure C3.1.





SINGLE REDUCTION PARTS LIST
(E05 to E55)

ITEM	PART NAME
1A	Housing
2A	Low speed cover
2B	Ring base
4A	Bearing cap closed
6	Low speed hollow shaft
•7A	High speed oil seal*
•8	Low speed oil seal (3 REQ'D)
•9A	Front high speed bearing
•9B	Rear high speed bearing
•10A/B	Low speed bearing (2 REQ'D)

ITEM	PART NAME
•12A	Low speed gear
•13A	High speed worm shaft
14	Motor adapter
16C	Gear spacer *(924 & 930 only)*
18A	Worm retaining ring
19A	Bearing retaining ring
•110	Flexible motor coupling
•226	Shim / Gasket kit, Input
•227	Shim / Gasket kit, Output

• = Recommended spare parts

* - NOTE: high speed input seal #7A may be installed in motor adapter #14

FIGURE C3.1

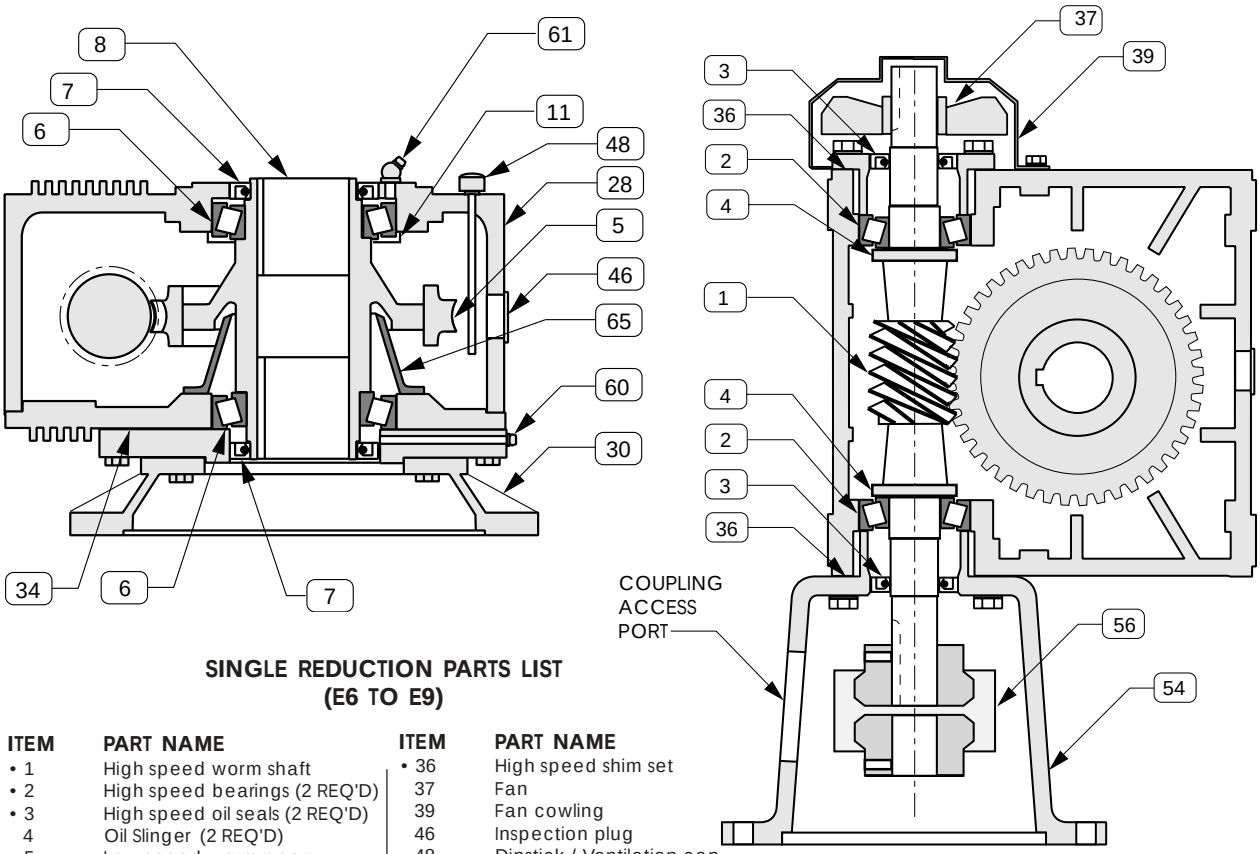
GEARBOX BEARINGS AND SEALS

Contact factory for all other parts.

GEARBOX	OIL SEALS		BEARINGS		
MODEL SIZE	HIGH SPEED Pos. No. 7A	LOW SPEED Pos. No. 8	FRONT H. S. Pos. No. 9A	REAR H.S. Pos. No. 9B	LOW SPEED Pos. No. 10A
E05	CR9761	CR14705	6205	6205	JL69310/JL69349
E1	CR9761	CR19762	6205	6304	JLM104910/LM104949
E2	CR13581	CR22354	6207	6207	382A/387
E3	CR13581	CR24898	6207	6306	394A/390A
E4	CR13581	CR26186	208S	6405	394A/399AS
E5	CR12446	CR28746	M88010/M88048	M88010/M88048	29620/29685
E55	CR12458	CR38692	M88610/M88649	M88610/M88649	52618/52400

TABLE C3.2

GEARBOX PARTS FOR E6 (A1002) TO E9 (A2002)



SINGLE REDUCTION PARTS LIST (E6 TO E9)

ITEM	PART NAME
• 1	High speed worm shaft
• 2	High speed bearings (2 REQ'D)
• 3	High speed oil seals (2 REQ'D)
4	Oil Slinger (2 REQ'D)
• 5	Low speed worm gear
• 6	Low speed bearings (2 REQ'D)
• 7	Low speed oil seals (2 REQ'D)
8	Low speed hollow shaft
11	Nilos Rings
28	Case
30	Ring base
• 34	Low Speed shim set

ITEM	PART NAME
• 36	High speed shim set
37	Fan
39	Fan cowling
46	Inspection plug
48	Dipstick / Ventilation cap
54	Motor adapter
• 56	Nylicon motor coupling
60	Grease nipple lower bearing
61	Grease nipple upper bearing
65	Drywell Shroud

• = Recommended spare parts

FIGURE C3.3

GEARBOX BEARINGS AND SEALS

Contact factory for all other parts.

GEARBOX	OIL SEALS		BEARINGS	
MODEL	HIGH SPEED Pos. No. 3	LOW SPEED Pos. No. 7	HIGH SPEED Pos. No. 2	LOW SPEED Pos. No. 6
E6	38 x 90 x 10	DPFA7810010	31308	32016X
E7	48 x 110 x12	DPFA9512012	31310	32020X
E8	50 x 120 x 12	DPFA10513012	31311	32022X
E9	54 x 140 x 12	DPFA12515012	31313	32026X
Description	Double Lip Viton	Double Lip Nitril	Taper Roller	Taper Roller

TABLE C3.4

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

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

ELLIS PART NUMBERS:
5913000186 -
Neutralization Tank Mixer

OPERATION and MAINTENANCE INSTRUCTIONS
for
SHARPE MIXERS
CLOSED TANK F-SERIES MIXERS
with VAPOR SEAL or PACKED GLAND

TABLE OF CONTENTS PAGE

CAUTION

Because neither manufacturer nor seller can control the application or installation of this product, their only obligation shall be to replace this part if defective and shall not be liable for any injury, loss, or damage, direct or consequential, arising from the installation of this product. User assumes all risk in using this product and is therefore cautioned in selecting the product suitable to the intended use. Refer to inside cover of this manual for Terms and Conditions.

SECTION 1
INITIAL INSPECTION, RECEIVING AND STORAGE

1.1 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 Sharpe Mixers.

1.2 Mixer and impellers are normally packed together. The mixer shaft is packed in a separate container. Impellers are usually banded to mixer drive or lag-bolted to drive skid. Side entry mixers are normally shipped on one skid with the shaft installed and the impeller lag-bolted to the skid. If space allows, keep shipping containers for possible future use.

1.3 Storage: storage is when a) mixer has been deivered to 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, and 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 build-up. 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 (if in doubt, measure resistance in windings). This will give approximately 50% rated current. There are also sprays available to help dry out motors. Relubricate motor before start-up when in storage six months or more. When gear drive models have been in storage for more than a year, the condition of the gear lubricant needs to be inspected (see Section 7, Lubrication).

SECTION 2
MOUNTING

2.1 Flange mount: Standard 150 # flanges are provided. Refer to the Data Sheet in the front of this manual for the specific size supplied. A gasket needs to be installed between the tank nozzle and the mixer flange to stop leakage of tank contents and keep tank pressurized. Using lock washers or double nutting the mounting bolts is recommended to prevent bolts from loosening by equipment vibration.

2.2 Mounting structure must be stable and strong enough to hold the full mixer weight, torque, and overhung moment. Please contact Sharpe Mixers for these values if they are not listed on the outline drawing in the front of the manual. Mounting to an unstable support may cause unacceptable mixing, damage to the equipment, tank, or other hazards.

2.3 Side Entry Flange mount: Tie rods are normally provided with side entry mixers. The tie rods need to be positioned approximately 45° above horizontal and 45° from the mixer shaft centerline. These aid in the support of the mixer and need to be attached securely (see paragraph 2.2 for mounting strength requirements). If pipe legs are supplied, see specific mixer outline drawing else where in this manual for pipe leg size required.

SECTION 3
INSTALLING THE MIXER SHAFT & IMPELLER
(refer to pages 10 or 11)

WARNING: Always lockout power before installing or removing mixer shaft or impeller.

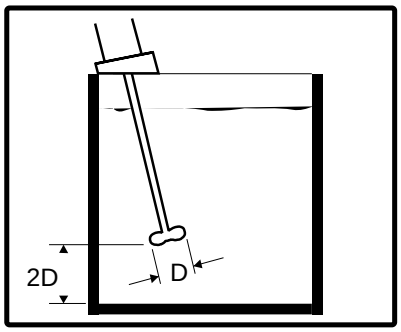
3.1 The mixer shaft will have one end (marked: motor end) ground to fit the drive bearing and coupling. Slide the impeller(s) onto the opposite end with the concave side of the blades facing AWAY from motor end of shaft. A single impeller is best mounted at the end of the shaft or 1-2 prop diameters above tank bottom. The upper impeller (if supplied) is normally mounted a minimum of 2 impeller diameters below the liquid surface. Tighten the set screws securely. High horsepower units will have "divots" into which the set screws should be tightened. FOR SIDE ENTRY MIXERS, skip paragraph 3.2 as the mixer shaft is installed at the factory.

3.2 Remove the service window (512) from the mixer spool so the bearing and coupling are visible (see page 10 or 11). Rotate the coupling until the two coupling bolts (651) are accessible. Install the mixer shaft (with the end marked motor end) up through the shaft seal packing, lip seal, bearing, and into the drive coupling (650). Be sure of full engagement of the shaft into the split coupling. DO NOT use oil to aid in assembly or slippage may occur. Using the 3/16" hex wrench supplied, *TIGHTEN THE TWO BOLTS IN THE COUPLING* (651), gripping the mixer shaft in position. Tighten SECURELY as these bolts transmit the mixer torque. *TIGHTEN THE TWO BEARING SET SCREWS* (310), using the 1/8" hex wrench provided.

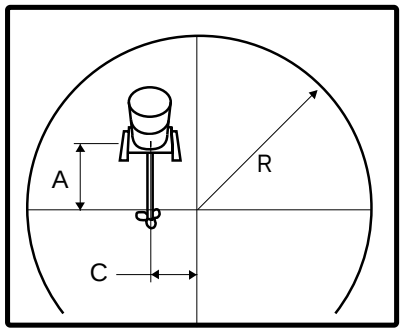
SECTION 4
POSITIONING

WARNING: Always lockout power before positioning or repositioning the mixer.

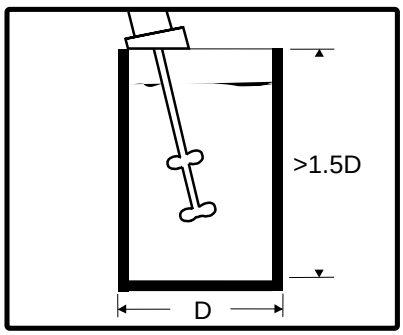
4.1 The following drawings are for reference only. If there is any question concerning the proper position of your F-series mixer, please contact your Sharpe Mixers representative or the factory as your specific application may be different than recommendations shown.



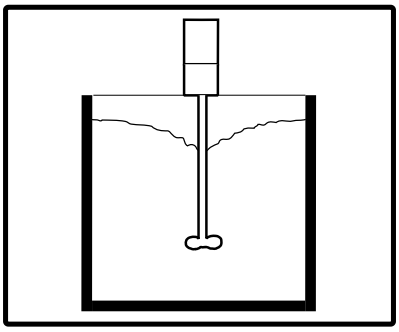
4.2 If tank diameter is approximately equal to liquid depth, use 1 prop, placed at least 2 prop diameters from the bottom of the tank.



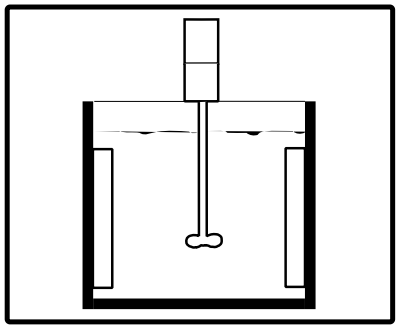
4.3 See drawing A2787 in section 14 for angular offset mounting dimensions. Consult factory for special applications, including square/rectangular tanks.



4.4 If tank height is greater than 1.5x the diameter, use 2 props. Position lower prop at least 2 prop diameters from bottom. Place upper prop halfway between bottom and top of liquid level.



4.5 For drawing down light powders, position mixer in center of tank to create a vortex. A vortex may not be recommended for some products. Depth of prop will vary vortex.



4.6 Baffles may be used to prevent vortexing when mixer is mounted on center. Baffling may not be required with more viscous products or square/rectangular tanks.

SECTION 5
INSTALLING THE STEADY BEARING
(optional equipment)

5.1 This section is for those mixers which include the optional steady bearing to accommodate longer than standard mixer shafts. A steady bearing must be installed only after the drive assembly and lower mixer shaft have been assembled and firmly bolted in place. DO NOT predetermine the exact bearing location from tank and mixer outline dimension drawings. The vertical center line of the steady bearing must coincide with the shaft's axis of rotation to minimize bearing preload (see Figure 5.1). This axis may not necessarily be at the center of the tank. The mixer shaft must be hand rotated (using input shaft coupling or motor fan) with a fixture attached to the shaft to mark a line on the tank bottom. NEVER APPLY POWER WITHOUT STEADY BEARING INSTALLED. The center of this inscribed area will be the location for the center of the steady bearing.

5.2 The steady bearing must be securely installed, with its vertical centerline coincident with the axis of rotation, as established. The amount of lateral movement required to bring the shaft into proper alignment with the final steady bearing location will vary, depending upon the shaft length and diameter.

5.3 The steady bearing is a wearing part and should be checked periodically for wear.

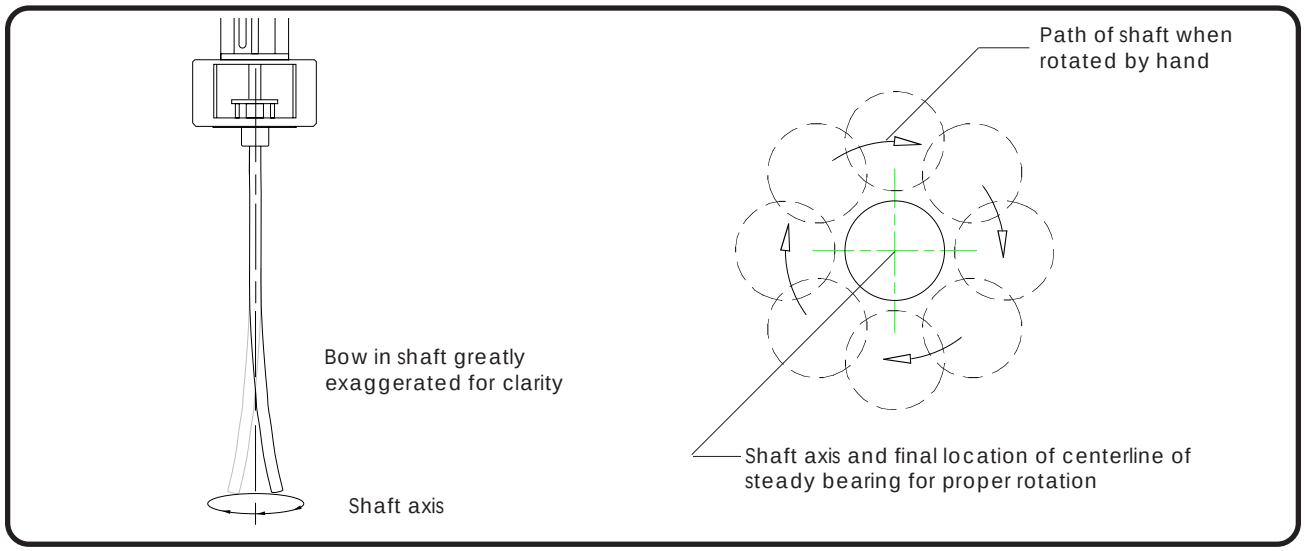


FIGURE 5.1

SECTION 6
MOTOR CONNECTIONS

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 Electric Code and local building codes are required.

6.1 **Wiring:** Starting and overload contol devices must be matched to motor rating. Follow control manufacturer's instructions for proper connections and installation.

6.2 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.

6.3 **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 rotation!*

6.4 **Electric motors - 3 phase:** Motors requiring 3 phase power should be wired according to the wiring diagrams on the motor. Rotation of the propeller must be clockwise looking down. Interchange lines if necessary for proper rotation.

6.5 **Electric Variable Speed:** Electric motors using an SCR or variable frequency controller must be wired following the instructions supplied with the controller. Many adjustments are often required to the controller and instructions should be read carefully before applying power. Adjust the controller to limit the maximum speed to the motor nameplate R.P.M. (or refer to the motor speed in the data sheet at the front of this manual).

6.6 **Air motors:** Air driven mixers must always have a filter, lubricator and moisture trap installed in the air line ahead of the motor to prevent damage. Use the same size or next size pipe size larger than intake port of motor. A regulator can be used to govern the mixer speed. Install the air line in the proper port to provide clockwise rotation of the propeller shaft when viewed from above. The muffler is always installed at the factory in its proper position.

WARNING: Damage to equipment or serious injury to personnel can result if speed limitations are not followed.

SECTION 7
LUBRICATION

6.1 Your mixer has been lubricated at the factory with the proper type and amount of lubrication for mixer service (gear drive units only). This lubricant needn't be changed under normal conditions for a period of 3 years. Under extreme conditions it is recommended that the lubricant in the gear box be changed more frequently . Remove motor to repack gearbox. Refer to the chart below for the lubricant recommended for temperatures in your area. When changing to a different lubricant, clean gearbox with mineral spirits before repacking.

SERVICE	LUBRICANT	CHEVRON EQUIVALENT
32˚F (0˚C) and up	oil based EP Semi fluid grease	Black Pearl NLGI 1 (standard from factory)
Down to -20˚F (-29˚C) and up to 300˚F (149˚C)	Synthetic EP	ULTI-PLEX synthetic grease EP
Food grade	Food grade EP-2	Chevron FM grease EP2

6.2 **Electric motor bearings** are usually sealed and need no relubrication. If zirc fittings are present relubricate with a No. 2 consistency lithium soap base and petroleum compound (every 6 months to 3 years depending on usage). Open and clean drains. Add grease until new grease is forced out drain. Remove excess grease and replace input plugs. Run motor one half hour before replaceing drain plugs. Mixer shaft bearings are sealed and need no relubrication.

6.3 **Air motor lubrication:** Lubricator needs to be adjusted to feed one drop of oil for every 50 - 75 CFM of air through the motor. Use a detergent SAE #10 automotive engine oil.

6.4 **Seal lubrication:** Vapor seal and high pressure packed glands need to be lubricated. A zirc fitting is present on the mounting flange and needs to be greased every day. A weight loaded lubricator or other self lubricating device is availible from Sharpe Mixers to aid in seal lubrication.

SECTION 8
SEAL START-UP AND OPERATION

8.1 The purpose of packing is to control leakage, not prevent it. Packings must leak to perform properly, otherwise they will burn up. TFE packings are especially sensitive in this respect.

8.2 **DO NOT OVER TIGHTEN!** Permit generous initial leakage on side entry units. Gradually take up gland nuts 1/6 turn (1 flat in hex nuts) at a time. Watch the temperature. **NEVER PERMIT HEAT TO DEVELOP** - IF HEAT DOES DEVELOP, BACK OFF GLAND NUTS. For top entry mixers, the temperature must be monitored carefully for overheating during start-up since there is no leakage of liquid. For side entry mixers, tighten gland at 15 minute intervals until leakage is controlled without developing heat. For a 1" diameter shaft, permit 5 to 20 drops per minute, a 2" diameter shaft would be allowed to leak twice as much. TFE packings must be permitted to leak 30 drops per minute on a 1" diameter shaft.

8.3 **PROVIDE LUBRICATION**, particularly when mixing non-lubricating liquids. A zirc fitting is standard from the factory for lubrication, see section 7.3 for lubrication instructions. For flushing , remove the 1/8" npt zirc fitting and replace with flushing lines (not included). Whenever flushing through a seal, a clean liquid having lubricating properties must be used.

8.3.1 **SEALING ABRASIVE LIQUIDS:** Abrasives is a term describing slurries, congealing liquids and crystallizing salts. These applications may damage the equipment, and present a sealing challenge for packing glands. The solution involves flushes, purges, and temperature controls. Sharpe Mixers recommends shaft hardening, or hard facings such as Stellite, Chrome, Ceramic, or Tungsten Carbide for these applications.

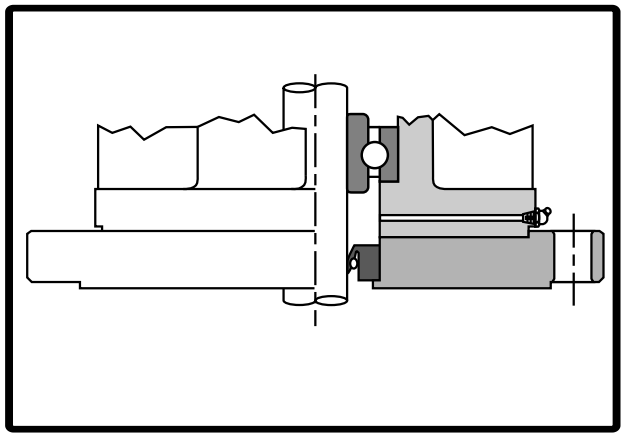
8.3.2 SUSPENDED SOLIDS: Examples of solids which are suspended in liquids include starch, contaminated or muddy water, sand, and other slurries. An external flush of liquid through a lantern ring is recommended. The flushing pressure needs to be 25 psi greater than the tank pressure.

8.3.3 PRECIPITATING LIQUIDS: Examples of precipitating liquids include caustic soda, calcium hydroxide, and ammonium nitrate. Precipitation occurs because of a change in concentration or temperature of the liquid. The resulting slurry can be very abrasive and destroy the packing. Sharpe Mixers recommends an external flush with clean fluid. The flushing pressure needs to be 25 psi greater than the tank pressure.

8.3.4 EVAPORATING LIQUIDS: Solids can form as a result of heat which promotes evaporation. Examples include any of the hot chemical salts - The chlorides, chlorates, sulfates and sulfides. Sharpe Mixers recommends an external flush with clean fluid. The flushing pressure needs to be 25 psi greater than the tank pressure.

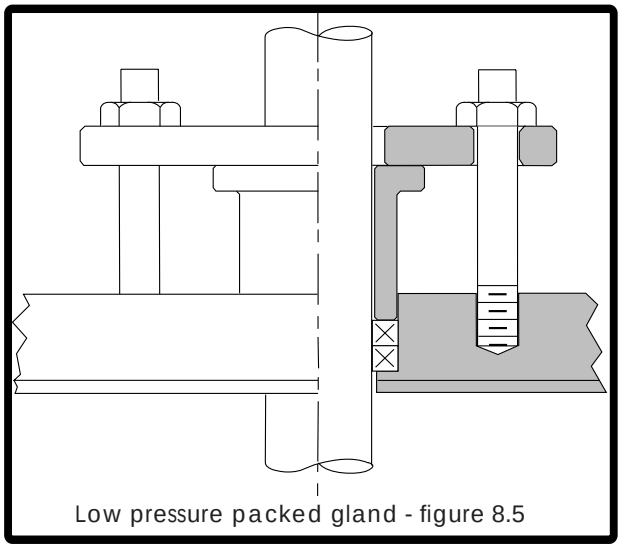
8.3.5 CONGEALING LIQUIDS: These liquids congeal because of a temperature decrease, or exposure to air. Sugar syrups fall into both categories. Good practice is to keep the fluid moving before congealing occurs. Control the process with heat. Asphalt and sugar syrups are typical of liquids which congeal during cooling. Be sure to heat thoroughly before start-up, during operation, and after shutdown if followed by a purge. Sharpe Mixers recommends an external flush or purge with clean fluid. The flushing pressure needs to be 25 psi greater than the tank pressure.

Some products such as glue, molasses, paint, and sugars harden to a solid state when exposed to air. An effective flush is a follower ring flush which will keep air out of the product. This type of flush does not enter the product, but only mixes with the product leakage. Sharpe Mixers recommends either an external flush with a non-hardening liquid or a purge using a solvent of the liquid being mixed.



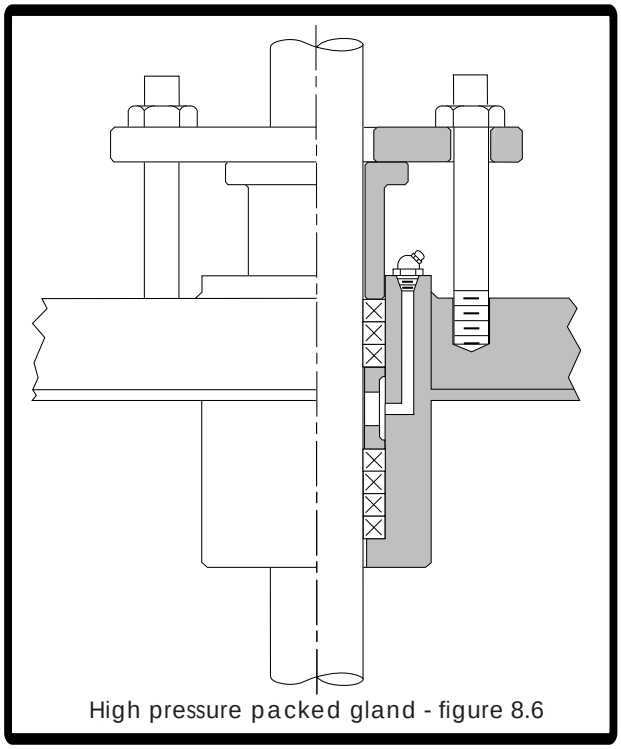
Vapor seal - figure 8.4

8.4 Vapor seals: Vapor seals normally come greased from the factory. This will keep in vapors from the product but will not hold pressure. See Section 7 for lubrication recommendations.



Low pressure packed gland - figure 8.5

8.5 Low pressure packed gland: Two rings packing is standard from the factory. This gland is designed for 15 psi of tank pressure.



High pressure packed gland - figure 8.6

8.6 High pressure packed gland: Seven rings with lantern ring is standard from the factory. This gland is designed for 150 psi of tank pressure. See section 7 for lubrication recommendations. Side entry mixers are standard with high pressure packed glands.

SECTION 9
OPERATION

WARNING: High voltage and rotating parts can cause serious or fatal injury. Lockout power before servicing.

9.1 Rotate mixer shaft by hand to check shaft straightness and to assure that the impeller is free of any obstructions in the tank.

9.2 **Always operate mixer with the lower impeller immersed** in the liquid by at least one prop diameter. Never operate mixer if fluid falls near the lower impeller.

9.3 The propeller rotates clockwise when viewed from above. Opposite rotation may cause overload and inefficient mixing.

9.4 Vortexing may occur if liquid level is too close to the upper impeller. This will cause aeration of the product and excessive vibration of the equipment. When mixing products of dissimilar viscosities and/or specific gravities the lighter or less viscous material should be introduced first. Gradually add the heavier material or powders into the center of the tank while the agitator is running. Never dump large amounts of powder or solids into the mixing tank. This may create clotting or "sanding in" of impeller and cause damage to the equipment.

CAUTION: Do not start mixer with impeller buried in solids or with liquid solution solidified. Damage will occur.

9.5 If impeller is buried in solids prior to starting mixer, solids must be dispersed. This may be achieved with an air hose, a recirculating pump, or a large stirring stick if necessary.

9.6 Keep motors free from oil, dust, dirt, water, and chemicals. Keep air intakes and outlets

4AM AIR MOTOR @ 1750 MAXIMUM R.P.M.					
H.P.	0.25	0.5	0.75	1.0	1.2
C.F.M.	14	22	30	39	48
P.S.I.	20	40	60	80	100

TABLE 9.1

6AM AIR MOTOR @ 1750 MAXIMUM R.P.M.					
H.P.	0.5	0.5	1.0	2.2	2.6
C.F.M.	23	39	53	68	82
P.S.I.	20	40	60	80	100

TABLE 9.2

free from foreign material. Electric motors supplied, although designed for outdoor use, may be damaged due to weather. A rain hood or other protection may be necessary to prolong motor life. Consult factory for recommendations.

9.8 Do not drive air motors in above 1750 R.P.M.. See Table 9.1 and 9.2 for proper air consumption and pressures.

9.9 Regular maintenance is the best assurance of trouble free, long life mixer operation. Inspect and relubricate at regular intervals. Frequency and thoroughness depends on operation, nature of service, and environment.

9.10 **Start-Up Checklist**

Prior and during start-up please check that the following things have been done:

a. Manual has been read and followed ☐

b. Coupling bolts tight (3/16" hex "tee" wrench) ☐

c. Bearing setscrews tight (1/8" hex allen wrench) ☐

d. Impeller is immersed in liquid ☐

e. Sufficient protection of motor (if outdoors) ☐

f. Impeller(s) installed correctly (see Section 3) ☐

g. Impellers spaced correctly (if two or more) for maximum and minimum liquid level (see Section 3) ☐

h. Impeller bolts tight ☐

i. All mounting bolts tight ☐

j. Proper type and amount of lubricant (when serviced; see Section 7) ☐

k. Wiring correctly installed, grounded and insulated ☐

l. Proper shaft rotation (clockwise looking down) ☐

m. Proper seal lubrication (see Section 7) ☐

n. Proper seal run-in time allowed (see Section 8) ☐

o. Steady bearing installed correctly (see Section 5) ☐

p. Correct voltage/amperage upon starting (check against motor nameplate data)

Record:_____Volts_____amps

q. Excessive noise after start-up ?

Record:_____db_____@3'

r. Excessive vibration of mixer support ? ☐

INSPECTOR _____ DATE _____

SECTION 10
SIDE ENTRY RETRACTION

10.1 Side entry mixers are provided with "shaft retraction" device which allows repacking without draining the tank. The following procedure outlines the operation of "shaft retraction". Refer to pages 10 and 11 for parts identification.

10.2 Disconnect the power from the mixer.

10.2 Remove the service window (512). Loosen the two bearing setscrews (310) and the two lower coupling bolts (651). Do not loosen the two coupling bolts closest to the motor. Do not remove any of the setscrews.

10.3 Remove the two retraction bolts (673) installed in the bearing spool. Move the retraction collar (672) to within an inch of the bearing spool. Tighten the collar on the shaft, lining up the drilled holes in the collar with the tapped holes in the bearing spool. Reinstall the two bolts through the holes in the retraction collar and into the tapped holes in the spool. Tightening these retraction bolts (673) will pull the retraction collar (672) and mixer shaft in a direction out of the tank and further into the split coupling. The shaft will move approximately 1/8" before further retraction becomes difficult. This tightness indicates that the seal collar (674) and gasket (675) has pressed tightly against the tank side of the mounting flange and a proper static seal is attained.

10.4 The mixer is now ready to have the stuffing box repacked (see Section 11).

10.5 To return the shaft to its original position, remove the retraction bolts from the retraction collar and the spool. Reinstall the bolts into the tapped holes in the retraction collar. These bolts (when tightened) will now press against the spool, and drive the shaft back into the tank. Move the mixer shaft back approximately 1/8" into its original position.

10.6 Tighten the two coupling bolts (651). Tighten the two bearing setscrews (310). Reinstall the service window (512) and gasket (513). Remove the retraction bolts from the collar (672). Move the collar away from the spool into its origional position and tighten collar in place. Reinstall the two retraction bolts into the tapped holes in the spool for storage. The mixer is now ready for service. See Section 8 and 9 for start-up and operation.

SECTION 11
STUFFING BOX REPACKING

11.1 PACKING TOOLS: Special flexible corkscrew tools specifically designed for packing make seal servicing an easy task. These tools are availible from Sharpe Mixers.

11.2 Remove the old rings. If a lantern ring is present, there are (4) slots cut into the outside edges. This helps the packing tools "grab" the lantern ring for removal. Before installing the new rings, be sure that the new packing is the proper type and size for your application (see Data Sheet in front of manual).

11.3 If the packing rings are purchased from a vendor other than Sharpe Mixers, it is likely that the rings will have to be cut. To do this, wind the packing around a mandrel of the same diameter as the mixer shaft for the desired number of rings (see Figure 11.1). Cut rings by making a straight cut along the mandrel as shown. When removing rings from mandrel, slip them off without opening the rings. This is especially important for metallic types. Do not open with a hinge-like action (see Figure 11.2).

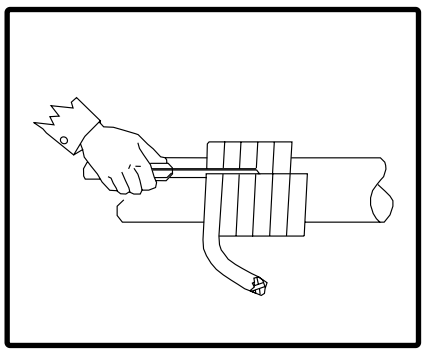


FIGURE 11.1

11.4 Check condition of stuffing box and the shaft in the seal area. If either are rough or scored, it needs to be reworked or replaced. Without repairing the damaged areas, gland take-up would then result in distortion of the rings and over compression of the packing on the mixer shaft. The packing would not seal properly and burn out sooner, damaging the seal area more. If wearing in the seal area is evident contact the factory for recommendations.

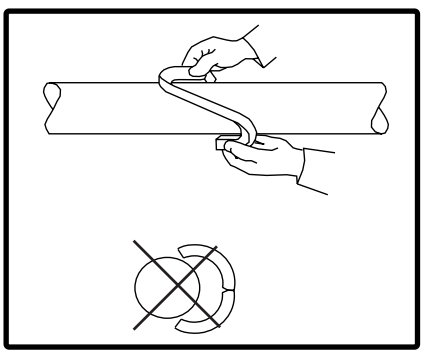


FIGURE 11.2

11.5 Coat new rings to be installed with a lubricant to assist installation and to help establish a proper initial break-in (Do not use on food grade packings, liquid oxygen service, nitric

acid, or any other non-compatible application). Check position of all gland parts against the applicable seal drawing. Replace all worn or damaged parts for proper seal.

11.5 Install rings over the shaft by twisting open as shown in Figure 11.2. This is especially important for metallic rings. NEVER open rings with hinge like action.

11.6 Insert rings one at a time with the joints staggered 90° apart (for 2-ring low pressure seals, stagger at 180°). Seat each ring individually, compressing in place with a tamping tool or by using a split hollow cylinder. Turn mixer shaft occasionally to assist seating. Unless each ring is properly seated, the gland follower will not be able to tighten the packing set, as it will overcompress the outboard rings, nearest the follower ring. Except for abrasives, 70% of the wear normally takes place on the two packing rings nearest the follower ring. Proper seating and lubrication spreads the wear more evenly over the entire set of rings. Adjust the follower plate nut finger tight to begin seal break in. See Section 8 for seal start-up procedures.

SECTION 12
DIRECT DRIVE DISASSEMBLY

12.1 Disconnect the power from the mixer.

WARNING: High voltage and rotating parts can cause serious or fatal injury. Lockout power before sevicing.

12.2 Rebuilding the drive unit is best accomplished by removing the entire mixer from the tank. Remove the impeller from the shaft before removing the mixer from the mounting flange.

12.3 Remove the service window (512). Loosen the two bearing setscrews (310) and the two lower coupling bolts (651). Loosen the follower nuts (457).

12.4 Remove the mixer shaft.

12.5 Remove the four bolts mounting the bearing spool (510) to the stuffing box housing (552). Remove the drive from the housing. The stuffing box can be repacked at this time, if needed (see Section10).

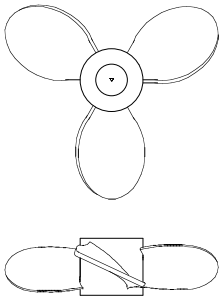
12.6 Remove the four 3/8" bolts mounting the motor to the spool and then the two may be separated.

12.7 BEARING AND SEAL REMOVAL: Place the mixer spool in a benchpress with the motor mounting face down. Use a 1 - 1/2" diameter arbor in the press on top of the lip seal (360) and press the lip seal and the bearing (301) down and out of the spool.

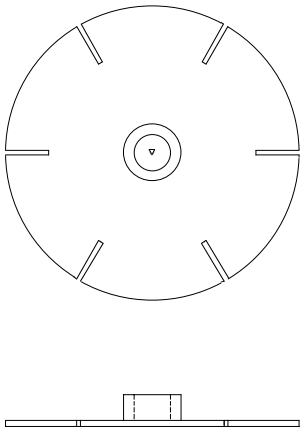
12.8 Reinstall the bearing from the inside of the spool, using LOCTITE sealant (609 or better) to hold the bearing in place. The lip seal (360) should be installed from the outside of the spool into position as shown in the drawing.

12.9 To reassemble, reverse procedure, being sure that the shaft has full engagement in the split coupling (650) and all fasteners are tight (for side entry units a gap of 1/16" must be maintained between the seal collar gasket and the flange).

STANDARD DIRECT DRIVE IMPELLERS:

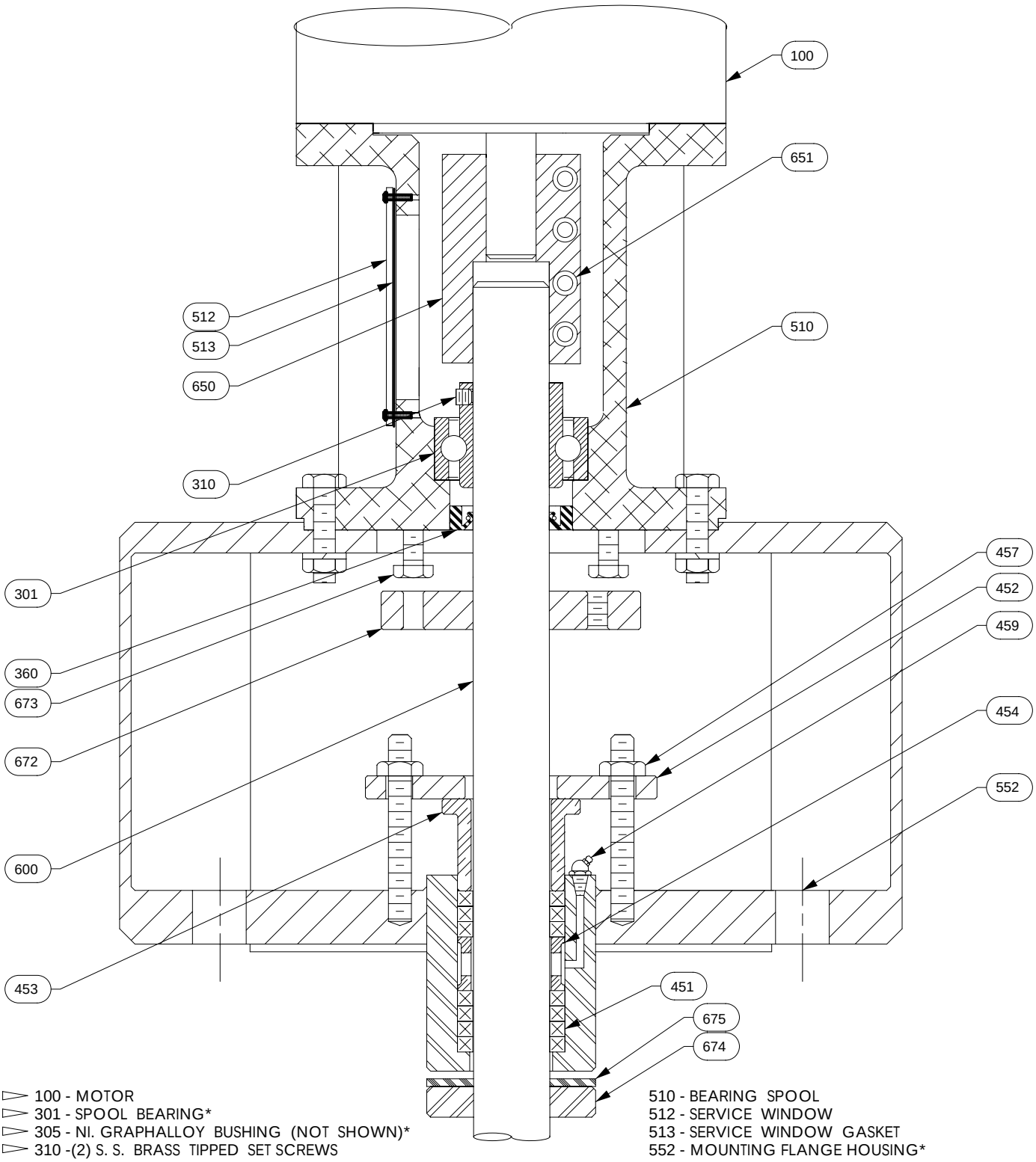


MARINE PROPELLER



HIGH SHEAR

DIRECT DRIVE 'F' SERIES

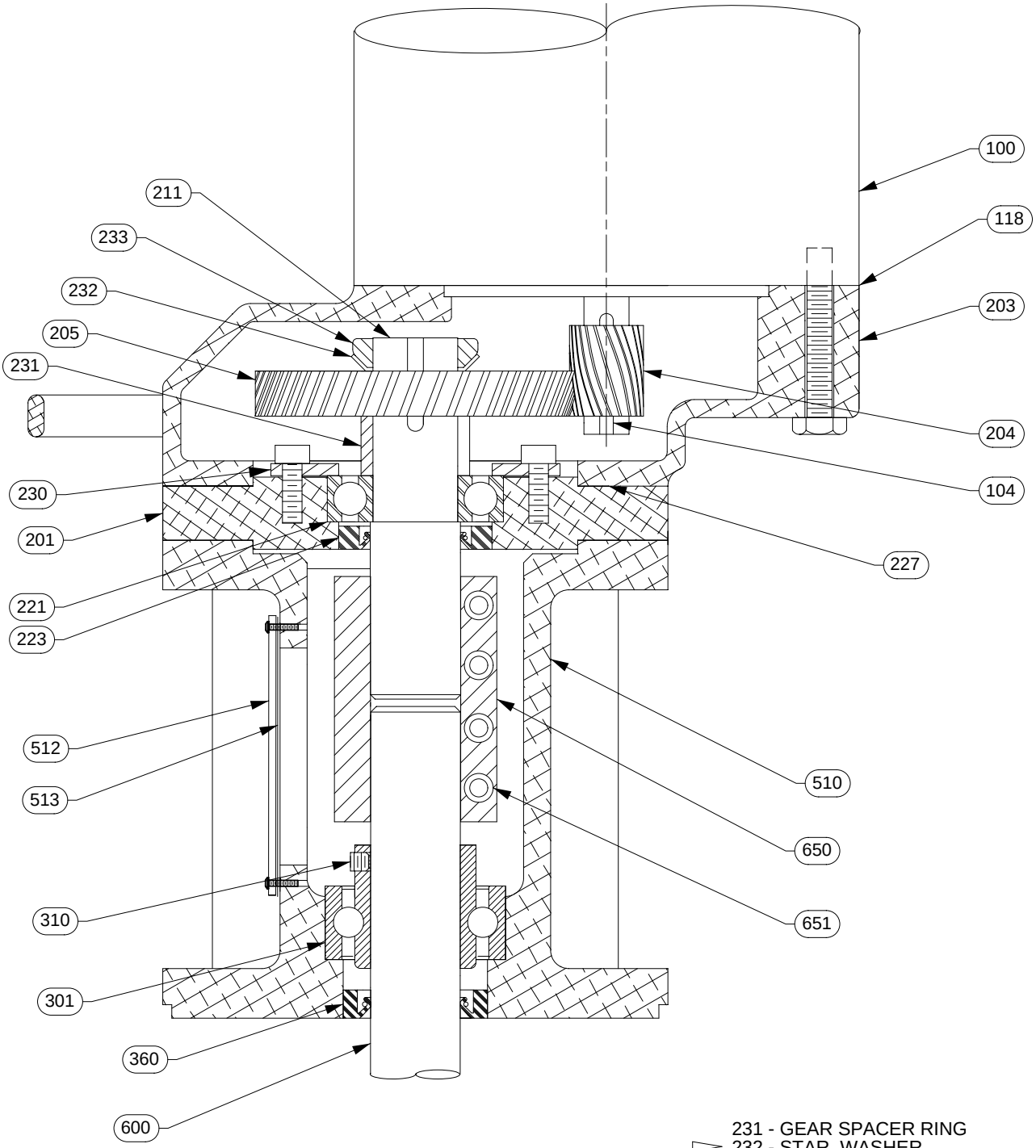


- 100 - MOTOR
- 301 - SPOOL BEARING*
- 305 - NI. GRAPHALLOY BUSHING (NOT SHOWN)*
- 310 -(2) S. S. BRASS TIPPED SET SCREWS
- 360 - SPOOL LIP SEAL*
- 451 - PACKING*
- 452 -FOLLOWER PLATE*
- 453 - FOLLOWER RING*
- 454 - LANTERN RING*
- 456 - FOLLOWER STUDS
- 459 - GREASE FITTING
- 510 - BEARING SPOOL
- 512 - SERVICE WINDOW
- 513 - SERVICE WINDOW GASKET
- 552 - MOUNTING FLANGE HOUSING*
- 600 - MIXER SHAFT*
- 650 - COUPLING*
- 651 - (4) SPLIT COUPLING BOLTS
- 672 - RETRACTION COLLAR* (SIDE ENTRY ONLY)
- 673 - RETRACTION BOLT (SIDE ENTRY ONLY)
- 674 - SEAL COLLAR (SIDE ENTRY ONLY)
- 675 - SEAL COLLAR GASKET (SIDE ENTRY ONLY)
- 750 - IMPELLER (SEE OPPOSITE PAGE)

* NOTE - HIGH PRESSURE SEAL SHOWN. SEE DATA SHEET FOR YOUR SPECIFIC SEAL APPLICATION. - WHEN ORDERING PARTS, GIVE SERIAL NO. AND SHAFT SIZE.

DENOTES RECOMMENDED SPARE PART

GEAR DRIVE 'F' SERIES



- 100 - MOTOR
- 104 - PINION GEAR KEY
- 118 - C-FACE GASKET
- 201 - BEARING PLATE
- 203 - GEAR HOUSING
- 204 - PINION GEAR
- 205 - HELICAL GEAR
- 211 - GEAR SHAFT
- 221 - GEARBOX BEARING
- 223 - GEARBOX LIP SEAL
- 227 - GEARBOX GASKET
- 230 - BEARING RETAINER
- 231 - GEAR SPACER RING
- 232 - STAR WASHER
- 233 - GEAR NUT
- 301 - SHAFT BEARING*
- 310 - (2) S. S. BRASS TIPPED SET SCREWS
- 360 - SHAFT LIP SEAL*
- 510 - BEARING SPOOL
- 512 - SERVICE WINDOW
- 513 - SERVICE WINDOW GASKET
- 600 - MIXER SHAFT*
- 650 - COUPLING*
- 651 - (4) SPLIT COUPLING BOLTS

* NOTE - WHEN ORDERING PARTS, GIVE SERIAL NO. AND SHAFT SIZE.

DENOTES RECOMMENDED SPARE PART

SECTION 13
GEAR DRIVE DISASSEMBLY

13.1 Disconnect the power from the mixer.

WARNING: High voltage and rotating parts can cause serious or fatal injury. Lockout power before sevicing.

13.2 Rebuilding the drive unit is best accomplished by removing the entire mixer from the tank. Remove the impeller from the shaft before removing the mixer from the mounting flange.

13.3 Remove the service window (512) . Loosen the two bearing setscrews (310) and the two lower coupling bolts (651) . Loosen the follower nuts (452).

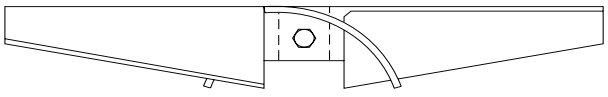
13.4 Remove the mixer shaft.

13.5 Remove the four bolts mounting the bearing spool (510) to the stuffing box housing (552). Remove the drive from the housing. The stuffing box can be repacked at this time, if needed (see Section 11).

13.6 Remove the three motor bolts and the motor may be lifted off the gear head assembly. Remove the four (4) 3/8" gear head assembly bolts and lift off the gearbox housing (203). The bearing plate (201) may now be removed with the gear, gear shaft and coupling assembled. Clean the assembly of grease and rinse with mineral spirits. Handling the gear shaft sub-assembly is best accomplished using a piece of round bar the same diameter as the mixer shaft. Clamp the round bar in a bench vise and tighten the drive coupling (650) onto the round bar. If a round bar is not available clamp the coupling in the vise using two pieces of wood so as not to damage the coupling. To remove the gear nut (233) first bend down the locking tab on the star washer from the slot in the gear nut. Using a spanner wrench, loosen the gear nut from the shaft. Remove the gear nut and the star washer. The slow speed gear (205) may be removed using a gear puller if it is too tight to remove by hand. Gear teeth are hardened and are easily chipped. Use care when handling. Loosen the upper two coupling bolts and remove the gear shaft/ bearing plate assembly from the coupling. Place the subassembly in a press with the threaded end of the shaft pointing up. Remove the spacer ring (231) from the gear shaft. Press the gear shaft (211) down, out of the bearing plate. Remove the four 1/4" cap screws and the bearing retaining ring (230). Turn the bearing plate upside down so that the lip seal (223) is on top. Using a 2" diameter arbor press the lip seal and the bearing out of the bearing plate. See Section 12.7 for removal of bearing and lip seal in the spool.

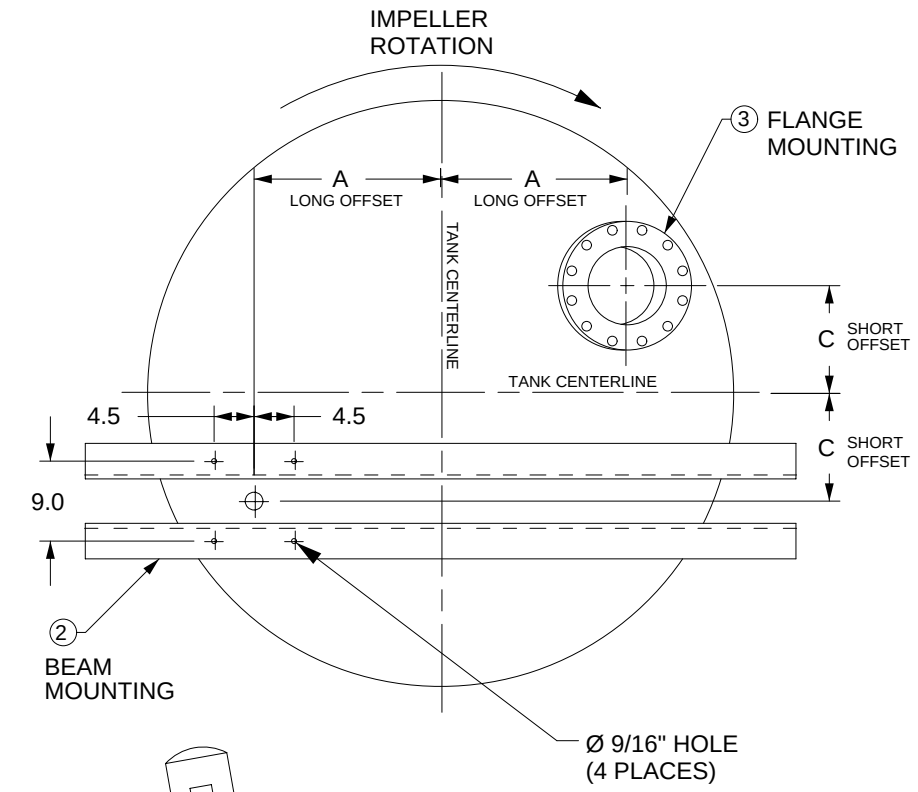
13.7 To remove the pinion gear (204) from the motor shaft, first clean the pinion gear of grease. Support the motor shaft with a soft block to prevent damage when removing the pinion gear. The pinion gear may be removed from the motor shaft using a gear puller. Use care not to chip the teeth of the hardened gear. Apply heat to break the adhesion of the Loctite®.

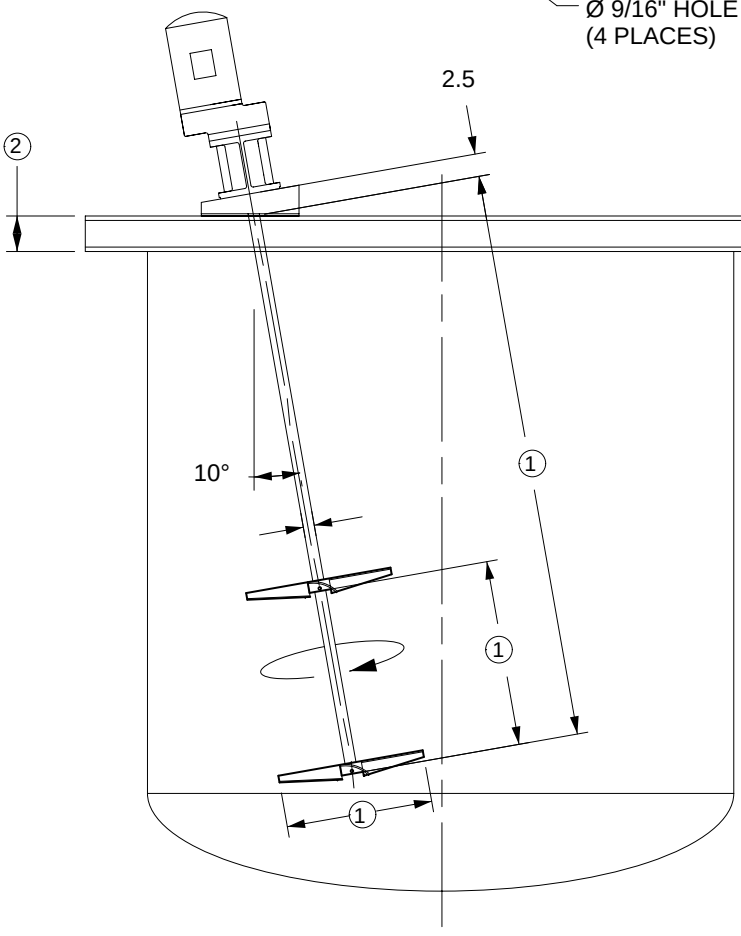
13.8 To reassemble a new gear on an existing motor, clean all parts and trial fit the pinion gear on the shaft. Never pound the pinion gear into place. Assemble gear and key flush with the end of the motor shaft using Loctite® # RC-680 compound. Remove any excess Loctite® from the gear, especially from the gear teeth. If replacing both the motor and pinion gear, Sharpe Mixers will normally supply the motor with the pinion gear installed. Pack the gearbox full of the appropriate lubricant (see Section 7).



HYFLO II ENERGY EFFICIENT IMPELLERS ARE STANDARD ON GEAR DRIVE F-SERIES MIXERS

Always reference mixer serial number when making a parts inquiry or placing an order. This serial number is located on the Sharpe Mixer nameplate and on the front cover of the service manual.





TANK DIA.	A	C
24	4.88	2.88
27	6.25	3.63
30	7.38	4.25
33	8.50	4.88
36	9.75	5.63
39	10.88	6.25
42	11.88	6.88
45	13.25	7.63
48	14.13	8.13
51	15.38	8.88
54	16.5	9.50
57	17.5	10.13
60	18.88	10.88
63	20.0	11.50
66	21.0	12.13
69	22.13	12.75
72	23.38	13.50
75	24.5	14.13
78	25.5	14.75
81	26.63	15.38
84	27.88	16.13
87	29.0	16.75
90	30.13	17.38
93	31.25	18.13
96	32.50	18.75
99	33.50	19.38
102	34.63	20
105	35.75	20.75
108	36.88	21.38
111	38.13	22
114	39.25	22.63
117	40.38	23.38
120	42.18	24
126	43.88	25.38
132	46.13	26.63
138	48.38	28
144	50.88	29.25
150	53.0	30.63
156	55.25	32
162	57.50	33.25
168	59.88	34.63

TANK DIA.	A	C

① REFER TO DATA SHEET FOR DIMENSIONS.

② MINIMUM MOUNTING CHANNEL REQUIRED:
TANK DIA. UP TO 96" - 4" x 7.25#
TANK DIA. OVER 96" - 6" - 8.2 #

③ OFFSET DIMENSIONS ARE TO CENTERLINES ON TOP OF FLANGE.

TANK DETAIL FOR ANGULAR-OFFSET PLATE MOUNTING

DWG NO.: A2787

*TANK,MNT,ANGLE,OFFSET.S by:KWS 11/97 revision: 1 - 7-20-04 JDH Dimensions are for reference only. Use certified prints for construction. Dimensions are in inches.

SECTION 15
TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	SOLUTION
• Shaft will not fit into drive	•Wrong end of shaft (only one end fits)	•Install end marked "motor end"
	•(2) bearing set screws (310) extend into bearing bore	•Loosen set screws
	•(2) coupling bolts (651) too tight	•Loosen bolts
	•Shaft over size (proper dia. 0.001" - 0.002" under nominal dia.	•Measure and consult factory
	•Wrong size shaft (600), coupling (650), or bearing (301)	•Consult factory
	•Damaged shaft (600), coupling (650), or bearing (301)	•Consult factory
•Mixer will not start	•Incorrect wiring	•Check wiring diagram and wire correctly
	•Loose connections	•Check and tighten connections
	•Blown fuse	•Replace fuse
	•Incorrect voltage	•Wire for correct voltage
	•Mechanical jamming	•Free all debris for rotation
	•Water damage to motor	•Service or replace motor
	•Wrong size heaters in starter	•Replace heaters
•Mixer will not reach correct speed	•Overload of motor	•Check amperage against nameplate data
	•Loose drive coupling bolts (651)	•Check coupling bolt tension (coupling and/or shaft may be damaged if mixer has been run with slipping coupling)
	• Air motor vanes/ports dirty	• Flush air motor with non-combustible solvent - relubricate
	• insufficient pressure for air motor	• increase air line/compressor size, decrease compressor distance from air motor
	•See all items under "Mixer will not start"	

PROBLEM	POSSIBLE CAUSE	SOLUTION
• Motor runs hot	• Low or high voltage • Amperage overload • Product too viscous • Restricted ventilation • Frequent starting and stopping • Unbalanced voltage between phases • Incorrect rotation • Air motor not properly lubricated • Impeller upside down • Exceeding maximum speed	• Wire for correct voltage • Contact factory • 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 • Lubricate (see Section 7) • Reinstall in correct position • Adjust variable speed drive to limit R.P.M.
• Noisy	• Loose drive coupling bolts (651) or bearing set screws (310) • Insufficient lubricant • Foreign material in lubricant • Incorrect lubricant • Worn or faulty bearings or gears • Dry lip seal (360) in spool	• Check and tighten coupling bolts and set screws (possible damage if run loose) • Fill proper amount of lubricant • Change lubricant • Change to correct lubricant • Check bearings/gears replace if necessary • Apply lubricant to lip seal
• 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 7) • 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	• Check manual for proper amount lubricant and drain excess • Replace gasket • Check and tighten bolts • Replace seals

PROBLEM	POSSIBLE CAUSE	SOLUTION
•Shaft vibration	•Impeller not immersed in liquid	•Fill tank
	•Impeller too close to surface	•Fill tank or lower impeller (see Section 3)
	•Bent mixer shaft	•Consult factory
	•Unstable mounting platform	•Reinforce platform
	• Operating at critical speed	• Consult factory
•Seal leakage	•Proper amount of leakage	•See Section 8
	•Worn packing	•Replace packing
	•Scored shaft	•Replace shaft and packing check stuffing box also for possible scoring
	•Insufficient/incorrect lubrication	•Lubricate properly (see Section 8) check for scoring - re place if necessary
	•Excessive heat in gland	•Back off gland nuts (replace packing if necessary) check for scoring - replace if necessary
	•Worn vapor seal	•Replace lip seal
	•Split in packing rings not off-set	•Remove packing, reinstall at off-set (see Section 11)

SECTION 16
ACCESSORIES

AIR FILTER, REGULATOR, LUBRICATOR

An air filter, regulator, and lubricator must be used with air drive portable mixers. If your system already has a filter, regulator, and lubricator, a needle valve is used for motor speed adjustment. These are available from Sharpe Mixers.

A "Mixer Fixer Kit" is available for rebuilding your Sharpe Mixers portable mixer. This kit includes all bearings, seals, (gears, when applicable) and other recommended spare parts as shown on pages 10 and 11 of this manual (motor optional). Call Sharpe Mixers for current prices.

Signet 9900 Transmitter

Ellis Part Number:
2236001099 - ph meter

English

3-9900.090 Rev. A2 08/11

Operating Instructions

Panel Mount

Field Mount

Quick Start

Your new Signet 9900 Transmitter needs to be calibrated and the sensor needs to be initialized prior to use. The following steps outline the recommended procedure to start up a new system.

Look for the Quick Start icon to quickly set up your new 9900.

1. **Module Installation (pg. 5)**
2. **Installation (pg. 8)**
3. **Wiring (pg. 9)**
4. **Sensor Wiring (pg. 12)**
5. **Power Wiring (pg. 15)**
6. **Relay and Open Collector Wiring (pg. 16)**
7. **Relay Functions (pg. 21)**
8. **Operation (pg. 22)**
9. **Menu System (pg. 24)**

Description

The 9900 Transmitter, a member of Signet's line of SmartPro™ instruments, provides a single-channel interface for all Flow, pH/ORP, Conductivity/Resistivity, Salinity, Pressure, Temperature, Level and other applications. The 9900 is available in either Panel Mount or Field Mount versions. Both versions can run on 12 to 32 VDC power (24 VDC nominal), and can power certain sensors on loop power.

This versatile tool also allows third-party 4 to 20 mA signals to be used as an input (optional Signet 8058 i-Go™ Signal Converter required, sold separately).

Safety

WARNING!

- Follow instructions carefully to avoid personal injury.
- This unit is designed to be connected to equipment which can be hazardous to persons and property if used incorrectly. Read and understand all associated equipment manuals and safety warnings before using with this product.
- Remove power to unit before wiring connections.
- Wiring connections to this product should only be performed by qualified personnel.
- Do not use unit if display is cracked or broken.

Georg Fischer Signet

Advanced Fluid Measurement

Table of Contents

New Features

Features of the 9900 include:

- Large auto-sensing backlit display, “at a glance” visibility; displays separate lines for the units, main and secondary measurements
- “Dial-type” digital bar graph
- Intuitive and “user-friendly” interface consistent with legacy Signet ProPoint® and ProcessPro® devices
- Field upgradable relays
- Selectable current outputs (3.6 mA or 22 mA) to indicate error
- 4 to 20 mA input (with optional 8058 i-Go Signal Converter)
- Warning LED indicator
- Custom 13-character label capabilities for the channel type
- Factory default reset capability
- Optional H COMM Module for two-way communication
- Optional PC COMM configuration tool

Base units, plug-in modules, accessories and spare parts are sold, packaged and shipped separately from the factory. Unpack all components carefully. The following items accompany every 9900 base unit:

- 9900 Base Unit
- Quick-clip panel mounting bracket (Panel Mount only)
- Adhesive template for panel cutout (Panel Mount only)
- Wiring connectors for sensor and power inputs
- Hardcopy Instruction Manual – English
- CD-ROM containing instruction manuals in English, German, French, Spanish, Chinese and Korean.

	Panel Mount	Field Mount
Mounting Bracket	X	
Wiring Connectors	X	X
Adhesive Template	X	
Instruction Manual	X	X
CD-ROM	X	X

Compatibility

The 9900 is compatible with all GF Signet Flow, pH/ORP, Conductivity/ Resistivity, Salinity, Level, Temperature, Pressure and Turbidity products listed in the column to the right.

- pH and ORP electrodes require the Signet 2750 DryLoc® Sensor Electronics (sold separately).
- Conductivity/Resistivity or Salinity measurement requires either the optional Direct Conductivity/Resistivity Module (part number 3-9900.394) or the Signet 2850 Conductivity/Resistivity Sensor Electronics (sold separately). (**NOTE:** If using the 2850, use ONLY the one-channel digital (S^3L) models, or the 2-channel with only one channel connected. The 2-channel and 4 to 20 mA models 3-2850-52, -53, -62 and -63 are incompatible with the 9900.)
- Turbidity measurement using Signet 4150 requires Signet 8058 i-Go™ Signal Converter (sold separately).

NOTE: Loop Power can be used ONLY for the following sensors: 515, 525, 2250, 2350, 2450, 2536, 2540 and 8058; all other measurement sensors require DC power.

Flow
515*, 525*, 2000, 2100, 2507, 2536*, 2537, 2540*, 2551, 2552

pH/ORP
2724-2726 with 2750
2756-WTx–2757-WTx with 3719
2764-2767 with 2750
2774-2777 with 2750

Conductivity/Resistivity
Salinity
2819-2823 with 2850 or Cond/Res Module
2839-2842 with 2850 or Cond/Res Module

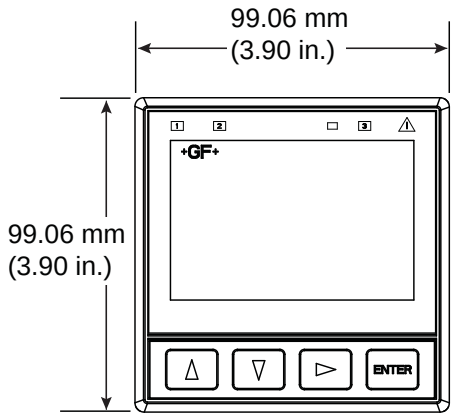
Level, Temperature, Pressure
2250*, 2350*, 2450*

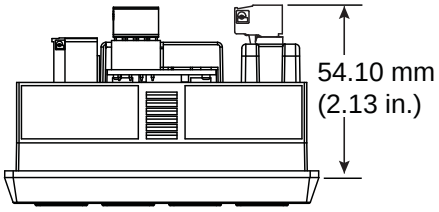
Turbidity
4150 with 8058

* Can be run on Loop Power

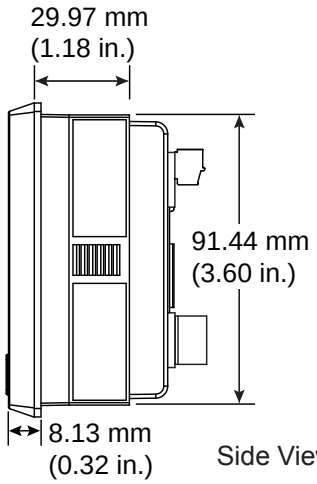
Dimensions

Panel Mount
3-9900-1P



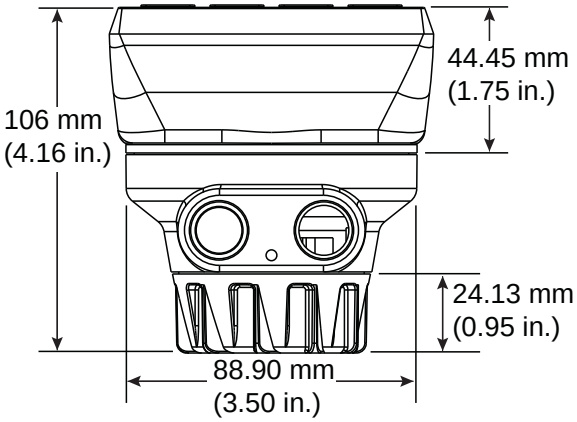


Top View



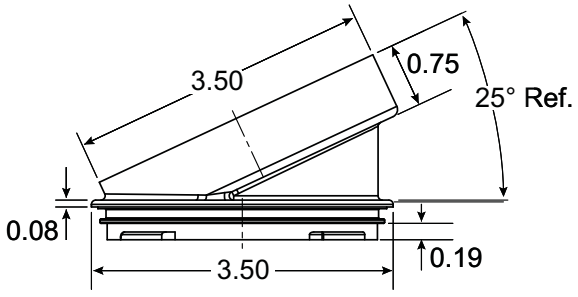
Side View

Field Mount
3-9900-1



(3-8051 shown)

NOTE: 3-8051 Integral Mount Kit sold separately.



3-9900.396 Angle Adjustment Adapter Kit

Module Installation

If the 9900 Base Unit will be mounted in a panel, the plug-in modules may be installed either before or after the base unit is mounted. If the 9900 Base Unit will be mounted using the accessory wall mount bracket, install plug-in modules first.

If installing both the Conductivity/Resistivity (Cond/Res) and the H COMM Modules, install the H COMM Module first, then the Cond/Res Module on top of it (see illustration on page 7).

The Relay and Cond/Res Modules attach with screws. The H COMM Module simply plugs in.

CAUTION
Exercise care when installing modules.
Do not bend connecting pins.

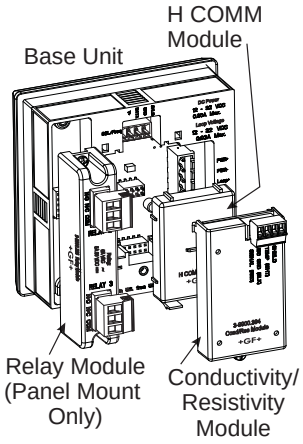
To install modules:
Remove power from the 9900. Carefully align pins and connectors (do not bend connecting pins) and push module firmly into place, then attach with screw(s) (except H COMM Module).

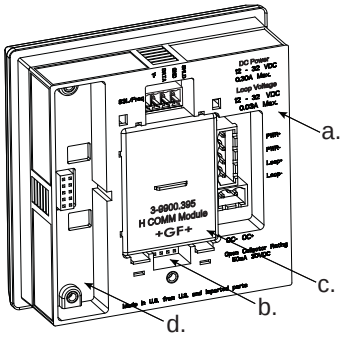
CAUTION
LOOP as well as DC power MUST be removed BEFORE installing H COMM Module.

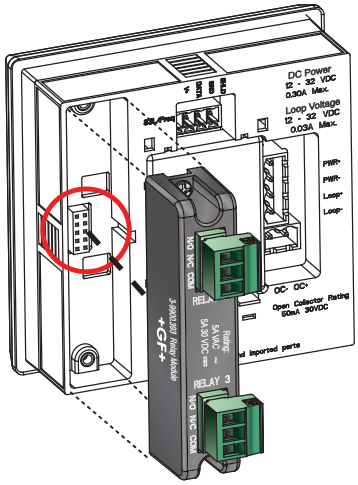
To remove modules:
Remove power from the 9900. For Relay and Cond/Res Modules, unplug connectors, remove screw(s), and carefully pull module straight out from the base unit. Do not bend the connecting pins. For H COMM Module, squeeze the tabs on the bottom edge, grasp the module using pliers and pull straight out. Do not bend the connecting pins.

CAUTION
Avoid Electrostatic Discharge (ESD)

- Minimize handling of the plug-in modules to reduce the possibility of damage due to ESD.
- Handle modules by the edges. Never touch any exposed circuitry or contacts.
- Wear an anti-static wristband or stand on an anti-static mat, or keep one hand touching a properly grounded pipe or other piece of properly grounded metal when handling modules.







CAUTION

Switching active loads (usually inductive) can cause contact arcing sufficient to damage the relays. The RC Filter Kit or "snubber" (part number 3-8050.396) is available as an accessory to reduce or eliminate these damaging effects. Recommended for inductive loads greater than 50 VAC (remote relays, solenoids, pumps, etc.)

Plug-In Modules

Optional modules and accessories are available for the 9900:

- Relay Module (not available on field mount)
- Direct Conductivity/Resistivity Module
- H COMM Module

Each item is ordered separately.

Modules are field-replaceable at any time.

See Installation and Ordering Information sections for more details.

a. Base Unit (required)
b. Slot for optional Cond/Res Module
c. Slot for optional H COMM Module
d. Slot for optional Relay Module.

Relay Module

(Panel Mount installations only)

Mfr. Part No.	Code	Description
3-9900.393	159 001 698	Relay Module - Two dry-contact relays

In addition to the standard programmable Open Collector output in the base unit, the Panel Mount version of the 9900 has a slot for an optional Relay Module, which adds two programmable dry-contact relays. The Open Collector output in the base unit uses the Relay 1 setting in the menus. If the optional Relay Module is installed, these are assigned to relays 2 and 3 in the menus.

Dry-contact relays are electromechanical switches with a moving contact armature. They are suitable for many general-purpose applications, AC or DC, including AC loads up to 250 V. Install RC Filter Kits, 3-8050.396, on relays used to switch motor or inductive loads.

- Two (2) SPDT dry-contact relay (DCR) inputs
- User programmable
- 250 V, 5 A maximum resistive loading (AC).
- Can switch line voltage (typically 120 to 240 VAC)
- Can switch DC voltage (< 30 VDC @ 5A)
- Larger voltage and current ratings than Open Collector outputs

NOTE: The Relay Module requires 12-32 VDC, 300 mA power connection to DC PWR Terminals. The Relay Module cannot be used with loop power.

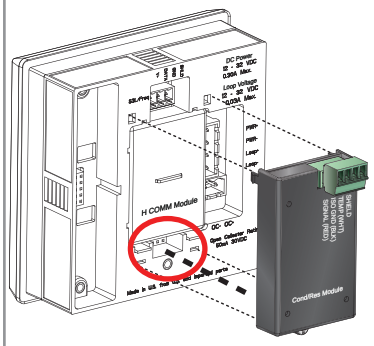
- The two red Mechanical Relay Indicator LEDs on the front panel of the 9900 (see page 22) show the status of relays 2 and 3. (Status of all relays and Open Collector is available at all times in a single screen in View mode.)
- Hysteresis and time delay are adjustable for each relay.

Direct Conductivity/Resistivity Module

Mfr. Part No.	Code	Description
3-9900.394	159 001 699	Direct Conductivity/Resistivity Module

The Direct Conductivity/Resistivity (Cond/Res) Module interfaces Signet 2819-2823 and 2839-2842 Conductivity electrodes directly to the 9900. (Conductivity/Resistivity and Salinity measurements may also be performed via the 2850 Sensor Electronics connected through the 9900 Digital (S^3L) inputs.)

- Provides filtering and conditioning.
- Sensor cable length can be extended to 30 m (100 ft) (except 2819/2839: 4.6 m (15 ft) max for >10 MΩ, no splices).

