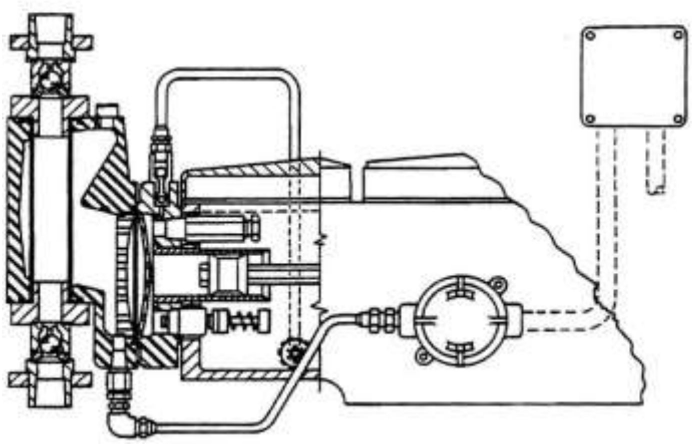
PULSA®

CHEMAlarm LEAK DETECTION

Installation Operation Maintenance Instruction



IOM-PUL-1011 REV B

PULSAFEEDER®

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Manufacturers of Quality Pumps, Controls and Systems.

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CHEMAlarm

LEAK DETECTION

Contents

1. PRINCIPLES OF OPERATION

1.1 General Description

(Figure 1: page 11)

The ChemAlarm monitors the electrical conductivity of the intermediate liquid in a double-diaphragm metering pump.

Monitoring is performed by a dual-electrode electrical probe installed in the intermediate chamber and associated electronic circuitry. The intermediate liquid is selected to have a different conductivity from the process liquid, the hydraulic liquid, or both. Failure of the primary (process) diaphragm, or the secondary (hydraulic) diaphragm, or both, results in contamination of the intermediate chamber by a foreign liquid, changing the conductivity within the chamber accordingly. This change is sensed by the circuit as an indicator of diaphragm failure.

In a typical installation, the conductivity probe is wired at the factory to a junction box mounted on the pump. A control box containing the control module and output relay is mounted remotely and wired to the junction box at the time of pump installation.

1.2 Process Specifications

ChemAlarm installations are of a custom nature, to meet the requirements of specific applications. These requirements, or process specifications, along with the resulting system specifications, are established prior to use; however, it is important for the user to be familiar with them in order to adapt to changes in process. Process specifications are:

- Conductivity of the process liquid
- Specific gravity of the process liquid
- Diaphragm monitored (Typically the primary, or process diaphragm)
- Output signal

1.3 System Specifications

These specifications are developed in response to process specifications. They define the system supplied.

Intermediate Liquid Selection
- Conductivity
- Specific gravity
- Miscibility with product liquid

Sensor Probe Location
- Top
- Bottom
- Midpoint

Sensing Mode
- Forward
- Reverse

Conductivity Range
- Standard

Output
- Relay

1.4 Process Description

Since the product diaphragm is the primary containment barrier and since it is more likely to fail than the secondary diaphragm, most installations are designed to detect primary diaphragm failure. In some instances, such a design will incidentally detect secondary diaphragm failure, but this is typically not the case. This discussion deals with detection of primary diaphragm failure; the same principles apply to the secondary diaphragm.

The unit of conductivity is microsiemens per centimeter The unit of resistance is measured in ohms. Liquid resistance ranges depending on the type being used. The relay itself has an adjustable resistance range. From 1kOhms to 250kOhms.

To facilitate detection, the intermediate liquid is selected to have as different a conductivity as possible from the process liquid. The selection is also influenced by chemical compatibility and viscosity.

Where the conductivity of the process liquid is greater than that of the intermediate liquid, the forward mode (PUMP UP) of sensing is applied: an increase in conductivity triggers detection. Where the conductivity of the process liquid is lower, the reverse of sensing (PUMP DOWN) is applied: a decrease in conductivity triggers detection.

The probe can be situated at the top, bottom, or midpoint of the intermediate chamber.

Where the process and intermediate liquids are immiscible or of significantly different specific gravities, change is likely to occur first at the top or bottom of the intermediate chamber. Detection is enhanced by positioning the probe in one of these locations, depending on the specific gravities.

For example, consider an application in which nitric acid, 5% by weight, is being pumped, and for which ethylene glycol solution, 50% by weight, has been selected as an intermediate liquid. Temperature is 25°C. Forward mode sensing has been specified.

The circuit will be calibrated to the ethylene glycol (intermediate head fluid), which has an approximate conductivity of 2150 microsiemens/cm. Since the nitric acid has an approximate conductivity of 275,000 microsiemens/cm, over a hundred times the initial level, effective detection can be anticipated. **Note that forward mode sensing is essential as reverse mode sensing detects only a decrease, but not an increase, in conductivity**. It is imperative to understand what the process fluid will be to help select the proper action of the relay.

