DensityPRO

Gamma Density System
Installation Guide
P/N 717774

Revision F

Part of Thermo Fisher Scientific

Thermo SCIENTIFIC

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Revision History

Revision Level	Date	Comments
1.0	06-2000	Initial release.
2.0	07-2001	Released.
A	03-2005	Name change.
B	09-2007	Revised per ECO 5987.
C	07-2010	Revised per ECO 7430.
D	09-2010	Revised per ECO 7508.
E	06-2011	Revised per ECO 7705.
F	07-2011	Revised per ECO 7778.

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Contents

Safety Information & Guidelines

This section contains information that must be read and understood by all persons installing, using, or maintaining this equipment.

Safety Considerations

Failure to follow appropriate safety procedures or inappropriate use of the equipment described in this manual can lead to equipment damage or injury to personnel.

Any person working with or on the equipment described in this manual is required to evaluate all functions and operations for potential safety hazards before commencing work. Appropriate precautions must be taken as necessary to prevent potential damage to equipment or injury to personnel.

The information in this manual is designed to aid personnel to correctly and safely install, operate, and/or maintain the system described; however, personnel are still responsible for considering all actions and procedures for potential hazards or conditions that may not have been anticipated in the written procedures. **If a procedure cannot be performed safely, it must not be performed until appropriate actions can be taken to ensure the safety of the equipment and personnel.** The procedures in this manual are not designed to replace or supersede required or common sense safety practices. All safety warnings listed in any documentation applicable to equipment and parts used in or with the system described in this manual must be read and understood prior to working on or with any part of the system.

Failure to correctly perform the instructions and procedures in this manual or other documents pertaining to this system can result in equipment malfunction, equipment damage, and/or injury to personnel.

Warnings, Cautions, & Notes

Warnings, cautions, and notes are used throughout this manual to alert users to potential hazards or important information. **Failure to heed the warnings and cautions in this manual can lead to injury or equipment damage.**

Warning Warnings notify users of procedures, practices, conditions, etc. which may result in injury or death if not carefully observed or followed. The triangular icon displayed with a warning depends on the type of hazard (general, electrical, radiation). ▲

Caution Cautions notify users of operating procedures, practices, conditions, etc. which may result in equipment damage if not carefully observed or followed. ▲

Note Notes emphasize important or essential information or a statement of company policy regarding an operating procedure, practice, condition, etc. ▲

Chapter 1
Introduction

Refer to the DensityPRO gauge user guide (p/n 717784) for a description of instrument functions and features, ordering information, and product specifications.

Associated Documentation

In addition to this guide, the following documents must be read and understood by all persons installing, using, or maintaining this equipment:

- DensityPRO gauge user guide, p/n 717784
- Gamma radiation safety guide, p/n 717904
- DensityPRO gauge with FOUNDATION™ Fieldbus application guide, p/n 717917 (if FOUNDATION fieldbus is installed)
- DensityPRO / DensityPRO+ gauge with HART operation manual, p/n 717816 (if using the HART® protocol)
- Thermo Scientific Model 9734 handheld terminal operation manual, p/n 717797 (if using the handheld terminal)

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Chapter 2
Handling & Storage

This chapter addresses procedures for handling electrostatic discharge (ESD) sensitive equipment, as well as procedures for unpacking, inspecting, and storing of the system.

Caution This system is an ESD sensitive instrument. Use proper ESD protective equipment and procedures. Failure to comply with ESD procedures can result in circuit damage. ▲

ESD Procedures

The instrument contains electronic components that can be damaged from discharges of static electricity. Ordinarily, handling the circuit boards by their edges will not damage the circuits.

Caution Do not touch the circuit board components. ▲

Observe the following when installing, setting up, servicing, troubleshooting, or repairing the instrument:

1. Use an antistatic bag. Most instrument subassemblies are shipped in a special antistatic bag. When not installed, keep the assembly in the bag as often as possible.

2. Remove ESD sensitive subassemblies only under the following conditions:
   a. When at a designated static-free workstation or when the bag is grounded at a field site.
   b. After the conductive area of the container has been neutralized.
   c. After making firm contact with an antistatic mat and / or firmly gripping a grounded individual.