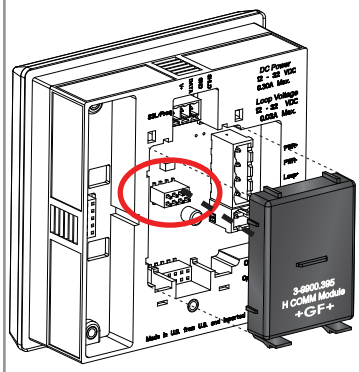


H COMM Module

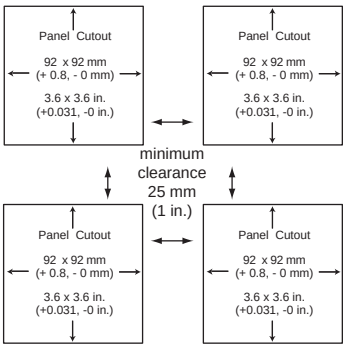
Mfr. Part No.	Code	Description
3-9900.395	159 001 697	H COMM Module

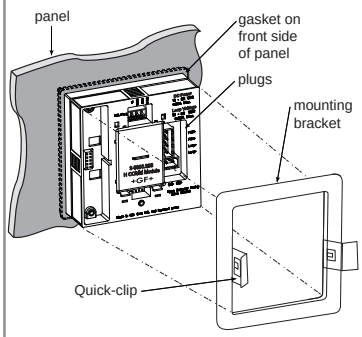
The H COMM Module enables communication between the 9900 and a HART®-enabled device. The HART (**H**ighway **A**ddressable **R**emote **T**ransducer) Protocol superimposes digital signals on top of the 4 to 20 mA analog signal.

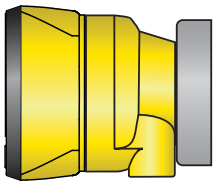
Refer to the 9900 H COMM Module Manual 3-9900.094 for further details.



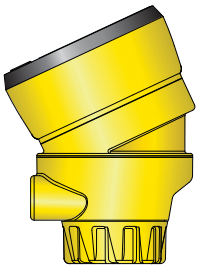
HART® is a registered trademark of the HART Communication Foundation, Austin, Texas, USA. Any use of the term HART hereafter in this document implies the registered trademark.







Field Mount with
3-8050 Mount Kit



Integral Mount with
3-8051 Mount Kit and
Angle Adjustment Adapter

Installation

System Start-up: Step 1
Prepare the transmitter installation location. If the back of the transmitter is difficult to access when installed, wire the removable terminal blocks first, then install it completely.

Next step: Wiring (see pg. 9).

For future reference, for each installation, it is recommended to record the part number and serial number of each of the components listed here:

Facility Tag Number or System ID (user assigned):_____

Base unit	3-9900._____	S/N _____
Relay Module	3-9900.393	S/N _____
Cond/Res Module	3-9900.394	S/N _____
H COMM Module	3-9900.395	S/N _____

Do not mount in direct sunlight.

Panel Mount Installation

Tools and Equipment Required

- File (fine)
- ¼ DIN punch or jigsaw suitable for cutting panel opening to within 1 mm (0.04 in) tolerance.
- ¼ DIN punches are available and recommended for creating clean, precise openings quickly and easily in most instrument panels.
- If a punch is not available, a jigsaw or other cutting tool can be used. An adhesive template is provided to help guide the cutting process. De-burr and smooth the opening with a file.

1. The panel mount transmitter is designed for installation using a ¼ DIN punch. For manual panel cutout, an adhesive template is provided as an installation guide. Recommended clearance on all sides between instruments is 25 mm (1 in).
2. Place gasket on instrument, and install in panel.
3. Slide mounting bracket over back of instrument until bracket snaps into latches on side of instrument.

To remove:

1. Secure instrument temporarily with tape from front or grip from rear of instrument. DO NOT RELEASE.
2. Press bracket clips outward and remove.

Field Mount Installation

Field mounting requires a separate mounting kit. The 3-8050 Universal Mount Kit, the 3-8051 or 8052 Integral Mount Kits, and the 3-9900.396 Angle Adjustment Adapter Kit enable the transmitter to be installed virtually anywhere. Detailed instructions for field installation options are included with the 3-8050, 8051, 8052 adapter kits (see Ordering Information section).

For Field Mount installations with a Cond/Res Module, the Angle Adjustment Adapter is required along with a 3-8050, 8051 or 8052 adapter kit to allow for sufficient clearance for the wiring.

Wiring

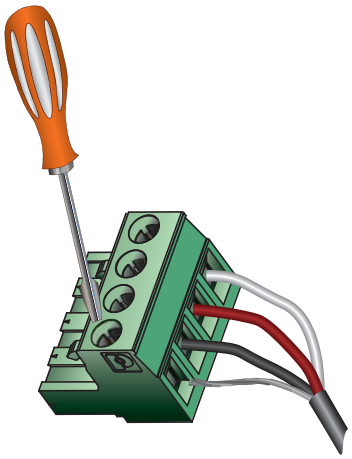
System Start-up: Step 2
Wire the transmitter for all connections with the power off. Keep any 4 to 20 mA and relay-actuated output devices that are connected to it offline at this time. Connect the sensors (pg. 12), power (pg. 15) and relay(s) (pg. 16).

Next step: Relay Functions (see pg. 21).

Tools Required

- Phillips screwdriver
- Flat-head screwdriver
- Wire strippers

For Field Mount installations, refer to the wiring diagram inside the Field Mount housing.



Wiring Tips:

- Do not route the sensor, DC power, or 4 to 20 mA cables in conduit containing AC power wiring. Electrical noise may interfere with sensor signal.
- Routing the sensor cable in grounded metal conduit can help prevent electrical noise and mechanical damage.
- Seal the cable entry points to prevent moisture damage.
- Only one wire should be inserted into a terminal.
- Splice double wires outside the terminal or use appropriate wire ferrule, not to exceed 2 mm (0.08 in) diameter.

All wiring connections to the 9900 are made via removable terminals.

In general:

- Terminals accept 12 to 24 AWG wire (Cond/Res Module plug accepts 16 to 28 AWG wire).
- Strip 7 mm (0.28 in.) of insulation from wire tips and tin bare ends to eliminate fraying.
- Insert wire tip or ferrule completely into the terminal and secure with the screw.
- Do not allow any AC leads that may be connected to the internal relays to come in contact with low voltage wiring.

Electrical noise may interfere with sensor signals:

- Do not route the sensor cable in conduit containing AC power wiring.
- Route the sensor cable in grounded metal conduit to help prevent electrical noise and mechanical damage.
- Seal the cable entry points to prevent moisture damage.

CAUTION:
Avoid Electrostatic Discharge (ESD)

- Minimize handling of plug-in modules to reduce the possibility of damage due to ESD.
- Handle modules by the edges. Never touch any exposed circuitry or contacts.
- Wear an anti-static wristband or stand on an anti-static mat, or keep one hand touching a properly grounded pipe or other properly grounded piece of metal when handling modules.

Flow sensor models with Frequency Output	Maximum Cable Length	
	60 m (200 ft)	305 m (1000 ft)
515	X	
525	X	
2000		X
2100		X
2507		X
2536		X
2537		X
2540		X
2551		X
2552		X

In case of noise interference, connect the cable shield to earth ground.

Maximum total cable length of the Digital (S^3L) Bus:

The quality of the cable used in the bus determines the maximum length of all branches combined. The maximum cable length may not exceed these limits, regardless of current requirements.

Cable Capacitance (pF/ft)	Max. Total Distance (ft)
< 50	900
< 30	1500
< 15	3000
Cable Capacitance (pF/m)	**Max. Total Distance (m)**
< 150	300
< 100	450
< 50	900

Signal Type: Frequency

Signet flow sensors 515, 525, 2000, 2100, 2507, 2536 and 2540 provide a frequency output. (Flow sensors 2551 and 2552 can be configured with either digital (S^3L) or Frequency outputs, see pg. 13.)

The maximum allowable cable length for sensors with frequency output is dependent upon the output signal strength of the sensors themselves, and the degree to which the signals are susceptible to EMI or "noise." This is largely a function of whether the sensors are self-powered (515 and 525), or powered by an external source.

- The Input terminals on the 9900 carry Frequency data signals from the sensor.
- Do not route sensor or output cables in conduit containing AC power wiring. Electrical noise may interfere with sensor signal.
- Routing cable in grounded metal conduit will help prevent electrical noise and mechanical damage.
- Seal cable entry points to prevent moisture damage.
- Only one wire should be inserted into a terminal. Splice double wires outside the terminal.
- In case of noise interference, ground the sensor SHIELD wire to a local earth ground at a point near the sensor.
- Consult the sensor manual for additional wiring information.

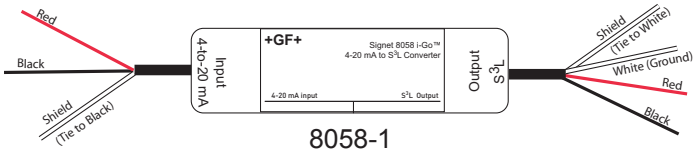
Signal Type: Digital (S^3L)

- The Input terminals on the 9900 carry digital (S^3L) serial data from the sensor.
- Do not route sensor or output cables in conduit containing AC power wiring. Electrical noise may interfere with sensor signal.
- Routing cable in grounded metal conduit will help prevent electrical noise and mechanical damage.
- Seal cable entry points to prevent moisture damage.
- Only one wire should be inserted into a terminal. Splice double wires outside the terminal.
- The TOTAL cable length from I/O devices to the transmitter must not exceed 60 m (200 ft).
- In case of noise interference, ground the sensor SHIELD wire to a local earth ground at a point near the sensor.
- Consult the sensor manual for additional wiring information.
- The maximum cable length of the digital (S^3L) bus varies depending on the types of sensors connected and the size of the conductors in the cable. For best results, determine the maximum cable length for the system before routing cables.
- There are several methods that can help route the digital cables and remain within the distance limitations.

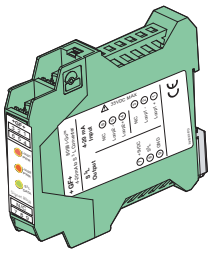
Signal Type: 4 to 20 mA

When connecting a non-Signet sensor to the 9900, the sensor's 4 to 20 mA signal must be converted to digital (S^{3}L). The 8058 i-Go Signal Converter accepts any 4 to 20 mA signal and converts it into digital (S^{3}L).

1. Wire the 8058 between the 4 to 20 mA loop source and the 9900 digital (S^{3}L) input terminals (see pg. 14). **NOTE:** If connecting 8058-2, use Channel 1 ONLY.
2. In the 9900 INPUT TYPE menu (see System Setup Menu discussion), specify 4 to 20 mA INPUT.
3. Set additional labels and abbreviations as described on pgs. 41-42.



8058-1



8058-2

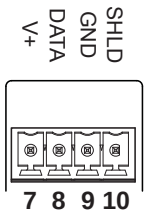
For the 8058-2, connect Channel 1 ONLY

Terminal Identification

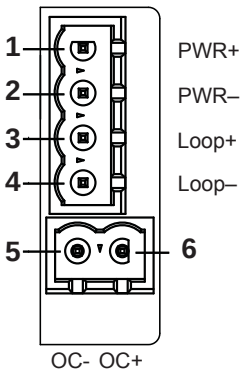
The 9900 requires regulated 12 to 32 VDC ±10% (24 VDC nominal) from an external power supply. Maximum current draw is 250 mA.

- **Terminals 1-2: DC Power**
  Required by the instrument
  - 12 to 32 VDC ± 10% input power to sensors, relays and the LCD backlight
- **Terminals 3-4: Loop Power (may also be used for system power)**
  12 to 24 VDC ±10%
  - Autoswitches to loop power if DC power is lost.
    NOTE: Backlight, LEDs and optional Relay Module do not operate on loop power. Any connected sensors or sensor electronics that cannot operate on loop power will also be inoperative.
- **Terminals 5-6: Open Collector**
  - Software selectable for Normally Open or Normally Closed.
  - May be disabled (Off) if not used.
- **Terminals 7-10: Digital (S^{3}L)/Frequency Input**
  7: V+: +5 VDC out to sensor (black wire)
  8: DATA: Input signal from sensor (red wire)
  9: GND: Sensor ground (white wire)
  10: SHLD: Cable shield

Digital (S^{3}L)/Freq



Power

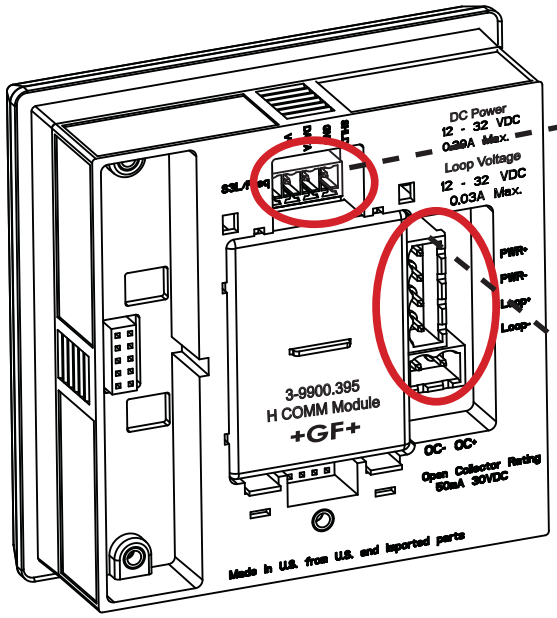


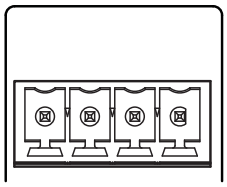
Sensor model	Freq Output	Digital (S^3L) Output	Run on Loop Power
515	X		X
525	X		X
2000	X		
2100	X		
2250		X	X
2350		X	X
2450		X	X
2507	X		
2536	X		X
2537-5		X	
2540	X		X
2551	X	X	
2552	X	X	
2724-2726		X	
2750		X	
2756-2757		X	
2764-2767		X	
2774-2777		X	
2819-2823		X	
2839-2842		X	
2850		X	
4150/8058		X	

Technical Notes:

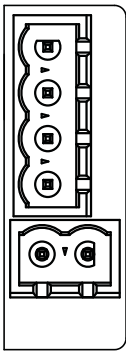
- See corresponding product manuals for maximum cable length.
- Maintain cable shield through cable splice.
- Route sensor cable away from AC power lines.
- 515 and 525 installations, connect the silver (shield) wire to earth ground in case of EMI noise interference.
- 515 and 525 installations can be made intrinsically safe by installing two intrinsic safety barriers (part number 6400-9001 for the 515 or 6402-9001 for the 525, two per sensor.

Sensor Wiring





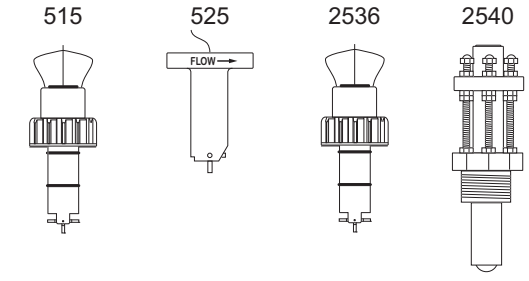
Connect sensor wires here as shown in the following figures.



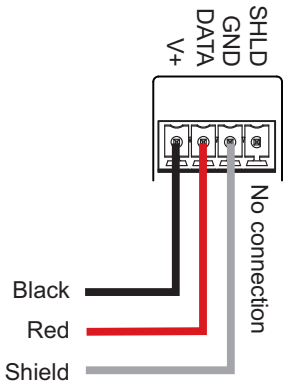
Connect power and open collector wires here as shown on pages 15 and 16.

NOTE: Loop Power cannot be used to power Signet models 2000, 2100, 2507, 2537, 2551 or 2552 Flow sensors.

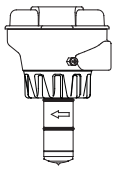
Wiring for:



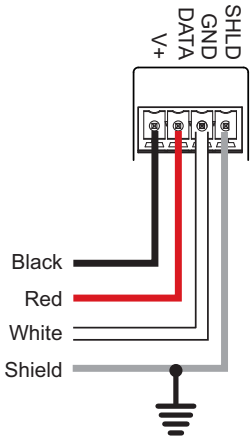
Frequency

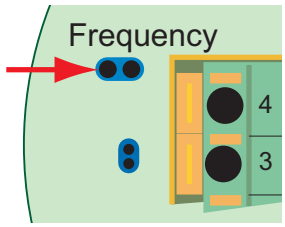


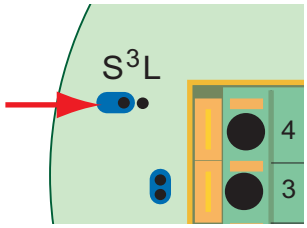
Wiring for:



2551-XX-11
Blind Magmeter





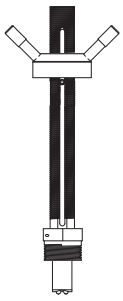


Input Wiring for 2551 and 2552 sensors
- Either Frequency or Digital (S^3L) may be used.
- Signet recommends configuring these sensors with the digital (S^3L) output.
- Input type is selected by choosing between “SENSOR FREQ” and "SENSOR S3L" in the FLOW sensor type INPUT menu (see page 31).
- Loop Power cannot be used to power these sensors.

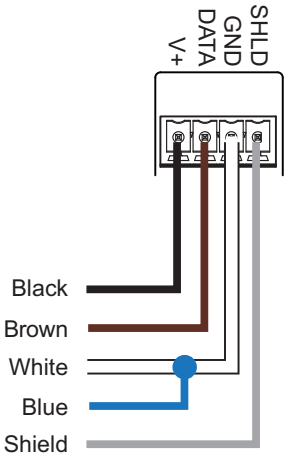
Technical Notes:
- When the blue jumper illustrated here is placed over both pins, the 2551-XX-11 (Blind Magmeter) outputs an open collector frequency signal. When the jumper is removed (or placed over one pin for storage) the 2551-XX-11 outputs a digital (S^3L) signal (recommended).
- The frequency output will be displayed as positive flow regardless of the flow direction. **Signet recommends configuring the 2551 with the digital (S^3L) output because it is more accurate and will also display reverse flow (negative numbers).**
- 5 VDC power is provided to the 2551 Magmeter by the 9900. No additional power is required.
- Connect the silver (shield) wire to earth ground in case of EMI noise interference.

Wiring for:

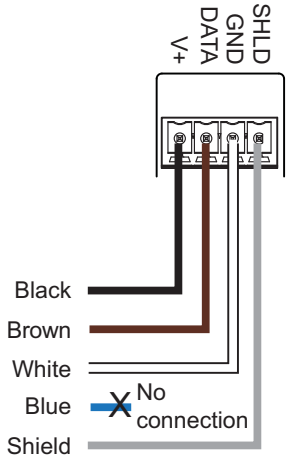
2552



S^3L



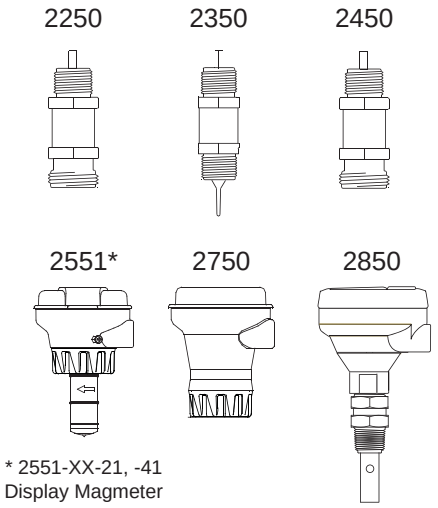
Frequency

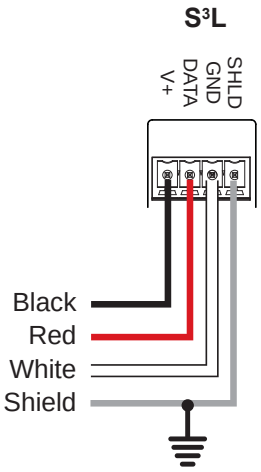


Technical Notes:
- The 2552 outputs an open collector frequency signal that can be connected to the 9900. **Signet recommends configuring the 2552 with the digital (S^3L) output because it is more accurate and will also display reverse flow (negative numbers).**
- DC power is provided to the 2552 Magmeter by the 9900. No additional power is required.
- Connect the silver (shield) wire to earth ground in case of EMI noise interference.

Technical Notes:
- Use 3-conductor shielded cable for sensor cable splices up to 300 m (1000 ft) max.
- Maintain cable shield through cable splice.
- Route sensor cable away from AC power lines.
- Connect the silver (shield) wire to earth ground in case of EMI noise interference.
- To work correctly with the 9900, the 2850 must be set for a 1.0 cell constant (the actual probe cell constant is set in the 9900).

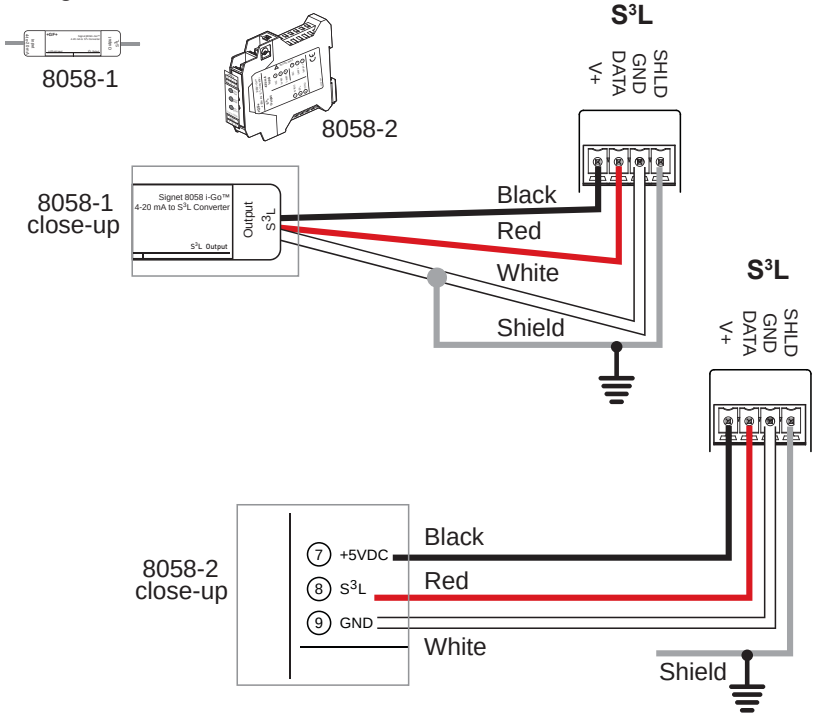
Wiring for:





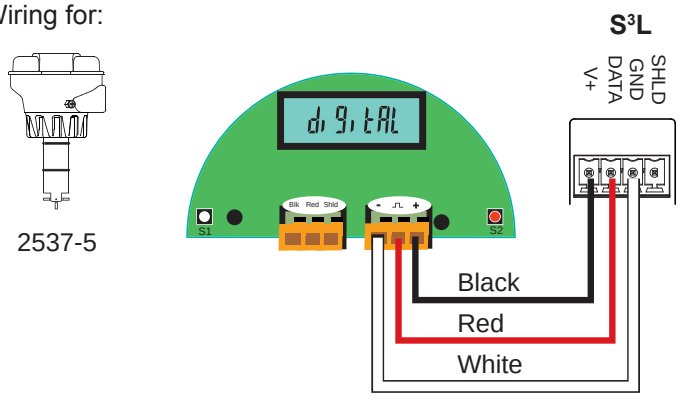
Technical Notes:
- The cable length from the 8058 to the 9900 must not exceed 60 m (200 ft).
- When using the 8058-2, connect ONLY channel 1 to the 9900.
- See the 8058 manual for more information.

Wiring for:



Technical Notes:
- Wiring terminals on the 2537 are rated for 16 to 22 AWG conductors.
- The cable must be 7 to 10 mm in diameter (0.275 to 0.394 in.) to seal properly in the liquid tight connector.
- The conduit ports have ½ inch NPT threads. After routing the cables, seal the port with a liquid tight conduit connector (3-9000.392-1) or with conduit.
- The 2537 models can connect to the 9900 via a relay frequency signal or with a digital (S³L) output. **Signet recommends installing the digital (S³L) output model (2537-5) because digital (S³L) is more accurate.**
- See 2537 instruction manual for additional installation information.

Wiring for:



Power Wiring

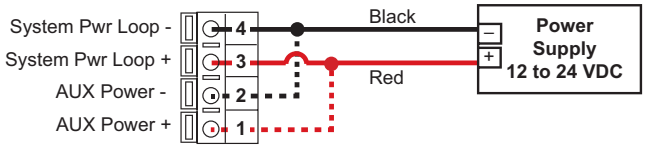
CAUTION!

DO NOT connect your 9900 to AC power.
The 9900 MUST be powered by 12 to 32 VDC ONLY.

Stand-alone application, no current loop used

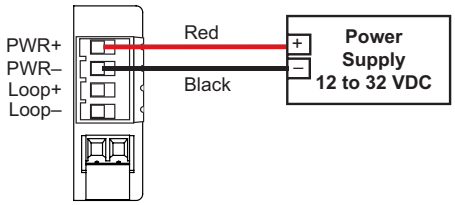
ProcessPro
(for reference only)

Transmitter Terminals



9900

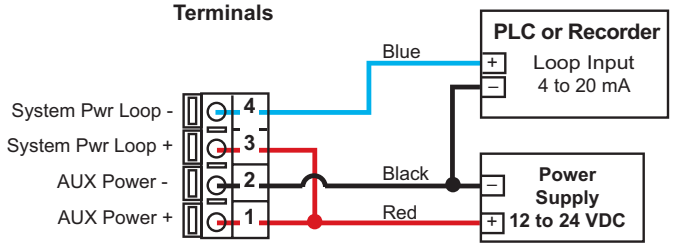
9900 Terminals



Connection to a PLC/Recorder, separate supply

ProcessPro
(for reference only)

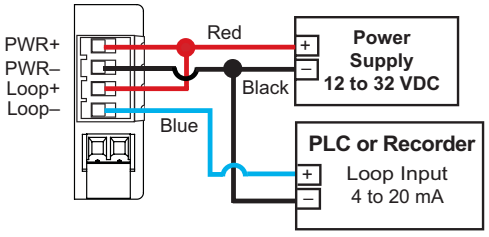
Transmitter Terminals



AUX power required for all 8750-2 systems

9900

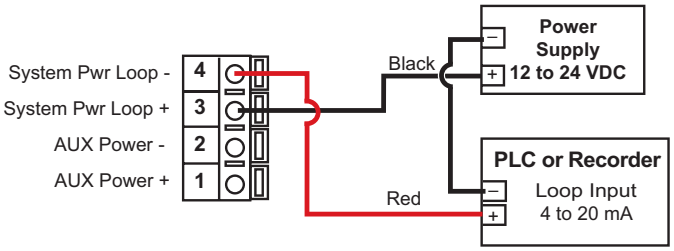
9900 Terminals



Loop Powered

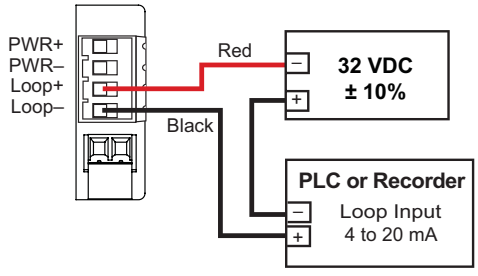
ProcessPro
(for reference only)

Transmitter Terminals



9900

9900 Terminals

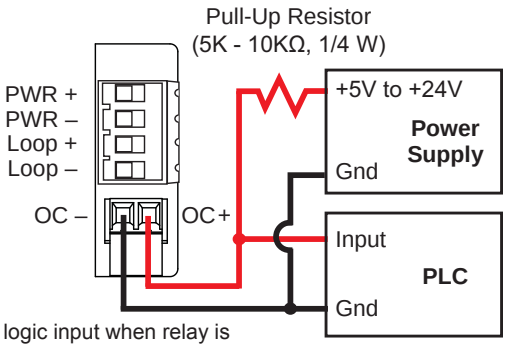


NOTE: Loop Power cannot be used to power certain Signet sensors. See table on pg. 12.

Relay and Open Collector Wiring

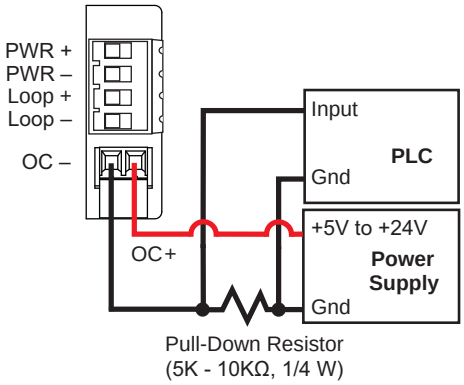
Open Collector wiring

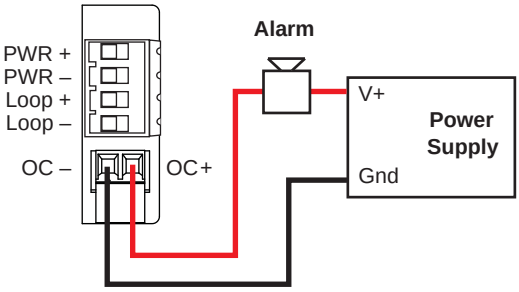
NPN Style Wiring



If PLC needs 0 logic input when relay is not energized, set NORMAL to CLOSED in the RELAY menu when using the Open Collector (R1) with NPN style wiring,

PNP Style Wiring





with NORMAL set to OPEN.

The 9900 Open Collector (R1) output provides high-speed switching capability. Signal frequencies can reach 400 pulses per minute.

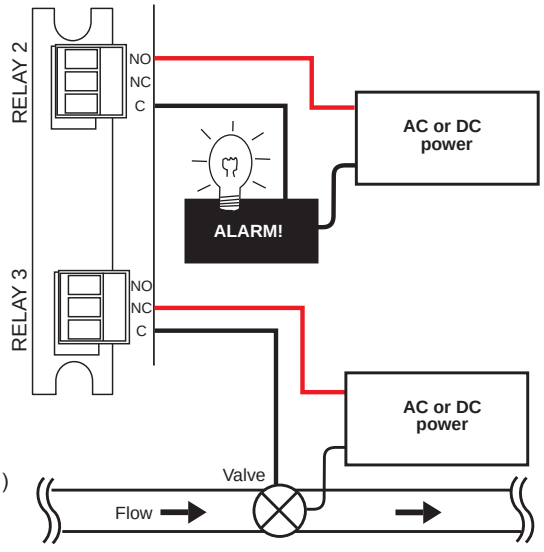
The 9900 Open Collector (R1) output connection is dependent upon the type of circuit being controlled by the output.

Most indicating instruments or control system inputs require a signal voltage of 0 to 5 V (TTL or CMOS logic levels) or 0 to 24 V. Therefore, the 9900 Open Collector output circuits must be equipped with a pull-up or pull-down resistor (not supplied), and a quality regulated 5 to 24 V (depending on the application) power supply (not supplied) is recommended to function properly.

Relay Module wiring

The alarm is OFF during normal operation, and will go ON when relay energizes according to 9900 Relay settings.

The valve is ON during normal operation, and will go OFF when relay energizes according to 9900 Relay settings.



NO = normally open (closes when energized)
NC = normally closed (opens when energized)

Relay and Open Collector Outputs

RELAY HIGH and LOW Settings
Depending on the desired function of the circuit attached to the Open Collector (R1) output, it may be necessary to have the Open Collector turned “on” or “off” when the criteria for the activation of this output are met.

If the 9900 is set to operate in RELAY LOW mode, when the user-defined condition for the activation is met (e.g. exceeding an alarm limit) the Open Collector switch is turned “on.” If wired as standard “NPN-style” output (see previous page) the logic level of the attached control system or PLC input consequently becomes “low” logic level (when NORMAL is set to OPEN).

If a high input logic level is required for activation, it can be accomplished in one of three ways.
In order of preference,

1. Change the Open Collector (Relay 1) output function to “high” in the instrument's RELAY menu, or
2. Wire the Open Collector (R1) output “PNP” style as described on the previous page, or
3. Set the Open Collector (R1) to NORMAL CLOSED in the RELAY menu.

Fail-Safe Behavior
No matter the setting, the Open Collector output turns off if the 9900 loses power. This must be taken into account when evaluating system failure consequences. If the system layout requires a “closed” or “on” condition for the output in case of power loss, a mechanical dry-contact relay (NC contacts) must be used instead of the Open Collector (R1) output.

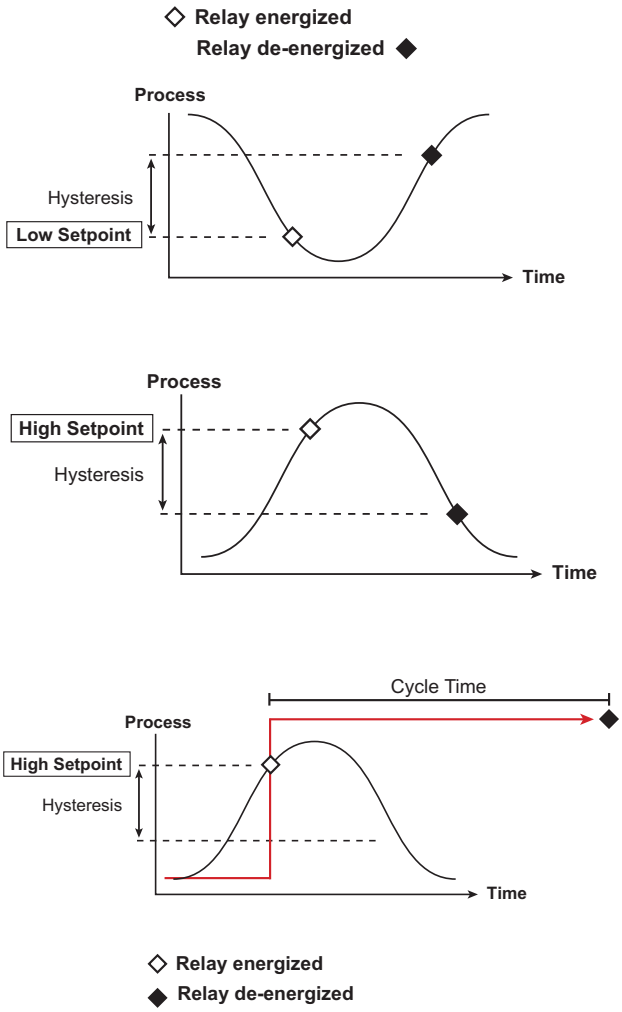
Voltage and Current Limitation
The supply voltage in the Open Collector output circuit MUST be limited to the specified maximum Open Collector voltage (see operating manual for specific instrument). The use of a quality 5 to 24 V (depending on the application) regulated power supply (not supplied) is recommended.

The current through the Open Collector switch also must be limited. Typical Open Collector outputs allow only for 10 to 50 mA switch current. Exceeding this current limit can burn out the Open Collector output components immediately.

Load and Pull-Up/Down Resistor Considerations
By utilizing basic arithmetic and Ohm’s law, the safe limits of load resistance can be determined. When the Open Collector switch is closed, almost the entire supply voltage is applied to the load, (e.g., the pull-up or pull-down resistor, the alarm horn input, a potential power relay coil or annunciator lamp). The resulting current through the load and through the Open Collector switch, as well, can be calculated as:

(Current) = (Supply Voltage) / (Load Resistance).

The 9900 open collector and relays are selectable and configurable and can be used as switches that respond when the process value moves above or below a user-defined setpoint or it can be used to generate a pulse at a rate proportional to the process value. They can be used for Low Alarm, High Alarm or Proportional Pulse triggering related to the process value. All relay functions are set up in the RELAY menus.



Open Collector Output

- Longer life than a mechanical relay
- No moving parts
- Faster ON/OFF switching capabilities than mechanical relays
- Can switch DC voltage only (< 30 VDC)
- Not recommended for use with inductive loads.

◇ **Low Setpoint:**
Relay is on when the measured value is less than the setpoint.

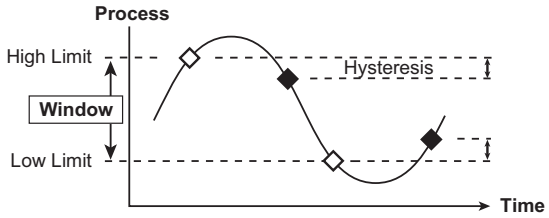
◇ **High Setpoint:**
Relay is on when the measured value is higher than the setpoint.

⌐¬ **Cycle High/Low:**
The relay can stay energized for a set length of time after the process value goes above (or below) the setpoint. The relay will stay on for the CYCLE TIME and then turn off, even if the process value is still above (or below) the setpoint. The cycle will not repeat until the process value goes below (or above) the setpoint minus the hysteresis after the relay times out.

In FLOW, Cycle High activates the relay each time the volume reaches the SET VOLUME setpoint (see page 27).

NOTE: To reset the timer (or volume in Flow): in the RELAY menu, select TEST RELAY function. The timer will reset to 0 if the condition no longer exists when the TEST is performed. The timer will restart if the condition still exists.

◆ **Window In/Out:**
Relay is on when the value is higher or lower than the high and low setpoint.
WINDow IN = relay on if measurement is inside the window of two setpoints minus the hysteresis.
WINDow OUT = relay on if measurement is outside the window of two setpoints minus the hysteresis.

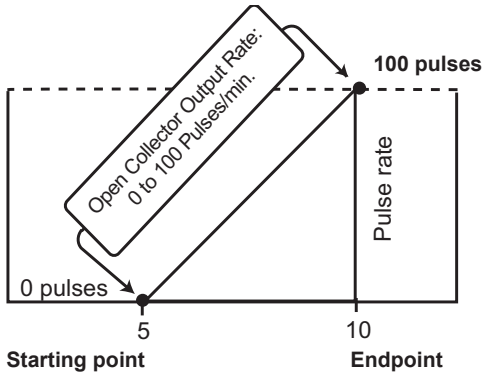


Window IN example

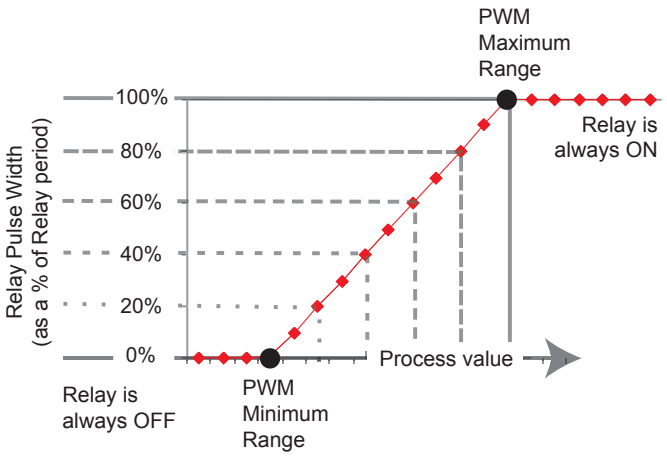
⎍⎍ **Proportional Pulse Operation:**
The transmitter can output a pulse at the rate defined by the settings in the CAL menu and the sensor input. The maximum pulse output from the relays is 400 pulses per minute. Example usage would be to control solenoid-operated dosing pumps.

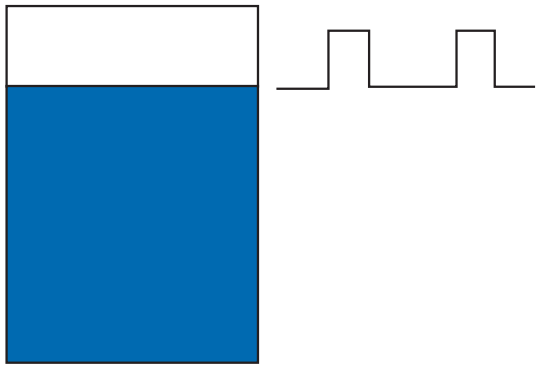
For example: As the process value drops below the setpoint, the output will start pulsing in relation to the process value, the maximum pulse endpoint and the programmed pulses/minute. The pulse rate will change as the process value changes and approaches the programmed endpoint. This functionality can be used to precisely control the process.

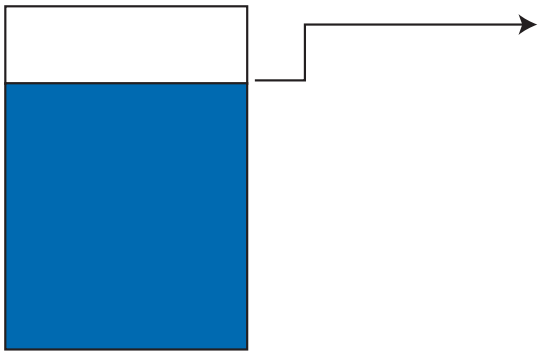
The starting point, endpoint and maximum pulse rate are selectable in the RELAY menus.



In the example:
- The output will be 0 pulses/min. when value is less than 5.
- The output will be 50 pulses/min. when value is 7.5.
- The output will be 100 pulses/min. when value is greater than 10.







- **Pulse Width Modulation**

PWM automatically varies the ratio of ON time to OFF time proportional to minimum and maximum range settings.

The relay period is the sum of the time a relay is ON and the time it is OFF.

Relay pulse width is the time the relay is ON.

The 9900 must be programmed with the relay period, and with the low and high setpoints.

NOTE: The PWM mode is not used for Pressure applications.

Example:

- The pulse width will be 0% of the relay period (relay always OFF) when the process value is less than the minimum range.
- The pulse width will be 100% of the relay period (relay always ON) when the process value is greater than the maximum range.
- The pulse width will be 60% of the relay period when the process value is at 60% of the span between the minimum and maximum range.

- **Volumetric Pulse**

A pulse is generated each time a specified volume of fluid is registered. For flow inputs only.

- **Totalizer Volume**

Relay activates and latches when a specified volume of fluid is registered. For Flow inputs only.

Total Volume mode counts the TOTALIZER Units until the setpoint volume is reached, then turns on the relay until the resettable totalizer is reset.

If the Resettable Totalizer reading is greater than the setpoint, the relay will be turned on immediately. The relay will be off when the totalizer is reset to zero.

This mode is useful to trigger a reminder when a process is due, as for a backwash cycle or filter change.

Relay Functions

System Start-up: Step 3
Set your relay functions to your own application requirements.

Next step: System Setup (see pg. 24).

Once a setting is saved it becomes immediately active.

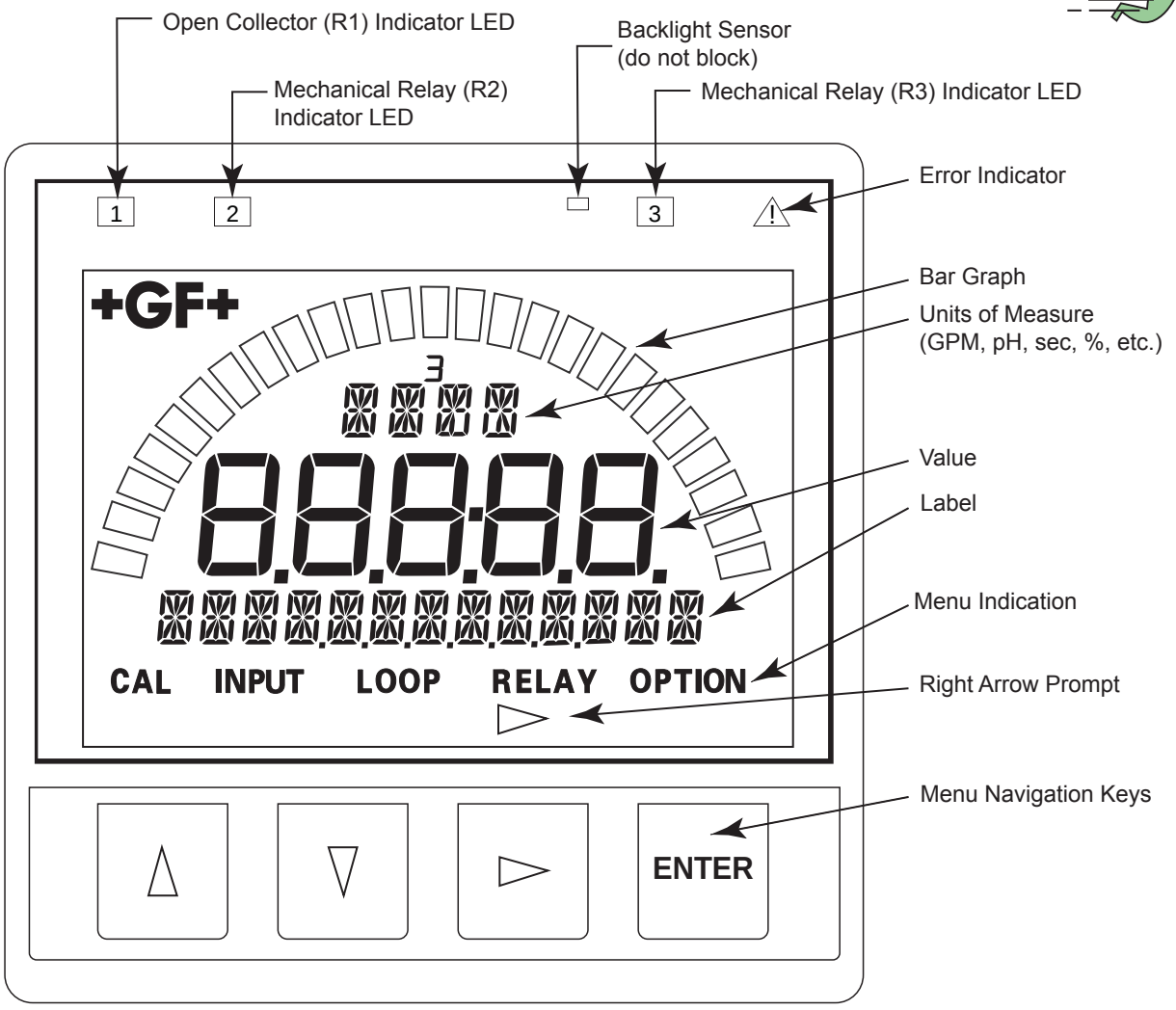
1. Go to the Relay Menu (RELAY flashing on screen, press ENTER).
2. If prompted, select desired source.
3. Press ▼ to relay **MODE** selection screen.
4. If necessary, press ► and then ▼ or ▲ to select **R1 MODE LOW**. Press ENTER to confirm.
5. Press ▼ to **R1 SET LOW**. Press ► to enter GPM value of 5.5.
6. Press ENTER to save.
7. Scroll ▼ to the **R1 HYSTERESIS** menu.
8. Press ► to edit.
9. Set the hysteresis for this relay. This affects the turn off only: **2.5 gpm**.
10. Press ENTER.
11. Scroll down ▼ to the **R1 ON DELAY** menu.
12. Press ► to edit.
13. Set the turn-on delay in seconds for the relay: **15.0**.
14. Press ENTER.
15. Exit to View Mode (▲▼) (▲▼)

- Relay function can be tested in the RELAY menu.

Example: Set a relay R1 to turn on at a low setpoint of 5.5 gpm with a time delay of 15 seconds and turn off at 8.0 gpm.

Remember, SET LOW + hysteresis = OFF point:
5.5 + 2.5 = 8.0

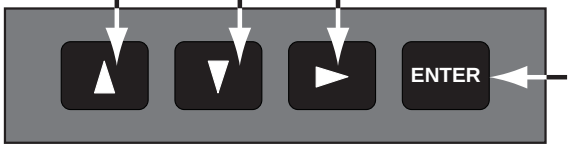
Operation



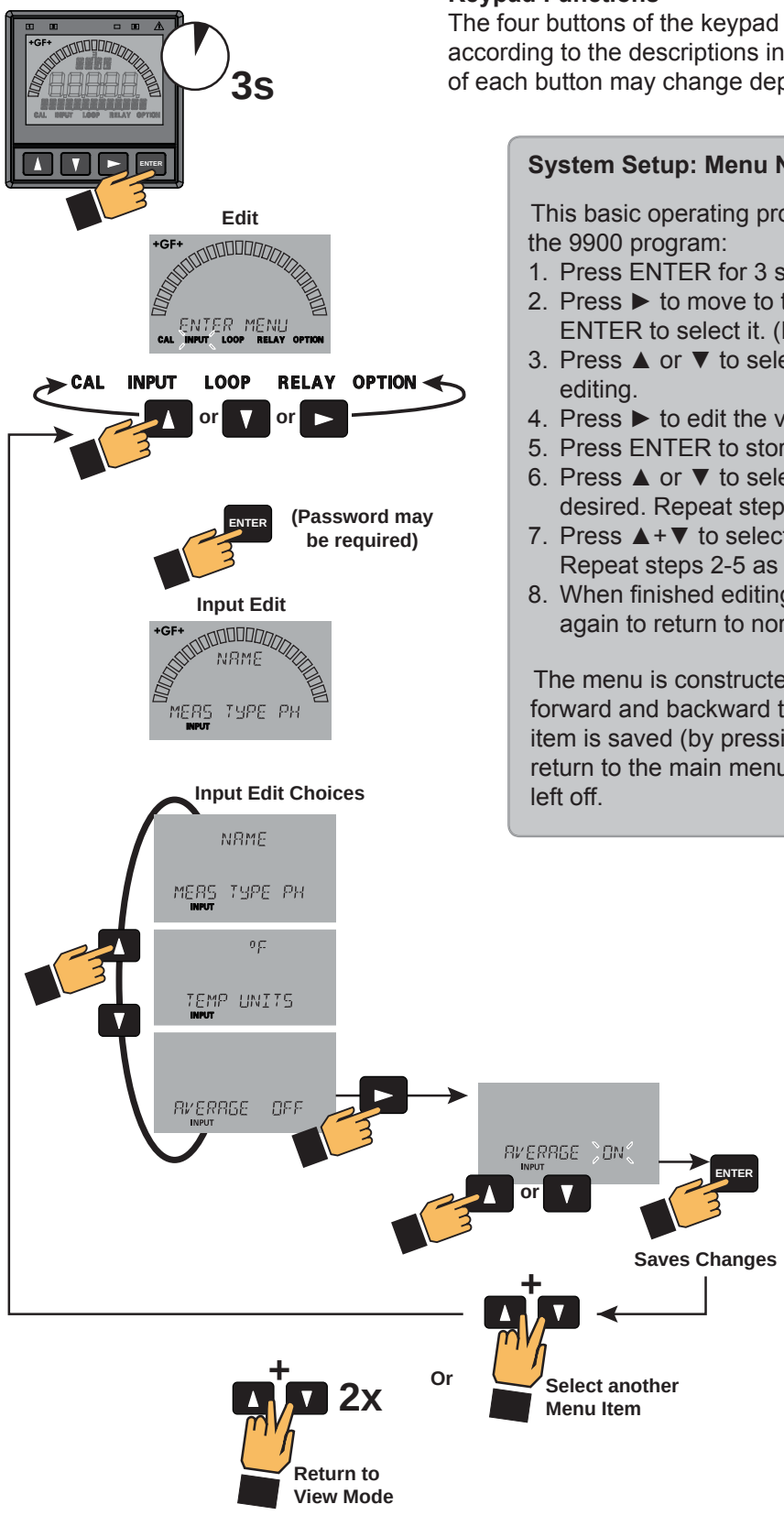
All possible segments shown in this illustration. The instrument's software controls which segments are shown at any particular time. Only the bar graph and +GF+ logo are visible when the unit is turned off.

UP, DOWN keys
Scroll through Menu options or adjust values during editing
Press both together to exit a menu or escape without saving

RIGHT key
Select item or character to edit



ENTER key
Access menus
Save changes



Keypad Functions

The four buttons of the keypad are used to navigate display modes according to the descriptions in this table. Notice that the function of each button may change depending on the display mode.

System Setup: Menu Navigation

This basic operating procedure repeats throughout the 9900 program:

1. Press ENTER for 3 seconds to enter MENU mode.
2. Press ► to move to the desired menu then press ENTER to select it. (Password may be required.)
3. Press ▲ or ▼ to select the desired menu item for editing.
4. Press ► to edit the value/selection.
5. Press ENTER to store the new value/selection.
6. Press ▲ or ▼ to select another menu item if desired. Repeat steps 3-5 as required.
7. Press ▲+▼ to select a different menu to edit. Repeat steps 2-5 as required.
8. When finished editing all menus, press ▲+▼ again to return to normal operation.

The menu is constructed in a loop, so you can move forward and backward to select an item. After any item is saved (by pressing ENTER), the display will return to the main menu in the same location where it left off.

Menu System

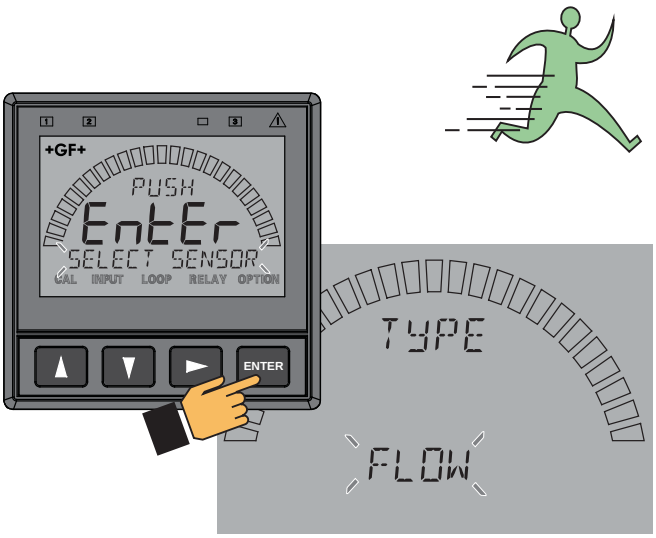
System Setup Menu

All of the basic system setup functions are automated in the 9900 for many sensors and sensor electronics. This includes identifying the sensor connected to the 9900, and configuring the display for the sensor. After installation and wiring is completed, proceed to the section in this manual discussing the sensor parameters.

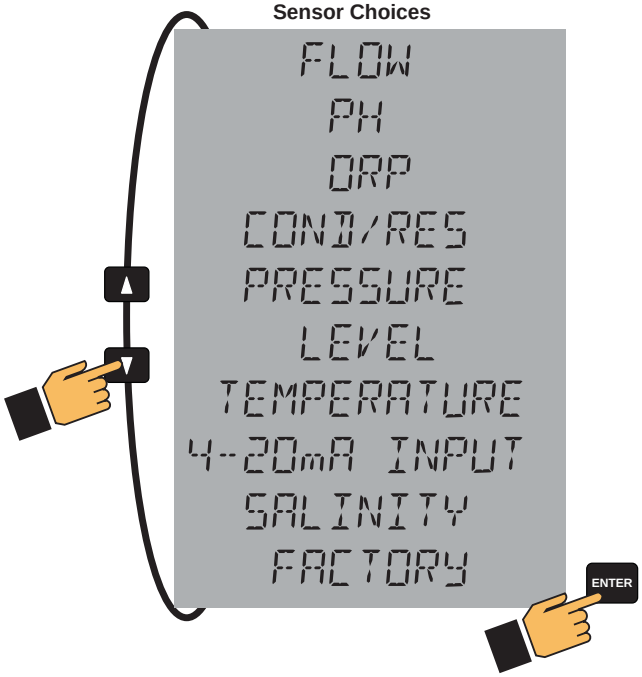
When the 9900 is first powered on, it will attempt to determine the sensor type connected when ENTER is pressed (display will display LOOKING FOR). If no sensor is attached to the 9900, the words “TYPE” and “FLOW” are displayed. When a sensor is attached, the 9900 will attempt to determine the instrument type. If the 9900 does not identify your sensor type, use the ▲ and▼ keys to scroll through the available sensor types.

As you scroll through the available sensor types, press ► to select the desired sensor and then press ENTER.

You may change sensor type after initial power-on (if the sensor type is changed after your 9900 is already in service). Enter the INPUT menu, scroll to TYPE, press ►, and scroll to select the desired sensor type (you may be prompted for your password). Press ENTER. The bottom line will display ALL SETTINGS WILL BE RESET. ARE YOU SURE? The top line of the display will blink NO (unless switching from Factory mode). Press ▼ or ▲ to select YES. Press ENTER again to finalize your selection. **NOTE:** User is **strongly** discouraged from changing the sensor type away from the correct sensor.



Sensor Choices



VIEW Mode Overview

The top level of menus is referred to as the **VIEW Mode**. This view displays measurement values as well as current outputs and relay status. The radial bar graph represents the measurement value that is also displayed in the 7-segment numeric field below the bar graph. The bar graph is primarily used to display the full scale range of the sensor, but can be scaled via a menu item.

During normal operation, the 9900 displays the VIEW mode.

- To select a display, press the ▲ or ▼ arrow keys. The display selections scroll in a continuous loop.
- Changing the display selection does not interrupt system operations.
- No password is necessary to change display selection.
- Output settings cannot be edited from the View Mode.
- The display will return to the VIEW mode if no button is pressed for 10 minutes.

MENU Mode Overview

The MENU mode enables the user to view and configure all menu items. The five menus available are: **CAL**, **INPUT**, **LOOP**, **RELAY**, and **OPTION**.

MENU Mode is entered by pressing and holding ENTER for three seconds.

The ► button is used to change the position of the blinking cursor. When the desired menu is blinking, press ENTER.

In the selected menu, use the ▲ and ▼ keys to navigate through the menu. Use the ▲, ▼ and ► keys to edit the selected item (see Menu System discussion, pg. 24).

To save the new selection, press the **ENTER** key. A message displaying "Saving…" will be displayed for 3 seconds. After this message is displayed, the newly selected value will be displayed, if applicable.

Password Overview

The password is often required to start editing. Once entered correctly, this password will not be needed for subsequent edits. However, once the menu system is exited, the password will be again be required when edit mode is re-entered.

Your choice of password (STD or CODE) is selected in the Options Mode.

- **STD**
  The standard (STD) password is ▲▲▲▼, pressed in sequence. This password is designed to protect the 9900 from unintentional changes. It is best suited for systems where a group of people need to be able to change settings.
- **CODE**
  The CODE default setting is 0000, adjustable to any 4-digit numerical code up to 9999. Using a personal code provides the maximum degree of security. This code can be modified in the Options mode.

Error Handling

Errors occurring while in the VIEW Mode show a specific message (e.g., CHECK SENSOR). This message is displayed every 10 seconds and stays on for 5 seconds. Once the error is resolved or cleared, the error message stops.

Scrolling

In some cases, more than one message or measurement may need to be displayed. This is accomplished by alternating the message portions across the screen.

In the MENU mode, if the wrong code or password is entered, an ERROR message is displayed.

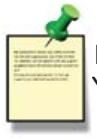
To change the password, go to OPTIONS mode, enter your desired code and press ENTER. (The STD password cannot be changed.)

Common Menus

System Start-up: Step 4
Customize your 9900 to your own installed sensors.

Common Menus

The menu system shares certain modes between sensor types. The following describes the EDIT Mode menus found in common between most sensor types.



NOTE: Menu and Mode displays shown are examples only. Your displays may vary.

LOOP Menu

	(COND/RES only) Select LIN/LOG. Default = LIN. See LOG Current Loop Output discussion in Appendix.
	(ALL) Set value corresponding to desired 4 mA output. 5 digits max. Default = 0 (ORP = -999).
	(ALL) Set value corresponding to desired 20 mA output. 5 digits max. (Not shown in COND/RES LOG Mode.) Defaults = 100 (Flow, Cond/Res, Temp), 14 (pH), 1000 (ORP), 10 (Lvl/Prs), 5 (4 to 20 mA), 80 (Sal).
	(ALL) Set desired Loop output value when sensor error (e.g., bad sensor, broken wire) is detected. Select (3.6 mA, 22 mA). Default = 22.
	(ALL) Allows fine-tuning to compensate for errors in other equipment connected to the 9900. Adjust the minimum and maximum current output. The display value represents the precise current output. Adjustment limits: from 3.80 mA minimum to 5.00 mA maximum. Default = 4.00 mA.
	(ALL) Allows fine-tuning to compensate for errors in other equipment connected to the 9900. Adjust the minimum and maximum current output. The display value represents the precise current output. Adjustment limits: from 19.00 mA minimum to 21.00 mA maximum. Default = 20 mA.
	(ALL) Press ▲ or ▼ to manually order any output current value from 3.6 mA to 21.00 mA to test the output loop.

RELAY Menu

	(pH, LEVEL/VOL, COND/RES and SALINITY only.) Select source for each of R1, R2 and R3 outputs. Choose pH/TEMP, LEVEL/VOLUME, COND/RES or SAL/TEMP. Defaults = pH, COND, LEVEL, SAL.
	(ALL) Set Open Collector (R1) as Normally Open or Normally Closed. Default = OPEN.
	(ALL) Select the desired mode of operation for the open-collector (R1) output (OFF, LOW, HIGH, WINDow IN, WINDow OUT, CYC LOW (except FLOW), CYC HIGH, PROP PuLSe, VOL PuLSe, PWM, TOTAL, USP, ERROR mode (See chart on pg. 28). Default = OFF. Continue stepping through to select R2 and R3 output modes. When MODE is set to ERROR, delays energizing relay until after ON DELAY time expires if sensor problem is detected. See Cycle High/Low discussion on pg. 18.
	(ALL) Relay turns on if process measurement goes lower than this value. Set desired value. (Shown if LOW, WIND IN/OUT or CYC LOW mode.) **NOTE:** The corresponding indicator lights do not light up in PROP PLS and PWM modes. The LEDs light up only when the Test Relay options are selected.
	(ALL) Relay turns on if process measurement goes higher than this value. Set desired value. (Shown if HIGH or WIND IN/OUT mode.) **NOTE:** The corresponding indicator lights do not light up in PROP PLS and PWM modes. The LEDs light only when the Test Relay options are selected.
	(FLOW only) Amount of accumulated flow that must be counted before a pulse is sent out. Relay turns on if flow volume exceeds this value. Set desired value. (Shown if CYC HIGH or VOL PLS mode.) Default = 100.00.
	(ALL) Hysteresis prevents the system from chattering around the set point. Set amount (in units of measure from INPUT Mode) to add to SET LOW or SET HIGH values. (Shown if LOW, HIGH, WIND IN/OUT, CYC LOW/HIGH or USP mode)
	(COND/RES only) Relay turns on if USP value drifts by this value away from USP limit. (Shown only in USP mode) See USP Limits discussion in the Appendix.
	(ALL) Set seconds (up to 9999.9) to wait before activating relay. (Shown if Low, High, WIND IN/OUT, CYC LOW/HIGH or Error mode.)
	(ALL except PRESSURE) Set minimum setpoint value for proportional pulsing. (Shown if PROP PLS mode.)
	(ALL except PRESSURE) Set maximum setpoint value for proportional pulsing. (Shown if PROP PLS mode.)
	(ALL except PRESSURE) Set desired maximum pulse rate (400 max) (Shown if PROP PLS mode.) **NOTE:** Pulse width fixed at 100 ms.
	(ALL except PRESSURE and FLOW) Set minimum value for pulse width modulation. (Shown if PWM mode)
	(ALL except PRESSURE and FLOW) Set maximum value for pulse width modulation. (Shown if PWM mode.)

NOTE: Defaults for most relay functions are dependent upon sensor type and are not listed here.

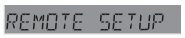
RELAY Menu - Cont.

	(ALL) Set time in seconds (up to 99999) for relay to remain on. See discussion on pg. 18. (Shown if CYC LOW/HIGH mode.)
	(FLOW only) Amount of accumulated flow that must be counted before a pulse is sent out. Set value. (Shown only if VOL PULS.)
	(FLOW only) Set time value for one pulse width. (Shown only if VOL PULS.)
	(ALL except PRESSURE and FLOW) Set time value for one complete pulse cycle (relay ON time + relay OFF time). (Shown if PWM mode)
	(FLOW only) Resettable value that, when exceeded, turns relay on. Must reset Totalizer (in VIEW Mode) to clear relay. Set maximum value. (Shown only if TOTAL.)
	(ALL) Press ▲ or ▼ to turn relay on or off for testing purposes.

Available Relay Modes by Sensor Type

	Flow	pH	ORP	Cond/Res	Pressure	Lvl/Vol	Temp	4 to 20 mA	Salinity
Off	X	X	X	X	X	X	X	X	X
Low	X	X	X	X	X	X	X	X	X
High	X	X	X	X	X	X	X	X	X
Wind In	X	X	X	X	X	X	X	X	X
Wind Out	X	X	X	X	X	X	X	X	X
Cyc Low		X	X	X	X	X	X	X	X
Cyc High	X	X	X	X	X	X	X	X	X
Prop Pulse	X	X	X	X		X	X	X	X
Vol Pulse	X								
PWM		X	X	X		X	X	X	X
Total	X								
USP				X					
Error	X	X	X	X	X	X	X	X	X

OPTION Menu

	Adjust the LCD contrast for best viewing. A setting of 1 is lowest contrast, 5 is highest. In general, select lower contrast if the display is in warmer ambient light surroundings. Default = 3.
	Select backlight level (OFF, LOW, HIGH, AUTO). Default = AUTO. (**NOTE:** No backlight when operating on loop power.)
	Enter 5 digit value to represent bar at minimum. Default = 0 (ORP = -999).
	Enter 5 digit value to represent bar at maximum. Defaults = 100 (Flow, Cond/Res, Temp), 14 (pH), 1000 (ORP), 10 (Lvl/Prs), 5 (4 to 20 mA), 80 (Sal)
	(ALL) Set the decimal to the best resolution for your application. The display will automatically scale up to this resolution. Select -----., ----.-, ---.-- or --.---. Default = ----.-.
	(FLOW only) Set the decimal to the best resolution for the Permanent Totalizer display. The display will automatically scale up to this resolution. Select -----., ----.-, ---.-- or --.---. Default = ----.-.
	(COND/RES only) Displays mS or µS as set in COND UNITS in INPUT Mode. Set ON/OFF. Default = OFF.
	(FLOW only) Locks the TOTALIZER output. Select OFF, ON (Does not affect Permanent Totalizer). Default = OFF.
	(ALL) Select STD, CODE. Default = STD.
	(ALL) Enter desired password code. 4-character entry not displayed, ---- displayed instead. (Shown if type = CODE.)
	(ALL) Enter 13-character string, if desired. Default = GFSIGNET_COM.
	Enables Remote Setup to configure the 9900 via a computer and the PC COMM tool. Press ► and select YES to enable. REMOTE SETUP flashes when mode is enabled. **NOTE:** Communication with PC COMM tool is automatic when 9900 is in FACTORY state (EntEr flashing). Refer to the PC COMM Configuration/Diagnostic Tool manual, 3-0251.090, included with your PC COMM tool.

Sensor-Specific Menus

The following pages list the sensor-specific settings for each sensor type.

Flow

This is the normal display and does not time out.

FLOW Setup Checklist

1. Make sure FLOW sensor type is selected (see System Setup Menu, pg. 24).
2. Set the Units of Measure.
3. Set Sensor Type (Freq or S^3L).
4. If Loop is used, set the minimum and maximum 4 to 20 mA setpoints.
5. Set K-Factor (pulses per Unit Volume) from Flow Sensor manual.
6. Set Totalizer factor.
7. Set Last Cal Date and initials.
8. If desired, set up relay functions for your own application.

VIEW Mode Menu

01234567	Display the flow rate and the resettable totalizer. Press ► to reset the totalizer. (If Reset is locked, enter the password first.) Lock or Unlock the totalizer in the OPTIONS menu. This is the resettable totalizer View display.
P 01234567	Display the Permanent Totalizer value (note the "P" indicating Permanent). Pressing ► displays units of measure.
LOOP 7.20 mA	Displays the 4 to 20 mA Loop output.
RLYS 1 2 3 OFF OFF OFF	Bottom line shows one of three states (OFF, ON, PLS) for each of the three relays. Displays remaining time for CYC LOW or CYC HIGH mode. The relay(s) will remain ON while counting down. **NOTE:** To reset the timer: In the RELAY menu, select TEST RELAY function. The timer will reset to 0 if the condition no longer exists when the TEST is performed. The timer will restart if the condition still exists.

CAL Menu

NO HOLD OUTPUTS	Prevents relays from activating while making adjustments. Relays in Pulse mode will suspend pulsing while HOLD OUTPUTS is set to YES. Select YES/NO. Default = NO.
KF 60.0000	Set K-Factor (pulses per unit volume) from Flow Sensor manual. Min: 0.0001, max 999999. Cannot be zero. Default = 60.0000.
TF 1.000	Sets the volume of each count of the Totalizer as a multiple of the volume unit of the K-Factor. Min: 0.0001, max 999999. Cannot be zero. Default = 1.0000.
RATE CAL	Select to calibrate using Rate method (see Appendix).
VOLUME CAL	Select to calibrate using Volume method (see Appendix).
LAST CAL MM-DD-YYYY II	Enter date of calibration (mm-dd-yyyy) and initials of calibrator (ii).

INPUT Menu

	If desired, a custom name can be entered. Enter 13-character string. Default = FLOW.
	If your flow sensor is configured for frequency output, select FREQ. If configured for digital (S^3L) output (recommended), select S3L. Default = FREQ.
	Set the units of measure. The last character sets the timebase: S (seconds) M (minutes) H (hours) D (days). Default = GPM.
	Identifies the Totalizer units. It has no effect on any calculation. Default = GALLONS.
	Dampens display, output and relay response rates. Select Low (4 sec), Med (8 sec), High (32 sec), OFF (near instantaneous). (See discussion in Appendix.) Default = OFF.
	Acts as a threshold for flow measurement response. A lower sensitivity setting gives a fast measurement response, a higher setting gives a slower response. Value expressed in units of measurement; response dependent on units of measurement being exceeded. (See discussion in Appendix.) Default = 100.

pH

This is the normal display and does not time out.

pH Setup Checklist

1. Make sure pH sensor type is selected (see System Setup Menu, pg. 24).
2. Set the Temperature Units (°C or °F).
3. If Loop is used, set the minimum and maximum 4 to 20 mA setpoints.
4. Perform calibration (EasyCal, Standard or Standard and Slope).
5. Set Last Cal Date and initials.
6. Select source for Open Collector and Relay output (pH or Temp).
7. If desired, set up relay functions for your own application.

VIEW Mode Menu

TEMP ------°C	Displays temperature at the sensor.
RAW ----- mV	Displays the millivolt input from the electrode. Use this display to determine the relative condition of your electrode during periodic calibration. (7 pH buffer = 0 mV, ± 50 mV)
LOOP 450 mA	Displays the 4 to 20 mA Loop output.
EASY CAL ->	Press ► to start the EasyCal process. You will be prompted to enter your password. (See pH EasyCal procedure in the Appendix).
RLYS 1 2 3 OFF OFF OFF	Bottom line shows one of three states (OFF, ON, PLS) for each of the three relays. Displays remaining time for CYC LOW or CYC HIGH mode. The relay(s) will remain ON while counting down. **NOTE:** To reset the timer: In the RELAY menu, select TEST RELAY function. The timer will reset to 0 if the condition no longer exists when the TEST is performed. The timer will restart if the condition still exists.

INPUT Menu

NAME MEAS TYPE PH	Enter string up to 13 characters (optional). Default = MEAS TYPE PH.
°C TEMP UNITS	Select °F or °C. Default = °C.
AVERAGE OFF	Dampens display, output and relay response rates. Select Low (4 sec), Med (8 sec), High (32 sec), OFF (near instantaneous) (see discussion in Appendix). Default = OFF. **NOTE:** Signet strongly recommends leaving averaging OFF for pH and Pressure measurements (see discussion in Appendix).

CAL Menu

CAL AT INSTRUMENT	Select AT SENSOR to perform calibration using the Signet 2750 sensor electronics. Select AT INSTRUMENT to perform calibration at the 9900 via EasyCal or manual calibration. (See pH Calibration procedures in the Appendix.) Default = AT INSTRUMENT.
NO HOLD OUTPUTS	Prevents relays from activating while making adjustments. Relays in Pulse mode will suspend pulsing while HOLD OUTPUTS is set to YES. Default = NO.
SET PH STANDARD	Applies a linear offset to the pH measurement. The ideal value is the average pH of your application. (A sample of your application at process temperature is recommended.) (See pH Calibration procedures in the Appendix.) Shows error message if offset too high.
SET PH SLOPE	Applies a slope to the pH measurement. The slope value and the standard value must be at least 2 pH units apart. The ideal values are the minimum and maximum values of your process. (See pH Calibration procedures in the Appendix.) Shows error message if slope is too low or high.
SET TEMPERATURE	Applies a linear offset to the temperature measurement. The ideal value is the average temperature of your application. "SAVING" will appear if offset is acceptable, "ERR TOO LARGE TO CALIBRATE" if offset is outside of range.
RESET PH CAL	Press ► to reset pH Calibration to factory default.
RESET TEMPCAL	Press ► to reset temperature calibration to factory default.
LAST CAL MM-DD-YYYY II	Enter date of calibration (mm-dd-yyyy) and initials of calibrator (ii).

NOTE: if CAL AT SENSOR is selected, the only windows shown will be CAL, HOLD OUTPUTS, and LAST CAL DATE.

ORP

This is the normal display and does not time out.

ORP Setup Checklist

1. Make sure ORP sensor type is selected (see System Setup Menu, pg. 24).
2. If Loop is used, set the minimum and maximum 4 to 20 mA setpoints.
3. Set Averaging.
4. Perform calibration or set Standard (and Slope if desired).
5. Set Last Cal Date and initials.
6. If desired, set up relay functions for your own application.

VIEW Mode Menu

RAW ------ mV	Displays the millivolt input from the electrode. Use this display to determine the relative condition of your electrode during periodic calibration.
LOOP 4.50 mA	Displays the 4 to 20 mA Loop output
EASY CAL -)	Press ► to start the EasyCal process. You will be prompted to enter your password. (See ORP EasyCal procedure in the Appendix).
RLYS 1 2 3 OFF OFF OFF	Bottom line shows one of three states (OFF, ON, PLS) for each of the three relays. Displays remaining time for CYC LOW or CYC HIGH mode. The relay(s) will remain ON while counting down. **NOTE:** To reset the timer: In the RELAY menu, select TEST RELAY function. The timer will reset to 0 if the condition no longer exists when the TEST is performed. The timer will restart if the condition still exists.

CAL Menu

CAL AT INSTRUMENT	Select AT SENSOR to perform calibration using the Signet 2750 sensor electronics. Select AT INSTRUMENT to perform calibration at the 9900 via EasyCal or manual calibration. (See ORP Calibration procedures in the Appendix.). Default = AT INSTRUMENT.
NO HOLD OUTPUTS	Prevents relays from activating while making adjustments. Relays in Pulse mode will suspend pulsing while HOLD OUTPUTS is set to YES. Default = NO.
SET ORP STANDARD	Applies a linear offset to the ORP measurement. For single point calibrations, assign the average value of your process to ORP STANDARD. For two-point calibrations, assign the min or max value of your process to ORP STANDARD. (See ORP Calibration procedures in the Appendix.).
SET ORP SLOPE	Applies a slope to the ORP measurement. The ORP SLOPE is used for two-point calibration along with the ORP STANDARD. If you applied the min value of your process to the ORP STANDARD, then apply the max value to the ORP SLOPE. Else, apply the min value to the ORP SLOPE. The slope value and the standard value must be at least 30 mV apart. (See pH Calibration procedures in the Appendix.)
RESET ORP CAL	Resets calibration to factory settings. After pressing ►, select YES/NO. (Shown if CAL AT INSTR)
LAST CAL MM-DD-YYYY II	Enter date of calibration (mm-dd-yyyy) and initials of calibrator (ii).

INPUT Menu

NAME ORP	Enter string up to 13 characters (optional). Default = ORP.
AVERAGE OFF	Dampens display, output and relay response rates. Select Low (4 sec), Med (8 sec), High (32 sec), OFF (near instantaneous). Default = OFF. (See discussion in Appendix.)

Conductivity/Resistivity

This is the normal display and does not time out.