1.5 Circuit Operation

There are two operation directions available for the Chemalarm. Pump up (increasing conductivity) & Pump down (decreasing conductivity).

In either application it is imperative to properly calibrate the system in order to determine if a diaphragm has failed.

(The terms pump up & pump down are printed on the side of the relay module, please look on the side for clarity to understand the type of relay you have… reword)

Pump up (rising setpoint) operation: In the pump up direction, the circuit will only detect an increase in conductivity, not a decrease. Once the circuit has detected an increase, the relay will trip, lighting a red LED on the top of the module. This will indicate that the relay has reached the trip point and is sending an alarm signal. Select this option if the fluid you wish to monitor has a higher conductivity than that of the intermediate fluid.

When the diaphragm fails and is subject to a more conductive liquid, the pump up circuit will detect an increase in conductivity, triggering the relay to send out an alarm signal.

You can identify a chemalarm module with this function by reading the nameplate printed on the side of the module. (Pump up)

Pump down (falling setpoint) operation: In the pump down direction, the circuit will only detect a decrease in conductivity, not an increase. Once the circuit has detected a decrease, the relay will trip, lighting a red LED on the top of the module. This will indicate that the relay has reached the trip point and is sending an alarm signal. Select this option if the fluid you wish to monitor has a lower conductivity than that of the intermediate fluid.

When the diaphragm fails and is subject to a less conductive liquid, the pump down circuit will detect a decrease in conductivity, triggering the relay to send out an alarm signal.

You can identify a chemalarm module with this function by reading the nameplate printed on the side of the module. (Pump down)

2. INSTALLATION

During installation, please be cautious when working around electrical components, all components should be locked out and de-energized prior to start up. (SAFTEY FIRST)

Connect AC power and probe leads per the pertinent wiring diaphragm (Figure 2). Output contact ratings are given under "Specifications" below.

To minimize electrical interference with the control signals, follow the procedure below for wiring of the probe leads between junction box and control box.

1. Ensure circuit is de-energized and locked out to prevent any injury or death to the operator.
2. Determine a proper mounting location for the enclosure, this can be either floor or wall mounted. Mount the enclosure.
3. Following local electrical guidelines, ensure conduit is run to the enclosure of the relay assembly to prevent any damage to conductors.
4. Remove the relay module from the socket to expose the terminals of the socket.
5. First, attach the Pulsafeeder probe to terminal 5 & one on terminal 6. The polarity is not critical. There is a junction box fixed on the pump that holds these probe wires.
6. Next, connect a jumper wire between terminals 5 & 8. There will now be two wires leading into terminal 5. One is a probe going to the pump, the other is a jumper.
7. Once the probe connections have been made and secured, complete the alarm circuit by connecting to any necessary components, such as lights, solenoids or PLC's. Ensure the alarm & probe wires are housed within the same section of conduit & shielded.

8. Hook up power supply (120V or 240V - single phase AC) to terminals 7 & 2. Terminal 7 will be line voltage & terminal 2 will be neutral. Ensure the power wires & signal wires are not run thru the same section of conduit. Doing so will ensure there is no signal interference.
9. Once all connections have been made, reinstall the module onto the top of the socket, ensuring the key lines up with the keyway.
10. You may now power up the box, the relay may make an audible clicking noise, and an LED will be lit on top.
11. As the calibration has not been done yet, the relay may be sending an alarm signal already & a red LED may be visible on top of the module, follow calibration steps below to calibrate the newly installed unit to the intermediate fluid.
12. Isolate lead wires from power wiring. Do not run lead wires in the same conduit as power wiring. This will prevent any signal interference.
13. All lead wires should be shielded, and the shields grounded.
14. Dual control cable within the same shield should not exceed a length of twenty feet. Separate lead wires, individually shielded, can be used up to a length of 100 ft.
15. If the module is installed as a component within an enclosure containing sources of electromagnetic interference, shield it with a grounded cover.

3. START-UP

3.1 Calibration

Calibration adjusts the conductivity-sensing circuit so that a slight change in conductivity in the desired direction, due to diaphragm leakage, triggers the alarm.

Initial calibration is the only procedure required at startup.

1. The control box must be powered and installed to properly calibrate the relay. Calibration of the relay can be done while the pump is idle or running.
2. It is recommended to calibrate the relay when the temperature of the pump has stabilized.
3. First, begin by testing the relay module. Simply rotate the knob on the top of the module, either direction until you see the led on top turn red. You may also hear an audible click. This is a basic test to verify if the relay is operational.
4. Next, you must identify the type of relay you have. There are two control options. A pump up & pump down option. On the side of the module, it will be clearly labeled.
5. Section 3.2 will cover calibrating a PUMP UP relay.
6. Section 3.3 will cover calibrating a PUMP DOWN relay.
7. Only one procedure must be followed, please follow the procedure that matches the module you have.