3. Personnel handling ESD sensitive devices should be neutralized to a static-free workstation by means of a grounding wrist strap that is connected to the station or to a good grounding point at the field site.

4. Do not allow clothing to make contact with ESD sensitive devices.

5. Avoid touching edge connectors and components.

6. Avoid partially connecting ESD sensitive devices. These devices, especially the power supply connector, can be damaged by floating leads.

7. Ground test equipment.

8. Avoid static charges during troubleshooting.

Unpacking, Inspection, & Storage

All personnel involved in the packing, shipping, or receiving of hazardous material must be trained in accordance with the United States Department of Transportation (DOT) and OSHA hazardous materials regulations or in accordance with the Canadian Nuclear Safety Commission (CNSC) regulations.

Note Inspection, adjustment, installation, and maintenance of the instrument must be performed by experienced personnel only. ▲

1. Upon receipt, inspect the instrument for damage that may have occurred while in transit. If there is evidence of rough handling or damage, file a damage claim with the transportation company immediately. Notify Thermo Fisher and / or your sales representative as soon as possible.

2. Carefully inspect the packing material prior to discarding it to ensure that all equipment and instruction paperwork has been removed.

3. Use the original packing material and container for storage if necessary.

4. If storing the instrument, the storage environment should be protected, free from extremes of temperatures and high humidity, and fall within the environmental constraints listed in the specification appendix.

Chapter 3
Installation

Read the gamma radiation safety guide (p/n 717904) prior to installing the equipment.

Note Copies of the drawings referenced in this manual are provided in Appendix C. ▲

General

The Thermo Scientific DensityPRO gamma density system consists of two components:

1. A detector-transmitter model: Model 9719A NEMA 4 housing or Model 9720A explosion proof housing.

2. A source head model. Standard model numbers include: 5200, 5201, 5202, 5203, and 5204.

Note The combination of the detector-transmitter and the source head is referred to as the "gauge head". ▲

Licensing

Warning The instrument is a nuclear device regulated by federal and / or state authorities. You are responsible for knowing and following the pertinent safety and regulatory requirements. Refer to the gamma radiation safety guide (p/n 717904) for a summary of these requirements. ▲

Warning Moving or removing an installed source housing or any assembly that includes a source housing requires a person who is specifically licensed to install and commission Thermo Scientific source heads. ▲

In the United States, your general license permits you to own and install all of the instrument's components, including the source head. However, you may not commission the instrument (remove the lock and open the source housing shutter for the first time) without a specific license authorizing radiation commissioning of the instrument. In Canada, you are only allowed to remove the instrument from the shipping container if your CNSC license has a condition authorizing mounting / dismounting of devices. For assistance obtaining a license or commissioning / decommissioning the instrument, contact Thermo Fisher.

Guidelines

Warning Do not install the system in any hazardous area other than those approved. Refer to the equipment tag for the specific approvals applicable to the configuration of your instrument. ▲

Warning Do not apply power to the instrument in any hazardous area unless the safety ground is properly wired inside the instrument and the cover is properly installed. ▲

General

Review the following guidelines when planning gauge installation.

1. Correct power source is available for the detector-transmitter:
   - 24 Vdc ± 20%, 12VA, at detector input
   - 115/230 Vac (± 15%), 50/60 Hz, 12 VA (with AC power option)

2. Operating temperature range: -40°C to +60°C (-40°F to +140°F)

3. There should be enough clearance to install and service the gauge head. Refer to the appropriate drawings for your type of gauge and mount (Appendix C).

4. The gauge head should be positioned so that the radioactive source identification tag is visible. The source housing tag should be upright.

5. The gauge should not be mounted where process overflow or other material can collect in the beam path. The source shutter mechanism must be kept free of debris.