Cond/Res Setup Checklist

1. Make sure COND/RES sensor type is selected (see System Setup Menu, pg. 24).
2. Set Cell Constant.
3. Set the Temperature Units (°C or °F).
4. Set Conductivity units.
5. If Loop is used, set the minimum and maximum 4 to 20 mA setpoints.
6. Set Temperature Compensation.
7. Set Last Cal Date and initials.
8. Select source for Open Collector and Relay output (primary measurement or temperature).
9. If desired, setup relay functions for your own application.

VIEW Mode Menu

TEMP ----- °C	Same as above with temperature, does not time out.
LOOP 450 mA	Displays the 4 to 20 mA Loop output.
RLYS 1 2 3 OFF OFF OFF	Bottom line shows one of three states (OFF, ON, PLS) for each of the three relays. Displays remaining time for CYC LOW or CYC HIGH mode. The relay(s) will remain ON while counting down. **NOTE:** To reset the timer: In the RELAY menu, select TEST RELAY function. The timer will reset to 0 if the condition no longer exists when the TEST is performed. The timer will restart if the condition still exists.

CAL Menu

NO HOLD OUTPUTS	Freezes measurement value; loop value continues normally. Relays in Pulse mode will suspend pulsing while HOLD OUTPUTS is set to YES. Select (No/Yes). Default = NO.
AUTO CAL	Shows real-time value and selected standard. “PLACE SENSOR IN STANDARD”. Unit waits until reading is stable; if bad cal, returns “ERROR, CANNOT DETERMINE STANDARD”. Refer to buffer values and AUTO CAL Procedure in the Appendix.
MANUAL CAL	Shows “CONDUCTIVITY” on bottom line; when user presses any button the live value is frozen and the user edits that value. If bad cal, returns “ERR TOO LARGE TO CALIBRATE”. See Manual Cal procedure in Appendix.
SET TEMPERATURE	Shows “TEMPERATURE” on bottom line; when user presses any button the live value is frozen and the user edits that value. If bad cal, returns “ERR TOO LARGE TO CALIBRATE”.
RESET CONDCAL	Resets Conductivity calibration. After pressing ►, select YES/NO.
RESET TEMPCAL	Resets Temperature calibration. After pressing ►, select YES/NO.
LAST CAL MM-DD-YYYY II	Enter date of calibration (mm-dd-yyyy) and initials of calibrator (II).

INPUT Menu

	Enter string up to 13 characters (optional). Default = COND/RES.
	Enter cell constant of sensor. Select 20.0, 10.0, 1.0, 0.1, 0.01, or CUSTOM. Default = 1.0.
	Enter the precise cell constant from the certificate provided with your sensor, or from the information label on the sensor. Shown if CELL CONSTANT = CUSTOM.
	Select °C, °F. Default = °C.
	Select µS, mS, PPM, PPB, KOhm, or MOhm. Default = µS.
	If the COND UNITS selection is PPM or PPB, set the ratio of Total Dissolved Solids to µS. Default = 0.50.
	Dampens display, output and relay response rates. Select Low (4 sec), Med (8 sec), High (32 sec), or OFF (near instantaneous). (See discussion in Appendix.) Default = “OFF”.
	Select temperature compensation (NONE, LINEAR, PURE H2O). Default = LINEAR.
	For LINEAR or PURE H2O temperature compensation, select a % per ºC slope. Maximum slope setting is 9.99 % per ºC. Default = 2.0. (If Temperature Compensation setting is NONE, this item will not be displayed.)

Factory-Set Span:

0.01 cell (2819, 2839) ..... 0 to 100 µS
0.10 cell (2820, 2840) ..... 0 to 1000 µS
1.0 cell (2821, 2841) ..... 0 to 10,000 µS
10.0 cell (2822, 2842) ..... 0 to 200,000 µS
20.0 cell (2823) ..... 0 to 400,000 µS

Pressure

This is the normal display and does not time out.

PRESSURE Setup Checklist

1. Make sure PRESSURE sensor type is selected (see System Setup Menu, pg. 24).
2. If Loop is used, set the minimum and maximum 4 to 20 mA setpoints.
3. Set Units of Measurement (PSI, BAR, KPa).
4. Set Last Cal Date and initials.
5. If desired, set up relay functions for your own application.

VIEW Mode Menu

LOOP 3.60 mA	Displays the 4 to 20 mA Loop output
RLYS 1 2 3 OFF OFF OFF	Bottom line shows one of three states (OFF, ON, PLS) for each of the three relays. Displays remaining time for CYC LOW or CYC HIGH mode. The relay(s) will remain ON while counting down. **NOTE:** To reset the timer: In the RELAY menu, select TEST RELAY function. The timer will reset to 0 if the condition no longer exists when the TEST is performed. The timer will restart if the condition still exists.

CAL Menu

NO HOLD OUTPUTS	Prevents relays from activating while making adjustments. Relays in Pulse mode will suspend pulsing while HOLD OUTPUTS is set to YES.
SET ZERO	With process pressure at zero, set zero point for measurement.
SET PRESSURE	Calibrate pressure reading to external reference. Provides a maximum 5 psi offset.
RESET CAL	Resets calibration to factory default. After pressing ►, select YES/NO.
LAST CAL MM-DD-YYYY II	Enter date of calibration (mm-dd-yyyy) and initials of calibrator (II)

INPUT Menu

NAME PRESSURE	Enter string up to 13 characters (optional). Default = PRESSURE.
PSI UNITS	Enter units of pressure measurement. Select PSI, BAR, or KPa. Default = PSI.
AVERAGE OFF	Dampens display, output and relay response rates. Select Low (4 sec), Med (8 sec), High (32 sec), OFF (near instantaneous). (See discussion in Appendix.) Signet strongly recommends leaving averaging OFF for pH and pressure measurements (see discussion in Appendix). Default = OFF.

Level/Volume

This is the normal display and does not time out.

LEVEL/VOLUME Setup Checklist

1. Make sure LEVEL/VOLUME sensor type is selected (see System Setup Menu, pg. 24).
2. Select Main Measurement (Level or Volume).
3. Set Units of Measurement for LEVEL display (FT, IN, M, CM).
4. If desired, set Units of Measurement for VOLUME display.
5. Set the minimum and maximum 4 to 20 mA setpoints.
6. Set Specific Gravity.
7. Set Sensor Offset.
8. If VOLUME is used, set Shape.
9. Set Last Cal Date and initials.
10. If desired, set up relay functions for your own application.

VIEW Mode Menu

VOL 0.0 GAL	Displays the Volume value on the bottom line of the screen when LVL is the MAIN MEAS selection in INPUT menu.
LVL 0.0 FT	Displays the Level value on the bottom line of the screen when VOL is the MAIN MEAS selection in INPUT menu.
LOOP 3.60 mA	Displays the 4 to 20 mA Loop output
RLYS 1 2 3 OFF OFF OFF	Bottom line shows one of three states (OFF, ON, PLS) for each of the three relays. Displays remaining time for CYC LOW or CYC HIGH mode. The relay(s) will remain ON while counting down. **NOTE:** To reset the timer: In the RELAY menu, select TEST RELAY function. The timer will reset to 0 if the condition no longer exists when the TEST is performed. The timer will restart if the condition still exists.

CAL Menu

NO HOLD OUTPUTS	Prevents relays from activating while making adjustments. Relays in Pulse mode will suspend pulsing while HOLD OUTPUTS is set to YES.
LEVEL CAL	Shows SET LEVEL on bottom line. When user presses any key, the live value is frozen and the user edits that value. Returns either GOOD CAL or LEVEL OFFSET TOO LARGE.
RESET CAL	Resets calibration to factory default. After pressing ►, select YES/NO.
LAST CAL MM-DD-YYYY II	Enter date of calibration (mm-dd-yyyy) and initials of calibrator (ii).

INPUT Menu

	Enter 13-character string (optional). Default = LEVEL/VOLUME.
	Select between Level or Volume. Default = LVL.
	Select unit of measure for LEVEL display (FT, IN, M, CM). Default = FT.
	Select ON = Measurement will be displayed as a percentage of full scale. OFF = Measurement will be displayed in unit of measure selected in previous setting. Default = OFF.
	If PERCENT LEVEL = ON, set the desired full scale (100%) value in units of measure. Default = 10.00.
	Select unit of measure for VOLUME display (GAL, LIT, Lb, KG, FT^3, in^3, M^3, cm^3). Default = GAL.
	Select ON = Measurement will be displayed as a percentage of full scale. OFF = Measurement will be displayed in unit of measure selected in previous setting. Default = OFF.
	If PERCENT VOLUME = ON, set the full scale value (100%) in units of measure. Default = 100.00.
	Enter the specific gravity of the fluid at normal operating temperature. This setting is required only if the level measurement is made by a pressure sensor or if kg or lb volume units are selected. Default = 1.0000 (water).
	Enter the distance from sensor location to the Zero reference point in the vessel (see discussion in Appendix). Displayed in units of measure chosen in LEVEL UNITS. Default = 0.
	Dampens display, output and relay response rates. Select Low (4 sec), Med (8 sec), High (32 sec), OFF (near instantaneous). (See discussion in Appendix.) Default = OFF.
	Select the shape of the vessel where the level sensor is located. VERT CYLINDER, HORIZ CYLINDER, RECTANGLE, or CUSTOM. (To define a custom tank shape, see Appendix, Defining a Custom Tank.) Default = VERT CYLINDER.
	If VERT CYLINDER or HORIZ CYLINDER is selected, enter the diameter of the cylinder. Displayed in units of measure chosen in LEVEL UNITS. Default = 2.0000.

Temperature

This is the normal display and does not time out.

TEMPERATURE Setup Checklist

1. Make sure TEMPERATURE sensor type is selected (see System Setup Menu, pg. 24).
2. If Loop is used, set the minimum and maximum 4 to 20 mA setpoints.
3. Set Units of Measurement (°C or °F).
4. Set Last Cal Date and initials.
5. If desired, set up relay functions for your own application.

VIEW Mode Menu

LOOP 4.50 mA	Displays the 4 to 20 mA Loop output
RLYS 1 2 3 OFF OFF OFF	Bottom line shows one of three states (OFF, ON, PLS) for each of the three relays. Displays remaining time for CYC LOW or CYC HIGH mode. The relay(s) will remain ON while counting down. **NOTE:** To reset the timer: In the RELAY menu, select TEST RELAY function. The timer will reset to 0 if the condition no longer exists when the TEST is performed. The timer will restart if the condition still exists.

CAL Menu

NO HOLD OUTPUTS	Prevents relays from activating while making adjustments. Relays in Pulse mode will suspend pulsing while HOLD OUTPUTS is set to YES. The temperature reading does not update while the 'HOLD OUTPUT' setting is set to 'ON'. The display will read "OUTPUTS HELD" and the temperature reading that is displayed is the last one that was shown prior to the 'HOLD OUTPUT' being set to 'ON'.
SET TEMPERATURE	Provides a maximum 20 °C offset to match to a known standard (external reference).
RESET CAL	Resets Temperature Calibration to factory settings. After pressing ►, select YES/NO.
LAST CAL MM-DD-YYYY II	Enter date of calibration (mm-dd-yyyy) and initials of calibrator (ii).

INPUT Menu

NAME TEMPERATURE	Enter string up to 13 characters (optional). Default = “TEMPERATURE”.
°F TEMP UNIS	Select °C or °F. Default = °C.
AVERAGE OFF	Dampens display, output and relay response rates. Select Low (4 sec), Med (8 sec), High (32 sec), OFF (near instantaneous). (See discussion in Appendix.) Default = “OFF”.

4 to 20 mA

This is the normal display and does not time out.

4 to 20 mA Setup Checklist

1. Make sure 4-20 mA INPUT sensor type is selected (see System Setup Menu, pg. 24).
2. Set 4 mA value (refer to your 3rd-party sensor manual).
3. Set 20 mA value (refer to your 3rd-party sensor manual).
4. If Loop is used, set the minimum and maximum 4 to 20 mA setpoints.
5. Set Last Cal Date and initials.
6. If desired, set up relay functions for your own application.

VIEW Mode Menu

LOOP 450 mA	Displays the 4 to 20 mA Loop output
INPUT ---.--mA	Diagnostic display showing raw input from 4 to 20 mA sensor.
RLYS 1 2 3 OFF OFF OFF	Bottom line shows one of three states (OFF, ON, PLS) for each of the three relays. Displays remaining time for CYC LOW or CYC HIGH mode. The relay(s) will remain ON while counting down. **NOTE:** To reset the timer: In the RELAY menu, select TEST RELAY function. The timer will reset to 0 if the condition no longer exists when the TEST is performed. The timer will restart if the condition still exists.

CAL Menu

NO HOLD OUTPUTS	Prevents relays from activating while making adjustments. Relays in Pulse mode will suspend pulsing while HOLD OUTPUTS is set to YES.
SET STANDARD	Applies a linear offset to the measurement. For single point calibrations, assign the average value of your process to STANDARD. For two-point calibrations, assign the min or max value of your process to STANDARD.
SET SLOPE	Applies a slope to the measurement. The SLOPE is used for two-point calibrations along with the STANDARD above. If you assigned the min value of your process to the STANDARD, then assign the max value to the SLOPE. Else, assign the min value to the SLOPE. The slope and standard values must be at least 0.1 units apart.
RESET CAL	Resets Standard and Slope calibration to factory settings. After pressing ►, select YES/NO.
LAST CAL MM-DD-YYYY II	Enter date of calibration (mm-dd-yyyy) and initials of calibrator (ii).

INPUT Menu

	Enter string up to 13 characters (optional). Default = “4-20 mA INPUT.
	Enter up to 4 characters describing unit of measure. Default = UNIT.
	Measurement value of your sensor when its output is 4.00 mA.
	Measurement value of your sensor when its output is 20.00 mA.
	Dampens display, output and relay response rates. Select Low (4 sec), Med (8 sec), High (32 sec), or OFF (near instantaneous). (See discussion in Appendix.) Default = “OFF”.

Salinity

This is the normal display and does not time out.

SALINITY Setup Checklist

1. Make sure SALINITY sensor type is selected (see System Setup Menu, pg. 24).
2. Set Cell Constant.
3. Set the Temperature Units (°C or °F).
4. If Loop is used, set the minimum and maximum 4 to 20 mA setpoints.
5. Set Last Cal Date and initials.
6. Select source for Open Collector and Relay output (primary measurement or temperature).
7. If desired, set up relay functions for your own application.

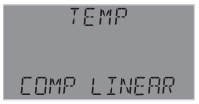
VIEW Mode Menu

TEMP 88888 °C	Displays temperature at the sensor.
LOOP 380 mA	Displays the 4 to 20 mA Loop output.
COND 88888 mS	Displays the equivalent conductivity value in milliSiemens.
RLYS 1 2 3 OFF OFF OFF	Bottom line shows one of three states (OFF, ON, PLS) for each of the three relays. Displays remaining time for CYC LOW or CYC HIGH mode. The relay(s) will remain ON while counting down. **NOTE:** To reset the timer: In the RELAY menu, select TEST RELAY function. The timer will reset to 0 if the condition no longer exists when the TEST is performed. The timer will restart if the condition still exists.

CAL Menu

NO HOLD OUTPUTS	Prevents relays from activating while making adjustments. Relays in Pulse mode will suspend pulsing while HOLD OUTPUTS is set to YES.
SET SALINITY	Manually set salinity value to match to a known standard (external reference).
SET TEMPERATURE	Provides a maximum 20 °C offset to match to a known standard (external reference).
RESET SAL CAL	Resets Salinity calibration to factory settings. After pressing ►, select YES/NO.
RESET TEMPCAL	Resets Temperature calibration to factory settings. After pressing ►, select YES/NO.
LAST CAL MM-DD-YYYY II	Enter date of calibration (mm-dd-yyyy) and initials of calibrator (II).

INPUT Menu

	Enter string up to 13 characters (optional). Default = SALINITY.
	Enter cell constant of sensor. Select 20.0, 10.0, 1.0 or CUSTOM. Default = 20.
	Enter the precise cell constant from the certificate provided with your sensor, or from the information label on the sensor. Shown if CELL CONSTANT = CUSTOM.
	Select °C or °F. Default = °C.
	Dampens display, output and relay response rates. Select Low (4 sec), Med (8 sec), High (32 sec), OFF (near instantaneous). (see discussion in Appendix.) Default = OFF.
	Select temperature compensation (NONE, LINEAR). Default = LINEAR.
	For LINEAR temperature compensation, select a % per ºC slope. Maximum slope setting is 9.99 % per ºC. (If Temperature Compensation setting is NONE, this item will not be displayed.)

Troubleshooting

Condition	Possible Causes	Suggested Solution
Wrong Sensor	Incorrect sensor installed	Connect correct sensor
	Sensor Type set incorrectly in 9900	Set correct sensor TYPE in INPUT menu (see pg. 24)
Wrong Code	Wrong password entered	Enter correct password (see pg. 25)
K-Factor Out Of Range	K-Factors cannot be set to 0	Enter K-Factor from 0.0001 to 99999
Backlight inoperative	9900 operating on loop power	Connect 9900 to 12 to 24 VDC power.
	Backlight turned OFF (**NOTE:** Backlight can turn off automatically in AUTO mode.)	Set BACKLIGHT to LOW, HIGH or AUTO in OPTION menu.
Relays 2 and 3 inoperative	9900 operating on loop power	Connect 9900 to 12 to 24 VDC power.
	Relay Module installed incorrectly	Remove and reseat relay module
	Wrong settings in RELAY menu	Use test relay to verify relay operation then check relay settings
Relay LEDs inoperative	9900 operating in Loop Power	Use DC power. Check relay states in VIEW mode for status.
Open Collector (R1) or Relay (R2 or R3) always on	Hysteresis value too large	Change the hysteresis value
	Defective Relay Module	Replace Relay Module
OVR relay state (Pulse Overrun)	Relay pulse rate exceeds maximum of 400 pulses per minute	Increase volume pulse setting
		Reduce system flow rate
	Pulse width set too wide	Decrease pulse width
	(**NOTE:** Max pulse rate = 400; max pulse width = 100 mS.	
– – – – –	Flow rate exceeds display capability	Increase Flow units time base
		Change unit of measure
Check Sensor	9900 cannot "talk" to sensor	Check wiring
		Replace sensor
	(pH/ORP, Cond/Res, Sal) Missing sensor or bad temperature element	Install or replace sensor
Check Preamp	9900 cannot "talk" to the preamp	Check wiring or replace preamp
Warning LED lit	Look for error message	Correct error condition

Averaging

NO AVERAGING, NO SENSITIVITY

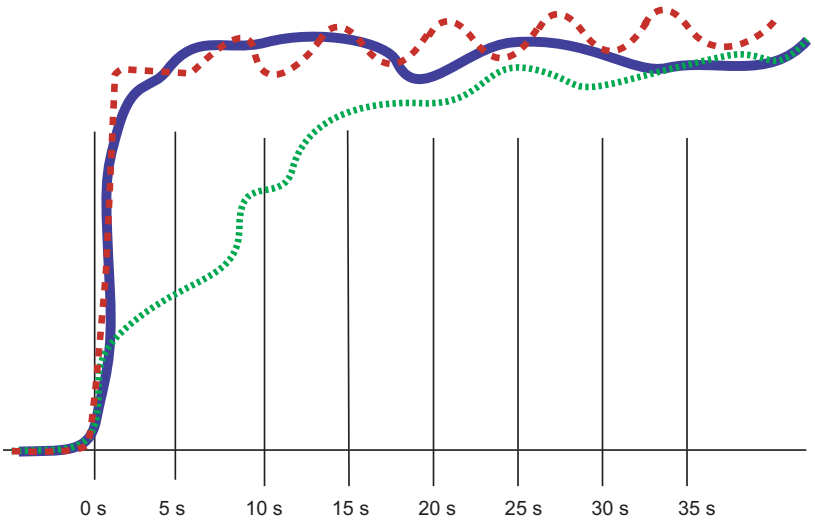
With SENSITIVITY set to 0 (zero) and AVERAGING set to OFF (0 seconds), the 9900 responds immediately to every shift in the process. The dashed red line represents the actual output of the sensor in varying conditions.

AVERAGING ONLY

With SENSITIVITY still set to zero and AVERAGING set to MED or HIGH the rate is stabilized, but a sharp change in rate is not represented for 8 to 32 seconds or longer.

AVERAGING AND SENSITIVITY

With SENSITIVITY at 50 and AVERAGING set to MED or HIGH, the rate is stabilized, while the sudden shift in process is reflected very quickly. **NOTE:** The SENSITIVITY function has no effect if the AVERAGING function is set to OFF.



LOG Current Loop Output

In Conductivity/Resistivity, the logarithmic (LOG) mode can be used when a very large measurement range is required, yet high resolution is needed at the low end, e.g., in a clean-in-place application where a high-resolution conductivity reading is needed at the low end while a very high conductivity reading is needed when a cleaning cycle is in progress.

Only two parameters need to be set up, the starting or base conductivity value (4 mA SETPNT) and the ending or maximum conductivity value (20 mA SETPNT). The 4 mA setpoint may be larger than the 20 mA point (reverse span).

What equation should be put in the PLC?

Conductivity = 10^{n}

[n = (mA value – 4.0) × ((Log_{10}(ending value) – Log_{10}(starting value) / 16 mA) + Log_{10}(starting value))]

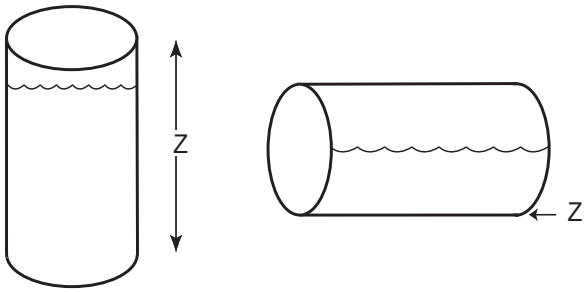
If only fixed thresholds are of interest, they can be calculated in mA and then the mA value can be checked directly. Inside the 9900 the following equation is used:

mA = [(Log_{10}(conductivity) – Log_{10}(starting value)) × 16 / Log_{10}(ending value) – Log_{10}(starting value)] + 4

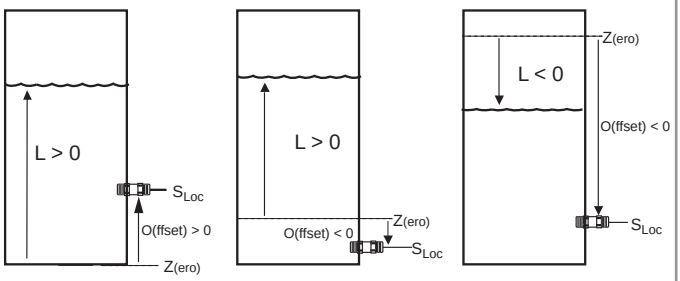
Notes: If ADJUST 4 mA or ADJUST 20 mA is used, the mA value can be affected. To prevent any problems the adjust function should only be used to get exactly 4.0 and 20.0 at the PLC. The 9900 is accurate and the adjust functions are only needed to compensate for an offset due to noise or a not-so-accurate PLC input card.

The error value of either 3.6 mA or 22 mA should be tested first before applying the conductivity equation.

Custom Measurements



For most vessels, the zero reference point (Z) may be designated as any height in the vessel.



Defining a Custom Tank

1. Determine where the level measurement should start. This is the zero reference point (Z). Review the diagram to help select the best option.
2. Determine where you will mount the sensor. This is S_{Loc}. Consult the Sensor manual for information regarding the best location for the sensor.
3. Measure the distance between Z and S_{Loc}. This is O(ffset).
4. Enter the Offset into the INPUT Mode menu.

Zero reference point (Z):
The point in the vessel where you want the 9900 to display zero (0 ft., 0 gal. etc.).

- If Z is located below the fluid surface, the 9900 will display a positive level measurement.
- If Z is located above the fluid surface, the 9900 will display a negative level measurement.

Sensor Location point (S_{Loc}):
The point on the level sensor where the measurement is taken.

- The pressure sensor measures from the centerline of the diaphragm.

Offset (O):
The distance from the zero reference point (Z) to the sensor location point (S_{Loc}).

- Enter a positive value in the Calibrate menu if the sensor is located above Z.
- Enter a negative value in the Calibrate menu if the sensor is located below Z.
- Enter 0 in the Calibrate menu if the sensor is located at Z.

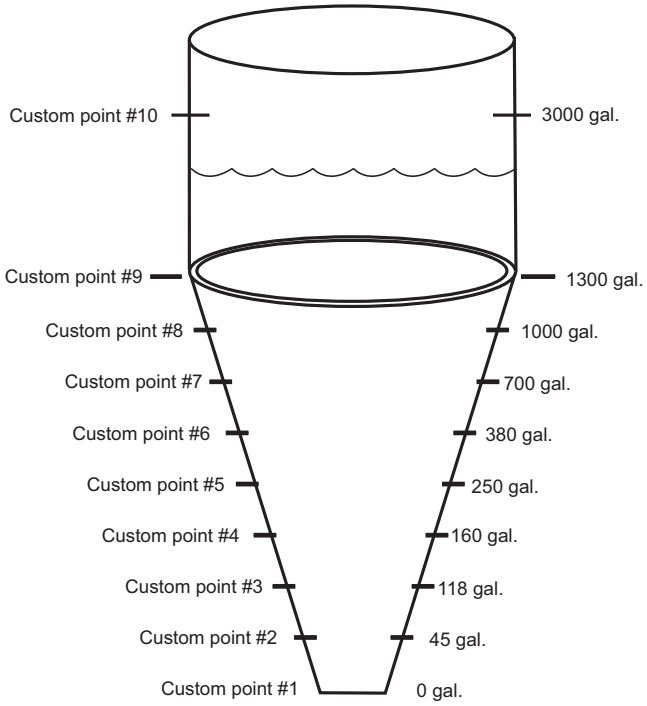
Level (L):
The distance from zero reference point (Z) to surface of fluid (displayed as “Level” by 9900.)

Level and Volume Calculation in Custom Shaped Vessels

In the LEVEL/VOLUME menu, if Custom Shape is selected in the INPUT menu, you can define from two to ten Custom Points to establish the relationship of level to volume in the vessel.

- Select Manual Level Measurement mode to edit both level and volume data (dry configuration).
- Select Automatic Level Measurement mode to accept the sensor measurement of the Level, while you assign a volumetric value to each custom point (wet configuration).
- Enter from 3 to 10 custom points to link level and volume values.
- The first custom point must be the lowest fluid level in the vessel. Each successive point must be greater than the preceding point.
- The last point must be equal to or greater than the highest fluid level in the vessel.
- A custom point should be located at all transition points in the vessel shape (for example, at custom point #9, where the shape changes from a cylinder to a cone).
- The more complex sections should be defined with more points. Note that the conical section of the illustration has been defined by custom points 1 through 9.
- Simpler sections require fewer defining points. Note that a cylinder requires only custom points 9 and 10.

Procedures for programming your 9900 for a custom tank shape are found on page 50.



In the LEVEL/VOLUME INPUT menu (see page 39), if SHAPE is set to HORIZ CYLINDER, RECTANGLE or CUSTOM, the tank shape can be defined with the following screens:

TANK LENGTH	If Horiz Cylinder or Rectangle shape is selected, enter the length of the vessel in LEVEL UNITS. 0.0000 to 99999.
TANK WIDTH	If Rectangle shape is selected, enter the width of the vessel in LEVEL UNITS. 0.0000 to 99999.
NUM CUST PNTS	If Custom shape is selected, enter the number of measurement points to be used to define the vessel shape (see Level and Volume Calculation in Custom Shaped Vessels discussion). Minimum 3 points, maximum 10 points. A larger number of points improves accuracy.
Auto LEVEL MEAS	Select (AUTO, MAN). Manual allows you to edit both the Level and the corresponding Volume for your custom tank. Automatic allows you to edit the Volume measurement (while displaying an automatically calculated Level value). See example below.
POINT 1 LEVEL	Enter the Level (if MAN measurement is selected) at each custom point in your vessel. If AUTO is selected, indication will read actual tank level in LEVEL UNITS at that point in your tank.
POINT 1 VOL	Set the Volume (if manual measurement is selected) at each custom point in your vessel.
POINT X LEVEL	Where (X) is number of custom points
POINT X VOL	Where (X) is number of custom points

To set AUTO LEVEL MEAS value:

1. Pour a known quantity of fluid into a tank.
2. POINT 1 LEVEL indicates actual tank level.
3. Press ▼ for POINT 1 VOL. Press ► to enter quantity of fluid (in VOLUME UNITS) you poured into the tank in step 1. Press ENTER.
4. Repeat for each point set in NUM CUST PNTS.

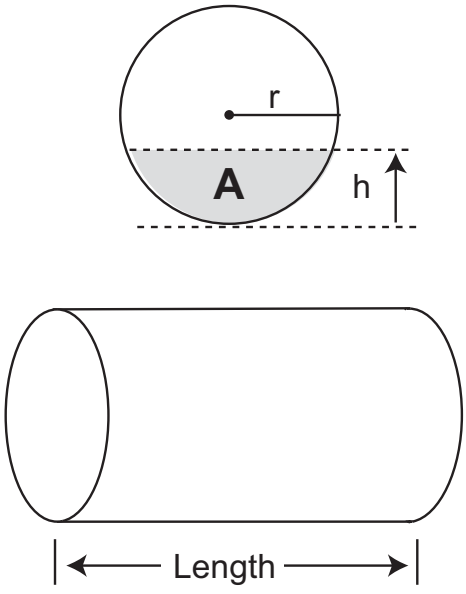
For example, in a 25-gallon conical tank set for three custom points:

1. Pour 10 gallons of fluid into the conical tank. POINT 1 LEVEL will indicate actual tank level.
2. In POINT 1 VOL, enter 10.
3. Pour another 10 gallons into the tank. POINT 2 LEVEL will indicate actual tank level.
4. In POINT 2 VOL, enter 10.
5. Pour the final 5 gallons into the tank. POINT 3 LEVEL will indicate actual tank level.
6. In POINT 3 VOL, enter 5.

Technical Reference for Level, Volume, and Mass Measurement

The 9900 can automatically perform level, volume and mass calculations:

- Pressure-to-level
- Mass
- Volume



Pressure to level conversion:

$$Level = P \div (SG \times D_{(water)})$$

where P = Pressure
SG = Specific Gravity of fluid
$D_{(water)}$ = Density of water

With pressure in psi:
Level (meters) = 0.703069 × (P/SG)
With pressure in bar:
Level (meters) = 1.019715 × (P/SG)

Mass Conversion

$$m = D_{(water)} \times SG \times V$$

where m = mass of fluid
$D_{(water)}$ = density of water = 1000 kg/m^3
SG = Specific Gravity of fluid
V = Volume of fluid (m^3)

m (kg) = 1000 × SG × V

Volume Calculations

Vertical cylinder:

$$V = \pi \times r^2 \times h$$

where r = radius of cylinder
h = height of fluid

Rectangular vessel:

$$V = w \times l \times h$$

where w = width
l = length
h = height

Horizontal cylinder:

$$V = L \times [(r^2 \times \cos^{-1}(r\text{-}h/r)) - \text{sqrt}(2rh - h^2) \times (r\text{-}h)] \times A$$

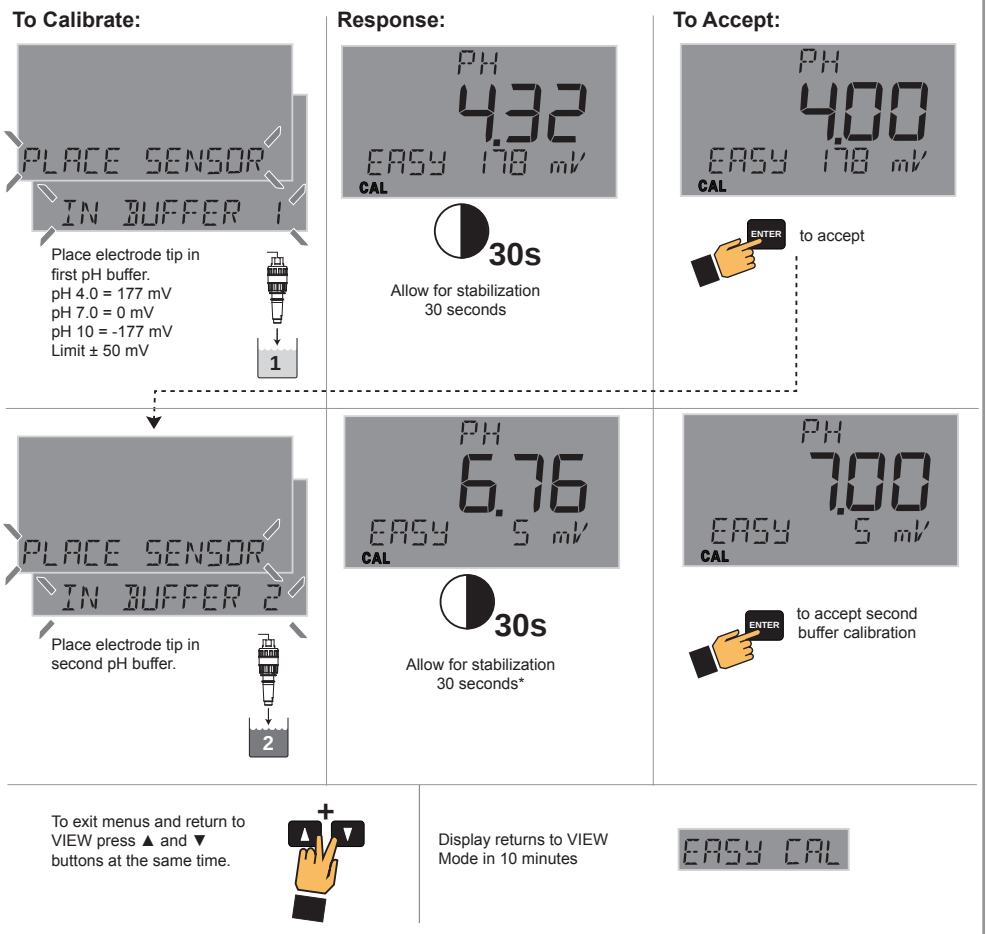
where A = area of segment
L = Length of vessel
r = radius of vessel
h = height of segment

Calibration Procedures

EasyCal Procedure - pH

EasyCal is the fastest and simplest periodic calibration method. Requires prepared 4, 7 or 10 pH buffers (any two).

- This procedure simplifies pH calibration using standard 4.0, 7.0, 10.0 pH buffers only. If these pH buffers are not available, use MANUAL CAL and calibrate the system using the STANDARD and SLOPE settings.
- Set sensor temperature in the CAL Mode before performing EasyCal for new electrode installations.



Theoretical mV values

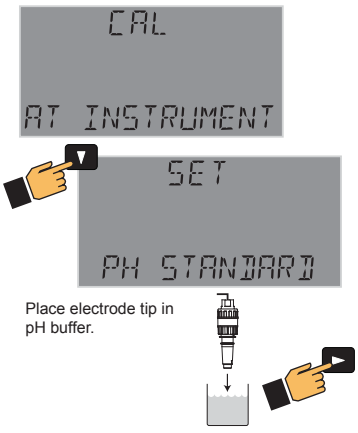
pH @ 25 °C	mV
2	+296
3	+237
4	+177
5	+118
6	+59
7	+0
8	–59
9	–118
10	–177
11	–237
12	–296

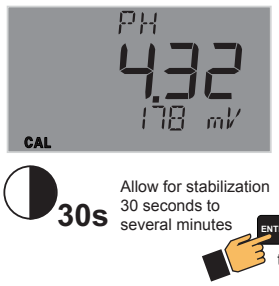
NOTE: The solutions can be used for calibrating more than one sensor; however, the solution must remain free of debris and must not be diluted by rinse water from previous calibrations.

Manual Calibration Procedure - pH

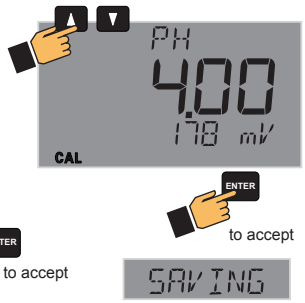
Requires prepared buffers. System calibration is possible with two known pH solutions within 0 to 14 pH (buffers of pH 4.01, 7, or 10 are recommended, but use a buffer close to your own process value.)

To Calibrate:

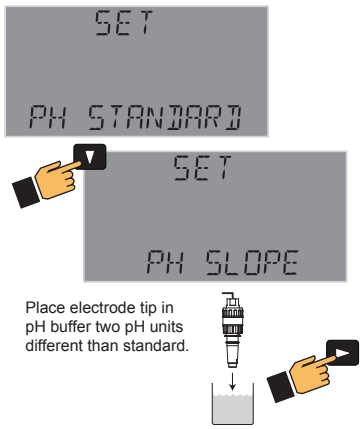


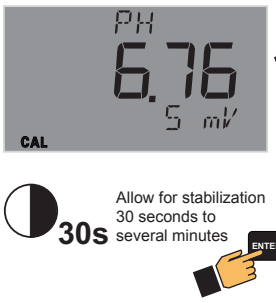


To Change Reading:

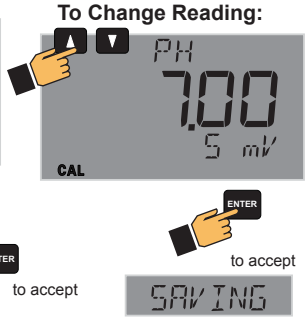


To Set Slope:





To Change Reading:



To Set Calibration Date:

Display returns to VIEW Mode

Single-point calibration sets STANDARD only; Signet recommends a two-point calibration to set SLOPE in addition to STANDARD.

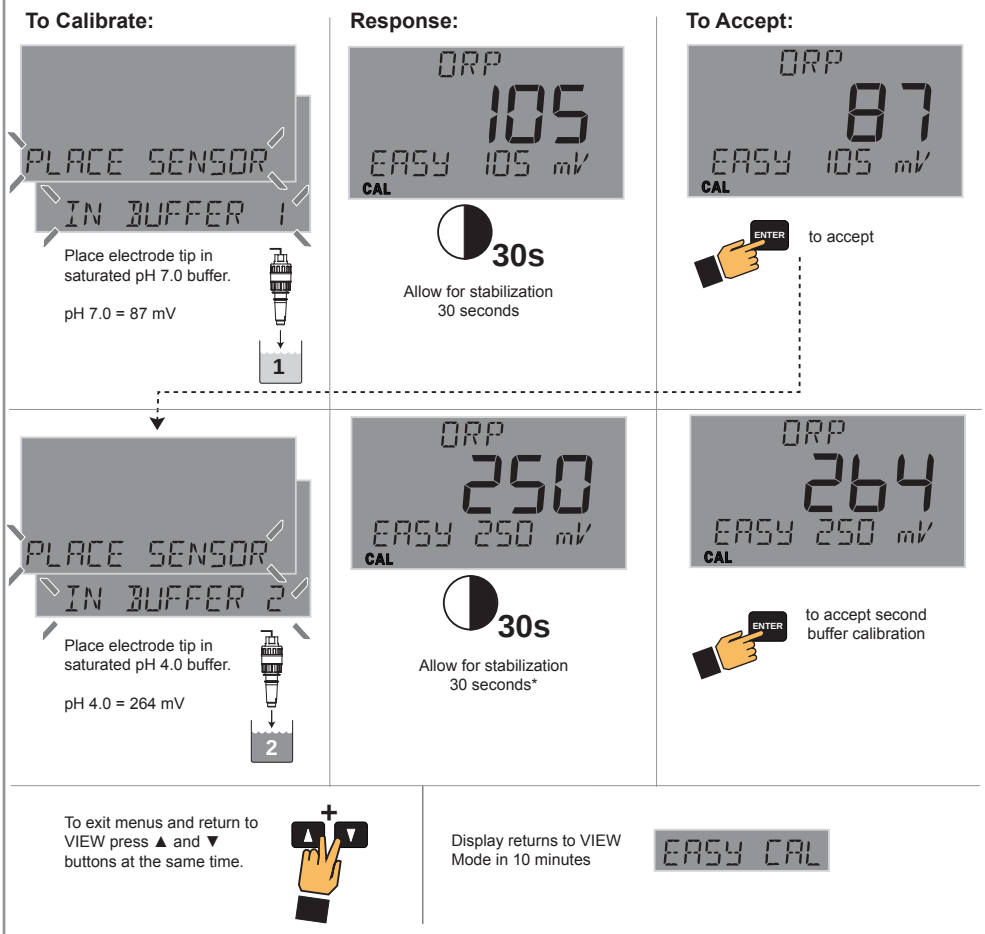
Quick Manual Calibration Procedures:

1-Point Calibration:
1. Set solution standard.

2-Point Calibration (recommended):
1. Set solution standard.
2. Set solution slope.

EasyCal Procedure - ORP

EasyCal is the fastest and simplest periodic calibration method. Requires a prepared quinhydrone solution: Saturate 50 mL of pH 4 and 7 buffers with 1/8 g quinhydrone.



NOTE: ORP solutions made with quinhydrone are very unstable and may not read properly once exposed to air for a prolonged time. These solutions must be disposed of within an hour.

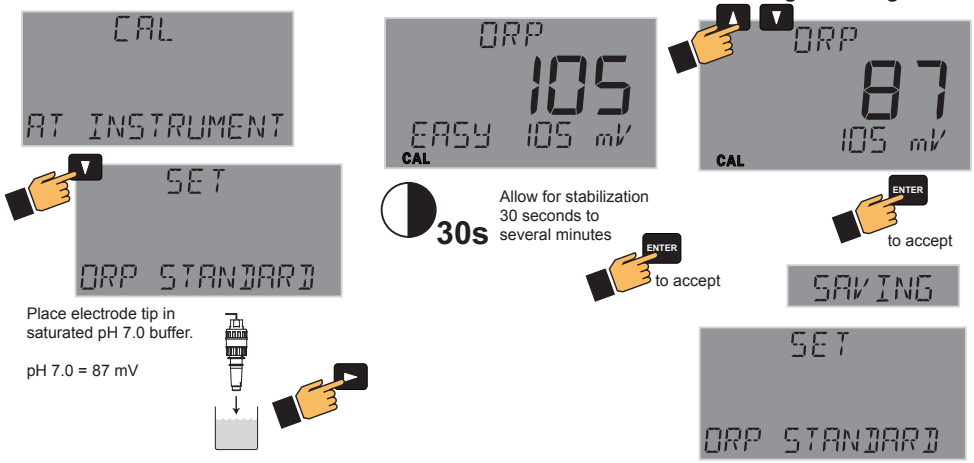
The solution can be used for calibrating more than one sensor; however, the solution must remain free of debris and must not be diluted by rinse water from previous calibrations.

Acceptable ranges for the readings are ± 80 mV (i.e., 87 ± 80 mV).

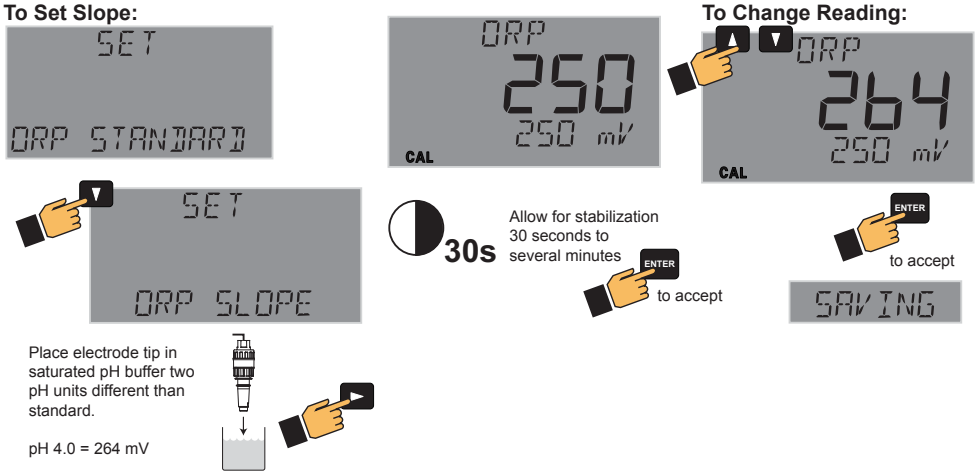
Manual Calibration Procedure - ORP

Requires prepared buffers and a prepared quinhydrone solution: Saturate 50 mL of pH 4 and 7 buffers with 1/8 g quinhydrone. (System calibration is possible with two known ORP solutions, but use a buffer close to your own process value).

To Calibrate:



To Set Slope:



To Set Calibration Date:

NOTE: ORP solutions made with quinhydrone are very unstable and may not read properly once exposed to air for a prolonged time. These solutions must be disposed of within an hour.

The solution can be used for calibrating more than one sensor; however, the solution must remain free of debris and must not be diluted by rinse water from previous calibrations.

Acceptable ranges for the readings are ± 80 mV (i.e., 87 ± 80 mV).

Single-point calibration sets STANDARD only; Signet recommends a two-point calibration to set SLOPE in addition to STANDARD.

Quick Manual Calibration Procedures:

1-Point Calibration:
1. Set solution standard.

2-Point Calibration (recommended):
1. Set solution standard.
2. Set solution slope.

Calibration Procedure - Conductivity/Resistivity

AutoCal is the fastest and simplest periodic calibration method. Requires prepared buffer of a value appropriate to your process.

Conductivity units are displayed as selected in the CALIBRATE menu. Resistivity displayed when KΩ or MΩ ranges are selected.

AutoCal Procedure

AutoCal is a single-point calibration system. During this procedure, if the measured value is within ± 10% of any of the test values listed below, the 9900 will automatically recognize the test value and calibrate the output to that value.

Available buffer values are:

- 10
- 100
- 146.93
- 200
- 500
- 1000
- 1408.8
- 5000
- 10,000
- 12856
- 50,000
- 100,000

(all values in µS)

NOTE: The first step (Reset) is recommended each time an electrode is replaced, but is NOT necessary upon initial installation or periodic calibration.

NOTE: Ensure that the buffer solution is within ± 5 °C of 25 °C.

1. Reset the sensor to factory calibration (refer to sensor manual for procedure).
2. On the 9900, select AUTO CAL from the CAL menu. Press ►.
3. Place the electrode/sensor assembly into the conductivity test solution appropriate to your operating range. Shake the electrode to dislodge any air bubbles visible on the surface of the electrode.
4. Allow at least 2 minutes for the electrode response to stabilize.
5. When the display stabilizes, press ENTER.
6. If calibration is successful, 9900 will display "SAVING". If error is too large, "OUT OF RANGE USE MANUAL CALIBRATION" will display.

Calibration is complete. Return the system to service.

Manual Cal Procedure

NOTE: The first step (Reset) is recommended each time an electrode is replaced, but is NOT necessary upon initial installation or periodic calibration.

NOTE: Ensure that the buffer solution is within ± 5 °C of 25 °C.

1. Reset the sensor to factory calibration (refer to sensor manual for procedure).
2. On the 9900, select MANUAL CAL from the CAL menu. Press ►.
3. Place the electrode/sensor assembly into the conductivity test solution appropriate to your operating range. Shake the electrode to dislodge any air bubbles visible on the surface of the electrode.
4. Allow at least 2 minutes for the electrode response to stabilize.
5. When the display stabilizes, enter the value of the buffer solution using the ▼, ▲ and ► buttons.
6. Press ENTER.
7. 9900 will display "SAVING". If error is too large, "ERR TOO LARGE TO CALIBRATE" will display.

Calibration is complete. Return the system to service.

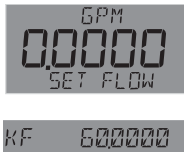
Calibration Procedure - Flow

Select RATE CALIBRATION to match the dynamic flow rate to an external reference. Entering a rate will modify the existing K-Factor.

Select VOLUME CALIBRATION if the flow rate can be determined by filling a vessel of known volume. The 9900 will count the number of pulses generated as the known volume of fluid passes through the sensor, and then use the information to calculate a new K-Factor.

Rate Calibration Procedure

1. Use ▲, ▼ and ► to set the flow rate in the flashing display to match the reference meter. Press ENTER when completed.
2. The 9900 displays the newly calculated K-Factor for your reference. (If the calculated K-Factor is less than 0.0001 or greater than 999999 (out of range at either extreme), the 9900 displays "ERROR NEW KF OUT OF RANGE" and returns to RATE CAL. If flow is too low to accurately calibrate, the 9900 displays "ERROR FLOW RATE TOO LOW and returns to RATE CAL.)
3. Press ENTER to accept the new K-Factor (9900 displays "SAVING") or press ▲+▼ keys simultaneously to escape without saving and return to Enter Volume. **NOTE:** You may enter your own calculated K-Factor in the INPUT menu.



Volume Calibration Procedure

1. Press ENTER to start the volumetric calibration period. The 9900 starts counting pulses from the flow sensor.
2. Press ENTER to stop the volumetric calibration period. The 9900 stops counting pulses from the flow sensor.
3. Enter the volume of fluid known to have flowed past the sensor during the volumetric calibration period. This will modify the existing Flow K-Factor.
4. The 9900 displays the newly calculated K-Factor for your reference. (If the calculated K-Factor is less than 0.0001 or greater than 999999 (out of range at either extreme), the 9900 displays "ERROR VOLUME TOO HIGH" (or LOW) and returns to VOLUME CAL.)
5. Press ENTER to accept the new K-Factor (9900 displays "SAVING") or press ▲+▼ keys simultaneously to escape without saving and return to Enter Volume. **NOTE:** You may enter your own calculated K-Factor in the INPUT menu.

Calibration Error Messages

Message	Cause	Solution
Out Of Range Use Manual Calibration	(Cond/Res) Error > 10% in AutoCal	Use manual calibration method
	(pH) Buffer not found; Error > ±1.5 pH units	Use 4, 7, 10 pH buffers (with quinhydrone for ORP calibration) Clean sensor and retry EasyCal Use manual calibration method
	(ORP) No quinhydrone in buffer Error greater than ±80 mV	
Err Too Large To Calibrate	(Cond/Res) Manual cal when error > 100%	Inspect sensor and wiring for damage
		Clean sensor
	(pH) Offset > 1.3 pH units; Slope error > 100%	Check reference Clean sensor Replace sensor
	(Press) Slope must be < ±50% or offset must be < 2.75 PSI or equivalent.	
	(Sal) Slope error > 1000%	
Error Volume Too Low	User-entered volume too small to calibrate	Correct volume entry
		Use longer calibration period
Error New KF Out Of Range	The calculated K-Factor too low or high	Verify volume or rate entered
		Verify flow is present
Error Flow Rate Too Low	(Rate Cal) Flow too low to accurately calibrate	Increase flow
Cal Error Out Of Range	(4 to 20 mA) Slope error > 1000%	Check input at 4 mA and 20 mA settings
	(Temp) Offset must be < ±20 °C or equivalent.	Check sensor range Check reference Replace sensor
Slope Too Close To Standard	(4 to 20 mA) Difference in calibration values must be > 0.1 units	Check sensor Use fresh buffer Use two different buffer values Clean sensor
	(pH) Difference in calibration values must be > 2 pH units	
	(ORP) Difference in calibration values must be > 30 mV	
Standard Too Close To Slope	(4 to 20 mA) Difference in calibration values must be > 0.1 units	Clean sensor Use fresh 4, 7, 10 pH buffers Use two different buffer values
	(pH) Difference in calibration values must be > 2 pH units	
	(ORP) Difference in calibration values must be > 30 mV	
Level Offset Too Large	Offset must be < 1.0 meter	Decrease offset
		Replace sensor
Pressure Too High To Zero	Pressure must be lower than 2.5 PSI or equivalent to do zero cal.	Decrease pressure
Pressure Too Close To Zero	Pressure must be higher than 3 PSI or equivalent to do slope calibration.	Increase pressure
		Check reference

USP Limits

USP (United States Pharmacopoeia) has defined a set of conductivity values (limits) to be used for pharmaceutical water. The standard requires that conductivity measurement without temperature compensation be used for these applications. The limits vary according to the temperature of the sample. The 9900 has the USP limits stored in memory. It will automatically determine the proper USP limit based on the measured temperature.

Using the USP function
USP setpoints are defined as a percentage below the USP limit, so a USP alarm is always a HIGH alarm. The 9900 can be set to warn you if the conductivity approaches within a set percentage of the USP limit.

The following settings and conditions are required for a USP relay function:

1. In the RELAY menu:
- RELAY MODE must be set to **USP**.

2. In the INPUT menu:
- COND UNITS must be set to **µS**.
- TEMP COMP must be set to **None**.

Example:
- The water temperature is 19 ºC, so the USP limit is 1.0 µS.
- The USP PERCNT is set to 40%.
- The relay will be activated when the conductivity value reaches 40% below the 1.0 USP limit, or 0.6 µS.
- If the water temperature drifts to more than 20 ºC, the 9900 will automatically adjust the USP limit to 1.1. The relay will now be activated when the conductivity value reaches 40% below 1.1 µS (0.66 µS).

Temperature Range (ºC)	USP limit (µS)
0 to < 5	0.6
5 to < 10	0.8
10 to < 15	0.9
15 to < 20	1.0
20 to < 25	1.1
25 to < 30	1.3
30 to < 35	1.4
35 to < 40	1.5
40 to < 45	1.7
45 to < 50	1.8
50 to < 55	1.9
55 to < 60	2.1
60 to < 65	2.2
65 to < 70	2.4
70 to < 75	2.5
75 to < 80	2.7
80 to < 85	2.7
85 to < 90	2.7
90 to < 95	2.7
95 to < 100	2.9
100 to < 105	3.1

Specifications

General
Input channels: ..... One

Enclosure and Display
Case Material: ..... PBT
Window: ..... Shatterproof glass
Keypad: ..... 4 buttons, injection-molded silicone rubber seal
Display: ..... Backlit, 7- and 14-segment
Indicators ..... "Dial-type" digital bar graph
Update rate: ..... 1 s
LCD Contrast: ..... 5 settings

Enclosure
- Size ..... ¼ DIN
- Color ..... Black (Panel Mount), Yellow and black (Integral Mount)

Mounting
- Panel ..... ¼ DIN, ribbed on four sides for panel mounting clip inside panel
- Field ..... Mounts to standard Signet field mount junction boxes. Optional angle adjustment adapter is available
- Wall ..... Large enclosure (sold as an accessory) that encases the panel mount transmitter

Environmental Requirements
Ambient operating temperature:
- Backlit LCD: ..... -10 to 70 °C (14 to 158 °F)
- Storage Temp: ..... -15 to 80 °C (5 to 176 °F)
- Relative Humidity: ..... 0 to 100% condensing for Field Mount and Panel Mount front only; 0 to 95% non-condensing for Panel Mount back side.
- Maximum Altitude: ..... 4,000 m (13,123 ft); use only DC power supply to maintain UL safety standard up to this altitude
- Enclosure Rating: ..... Designed to meet NEMA 4X/IP65 (front face only on panel mount; field mount is 100% NEMA 4X/IP65).

Performance Specifications
System Accuracy
- Primarily dependent upon the sensor.

System Response
- Primarily dependent upon the sensor. Controller adds a maximum of 150 ms processing delay to the sensor electronics.
- Minimum update period is 100 ms
- System response is tempered by the display rate, output averaging and sensitivity feature.

Electrical Requirements

Power to Sensors

Voltage:	+4.9 to 5.5 VDC @ 25 °C, regulated
Current:	1.5 mA max in loop power mode; 20 mA max when using DC power
Short Circuit	Protected
Isolation:	Low voltage (< 48 V AC/DC) to loop with DC power connected

No isolation when using loop power only

Terminal Blocks

- Pluggable screw type
- 14 AWG max wire gauge

Input Power Requirements

DC (preferred)	24 VDC; input range: 10.8 to 35.2 VDC regulated 22 mA maximum
Loop	12 to 32 VDC ± 10%, 4 to 20 mA
Overvoltage protection	48 Volt Transient Protection Device (for DC ONLY)

Current limiting for circuit protection

Reverse-Voltage protection

Loop Characteristics

With DC power input (preferred)

Max. loop impedance

@ 12 V loop power	250 Ω max.
@ 18 V loop power	500 Ω max.
@ 24 V loop power	750 Ω max.

No DC power input

Max. loop impedance

@ 12 V loop power	50 Ω max.
@ 18 V loop power	325 Ω max.
@ 24 V loop power	600 Ω max.

Relay Specifications

Hysteresis	Adjustable (absolute in Engineering Units)
Latch	Reset in test screen only
On Delay	9999.9 seconds (max)
Cycle Delay	99999 seconds (max)
Test Mode	Set On or Off
Maximum pulse rate:	400 pulses/minute
Proportional Pulse:	400 pulses/minute
Volumetric Pulse Width:	0.1 to 3200 s
PWM period:	0.1 to 320 s

Open Collector

Type:	NPN
Max. Voltage Rating:	30 VDC
Max. Current Rating:	50 mA

Dry-Contact Relays

Type:	SPDT
Form:	C
Max. Voltage Rating:	30 VDC or 250 VAC
Max. Current Rating:	5 A

Shipping Weights

Base Unit	0.63 kg (1.38 lb)
H COMM Module	0.16 kg (0.35 lb)
Conductivity Module	0.16 kg (0.35 lb)
Relay Module	0.19 kg (0.41 lb)

Standards and Approvals

CE

UL

RoHS Compliant

China RoHS (Go to gfsignet.com for details)

Manufactured under ISO 9001 for Quality and ISO 14001 for Environmental Management

Input Types

- Digital (S^3L) or AC frequency
- 4 to 20 mA input via the 8058
- Open collector
- pH/ORP input via the digital (S^3L) output from the 2750 pH/ORP Sensor Electronics
- Raw Conductivity/Resistivity input directly from Signet Conductivity/Resistivity electrodes via Direct Conductivity/Resistivity Module

Sensor Types..... Flow, pH/ORP, Conductivity/ Resistivity, Salinity, Pressure, Temperature, Level/Volume, Other (4 to 20 mA)

Input Specifications

Digital (S^3L):..... Serial ASCII, TTL level, 9600 bps

Frequency:

- Sensitivity: ..... 80 mV @ 5 Hz, gradually increasing with frequency
- Span: ..... 0.5 Hz to 1500 Hz @ TTL level input
- Accuracy: ..... ± 0.5% of reading max error @ 25 °C
- Range..... 0.5 to 1500 Hz
- Resolution: ..... 1 µs
- Repeatability: ..... ± 0.2% of reading
- Power Supply
  - Rejection: ..... No Effect ± 1 µA per volt
  - Short Circuit ..... Protected
  - Reverse Polarity Protected (no isolation when using loop power only)
- Update Rate: ..... (1/frequency) + 150 ms

Display Ranges:

pH: .....0.00 to 15.00 pH
pH Temp.: .....-99 to 350 °C (-146 to 662 °F)
ORP: .....-1999 to 1999.9 mV
Flow Rate: .....-9999 to 99999 units per second, minute, hour or day
Totalizer: .....0.00 to 99999999 units
Conductivity: .....0.0000 to 99999 µS, mS, PPM and PPB (TDS), kΩ, MΩ
Cond. Temp.: .....-99 to 350 °C (-146 to 662 °F)
Temperature: .....-99 to 350 °C (-146 to 662 °F)
Pressure: .....-40 to 1000 psi
Level: .....-9999 to 99999 m, cm, ft, in, %
Volume:.....-9999 to 99999 cm^3, m^3, in^3, ft^3, gal, L, lb, kg, %
Salinity .....0-100 PPT

Output Specifications

Current Loop Out	ANSI-ISA 50.00.01 Class H
Span	3.8 to 21 mA
Zero	4.0 mA factory set; user programmable from 3.8 to 4.2 mA
Full Scale	20.00 mA factory set; user programmable from 19.0 to 21.0 mA
Accuracy	± 32 µA max. error @ 25 °C @ 24 VDC
Resolution	6 µA or better
Temp. Drift	± 1 µA per °C
Pwr Sply Rejection	± 1 µA per V
Isolation	Low voltage (< 48 VAC/DC)
Voltage	12 to 32 VDC ± 10%
Max. Impedance:	250 Ω @ 12 VDC 500 Ω @ 18 VDC 750 Ω @ 24 VDC
Update Rate	100 mS nominal

Short circuit and reverse polarity protected
Adjustable span, reversible

Error Condition	Selectable error condition 3.6 or 22 mA.

Actual update rate determined by sensor type

Test Mode:	Increment to desired current (range 3.6 to 21.00 mA)

Open Collector Outputs:	1
Analog Outputs:	1 passive

Current Outputs

- One 4 to 20 mA output
- Linear scaling
- Logarithmic scaling for Conductivity
- Reverse span
- Selectable error mode: 3.6 mA or 22 mA
- Test Output mode that allows the user to test the current output
- Adjustable 4 to 20 mA end points
- HART output via optional H COMM Module

Ordering Information

9900 Transmitter Base Unit - Single Channel, Multi-Parameter, 4 to 20 mA, Open Collector, DC Power

Mfr. Part No	Code	Description
3-9900-1P	**159 001 695**	9900 Base Unit, Panel Mount
3-9900-1	**159 001 696**	9900 Base Unit, Field Mount

Optional Modules

Mfr. Part No	Code	Description
3-9900.393	**159 001 698**	Relay Module - 2 DCR (Dry Contact Relays)
3-9900.394	**159 001 699**	Direct Conductivity/Resistivity Module
3-9900.395	**159 001 697**	H COMM Module

Accessories

Mfr. Part No	Code	Description
6682-0204	**159 001 709**	Conductivity Module Plug, 4 Pos, Right Angle
6682-1102	**159 001 710**	DC Power Plug, 2 Pos, Right Angle
6682-1103	**159 001 711**	Relay Module Plug, 3 Pos, Right Angle
6682-1104	**159 001 712**	Loop Power Plug, 4 pos, Right Angle
6682-3004	**159 001 725**	Terminal Block Plug
6682-3104	**159 001 713**	Freq/S^{3}L Plug, 4 pos, Right Angle
7300-7524	**159 000 687**	24 VDC power supply 7.5 W, 300 mA
7300-1524	**159 000 688**	24 VDC power supply 15 W, 600 mA
7300-3024	**159 000 689**	24 VDC power supply 30 W, 1.3 A
7300-5024	**159 000 690**	24 VDC power supply 50 W, 2.1 A
7300-1024	**159 000 691**	24 VDC power supply 100 W, 4.2 A
3-0251	**159 001 724**	PC COMM Configuration/Diagnostic tool
3-8050	**159 000 184**	Universal Mount Kit
3-8050.396	**159 000 617**	RC Filter Kit (for relay use), 2 per kit
3-8051	**159 000 187**	Flow Sensor Integral Mount Kit
3-8052	**159 000 188**	¾ in. Integral Mount Kit
3-8058-1	**159 000 966**	i-Go™ Signal Converter, wire-mount
3-8058-2	**159 000 967**	i-Go™ Signal Converter, DIN rail mount
3-9900.390	**159 001 714**	Standard Connector Kit, Right Angle, 9900 Transmitter
3-9900.391	**159 001 715**	Connector Kit, In-Line, 9900 Transmitter
3-9900.392	**159 001 700**	Wall Mount Accessory for 9900
3-9000.392-1	**159 000 839**	Liquid Tight Connector Kit, NPT (1 pc.)
3-9900.396	**159 001 701**	Angle Adjustment Adapter Kit (for Field Mounting)

+GF+

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For Worldwide Sales and Service, visit our website: gfsignet.com • or call (in the U.S.): (800) 854-4090
For the most up-to-date information, please refer to our website at gfsignet.com

3-9900.090 Rev. A2 08/11 English

Signet 2724-2726 pH and ORP Electrodes

Ellis Part Number: 2236001092 - pH Transmitter

+GF+

Compatible with ALL Signet pH/ORP Instruments

Flat Glass

Protected Bulb

Description

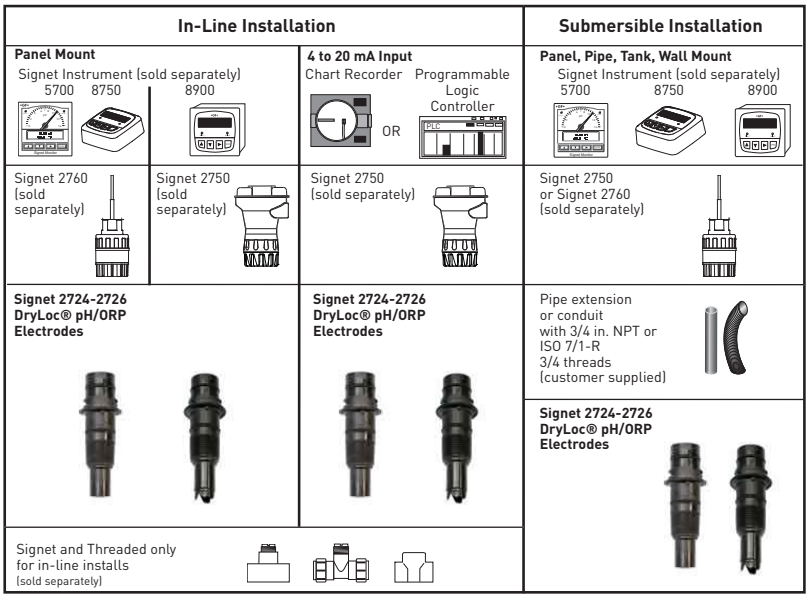
The Signet 2724-2726 pH and ORP Electrodes features a patented reference electrode design and uses the unique foul-proof patented DryLoc® connector. The large area PE reference junction and pathway is constructed to increase the total reference effectiveness and ensures long service life.

The DryLoc® connector with corrosion resistant gold plated contacts readily connects the sensor to the mating 2760 preamplifier or the 2750 sensor electronics. The robust Ryton® threaded sensor body and choice of flat pH, bulb pH, or flat ORP sensing elements provides broad range of chemical compatibility for a wide variety of applications.

There are two optional pH sensing versions available, HF and LC. The HF version is for applications where traces of hydrofluoric acid (2% or less) will attack standard pH glass in levels of pH 6 and below. The LC version can be used for low conductivity fluids (20 - 100 µS/cm recommended).

The quick temperature response is available in either a PT1000 or 3 KΩ temperature sensor and allows compatibility with all Signet pH/ORP instruments. The 2724-2726 electrodes are general-purpose sensors ideal for a wide range of applications. The sensors incorporate ¾" NPT or ISO 7/1-R 3/4 threads for installing into standard pipe-tees. They can also be mounted directly into Signet standard fittings, ½ to 4 inch.

System Overview



Ryton (PPS) is a registered trademark of Chevron Phillips Chemical Co. LLC
Go to www.cpchem.com for more information on Ryton

Features

- **Patented DryLoc® connector with gold plated contacts**
- **Mounts in Signet standard fittings from DN15 to DN100 (½ to 4 in.)**
- **¾" NPT or ISO 7/1-R 3/4 threaded sensors for use with reducing tees up to 4 in.**
- **Special design allows for installation at any angle, even inverted**
- **Ryton® (PPS) body for broad range of chemical compatibility**
- **Patented* reference design for exceptional performance**
- **Quick temperature response**
- **HF resistant glass available for trace HF of ≤2%**
- **Optional Low conductivity sensor for liquids down to 20 µS/cm**

Applications

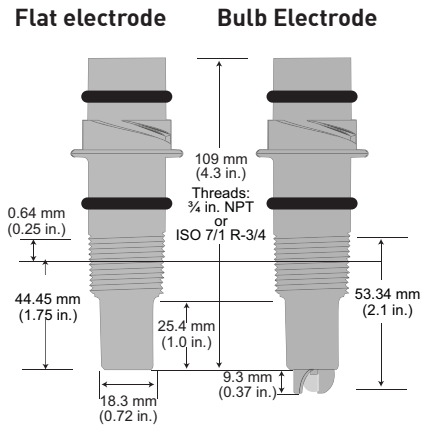
- **Water & Wastewater Treatment**
- **Neutralization Systems**
- **Effluent Monitoring**
- **Sanitization Systems**
- **Pool & Spa Control**
- **Aquatic Animal Life Support Systems**
- **Process Control**
- **Cooling Towers**

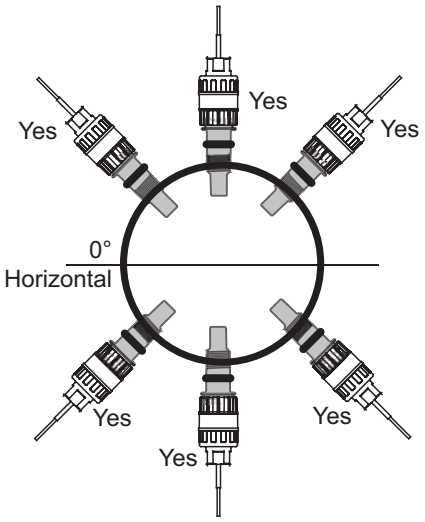
See Technical Reference section for assistance in choosing the correct sensor.

U.S. Patent No.: 6,666,701

*Patents pending

Dimensions





Mounting Angle
Models 2724-2726 may be mounted at any angle without affecting the performance. Avoid locations with air pockets and sediment.

Specifications

General
Performance
- Efficiency: ›97% @ 25 °C (77 ° F)

Operating Range:
- pH: 0 to 14 pH
- ORP: ±2000 mV
- 3-2726-LC: Low Conductivity fluids; 20 - 100 µS/cm recommended
- 3-2726-HF: Hydrofluoric acid resist glass, pH 6 or below; trace HF ≤2%

Compatibility:
2750 Electronics, 2760 Preamplifier pH Temperature Sensor:
- PT1000 versions are compatible with Signet 2750 pH/ORP Sensor electronics for connection to a PLC or to the Signet 8900 Multi-Parameter Controller.
- 3 KΩ Balco versions are compatible with the Signet 2760 pH/ORP preamplifier for connection to the Signet 5700 pH/ORP Monitor and the Signet 8750 pH/ORP Transmitter.

Process Connection:
- ¾ in. NPT
- ISO 7/1-R 3/4
- Mounts into Signet fittings

Wetted Materials
- pH: Ryton® (PPS), glass, UHMW PE, FPM
- ORP: Ryton® (PPS), glass, UHMW PE, FPM, Platinum

Max. Temperature/Pressure Rating
Operating Temperature Range:*
-10 °C to 85 °C (14 °F to 185 °F)
Operating Pressure Range:
-10 °C to 65 °C (14 °F to 149 °F): 0 to 100 psi
65 °C to 85 °C (149 °F to 185 °F), linearity derated 100 psi to 58 psi

*Best performance for 2726-HF sensors is above 10 °C (50 °F)

See Temperature and Pressure Graphs for more information for more information

Recommended Storage Temperature
The best storage temperature for the 272X pH and ORP electrodes is 0 °C to 50 °C (32 °F to 122 °F)
- The electrode glass will shatter if shipped or stored at temperature below 0 °C (32 °F)
- The performance life of the electrode will shorten if stored at temperatures above 50 °C (122 °F)

Mounting
In-line Mounting:
- Use the sensor threads
- Use a Signet standard fitting up to 4 in.
- Sensor can be mounted at any angle

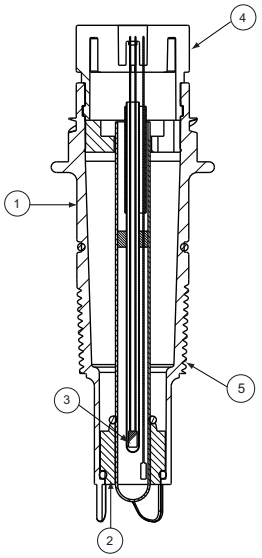
Submersible Mounting:
- Use threads on models 2750 or 2760
- Requires ¾ inch NPT or ISO 7/1-R 3/4 male threaded liquid tight extension conduit.

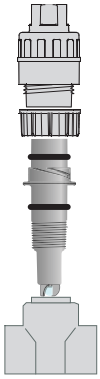
Shipping Weight 0.25 kg 0.55 lb

Standards and Approvals
- Manufactured under ISO 9001 for Quality and ISO 14001 for Environmental Management

Electrode Key Features and Benefits:

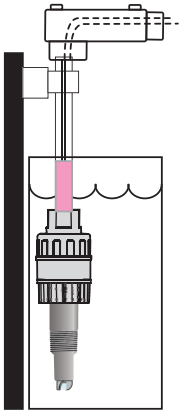
1. Ryton® body for chemical compatibility with most harsh chemicals.
2. Porous UHMW PE (ultra high molecular weight polyethylene) junction resists fouling and build-up.
3. Internal temperature sensor located in the glass stem for a quick temperature response.
4. DryLoc® connector with corrosion resistant gold pins for quick and easy sensor removal.
   - Resists moisture and dirt intrusion.
5. Threads for NPT or ISO process connection into reducing tees
   - Use off-the-shelf GF reducing tees DN20 to DN100 (¾ to 4 in.).
6. Mounts directly into Signet fittings (½ in. 4 in.) for easy sensor retrofitting.
7. Mount submersed into a tank via the 2750 or 2760 back threads.





5 Sensor in threaded reducing tee

6 Sensor in Signet fitting



7 Sensor submersible installation

Accessories

Buffer Solutions

The Signet pH buffers are ideal for routine calibration requirements. The liquid solutions are conveniently packaged in one pint (473 ml) bottles. pH buffer kits in powder pillows are available for mixing fresh solutions with water at the time of use.

All pH buffers are color coded for easy identification; 4.01 pH is red, 7.00 pH is yellow, and 10.00 pH is blue.
All pH buffers are traceable to NIST standards.
These buffer solutions can be used to calibrate ORP sensors when saturated with quinhydrone.

Model 2724-2726
Ordering Notes

1) pH and ORP electrodes require connection to model 2750 sensor electronics or 2760 preamplifier.
2) Use the flat glass electrodes when a self-cleaning feature is desired; especially useful in applications with abrasive chemicals.
3) Use bulb protected electrodes for general purpose applications.
4) ORP electrodes are generally used for chemical reaction monitoring, not control.
5) The 2750 "EasyCal" feature recognizes common pH and ORP buffer values of 4, 7 and 10 pH and +87 and 264 mV for ORP.

Application Tips

- Use the flat glass electrodes when a self-cleaning feature is desired; especially useful in applications with abrasive chemicals.
- Use bulb protected electrodes for general purpose applications
- ORP electrodes are generally used for chemical reaction monitoring, not control.
- Ensure that sensor materials are chemically compatible with the process liquid.
- Keep electrode tip wet, avoid air pockets and sediment.

Ordering Information

pH Electrodes			
3-2724	Flat glass pH		
3-2726	Bulb glass pH		
3-2726-HF	Bulb glass pH, HF resistant ≤2% HF		
3-2726-LC	Bulb glass pH, Low conductivity applications, 20 - 100 µS/cm recommended		
↓	Temperature Element - Choose One		
	-0	PT1000; use with 2750 sensor electronics*	
	-1	3 KΩ Balco; use with 2760 preamplifier**	
	↓	Threaded Process Connection	
		0	¾ in. MNPT, Thread
		1	ISO 7/1-R 3/4 Thread
3-2726	**-1**	**1**	**Example Part Number**
ORP Electrodes			
3-2725-6	Flat ORP with 10 k Ohm ID Resistor		
↓	Threaded Process Connection		
	0	¾ in. MNPT, Thread	
	1	ISO 7/1-R 3/4 Thread	
3-2725-6	**0**	**Example Part Number**	

*The 2750 sensor electronics has a digital (S^3L) output which is used with the 8900 Controller. It also has a 4 to 20 mA output for connections to PLC's, data recorders, etc.