3.2 Pump Up relay calibration

1. First, set the relay to the highest possible sensitivity value. (250k ohms)
2. Begin slowly adjusting the knob on the top of the module in the counter clockwise direction until the relay makes an audible click & the LED light on top turns from green to red. Keep note of the position of the knob. (See image 1)
3. Once this is done, begin rotating clockwise again until the relay clicks and the LED turns from red to green.

4. Continue to fine tune the position of the knob, the desired goal is to have the sensitivity position set as close to the trip point as possible. This will provide your system with the most accurate monitoring setup.
5. NOTE: Liquid conductivity varies significantly with temperature, an increase beyond calibration temperature could trigger a false alarm. Final calibration should be performed at pumps operating temp.

3.3 Pump Down relay calibration

1. First, set the relay to the lowest possible sensitivity value. (1k ohms)
2. Begin slowly adjusting the knob on the top of the module in the clockwise direction until the relay makes an audible click & the LED light on top turns from green to red. Keep note of the position of the knob. (See image 1)
3. Once this is done, begin rotating counter clockwise again until the relay clicks and the LED turns from red to green.
4. Continue to fine tune the position of the knob, the desired goal is to have the sensitivity position set as close to the trip point as possible. This will provide your system with the most accurate monitoring setup.
5. NOTE: Liquid conductivity varies significantly with temperature, an increase beyond calibration temperature could trigger a false alarm. Final calibration should be performed at pumps operating temp.

Image 1: Top of the Chemalarm relay module

4. MAINTENANCE

4.1 Periodic Checks

System operation should be confirmed on a regularly scheduled basis. Check calibration (see "Calibration"), which also verifies alarm circuit operation, except for an intermediate liquid of very low conductivity. In the latter case, confirm alarm circuit operation as follows:

1. For a PUMP UP (increasing conductivity) system, simulate the alarm by selecting a resistor such that it is lower than the calibrated sensitivity. i.e. a resistor with a value of 500Ohms.
2. You will be shorting the probe wires. Pin #5 & #6 (See figure 2). Once you short these two wires, the relay will trip and an alarm signal will be output.

1. For a PUMP DOWN (decreasing conductivity) system, simulate the alarm by selecting a resistor such that it is much greater than the calibrated sensitivity. i.e. a resistor with a value of 300kOhm.
2. You will be shorting the probe wires. Pin #5 & #6 (see figure 2). Once you short these two wires, the relay will trip and an alarm signal will be output.

4.2 Pulsafeeder Probe Disassembly

(See Figure 3)

1. Drain the intermediate liquid to a level below the probe. Refer to the pump operation bulletin.
2. Unscrew the tubing nut (1) and free the metal protective tubing from the elbow fitting (2).
3. Disconnect the wire leads at the junction box and withdraw them from the protective tubing to free up the probe assembly. The wire can be reused, provided sufficient length remains after trimming.
4. Unscrew bulkhead fitting (8) from the intermediate head.
5. Unscrew gland fitting (3) from the bulkhead fitting.
6. Straighten or clip the two protruding probe wires.
7. Remove all parts and inspect for damage.

4.3 Pulsafeeder Probe Assembly

(See Figure 3)

1. Strip about ¼” of insulation from both wire ends. Ensure that the lengths of the probe wires are sufficient to reach the termination point in the junction box.
2. Insert two or three inches of the wires through the tubing nut (1) and elbow fitting (2).
3. Screw gland fitting (3) into the elbow fitting and tighten.
4. Position anti-rotation set pin (5) into the blind end of the external groove in compression sleeve (4). It can be held in position during assembly by a metal-to-metal adhesive.
5. Insert the wire ends into the compression sleeve and lower the sleeve until it bottoms against the gland fitting.
6. Insert the wire ends in one insulator (6), followed by Teflon gland seal (7). Slide the insulator and seal down flush against sleeve (4).
7. Insert the wire ends in the other insulator (6) and slide the insulator down flush against the gland seal.
8. Slip bulkhead fitting (8), straight threads down, over the assembly, taking care to engage set pin (5) in the interior groove in the bore of the bulkhead fitting. Screw the

bulkhead fitting into the gland fitting (3) and hand tighten. Pull the wires back through from the tubing nut end until only a 1/8” extension is left. Tighten the bulkhead and gland fitting together.