Mounting

Warning Installation must be in accordance with local and national electric codes for the area classifications. ▲

Warning The source housing handle must be in the OFF position during installation. ▲

Warning Do not reach inside the source housing at any time during installation. ▲

Warning Use proper lifting procedures during installation to avoid injury. ▲

Mounting Configurations

The optimum gauge mounting configuration depends on the application; however, the source head and the detector-transmitter are typically mounted together on the opposite sides of a pipe. The following mounting options are supported for the gauge:

- Dual chain mount
- Pipe saddle (cradle) mount
- Pipe spool with gauge head pre-installed
- Z-pipe (axial) mount for small diameter pipes

The chain mount is the most frequently used mounting configuration because it allows the unit to be mounted on a range of pipe sizes using the same mounting hardware.

Note Moving the gauge to a pipe with a different diameter may require changing the radiation source size. Contact Thermo Fisher Scientific Technical Support for assistance. ▲

In addition to the guidelines listed earlier in this chapter, note the following when planning gauge head installation.

- Whichever mounting configuration is used, it is important to align the beam path (the centerline of the source housing) as closely as possible with the centerline of the detector housing. Be sure to mount the gauge head securely, since any movement or change in alignment can affect the gauge's calibration.
- The gauge measures only the material that passes through the beam. For best performance the beam must pass through a representative cross-section of the process material being measured. Prevent suspended solids from settling out of the measured area by mounting the gauge head on a vertical section of pipe.
- For mounting on a horizontal pipe:
  - Position the beam path at a 30- to 45-degree angle from vertical. This position tends to average density variations caused by settling, while reducing the effect of any trapped gases or solids that accumulate in the top or bottom of the pipe.
  - If the process material is a solution, light slurry, or single-phase liquid that will not separate, the gauge head can be mounted such that the beam is horizontal.
- If the process material is a slurry, position the gauge head as far as possible from any elbows, tees, or valves (these tend to separate suspended solids). Position the beam path in the plane of the upstream elbow so the measurement includes any uneven distribution caused by the fitting.

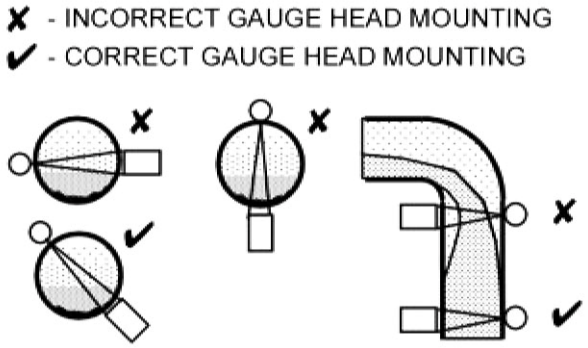

Figure 3–1. Gauge installation examples

Mounting Instructions

The following sections provide installation details for the various mounting configurations. Refer to the dimensional drawings in the drawing appendix.

Warning Use proper lifting procedures during installation to avoid injury. ▲

Caution Do not over tighten the bolts. ▲

Single Chain (Unichain) Mount

The single chain or unichain mount was offered with the Model 5211 source head. For this mounting configuration, a mounting chain is inserted through an eye bolt in the rear of the source housing. The two ends of the chain are wrapped around the pipe and engaged in slotted tabs in the detector housing.

Note The single chain mount and Model 5211 source head are obsolete. This material is for reference only. ▲

Refer to the following drawings for mounting details.

- 867456: Model 9719A NEMA 4 housing
- 867465: Model 9720A explosion proof housing

The mounting hardware kit shipped with the gauge should include:

- 1 eye bolt (.500-13 x 3 in), 1 nut (.500-13), 1 Belleville washer
- 1 chain

The following steps describe the installation of the gauge head using a single chain mount.

1. Insert the eye bolt through the hole in the rear of the source housing. Place the Belleville washer, cupped-side first, onto the eye bolt. Thread the nut on the eye bolt until the bolt just begins to come through the nut.

2. Insert the chain through the eye bolt so that approximately the same length of chain extends on each side of the eye bolt.

3. Position the source housing and detector housing so that the V-shaped mounting features center the housings on the pipe.

4. With the axis of the source and detector housings aligned, attach one end of the chain in the slotted tab on one side of the detector housing. Pull the chain tight on the other side and attach it into the slotted tab on the other side of the detector housing.

5. Maintain alignment of the housings and tighten the nut on the eye bolt approximately 1/2 turn past the point where the Belleville washer becomes fully flattened.