**The 2760 preamplifier is used for connection directly to Signet 5700 Monitor or 8750 transmitter.

Mfr. Part No.	Code	Mfr. Part No.	Code	Mfr. Part No.	Code
3-2724-00	**159 001 545**	3-2726-10	**159 001 555**	3-2726-LC-00	**159 001 557**
3-2724-01	**159 001 546**	3-2726-11	**159 001 556**	3-2726-LC-01	**159 001 558**
3-2724-10	**159 001 547**	3-2726-HF-00	**159 001 549**	3-2726-LC-10	**159 001 559**
3-2724-11	**159 001 548**	3-2726-HF-01	**159 001 550**	3-2726-LC-11	**159 001 560**
3-2726-00	**159 001 553**	3-2726-HF-10	**159 001 551**	3-2725-60	**159 001 561**
3-2726-01	**159 001 554**	3-2726-HF-11	**159 001 552**	3-2725-61	**159 001 562**

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
3-2700.395	**159 001 605**	Calibration kit: includes 3 PP cups, cup stand, 1 pint pH 4.01, 1 pint pH 7.00
3822-7115	**159 001 606**	20 gm bottle Quinhydrone for ORP calibration (must use pH 4.01 and/or pH 7.00 buffer solutions)
3-2759	**159 000 762**	pH/ORP System Tester (adapter cable sold separately)
3-2759.391	**159 000 764**	2759 DryLoc® Adapter Cable (for use with 2750 and 2760)
3-0700.390	**198 864 403**	pH Buffer Kit (1 each 4, 7, 10 pH buffer in powder form, makes 50 ml of each)
3822-7004	**159 001 581**	pH 4.01 buffer solution, 1 pint (473 ml) bottle
3822-7007	**159 001 582**	pH 7.00 buffer solution, 1 pint (473 ml) bottle
3822-7010	**159 001 583**	pH 10.00 buffer solution, 1 pint (473 ml) bottle

Rev A (3/09)

3401 Aerojet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057 • www.gfsignet.com • e-mail: signet.ps@georgfischer.com

Signet 2750 DryLoc® pH/ORP Sensor Electronics

Ellis Part Number:
2236001111 - pH Electrode

For Signet fittings up to 4 in. and wet tap assemblies.

In-line 2750

In-line when electrode has ¾ in. or 1 in. process connection

Submersible 2750

DryLoc® Electrodes sold separately.

Features

- **In-line integral mount and submersible installation versions**
- **Automatic temperature compensation**
- **Auto configuration for pH or ORP operation**
- **Optional EasyCal calibration aid with automatic buffer recognition**
- **Junction boxes for convenient wiring**

Description

The Signet 2750 pH/ORP Sensor Electronics featuring the DryLoc® connector, provides a variety of functions to suit various requirements.

The 2750 has a preamplified signal and features two different outputs: a two-wire 4 to 20 mA loop output with EasyCal function or a digital (S^3L) output which allows for longer cable lengths and is compatible with the Signet 8900 Multi-Parameter Controller.

The 2750 self-configures for pH or ORP operation via automatic recognition of the electrode type. The optional EasyCal feature allows simple push-button calibration and includes an LED indicator for visual feedback.

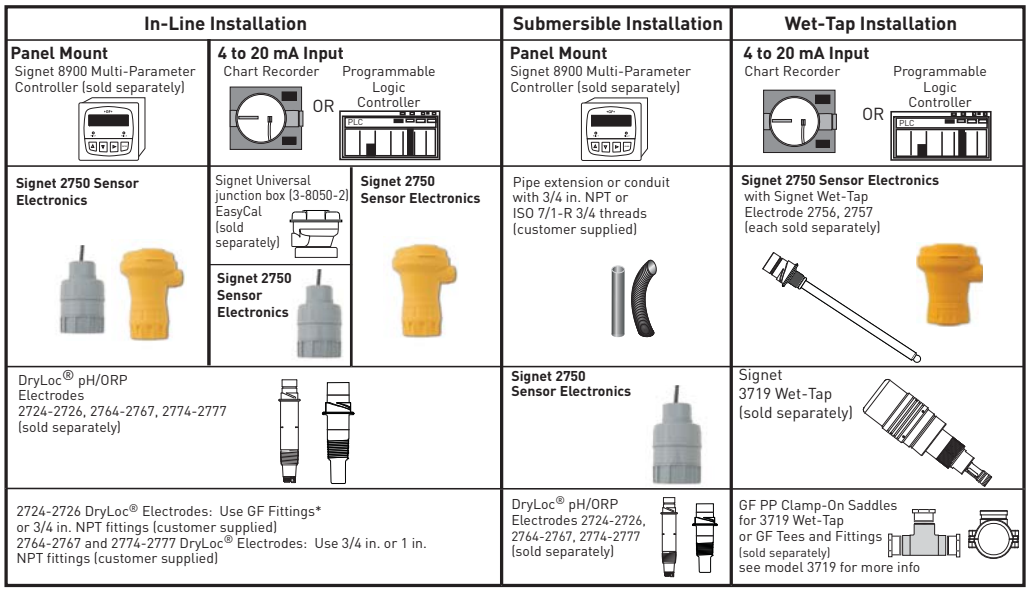
The DryLoc® electrode connector quickly forms a robust assembly for submersible and in-line installations. NEMA 4X junction enclosures are integral parts of the 2750 in-line version and are also available as accessories for the submersible 2750.

The 2750 submersible preamplifier can also be used as an In-line preamplifier when used with the 3/4" or 1" threaded sensors including the 2724, 2774 and 2764 series electrodes. The 2750 In-line preamplifier can be used with Signet fittings up to DN100 (4 in.) and wet-tap assemblies.

Applications

- **Water/Wastewater Treatment**
- **Neutralization Systems**
- **Scrubber Control**
- **Effluent Monitoring**
- **Surface Finishing**
- **Flocculent Coagulation**
- **Heavy Metal Removal and Recovery**
- **Toxics Destruction**
- **Sanitization Systems**
- **Pool & Spa Control**
- **Aquatic Animal Life Support Systems**

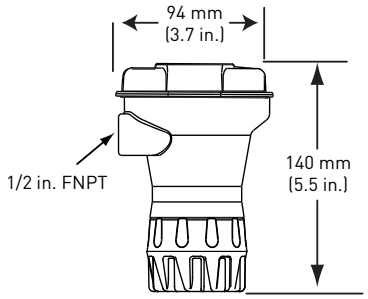
System Overview



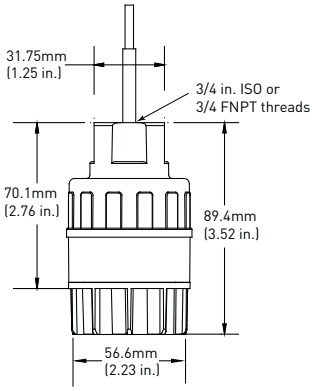
*See Fittings section for more information.

Dimensions

3-2750-1,-2



3-2750-3, -4



Specifications

General

Compatible Electrodes:
Signet DryLoc® pH and ORP Electrodes Models 2724-2726, 2756-2757 Wet-Tap, 2764-2767, 2774-2777,

Operating Range:
- pH: 0 to 14 pH
- ORP: ± 2,000 mV

Response Time:
- pH: < 6 sec. for 95% of change
- ORP: application dependent

Materials:
- In-line: Valox® (PBT)
- submersible: CPVC

Electrical

Cable:
4.6 m/15 ft, 3-conductor shielded 22 AWG, 100 ft max.

Power:
- 12 to 24 VDC ±10%, regulated for 4 to 20 mA output
- 5 to 6.5 VDC ±5% regulated recommended, 3 mA max., for digital (S^3L) output

Current output:
- pH:
  Fixed 4 to 20 mA, isolated, = 0 to 14 pH (custom scaling available)
- ORP:
  Fixed 4 to 20 mA, isolated, = -1000 to 2000 mV (custom scaling available from ± 2000 mV)
- Max Loop Resistance:
  100 Ω max. @ 12 V
  325 Ω max. @ 18 V
  600 Ω max. @ 24 V
- Accuracy: ± 32 µA
- Resolution: ± 5 µA
- Update Rate: 0.5 seconds
- Error indication: 3.6 mA

Digital (S^3L) output:
- Serial ASCII, TTL level 9600 bps
- Accuracy:
  pH: ± 0.03 pH @ 25 °C (77 °F)
  ORP: ± 2 mV @ 25 ° C (77 °F)
- Resolution:
  pH: ≤ 0.01 pH
  ORP: 1 mV
  Temp.: ≤ 0.2 °C (32.3 °F)

Electrical (continued)
- Update Rate: 0.5 seconds
- Available Data:
  Raw mV, pH or ORP, temperature (pH)
- Error indication:
  Open input diagnostic
- Input Impedance, Z: $>10^{11}\Omega$

Environmental

Enclosure:
- 3-2750-1 & -2: NEMA 4X/IP65 with electrode connected
- 3-2750-3 & -4: NEMA 6P/IP68 with electrode and watertight conduit and/or extension pipe connected

Max. Temperature/Pressure Rating

Operating Temperature:
- Temperature (submersible):
  0 °C to 85 °C (32 °F to 185 °F)
- Temperature (in-line):
  0 °C to 110 °C (32 °F to 230 °F)

Storage Temperature:
-20 °C to 85 °C (-4 °F to 185 °F)

Relative Humidity:
0 to 95%, non-condensing (without electrode connected)

Shipping Weight
- 2750-1 & 2: 0.75 kg 1.65 lb
- 2750-3 & -4: 0.64 kg 1.41 lb

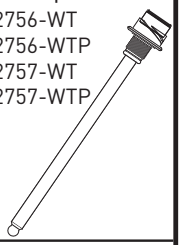
Standards and Approvals
- CE
- Manufactured under ISO 9001 for Quality and ISO 14001 for Environmental Management

2750 Product Selection Guide

1. Choose the Electrode

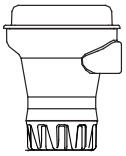
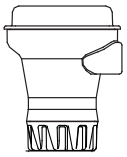
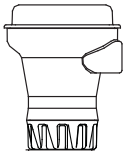
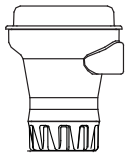
2724-2726	2764-2767 Differential	2774-2777	2756 and 2757 Wet-Tap
3-2724-00, -01 3-2725-60, -61 3-2726-00, -01 3-2726-HF-00, -01 3-2726-LC-00, -01	3-2764-2 3-2765-1 3-2766-2 3-2767-1	3-2774-1 3-2775-1 3-2776-1 3-2777-1	3-2756-WT 3-2756-WTP 3-2757-WT 3-2757-WTP



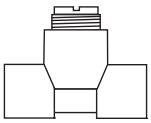
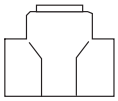
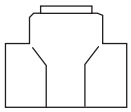
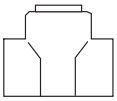
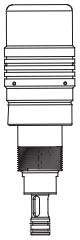



2. Determine the mounting style:

In-line

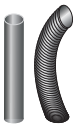
2750-1 or -2	2750-3 or -4	2750-1 or -2	2750-3 or -4	2750-1 or -2	2750-3 or -4	2750-1 or -2
						

-In-line fitting

Signet fitting	¾" reducing tee	1" threaded tee	¾" reducing tee	3719 Wet-Tap Assembly
				

Submersible

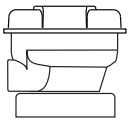
2750-3 or -4
and cable conduit (customer supplied)
connected to ¾" sensor electronics


+


(Submersible not applicable with Wet-Tap assembly)

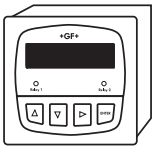
3. Junction Boxes

3-8050-1: Use when extending the submersible cable over long distance.
3-8050-2: Use with the submersible 2750-3 or -4 and the in-line 2750-1 for best calibration results with the EasyCal function when using the blind 4 to 20 mA output.



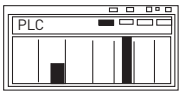
4. Choose the output instrument

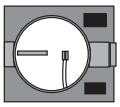
Digital (S^3L)
4 to 20 mA



8900 Multi-Parameter Controller

OR





PLCs or Chart Recorders

Model 2750
Ordering Information

1) Model 2750 requires 12 to 24 VDC to function as a blind 4 to 20 mA output transmitter.
2) Order a 3-2750-2 or any other 2750 with a junction box 3-8050-2 if the EasyCal feature is desired.
3) Conduit and mounting brackets for submersion installation must always be used (customer supplied).
4) The 3-2759 System Tester must be ordered with the adapter cable 3-2759.391 for exclusive use with the 2750.
5) All sensor electronics, preamplifiers and connectors require a DryLoc® electrode for full system installation.

Ordering Information

Sensor Electronics		
3-2750		Sensor Electronics with preamplified signal and Digital (S^3L) output (for use with the 8900 controller) or 4 to 20 mA output - power supplied to unit dictates output type.
	-1	In-line Sensor electronics (yellow body) - recommended for 8900 Controller
	-2	In-line Sensor electronics with EasyCal (yellow body) - recommended for 4 to 20 mA use
	-3	Submersible Sensor electronics with 4.6 m (15 ft) cable and ¾ in. NPT threads - when 4 to 20 mA is required use the 3-8050-2 junction box with EasyCal
	-4	Submersible Sensor electronics with 4.6 m (15 ft) cable and ISO 7/1R 3/4 threads - when 4 to 20 mA is required use the 3-8050-2 junction box with EasyCal
	↓	
3-2750	**-2**	**Example Part Number**

Mfr. Part No.	Code
3-2750-1	**159 000 744**
3-2750-2	**159 000 745**
3-2750-3	**159 000 746**
3-2750-4	**159 000 842**

Application Tips

- The EasyCal feature automatically recognizes standard 4.0, 7.0, and 10.0 pH buffer or ORP Quinhydrone solutions of 87 and 264 mV and simplifies calibration
- Frequency of calibration of electrodes is dependent upon the application.

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
Calibration		
3-2700.395	**159 001 605**	Calibration kit: includes 3 PP cups, cup stand, 1 pint pH 4.01, 1 pint pH 7.00
3822-7115	**159 001 606**	20 gm bottle Quinhydrone for ORP calibration (must use pH 4.01 and/or pH 7.00 buffer solutions)
3-2759	**159 000 762**	pH/ORP system tester (adapter cable sold separately)
3-2759.391	**159 000 764**	2759 adapter cable for use with 2750 DryLoc® sensor electronics
3-0700.390	**198 864 403**	pH buffer kit (1 each 4, 7, 10 pH buffer in powder form, makes 50 ml of each)
3822-7004	**159 001 581**	pH 4 buffer solution, 1 pint (473 ml) bottle
3822-7007	**159 001 582**	pH 7 buffer solution, 1 pint (473 ml) bottle
3822-7010	**159 001 583**	pH 10 buffer solution, 1 pint (473 ml) bottle
Mounting		
3-8050-1	**159 000 753**	Universal mount junction box
3-8050-2	**159 000 754**	Universal mount junction box w/EasyCal (for submersible applications, use with 3-2750-3/4 where 4 to 20 mA is required)
3-9000.392-1	**159 000 839**	Liquid tight connector kit, NPT (1 connector)
3-9000.392-2	**159 000 841**	Liquid tight connector kit, PG 13.5 (1 connector)
Other		
5523-0322	**159 000 761**	Sensor cable (per ft), 3-cond. plus shield, 22 AWG, black/red/white (for use with 2750)

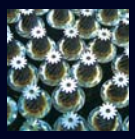
Rev A (3/09)

3401 Aerojet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057 • www.gfsignet.com • e-mail: signet.ps@georgfischer.com

ELLIS PART NUMBERS:
2230001062 - IPC Auger Gear Box







VARVEL®
MOTION CONTROL SINCE 1955

technology made in Italy

Working and Maintenance Instructions

ATEX Manual

GB

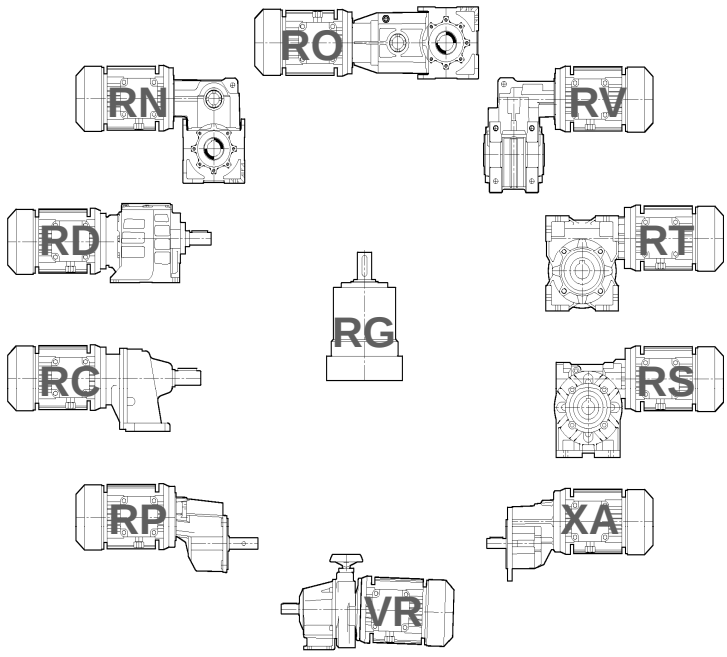
* VS made in China

Technology Made in Italy

Since 1955 Varvel has been making speed reducers and variators for light industry applications. Reliable partner in power transmission equipment offers also customized solutions always according to a socially responsible company values. Modularity and flexibility lead Varvel products by a unique kit form, common to all gearbox series. This feature allows distributors an easier job to set up required products in few minutes.

WORKING INSTRUCTIONS & MAINTENANCE

ATEX MANUAL



VARVEL
MOTION CONTROL SINCE 1955

Working Instructions & Maintenance

Contents

GENERAL INFORMATION

Varvel speed reducers and variators are not in the field of application of the Machinery Directive 2006/42/CE as considered "**machinery components**".

Guide of Machinery Directive - § 35 - decrees:

"The Machinery Directive does not apply directly to machinery components, such as, for example, valves, hydraulic cylinders or **gearboxes**, that do not have a specific application as such but are intended to be incorporated into machinery, although the design and construction of such components must enable the complete machinery to comply with the relevant essential health and safety requirements."

Regular operation and the right to guarantee servicing request the observance of information contained in this manual that must be read before the gearbox is put into service.

SAFETY WARNINGS

2.1 Product Operation

During operation, outer surfaces of gearboxes and variators may warm up because of in motion parts and also by external environmental conditions.

Everything referred to transport, stocking, assembling, setting up, starting and maintenance must be performed by trained personnel and that follows this manual within specific national / regional regulations about safety and prevention of accidents.

2.2 Prevalent Use

Gearboxes and variators referred to in this manual are destined to operate industrial applications and they correspond to standards and regulations where applicable.

Performances and technical data are available in the unit's nameplate and from the related documentation.

2.3 Transport

Carefully check the state of the goods at their receipt and immediately notify the possible damages to the carrier.

2.4 Long-Term Storage

Stocked units must be kept in dry warehouse and dust free.

For storage longer than 3 months, apply anti-oxidants on the shafts and machined surfaces paying special attention to oil seal lips.

Storages longer than one year reduce bearing grease lifetime .

2.5 Environmental Management

In conformity with Environmental Certification ISO14001, we recommend the following to dispose of

- scrapped gearbox components: to deliver to authorised centres for metal object collection:
- drained oils and lubricants: to deliver to Exhausted Oil Centres;
- product accompanying packages (pallets, carton boxes, paper, plastic, etc.): to deliver into regeneration / recycling circuits as far as possible, by delivering separate waste classes to authorised companies.

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PRODUCT LAYOUT

The following layouts supply a generic help in finding out the most significant parts of the products.

Various design executions, assembling versions, number of stages actually origin a variety of solutions and therefore, we recommend to refer to the appropriate catalogue and/or Engineering Department.

Working Instructions & Maintenance

Product Layout

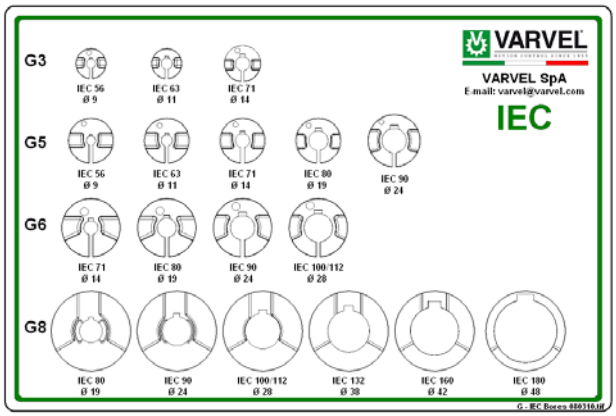
Elastic Coupling “G”

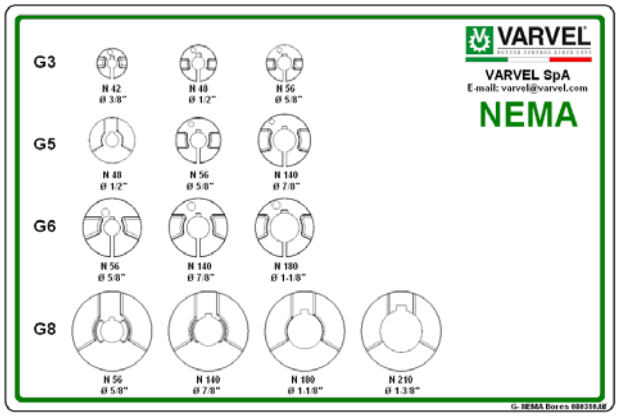
The elastic coupling “G” is supplied as standard fitting on the Series RD, RN, RO, RV, RP, RS, RT.

Reducer half-coupling
- Material: steel alloy
- One piece built-in input shaft
- Two bearing mounting
- Unchanged casing dimensions

Spider
- External tooth connection
- Material: Thermoplastic Elastomer
  - Elastollan ® TPU - Polyurethane
  - Hytrel ® TPE - Polyester
- Hardness
  - TPU 98 Shore A
  - TPE 72 Shore D
- Temperature
  - TPU -20/+75°C (-4 / +167°F)
  - TPE -30/+100°C (-22 / +212°F)

Motor half-coupling
- Material:
  - Aluminium die cast (G3, G5, G6)
  - Alloy steel (GS8)
- Dynamic balancing
- Fitting:
  - Clamp (G3, G5, G6)
  - Key (GS8)
- Bores:
  - IEC 72 / N42948
  - NEMA C y TC



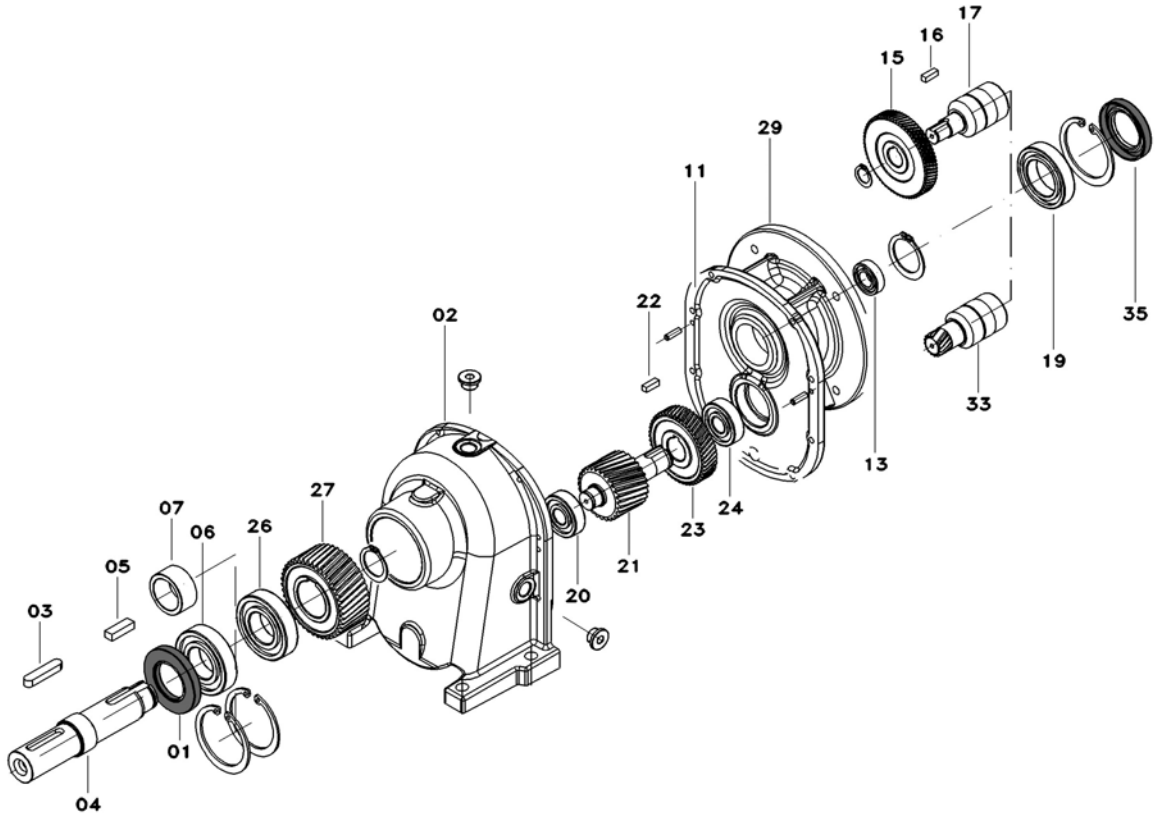


Advantages:
- One gearbox only for each reduction ratio
- Greater flexibility
- Increased stock rotation
- Fretting corrosion elimination between key and keyway
- Zero backlash in gearbox/motor connection
- Allowed angular misalignment 1° max
- Torsional rigidity
- High vibration damping

Input flanges:
- Material:
  - Aluminium up to IEC112 and NEMA TC180
  - Cast iron from IEC 132 and NEMA TC200

Series RC - 2 stages

The layout shows the general structure of a two-stage foot-mounted helical gearbox type FRC (sizes 05 to 30).



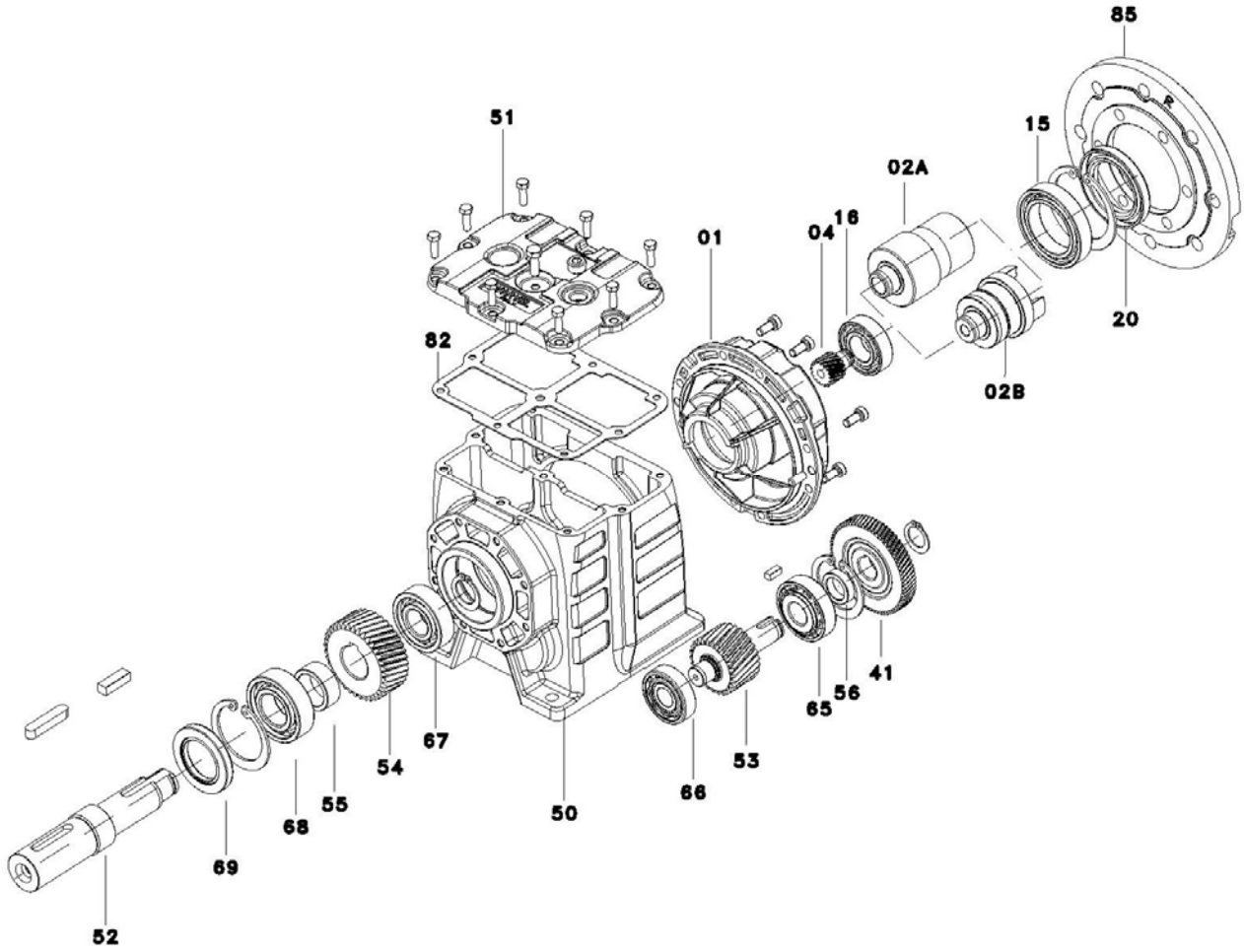
01	Oil seal	19	Bearing		
02	Housing	20	Bearing		
03	Key	21	Pinion		
04	Output shaft	22	Key		
05	Key	23	Gear		
06	Bearing	24	Bearing		
07	Spacer	26	Bearing		
11	Gasket	27	Gear		
13	Bearing	29	IEC input cover		
15	Pinion	33	Hollow input		
16	Key	35	Oil seal		
17	Hollow input				

Working Instructions & Maintenance RD

Product Layout

Series RD - 2 stages

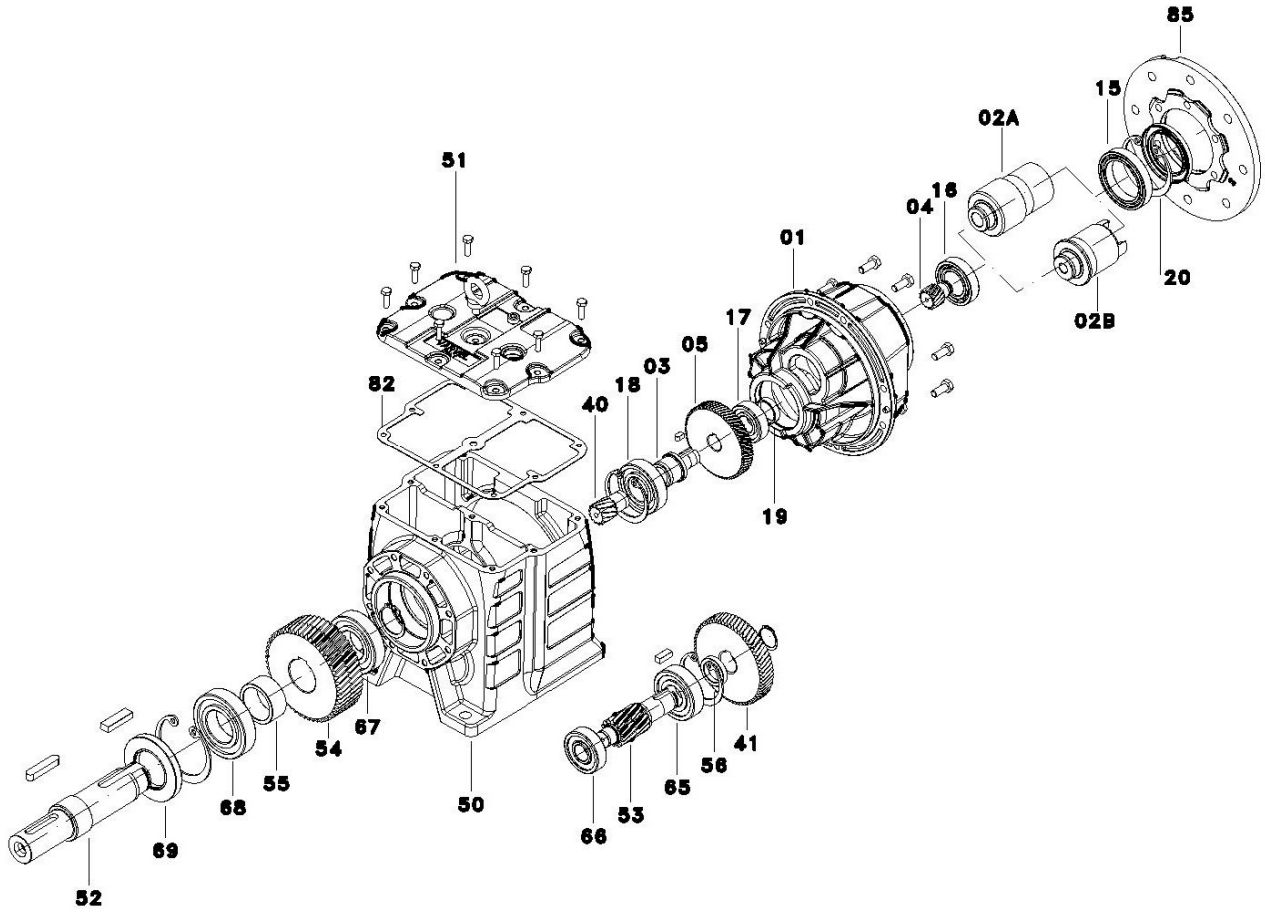
The layout shows the general structure of a two-stage foot-mounted helical gearbox type FRD.



01	Input cover	54	Gear		
02A	Hollow input IEC	55	Spacer		
02B	Hollow input “G”	65	Bearing		
04	Pinion	66	Bearing		
15	Bearing	67	Bearing		
16	Bearing	68	Bearing		
20	Oil seal	69	Oil seal		
41	Gear	82	Gasket		
50	Housing	85	Motor Flange		
51	Upper cover				
52	Output shaft				
53	Pinion				

Series RD - 3 stages

The layout shows the general structure of a three-stage foot-mounted helical gearbox type FRD.



01	Input cover	40	Pinion	68	Bearing
02A	Hollow input IEC	41	Gear	69	Oil seal
02B	Hollow input “G”	50	Housing	82	Gasket
03	3rd stage shaft	51	Upper cover	85	Motor flange
04	Pinion	52	Output shaft		
05	Gear	53	Pinion		
15	Bearing	54	Gear		
16	Bearing	55	Spacer		
17	Bearing	56	Spacer		
18	Bearing	65	Bearing		
19	Spacer	66	Bearing		
20	Oil seal	67	Bearing		

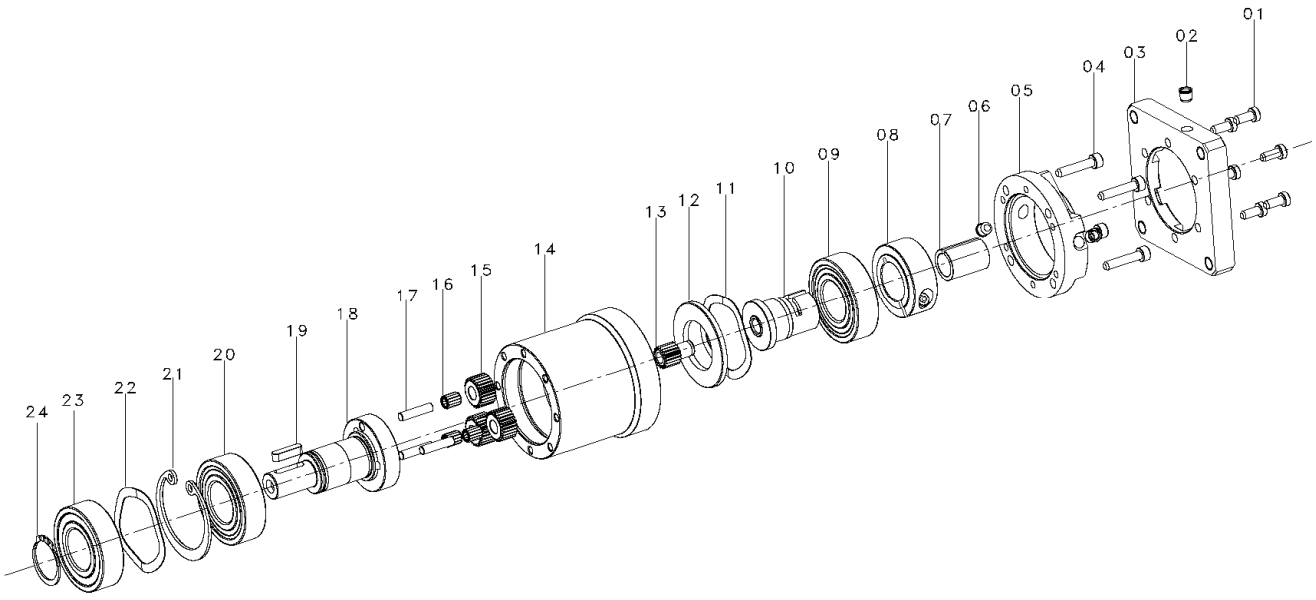
Working Instructions & Maintenance

RG

Product Layout

Series RG - 1 stage

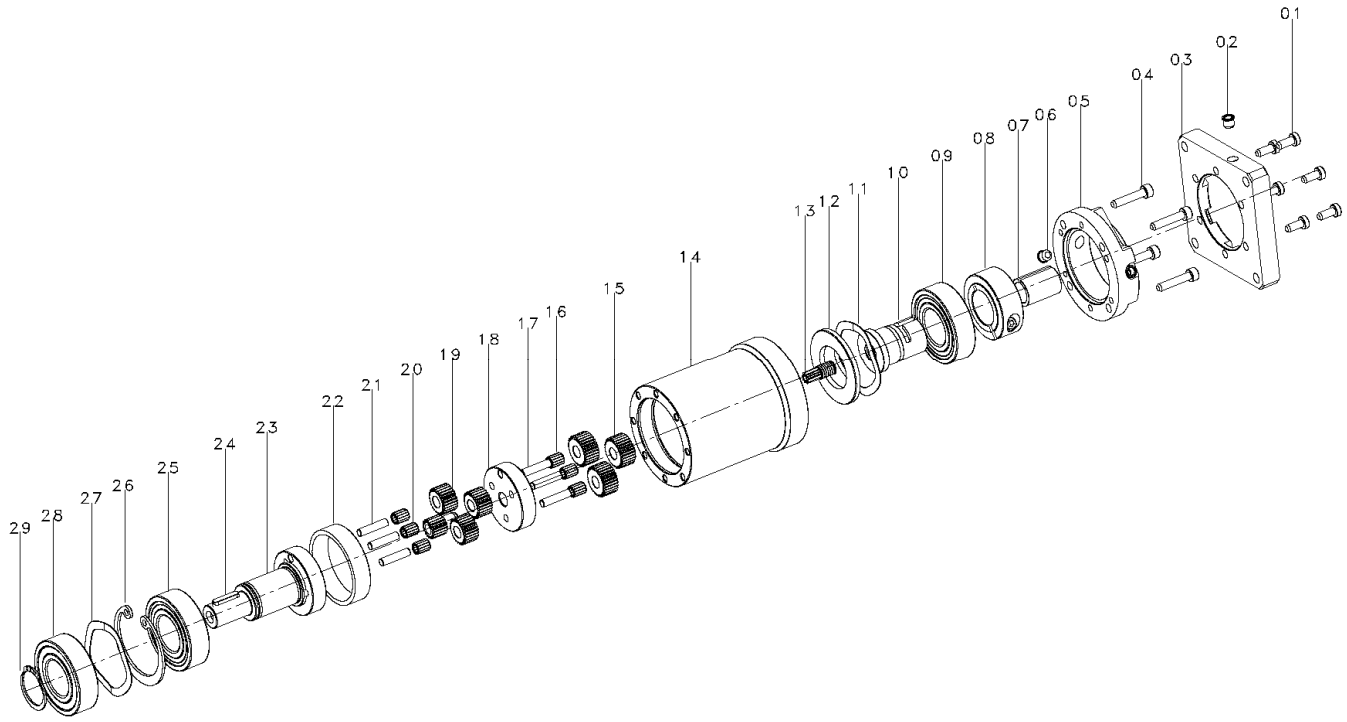
The layout shows the general structure of a one-stage reduced backlash planetary gearbox type FRG.



01	Screw	13	Sun gear		
02	Plug	14	Ring gear body		
03	Motor flange	15	Planet gear		
04	Screw	16	Needle bearing		
05	Input flange	17	Planet shaft		
06	Plug	18	Planet carrier		
07	Adapter	19	Key		
08	Clamp coupling	20	Bearing		
09	Bearing	21	Snap ring		
10	Input shaft	22	Shim		
11	Shim	23	Bearing		
12	Spacer	24	Snap ring		

Series RG - 2 stages

The layout shows the general structure of a two-stage reduced backlash planetary gearbox type FRG.



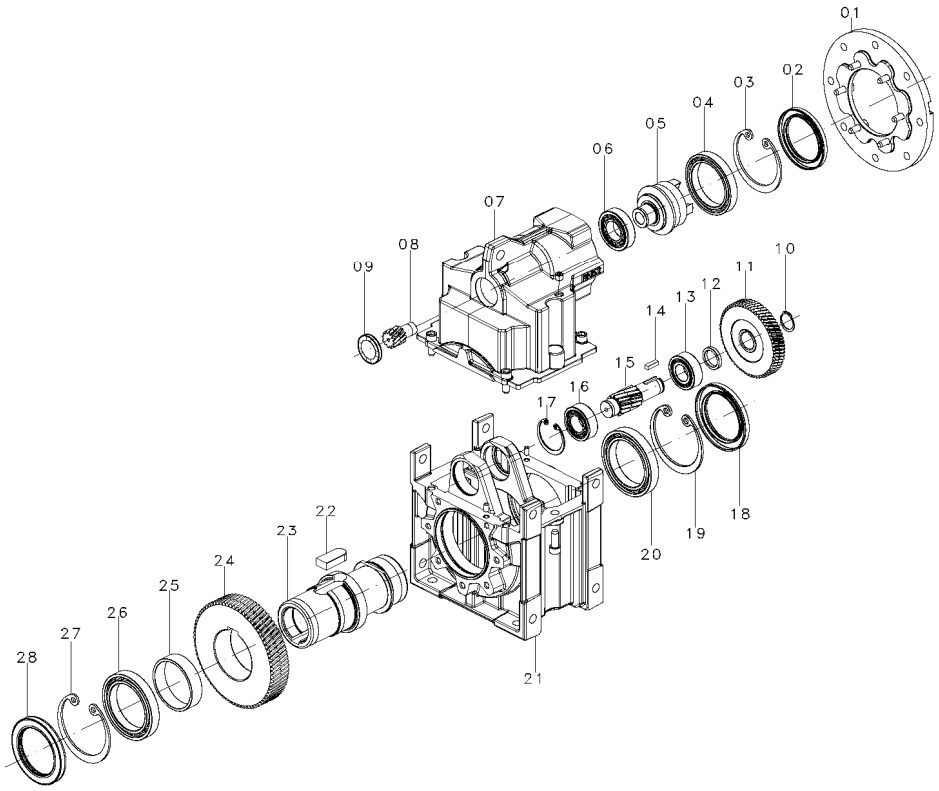
01	Screw	13	Sun gear	25	Bearing
02	Plug	14	Ring gear body	26	Snap ring
03	Motor flange	15	Planet gear	27	Shim
04	Screw	16	Needle bearing	28	Bearing
05	Input flange	17	Planet shaft	29	Snap ring
06	Plug	18	Planet carrier		
07	Adapter	19	Planet gear		
08	Clamp coupling	20	Needle bearing		
09	Bearing	21	Planet shaft		
10	Input shaft	22	Spacer		
11	Shim	23	Planet carrier		
12	Spacer	24	Key		

Working Instructions & Maintenance RN

Product Layout

Series RN - 2 stages

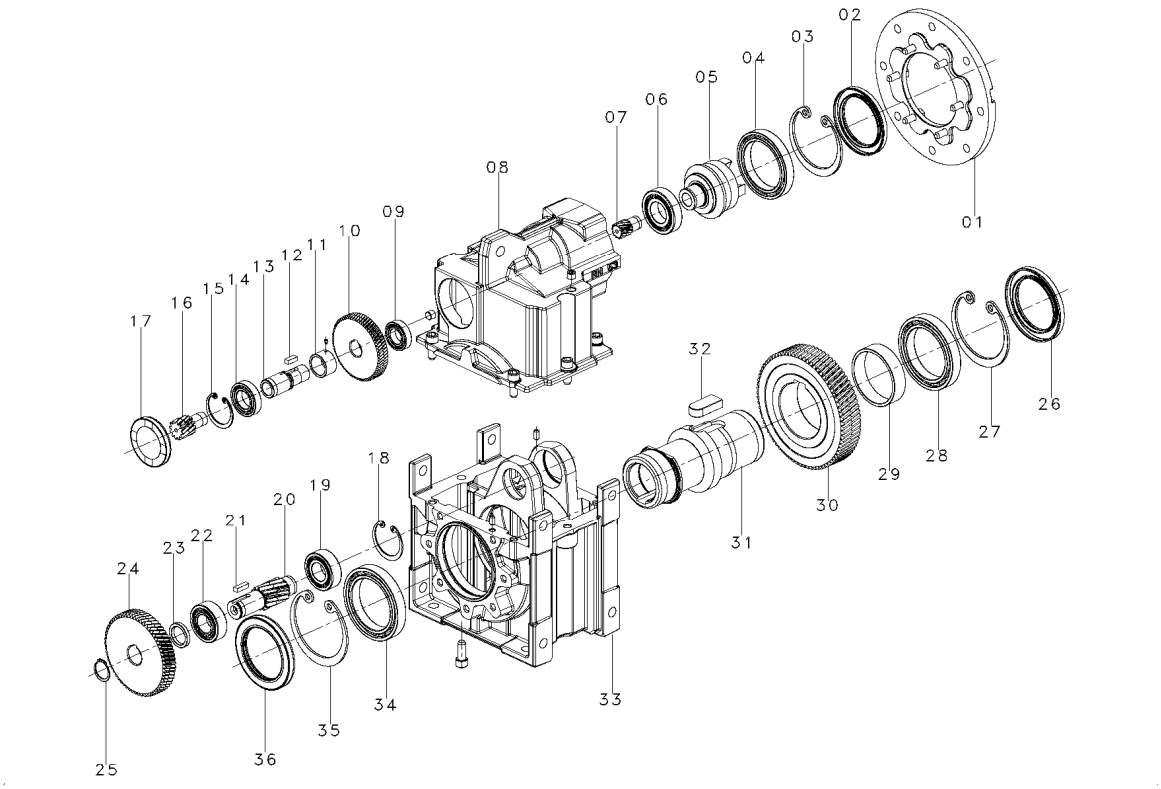
The layout shows the general structure of a two-stage parallel shaft gearbox type FRN with through hollow output shaft.



01	Input flange	13	Bearing	25	Spacer
02	Oil seal	14	Key	26	Bearing
03	Snap ring	15	Pinion	27	Snap ring
04	Bearing	16	Bearing	28	Oil seal
05	Input shaft	17	Snap ring		
06	Bearing	18	Oil seal		
07	Cover	19	Snap ring		
08	Pinion	20	Bearing		
09	Oil seal RCA	21	Body		
10	Snap ring	22	Key		
11	Gear	23	Output shaft		
12	Spacer	24	Gear		

Series RN - 3 stages

The layout shows the general structure of a three-stage parallel shaft gearbox type FRN with through hollow output shaft.



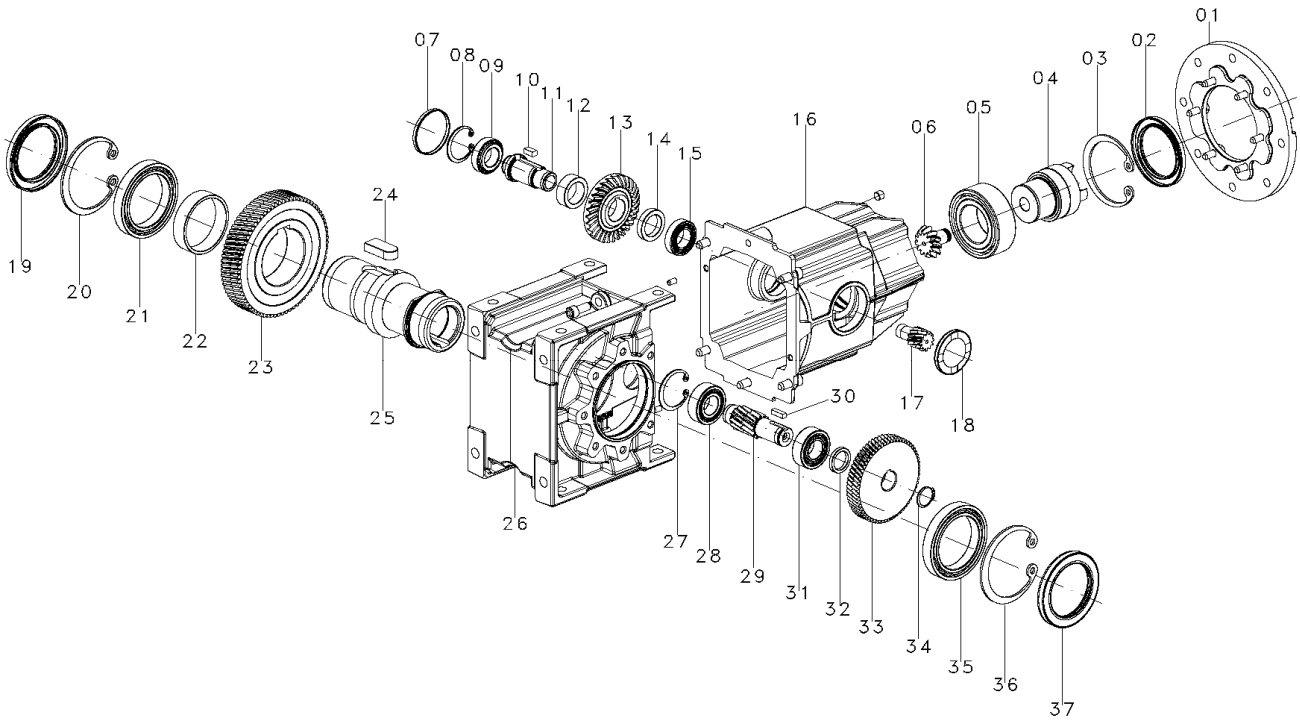
01	Motor flange	13	Shaft	25	Snap ring
02	Oil seal	14	Bearing	26	Oil seal
03	Snap ring	15	Snap ring	27	Snap ring
04	Bearing	16	Pinion	28	Bearing
05	Input shaft	17	Oil seal RCA	29	Spacer
06	Bearing	18	Snap ring	30	Gear
07	Pinion	19	Bearing	31	Output shaft
08	Cover	20	Pinion	32	Key
09	Bearing	21	Key	33	Body
10	Gear	22	Bearing	34	Bearing
11	Spacer	23	Spacer	35	Snap ring
12	Key	24	Gear	36	Oil seal

Working Instructions & Maintenance RO

Product Layout

Series RO

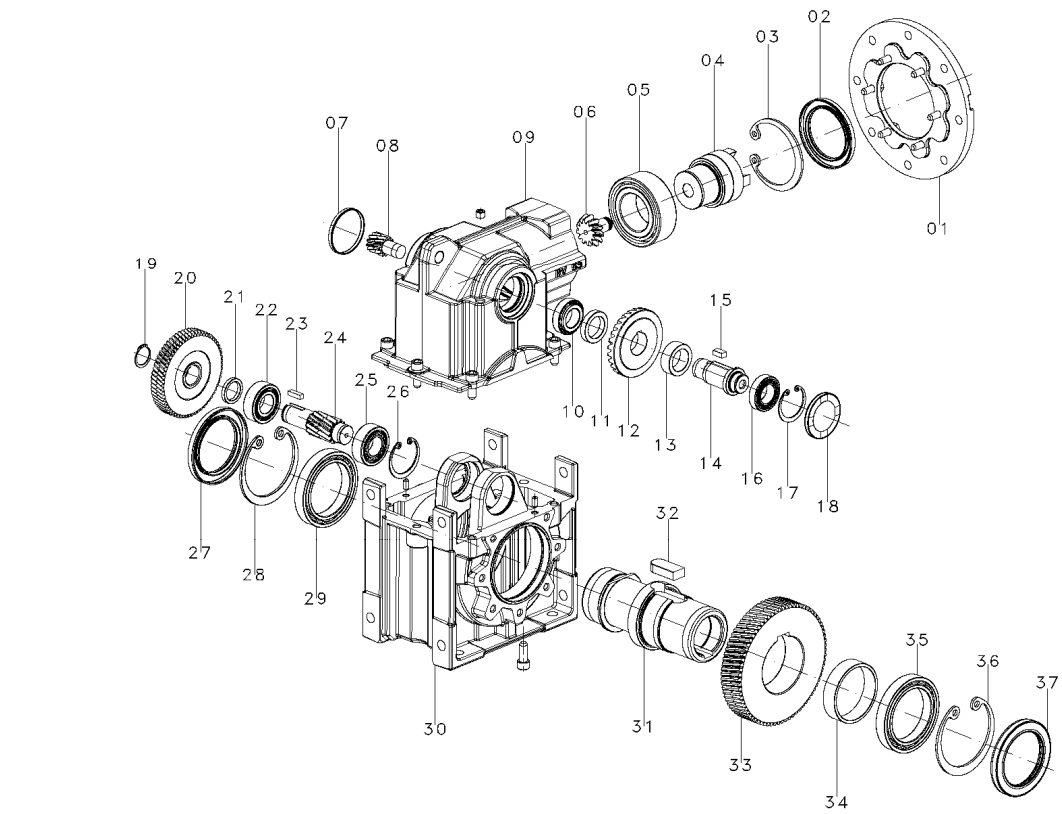
The layout shows the general structure of a three-stage bevel/helical gearbox type FRO with through hollow output shaft.



01	Motor flange	13	Gear	25	Output shaft
02	Oil seal	14	Spacer	26	Body
03	Snap ring	15	Bearing	27	Snap ring
04	Input shaft	16	Cover	28	Bearing
05	Bearing	17	Pinion	29	Pinion
06	Pinion	18	Oil seal RCA	31	Bearing
07	Oil seal RCA	19	Oil seal	32	Spacer
08	Snap ring	20	Snap ring	33	Gear
09	Bearing	21	Bearing	34	Snap ring
10	Key	22	Spacer	35	Bearing
11	Shaft	23	Gear	36	Snap ring
12	Spacer	24	Key	37	Oil seal

Series RV

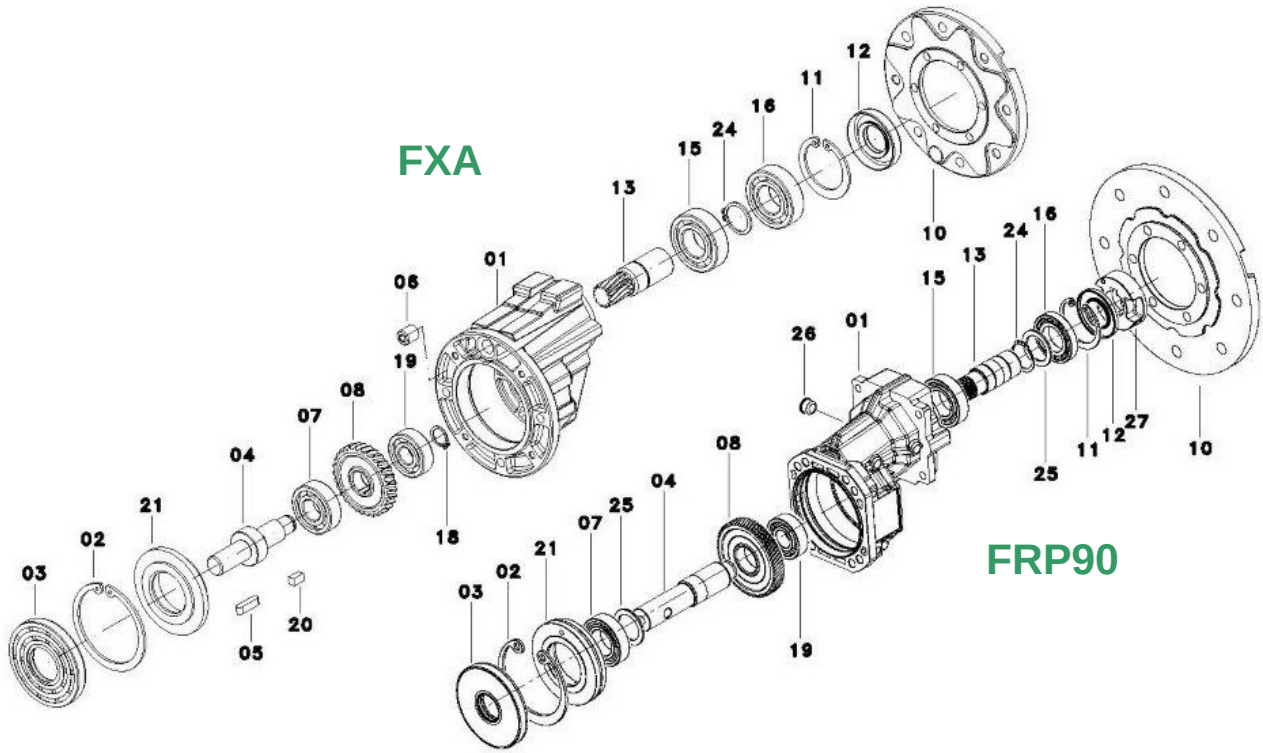
The layout shows the general structure of a three-stage bevel/helical gearbox type FRV with through hollow output shaft.



01	Motor flange	13	Bearing	25	Bearing
02	Oil seal	14	Shaft	26	Snap ring
03	Snap ring	15	Key	27	Oil seal
04	Input shaft	16	Bearing	28	Snap ring
05	Bearing	17	Snap ring	29	Bearing
06	Pinion	18	Oil seal RCA	30	Body
07	Oil seal RCA	19	Snap ring	31	Output shaft
08	Pinion	20	Gear	33	Gear
09	Cover	21	Spacer	34	Spacer
10	Bearing	22	Bearing	35	Bearing
11	Spacer	23	Key	36	Snap ring
12	Gear	24	Pinion	37	Oil seal

Series RP and XA

The layout shows the general structure of a one-stage helical gearbox type FRP and FXA, flange mounting.

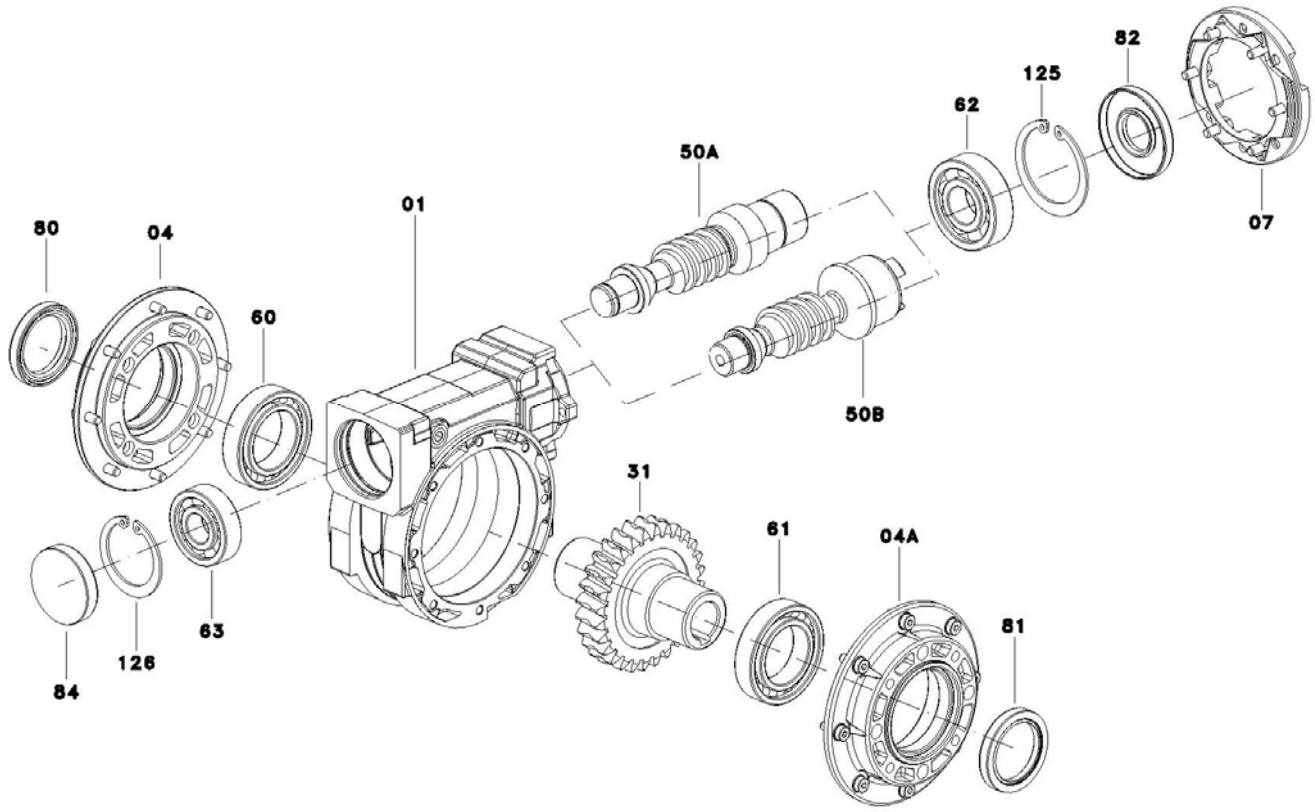


01	Body	15	Bearing		
02	Snap ring	16	Bearing		
03	Oil seal	18	Snap ring		
04	Output shaft	19	Bearing		
05	Key	20	Key		
06	Screw	21	Adapter		
07	Bearing	24	Snap ring		
08	Gear	25	Spacer		
10	Motor flange	26	Plug		
11	Snap ring	27	Flexible coupling		
12	Oil seal				
13	Pinion				

Series RS

The layout shows the general structure of a worm gearbox type FRS with through hollow output shaft and shaft mounting.

The Series TA (helical / worm) are made of a helical one-stage gearbox XA mounted as input stage onto a standard worm box RS and the Series RS/RS (two stage worm) of two standard worm boxes RS and an appropriate combination kit.



01	Body	84	Oil seal RCA		
04	Side cover	125	Snap ring		
07	Motor flange	126	Snap ring		
31	Worm wheel				
50	Worm shaft				
60	Bearing				
61	Bearing				
62	Bearing				
63	Bearing				
80	Oil seal				
81	Oil seal				
82	Oil seal				

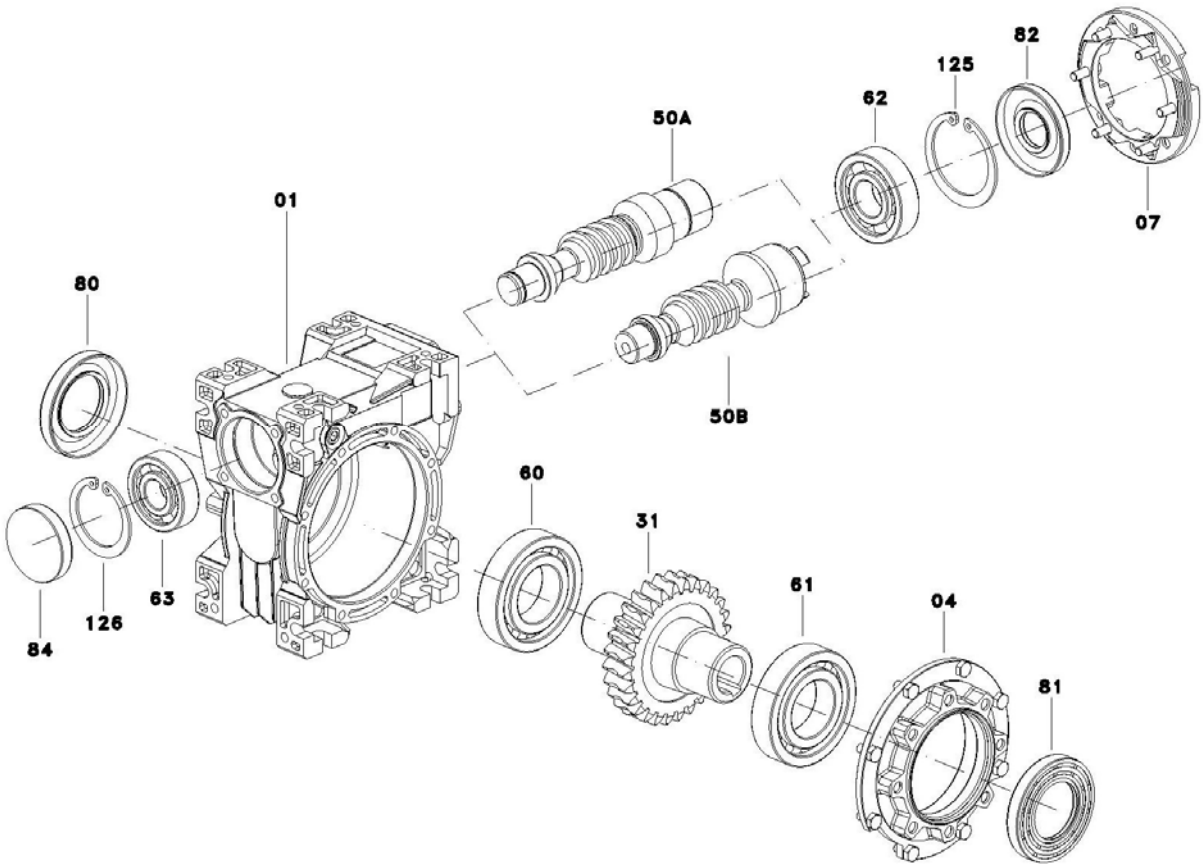
Working Instructions & Maintenance

Product Layout

Series RT

The layout shows the general structure of a foot-mounted worm gearbox type FRT.

The Series TA (helical / worm) are made of a helical one-stage gearbox XA mounted as input stage onto a standard worm box RT and the Series RT/RT (two stage worm) of two standard worm boxes RT and an appropriate combination kit.

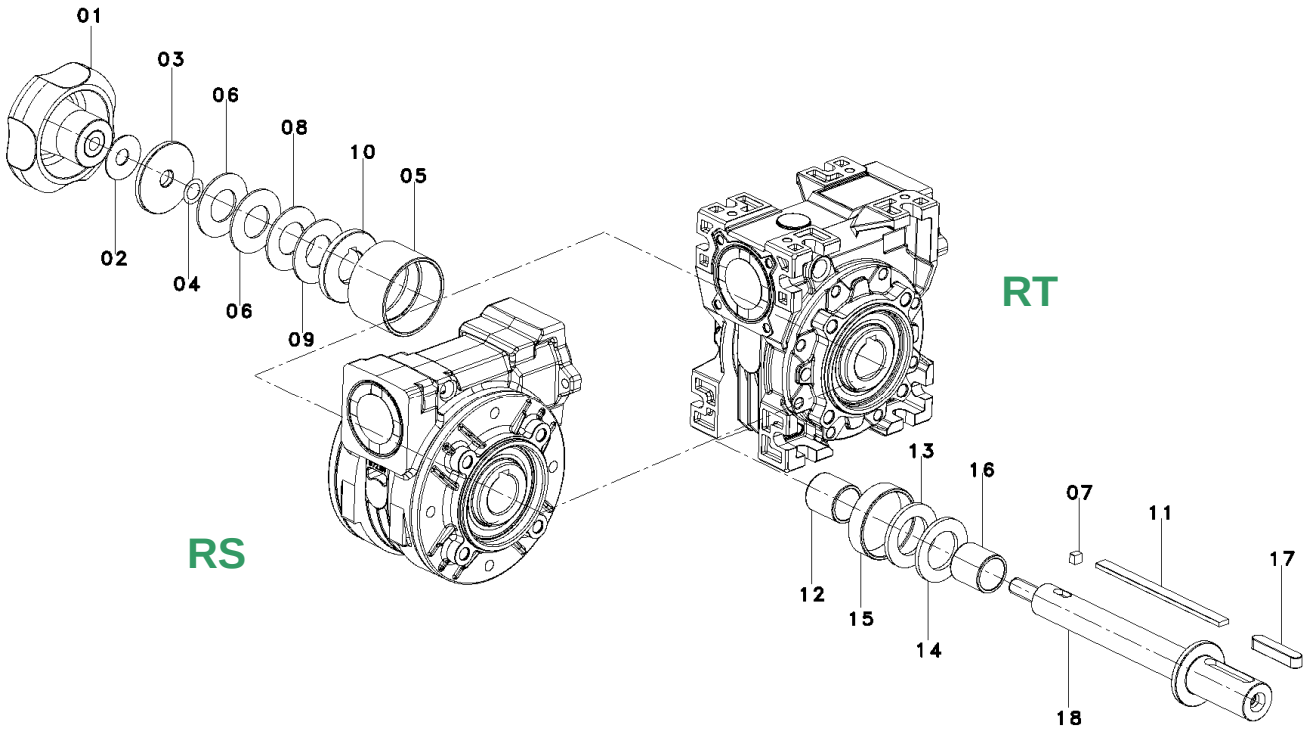


01	Housing	82	Oil seal		
04	Side cover	84	Oil seal RCA		
07	Motor flange	125	Seeger ring		
31	Worm wheel	126	Seeger ring		
50A	Worm shaft IEC				
50B	Worm shaft “G”				
60	Bearing				
61	Bearing				
62	Bearing				
63	Bearing				
80	Oil seal				
81	Oil seal				

TLE - Torque Limiter Option

The layout shows the general structure of a torque limiter type TLE to fit inside a worm gearbox Series RS or RT.

The Torque Limiter TLE is directly fitted into the hollow shaft of already assembled standard gearboxes without any special tooling.



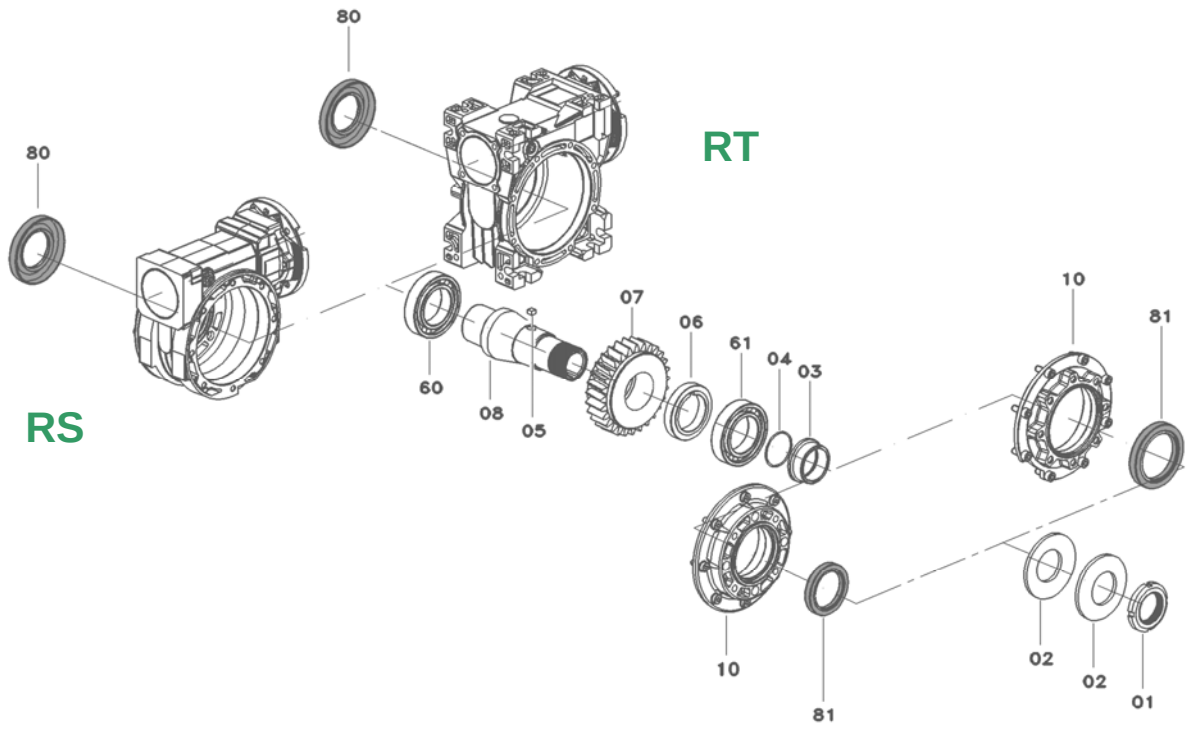
01	Setting torque hand wheel	13	Front washer		
02	Belville washer	14	Front friction		
03	Spacer	15	Front protection		
04	Spacer	16	Front bush		
05	Rear protection	17	Key		
06	Belville washer	18	Low speed shaft		
07	Key				
08	Thrust washer				
09	Rear friction				
10	Rear washer				
11	Key				
12	Rear bush				

Working Instructions & Maintenance TLI

Product Layout

TLI - Torque Limiter Option

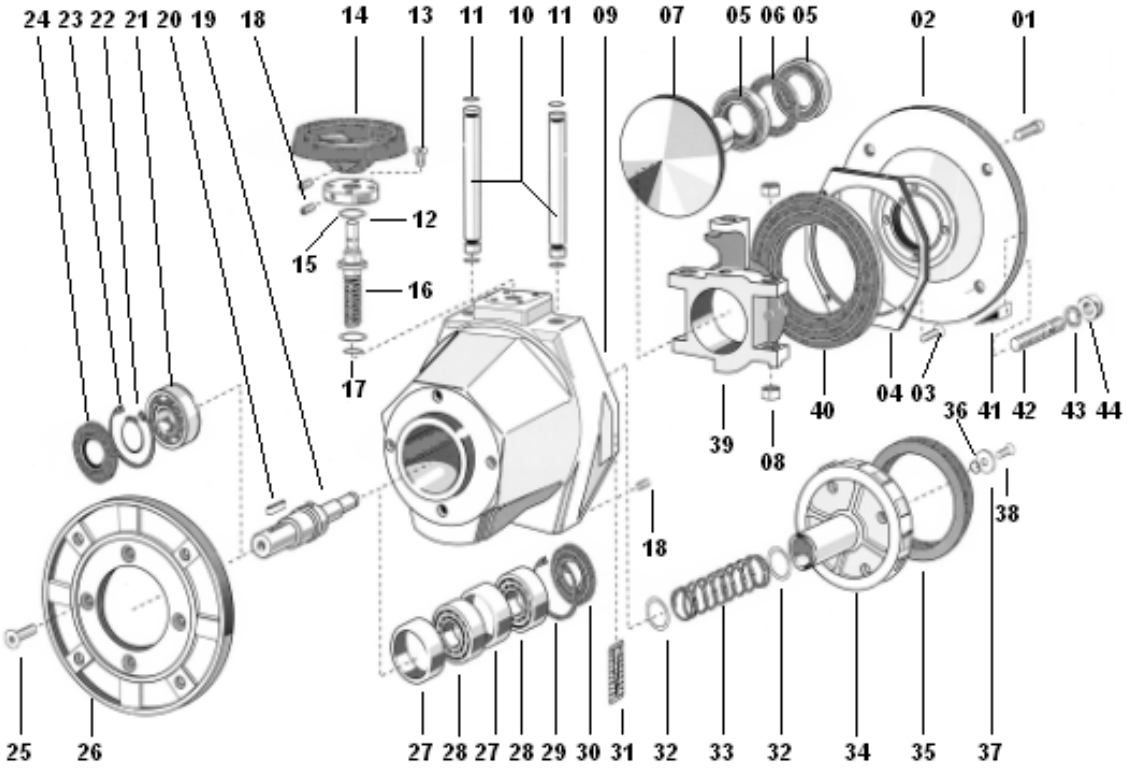
The layout shows the general structure of a built-in torque limiter type TLI incorporated inside a worm gearbox Series RS or RT.