9. Spread the wires into an included bottom angel of about 60°.
10. Trim the wire ends to 1/8” approximate length. Verify that they do not contact one another and that neither will contact the walls of the probe port in the intermediate head.
11. Install the probe assembly in the intermediate head and tighten the bulkhead fitting (8) only.
12. Using a multimeter, verify that the probe leads are not shorted to one another and that neither is grounded to probe assembly or intermediate head.
13. Install the protective tubing. Install and terminate the wire leads in the junction box.
14. Refill and plug the intermediate chamber. Prime and start the pump in accordance with procedures in the pump operations manual.
15. Check calibration (see “Calibration”).

5. TROUBLESHOOTI NG

DIFFICULTY	PROBABLE CAUSE
Failure to alarm	No power to module
	No power to alarm circuit(s)
	Wiring discontinuity in control box
	Probe leads shorted, open, or grounded
	Relay failure
	Calibration (consider temperature change beyond the limit of previous calibration)
	Corroded probes
	Circuit board failure
False alarm	Probe leads shorted, open, or grounded
	Calibration (consider temperature change beyond the limit of previous calibration)
	Corroded probes
	Circuit board failure
Module check	NOTE: Relay operation is audible and can be observed by the LED on top of the module. GREEN is normal, RED indicates an alarm signal is being output.
	Disconnect pins #5 & #6. Insert a jumper wire between these two. A function relay will actuate.
	For a PUMP UP setting, turn the sensitivity knob to the lowest possible value. The relay should trip before reaching this value.
	For a PUMP DOWN setting, turn the sensitivity knob to the highest possible value. The relay should trip before reaching this value.

6. REPLACEMENT PARTS

When ordering replacement parts, always specify:

1. Pump model and serial number (stamped on pump nameplate) e.g., Model 7120-S-AE, Serial No. 8604146-1.
2. The part name and number from the Parts List.

7. SPECIFICATIONS

Output Contact Ratings	10A @ 240V AC / 7A @ 28V DC, 1/4HP @ 120V AC (N.O.)		
Control options	Model	Resistance Range	Mode
	LCP-XD	Up to 250,000 ohms	Forward (actuates upon increase in conductivity)
	LCP-XC	Up to 250,000 ohms	Reverse (actuates upon decrease in conductivity)
Control box ambient temperature range	32°F to 140°F		
Control box enclosure (optional)	NEMA 4X		
	NEMA 7		

8. ILLUSTRATIONS

8.1 Typical Pump Installation

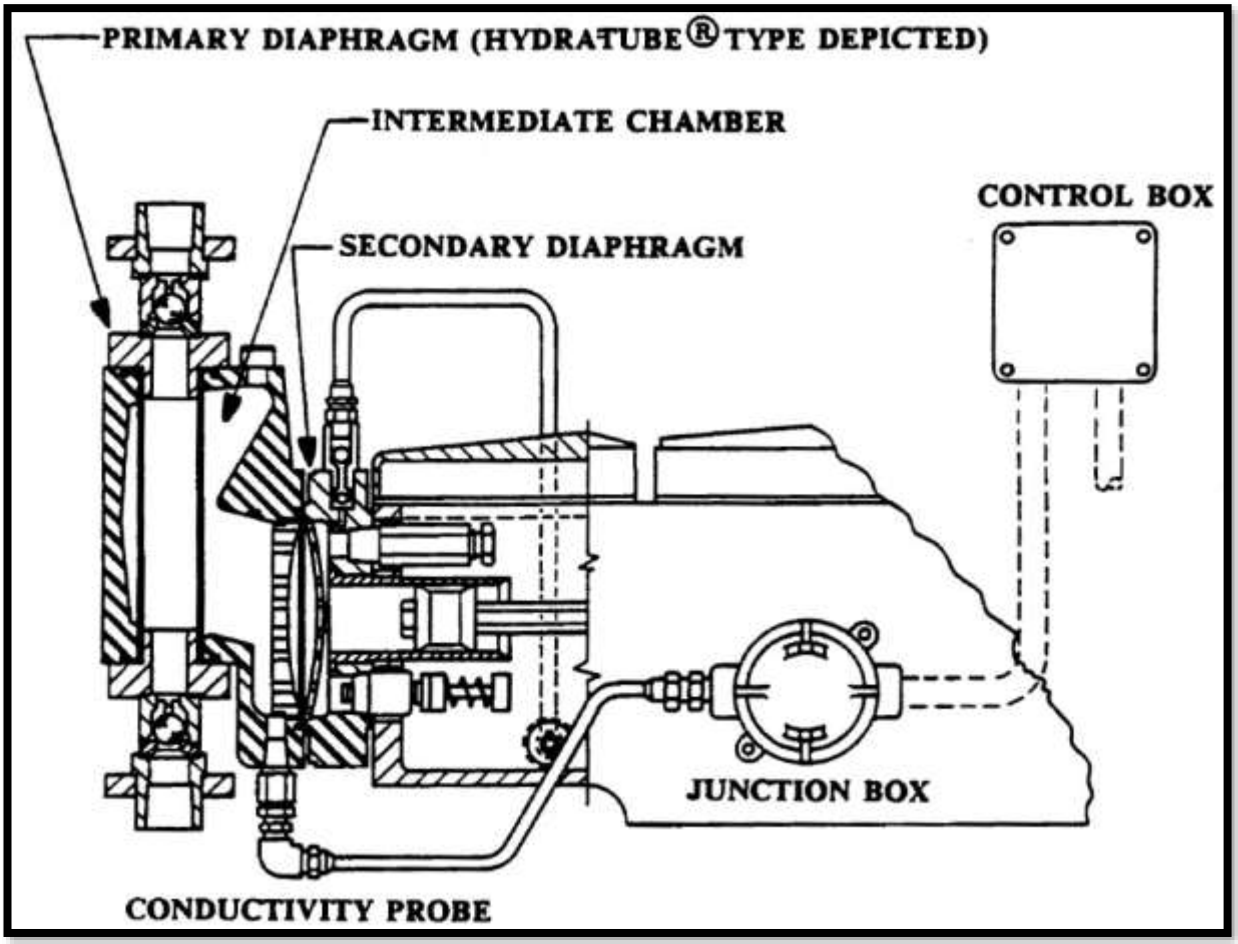


Figure 1