01	Lock nut	81	Oil seal		
02	Bellville washer				
03	Bush				
04	Oil seal				
05	Key				
06	Spacer				
07	Worm wheel				
08	Hollow output shaft				
10	Cover				
60	Bearing				
61	Bearing				
80	Oil seal				

Series VR

The layout shows the general structure of a flange-mounted variator without gearbox type.



01	Screw	14	Control hand wheel	27	Spacer
02	IEC motor flange	15	Control shaft lock	28	Bearing
03	Screw	16	Control shaft	29	Snap ring
04	Seal plate	17	Oil seal OR	30	Oil seal
05	Bearing	18	Screw	31	Index scale
06	Spacer	19	Output shaft	32	Snap ring
07	Cone	20	Key	33	Spring
09	Body	21	Bearing	34	Friction ring carrier
10	Cylindrical slide	22	Snap ring	35	Friction ring
11	Oil seal OR	23	Snap ring	39	Cone holder
12	Oil seal OR	24	Oil seal	40	Bellows seal
13	Screw	26	Output flange	41	Index

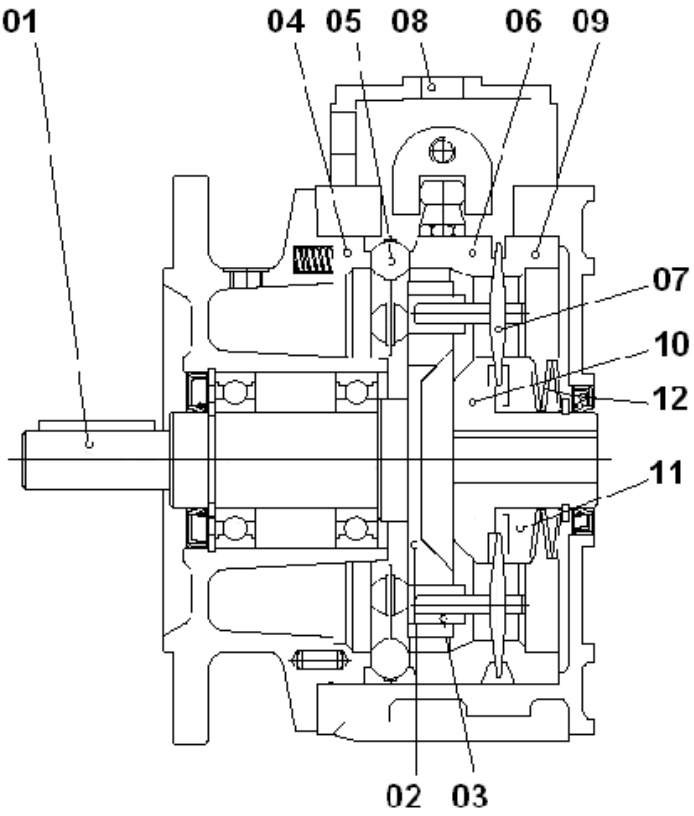
Working Instructions & Maintenance

VS

Product Layout

Series VS

The layout shows the general structure of a flange-mounted variator without gearbox type.



01	Output shaft				
02	Planet carrier				
03	Sliding bush				
04	Adjusting track				
05	Ball carrier				
06	External mobile track				
07	Planet				
08	Adjusting box				
09	External fixed track				
10	Internal fixed track				
11	Internal mobile track				
12	Belville washer				

INSTALLATION

4.1 Tolerances

Tolerances are recommended according to DIN 748 as follows

- Shafts: solid input or output ISO h6
  hollow input ISO E8
  hollow output ISO EH7
  centre hole DIN 332, DR
- Flanges: spigot ISO h7

4.2 Precautions

Check that the unit to be put into service is rightly sized to perform the required function and that its mounting position complies with the order. Such data are shown in the nameplate fitted on the unit.

Check mounting stability so that the unit operates without vibrations or overloads, or insert damping couplings or torque limiters.

Care must be taken to ensure exact positioning and steadiness when handling the units to not origin damages to normal operation of the unit.

When hoisting, use relevant locations of the housing or eyebolts if provided, or foot or flange holes.

Never hoist on any moving part (input or out-put shafts).

4.3 Groundwork

Clean carefully all the surfaces of shafts and flanges paying attention that the used product for cleaning does not came in contact with sealing lips of oil seals to avoid any damage and lubricant leakages.

4.4 Set up

The unit may be connected for clockwise or counter-clockwise rotation.

Stop immediately the unit when unexpected running or noise occurs: if the part originating the anomaly is not identified, other parts may be damaged with consequent difficulty in going back to the cause.

4.5 Pulleys, Pinions, Couplings

Bore tolerance F7 is recommended when fitting pulleys, pinions, couplings, etc. on the output shaft.

It is also recommended to not fit or extract with mallets or hammer hits to not damaging internal parts, but to use the shaft-head threaded bore as reaction to fitting or extraction.

- Belt drives: the force imposed on the shaft due to belt tension to not exceed the maximum permissible radial force of the unit.
- Chain drives: properly lubricate the chain drive and check that no pitch differences hinder its smooth running.

4.6 Torque arm

The torque arm Type BR (Series RS) or Type BT (Series RT) can rotate by 45° within the arc 45° to 315°.
The types BRV (Series RS) and Type BTV (Series RT) incorporate a Vulkollan® bush to allow vibration dumping.

4.7 Painting

Carefully protect oil seals, coupling faces and shafts when re-painting the units.

5 STARTING

5.1 Series RS, RT

The worm gearbox originates the following rotations of input and output shafts, with worm shaft upwards :

- inverse rotation
  one-stage gearboxes (RS, RT);
- original rotation
  helical/worm gearboxes (RA, TA);
- inverse rotation
  two-stage gearboxes (RS/RS, RT/RT).

Worm shaft downwards: opposite rotations.

5.2 Series RC, RD, RN, RO/RV, RP, XA, VR, VS

The helical or bevel/helical gearbox and the variator originate the following rotations of input and output shafts :

- inverse rotation
  odd-stage gearboxes (one, three, etc.)
  and variators with odd-stages ;
- original rotation
  even-stage gearboxes (two, four, etc.)
  and variators without stages or even-stages .

6 INSPECTIONS AND MAINTENANCE

6.1 Intervals

Although the units are no-load run tested in the factory before despatch, it is advisable not to run them at maximum load for the first 20-30 hours to allow proper running in.

For variators, run throughout the full speed range at reduced load before the full load is applied.

The units are delivered already filled with synthetic long-life oil: no servicing or refilling within the average lifetime of 15,000 hours for operation according to SF1.0.

Refer to the Catalogues as appropriate to the right definition of Service Factor.

Variators Series VR run dry and bearings are lifetime grease packed; therefore, there is no part needing periodical maintenance, the friction ring replacement excepted on normal wearing conditions. .

6.2 Maintenance Servicing

Units supplied without any oil plugs:

Series RC (sizes 05, 10, 20, 30)
Series RD (sizes 0, 1, 2, 3, 4)
Series RG (sizes 05, 07, 09, 12)
Series RN (sizes 1, 2, 3, 4, 5, 6)
Series RO (sizes 1, 2, 3, 4, 5, 6)
Series RV (sizes 1, 2, 3, 4, 5, 6)
Series RP (size 71)
Series RS (sizes 28, 40, 50, 60, 70, 85)
Series RT (sizes 28, 40, 50, 60, 70, 85, 110)
Series XA (sizes 63, 71, 80, 100)
Series VR (sizes 63, 71, 80, 90)

6 INSPECTIONS AND MAINTENANCE (contd)

6.2 Maintenance Servicing

Units supplied with oil plugs:

Series RC (sizes 40, 50, 60)

Series RS (sizes 110, 130, 150)

Series VS (sizes 63, 71, 80, 90, 100, 112)

Periodically check the seal condition and possible evidence of lubricant leakages.

If lubricant replacement or topping is required, do not mix synthetic lubricants with mineral based lubricants.

According to working conditions:

Eliminate by means of a vacuum cleaner any dust accumulation thicker than 5 mm.

- **GEARBOXES**
  - ➔ **Every 500 working hours or every month:**
    Oil seal visual check to monitoring any lubricant leakage.
  - ➔ **Every 3000 working hours or every 6 months:**
    Oil seal check and replacement if considerably used.
  - ➔ **Every 5 years:**
    Replace synthetic oil.

- **VARIATORS - Series VR only**

Series VR
Variation section, dry running and with lifetime grease-packed bearings, does not require any periodic servicing, excepted the friction ring replacement on normal wearing conditions.

- ➔ **According to working conditions**:
  Replace friction ring, if considerably used.
- ➔ **Every 3000 working hours or every 6 months:**
  Check output shaft angular play and oil seal and corrugated hood integrity.
- ➔ **Every 6000 working hours or every year:**
  Replace friction ring.

Series VS
Variation section, mineral oil lubricated, requires periodic servicing as follows:

- ➔ **Every 500 working hours or every month:**
  Oil seal visual check to monitoring any lubricant leakage.
- ➔ **Every 3000 working hours or every 6 months:**
  Oil seal check and replacement if considerably used.
- ➔ **Every 5 years:**
  Replace mineral oil .

7 MALFUNCTIONING

7.1 Major Events

- **Running noise, continuous**

  ➔ Grinding sound: damaged bearing .
  Replace bearing & check the oil

  ➔ Knocking sound: irregular gearing
  Contact Customer Service

- **Running noise, intermittent**

  ➔ Foreign particles in the oil
  Contact Customer Service

  ➔ Series VR - Damaged friction ring
  Rectify the cause and replace friction ring.
  See the next Section «Friction Ring Replacement»

- **Oil leakages**
  (see also next note)

  ➔ Damaged oil seal
  Replace the oil seal

  ➔ Loosen screws
  Tighten the screws

  ➔ Inner overpressure
  Contact Customer Service

  ➔ Oil seal fitting
  Defective fitting or fitting-lubricant melting

- **No rotation of output shaft**

  ➔ Internal connection cut off
  Contact Customer Service

  ➔ Series VR - Friction ring end of life
  Replace the friction ring
  See the next Section «Friction Ring Replacement»

  ➔ Series VR - Contaminated friction ring
  Clean carefully cone and ring working areas with solvent of similar product .
  See the next Section «Friction Ring Replacement»

7.2 Customer Service

We recommend to always provide the Customer Service with the following information:

- Full data of name plate and/or Serial No.
- Type of application
- Duty cycle
- Circumstances of malfunctioning
- Supposed causes.

8 LUBRICANTS

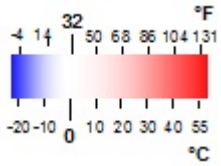
8.1 Recommended Types

All the units are delivered already filled with synthetic long-life oil.

The safe operation of the units with ISO VG 320 grade lubricant is recommended in the ambient temperature range

-20 to +55 °C (-4 to 131 °F)

Other temperatures require specific recommendations for low or high temperatures to ask the Customer Service.

Temperature range	ISO VG	ARAL	bp	Castrol	EXXON	Mobil	TEXACO	TOTAL	
	* 320	Degol GS 320	Enersyn SG-XP320	Alphasyn PG 320	Glycolube 320	Glygoyle HE 320	Synlube CLP 320	Carter SY 320	Tivela SC 320
	** 320	Eural Gear 320	---	Vitalube GS 320	Gear Oil FM 320	Mobil DTE FM 320	---	Nevas-tane EP 320	Cassida Fluid GL 320

* - Synthetic Oil

** - Food Industry Oil

8.2 Quantity [litres]

RC

1c	l_1	l_2	l_3	2c	l_1	l_2	l_3	3c	l_1	l_2	l_3
RC105	0.05	0.65	0.05	RC205	0.13	0.15	0.15	RC305	0.17	0.30	0.30
RC110	0.10	0.13	0.10	RC210	0.17	0.25	0.17	RC310	0.25	0.50	0.35
RC120	0.17	0.25	0.17	RC220	0.50	0.60	0.50	RC320	0.60	0.80	0.60
RC130	0.30	0.50	0.30	RC230	0.70	1.15	0.80	RC330	1.15	1.50	1.15
RC140	0.60	1.15	0.60	RC240	1.15	2.25	2.00	RC340	1.50	3.00	2.25
RC150	1.50	2.25	1.50	RC250	2.25	4.40	4.00	RC350	3.75	6.00	5.00
RC160	3.00	4.40	3.00	RC260	6.00	8.80	8.00	RC360	8.00	10.00	8.80

1c - One stage 2c - Two stages 3c - Three stages

l_1 - B3, B6, B7, B8, B5 l_2 - V1, V5 l_3 - V3, V6

RD

2c	H	V	3c	H	V
RD02	0.20	0.28	RD03	0.30	0.38
RD12	0.50	0.70	RD13	0.50	0.70
RD22	0.80	1.00	RD23	0.80	1.00
RD32	1.30	1.80	RD33	1.60	2.10
RD42	2.20	3.00	RD43	2.20	3.40
RD52	4.50	5.50	RD53	4.50	6,.50
RD62	7.00	9.00	RD63	7.00	11.00

2c - Two stages 3c - Three stages

H = H1, H2, H3, H4

V = V5, V6

Working Instructions & Maintenance

Lubricants

8.2 **Quantity** [litres] (contd)

RP

FRP	l
71	0.05

RS

RS	l
28	0.03
40	0.08
50	0.13
60	0.20
70	0.35
85	0.60
110	1.50
130	2.75
150	4.40

l - Litres FRS

RA	l_1 / l_2
63 / 40	0.04 / 0.08
63 / 50	0.04 / 0.13
63 / 60	0.04 / 0.20
71 / 50	0.06 / 0.13
71 / 60	0.06 / 0.20
71 / 70	0.06 / 0.35
71 / 85	0.06 / 0.60
80 / 60	0.10 / 0.20
80 / 70	0.10 / 0.35
80 / 85	0.10 / 0.60
80 / 110	0.10 / 1.50
100 / 110	0.20 / 1.50
100 / 130	0.20 / 2.75
100 / 150	0.20 / 4.40

l_1 / l_2 - Litres FXA / FRS

RS / RS	l_3 / l_4
28 / 28	0.03 / 0.03
28 / 40	0.03 / 0.10
28 / 50	0.03 / 0.15
28 / 60	0.03 / 0.25
40 / 70	0.10 / 0.35
40 / 85	0.10 / 0.63
50 / 110	0.15 / 1.50
60 / 130	0.25 / 2.75
70 / 150	0.35 / 4.40

l_3 / l_4 - Litres FRS / FRS

RT

RT	l
28	0.03
40	0.08
50	0.13
60	0.20
70	0.35
85	0.60
110	1.50

l - Litres FRT

TA	l_1 / l_2
63 / 40	0.04 / 0.08
63 / 50	0.04 / 0.13
63 / 60	0.04 / 0.20
71 / 50	0.06 / 0.13
71 / 60	0.06 / 0.20
71 / 70	0.06 / 0.35
71 / 85	0.06 / 0.60
80 / 60	0.10 / 0.20
80 / 70	0.10 / 0.35
80 / 85	0.10 / 0.60
80 / 110	0.10 / 1.50
100 / 110	0.20 / 1.50

l_1 / l_2- Litres FTA / FRT

RT / RT	l_3 / l_4
28 / 28	0.03 / 0.03
28 / 40	0.03 / 0.08
28 / 50	0.03 / 0.13
28 / 60	0.03 / 0.20
40 / 70	0.08 / 0.35
40 / 85	0.08 / 0.60
50 / 110	0.13 / 1.50

l_3 / l_4 - Litres FRT / FRT

XA

FXA	l
63	0.04
71	0.05
80	0.08
100	0.20

8.2 **Quantity** [litres] (contd)

RN

RN-2	H1 [l]	H2 [l]	H3 [l]	H4 [l]	V1 [l]	V2 [l]	RN-3	H1 [l]	H2 [l]	H3 [l]	H4 [l]	V1 [l]	V2 [l]
12	0.5	0.6	0.4	0.6	0.6	0.6	13	0.5	0.4	0.3	0.4	0.6	0.4
22	0.6	0.7	0.5	0.7	0.7	0.7	23	0.6	0.5	0.4	0.5	0.7	0.5
32	1.1	1.3	0.8	1.3	1.2	1.2	33	1.2	1.0	0.6	1.0	1.2	1.0
42	2.8	1.8	1.2	1.8	2.7	2.7	43	2.5	1.5	0.9	1.5	2.2	1.9
52	5.1	3.2	2.1	3.2	4.9	4.9	53	5.0	2.8	1.6	2.8	4.0	3.4
62	9.2	5.8	3.8	5.8	8.8	8.8	63	9.0	5.0	2.9	5.0	7.2	6.1

RO
RV

RO	H1 [l]	H2 [l]	H3 [l]	H4 [l]	V1 [l]	V2 [l]	RV	H1 [l]	H2 [l]	H3 [l]	H4 [l]	V1 [l]	V2 [l]
13	0.6	0.6	0.6	0.6	0.7	0.7	13	0.6	0.5	0.4	0.5	0.6	0.6
23	0.9	0.7	0.9	0.7	1.0	1.0	23	0.9	0.6	0.5	0.6	0.7	0.7
33	1.5	1.2	1.4	1.2	1.7	1.7	33	1.5	1.0	0.8	1.0	1.2	1.2
43	2.8	2.0	1.6	2.0	2.5	2.5	43	2.9	1.9	1.2	1.8	2.6	2.6
53	5.1	3.6	2.9	3.6	5.0	5.0	53	5.2	3.4	2.1	3.2	4.7	4.7
63	9.2	6.5	5.2	6.5	9.0	9.0	63	9.4	6.1	3.8	5.8	8.5	8.5

RG

Low backlash planetary gearboxes are Kluber Synth GE 46 life-greased.

9 DIRECTIVE 94/9/CE - ATEX

9.1 General Information

Directive relates not only to electrical equipment, but also to all kind of machines and control components, separately or jointly, for use in potentially explosive atmospheres.

The following recommendations, issued to operations in potentially explosive environment, are meant as specific completion to the preceding «Working Instructions».

VARVEL-ATEX gearboxes are manufactured with housings and covers of metallic material, incorporating the transmission elements fitted on ball and roller bearings, with Viton oil seals on input and output shafts et with the adequate oil quantity to assure the design operation.

9.2 Prevalent Use

VARVEL-ATEX gearboxes are identified as « components », fundamental but without any autonomous function to operate units and protection systems for production, transport, storage, measurement, control and conversion of energy, or the processing of materials which are capable of causing an explosion through their own potential source of ignition.

9.3 References

VARVEL-ATEX gearboxes are designed and produced according to Directive 94/9/CE and the following standards

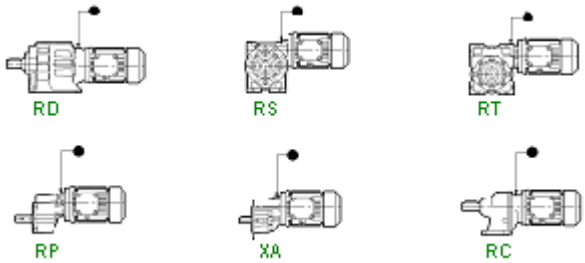
- EN 1127-1 - Explosion prevention and explosion protection**,** Fundamental notions and methodology.
- EN 13463-1 - Not electrical devices for potentially explosive atmospheres, Basic methods and required conditions.
- EN 13463-5 - Not electrical devices for potentially explosive atmospheres**,** Section 5: protection by construction safety « c ».
- EN 13463-6 - Not electrical devices for potentially explosive atmospheres, Section 6: protection by trigger source control « b ».
- EN 13463-8 - Not electrical devices for potentially explosive atmospheres, Section 8: protection by construction safety « k ».

9.4 Temperature

The units must be properly ventilated: check that ventilation temperature does not exceed 55 °C.

Measure housing temperature after 2 hours from start up and check that the difference between measured temperature (see sketch) and ambient temperature does not exceed the max. value of 80 °C.

In such a case, immediately stop the unit and call for Customer Service.



9.5 Safety Instructions

Electric motors and other elements to fit at the input or at the output of VARVEL-ATEX products, must be ATEX approved according the Directive 94/9/CE.

Expected temperature limits of the products must comply with temperature classes and max. temperature.

VARVEL gearboxes must be installed and serviced according to installation and servicing standards for classified environments against explosion hazard because of gas or dust presence (e.g. EN 60079-14, EN 60079-17, EN 50281-1-2 and any other acknowledged national standard).

In case of combustible dusts, it is mandatory the regular cleaning to avoid any accumulation of dust layers on product surfaces.

9.6 ATEX Marking

VARVEL Series RC, RD, RP, RS, RT, XA conform to design requirements required by Group II, Category 2 and to operate in areas with explosion danger of gas (Zone 1 and Zone 2) and combustive dust (Zone 21 and Zone 22).

- Dust accumulation: max. thickness on sur-face 5 mm maximum (EN50281-1-2)
- Casing: IP66 (Ingress Protection)

VARVEL-ATEX products are identified by the corresponding technical files, deposited at the Notified Body of Technical File Deposit, INERIS - France:

- Series RC **"ATEX 03RC"** - Series RD **"ATEX 03RD"** - Series RP **"ATEX 03RP"**
- Series RT **"ATEX 03RT"** - Series RS **"ATEX 03RS"** - Series XA **"ATEX 03XA"**

and marked

Ex **II 2 GD ck IP66**
T_{max}=120°C or
T_{max}=135°C T_{amb} -20/+55 °C-

where**:**

II	- Group II (Surface Industries)
2	- Category 2
G	- Explosive atmosphere with presence of gas, vapours or clouds Zone1 (2G) and Zone 2 (2G o 3G)
D	- Explosive atmosphere with presence of dust Zone 21 (2D) and Zone 22 (2D o 3D)
b	- Trigger Source Control « b »
c	- Construction Safety « c »
k	- Liquid Dipping « k »
IP66	- Protection Grade (Ingress Protection)
T_{max}	- Max. Surface Temperature
T_{amb}	- Ambient Temperature
ATEX 03XX	- Technical File Ref. No.

Working Instructions & Maintenance

Directive 94/9 CE (ATEX)

9.7 Maintenance Servicing

Strict observance of maintenance intervals is recommended to ensure appropriate working conditions and explosion-proof protection.

- ➔ **According to working conditions:**
  Elimination of any dust accumulation thicker than 5 mm by means of a vacuum cleaner.
- ➔ **Every 500 working hours or every month:**
  Visual inspection of oil seals to monitor any lubricant leakage.
- ➔ **Every 3000 working hours or every 6 months:**
  Inspection of oil seals and replacement if worn-out.
- ➔ **Every 5 years:**
  Replacement of synthetic oil.

9.8 Materials - Dangerous Zones - Categories

CORRESPONDENCE AMONG MATERIALS, DANGEROUS ZONES AND CATEGORIES
(ACCORDING TO DIRECTIVE 94/9/CE)

MATERIALS	DANGEROUS ZONES	CATEGORIES		
Gas Vapour Cloud	Zone 0	1G		
	Zone 1	1G	2G	
	Zone 2	1G	2G	3G
Dust	Zone 20	1D		
	Zone 21	1D	2D	
	Zone 22	1D	2D	3D

VARVEL-ATEX Products to not supply

9.9 Gas Temperature Class

GAS TEMPERATURE CLASS

GROUP	T1	T2	T3	T4	T5	T6
I	*Natural gas (Firedamp)					
II A	Ethyl acetate Methyl acetate Acetone Ammonia Benzene Benzol Chlorine methylene Chlorine ethylene Ethane Methane Methanol Carbon monoxide Naphtalene Propane Toluene Xylene	Butyl acetate Propyl acetate Amyl alcohol Ethyl alcohol Isobutyl alcohol Methyl alcohol n-butyl alcohol Acetic anhydride Ciclohexanone Liquefied petroleum gas Natural gas Iso-Propane Mono amyl acetate n-Butane	Cyclohexane Cyclohexanol Decane Heptane Hexane Gasoil Kerosene Naphtha Pentane Oil **	acetaldehyde Ethylic ether		
II B	Coke gas Water gas	1.3-butadiene Ethyl benzene Ethylene Ethylene oxide	Sulphydric acid Isoprene Oil **	Ethylic ether		
II C	Hydrogen	Acetylene				Ethyl nitrate carbon sulphide

* - VARVEL-ATEX Products to not supply

** - According to chemical composition

Working Instructions & Maintenance

Conformity Certificate (specimen)

VARVEL Spa Via 2 Agosto 1980. 9 40056 Crespellano BO Italy	dichiara sotto la propria responsabilità che il prodotto *declares on his own responsibility that the product*	**Riduttori** *Gearboxes* **Serie/s RS** **Serie/s RT** **Serie/s RD** **Serie/s RC** **Serie/s RP** **Serie/s XA**
	al quale questa dichiarazione si riferisce, è conforme alla Direttiva *to which this declaration relates to, complies with the Directive*	**94/9/EC (ATEX).**
	La conformità è stata verificata sulla base dei requisiti delle norme o dei documenti normativi *The conformity is under observance of the standard documents*	**EN 1127-1** **EN 13463-1** **EN 13463-5** **EN 13463-8**
	Modo di protezione: *Type of protection:*	**II 2 GD ck IP66** Tmax = 120°C oppure/*or* Tmax = 135°C Tamb. -20/+55°C
	I File Tecnici *The Technical Files* sono stati depositati presso l'Organismo Notificato di deposito del fascicolo tecnico *were deposited at the Notified Body of Technical File Deposit*	**ATEX 03RS, ATEX 03RT, ATEX 03RC, ATEX 03RD, ATEX 03RP, ATEX 03XA** **0080 INERIS,** **F-60550 Verneuil en Halatte, France**
	Firma autorizzata (Funzione: Presidente) *Authorized Signature* *(Function: President)*	**VARVEL Spa**
	Luogo e data dell'emissione *Place and Date of Issue*	**Crespellano, ../../....**

C-IUM ed01-2013 rev01 GB 251113

A socially responsible company

To the scope of intensifying our commitment to society, Varvel since 2004 started an ongoing support programme with three non-profit institutions: UNICEF (United Nations Children's Fund), MSF (Médicins sans Frontères) and ANT (National Cancer Association). Environmental respect and protection are also part of Varvel's values and this is why Varvel certified in 2001 its Environmental System to standard UNI EN ISO 14001.

borderline


RN•RO•RV


RS•RT


RD


RG


VR•VS


ISM•BSM


VARfarm
by VARVEL





VARVEL®
MOTION CONTROL SINCE 1955

VARVEL SpA
Via 2 Agosto 1980, 9
40056 Crespellano (BO) Italy
☎ +39 051 6721811
☎ +39 051 6721825
varvel@varvel.com
www.varvel.com

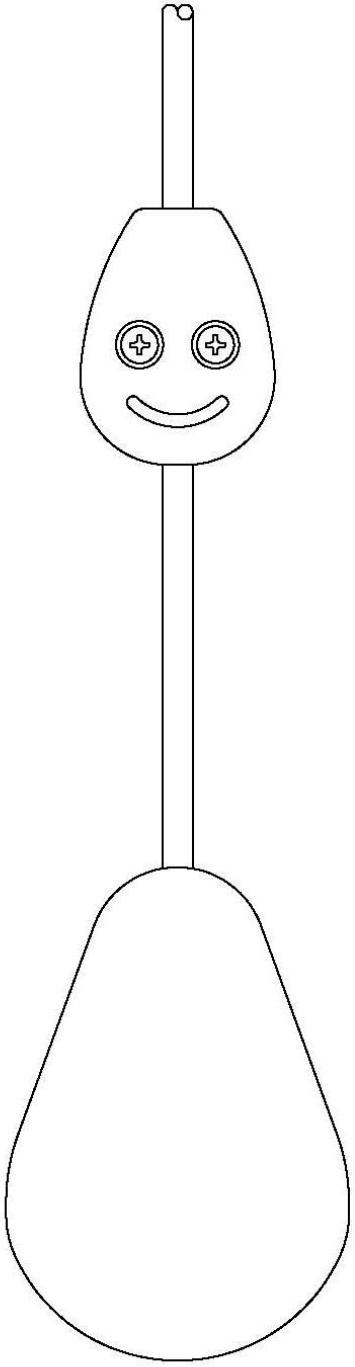
Branch:
MGM-VARVEL
Power Transmission Pvt Ltd
Chennai 600 095
Tamil Nadu - India
info@mgmvarvelindia.com
www.mgmvarvelindia.com

ELLIS PART NUMBERS:
2242000105 CONERY 2901-15 N.C. 15 FOOT CORD
2242000095 CONERY 2900-15 N.O. 15 FOOT CORD

CONERY MFG. INC.

NON-MERCURY FLOAT SWITCH - CONTROL DUTY

2900 MECHANICAL SERIES - NARROW ANGLE FLOAT SWITCH



GENERAL

DESIGNED FOR ACCURATE LIQUID LEVEL CONTROL IN MANY APPLICATIONS INCLUDING POTABLE WATER OR SEWAGE ENVIRONMENTS. THE FLOAT SWITCH CAN BE UTILIZED TO SIGNIFY SPECIFIC WATER LEVELS OR FOR DIRECT ALARM ACTUATION.

SWITCH VARIATIONS

NORMALLY OPEN (N/O) - GREEN SHELL

THE CONTACTS ARE OPEN (OR OFF) IN THE HANGING POSITION. AS THE FLOAT RISES 1" (5°) ABOVE HORIZONTAL, THE CONTACTS BECOME CLOSED AND ACTUATE (TURN ON) THE SWITCH. THIS FLOAT IS GENERALLY USED IN PUMP DOWN APPLICATIONS.

NORMALLY CLOSED (N/C) - GREEN/RED SHELL

THE CONTACTS ARE CLOSED (OR ON) IN THE HANGING POSITION. AS THE FLOAT RISES 1" (5°) ABOVE HORIZONTAL, THE CONTACTS BECOME OPEN AND ACTUATE (TURN OFF) THE SWITCH. THIS FLOAT IS GENERALLY USED IN PUMP UP APPLICATIONS.

SINGLE POLE, DOUBLE THROW (SPDT) - GREEN/BLUE SHELL

A VARIATION OF THE PREVIOUSLY LISTED SWITCHES. THIS FLOAT SWITCH CAN BE WIRED TO OPERATE AS EITHER (BUT NOT BOTH) A NORMALLY OPEN OR NORMALLY CLOSED SWITCH BASED ON THE USER'S NEED.

SWITCH SPECIFICATIONS

2900 SERIES MECHANICAL FLOAT SWITCHES ARE DESIGNED TO OPERATE UNDER THE FOLLOWING PARAMETERS.

MINIMUM OPERATING TEMPERATURE	-	32 DEGREES F.
MAXIMUM OPERATING TEMPERATURE	-	170 DEGREES F.
ELECTRICAL RATING	-	10 AMP-120 VAC, 5 AMP-240 VAC
ACTUATION POINT	-	1" ABOVE / BELOW HORIZONTAL.

POWER CORD SPECIFICATIONS

CONDUCTOR CORD - PHYSICAL	-	CHLORINATED POLY ETHYLENE.
ELECTRICAL FOR N/O OR N/C SWITCH	-	18 AWG 2, TYPE SJOOW - 300 V.
ELECTRICAL FOR SPDT SWITCH	-	18 AWG 3, TYPE SJOOW - 300 V.

FLOAT SPECIFICATIONS

DURABLE POLYPROPYLENE MATERIAL CONSTRUCTION.
SOLID POLYURETHANE FOAM INTERIOR.
LEAK PROOF, SHOCK PROOF, AND IMPACT RESISTANT.
RESISTANT TO SEWAGE AND WASTEWATER APPLICATIONS.

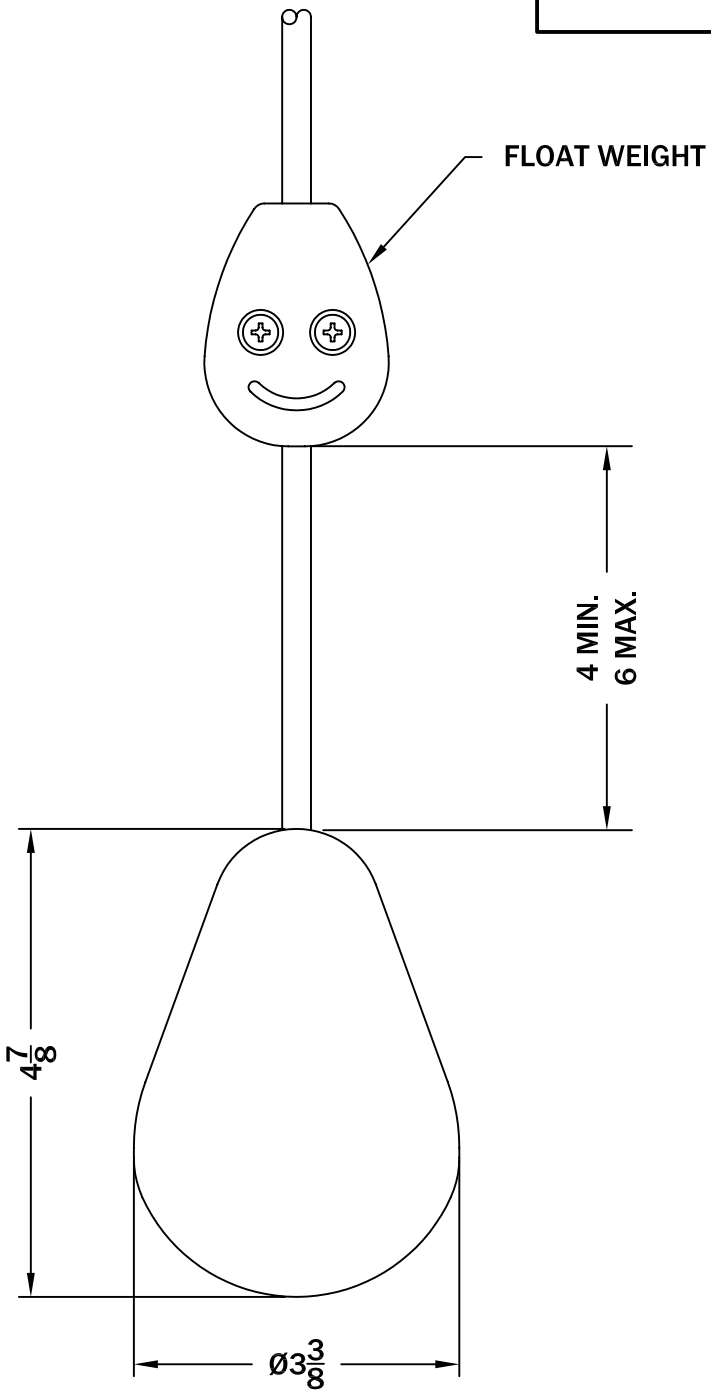
CORD WEIGHT

ZINC PLATED CAST IRON - 1.22 LBS.
SPLIT WEIGHT DESIGN ALLOWS FOR EASY ADJUSTMENT.
DESIGN ALLOWS FOR SECURE AND PERMANENT ATTACHMENT TO CORD.

c UL us
LISTED
Ind. Cont. Eq.
47UF

CONERY MFG INC 1380 ENTERPRISE PKWY ASHLAND, OH 44805
info@conerymfg.com PH (419) 289-1444 FAX (419) 281-0366

2900 SERIES B8



CONERY MFG INC

CHANGES		TOLERANCES	DRAWN BY	DATE
F		DECIMALS .XXX = ±.005 .XX = ±.010 FRACTIONAL X/X = ±.1/64 ANGLES X° = ±1/2°	D. MIDDLETON	07/30/09
E			MATERIAL SPECIFICATION:	
D				
C				
B				
A				

SPECIFICATION SHEET
MECHANICAL FLOAT

SCALE: HALF

2900 SERIES B8
NON–MERCURY

NOTE: ALL ELECTRICAL DIAGRAMS SHOWN ARE EXAMPLES ONLY, CONSULT WITH LOCAL ELECTRICAL AUTHORITIES AND CODES. DO NOT USE THESE PRODUCTS IN GASOLINE, VOLATILES, OTHER COMBUSTIBLES.

2900 SERIES B8

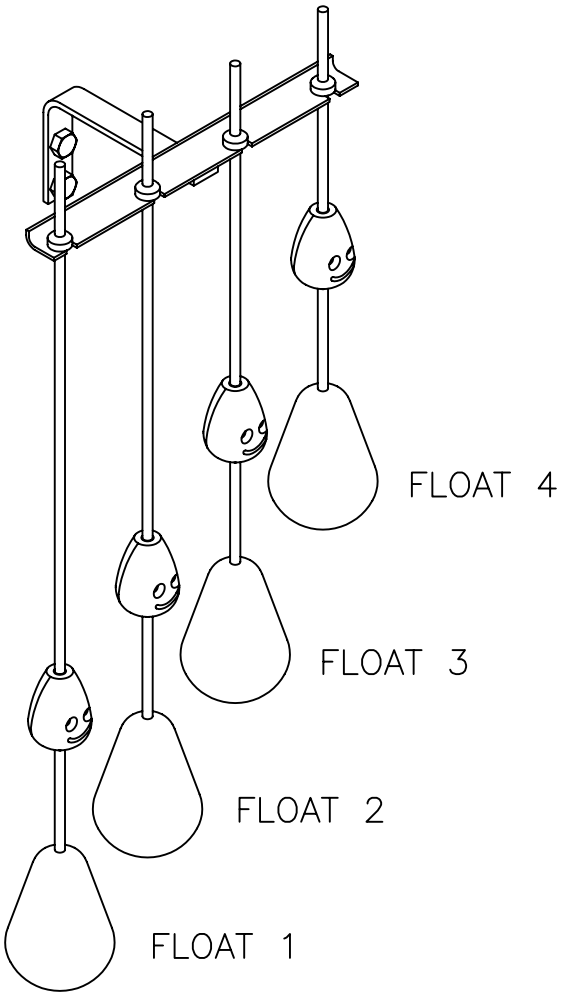
FOR PUMP DOWN USE
(NORMALLY OPEN FLOATS)

FOR PUMP UP USE
(NORMALLY CLOSED FLOATS)

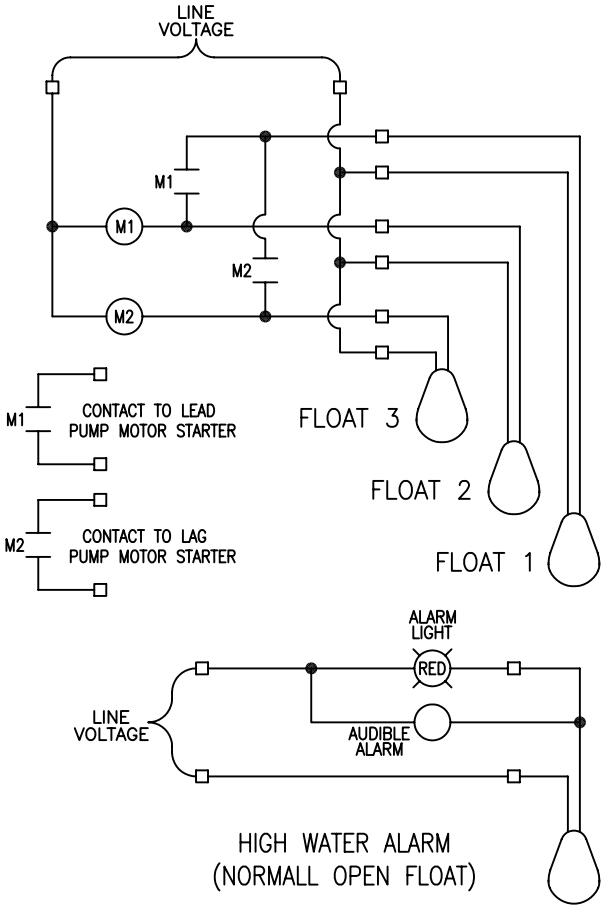
FOR SPDT FLOATS
GREEN – N/O
WHITE – COMMON
BLACK – N/C

c UL us LISTED

TYPICAL MOUNTING



TYPICAL 2 PUMP USES



CONERY MFG INC

CHANGES	TOLERANCES	DRAWN BY	DATE
F	DECIMALS	D. MIDDLETON	07/30/09
E	.XXX = ±.005		
D	.XX = ±.010	MATERIAL SPECIFICATION:	
C	FRACTIONAL		
B	X/X = ±.1/64		
A	ANGLES		
	X° = ±1/2°		

SPECIFICATION SHEET
MECHANICAL FLOAT

SCALE: NONE

2900 SERIES B8
NON–MERCURY

Doc. No.	NDP 027M-35

MAINTENANCE MANUAL

YAMADA AIR-OPERATED DIAPHRAGM PUMPS

NDP-40 series
NDP-50 series
NDP-80 series

ELLIS PART NUMBERS:
2231000111 - IPC Sludge Pump

⚠ WARNING

- For your own safety, be sure to read these procedures carefully before performing maintenance on this product. After reading this document, be sure to keep it handy for future reference.

This maintenance manual covers what you should know about maintenance of the Yamada NDP-40 series, NDP-50 series and NDP-80 series Diaphragm Pumps.
This edition is based on the standards for the March 2011 production run. Remember, the specifications are always subject to change; therefore, some of the information in this edition may not apply to new specifications.

·Warnings and Cautions

For safe use of this product, be sure to note the following: In this document, warnings and cautions are indicated by symbols. These symbols are for those who will operate this product and for those who will be nearby, for safe operation and for prevention of personal injury and property damage. The following warning and caution symbols have the meanings described below. Be sure to remember their meanings.

⚠ WARNING : If you ignore the warning described and operate the product in an improper manner, there is danger of serious bodily injury or death.

⚠ CAUTION : If you ignore the caution described and operate the product in an improper manner, there is danger of personal injury or property damage.

Furthermore, to indicate the type of danger and damage, the following symbols are also used along with those mentioned above:

This symbol indicates a DON'T, and will be accompanied by an explanation on something you must not do.

This symbol indicates a DO, and will be accompanied by instructions on something you must do in a certain situation.

⚠ WARNING

- Before starting maintenance work, cut off the feed air and clean the pump. If air pressure or residue remain in the pump, there is danger of explosion, or possible poisoning resulting in serious injury or death if chemicals adhere to the skin or are accidentally swallowed.
  (For details on cleaning the pump, refer to Chapter 6 of the operating manual.)
- When replacing parts, be sure to use the recommended genuine parts or Equivalents. Use of other parts may cause a malfunction of the product.
  (Refer to Exploded View and Reminder to order correct item on the separate sheets.)

⚠ CAUTION

- When it is instructed that special tools must be used, be sure to use the specified tools. Otherwise, the pump may be damaged.
- Refer to 10.1 "Specifications" in the Operating Manual. Also, remember that the pump is heavy, and extreme care must be taken when lifting it.

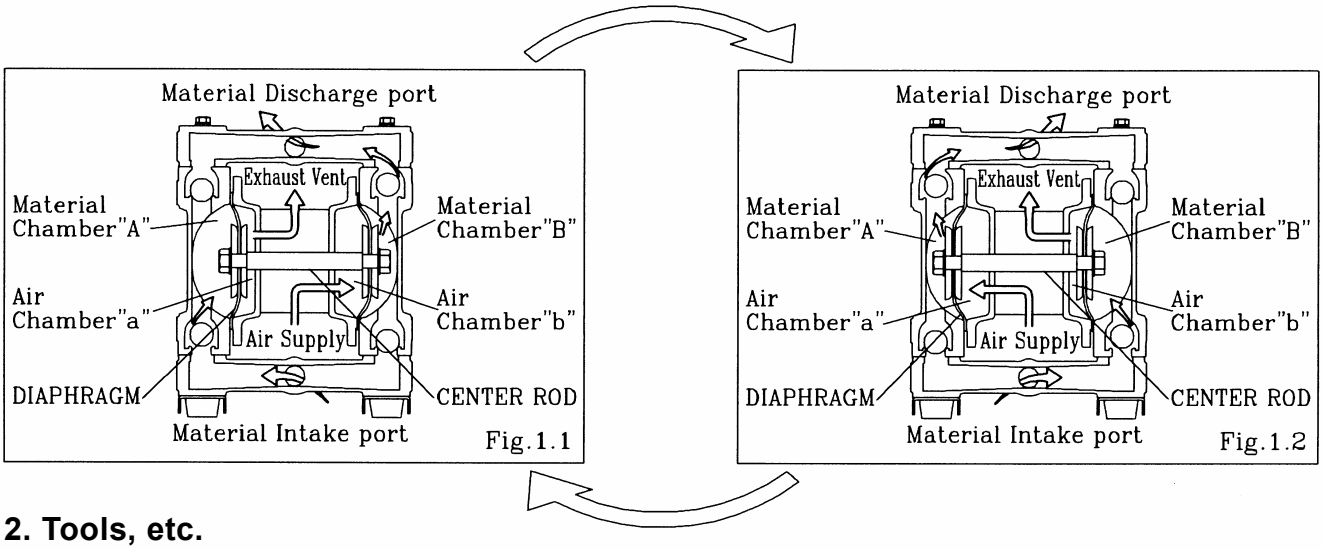
Table of Contents

1. Principles of operation

There are two diaphragms fixed to the center rod, one at each end. When compressed air is supplied to air chamber b (right side, see Fig. 1.1), the center rod moves to the right, the material in material chamber B is pushed out, and at the same time material is sucked into material chamber A.

When the center rod is moved full-stroke to the right, the air switch valve is switched, compressed air is sent to air chamber a (left side, see Fig.1.2), and the center rod moves to the left. The material in material chamber A is pushed out, and at the same time material is sucked into material chamber B.

Through repetition of this operation, material is repeatedly taken in and discharged out.



2. Tools, etc.

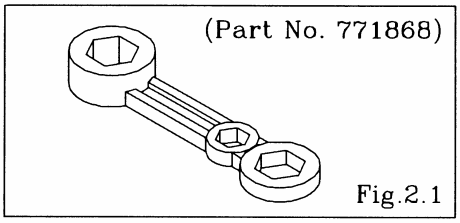
2.1 General tools

・Socket wrenches	13mm, 17mm, 19mm (except with the NDP-40 BP_, BV_), 24mm (BA_, BS_, BF_)
・Hexagonal box wrenches	5mm, 6mm
・Small crowbars	2 (B_C, B_N, B_E, B_V)
・Open-end wrenches	17mm (NDP-40 BP_, BV_), 19mm (BA_, BS_, BF_), 24mm (BA_, BS_, BF_)
・Plastic hammer	

2.2 Special tools

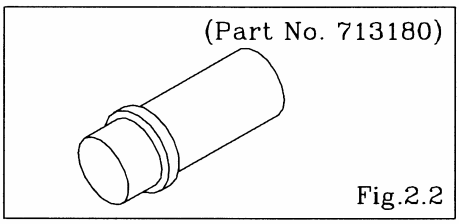
・PP wrench (sold separately)

Purpose: Removing the center disk of BP_ and BV_ types



・Sleeve remover (sold separately)

Purpose: For removing sleeve



2.3 Misc.

・Assembly oil	Turbine oil none addition class 1(equivalent ISO VG32 grade)
・Nuts	M16 X 1.5
・Thread locker	
・Grease	Urea grease grade (NLGI) No. 2

3. Ordering Replacement parts

For accurate and speedy shipment of parts, be sure to order the right parts for your model to distributor. Indicate the part numbers, descriptions, and quantities.

4. Balls and Valve seats

4.1 Removal

■BA_, BS_, BF_ types

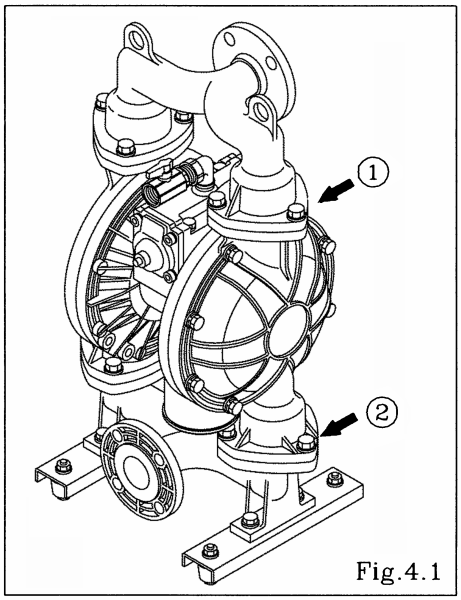


Fig.4.1

▪ Remove the 6 (8 on the NDP-80) retainer bolts ”1” from the out manifold, and remove the out manifold. [Fig.4.1]

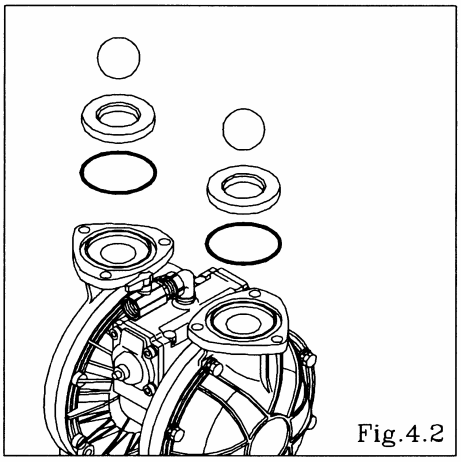


Fig.4.2

▪ Remove the ball, valve seat and O ring. [Fig.4.2]

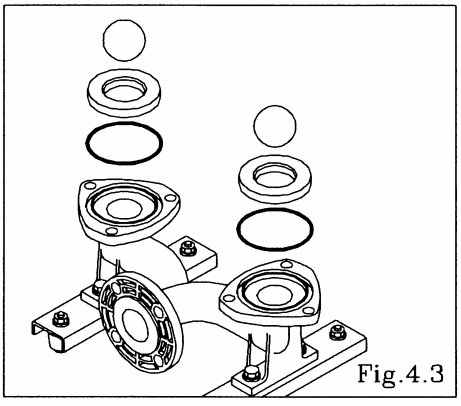


Fig.4.3

▪ Remove the 6 (8 on the NDP-80) retainer bolts ”2” from the in manifold, and remove the in manifold. [Fig.4.1]
▪ Remove the ball, valve seat and O ring. [Fig.4.3]

■NDP-40 BP_·BV_ type

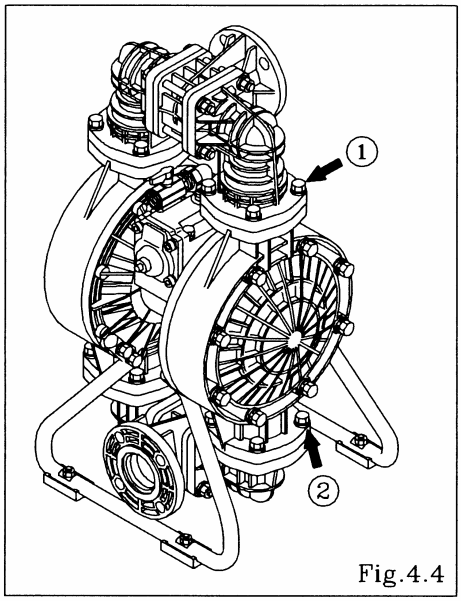


Fig.4.4

▪ Remove the 8 retainer bolts ”1” from the out manifold, and remove the out manifold. [Fig.4.4]

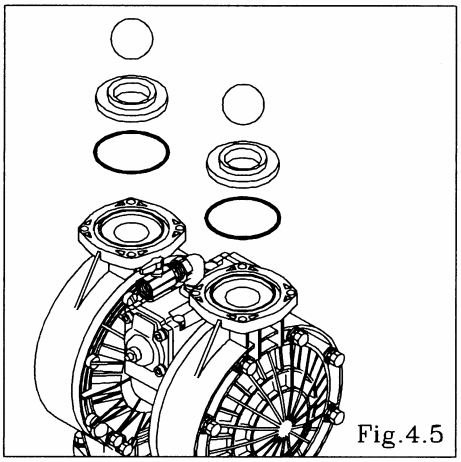


Fig.4.5

▪ Remove the ball, valve seat and O ring. [Fig.4.5]

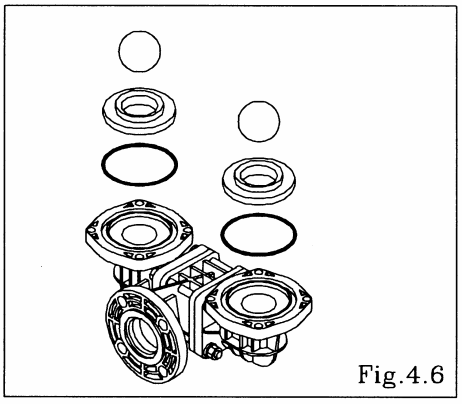


Fig.4.6

▪ Remove the 8 retainer bolts ”2” from the in manifold, and remove the in manifold. [Fig.4.4]
▪ Remove the ball, valve seat and O ring. [Fig.4.6]

■NDP-50 BP_·BV_, NDP-80 BP_ types

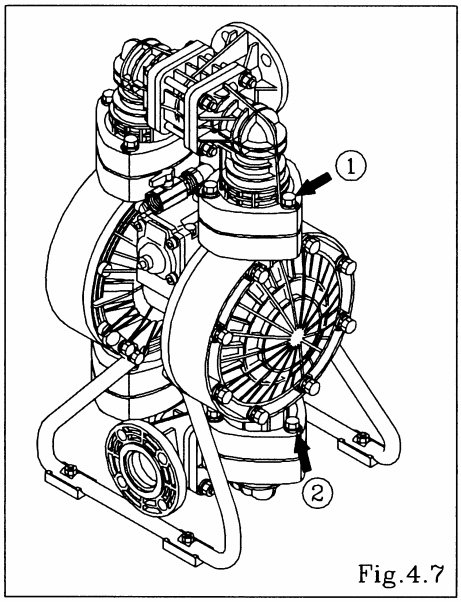


Fig.4.7

▪ Remove the 6 (8 on the NDP-80) retainer bolts ”1” from the out manifold, and remove the protector and out manifold. [Fig.4.7]

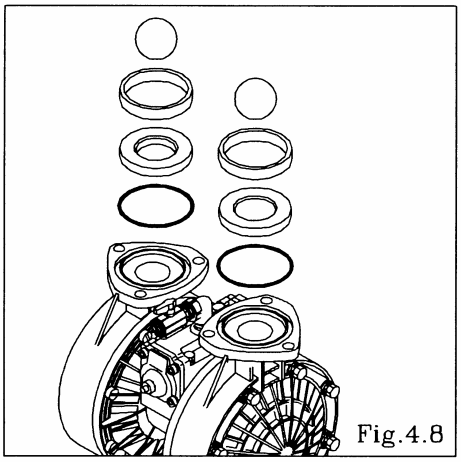


Fig.4.8

▪ Remove the ball, valve guide (only NDP-80), valve seat and O ring. [Fig.4.8]

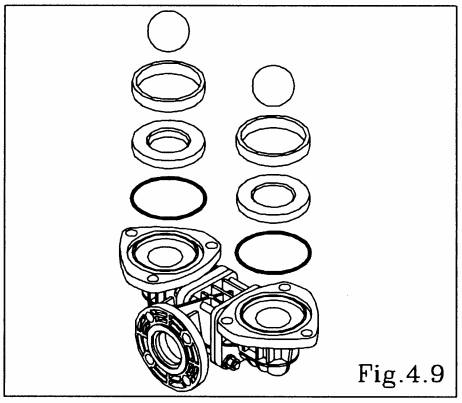


Fig.4.9

▪ Remove the 6 (8 on the NDP-80) retainer bolts ”2” from the in manifold, and remove the protector and in manifold. [Fig.4.7]
▪ Remove the ball, valve guide (only NDP-80), valve seat and O ring. [Fig.4.9]

4.2 Inspection

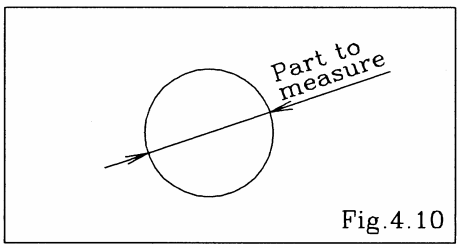


Fig.4.10

▪ Ball [Fig.4.10]
Measure the outside diameter, and if it is outside the usable range, replace the ball.

Usable range of ball

NDP-40	Sø1.772 ~ Sø2.028 in {Sø45.0 ~ Sø51.5 mm}
NDP-50	Sø2.232 ~ Sø2.555 in {Sø56.7 ~ Sø64.9 mm}
NDP-80	Sø3.189 ~ Sø3.650 in {Sø81.0 ~ Sø92.7 mm}

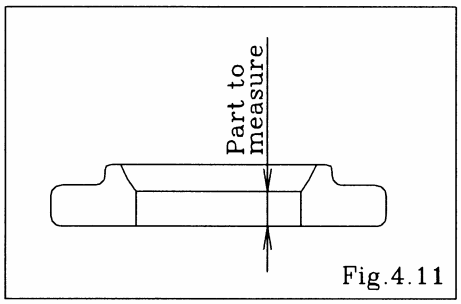


Fig.4.11

▪ Valve seat [Fig.4.11]
Measure the dimension shown at left, and if it is outside the usable range, replace the seat.

Usable range of valve seat

	B_C, B_N, B_E B_V, B_H, B_S	B_T
NDP-40	0.181 ~ 0.453 in {4.6 ~ 11.5 mm}	0.067 ~ 0.161 in {1.7 ~ 4.1 mm}
NDP-50	0.197 ~ 0.492 in {5.0 ~ 12.5 mm}	
NDP-80		

▪ O ring (other than PTFE)
If O ring is worn out or cracked, replace it.

4.3 Installation

For installation, see [Exploded View] on the separate sheet and install in the reverse order of disassembly.

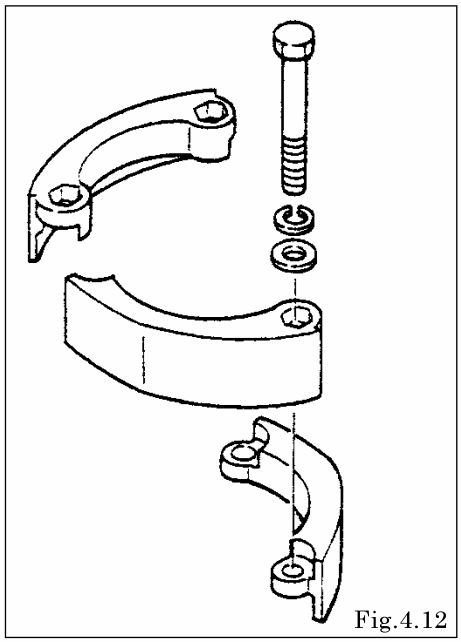


Fig.4.12

Tightening torque for manifold retainer bolts

15 ft-lbf {20 N-m}

NDP-50	BP_, BV_	18 ft-lbf {25 N-m}
NDP-80	BP_	

<NOTE>
- Make sure there is no dust on the seal surface and the seal is not damaged.
- Replace the PTFE O ring regardless of its condition.
- Match the convex and concave parts of the protector. [Fig.4.12] (NDP-50 BP_·BV_, NDP-80 BP_)

5. Diaphragm and Center rod

5.1 Removal

■BA_, BS_, BF_ types

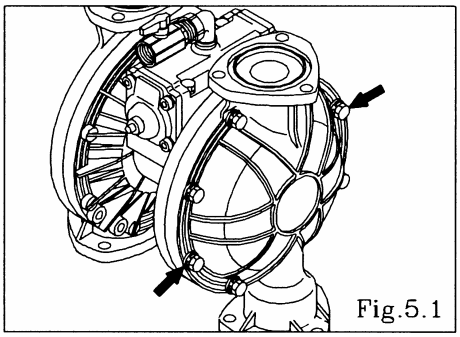


Fig.5.1

- Remove the ball and valve seat etc.(see [4.1 Removal BA_, BS_, BF_ types])
- Remove the 16 (24 on the NDP-80) retainer bolts from the out chamber, and remove the out chamber. [Fig.5.1]

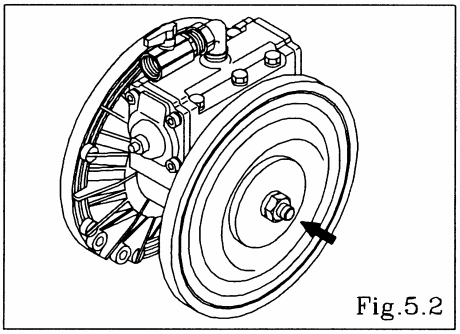


Fig.5.2

- Remove the nuts on both sides of the center rod. [Fig.5.2]
- After the nut on one side have been removed, remove the center disk and diaphragm. Remove the diaphragm, center disk and center rod from the opposite side of the main body.

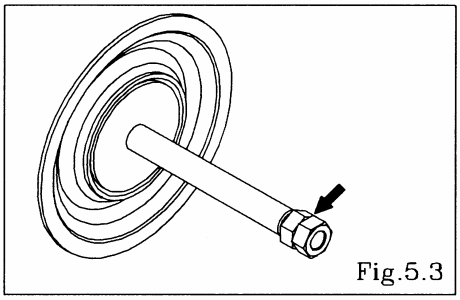


Fig.5.3

- Remove the nut on the opposite side using the double nut. [Fig.5.3]
- Remove the coned disk spring, center disk and diaphragm.

■BP_, BV_ types

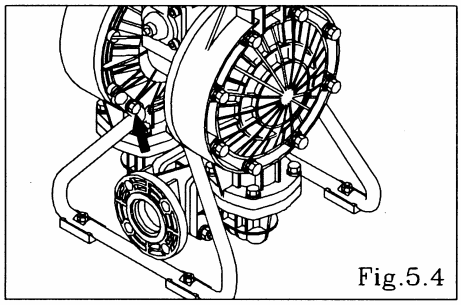


Fig.5.4

- Remove the ball etc.(see [4.1 Removal BP_, BV _types])
- Remove the 8 (4 on the NDP-40) retainer bolts from the stand body, and remove the stand body. [Fig.5.4]

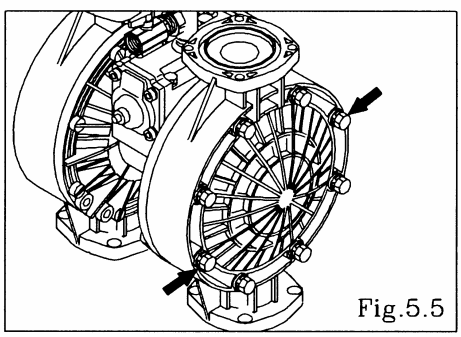


Fig.5.5

- Remove the 16 (24 on the NDP-80) retainer bolts from the out chamber, and remove the out chamber. [Fig.5.5]

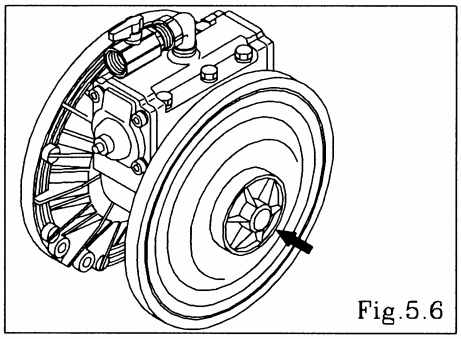


Fig.5.6

- Remove the center disk from one side using the PP wrench (special tool: Part No. 771868). [Fig.5.6]
- After the center disk (outside) has been removed, remove the diaphragm and the center disk (inside).
  Remove the center disk and center rod from the opposite side of the main body.

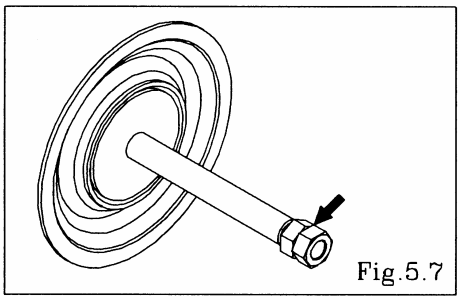


Fig.5.7

- Fix a double nut to one end of the center rod and take the diaphragm and center disk off the opposite end. [Fig.5.9]
  Be careful not to scratch or score the center rod.

5.2 Inspection

- Diaphragm
  If the diaphragm is worn out or damaged, replace it.
  New replace just one diaphragm.

Guideline of diaphragm life

CR, NBR, EPDM	10,000,000 cycle
FKM	2,500,000 cycle
PTFE	3,000,000 cycle
TPEE, TPO	15,000,000 cycle

(When used with clean water at room temperature)

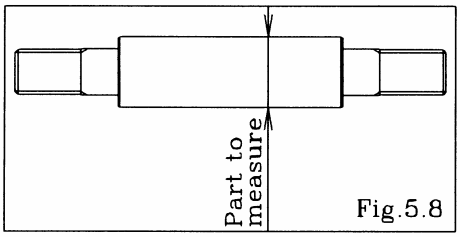


Fig.5.8

- Center rod [Fig.5.8]
  Measure the diameter, and if it is outside the usable range, replace the rod.

Usable range of center rod

ø0.9815 ~ ø0.9843 in {ø24.93 ~ ø25.00 mm}

5.3 Installation

■B_C, B_N, B_E, B_V, B_H, B_S types

For installation, see [Exploded View] on the separate sheet and install in the reverse order of disassembly.

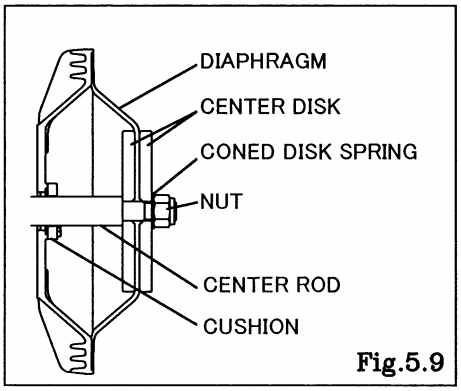


Fig.5.9

- Apply assembly grease to the center rod, and insert it into the main body.
- Insert the cushion (except with the NDP-80). (cf. Fig.5.9)
- Keep the marking “OUTSIDE” to liquid end for CR, NBR, EPDM, FKM diaphragms.
  Keep the convex side to the outside for TPEE, TPO diaphragms.
- Tighten the center disk using the PP wrench(special tool: Part No.771868) for the BP_, BV_ types. Apply proper Thread locker to the thread of center disk.
  (No coned disk springs and nuts are needed.)

Tightening torque for center rod

BA_, BS_, BF_	43 ft-lbf {60 N-m}
BP_, BV_	36 ft-lbf {50 N-m}

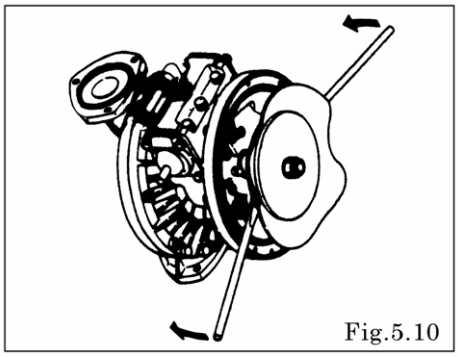


Fig.5.10

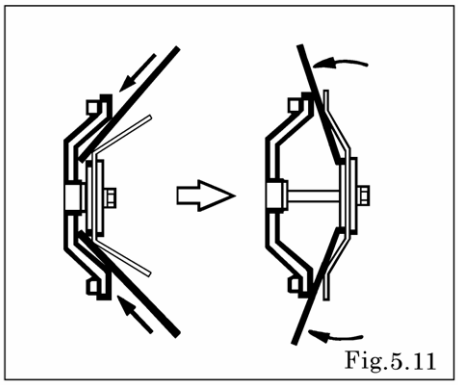


Fig.5.11

- Draw the center disk to one side (exclude B_H, B_S type cf.Fig.5.9).
- And install the out chamber. Tighten the bolts temporarily.
- Grip the inside center disk using crowbars and draw it to the opposite side, then turn the diaphragm over. (exclude B_H, B_S type) [Fig.5.10, 5.11]
- And install the out chamber. Tighten the bolts temporarily.
- After installation of the out chambers on both sides, place the pump on a flat surface and stand the pump upright for further assembly.

Tightening torque for out chamber.

BA_, BS_, BF_	29 ft-lbf {40 N-m}
BP_, BV_	26 ft-lbf {35 N-m}

<NOTE>
- Make sure there is no dust on the seal surface in order to prevent seal damaged.
- Be careful not to damage the R portion of the air chamber using a crowbar, etc.
- Tighten the bolts gradually in a diagonal sequence with even torque. (cf. Fig.5.12)

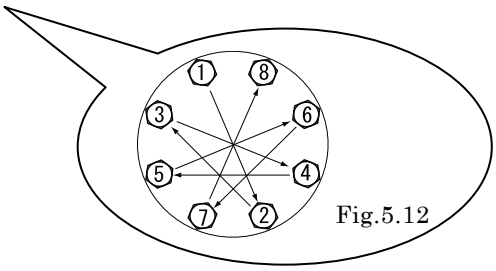


Fig.5.12

■B_T type

For installation, see [Exploded View] on the separate sheet and install in the reverse order of disassembly.

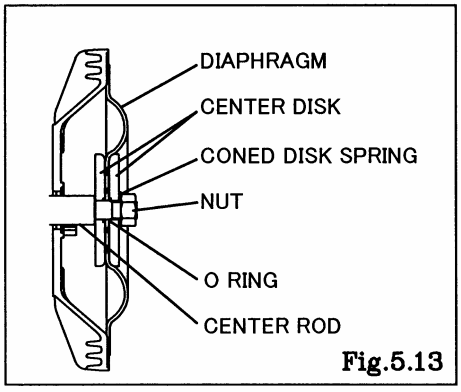


Fig.5.13

- Apply assembly grease to the center rod, and insert it into the main body.
- Keep the convex side to the outside (cf. Fig.5.13).
- Put the O rings to both sides of the diaphragm. (cf. Fig.5.13)
- Tighten the center disk using the PP wrench(special tool: Part No. 771868) for the BPT, BVT type. Apply proper Thread locker to the thread of center disk. (No coned disk springs and nuts are needed.)

Tightening torque for center rod

BAT, BST, BFT	43 ft-lbf {60 N-m}
BPT, BVT	36 ft-lbf {50 N-m}

- Tighten the out chamber temporarily at first. After installation of the out chambers on both sides, place the pump on a flat surface and stand the pump upright for further assembly.

Tightening torque for out chamber

BAT, BST, BFT	29 ft-lbf {40 N-m}
BPT, BVT	26 ft-lbf {35 N-m}

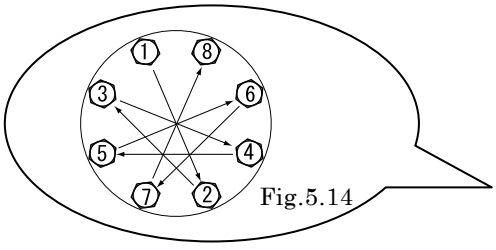


Fig.5.14

<NOTE>
- Make sure there is no dust on the seal surface in order to prevent seal damaged.
- Replace the PTFE O ring by new one.
- Tighten the bolts gradually in a diagonal sequence with even torque. (cf. Fig.5.14)

6. Throat bearing and Pilot valve

6.1 Removal

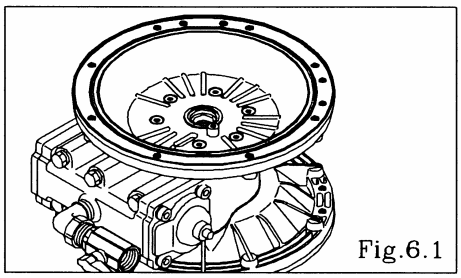


Fig.6.1

- Remove the diaphragm and center rod (see [5.1 Removal]).
- Remove the 12 retainer bolts from the air chamber, and remove the air chamber. [Fig.6.1]

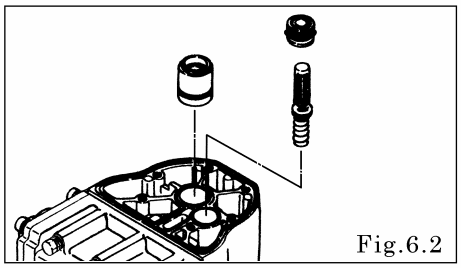


Fig.6.2

- Draw out the pilot valve and valve seat. [Fig.6.2]
- Draw out the throat bearing. [Fig.6.2]

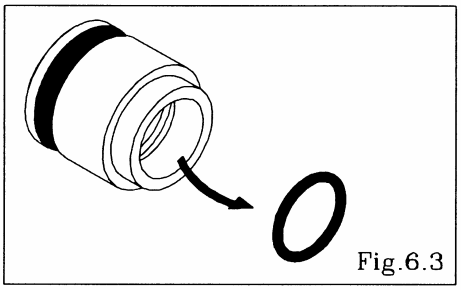


Fig.6.3

- Remove the packing from the throat bearing. [Fig.6.3]

6.2 Inspection

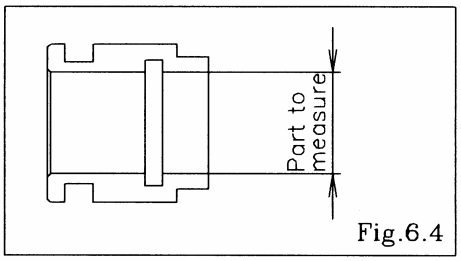


Fig.6.4

- Throat bearing [Fig.6.4]
  Measure the inside diameter, and if it is outside the usable range, replace the throat bearing

Usable range of throat bearing

ø0.9859 ~ ø0.9894 in {ø25.04~ ø25.13 mm}

- O ring, Packing
  If the O ring is worn out or cracked, replace it.
- Pilot valve
  If the pilot valve is worn out or cracked, replace it.

6.3 Installation

For installation, see [Exploded View] on the separate sheet and install in the reverse order of disassembly.

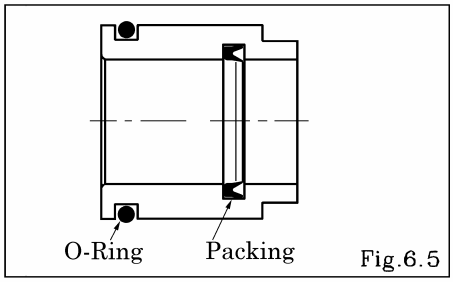


Fig.6.5

Tightening torque for air chamber retainer bolts

15 ft-lbf {20 N-m}

<NOTE>

- Make sure there is no dust on the seal surface and the seal is not damaged.
- Apply grease to packing.