8.2 Wiring Diagram-Standard Relay Output

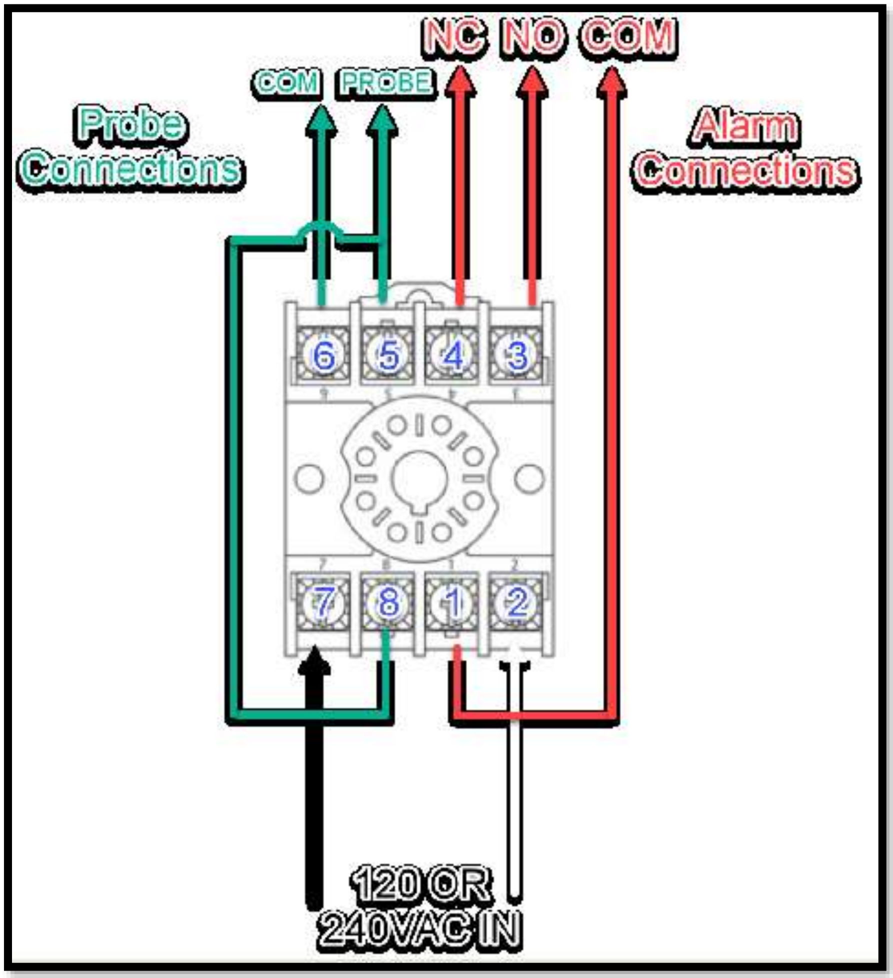


Figure 2

8.3 Pulsafeeder Probe Assembly