7. C spool valve assembly
7.1 Removal

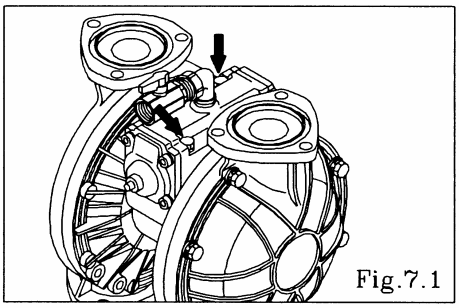


Fig.7.1

- Remove the out manifold (see [4.1 Removal]).
- Remove the 6 retainer bolts from the valve body, and remove the valve body. [Fig.7.1]

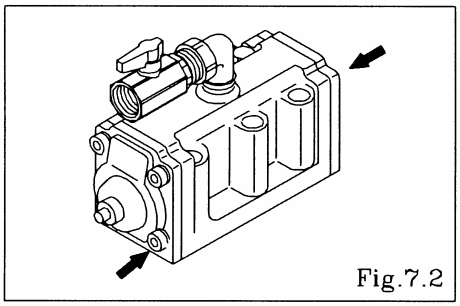


Fig.7.2

- Remove the 8 cap A and cap B retainer bolts, and remove cap A and cap B. [Fig.7.2]

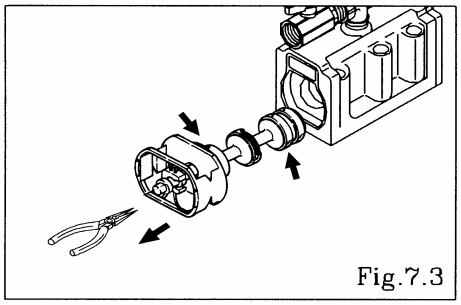


Fig.7.3

- Draw out the C spool valve assembly, and remove the seal ring from the C spool valve assembly.
- Remove the spring stopper. [Fig.7.3]

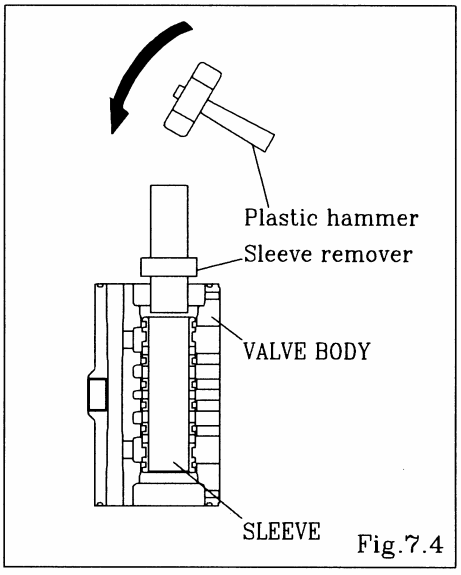


Fig.7.4

- Remove the sleeve using the sleeve remover (special tool: Part number 713180). [Fig.7.4]

7.2 Inspection

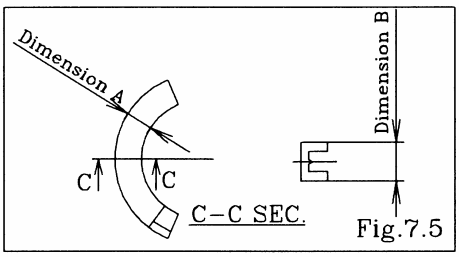


Fig.7.5

▪ C Spool Valve Assembly
Seal ring [Fig.7.5]
Measure dimensions A and B, and if there is sufficient wear to require replacement, replace the c spool valve assembly.
If the seal ring is worn out or cracked, replace c spool valve assembly.

Dimension A	More than 0.1988 in {5.05 mm}
Dimension B	More than 0.2874 in {7.30 mm}

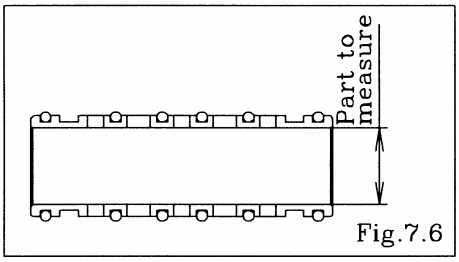


Fig.7.6

▪ Sleeve Assembly [Fig.7.6]
Measure the inside diameter, and if it is outside the usable range, replace the c spool valve assembly.

Usable range of sleeve

ø1.305 ~ø1.313 in {ø33.15 ~ø33.35 mm}

▪ O ring
If the O ring is worn out or cracked, replace it.

<NOTE>
▪ C Spool Valve Assembly must be replaced as a complete set. Unable to replace individual component.

7.3 Installation

For installation, see [Exploded View] on the separate sheet and install in the reverse order of disassembly.

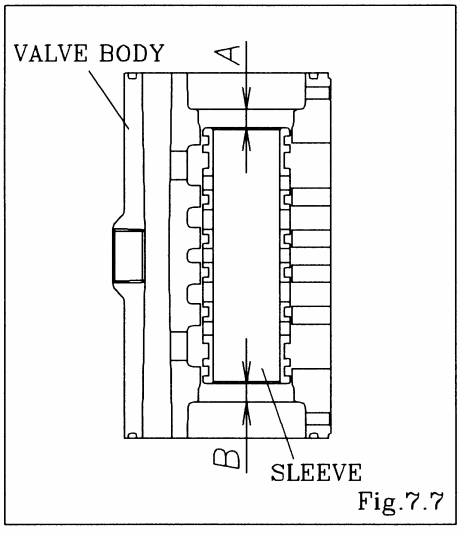


Fig.7.7

▪ Install the sleeve using the sleeve remover (special tool: Part No. 713180). At this point, apply assembly oil around the sleeve and O ring.
▪ Install the sleeve at the center of the valve body. (A = B)

Tightening torque for installation cap A, cap B

8 ft-lbf {10 N-m}

Tightening torque for valve body installation bolts

12 ft-lbf {17 N-m}

<NOTE>
▪ Make sure there is no dust on the seal surface and it is not damaged.

8. Retightening of Tie rods

■ Plastic type

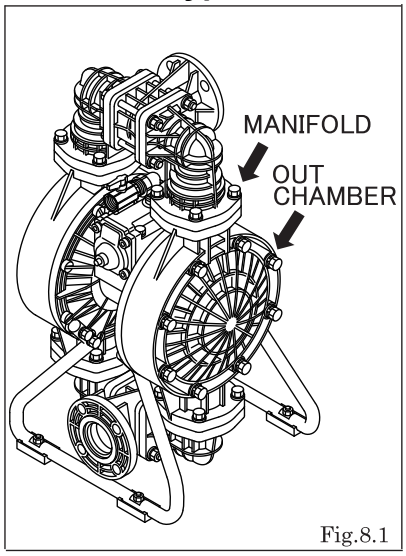


Fig.8.1

▪ All bolts should be retorqued:
(1) Right before start up.
(2) There are any leaks of material on daily inspecting a pump.

		Retain bolts for the out chamber	Retain bolts for the manifold
NDP-40.50.80	BP_	26 ft-lbf {35 N-m}	15 ft-lbf {20 N-m}
NDP-40.50	BV_		

<NOTE>
▪ Retighten the Out chamber and then the manifold in this order. [Fig.8.1]
▪ Tighten the bolts in the order shown. [Fig.8.2]

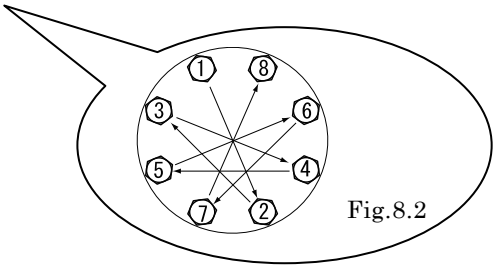


Fig.8.2

■ Metal type

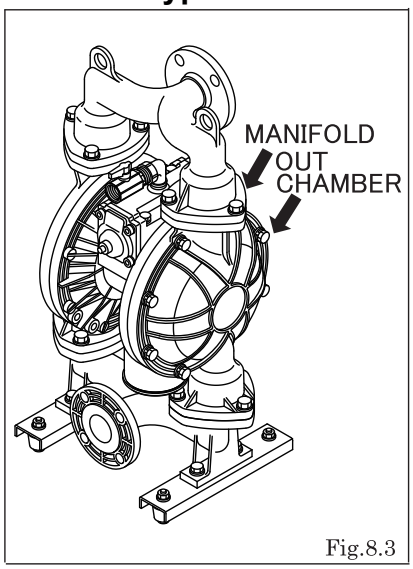


Fig.8.3

▪ All bolts should be retorqued:
(1) Right before start up.
(2) There are any leaks of material on daily inspecting a pump.

		Retain bolts for the out chamber	Retain bolts for the manifold
NDP-40.50.80	B_C, B_N B_E, B_V B_T, B_H B_S	29 ft-lbf {40 N-m}	15 ft-lbf {20 N-m}

<NOTE>
▪ Retighten the Out chamber and then the manifold in this order. [Fig.8.3]
▪ Tighten the bolts in the order shown. [Fig.8.4]

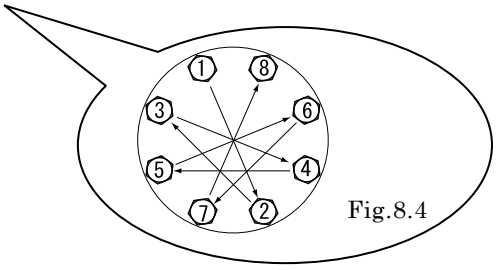


Fig.8.4

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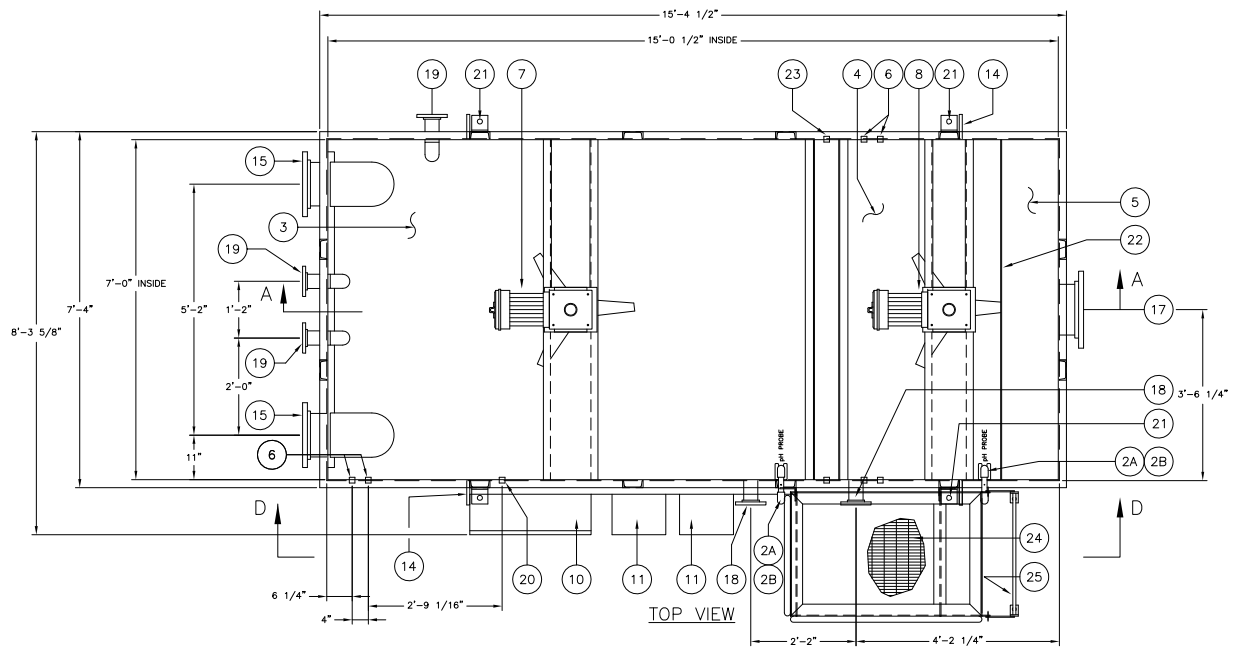
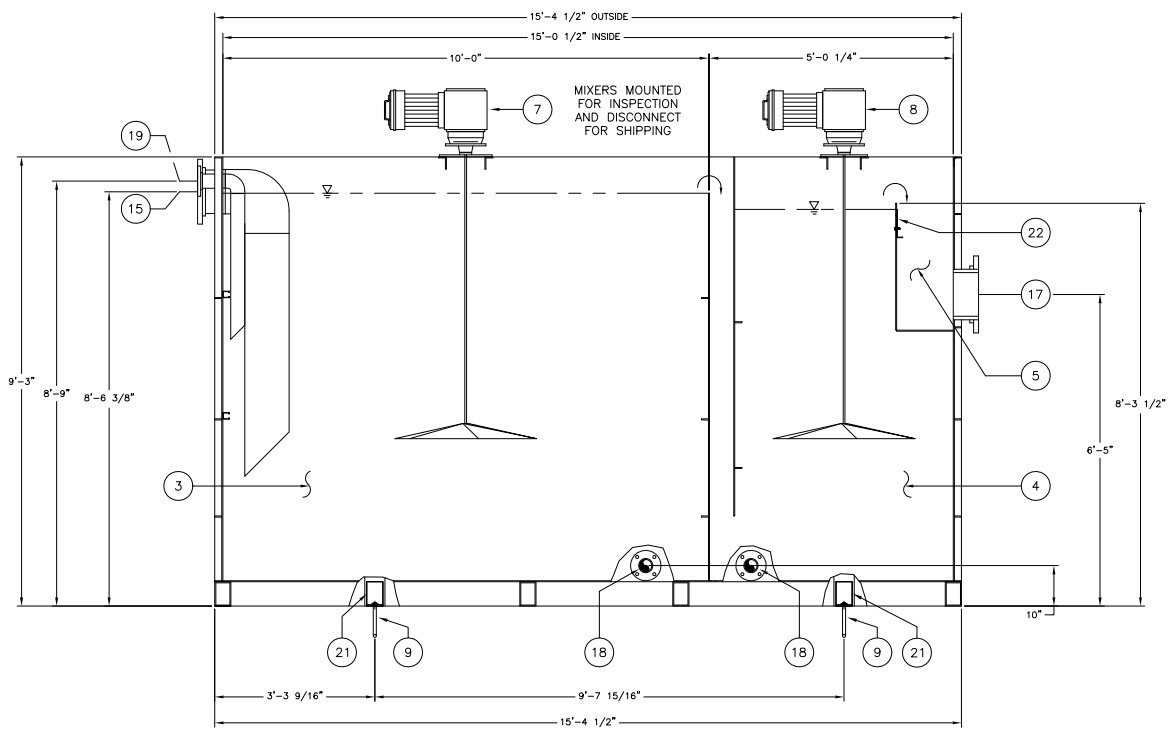
PHONE : +81-(0)3-3777-0241 FAX : +81-(0)3-3777-0584

201104 NDP027M





Ellis Corporation
1400 W. Bryn Mawr Ave.
Itasca, IL. 60143

MODEL No.	SERIAL No.
CRT–400	C06112–00

MAXIMUM CAPACITY: 400 GPM

VOLTAGE: 480 PHASE: 3 FREQ.: 60

FLA: ---

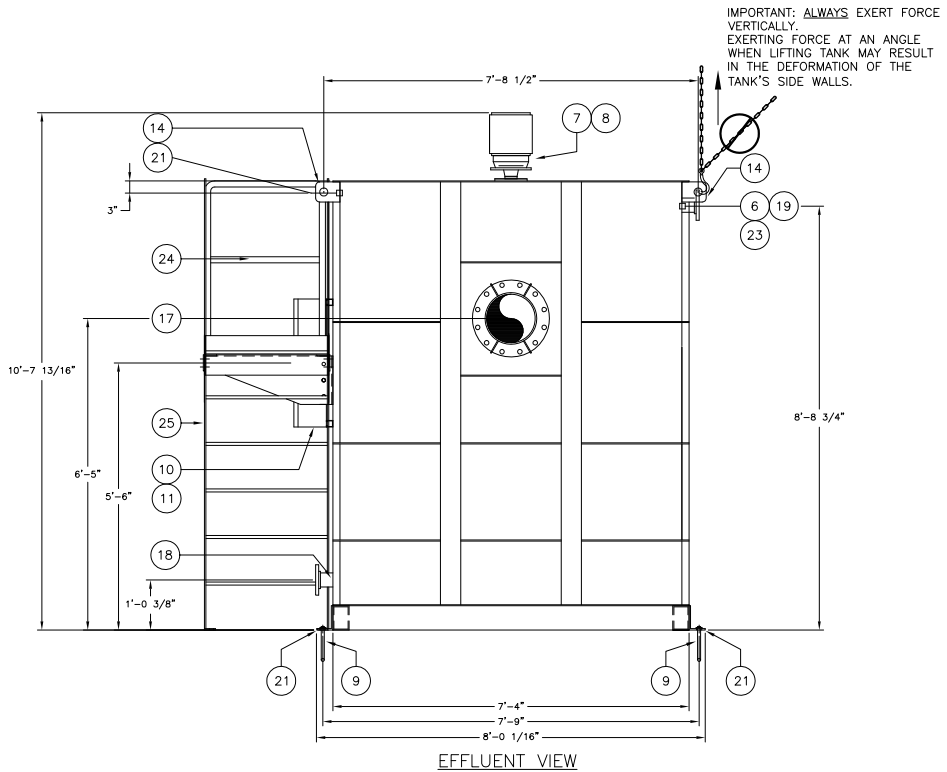
SUPPLY GAS PRESSURE: ____ IN W.C.

WORKING GAS PRESSURE: ____ IN W.C.

AIR PRESSURE: MIN ____ PSI MAX ____ PSI

U.S. PATENT #: ____

NAMEPLATE, ITEM 12,
DATA DETAIL
FULL SCALE



ITEM	DESCRIPTION	MATERIAL	QTY.	PART #
1	WELDMENT, CRT–400 (4,180/2000), 2 CHAMBER	HRS	1	381108D00W
R2	PH ELECTRODE, CONNECTOR & TRANSMITTER		1	387002B
2A	SUBMERSIBLE pH TRANSMITTER		1	2236001092
2B	pH ELECTRODE	HRS	1	2236001111
3	1ST MIXING CHAMBER, 4,180 GAL VOLUME	HRS	1	SEE FAB DWG
4	2ND MIXING CHAMBER, 2005 GAL VOLUME	HRS	1	SEE FAB DWG
5	EFFLUENT WEIR CHAMBER	HRS	1	SEE FAB DWG
6	CHEMICAL INJECTION POINTS, 3/4" FNPT 3000# FULL COUPLING	316L SS	4	SEE FAB DWG
B	7 MIXER, 1 HP, 58 RPM, 460/3/60HZ W/32" IMPELLER		1	5913000187
8	MIXER, 1/2 HP, VFD TO 58 RPM, 460/3/60HZ, W/32" IMPELLER		1	5913000185
9	1–1/4" ANCHOR HOLE, BOLT SUPPLIED BY OTHERS		4	SEE FAB DWG
B	10 CONTROL PANEL, NEMA 4X 316L		1	???????
11	VFD CONTROLLER, NEMA 4		1	BY OTHERS
12	NAMEPLATE, SEE DETAIL	304 SS	1	600597B01
13	"ELLIS" LOGO–ADHESIVE BACKED LABEL	–	4	5912000011
14	TANK LIFTING LUGS	HRS	4	SEE FAB DWG
B	15 12" INLET FLANGE, 150#, FLAT FACE	HRS	2	SEE FAB DWG
16	PIPE, 12" SCH 80 X 92" LONG	PVC	1	SEE FAB DWG
17	12" OUTLET FLANGE, 150# FLAT FACE	HRS	1	SEE FAB DWG
B	18 3" DRAIN FLANGE, 150# FLAT FACE	HRS	2	SEE FAB DWG
C B	19 RETENTION TANK SLUDGE INLET, 3" FLANGE, 150# FLAT FACE	HRS	3	SEE FAB DWG
B	20 HIGH LEVEL SWITCH POINTS, 3/4" FNPT 3000# FULL COUPLING	316L SS	4	SEE FAB DWG
B	21 ANCHOR PAD, 4" x 4" x 3/8' THK WITH 1–1/4" HOLE	HRS	4	SEE FAB DWG
B	22 ADJUSTABLE WEIR, EFFLUENT	316L	1	SEE FAB DWG
B	23 POLYMER CHEMICAL INJECTION POINT, 3/4" FNPT 3000# FULL COUPLING	316L SS	1	SEE FAB DWG
C	24 PLATFORM WITH SAFETY GATE, FIBERGLASS GRATING	HRS	1	SEE FAB DWG
C	25 LADDER	HRS	1	SEE FAB DWG
26	–	–	–	–
27	–	–	–	–

NOTES:
1) TANK AND INTERIOR PLATES TO BE FABRICATED OF 1/4" THK CARBON STEEL ASTM A–36.

2) PIPING INTEGRAL TO TANK TO BE ASTM A–53, BLACK SCH. 40. ALL OTHER PIPING TO BE PVC SCH. 80.

3) FLANGES TO BE FLAT FACE, 150# ANSI, BOLT CIRCLE TO STRADDLE CENTER LINE AND WILL HAVE A 6" PROJECTION UNLESS OTHERWISE NOTED

4) INFLUENT FLOW RATE IS 400 GPM.

5) ANCHOR BOLTS SUPPLIED BY OTHERS, 1–1/4" HOLES PROVIDED

6) ALL WETTED MOUNTING HARDWARE TO BE STAINLESS STEEL, ANTI SEIZE TO BE USED.

7) ALL WELDS TO BE CONTINUOUS, INTERNALLY AND EXTERNALLY

WEIGHTS (APPROXIMATE):

EMPTY – 8,700 LBS.
FLOODED – 55,200 LBS.

PAINT SPECIFICATIONS:

INTERIOR:
SURFACES PREPARED TO SSPC–SP10, NEAR WHITE METAL BLAST AND COATED WITH POLYAMINE EPOXY – CAROLINE PHENOLINE 309 (GRAY), 20 MILS. DFT.

EXTERIOR:
SURFACES PREPARED TO SSPC–SP6, COMMERCIAL BLAST AND COATED WITH DUPONT CORLAR 825–Y–9031/VF–Y–632 CHROMATE FREE PRIMER, 4 MILS, MIN., FINISH COAT TO BE DUPONT IMRON 326 POLYURETHANE ENAMEL, 2 MILS. MIN., FINISH COLOR TO BE SAFETY BLUE.

NOTES FOR WALKWAY ASSEMBLY:
1) ALL MATERIALS FOR WALKWAY, INCLUDING POSTS, GRATING AND LADDER, ARE TO BE A–36 HRS. WALKWAY GRATING TO BE 1" THICK FIBERGLASS, MESH TO BE 1" X 4" PATTERN. NOT SLIP SURFACE FOR TOP OF GRATING REQUIRED. GRATING SHALL BE ANCHORED TO EACH SUPPORTING MEMBER WITH AT LEAST TWO ANCHORING DEVICES.

2) SAFETY GATE INCLUDED BUT NOT SHOWN. GATE WILL BE ANCHORED TO THE POST NOT THE TANK. MCMASTER CARR SWING GATE MODEL 8109T11 – STYLE D, GATE TO BE PAINTED SAFETY YELLOW.

MACHINE MODEL NUMBER: WCRT–400–001

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 12–30–14

SHEET 1 OF 1 PART #: 381107D

CAD FILE: 38–1107.dwg

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

CRT–400 (4180/2000) GENERAL ARRANGEMENT DRAWING
OMNI WATER SOLUTIONS

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	C – 12/30/14	A – 12/15/14	B – 12/16/14
ALL 304 SS				

DRAWN BY: DWN DATE: 12/05/14	CHECKED BY: dnoltin DATE: 12/30/2014	MFG. ENG.: DATE:	APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

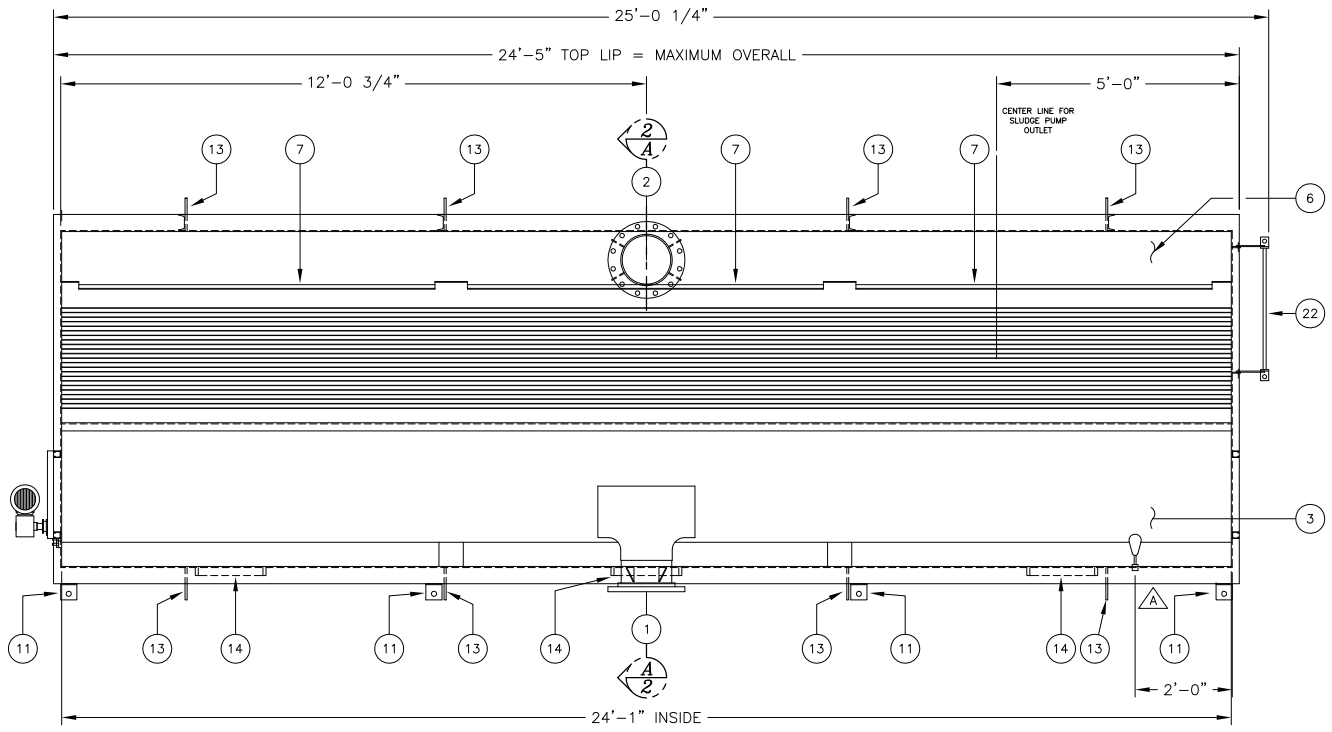
NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
Varies	38	1107	D

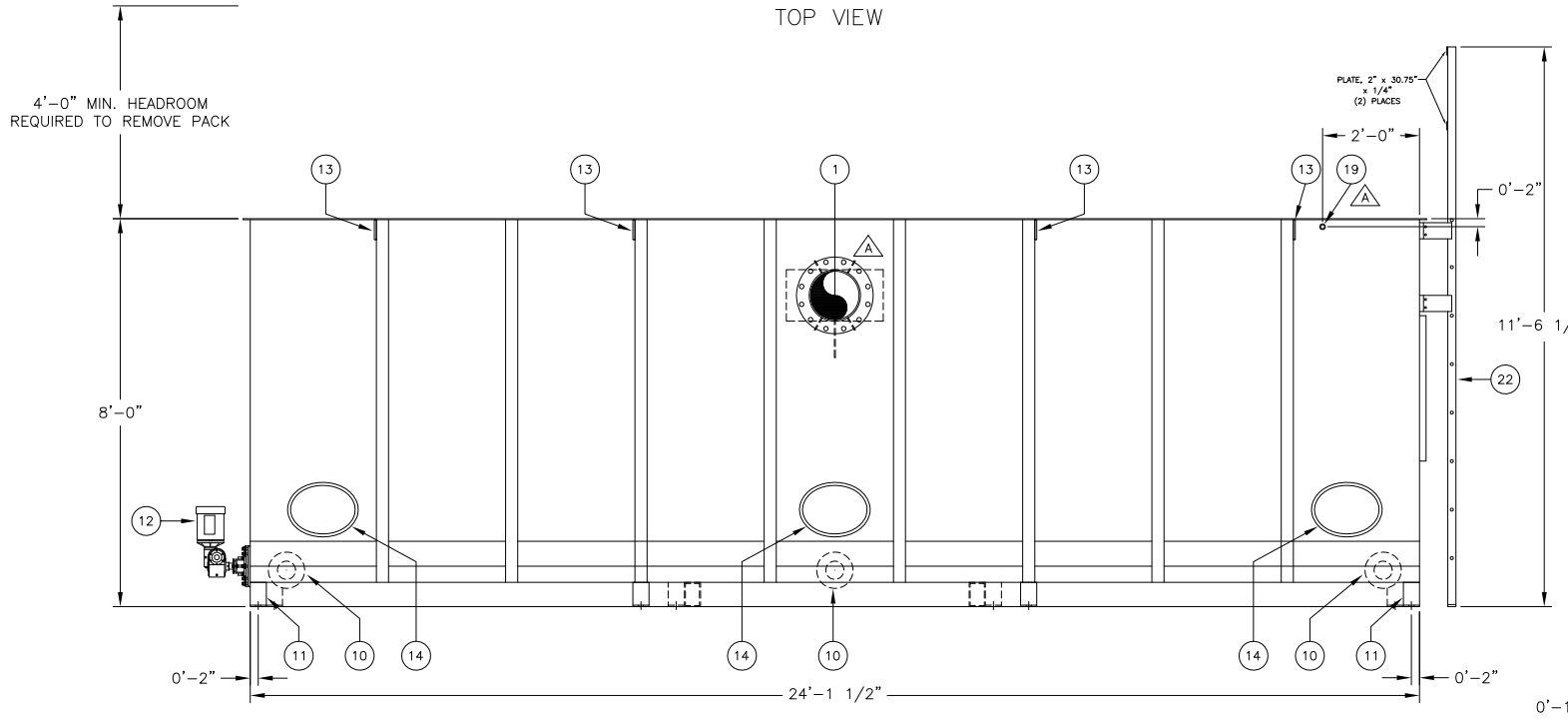
FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 12–30–14

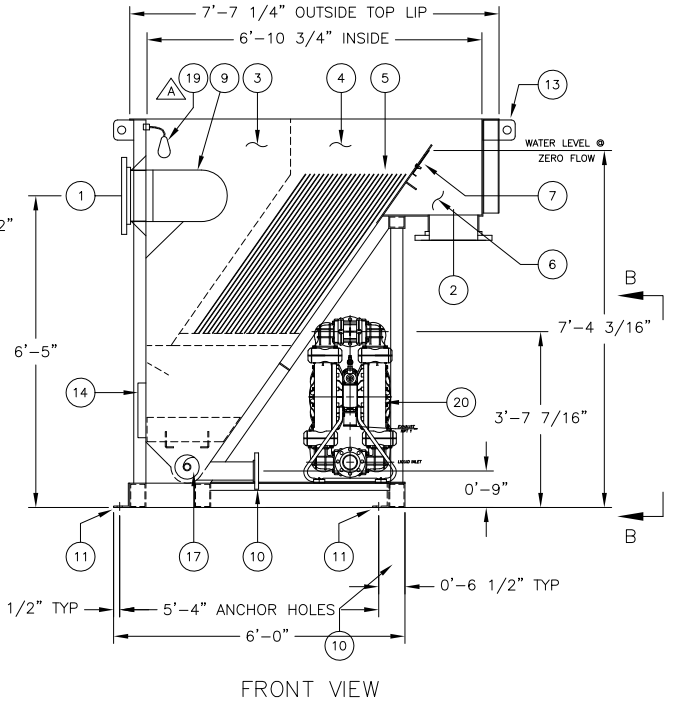


TOP VIEW



INFLUENT END VIEW

VIEW B–B
PUMP ASSEMBLY



FRONT VIEW

Ellis Corporation
1400 W. Bryn Mawr Ave.
Itasca, IL. 60143

MODEL No.	SERIAL No.
IPC–4–1320	C06112–00

MAXIMUM CAPACITY: 400 GPM

VOLTAGE: 120 PHASE: 1 FREQ.: 60

FLA: 10A

SUPPLY GAS PRESSURE: ____ IN W.C.

WORKING GAS PRESSURE: ____ IN W.C.

AIR PRESSURE: MIN ____ PSI MAX ____ PSI

U.S. PATENT #

NAMEPLATE, ITEM 23,
DATA DETAIL
FULL SCALE

DET.	DESCRIPTION	MATERIAL	LENGTH	QTY.	PART No.
–	IPC–4–1320 GENERAL ARRANGEMENT DRAWING	CARBON STEEL	–	1	313350D00B
1	INFLUENT FLANGE, 12"ø 150# F.F. FLANGE W/GUSSETS	SCH.40 C.S.	–	1	SEE FAB DWG
2	EFFLUENT FLANGE, 12"ø 150# F.F. FLANGE W/GUSSETS	SCH.40 C.S.	–	1	SEE FAB DWG
3	INFLUENT DIFFUSION CHAMBER, APPROX. 1,860 GALLONS	–	–	1	SEE FAB DWG
4	SEPARATION CHAMBER	–	–	1	SEE FAB DWG
5	REMOVABLE PLATE PACK, 1/8" THICK PLATES	POLYPROPYLENE	4'–0"	6	SEE FAB DWG
6	EFFLUENT CHAMBER, APPROX. 370 GALLONS	–	–	1	SEE FAB DWG
7	ADJUSTABLE EFFLUENT WEIR PLATE	316L S.S.	11'–10 1/2"	3	SEE FAB DWG
8	SLUDGE COLLECTION CHAMBER, APPROX. 930 GALLONS	–	–	1	SEE FAB DWG
9	INFLUENT DIFFUSION BAFFLE	SCH.40 C.S.	–	1	SEE FAB DWG
10	SLUDGE OUTLET, 4"ø 150# F.F. FLANGE	SCH.40 C.S.	–	3	SEE FAB DWG
11	ANCHOR PLATE WITH 1 1/4" HOLE PROVIDED	3/8" C.S.	–	8	SEE FAB DWG
12	AUGER DRIVE, 1/2 HP, 115 V, 1ø, 60 HZ.,	–	–	1	317045D00K
	TEFC MOTOR, 250:1 RATIO, 7 RPM OUTPUT.				
13	LIFTING LUG	CARBON STEEL	5"	8	SEE FAB DWG
A 14	INSPECTION HATCH WITH NEOPRENE GASKET	CARBON STEEL	–	3	SEE FAB DWG
15	–				
B 16	–	–	–	–	–
R17	HELICOID AUGER	316L S.S.	–	2	317045D00K
18	IPC–4–1320 WELDMENT	STEEL	–	1	314003D
19	HIGH LEVEL SWITCH & 3/4' NPT COUPLING	STEEL	–	1	2242000105
20	3" AIR SLUDGE TRANSFER PUMP	–	–	1	2231000111
A 21	AIR ASSEMBLY, 1/2", MOUNTED TO TANK	–	–	1	307011B01
B 22	LADDER	HRS	–	1	SEE FAB DWG
C 23	NAMEPLATE, EQUIPMENT	–	–	1	600597B01

NOTES:
1) TANK AND INTERIOR PLATES TO BE FABRICATED OF 1/4" THK CARBON STEEL ASTM A–36.

2) PIPING INTEGRAL TO TANK TO BE ASTM A–53, BLACK SCH. 40. ALL OTHER PIPING TO BE PVC SCH. 80.

3) FLANGES TO BE FLAT FACE, 150# ANSI, BOLT CIRCLE TO STRADDLE CENTER LINE AND WILL HAVE A 6" PROJECTION UNLESS OTHERWISE NOTED

4) INFLUENT FLOW RATE IS 400 GPM.

5) ANCHOR BOLTS SUPPLIED BY OTHERS, 1–1/4" HOLES PROVIDED

6) ALL WETTED MOUNTING HARDWARE TO BE STAINLESS STEEL, ANTI SEIZE TO BE USED.

7) ALL WELDS TO BE CONTINUOUS, INTERNALLY AND EXTERNALLY.

WEIGHTS (APPROXIMATE):

EMPTY – 11,500 LBS.
FLOODED – 60,000 LBS.

PAINT SPECIFICATIONS:

INTERIOR:
SURFACES PREPARED TO SSPC–SP10, NEAR WHITE METAL BLAST AND COATED WITH POLYAMINE EPOXY – CAROLINE PHENOLINE 309 (GRAY), 20 MILS. DFT.

EXTERIOR:
SURFACES PREPARED TO SSPC–SP6, COMMERCIAL BLAST AND COATED WITH DUPONT CORLAR 825–Y–9031/VF–Y–632 CHROMATE FREE PRIMER, 4 MILS, MIN., FINISH COAT TO BE DUPONT IMRON 326 POLYURETHANE ENAMEL, 2 MILS. MIN., FINISH COLOR TO BE SAFETY BLUE.

SHEET 1 OF 1 PART #: 314002D00B

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

IPC–4–1320 INCLINED PLATE CLARIFIER
GENERAL ARRANGEMENT DRAWING, OMNI WATER

MATERIAL	REV. LEVEL ECO No. DATE REV.	C 01/30/15	A 12–12–14	B 12–30–14			
CS SHELL SEE BOM							

DRAWN BY: DWN DATE: 12/02/14	CHECKED BY: dnoltin DATE: 1/30/2015	MFG. ENG.: DATE:	APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

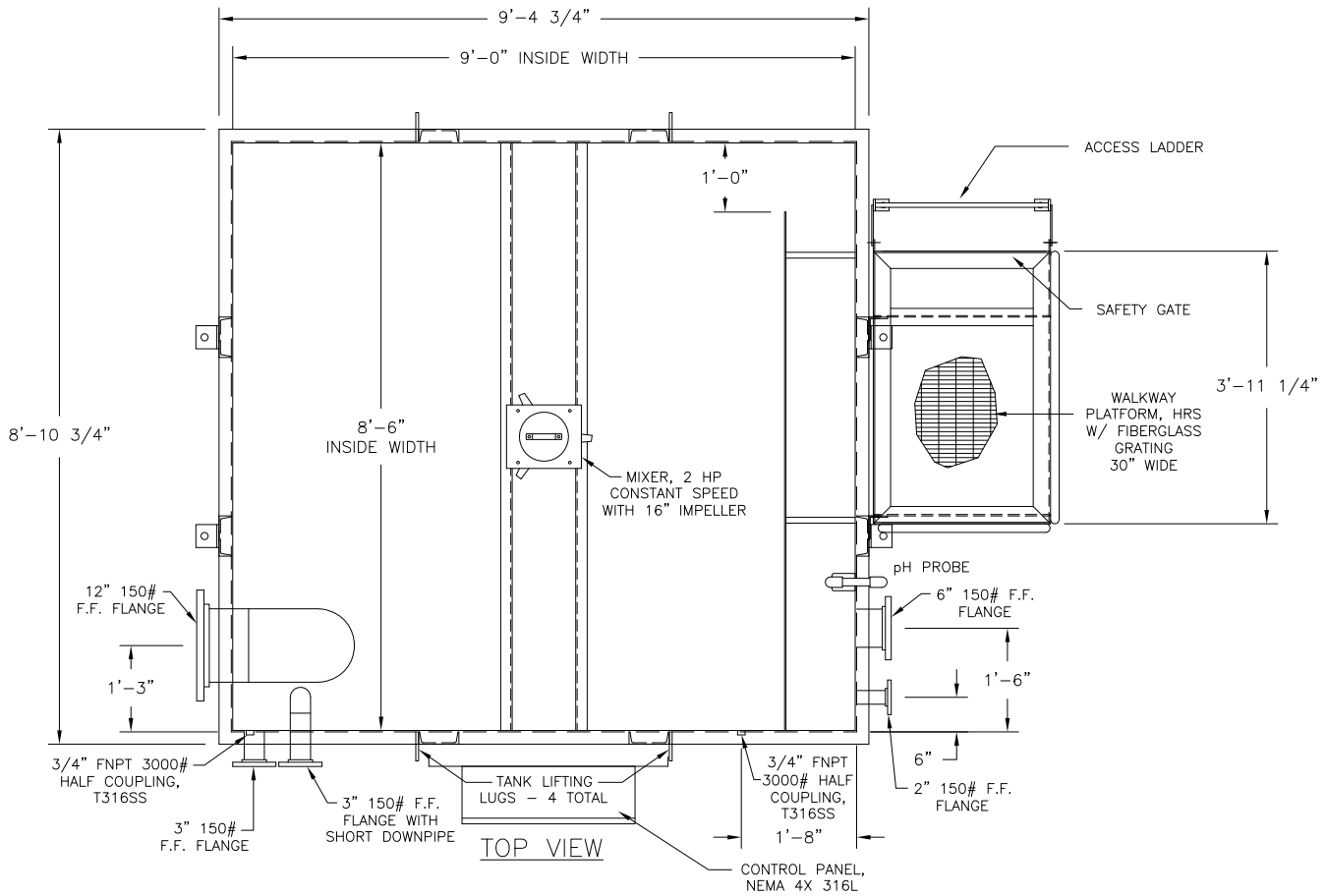
SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
1/20	31	4001	D

CAD FILE: 31–4002.dwg

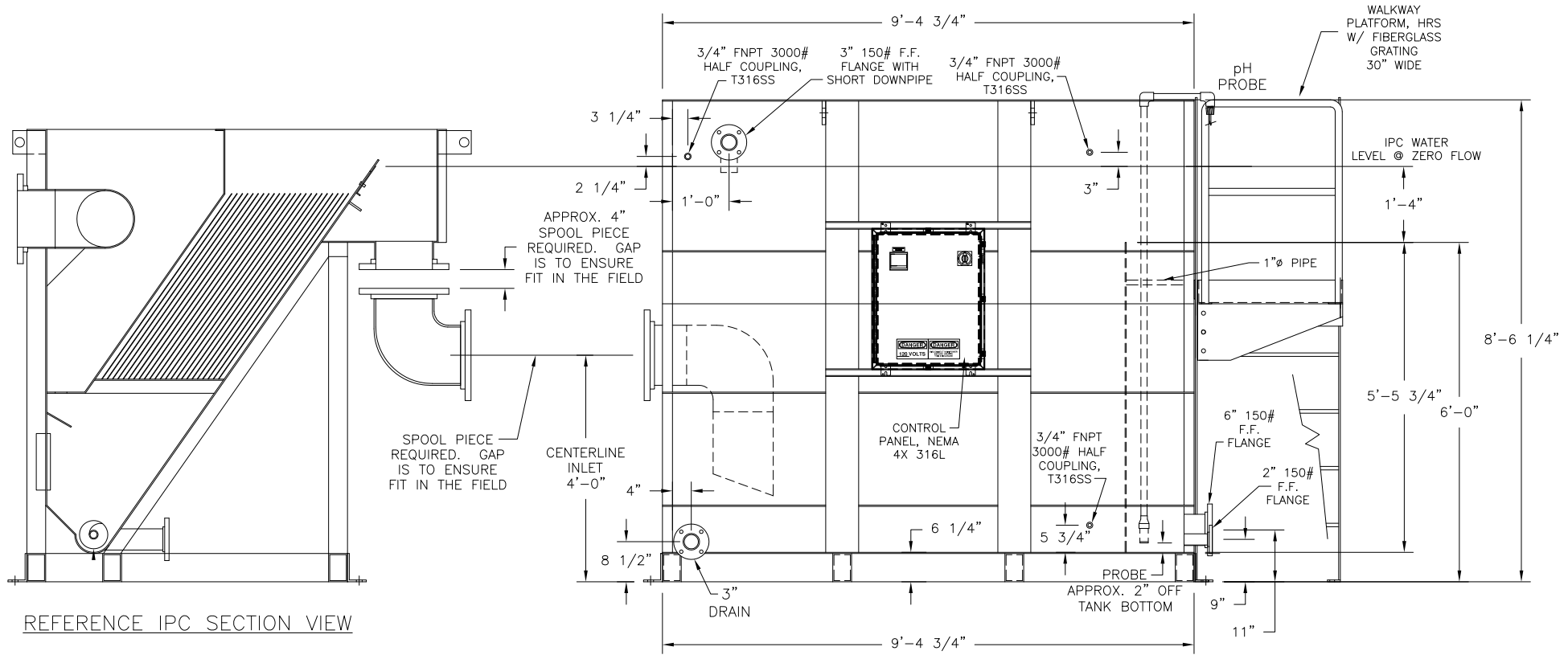
Ellis Corporation
1400 W. Bryn Mawr Ave.
Itasca, IL. 60143

MODEL No.	CNT–400	SERIAL No.	C06112–00
MAXIMUM CAPACITY	400 GPM		
VOLTAGE	480	PHASE 3	FREQ. 60
FLA	4		
SUPPLY GAS PRESSURE		IN W.C.	
WORKING GAS PRESSURE		IN W.C.	
AIR PRESSURE: MIN		PSI MAX	PSI
U.S. PATENT #			

NAMEPLATE,
DATA DETAIL
FULL SCALE



4,570 GALLONS OVERALL CAPACITY,
3,135 GALLON OPERATING CAPACITY
AT 5'–5 3/4" WALL HEIGHT



REFERENCE IPC SECTION VIEW

SIDE VIEW

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 12–30–14

NOTES:
1) TANK AND INTERIOR PLATES TO BE FABRICATED OF 1/4" THK CARBON STEEL ASTM A–36.

2) PIPING INTEGRAL TO TANK TO BE ASTM A–53, BLACK SCH. 40. ALL OTHER PIPING TO BE PVC SCH. 80.

3) FLANGES TO BE FLAT FACE, 150# ANSI, BOLT CIRCLE TO STRADDLE CENTER LINE AND WILL HAVE A 6" PROJECTION UNLESS OTHERWISE NOTED

4) INFLUENT FLOW RATE IS 400 GPM.

5) ANCHOR BOLTS SUPPLIED BY OTHERS, 1–1/4" HOLES PROVIDED

6) ALL WETTED MOUNTING HARDWARE TO BE 316 STAINLESS STEEL, ANTI SEIZE TO BE USED.

7) ALL WELDS TO BE CONTINUOUS, INTERNALLY AND EXTERNALLY.

WEIGHTS (APPROXIMATE):

EMPTY – 5,900 LBS.
FLOODED – 44,000 LBS.

PAINT SPECIFICATIONS:

INTERIOR:
SURFACES PREPARED TO SSPC–SP10, NEAR WHITE METAL BLAST AND COATED WITH POLYAMINE EPOXY – CARBOLINE PHENOLINE 308 (GRAY) 20 MILS DFT.

EXTERIOR:
SURFACES PREPARED TO SSPC–SP6, COMMERCIAL BLAST AND COATED WITH DUPONT CORLAR 825–Y–9031/VF–Y–632 CHROMATE FREE PRIMER, 4 MILS, MIN., FINISH COAT TO BE DUPONT IMRON 326 POLYURETHANE ENAMEL, 2 MILS. MIN., FINISH COLOR TO BE SAFETY BLUE.

NOTES FOR WALKWAY ASSEMBLY:
1) ALL MATERIALS FOR WALKWAY, INCLUDING POSTS, GRATING AND LADDER, ARE TO BE A–36 HRS. WALKWAY GRATING TO BE 1" THICK FIBERGLASS, MESH TO BE 1" X 4" PATTERN. NOT SLIP SURFACE FOR TOP OF GRATING REQUIRED. GRATING SHALL BE ANCHORED TO EACH SUPPORTING MEMBER WITH AT LEAST TWO ANCHORING DEVICES.

2) SAFETY GATE INCLUDED BUT NOT SHOWN. GATE WILL BE ANCHORED TO THE POST NOT THE TANK. MCMASTER CARR SWING GATE MODEL 8109T11 – STYLE D, GATE TO BE PAINTED SAFETY YELLOW.

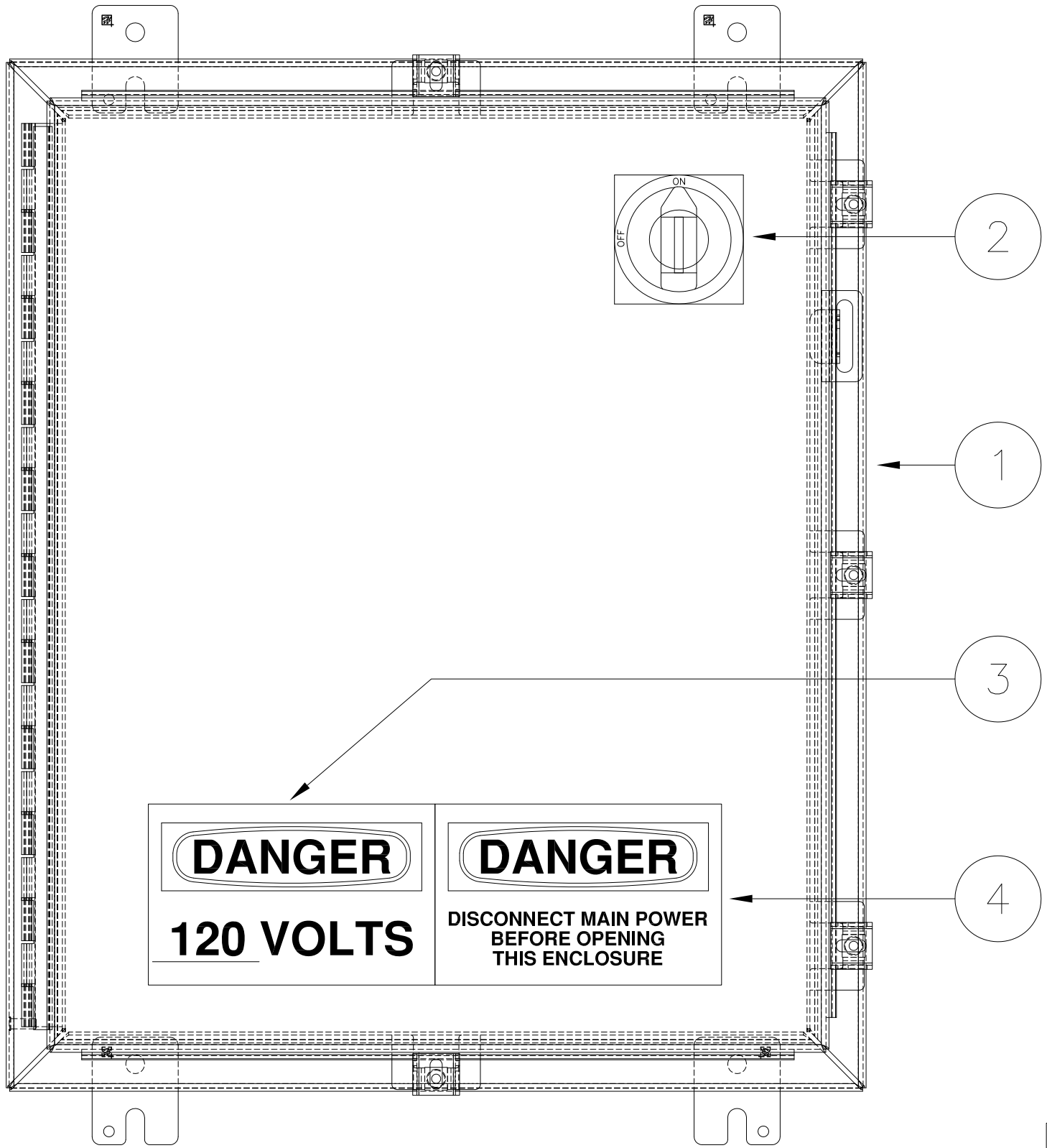
PART NUMBER: 391047

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

ANADARKO/OMNI WATER SOLUTIONS
EFFLUENT NEUTRALIZATION TANK PRELIMINARY DWG.

MATERIAL: CARBON STEEL TANK	REV. LEVEL ECO No. DATE REV.	A 12–4–14	B 12–5–14	C 12–9–14	D 12–30–14	E 01–30–15
DRAWN BY: JAS DATE: 12–4–14	CHECKED BY: DATE:	APPROVED BY: DATE:		MFG. ENG.: DATE:		
UNLESS OTHERWISE NOTED	THIS DRAWING IS THE PROPERTY OF ELLIS CORP. IT IS LOANED UPON THE EXPRESS CONDITION THAT IT SHALL NOT BE COPIED OR REPRODUCED IN ANY MANNER, THAT IT SHALL NOT BE SUBMITTED TO OTHERS FOR EXAMINATION WITHOUT THE CONSENT OF THIS COMPANY, THAT IT SHALL NOT BE USED IN ANY OTHER WAY DETRIMENTAL TO THE INTERESTS OF THIS COMPANY, AND THAT IT SHALL BE RETURNED UPON DEMAND.	NEXT ASSEMBLY: —				
TOLERANCE ON TWO DECIMAL PLACES ±0.030, TOLERANCE ON THREE DECIMAL PLACES ±0.015 SURFACE FINISH ON MACHINED FACES 125 INTERNAL CORNERS 0.030 RADIUS MAX. EXTERNAL CORNERS 0.030 X 45° CHAMFER HOLES COUNTERSINK 0.030 X 45°		SCALE: NTS	DRAWING NUMBER: PROD. CLASS 39	SERIAL # 1047	SHEET D	

CAD FILE:



DET.	DESCRIPTION 398003D00B	MATERIAL	LENGTH	QTY.	PART No.
1	ENCLOSURE, 24" x 20" x 8"	FRP, NEMA 4X	X	1	–
2	DISCONNECT HANDLE	–	X	1	–
3	LABEL, VOLAGE 120V	–	X	1	5912000229
4	LABEL, WARNING DISCONNECT POWER	–	X	1	5912000015
5	PANEL LAYOUT	SEE PANEL LAYOUT TAB	X	1	–
6	X	–	X	X	X
7	X	X	X	X	X
8	X	X	X	X	X
9	X	X	X	X	X
10	X	X	X	X	X
11	X	X	X	X	X
12	X	X	X	X	X
13	X	X	X	X	X
14	X	X	X	X	X
15	X	X	X	X	X
16	X	X	X	X	X
17	X	X	X	X	X
18	X	X	X	X	X
19	X	X	X	X	X
20	X	X	X	X	X

N O T E S:

1. FIELD WIRING BY ELLIS =
2. FIELD WIRING BY CUSTOMER =
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (–).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310–16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

NEMA 4X FIBERGLASS ENCLOSURE

24" H 20" W x 8" D

ZONE 1 CABINET LAYOUT

CABINET TO BE SHIPPED LOOSE,

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 1 OF 5 PART #: 39–8153

CAD FILE: 39–8153.dwg

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #1 CABINET

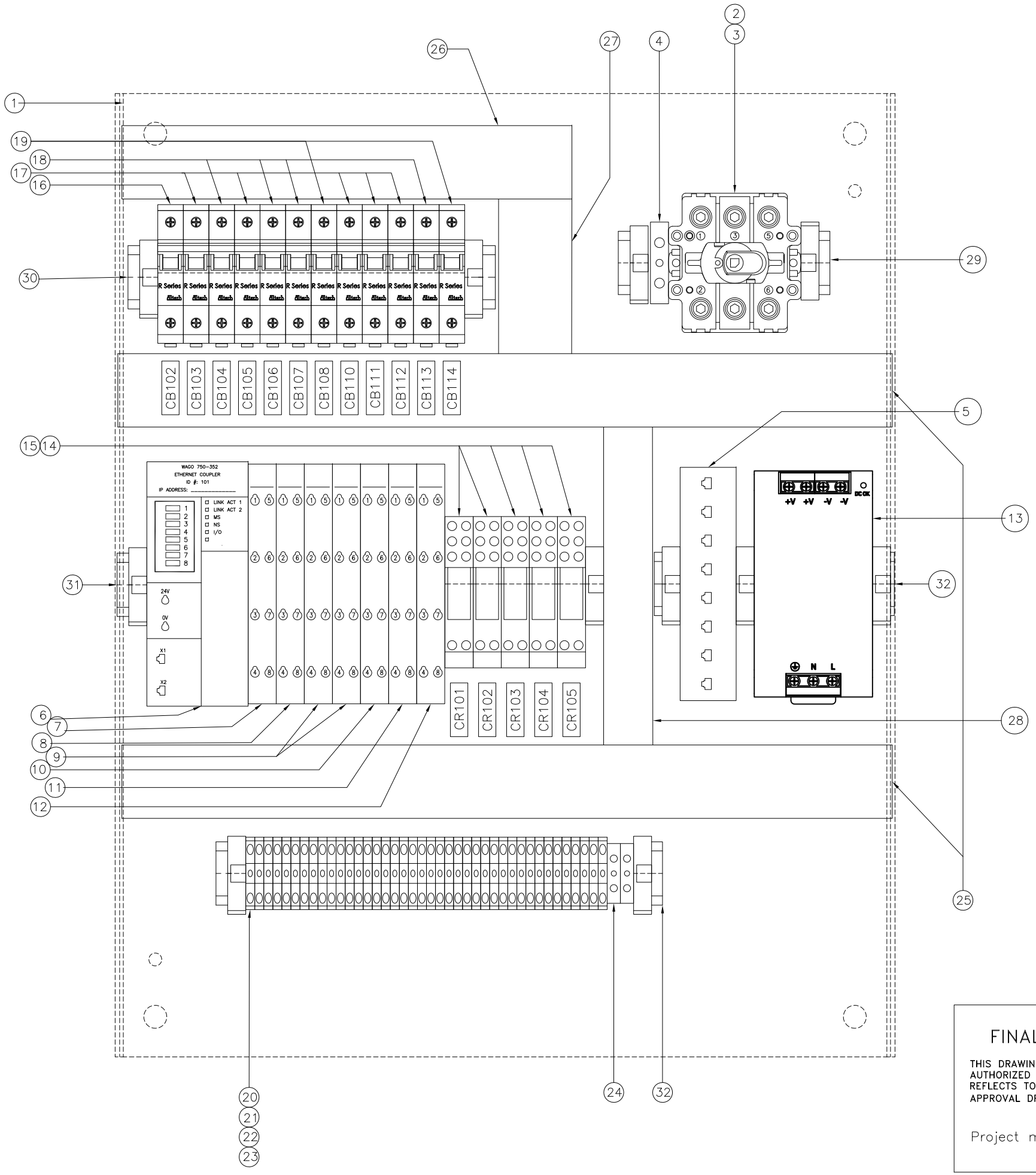
MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		

DRAWN BY: DWN DATE: 12/10/14 | CHECKED BY: DATE: | MFG. ENG.: DATE: | APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8153	D



#	Part No.	Description	Length	Qty.
1			–	1
2			–	1
3			–	1
4				1
5			–	1
6			–	1
7			–	1
8			–	1
9			–	2
10			–	1
11			–	1
12			–	
13			–	
14			–	
15			–	
16			–	
17			–	
18			–	
19			–	
20			–	
21			–	
22			–	
23			–	
24			–	
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				

N O T E S:

1. FIELD WIRING BY ELLIS = – – – – – –
2. FIELD WIRING BY CUSTOMER = ——·——
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (–).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310–16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 2 | OF 5 | PART #: 39–8153

CAD FILE: 39–8153.dwg

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #1 CABINET

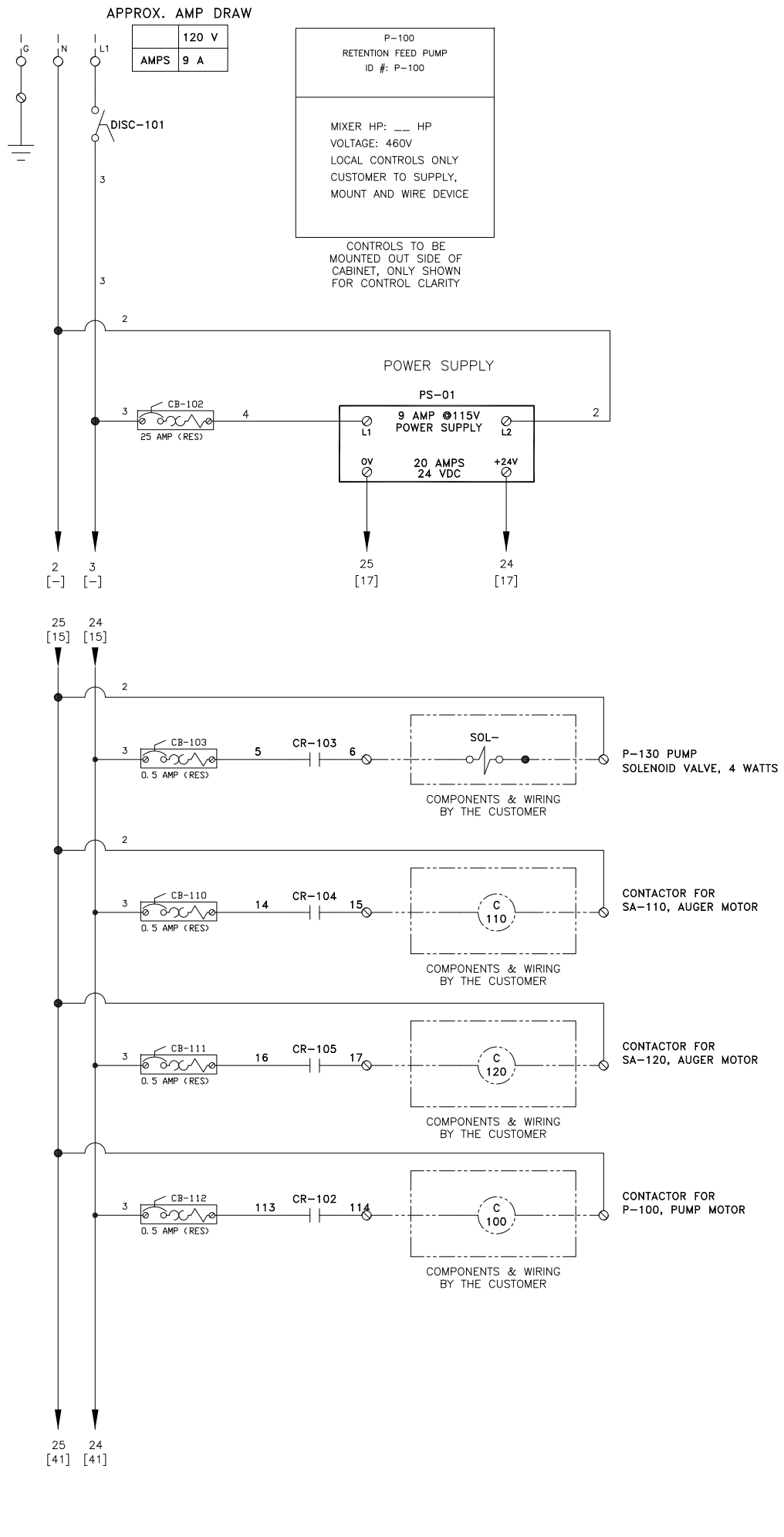
MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D – 01/30/15	A – 12/24/14	B – 01/05/15	C – 01/12/15		

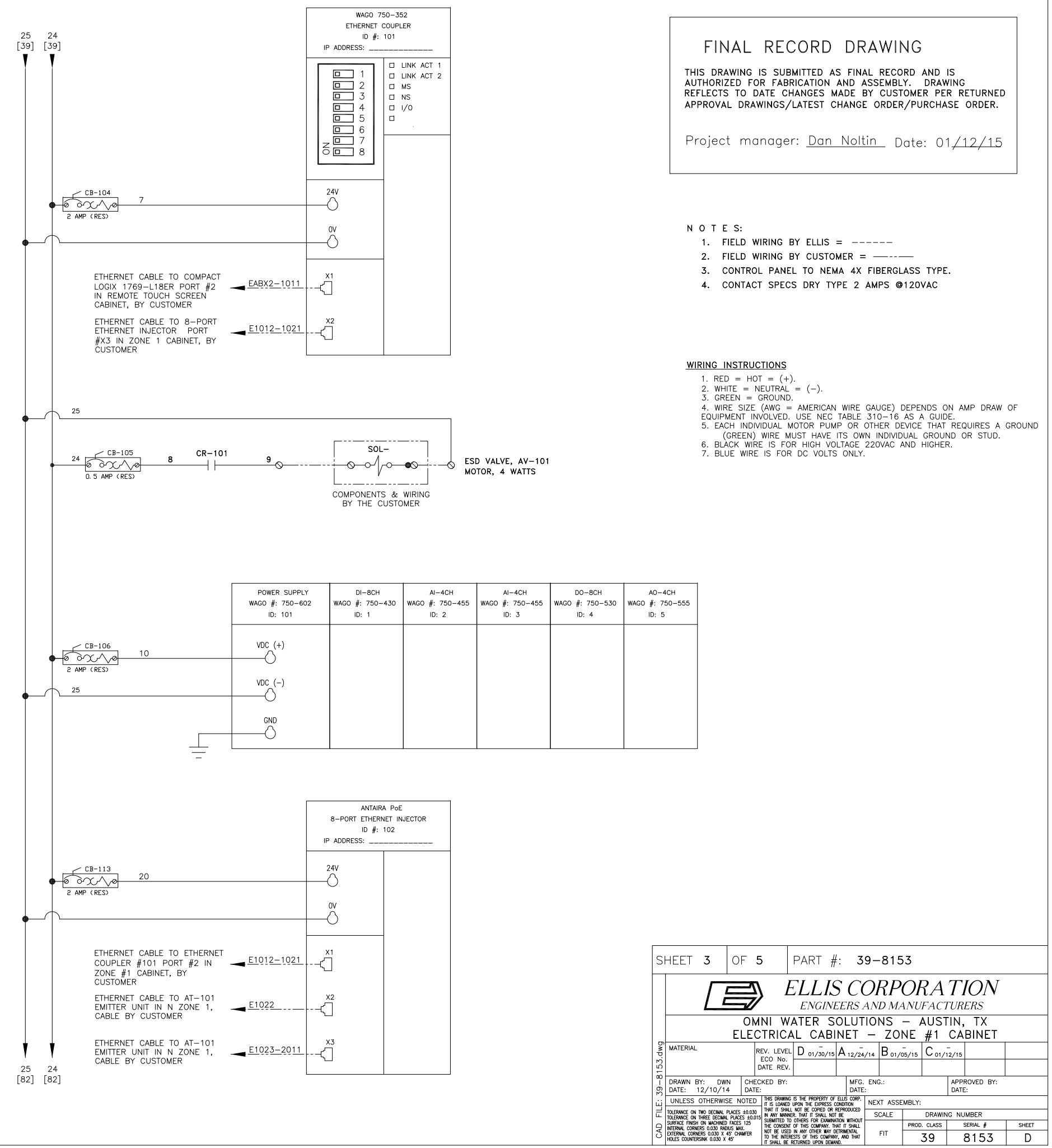
DRAWN BY: DWN DATE: 12/10/14 | CHECKED BY: DATE: | MFG. ENG.: DATE: | APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.010
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8153	D





FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = —·—
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (-).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310-16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

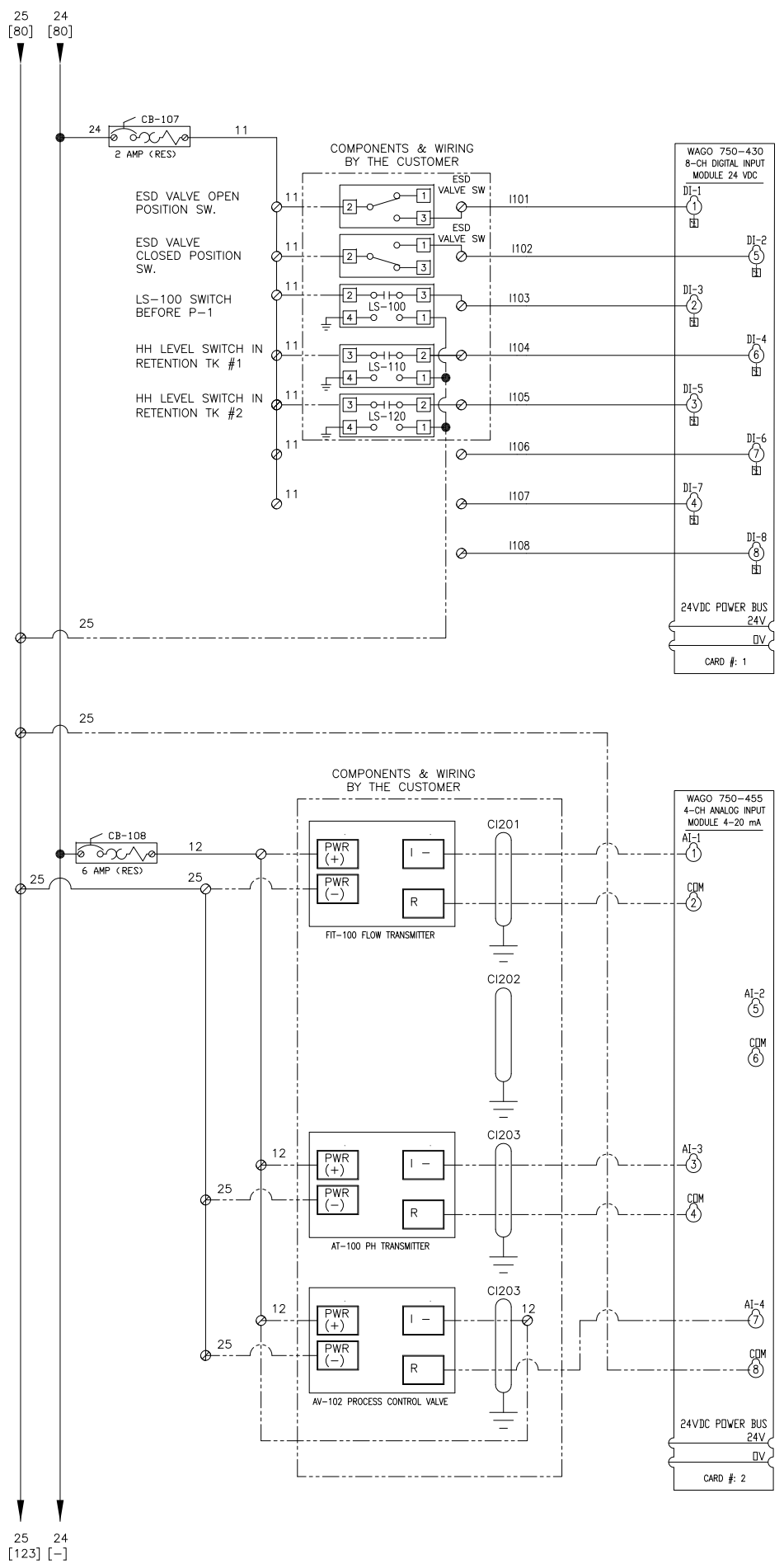
SHEET 3 OF 5 PART #: 39-8153

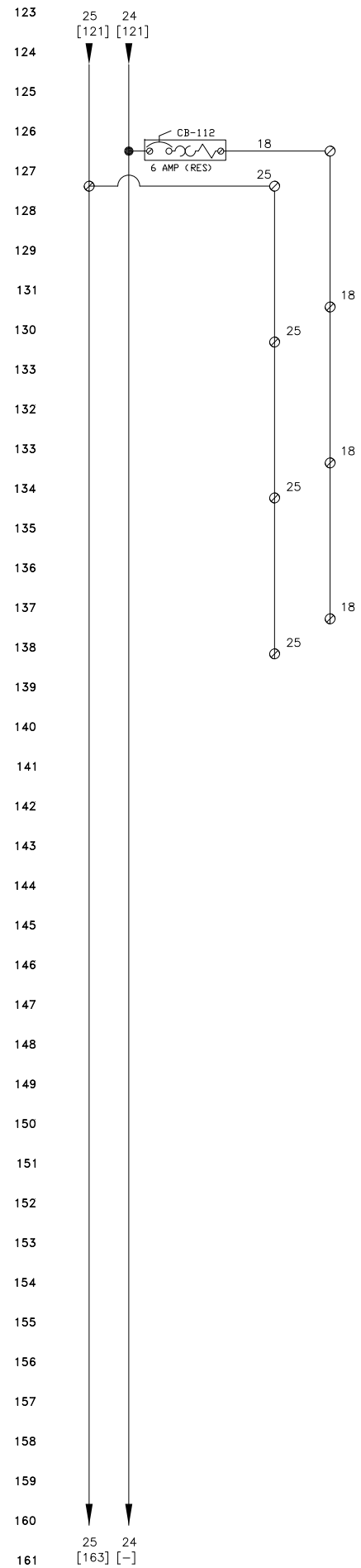
ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #1 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		
DRAWN BY: DWN 1 DATE: 12/10/14	CHECKED BY: DATE:		MFG. ENG.: DATE:		APPROVED BY: DATE:		
UNLESS OTHERWISE NOTED TOLERANCE ON TWO DECIMAL PLACES ±0.030 TOLERANCE ON THREE DECIMAL PLACES ±0.015 SURFACE FINISH ON MACHINED FACES 125 INTERNAL CORNERS 0.030 RADIUS MAX. EXTERNAL CORNERS 0.030 X 45° CHAMFER HOLES COUNTERSINK 0.030 X 45°	THIS DRAWING IS THE PROPERTY OF ELLIS CORP. IT IS LOANED UPON THE EXPRESS CONDITION THAT IT SHALL NOT BE COPIED OR REPRODUCED IN ANY MANNER, THAT IT SHALL NOT BE SUBMITTED TO OTHERS FOR EXAMINATION WITHOUT THE CONSENT OF THIS COMPANY, THAT IT SHALL NOT BE USED IN ANY OTHER WAY DETRIMENTAL TO THE INTERESTS OF THIS COMPANY, AND THAT IT SHALL BE RETURNED UPON DEMAND.	NEXT ASSEMBLY:					
		SCALE: FIT	DRAWING NUMBER: PROD. CLASS: 39	SERIAL #: 8153	SHEET: D		

CAD FILE: 39-8153.dwg





FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = ——-·——
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (−).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310-16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

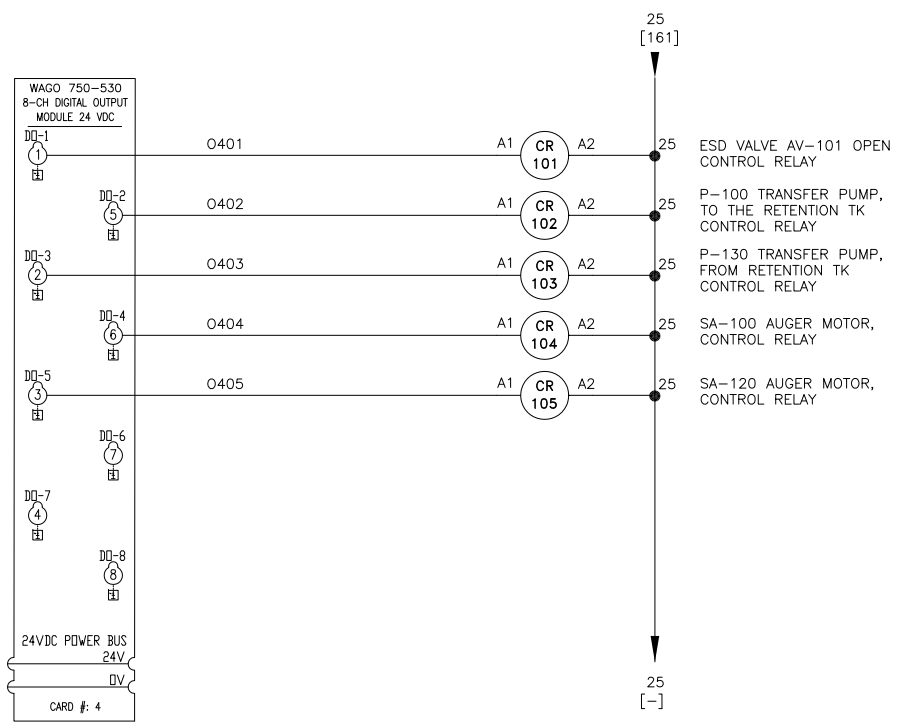
SHEET 4 OF 5 PART #: 39-8153

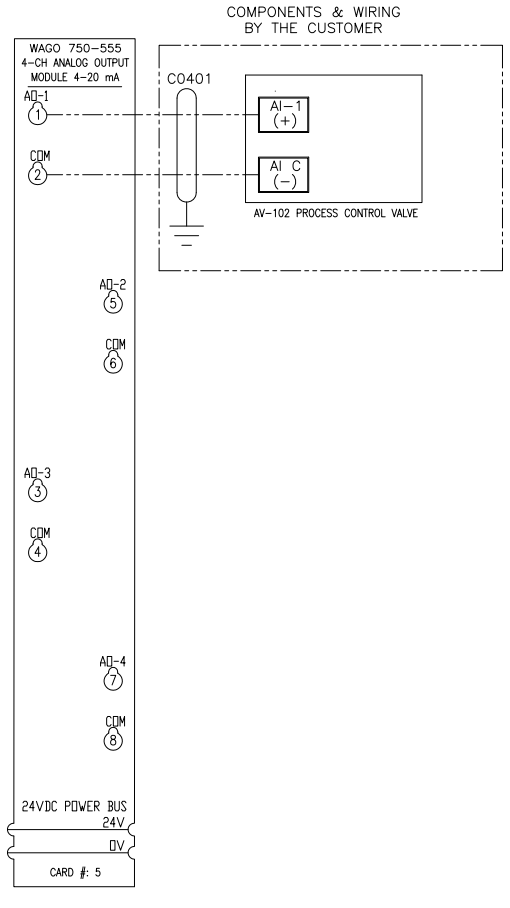
ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #1 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D – 01/30/15	A – 12/24/14	B – 01/05/15	C – 01/12/15		
DRAWN BY: DWN DATE: 12/10/14	CHECKED BY: DATE:	MFG. ENG.: DATE:	APPROVED BY: DATE:				
UNLESS OTHERWISE NOTED	THIS DRAWING IS THE PROPERTY OF ELLIS CORP. IT IS LOANED UPON THE EXPRESS CONDITION THAT IT SHALL NOT BE COPIED OR REPRODUCED IN ANY MANNER, THAT IT SHALL NOT BE SUBMITTED TO OTHERS FOR EXAMINATION WITHOUT THE CONSENT OF THIS COMPANY, THAT IT SHALL NOT BE USED IN ANY OTHER WAY DETRIMENTAL TO THE INTERESTS OF THIS COMPANY, AND THAT IT SHALL BE RETURNED UPON DEMAND.	NEXT ASSEMBLY:					
TOLERANCE ON TWO DECIMAL PLACES ±0.030 TOLERANCE ON THREE DECIMAL PLACES ±0.010 SURFACE FINISH ON MACHINED FACES 125 INTERNAL CORNERS 0.030 RADIUS MAX. EXTERNAL CORNERS 0.030 X 45° CHAMFER HOLES COUNTERSINK 0.030 X 45°		SCALE: FIT	DRAWING NUMBER: PROD. CLASS 39	SERIAL # 8153	SHEET D		

CAD FILE: 39-8153.dwg





N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = —·—·—
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (−).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310−16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 5 OF 5 PART #: 39−8153

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS − AUSTIN, TX
ELECTRICAL CABINET − ZONE #1 CABINET

MATERIAL	REV. LEVEL	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		
	ECO No.						
	DATE REV.						