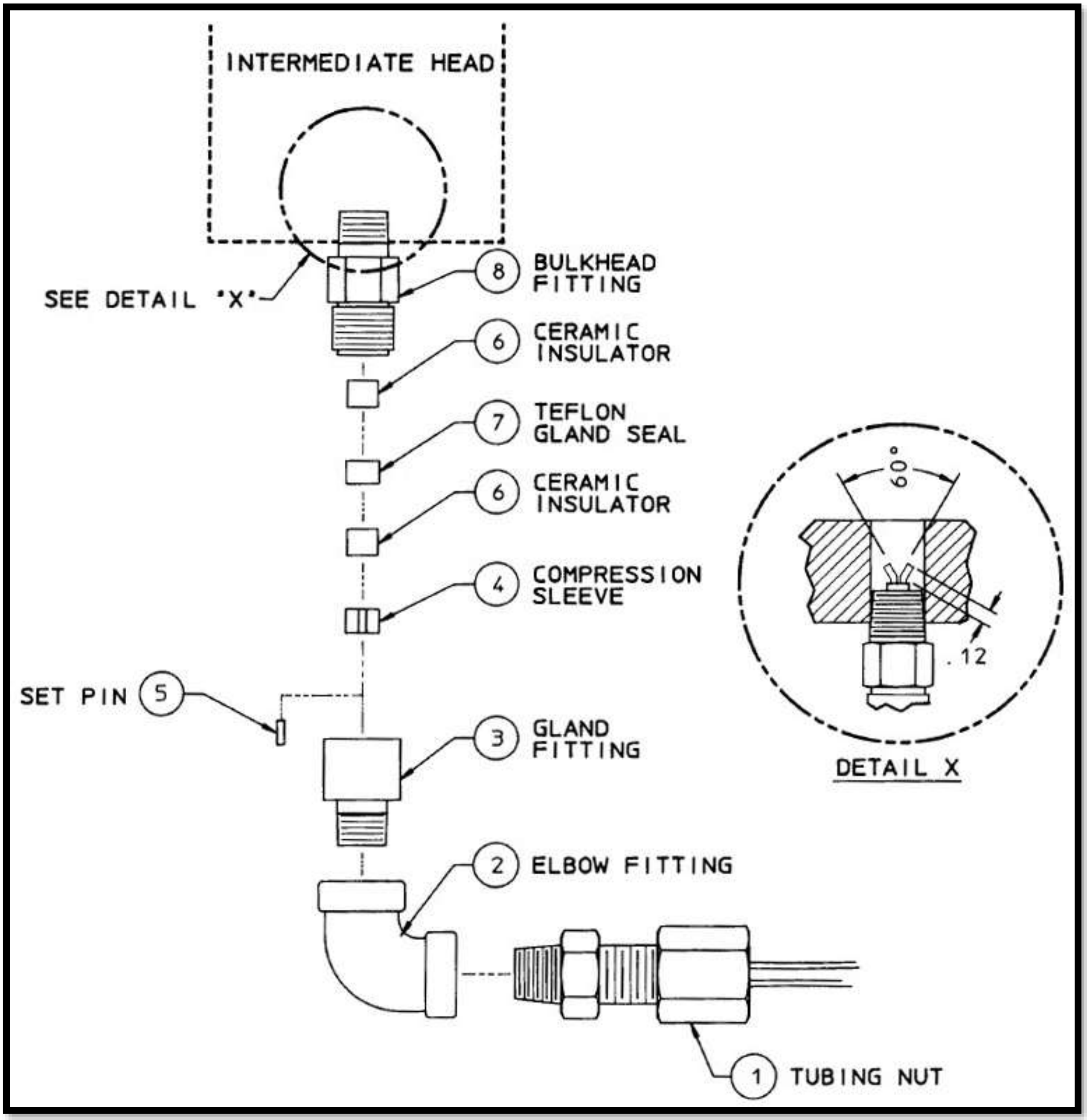
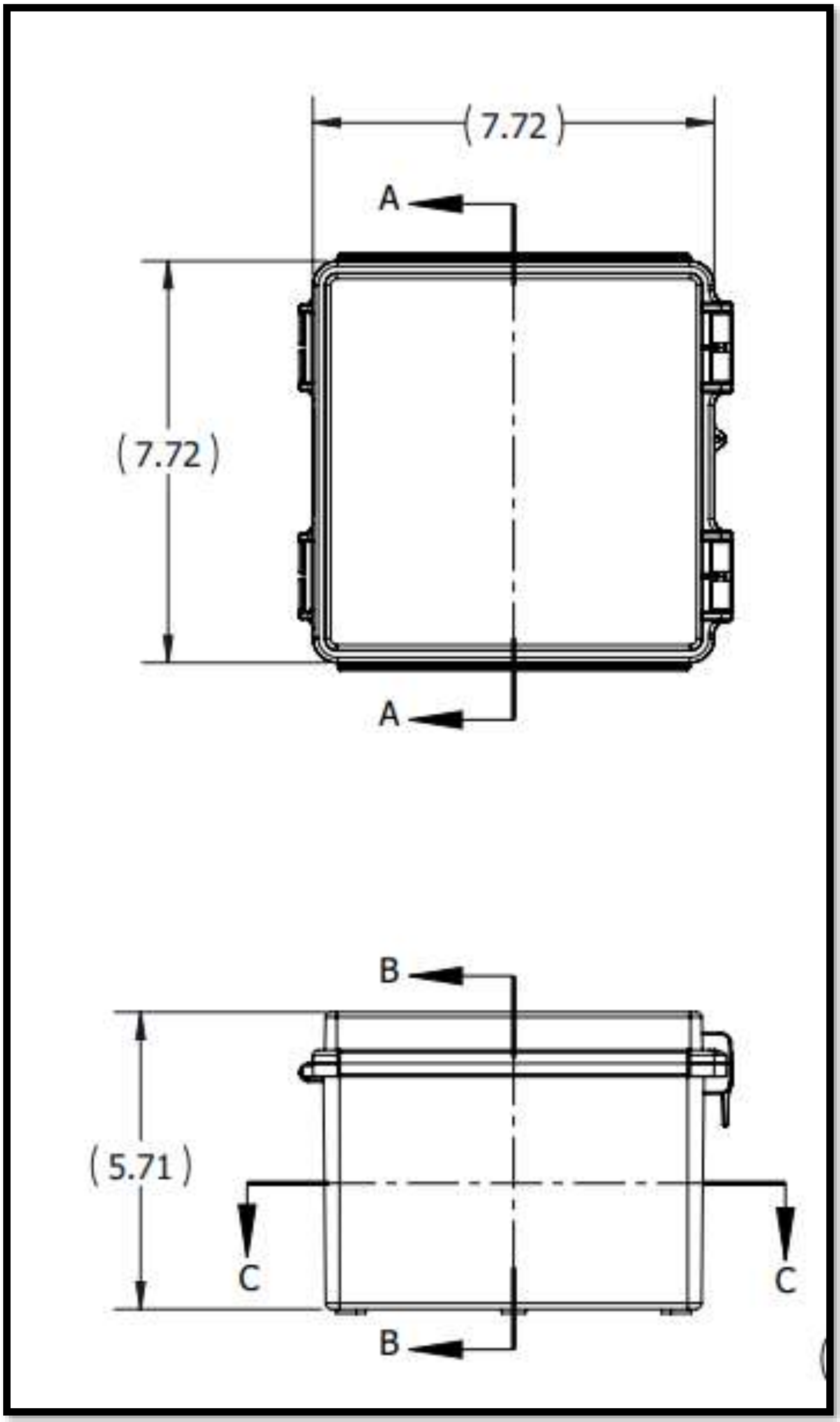
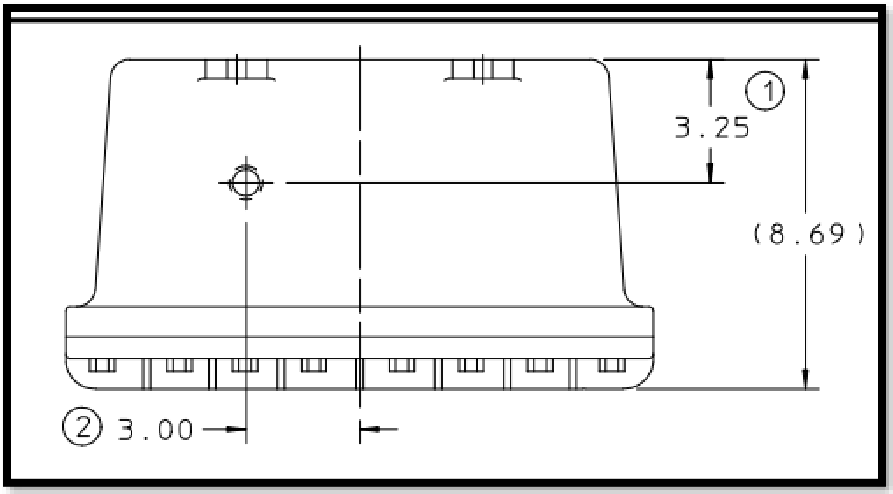


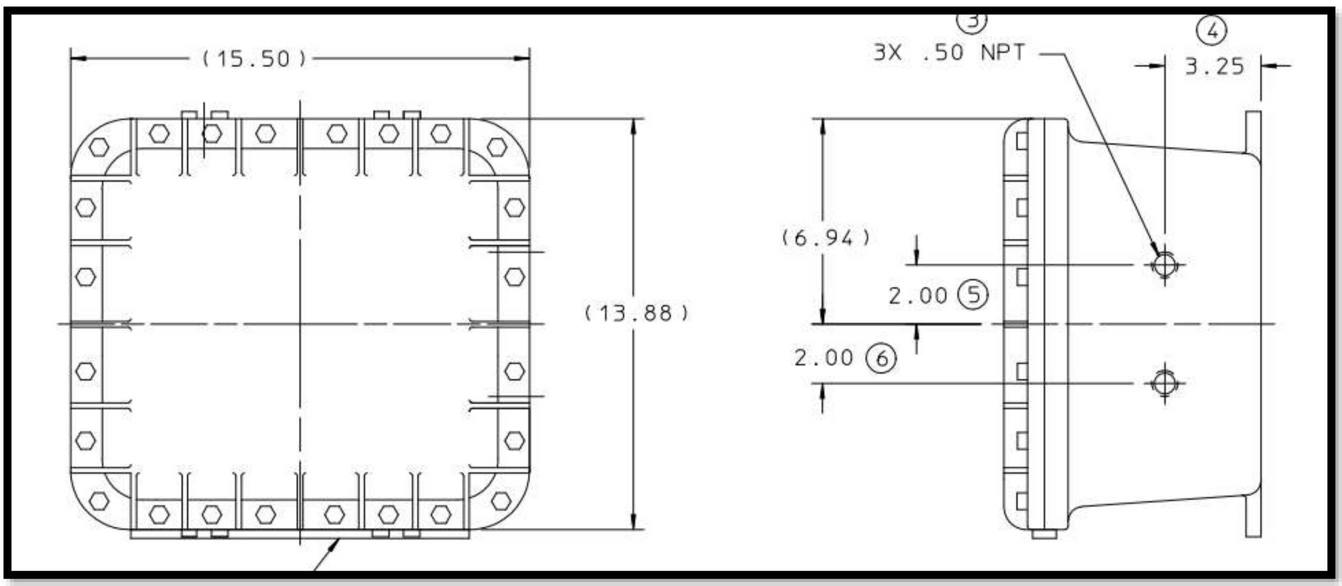
Figure 3

8.4 Enclosures



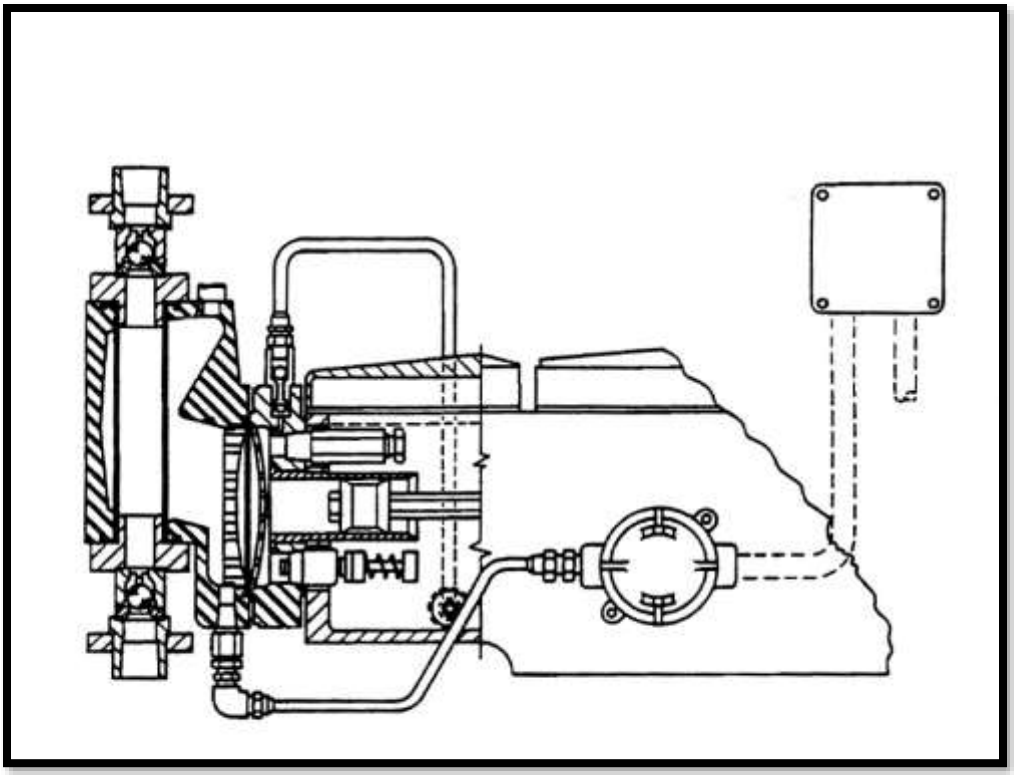
NEMA 4X enclosure





NEMA 7 enclosure: Intrinsically safe

Figure 4



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Pulsafeeder, Inc.
A unit of IDEX Corporation
2883 Brighton Henrietta Town Line Road
Rochester NY 14623
+1 (585) 292-8000
www.pulsafeeder.com
pulsa@idexcorp.com