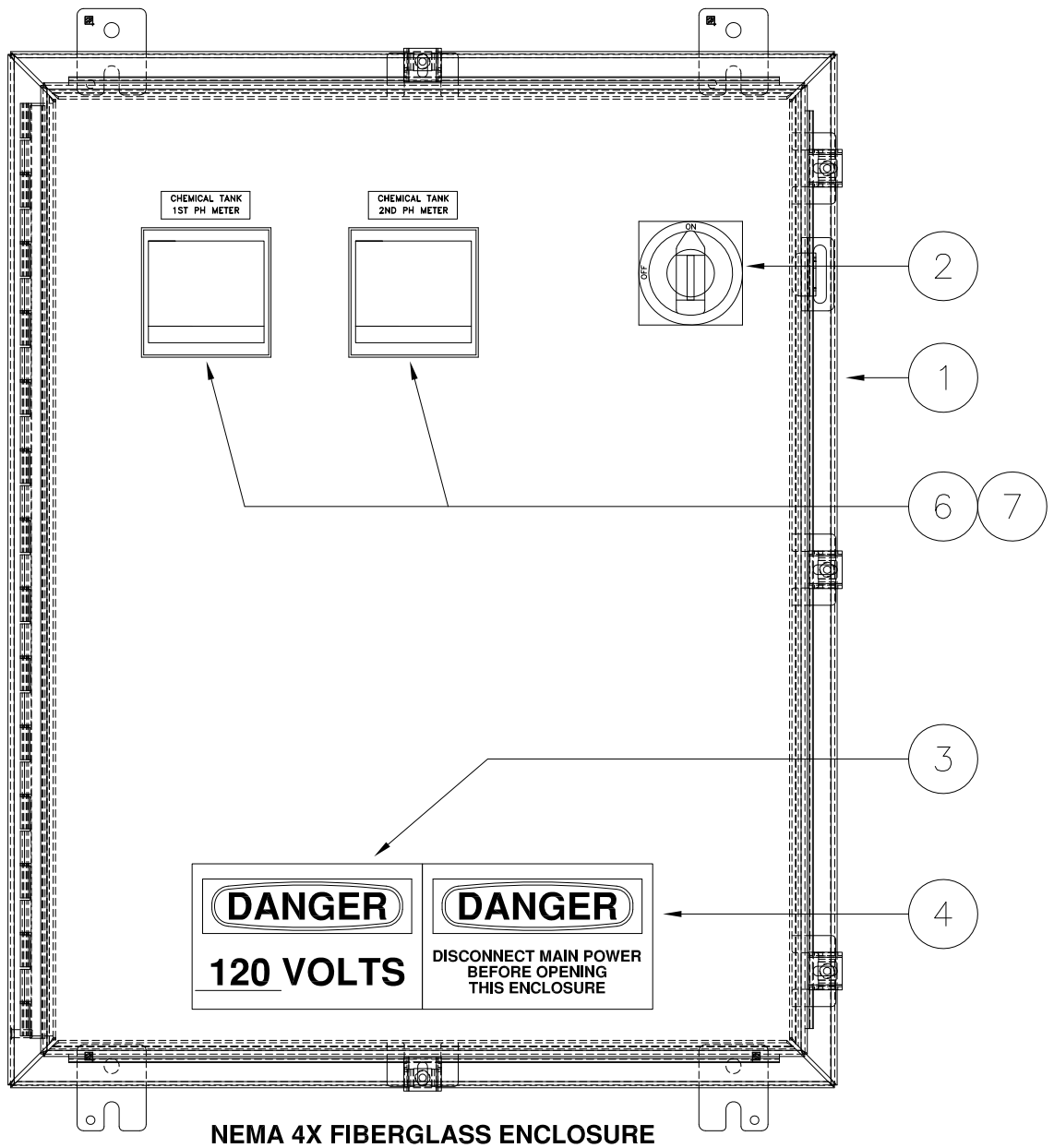
DRAWN BY: DWN DATE: 12/10/14	CHECKED BY: DATE:	MFG. ENG.: DATE:	APPROVED BY: DATE:

UNLESS OTHERWISE NOTED, TOLERANCE ON TWO DECIMAL PLACES ±0.030 TOLERANCE ON THREE DECIMAL PLACES ±0.015 SURFACE FINISH ON MACHINED FACES 125 INTERNAL CORNERS 0.030 RADIUS MAX. EXTERNAL CORNERS 0.030 X 45° CHAMFER HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8153	D

CAD FILE: 39−8153.dwg



NEMA 4X FIBERGLASS ENCLOSURE

30" H 24" W x 10" D

ZONE 2 CABINET LAYOUT

CABINET TO BE MOUNTED ON THE REACTION TANK,

MOUNTING AND WIRING BY ELLIS

DET.	DESCRIPTION 398003D00B	MATERIAL	LENGTH	QTY.	PART No.
1	ENCLOSURE, 30" x 24" x 8"	FRP, NEMA 4X	X	1	–
2	DISCONNECT HANDLE	–	X	1	–
3	LABEL, VOLAGE 120V	–	X	1	5912000229
4	LABEL, WARNING DISCONNECT POWER	–	X	1	5912000015
5	PANEL LAYOUT	SEE PANEL LAYOUT TAB	X	1	–
6	PH CONTROLLER	–	X	1	2236001099
7	ANAGLOG MODULE, PH CONTROLLER	–	X	1	2236001099B
8	X	X	X	X	X
9	X	X	X	X	X
10	X	X	X	X	X
11	X	X	X	X	X
12	X	X	X	X	X
13	X	X	X	X	X
14	X	X	X	X	X
15	X	X	X	X	X
16	X	X	X	X	X
17	X	X	X	X	X
18	X	X	X	X	X
19	X	X	X	X	X
20	X	X	X	X	X

N O T E S:

1. FIELD WIRING BY ELLIS =
2. FIELD WIRING BY CUSTOMER =
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (−).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310−16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 1 OF 4 PART #: 39−8154

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS − AUSTIN, TX
ELECTRICAL CABINET − ZONE #2 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		

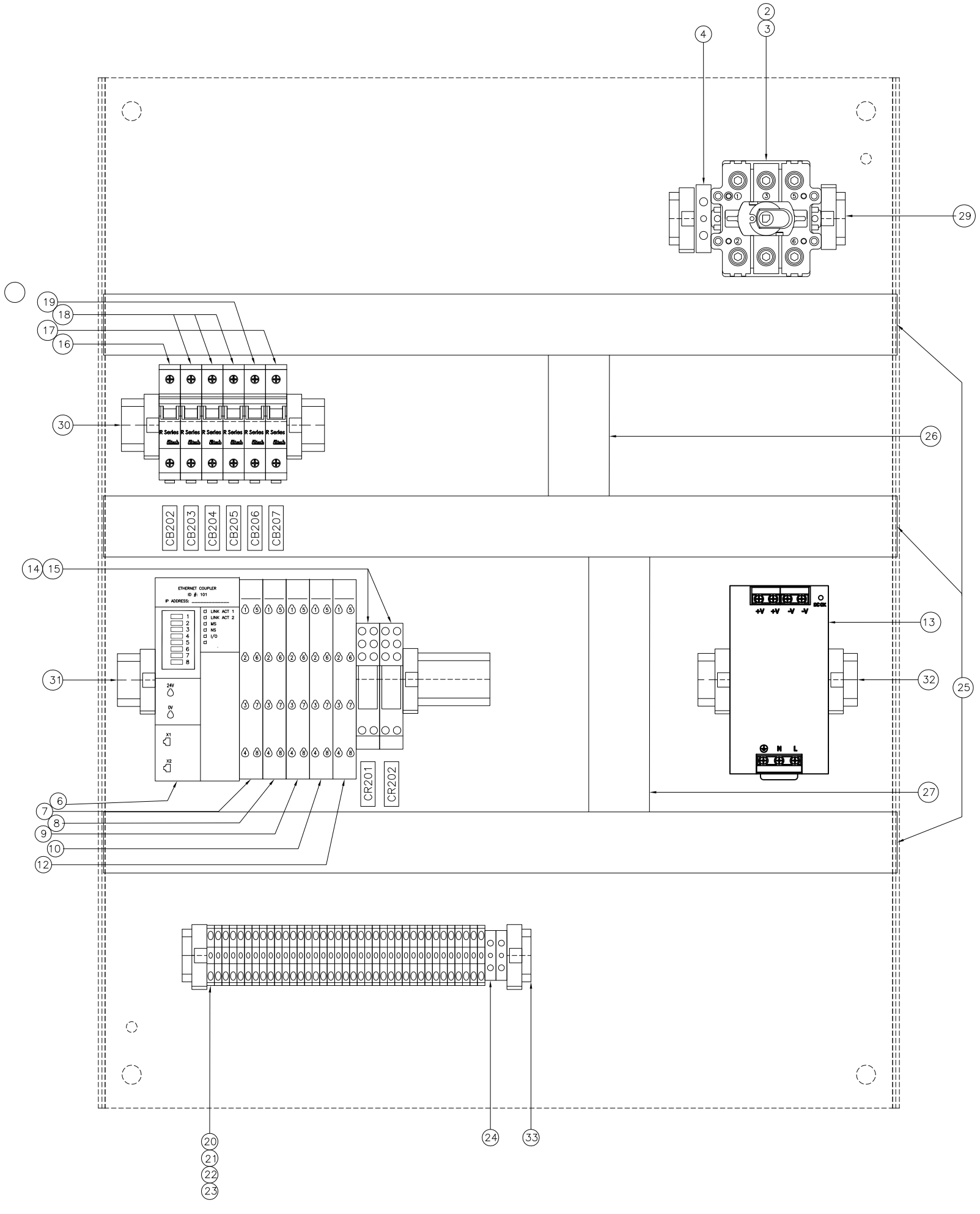
DRAWN BY: DWN DATE: 12/10/14 | CHECKED BY: dnoltin DATE: 1/30/2015 | MFG. ENG.: DATE: | APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8154	D

CAD FILE: 39−8154.dwg



#	Part No.	Description	Length	Qty.
1			–	1
2			–	1
3			–	1
4				1
5			–	1
6			–	1
7			–	1
8			–	1
9			–	2
10			–	1
11			–	1
12			–	
13			–	
14			–	
15			–	
16			–	
17			–	
18			–	
19			–	
20			–	
21			–	
22			–	
23			–	
24			–	
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				

N O T E S:

1. FIELD WIRING BY ELLIS = – – – – – –
2. FIELD WIRING BY CUSTOMER = ——·——
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (–).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310–16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 2 OF 4 PART #: 39–8154

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #2 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D – 01/30/15	A – 12/24/14	B – 01/05/15	C – 01/12/15		

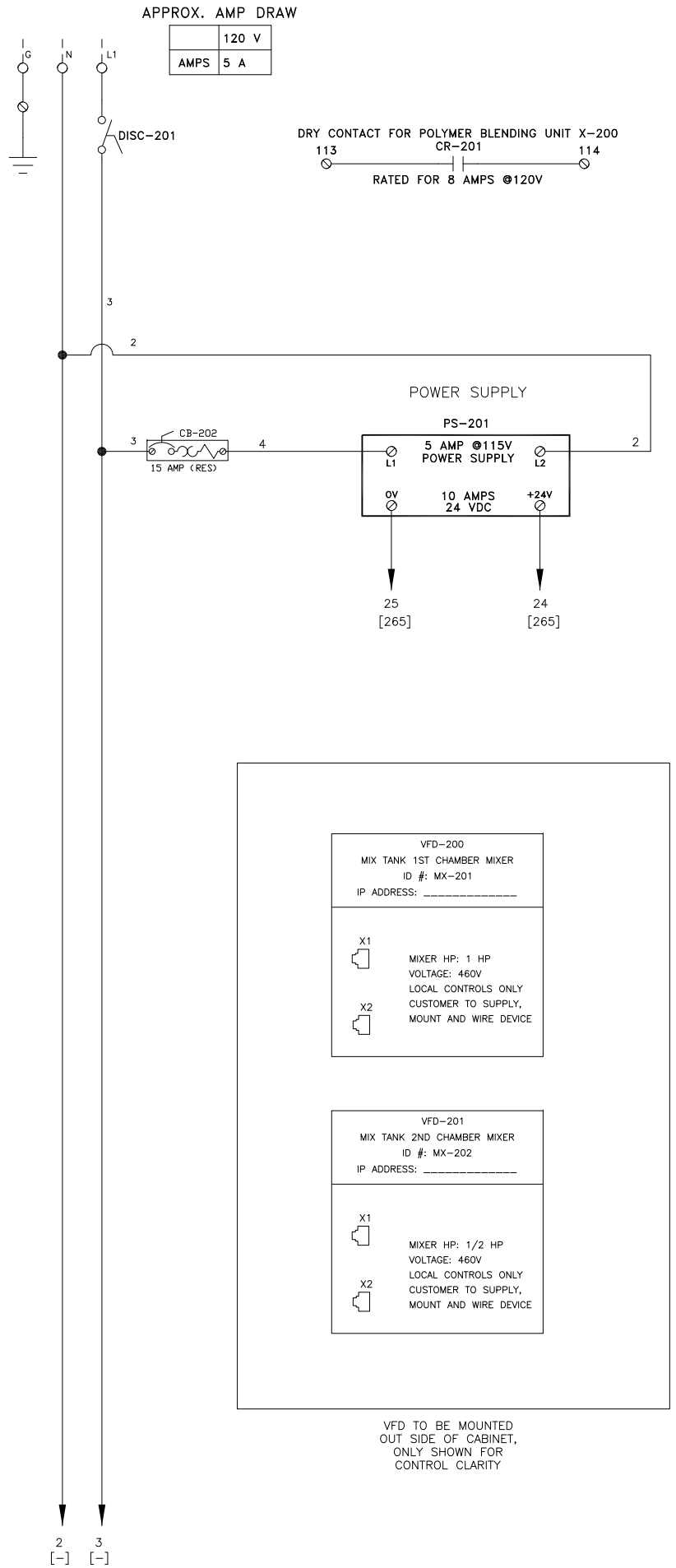
DRAWN BY: DWN DATE: 12/10/14 | CHECKED BY: dnoltin DATE: 1/30/2015 | MFG. ENG.: DATE: | APPROVED BY: DATE:

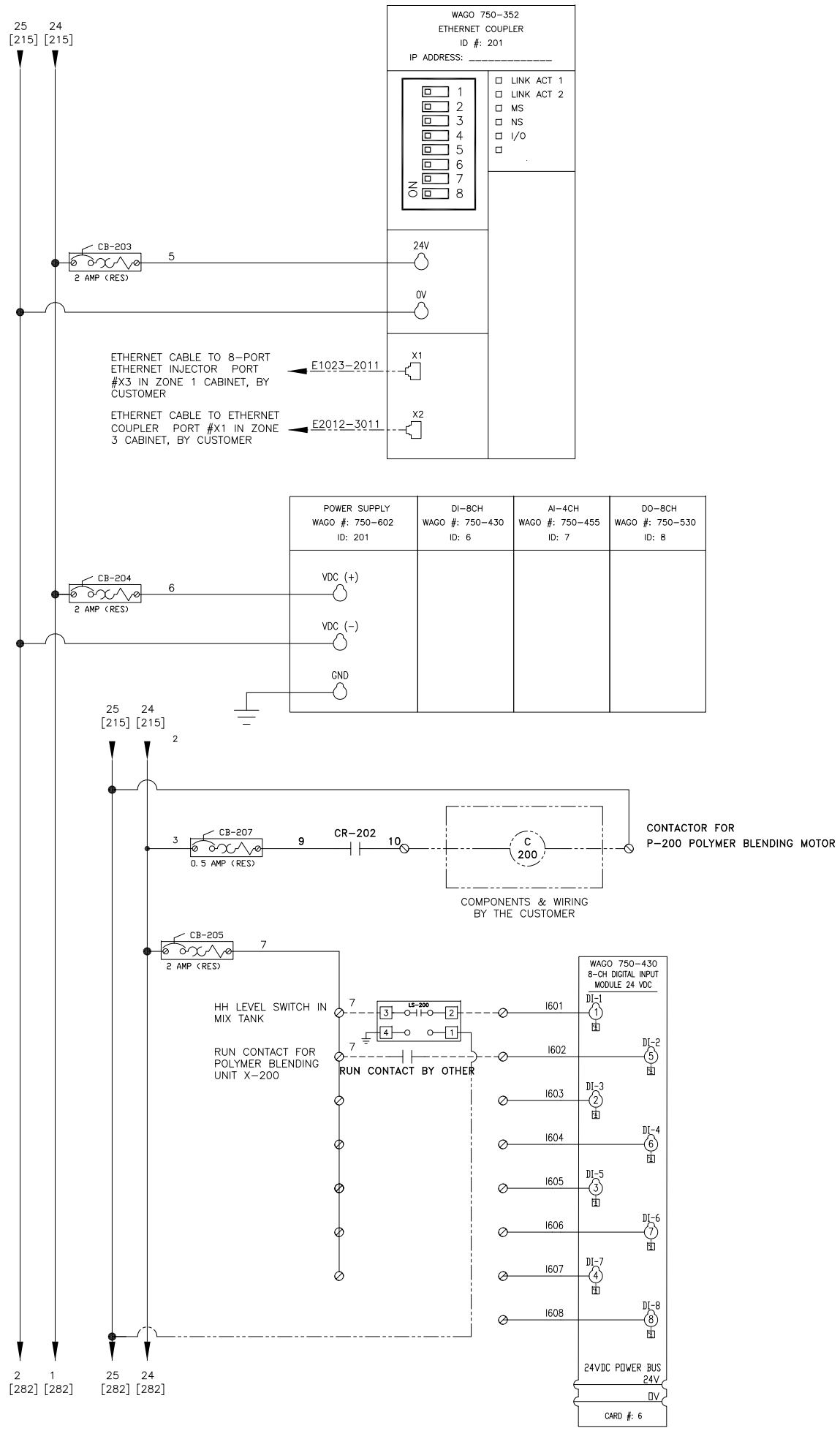
UNLESS OTHERWISE NOTED | NEXT ASSEMBLY:

TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.010
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8154	D

CAD FILE: 39–8154.dwg





FINAL RECORD DRAWING

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Project manager: Dan Noltin Date: 01/12/15

N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = —·—·—
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (-).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310-16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

SHEET 3 OF 4 PART #: 39-8154

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #2 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		

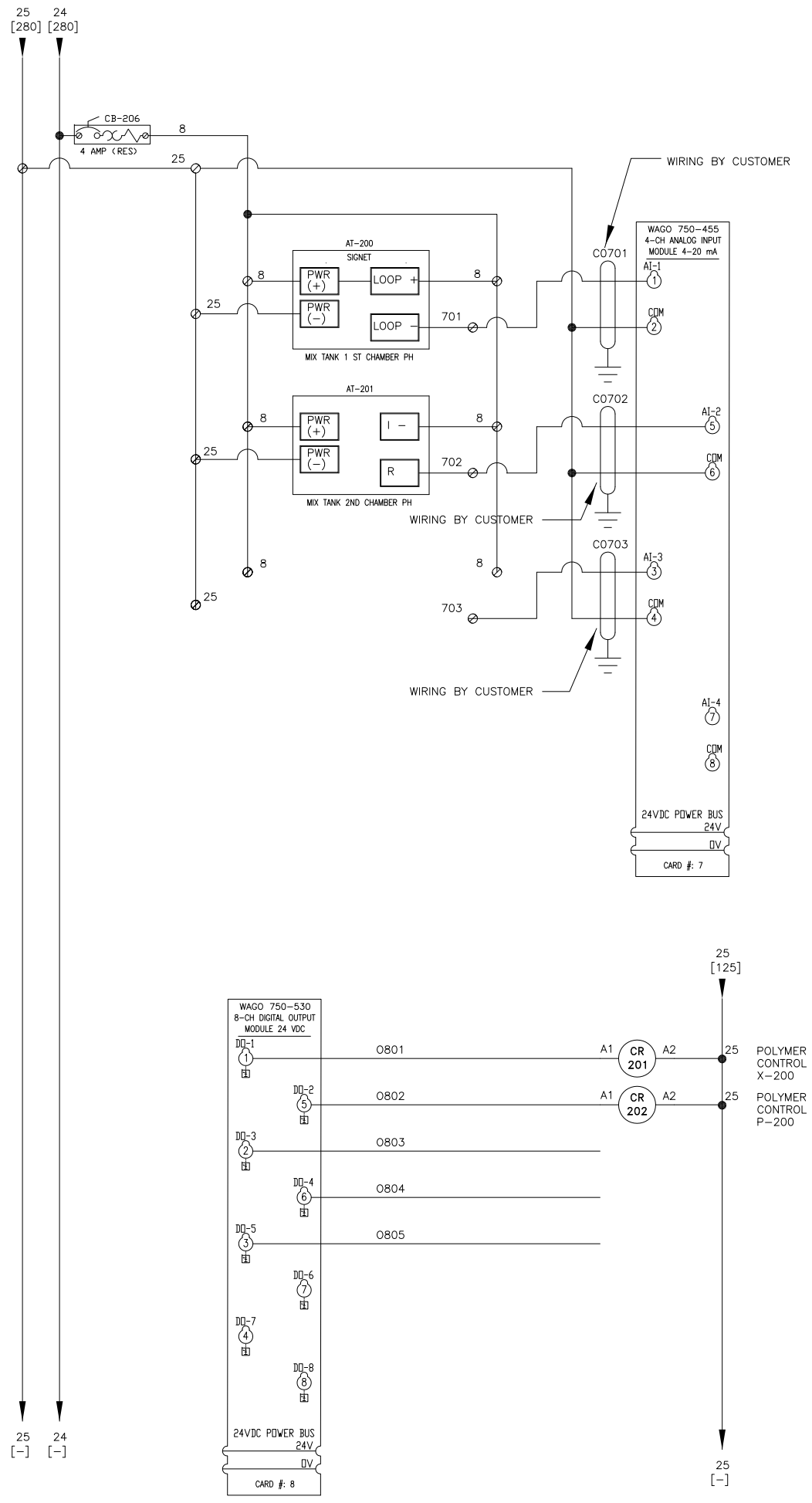
DRAWN BY: DWN DATE: 12/10/14	CHECKED BY: dnoltin DATE: 1/30/2015	MFG. ENG.: DATE:	APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.010
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8154	D

CAD FILE: 39-8154.dwg



FINAL RECORD DRAWING

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Project manager: Dan Noltin Date: 01/12/15

N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = ——--——
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
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3. GREEN = GROUND.
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6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

SHEET 4	OF 4	PART #: 39-8154	

CAD FILE: 39-8154.dwg

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #2 CABINET

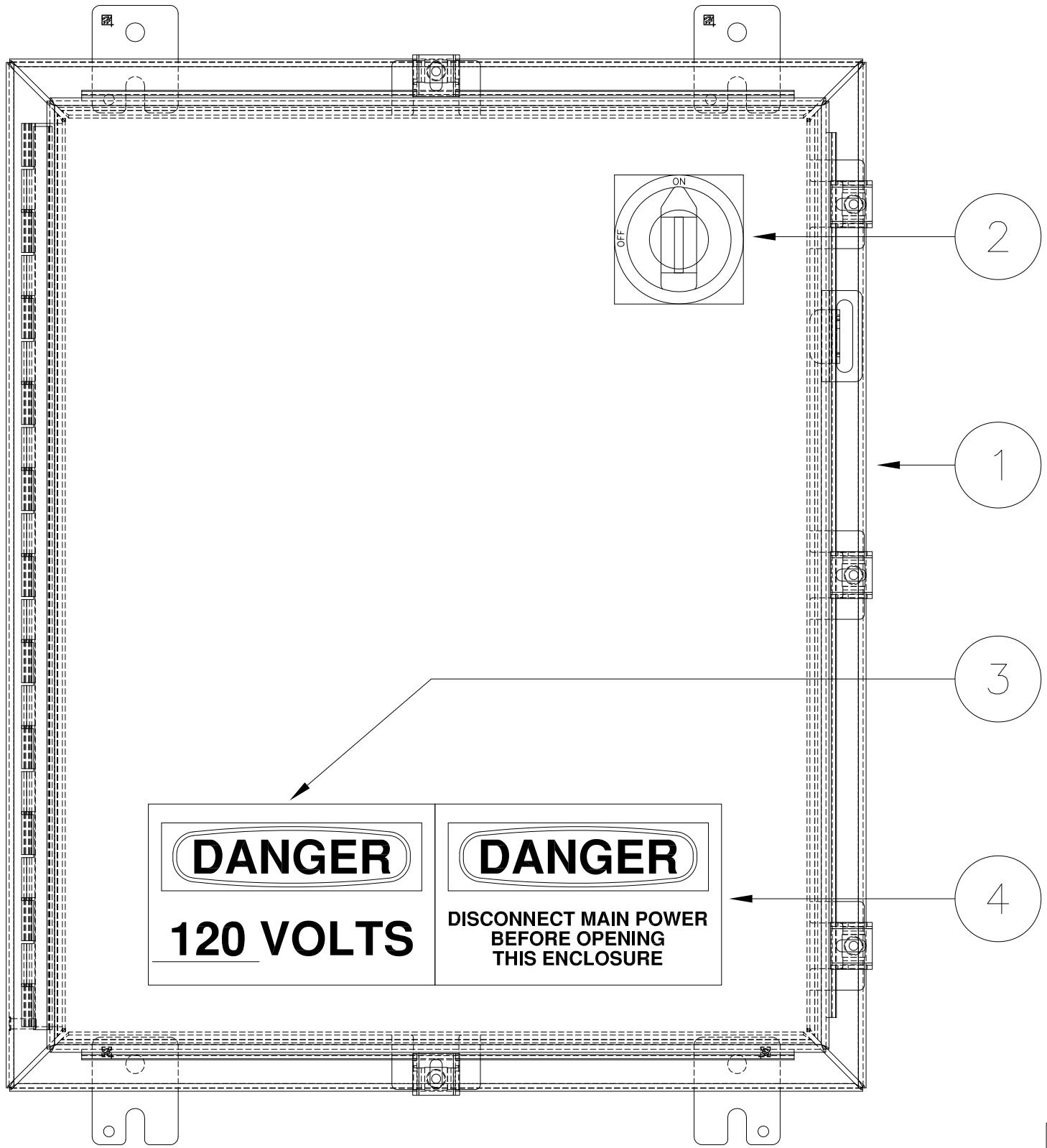
MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D – 01/30/15	A – 12/24/14	B – 01/05/15	C – 01/12/15		

DRAWN BY: DWN DATE: 12/10/14	CHECKED BY: dnoltin DATE: 1/30/2015	MFG. ENG.: DATE:	APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8154	D



DET.	DESCRIPTION 398003D00B	MATERIAL	LENGTH	QTY.	PART No.
1	ENCLOSURE, 24" x 20" x 8"	FRP, NEMA 4X	X	1	–
2	DISCONNECT HANDLE	–	X	1	–
3	LABEL, VOLAGE 120V	–	X	1	5912000229
4	LABEL, WARNING DISCONNECT POWER	–	X	1	5912000015
5	PANEL LAYOUT	SEE PANEL LAYOUT TAB	X	1	–
6	X	–	X	X	X
7	X	X	X	X	X
8	X	X	X	X	X
9	X	X	X	X	X
10	X	X	X	X	X
11	X	X	X	X	X
12	X	X	X	X	X
13	X	X	X	X	X
14	X	X	X	X	X
15	X	X	X	X	X
16	X	X	X	X	X
17	X	X	X	X	X
18	X	X	X	X	X
19	X	X	X	X	X
20	X	X	X	X	X

N O T E S:

1. FIELD WIRING BY ELLIS =
2. FIELD WIRING BY CUSTOMER =
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (−).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310−16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

NEMA 4X FIBERGLASS ENCLOSURE

24" H 20" W x 8" D

ZONE 3 CABINET LAYOUT

CABINET TO BE SHIPPED LOOSE,

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 1 OF 4 PART #: 39−8155

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS − AUSTIN, TX
ELECTRICAL CABINET − ZONE #3 CABINET

MATERIAL	REV. LEVEL	D	A	B	C		
	ECO No.	–	–	–	–		
	DATE REV.	01/30/15	12/24/14	01/05/15	01/12/15		

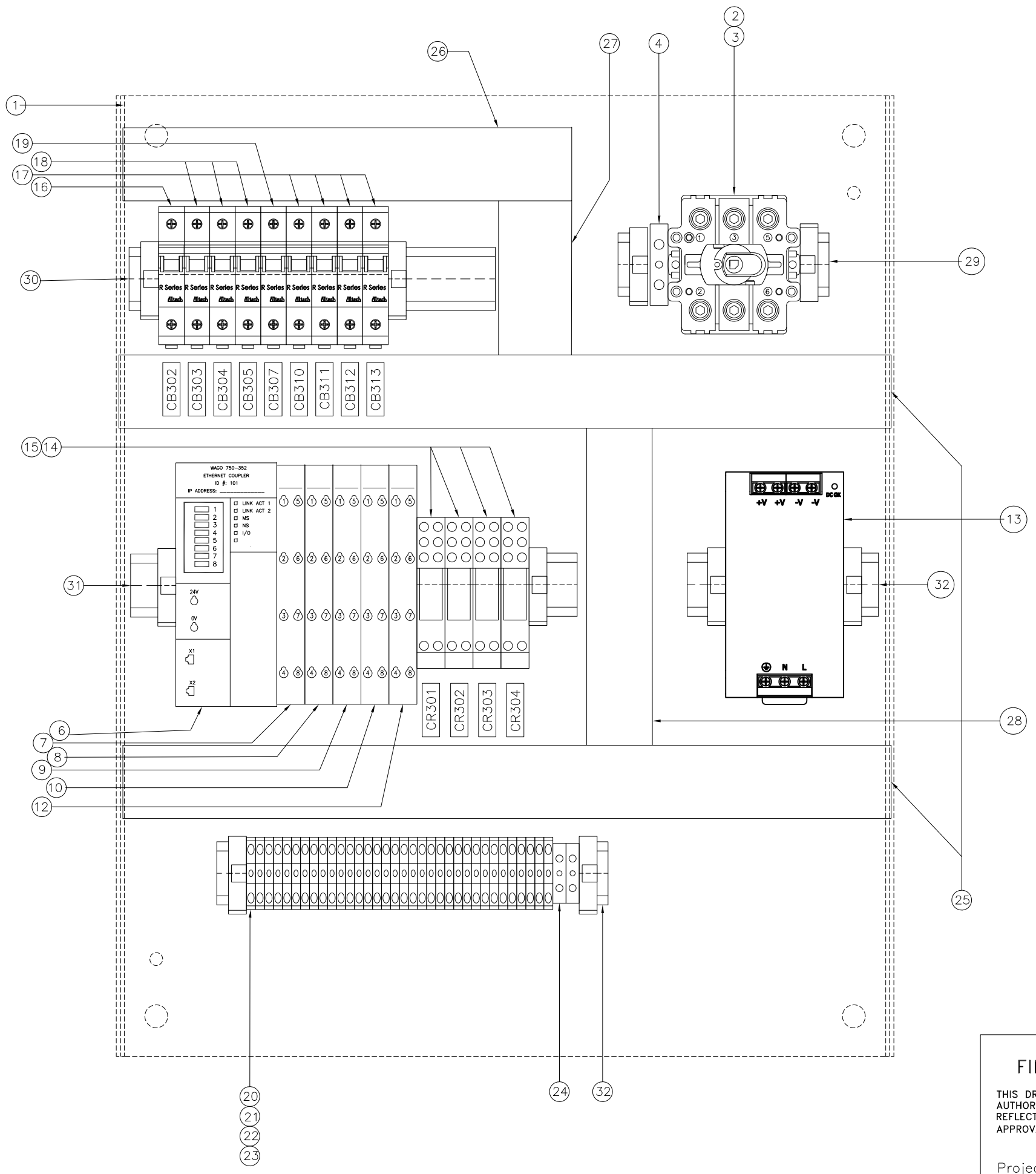
DRAWN BY: DWN DATE: 12/10/14 | CHECKED BY: dnoltin DATE: 1/30/2015 | MFG. ENG.: DATE: | APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8155	D

CAD FILE: 39−8155.dwg



#	Part No.	Description	Length	Qty.
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2			–	1
3			–	1
4				1
5			–	
6			–	1
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9			–	
10			–	1
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N O T E S:

1. FIELD WIRING BY ELLIS = – – – – – –
2. FIELD WIRING BY CUSTOMER = ——·——
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (–).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310–16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 2 OF 4 PART #: 39–8155

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #3 CABINET

MATERIAL	REV. LEVEL	D	A	B	C		
	ECO No.	–	–	–	–		
	DATE REV.	01/30/15	12/24/14	01/05/15	01/12/15		

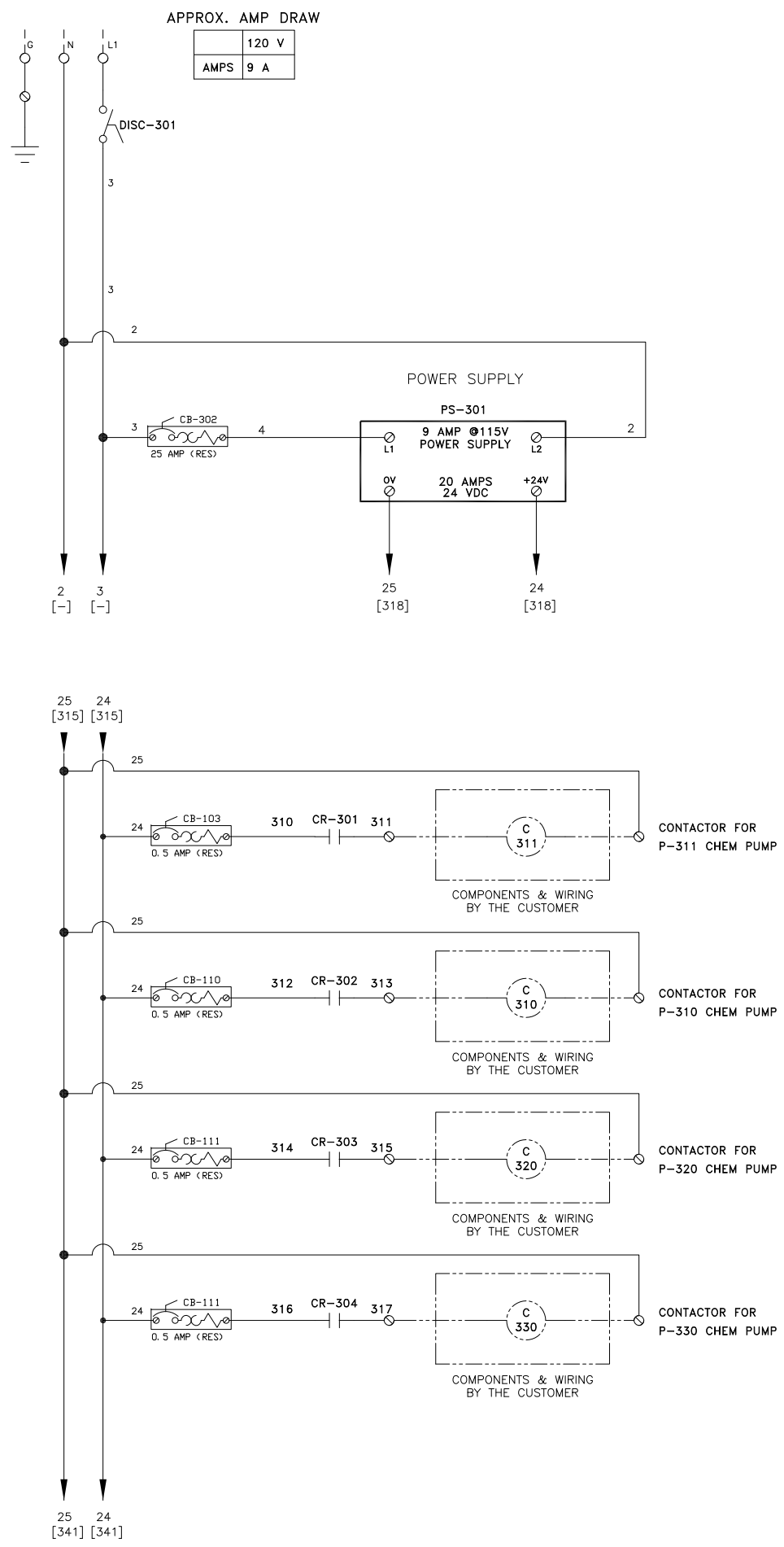
DRAWN BY: DWN	CHECKED BY: dnoltin	MFG. ENG.:	APPROVED BY:
DATE: 12/10/14	DATE: 1/30/2015	DATE:	DATE:

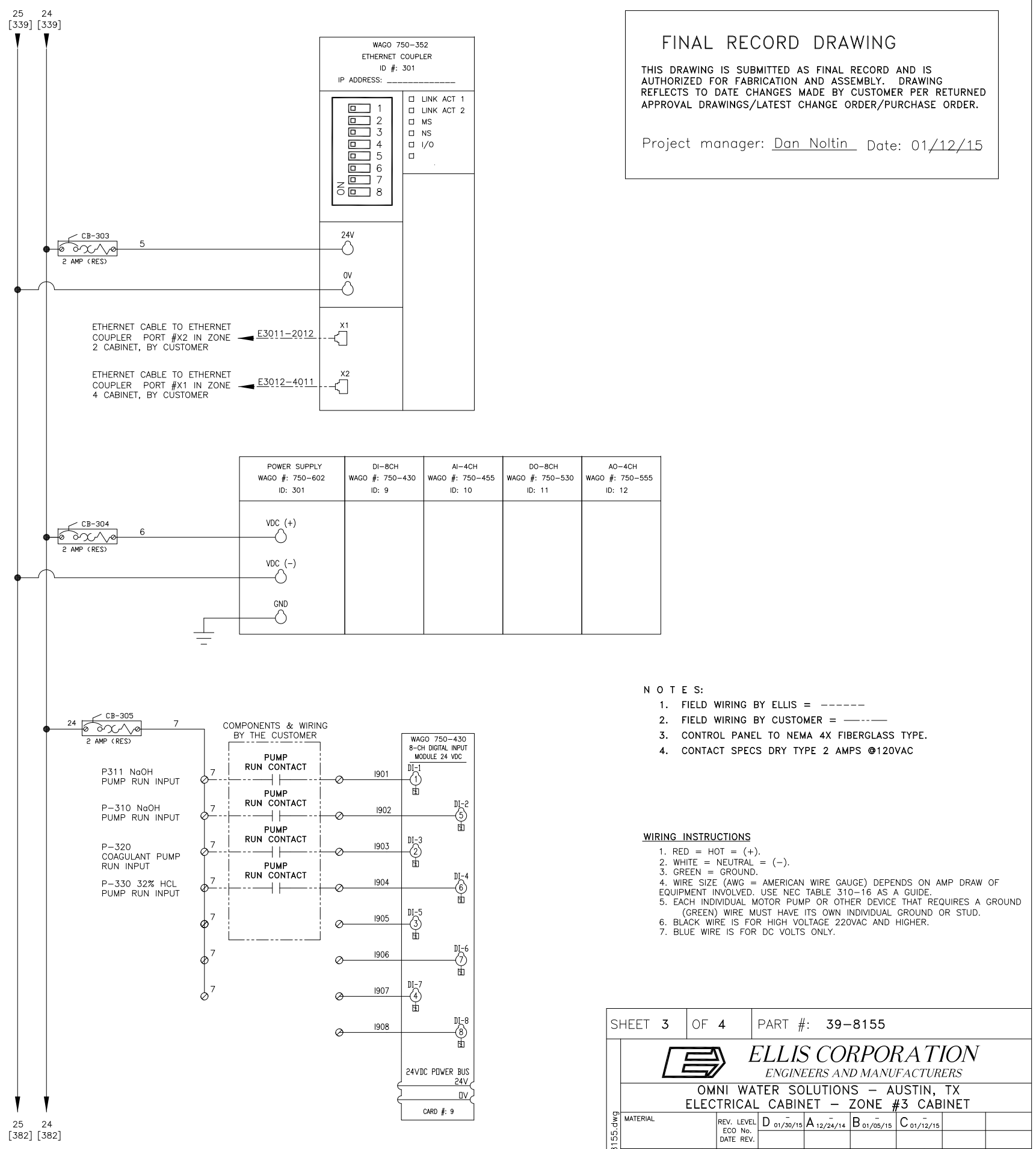
UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8155	D

CAD FILE: 39–8155.dwg





FINAL RECORD DRAWING

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Project manager: Dan Noltin Date: 01/12/15

N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = —·—·—
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (-).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310-16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

SHEET 3 OF 4 PART #: 39-8155

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #3 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		

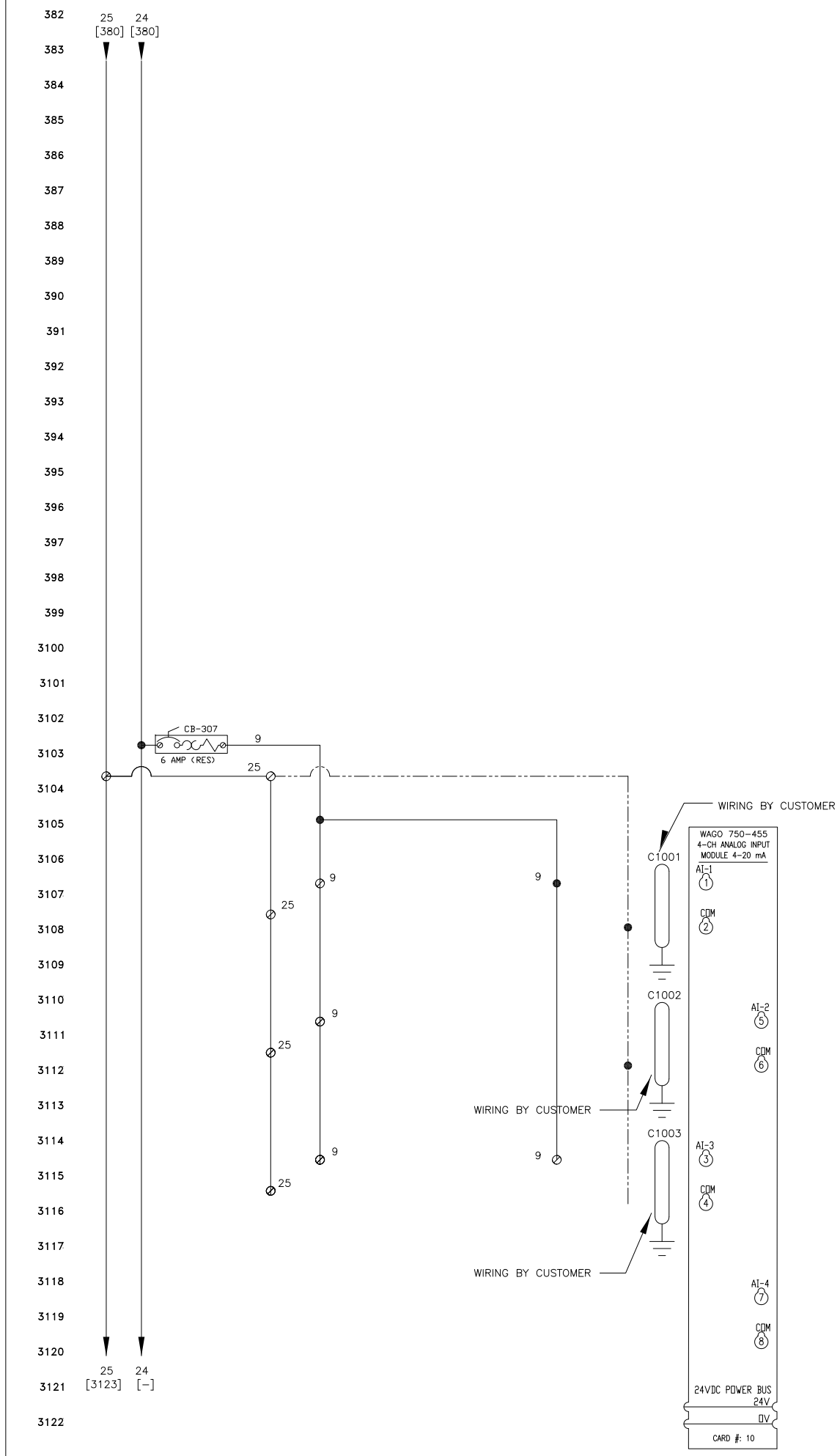
DRAWN BY: DWN	CHECKED BY: dnoltin	MFG. ENG.:	APPROVED BY:
DATE: 12/10/14	DATE: 1/30/2015	DATE:	DATE:

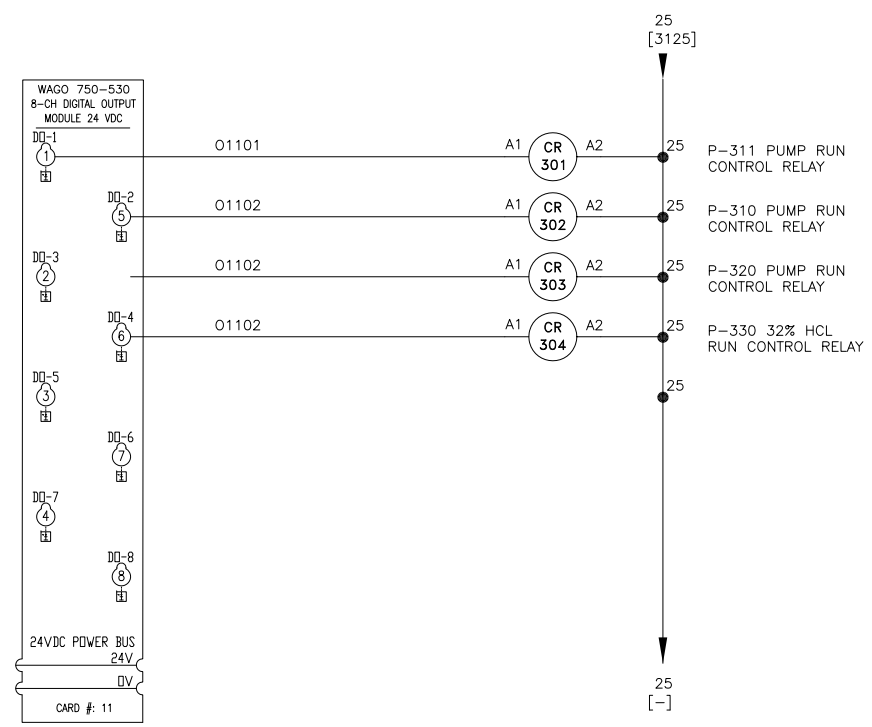
UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

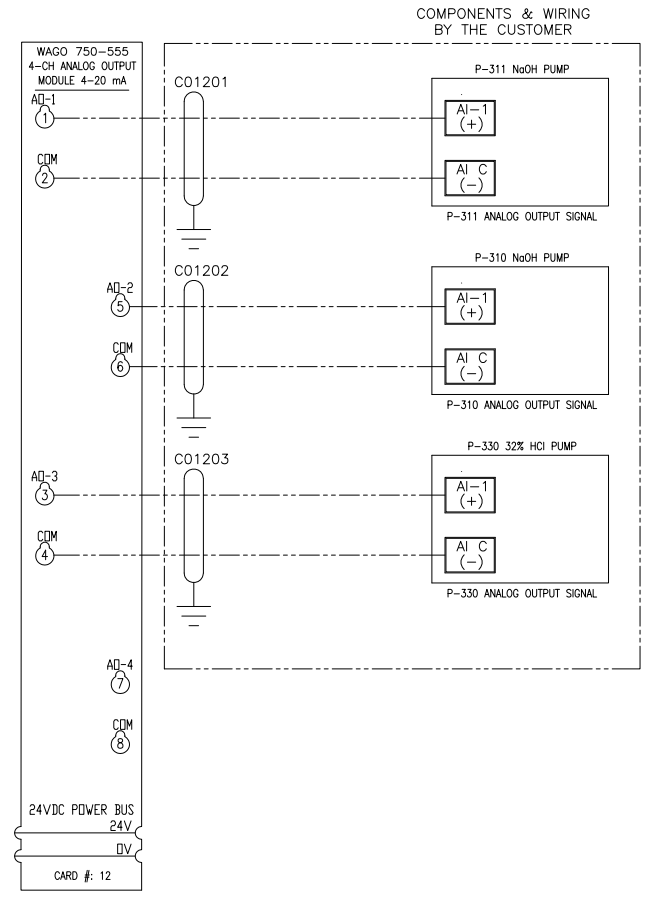
NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8155	D

CAD FILE: 39-8155.dwg







FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = —·—·—
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (−).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310-16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

SHEET 4 OF 4 PART #: 39-8155

CAD FILE: 39-8155.dwg

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #3 CABINET

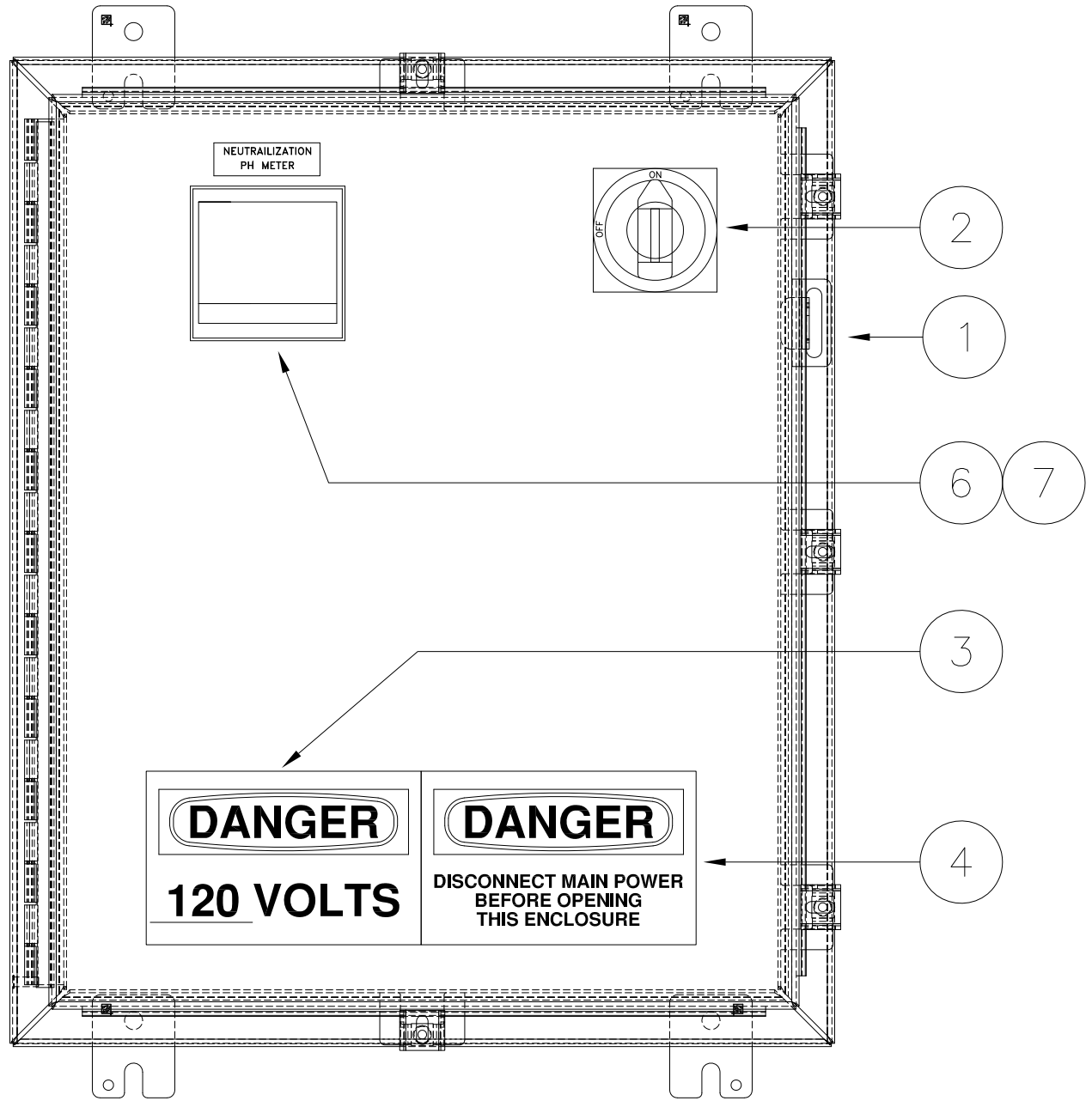
MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		

DRAWN BY: DWN DATE: 12/10/14 | CHECKED BY: dnoltin DATE: 1/30/2015 | MFG. ENG.: DATE: | APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.010
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8155	D



DET.	DESCRIPTION 398003D00B	MATERIAL	LENGTH	QTY.	PART No.
1	ENCLOSURE, 24" x 20" x 8"	FRP, NEMA 4X	X	1	–
2	DISCONNECT HANDLE	–	X	1	–
3	LABEL, VOLAGE 120V	–	X	1	5912000229
4	LABEL, WARNING DISCONNECT POWER	–	X	1	5912000015
5	PANEL LAYOUT	SEE PANEL LAYOUT TAB	X	1	–
6	PH CONTROLLER	–	X	1	2236001099
7	ANALOG CARD, PH CONTROLLER	–	X	1	2236001099B
8	X	X	X	X	X
9	X	X	X	X	X
10	X	X	X	X	X
11	X	X	X	X	X
12	X	X	X	X	X
13	X	X	X	X	X
14	X	X	X	X	X
15	X	X	X	X	X
16	X	X	X	X	X
17	X	X	X	X	X
18	X	X	X	X	X
19	X	X	X	X	X
20	X	X	X	X	X

N O T E S:

1. FIELD WIRING BY ELLIS =
2. FIELD WIRING BY CUSTOMER =
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

NEMA 4X FIBERGLASS ENCLOSURE

24" H 20" W x 8" D

ZONE 4 CABINET LAYOUT

CABINET TO BE MOUNTED ON THE NEUTRAILIZATION TANK,

MOUNTING AND WIRING BY ELLIS

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (–).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310–16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 1 OF 4 PART #: 39–8156

CAD FILE: 39–8156.dwg

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #4 CABINET

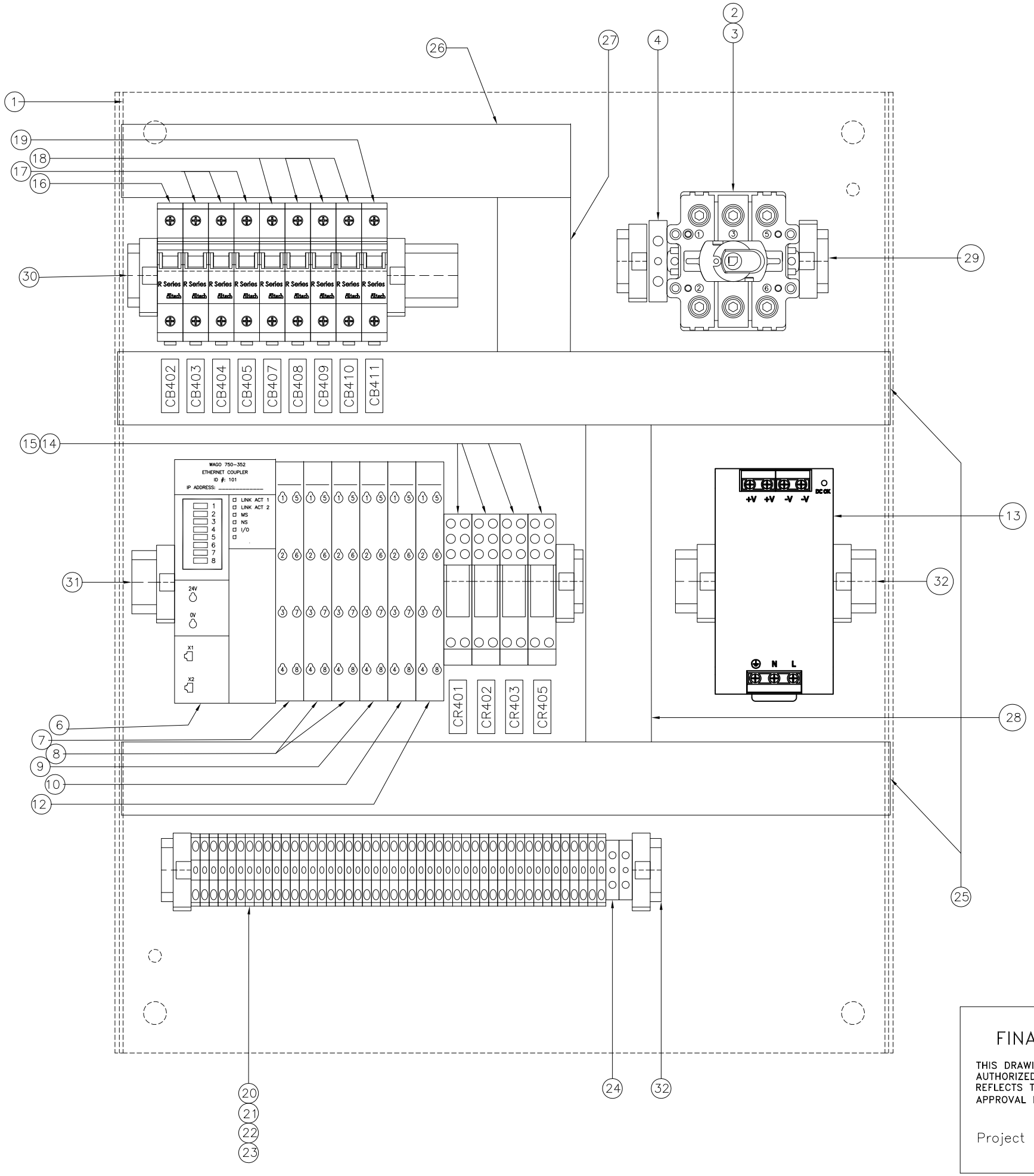
MATERIAL	REV. LEVEL ECO No. DATE REV.	D ~ 01/30/15	A ~ 12/24/14	B ~ 01/05/15	C ~ 01/12/15		

DRAWN BY: DWN DATE: 12/10/14 | CHECKED BY: dnoltin DATE: 1/30/2015 | MFG. ENG.: DATE: | APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8156	D



#	Part No.	Description	Length	Qty.
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2			–	1
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4				1
5			–	
6			–	1
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N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = —·—·—
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (–).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310–16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 2 OF 4 PART #: 39–8156

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #4 CABINET

MATERIAL	REV. LEVEL	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		
	ECO No.						
	DATE REV.						

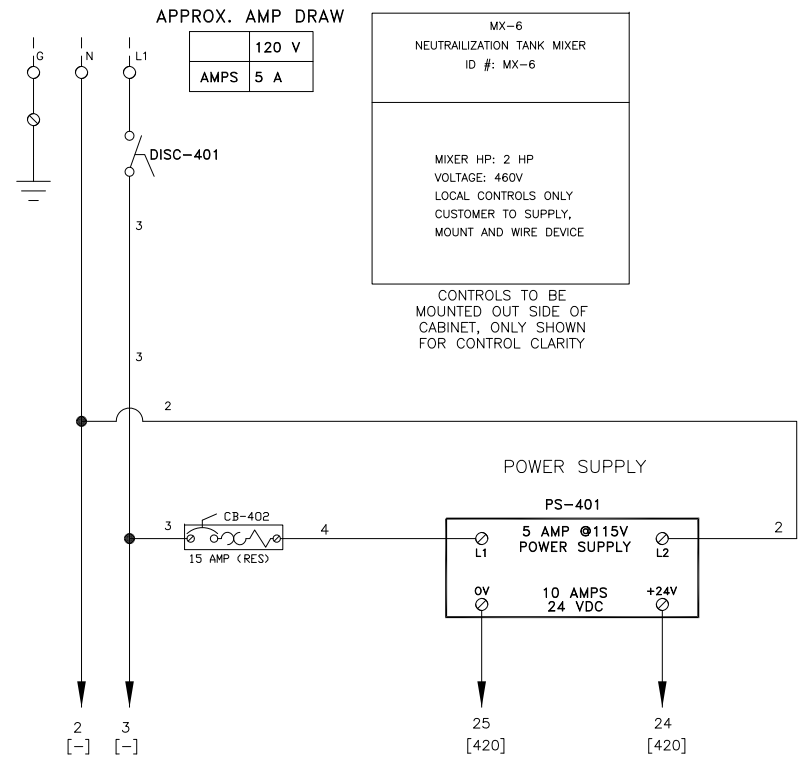
DRAWN BY: DWN DATE: 12/10/14 | CHECKED BY: dnoltin DATE: 1/30/2015 | MFG. ENG.: DATE: | APPROVED BY: DATE:

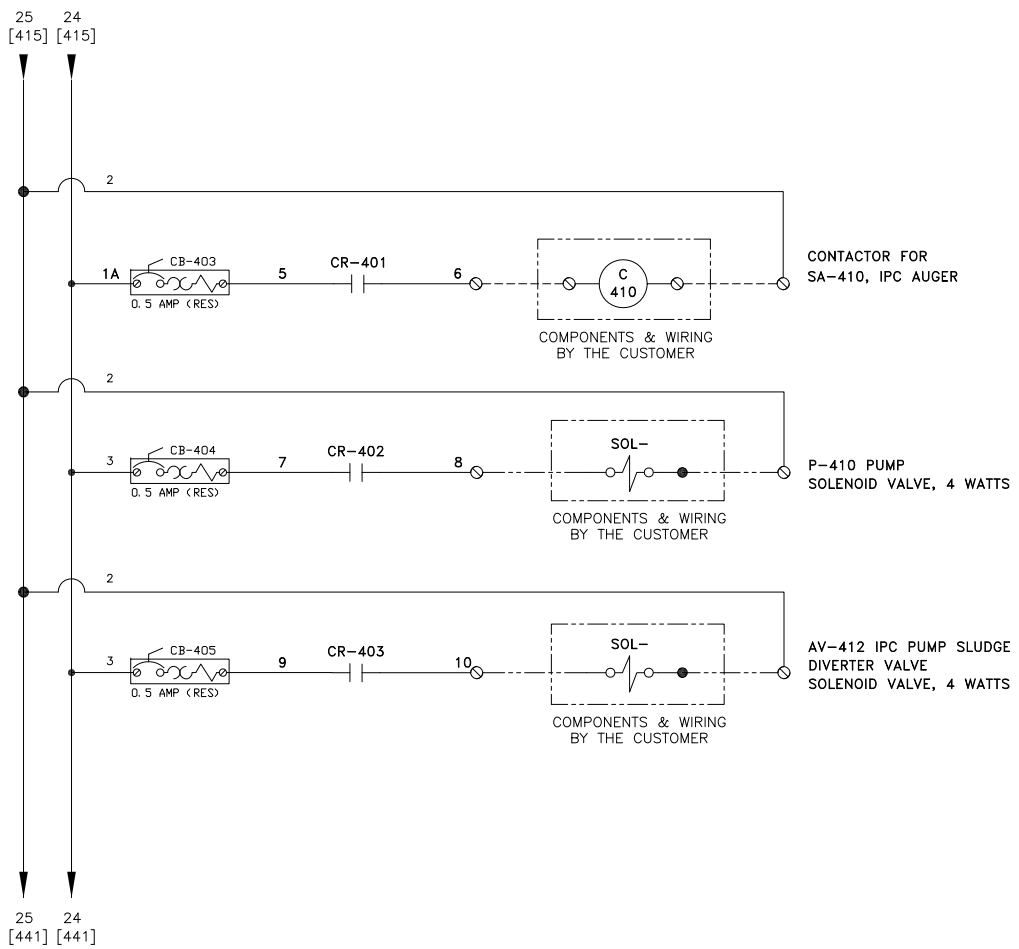
UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

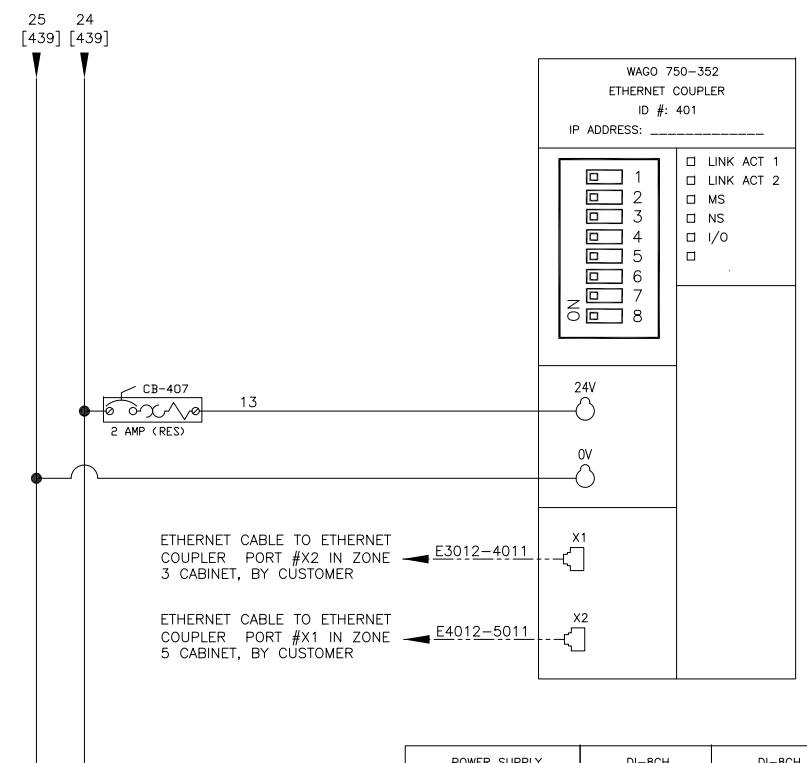
NEXT ASSEMBLY:

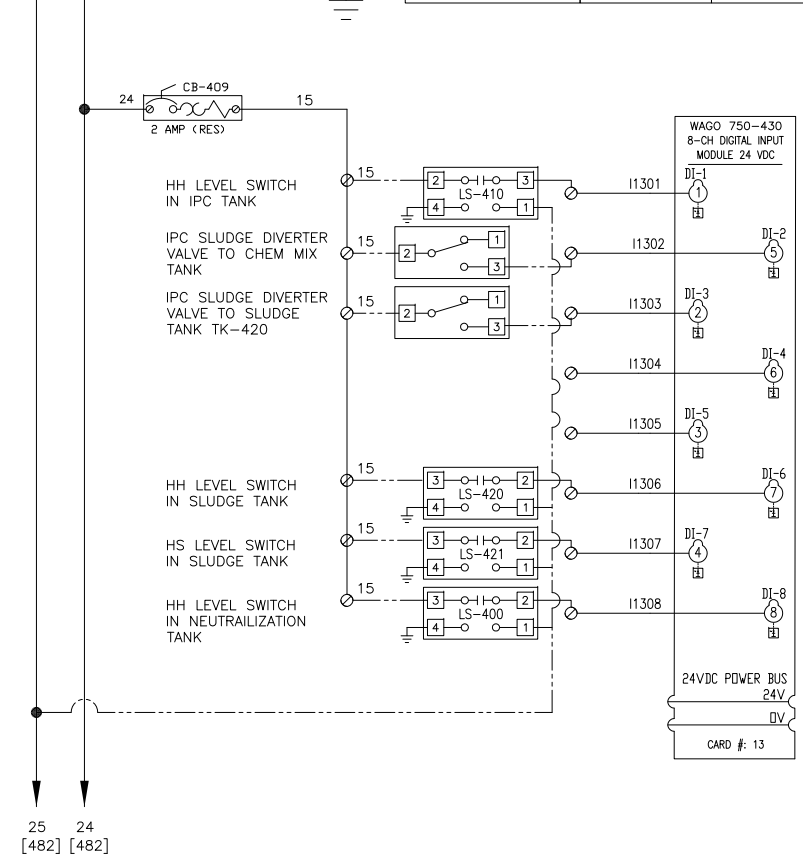
SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8156	D

CAD FILE: 39-8156.dwg









FINAL RECORD DRAWING

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Project manager: Dan Noltin Date: 01/12/15

N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = ——-——
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (-).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310-16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

SHEET 3 OF 4 PART #: 39-8156

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #4 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		

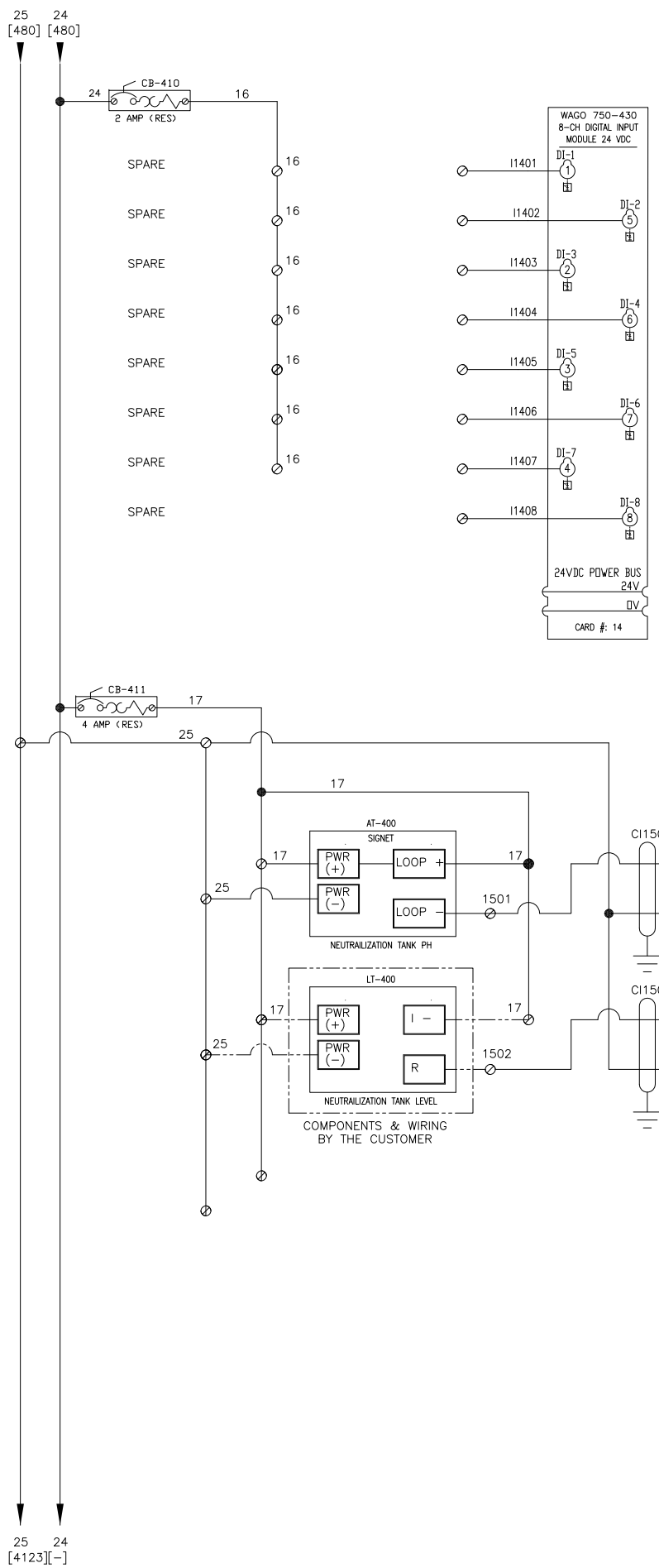
DRAWN BY: DWN DATE: 12/10/14	CHECKED BY: dnoltin DATE: 1/30/2015	MFG. ENG.: DATE:	APPROVED BY: DATE:

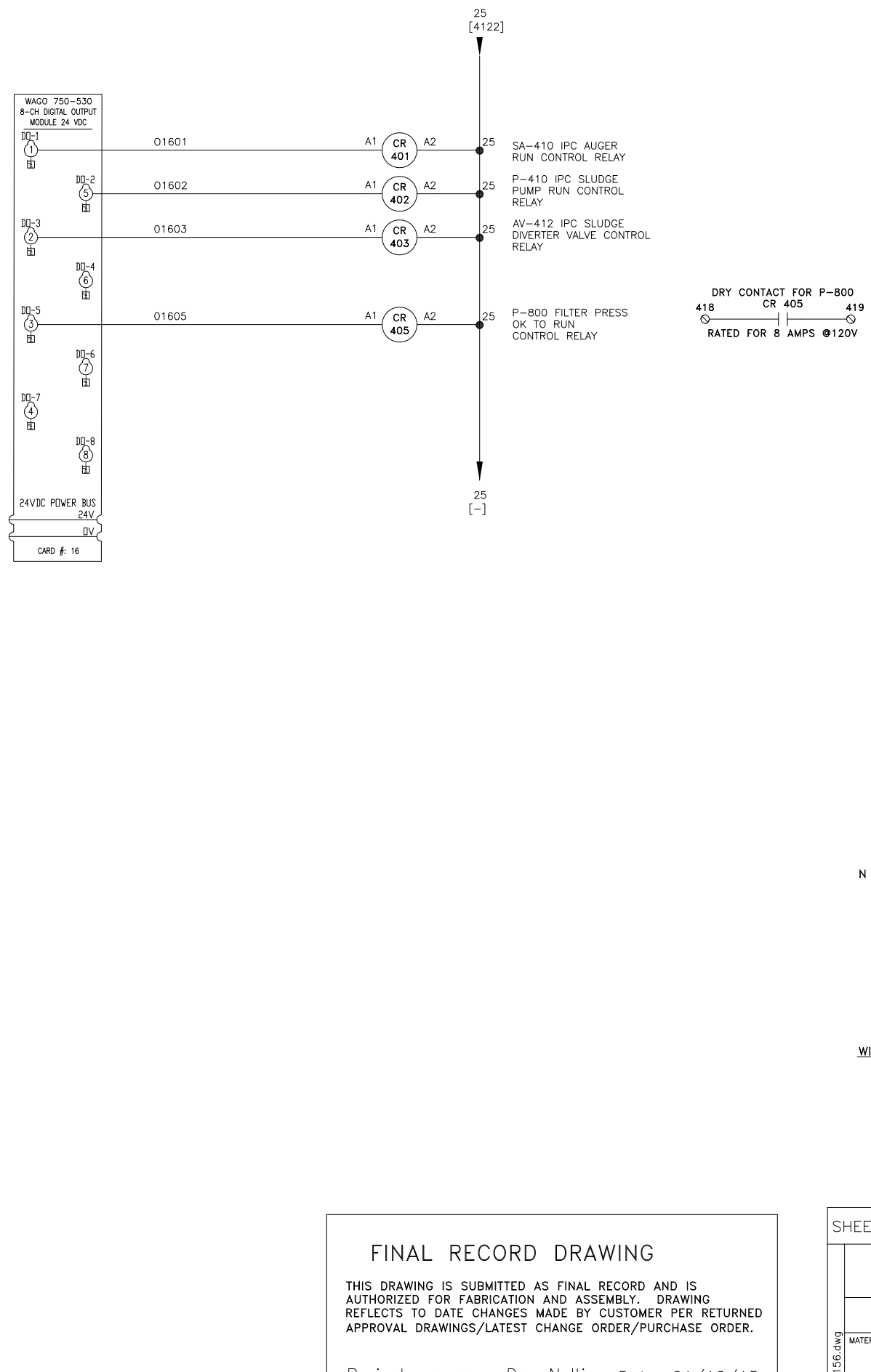
UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8156	D

CAD FILE: 39-8156.dwg





DRY CONTACT FOR P-800

RATED FOR 8 AMPS @120V

N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = —·—·—
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (-).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310-16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

FINAL RECORD DRAWING

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Project manager: Dan Noltin Date: 01/12/15

SHEET 4 OF 4 PART #: 39-8156

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #4 CABINET

MATERIAL	REV. LEVEL	D	A	B	C		
	ECO No.	–	–	–	–		
	DATE REV.	01/30/15	12/24/14	01/05/15	01/12/15		

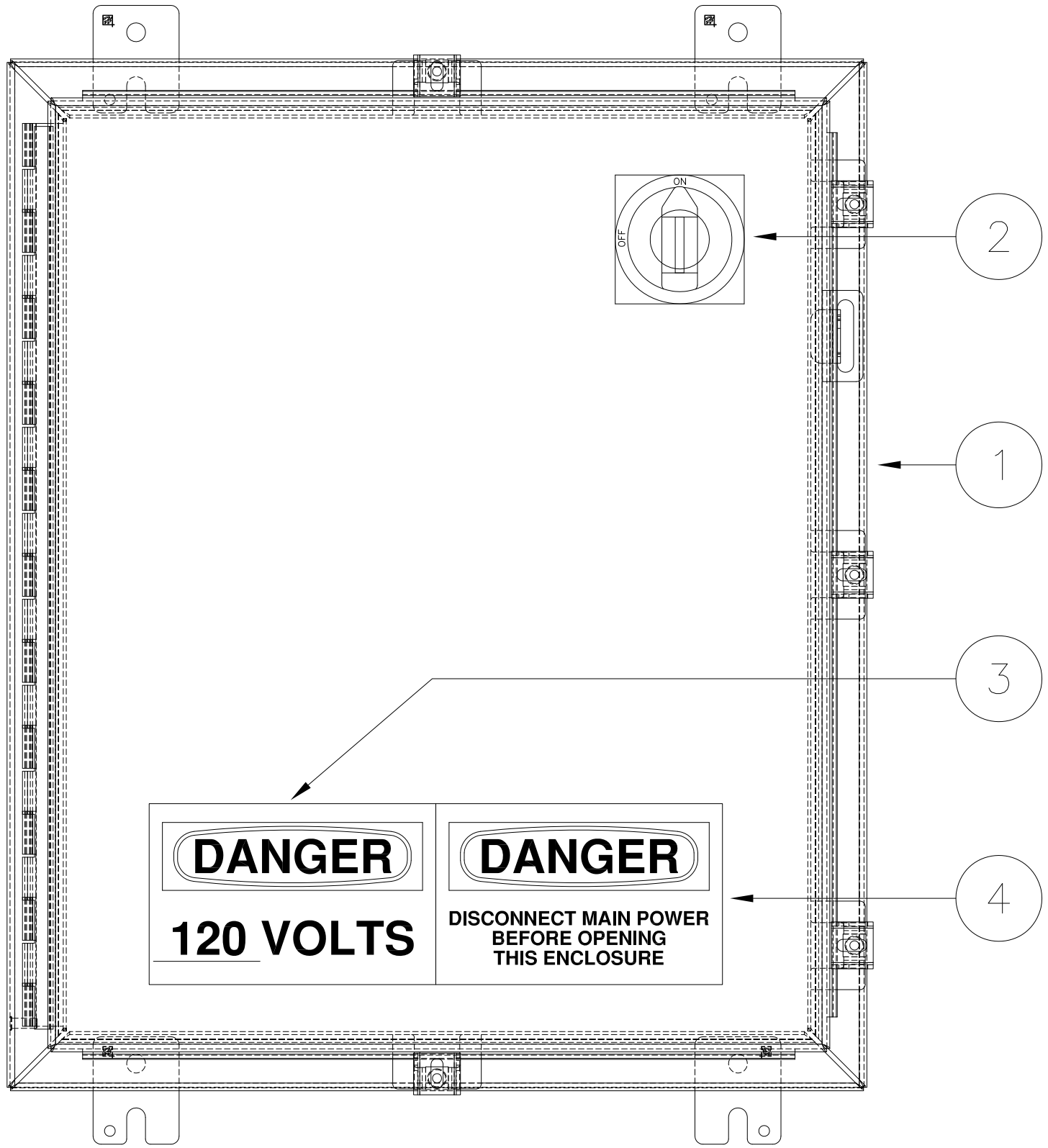
DRAWN BY: DWN DATE: 12/10/14 | CHECKED BY: dnoltin DATE: 1/30/2015 | MFG. ENG.: DATE: | APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8156	D

CAD FILE: 39-8156.dwg



DET.	DESCRIPTION 398003D00B	MATERIAL	LENGTH	QTY.	PART No.
1	ENCLOSURE, 24" x 20" x 8"	FRP, NEMA 4X	X	1	–
2	DISCONNECT HANDLE	–	X	1	–
3	LABEL, VOLAGE 120V	–	X	1	5912000229
4	LABEL, WARNING DISCONNECT POWER	–	X	1	5912000015
5	PANEL LAYOUT	SEE PANEL LAYOUT TAB	X	1	–
6	X	–	X	X	X
7	X	X	X	X	X
8	X	X	X	X	X
9	X	X	X	X	X
10	X	X	X	X	X
11	X	X	X	X	X
12	X	X	X	X	X
13	X	X	X	X	X
14	X	X	X	X	X
15	X	X	X	X	X
16	X	X	X	X	X
17	X	X	X	X	X
18	X	X	X	X	X
19	X	X	X	X	X
20	X	X	X	X	X

NOTES:
1. FIELD WIRING BY ELLIS =
2. FIELD WIRING BY CUSTOMER =
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

NEMA 4X FIBERGLASS ENCLOSURE

24" H 20" W x 8" D

ZONE 5 CABINET LAYOUT

CABINET TO BE SHIPPED LOOSE,

MOUNTING AND WIRING BY CUSTOMER

WIRING INSTRUCTIONS
1. RED = HOT = (+).
2. WHITE = NEUTRAL = (–).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310–16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

ZONE 1 CABINET SHT #3

SHEET 1 OF 3 PART #: 39–8157

CAD FILE: 39–8157.dwg

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #5 CABINET

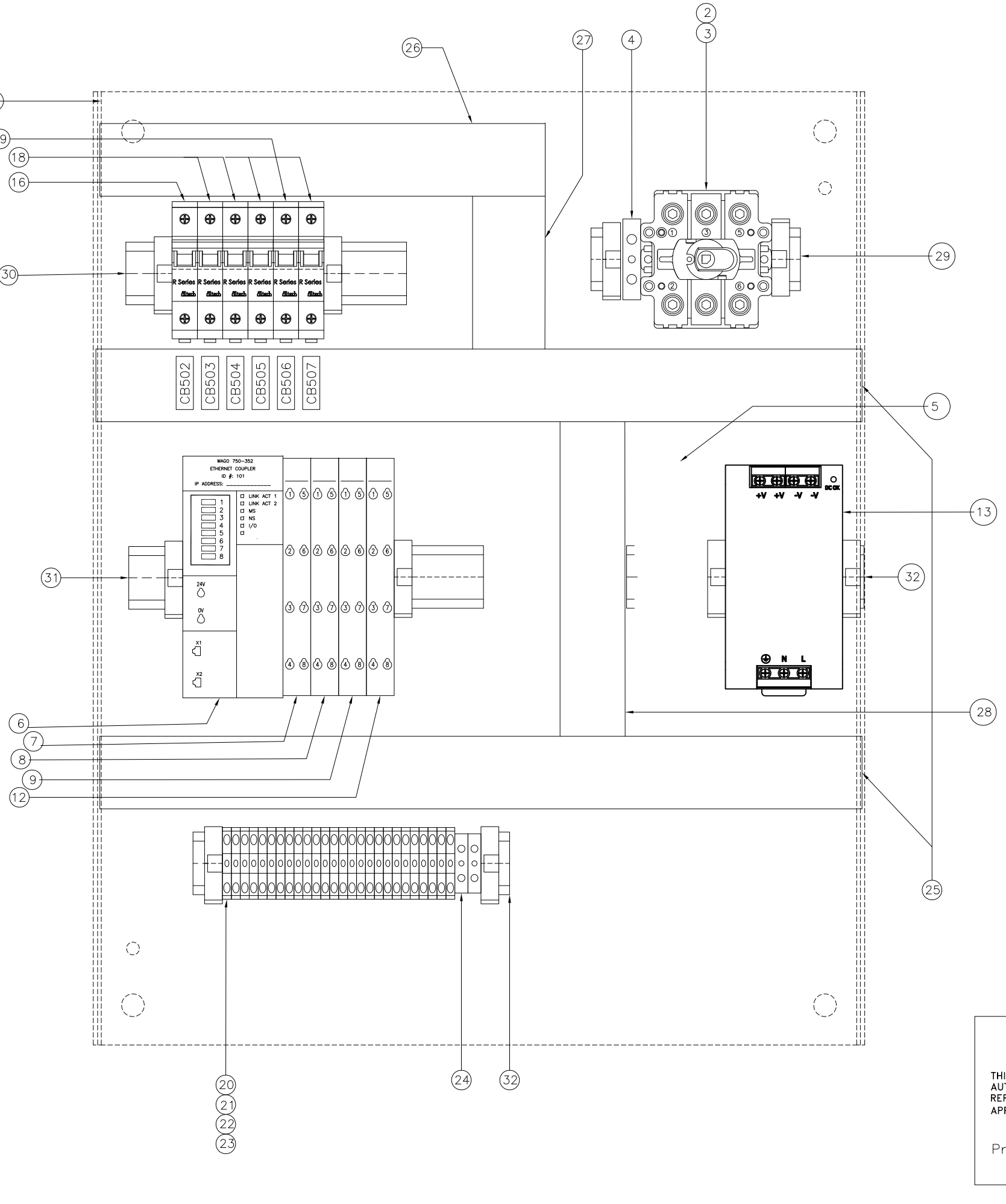
MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D – 01/30/15	A – 12/24/14	B – 01/05/15	C – 01/12/15		

DRAWN BY: DWN DATE: 12/10/14	CHECKED BY: dnoltin DATE: 1/30/2015	MFG. ENG.: DATE:	APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.010
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8157	D



#	Part No.	Description	Length	Qty.
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2			–	1
3			–	1
4				1
5			–	1
6			–	1
7			–	1
8			–	1
9			–	
10			–	
11			–	
12			–	
13			–	
14			–	
15			–	
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N O T E S:

1. FIELD WIRING BY ELLIS = – – – – – –
2. FIELD WIRING BY CUSTOMER = ——·——
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (–).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310–16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 2 OF 3 PART #: 39–8157

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #5 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D – 01/30/15	A – 12/24/14	B – 01/05/15	C – 01/12/15		

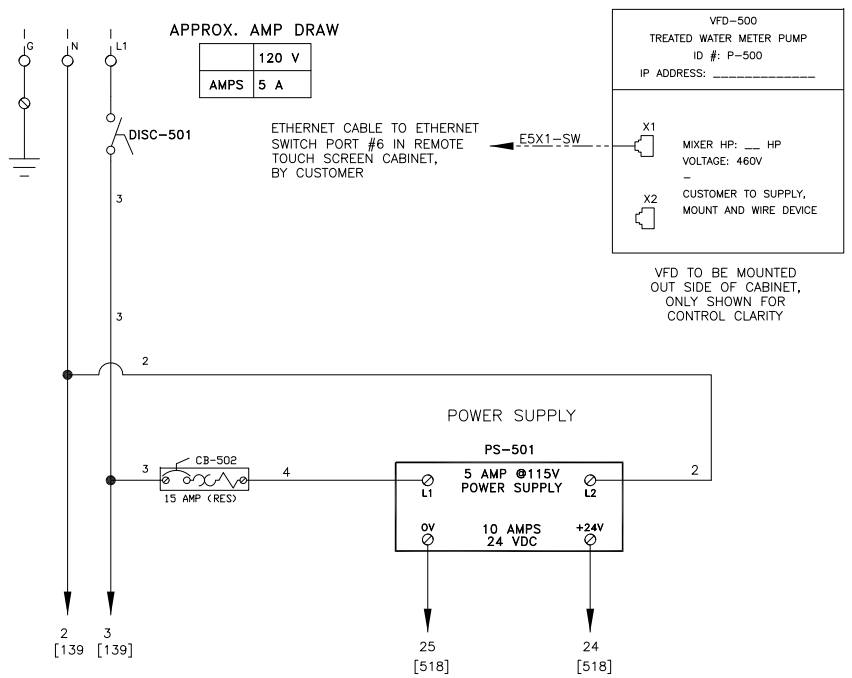
DRAWN BY: DWN DATE: 12/10/14 | CHECKED BY: dnoltin DATE: 1/30/2015 | MFG. ENG.: DATE: | APPROVED BY: DATE:

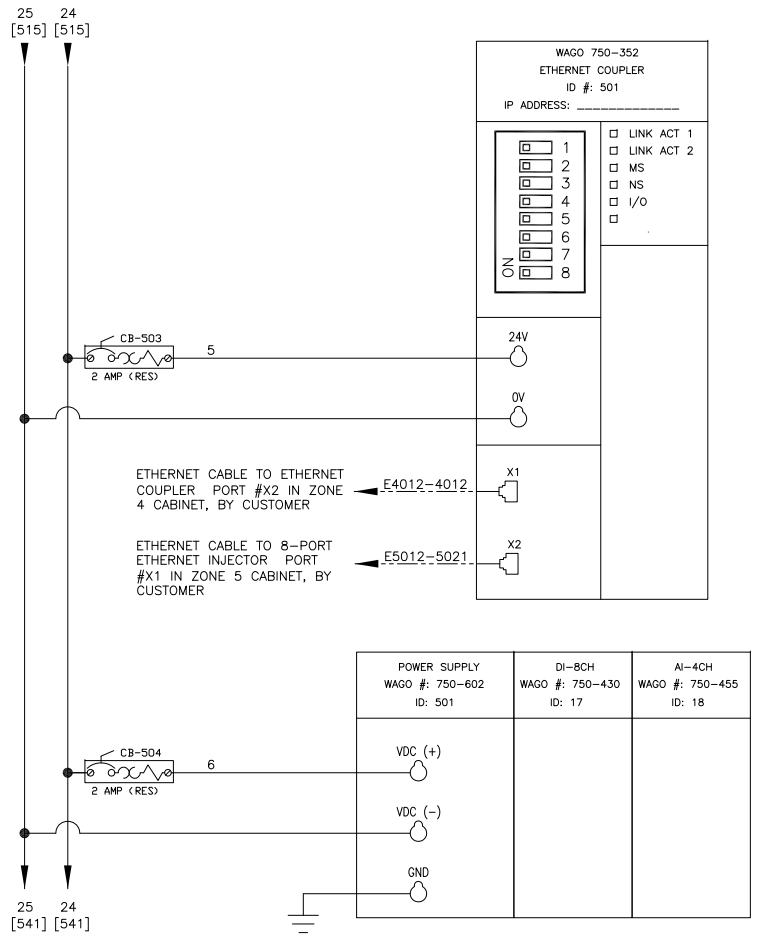
UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.016
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

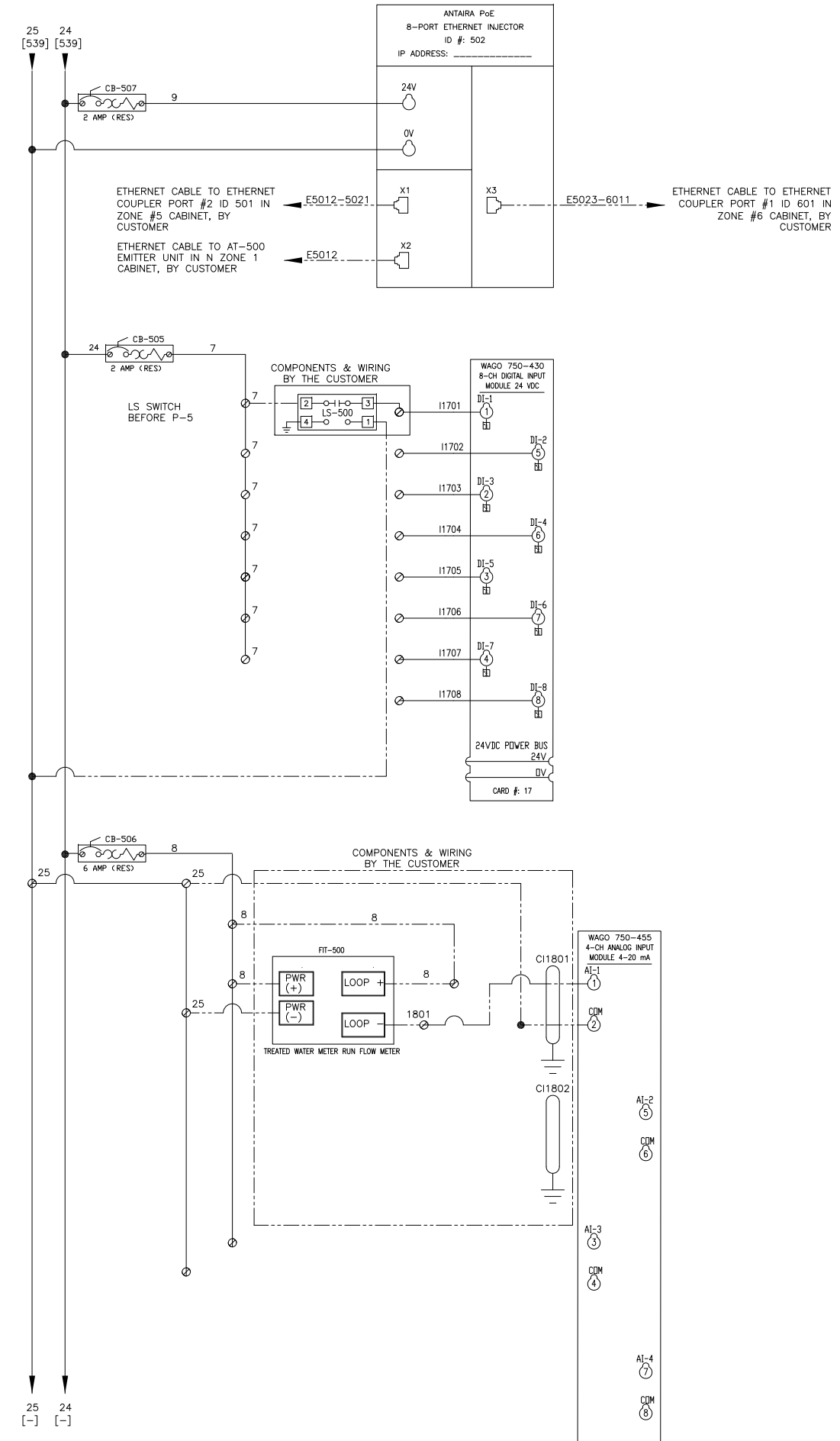
SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8157	D

CAD FILE: 39-8157.dwg





POWER SUPPLY	DI-8CH	AI-4CH
WAGO #: 750-602	WAGO #: 750-430	WAGO #: 750-455
ID: 501	ID: 17	ID: 18



FINAL RECORD DRAWING

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Project manager: Dan Noltin Date: 01/12/15

N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = ——-·——
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (–).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310–16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

SHEET 3 OF 3 PART #: 39–8157

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #5 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D – 01/30/15	A – 12/24/14	B – 01/05/15	C – 01/12/15		

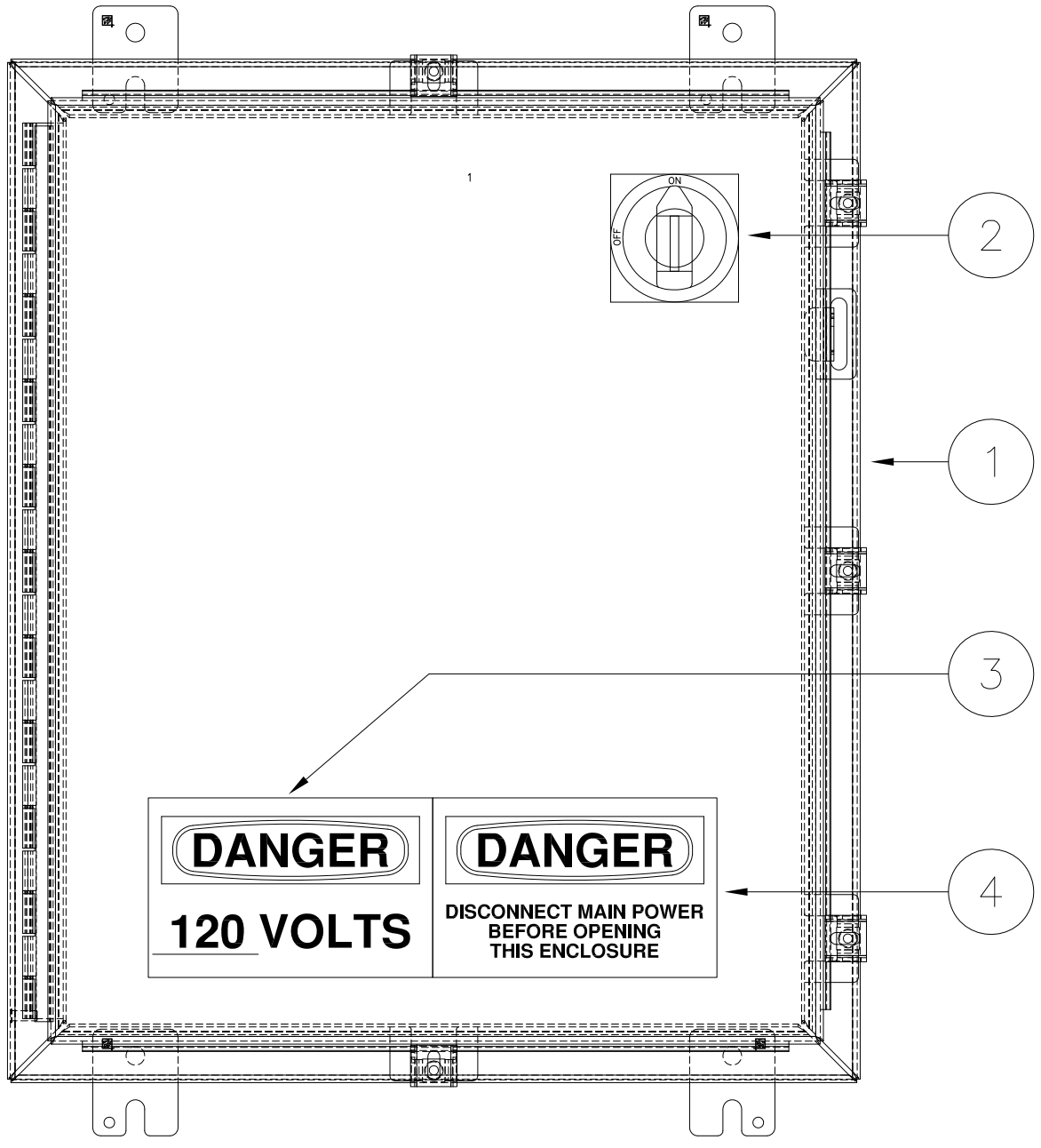
DRAWN BY: DWN DATE: 12/10/14	CHECKED BY: dnoltin DATE: 1/30/2015	MFG. ENG.: DATE:	APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8157	D

CAD FILE: 39–8157.dwg



NEMA 4X FIBERGLASS ENCLOSURE

24" H 20" W x 8" D

ZONE 6 CABINET LAYOUT

CABINET TO BE SHIPPED LOOSE,

MOUNTING AND WIRING BY CUSTOMER

DET.	DESCRIPTION 398003D00B	MATERIAL	LENGTH	QTY.	PART No.
1	ENCLOSURE, 24" x 20" x 8"	FRP, NEMA 4X	X	1	–
2	DISCONNECT HANDLE	–	X	1	–
3	LABEL, VOLAGE 120V	–	X	1	5912000229
4	LABEL, WARNING DISCONNECT POWER	–	X	1	5912000015
5	PANEL LAYOUT	SEE PANEL LAYOUT TAB	X	1	–
6	X	–	X	X	X
7	X	X	X	X	X
8	X	X	X	X	X
9	X	X	X	X	X
10	X	X	X	X	X
11	X	X	X	X	X
12	X	X	X	X	X
13	X	X	X	X	X
14	X	X	X	X	X
15	X	X	X	X	X
16	X	X	X	X	X
17	X	X	X	X	X
18	X	X	X	X	X
19	X	X	X	X	X
20	X	X	X	X	X

N O T E S:

1. FIELD WIRING BY ELLIS =
2. FIELD WIRING BY CUSTOMER =
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (–).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310–16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 1 OF 4 PART #: 39–8158

CAD FILE: 39–8158.dwg

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #6 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D – 01/30/15	A – 12/24/14	B – 01/05/15	C – 01/12/15		

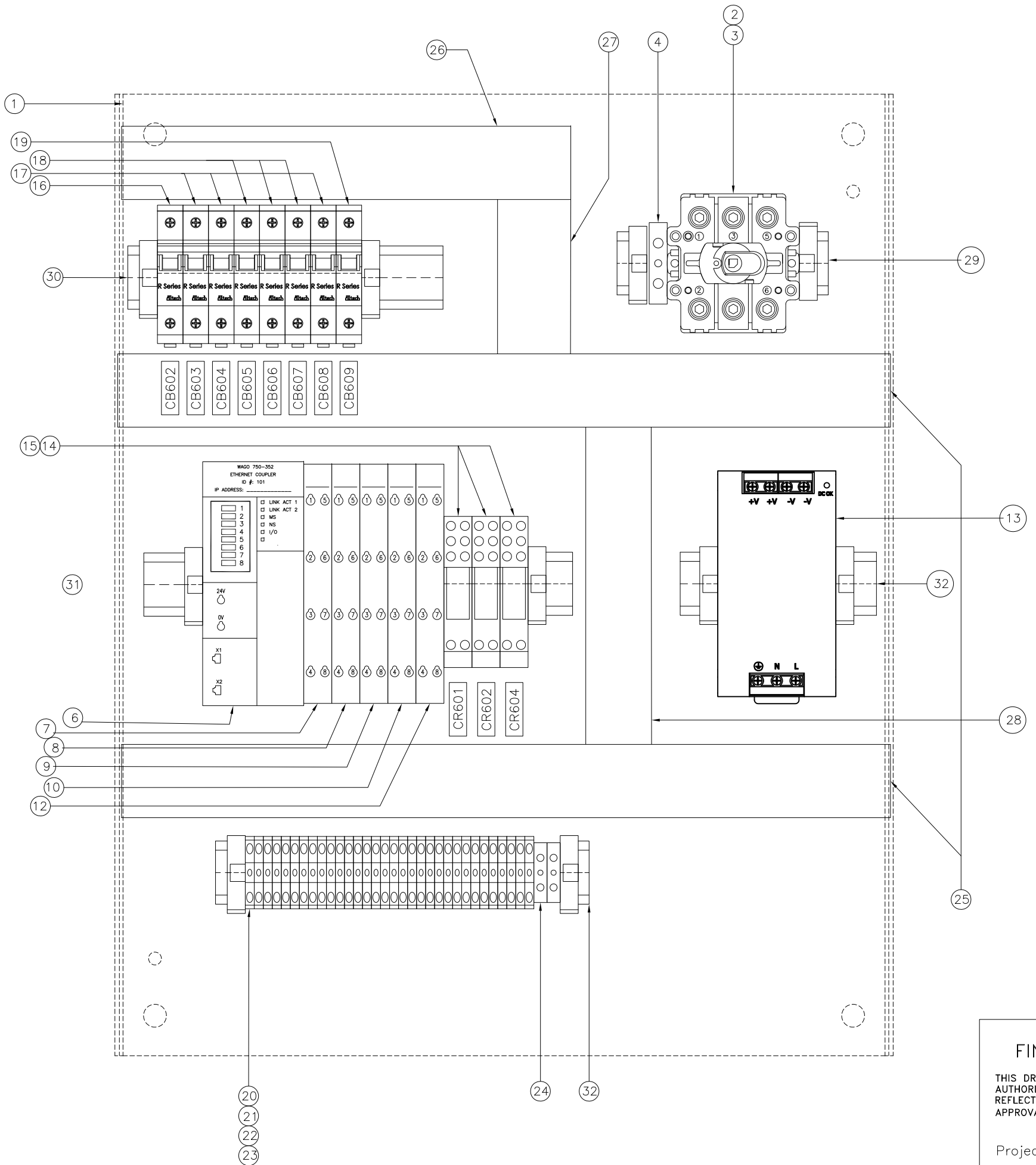
DRAWN BY: DWN DATE: 12/10/14 | CHECKED BY: dnoltin DATE: 1/30/2015 | MFG. ENG.: DATE: | APPROVED BY: DATE:

UNLESS OTHERWISE NOTED

TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8158	D



#	Part No.	Description	Length	Qty.
1			–	1
2			–	1
3			–	1
4				1
5			–	
6			–	1
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9			–	
10			–	1
11			–	
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N O T E S:

1. FIELD WIRING BY ELLIS = – – – – – –
2. FIELD WIRING BY CUSTOMER = ——·——
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (–).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310–16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 2 OF 4 PART #: 39–8158

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #6 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		

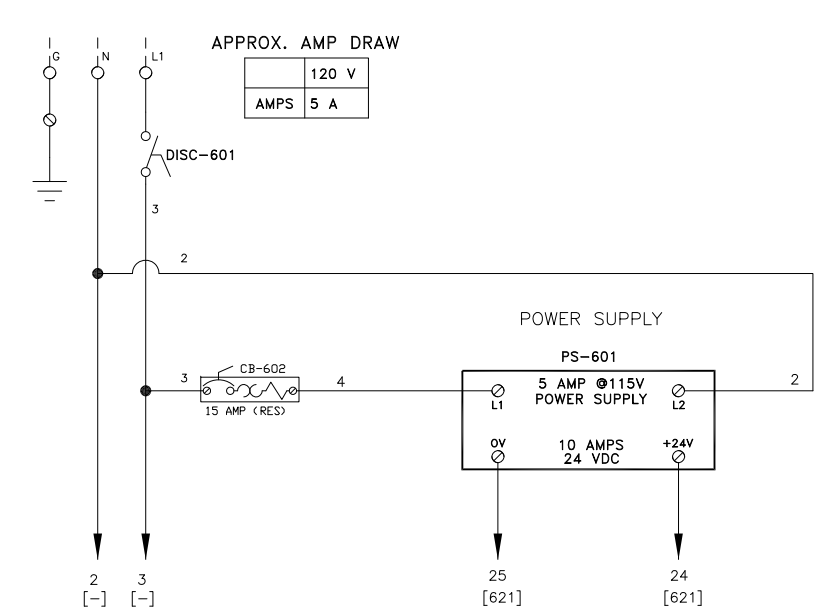
DRAWN BY: DWN DATE: 12/10/14 | CHECKED BY: dnoltin DATE: 1/30/2015 | MFG. ENG.: DATE: | APPROVED BY: DATE:

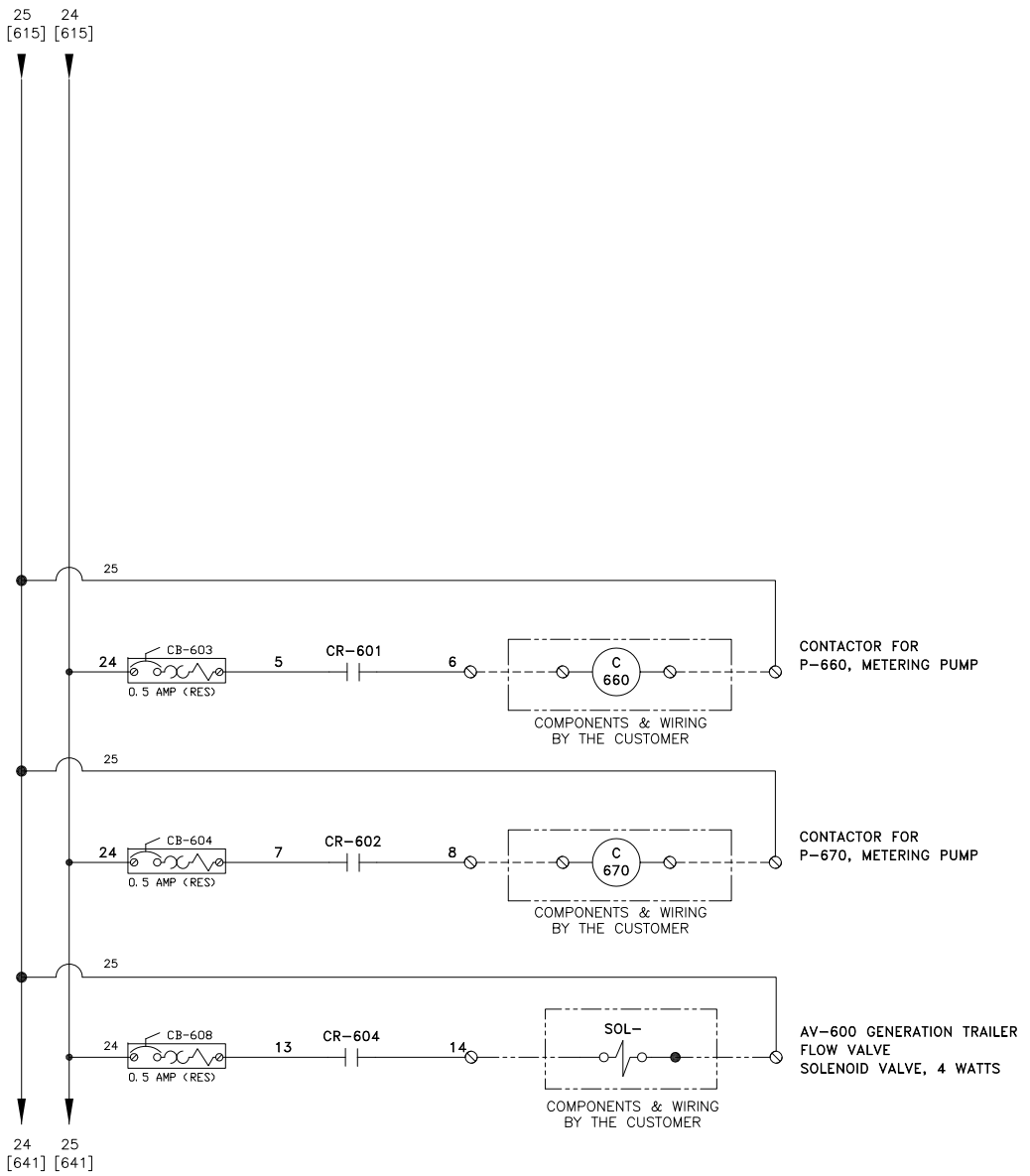
UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

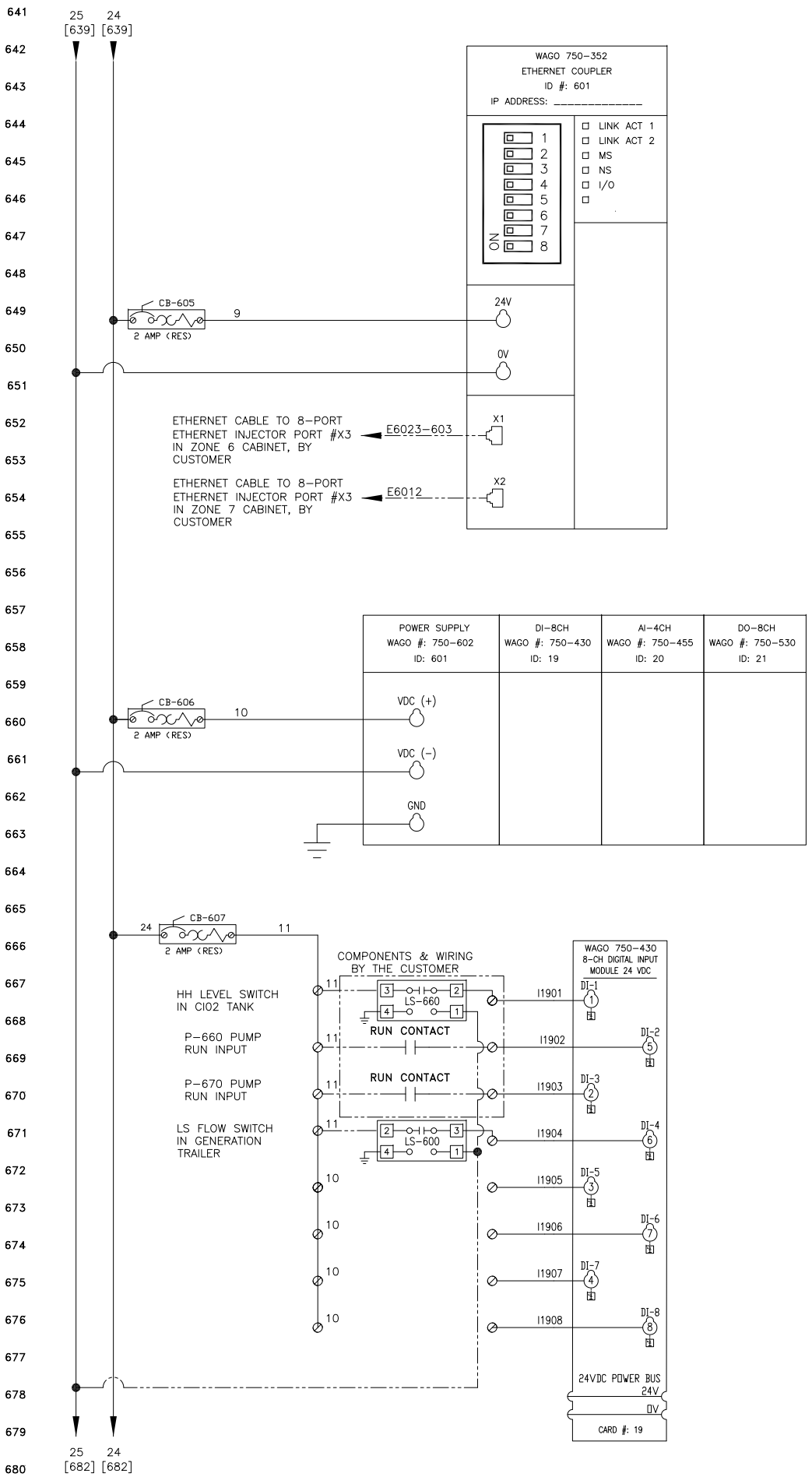
NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8158	D

CAD FILE: 39–8158.dwg







FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = ——-·——
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (−).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310-16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

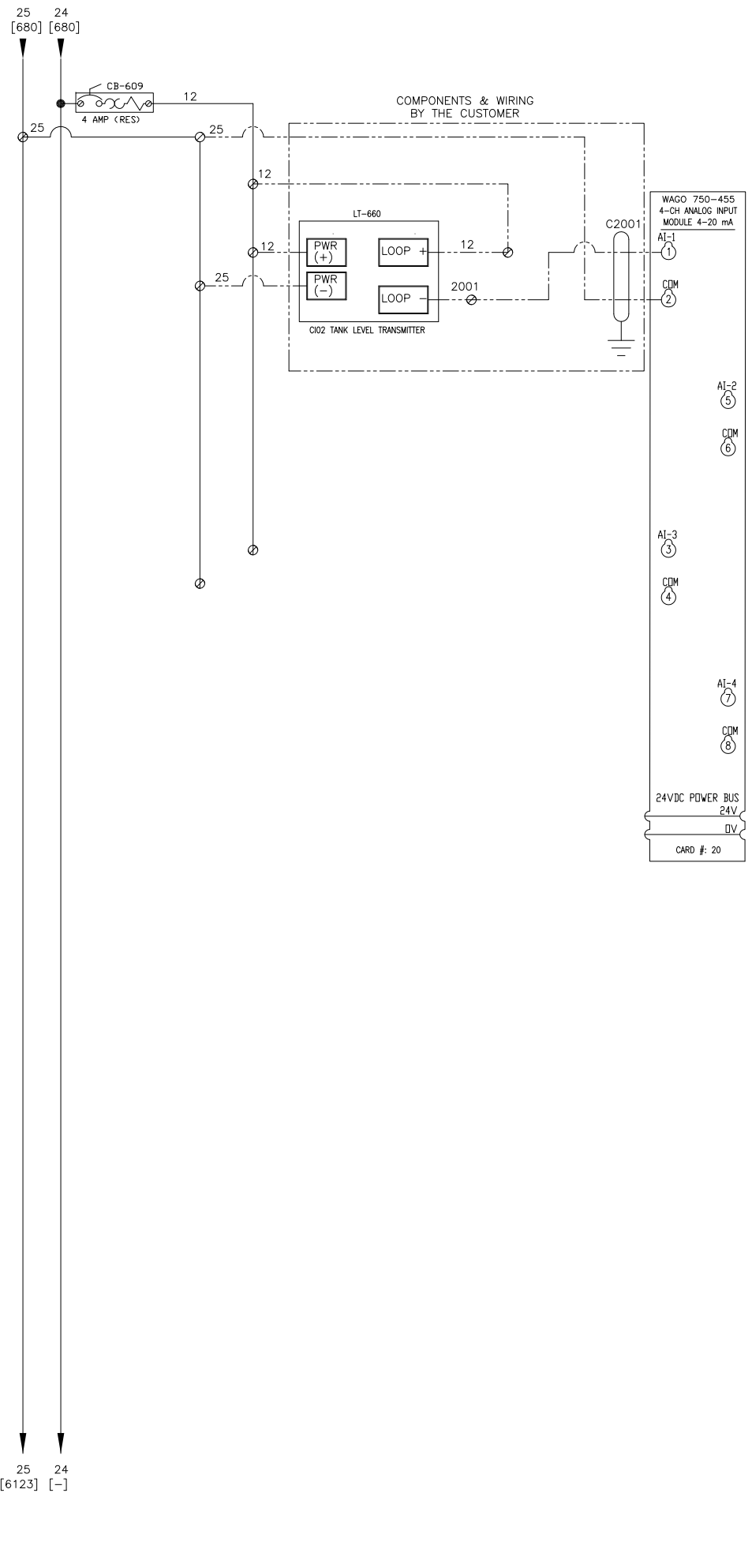
SHEET 3 OF 4 PART #: 39-8158

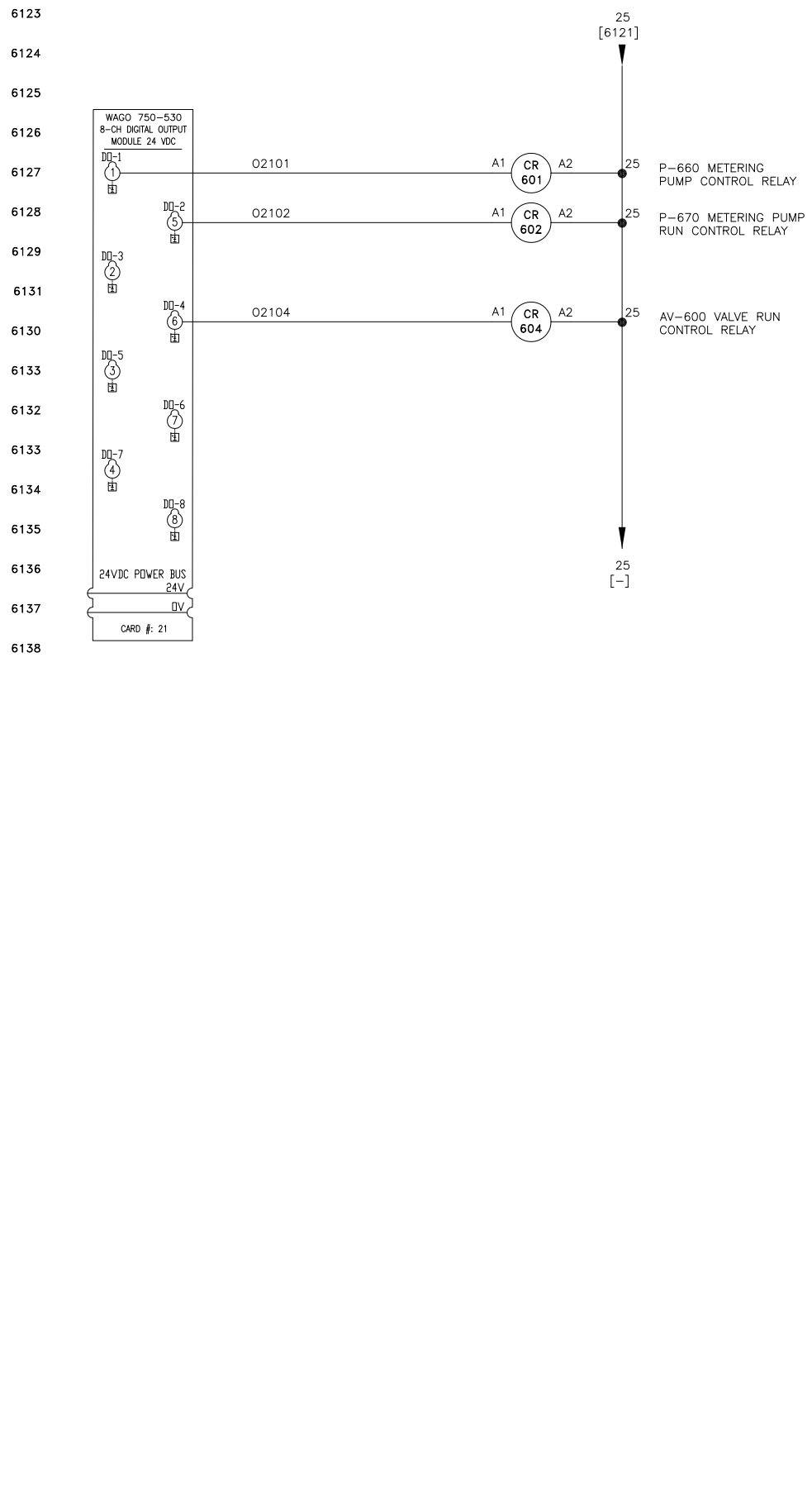
ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #6 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		
DRAWN BY: DWN DATE: 12/10/14	CHECKED BY: dnoltin DATE: 1/30/2015	MFG. ENG.: DATE:	APPROVED BY: DATE:				
UNLESS OTHERWISE NOTED	THIS DRAWING IS THE PROPERTY OF ELLIS CORP. IT IS LOANED UPON THE EXPRESS CONDITION THAT IT SHALL NOT BE COPIED OR REPRODUCED IN ANY MANNER, THAT IT SHALL NOT BE SUBMITTED TO OTHERS FOR EXAMINATION WITHOUT THE CONSENT OF THIS COMPANY, THAT IT SHALL NOT BE USED IN ANY OTHER WAY DETRIMENTAL TO THE INTERESTS OF THIS COMPANY, AND THAT IT SHALL BE RETURNED UPON DEMAND.	NEXT ASSEMBLY:					
TOLERANCE ON TWO DECIMAL PLACES ±0.030 TOLERANCE ON THREE DECIMAL PLACES ±0.010 SURFACE FINISH ON MACHINED FACES 125 INTERNAL CORNERS 0.030 RADIUS MAX. EXTERNAL CORNERS 0.030 X 45° CHAMFER HOLES COUNTERSINK 0.030 X 45°		SCALE: FIT	DRAWING NUMBER: PROD. CLASS 39	SERIAL # 8158	SHEET D		

CAD FILE: 39-8158.dwg





FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = ——-——
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (-).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310-16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

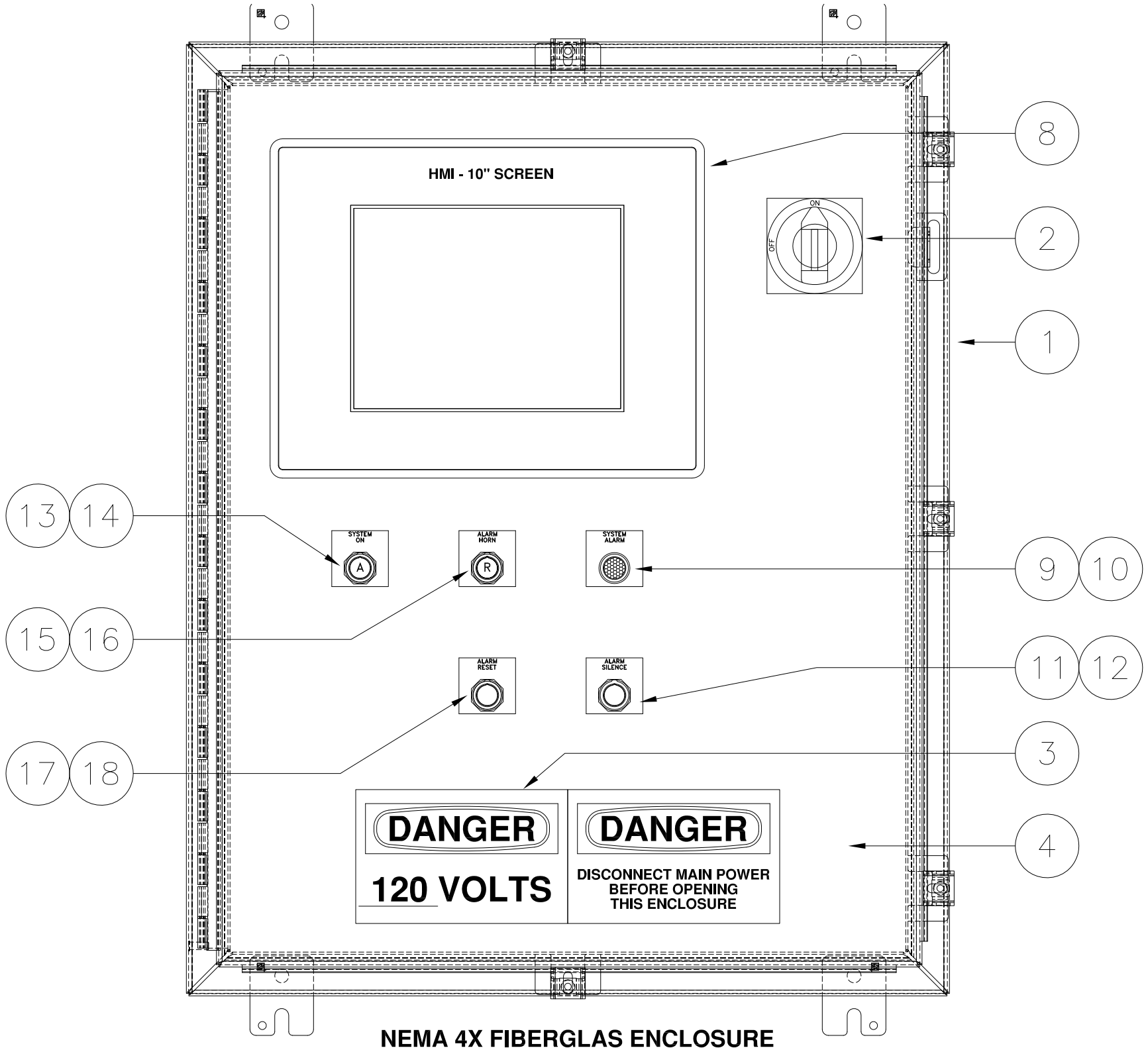
SHEET 4	OF 4	PART #: 39-8158	

CAD FILE: 39-8158.dwg

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #6 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		
DRAWN BY: DWN DATE: 12/10/14	CHECKED BY: dnoltin DATE: 1/30/2015	MFG. ENG.: DATE:	APPROVED BY: DATE:				
UNLESS OTHERWISE NOTED	THIS DRAWING IS THE PROPERTY OF ELLIS CORP. IT IS LOANED UPON THE EXPRESS CONDITION THAT IT SHALL NOT BE COPIED OR REPRODUCED IN ANY MANNER, THAT IT SHALL NOT BE SUBMITTED TO OTHERS FOR EXAMINATION WITHOUT THE CONSENT OF THIS COMPANY, THAT IT SHALL NOT BE USED IN ANY OTHER WAY DETRIMENTAL TO THE INTERESTS OF THIS COMPANY, AND THAT IT SHALL BE RETURNED UPON DEMAND.	NEXT ASSEMBLY:					
TOLERANCE ON TWO DECIMAL PLACES ±0.030 TOLERANCE ON THREE DECIMAL PLACES ±0.010 SURFACE FINISH ON MACHINED FACES 125 INTERNAL CORNERS 0.030 RADIUS MAX. EXTERNAL CORNERS 0.030 X 45° CHAMFER HOLES COUNTERSINK 0.030 X 45°		SCALE: FIT	DRAWING NUMBER: PROD. CLASS 39	SERIAL # 8158	SHEET D		



NEMA 4X FIBERGLAS ENCLOSURE

30" H 24" W x 10" D

ZONE 7 CABINET LAYOUT

CABINET TO BE SHIPPED LOOSE,

MOUNTING & WIRING BY CUSTOMER

DET.	DESCRIPTION 398003D00B	MATERIAL	LENGTH	QTY.	PART No.
1	ENCLOSURE, 24" x 20" x 8"	FRP, NEMA 4X	X	1	–
2	DISCONNECT HANDLE	–	X	1	–
3	LABEL, VOLAGE 120V	–	X	1	5912000229
4	LABEL, WARNING DISCONNECT POWER	–	X	1	5912000015
5	PANEL LAYOUT	SEE PANEL LAYOUT TAB	X	1	–
6	X	–	X	X	X
7	X	X	X	X	X
8	DISPLAY UNIT, TOUCH SCREEN	X	X	1	–
9	ALARM HORN	X	X	1	–
10	LEGEND PLATE, SYSTEM ALARM	X	X	1	–
11	PUSH BUTTON	X	X	1	–
12	LEGEND PLATE, ALARM SILENCE	X	X	1	–
13	PILOT LIGHT, AMBER 24VDC	X	X	1	–
14	LEGEND PLATE SYSTEM ON	X	X	1	–
15	PILOT LIGHT, RED 24 VDC	X	X	1	–
16	LEGEND PLATE, ALARM HORN	X	X	1	–
17	PUSH BUTTON	X	X	1	–
18	LEGEND PLATE, ALARM RESET	X	X	1	–
19	X	X	X	X	X
20	X	X	X	X	X

N O T E S:

1. FIELD WIRING BY ELLIS =
2. FIELD WIRING BY CUSTOMER =
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (–).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310–16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 1 OF 4 PART #: 39–8159

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #7 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		

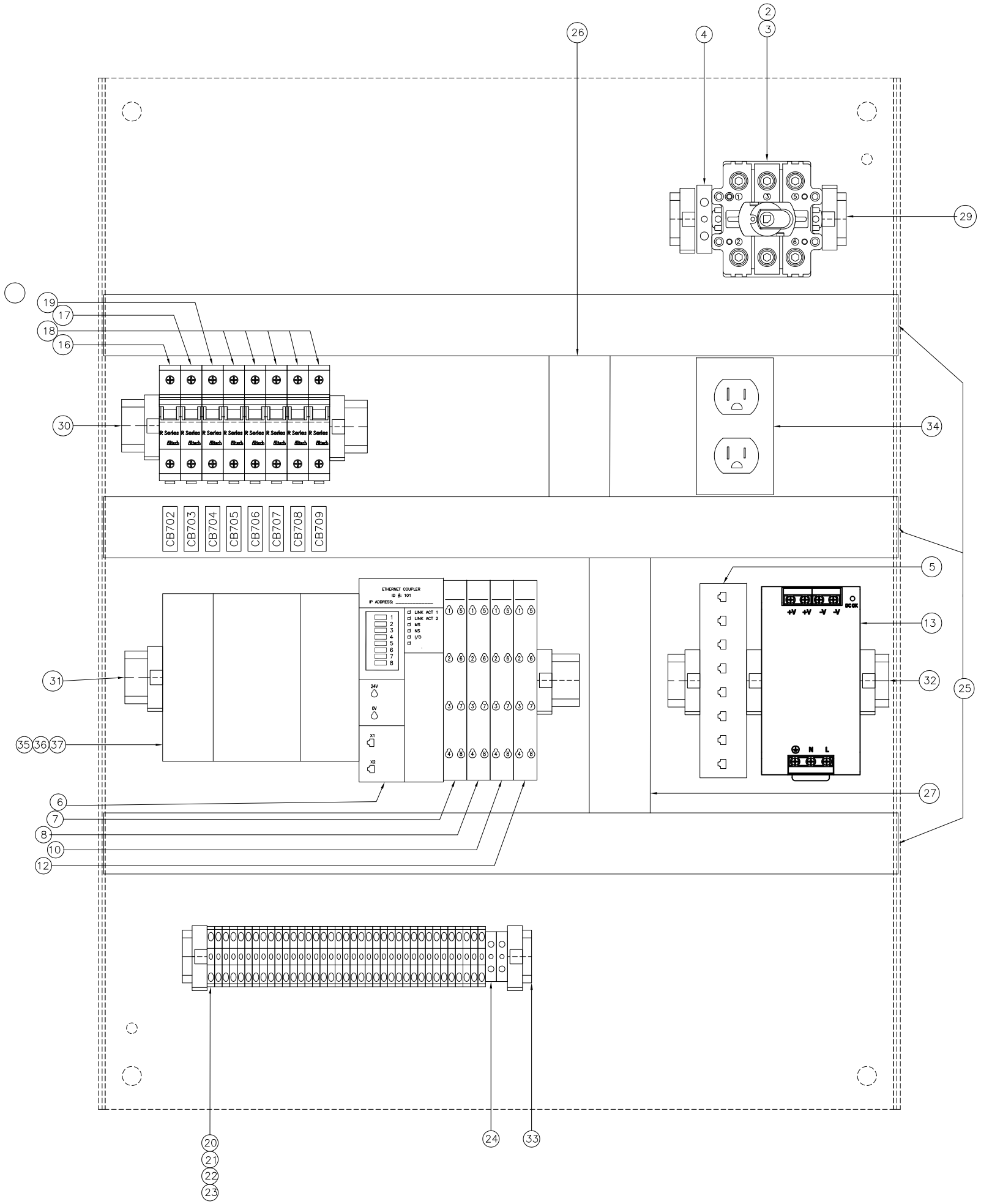
DRAWN BY: DWN DATE: 12/10/14 | CHECKED BY: dnoltin DATE: 1/30/2015 | MFG. ENG.: DATE: | APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.015
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8159	D

CAD FILE: 39-8159.dwg



#	Part No.	Description	Length	Qty.
1			–	1
2			–	1
3			–	1
4				1
5			–	1
6			–	1
7			–	1
8			–	1
9			–	
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N O T E S:

1. FIELD WIRING BY ELLIS = – – – – – –
2. FIELD WIRING BY CUSTOMER = ——·——
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (–).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310–16 AS A GUIDE.
5. EACH INDIVIDUAL MOTOR PUMP OR OTHER DEVICE THAT REQUIRES A GROUND (GREEN) WIRE MUST HAVE ITS OWN INDIVIDUAL GROUND OR STUD.
6. BLACK WIRE IS FOR HIGH VOLTAGE 220VAC AND HIGHER.
7. BLUE WIRE IS FOR DC VOLTS ONLY.

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 2 OF 4 PART #: 39–8159

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #7 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		

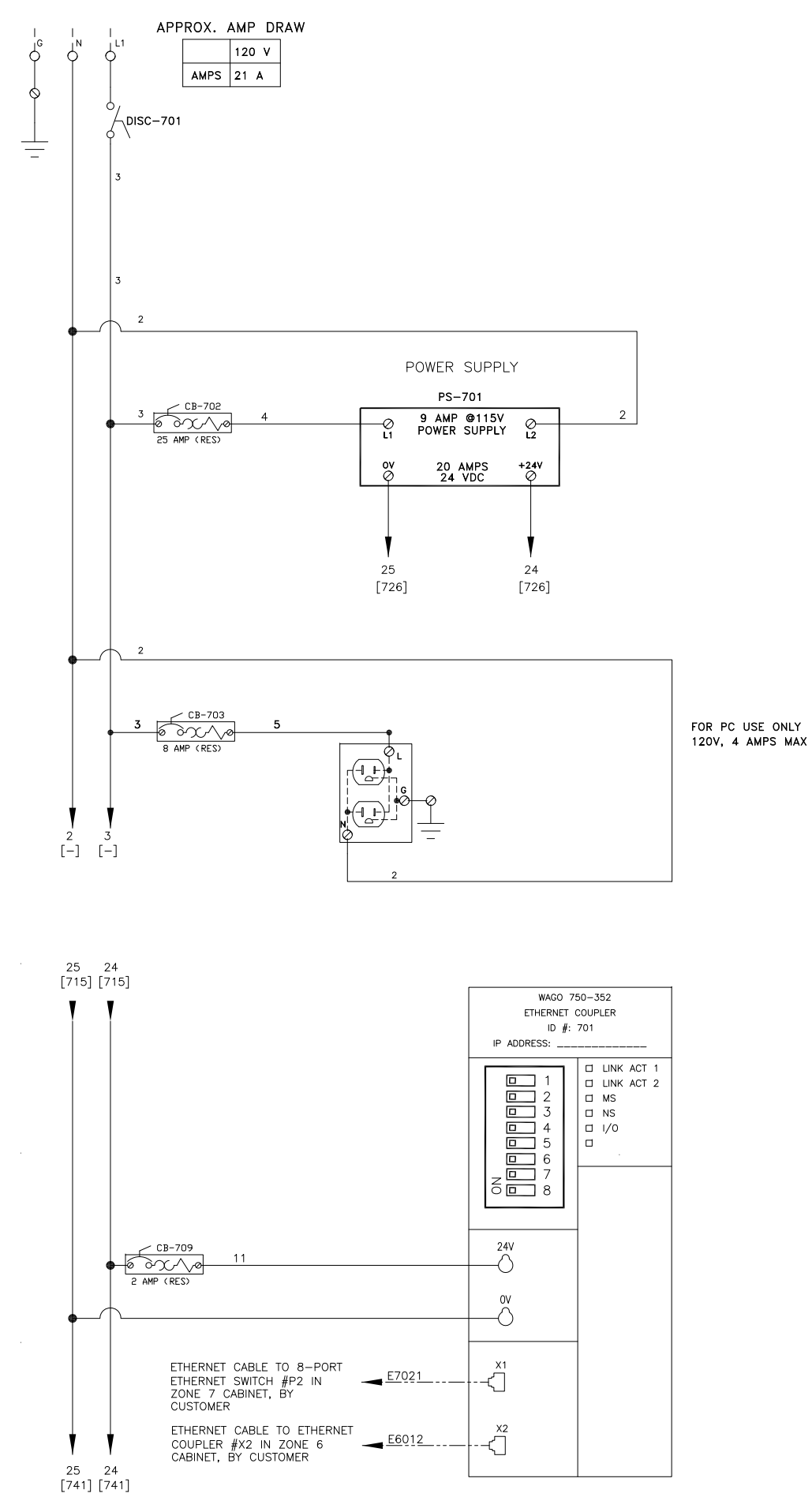
DRAWN BY: DWN DATE: 12/10/14 | CHECKED BY: dnoltin DATE: 1/30/2015 | MFG. ENG.: DATE: | APPROVED BY: DATE:

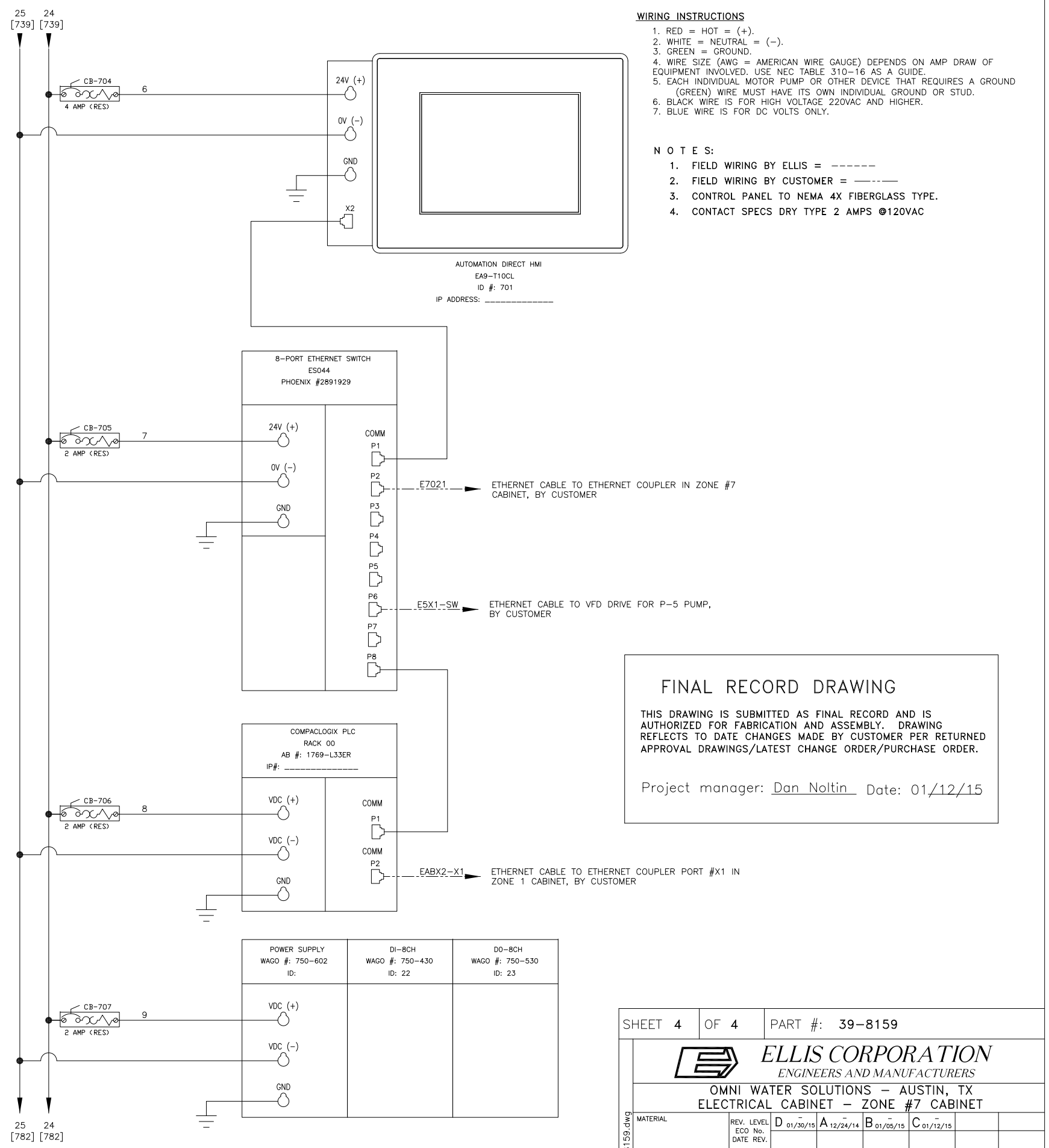
UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.010
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8159	D

CAD FILE: 39–8159.dwg





WIRING INSTRUCTIONS

1. RED = HOT = (+).
2. WHITE = NEUTRAL = (-).
3. GREEN = GROUND.
4. WIRE SIZE (AWG = AMERICAN WIRE GAUGE) DEPENDS ON AMP DRAW OF EQUIPMENT INVOLVED. USE NEC TABLE 310-16 AS A GUIDE.
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N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = ——-——
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

FINAL RECORD DRAWING

THIS DRAWING IS SUBMITTED AS FINAL RECORD AND IS AUTHORIZED FOR FABRICATION AND ASSEMBLY. DRAWING REFLECTS TO DATE CHANGES MADE BY CUSTOMER PER RETURNED APPROVAL DRAWINGS/LATEST CHANGE ORDER/PURCHASE ORDER.

Project manager: Dan Noltin Date: 01/12/15

SHEET 4 OF 4 PART #: 39-8159

CAD FILE: 39-8159.dwg

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #7 CABINET

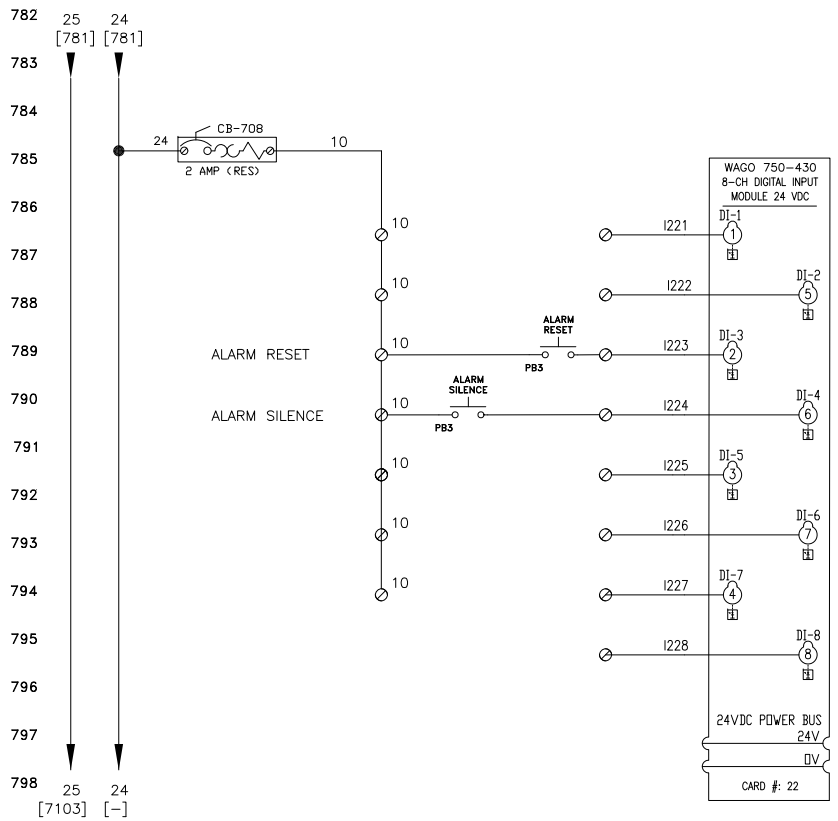
MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D – 01/30/15	A – 12/24/14	B – 01/05/15	C – 01/12/15		

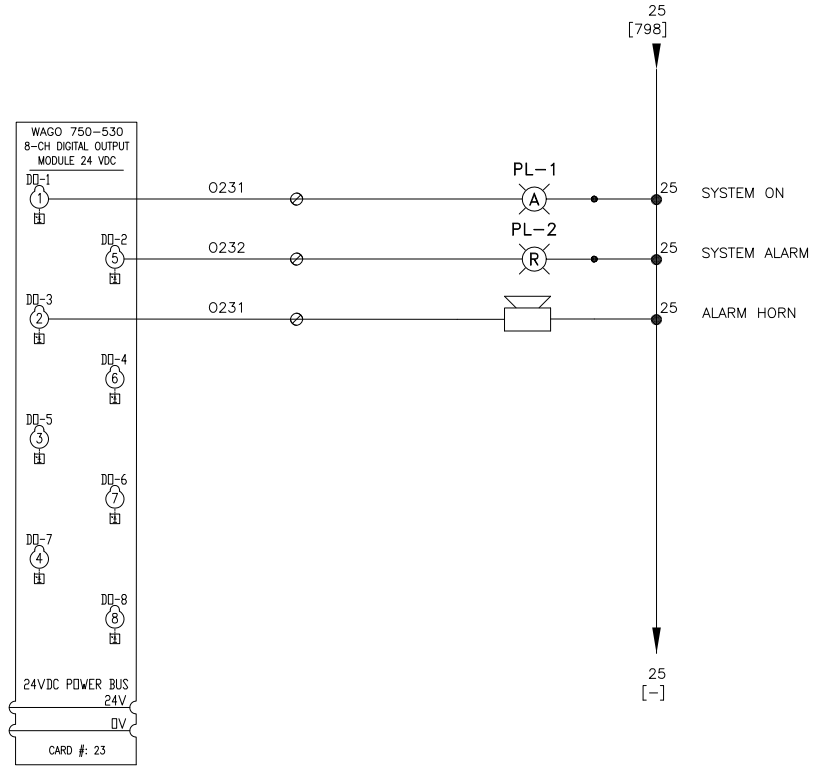
DRAWN BY: DWN DATE: 12/10/14	CHECKED BY: dnoltin DATE: 1/30/2015	MFG. ENG.: DATE:	APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.010
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8159	D





N O T E S:

1. FIELD WIRING BY ELLIS = ------
2. FIELD WIRING BY CUSTOMER = ——--——
3. CONTROL PANEL TO NEMA 4X FIBERGLASS TYPE.
4. CONTACT SPECS DRY TYPE 2 AMPS @120VAC

WIRING INSTRUCTIONS

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FINAL RECORD DRAWING

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Project manager: Dan Noltin Date: 01/12/15

SHEET 5	OF 4	PART #: 39–8159	

CAD FILE: 39-8159.dwg

ELLIS CORPORATION
ENGINEERS AND MANUFACTURERS

OMNI WATER SOLUTIONS – AUSTIN, TX
ELECTRICAL CABINET – ZONE #7 CABINET

MATERIAL	REV. LEVEL / ECO No. / DATE REV.	D 01/30/15	A 12/24/14	B 01/05/15	C 01/12/15		

DRAWN BY: DWN DATE: 12/10/14	CHECKED BY: dnoltin DATE: 1/30/2015	MFG. ENG.: DATE:	APPROVED BY: DATE:

UNLESS OTHERWISE NOTED
TOLERANCE ON TWO DECIMAL PLACES ±0.030
TOLERANCE ON THREE DECIMAL PLACES ±0.010
SURFACE FINISH ON MACHINED FACES 125
INTERNAL CORNERS 0.030 RADIUS MAX.
EXTERNAL CORNERS 0.030 X 45° CHAMFER
HOLES COUNTERSINK 0.030 X 45°

NEXT ASSEMBLY:

SCALE	DRAWING NUMBER		
	PROD. CLASS	SERIAL #	SHEET
FIT	39	8159	D