Note There must be an even number of chain links between the slotted tabs so that there will be an equal number of links on both sides. ▲

Dual Chain Mount

For the dual chain mount, two mounting chains are wrapped around the pipe with their ends engaging keyhole-shaped openings in the source head mounting plate. The detector housing is then clamped to the two chains' center links (opposite the source mounting plate) by tensioning bolt assemblies.

Refer to the following drawings for mounting details.

- 867466: Model 9719A NEMA 4 housing
- 867467: Model 9720A explosion proof housing

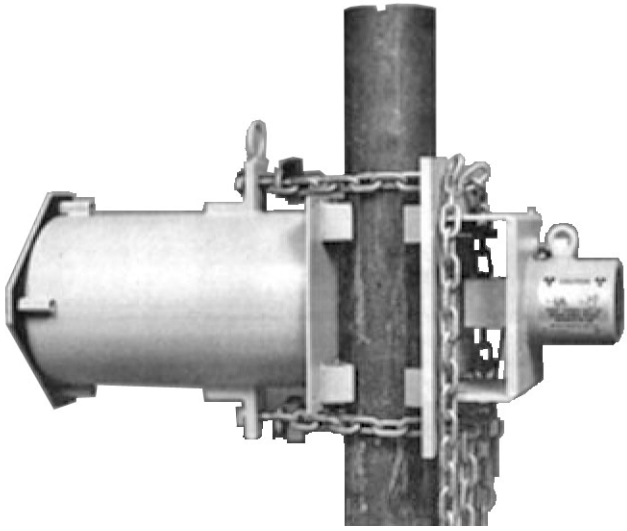

Figure 3–2. Dual chain mount

1. Use the tables below to determine the number of chain links to thread through the keyhole slots. Count the links and mark the ones that will be engaged at each end of the two chains (four links in all).

   Table 3–1. Dual chain mounting (chain p/n 867103)

Pipe Size (inches)	Links from Center	Links from End	Links from Center	Links from End
2	7	23	6	24
2.5	7	23	6	24
3	8	22	7	23
3.5	8	22	7	23
4	9	21	8	22
5	10	20	9	21
6	12	18	11	19
8	14	16	13	17
10	17	13	16	14
12	20	10	19	11
14	21	9	20	10
16	24	6	23	7
18	25	5	24	6

2. Partially assemble the two tensioning bolts (hardware kit 885826) in the following order:

   a. 1 tensioning bolt (large)

   b. 1 chain: Place center ring of chain over the bolt head.

   c. 1 bar nut: Position the guard tube towards the bolt head.

   d. 1 special nut: Thread the nut securely onto the bolt end. After the special nut is fully threaded, thread the bar nut back down the bolt so that it rests against the special nut.

3. From the pipe side of the source mounting plate, thread one end of a chain through the plate's top keyhole opening until you reach one of the four end links you marked in step 1. Engage this link by sliding it into one of the keyhole slots.

4. Thread one end of the other chain through the bottom keyhole and engage the marked link as you did with the top chain.

5. Position the source housing mounting plate on the pipe. If necessary, use a lift, hoist, or other means to hold it in position.

6. Pass the center part of the upper and lower chains around the pipe and thread their ends through the corresponding keyholes. Engage the marked links in the empty slots.

Note All four chain ends must engage at the same link. If you make an adjustment, adjust all four chain ends by the same amount. Also make sure there are no twists in the chain as you wrap it around the pipe. Otherwise the gauge head will not be aligned correctly. ▲

Note You may need to adjust chain links (thread more or fewer links through each slot) to allow for pipe size tolerance, insulation, etc. Start with approximately 4" (10 cm) of play. ▲

7. Position the detector on the pipe, opposite the source mounting plate. If necessary, use a lift, hoist, or other means to hold it in position.

8. To secure the detector and the source head mounting plate on the pipe:
   a. Position the upper chain, including the tensioning bolt assembled earlier, over the detector's top mounting arm.
   b. Place a spacer ring and two Belleville washers with concave sides together onto the pilot end of the special nut.
   c. Insert the pilot end of the chain tensioning bolt into the hole in the top detector mounting arm and tighten the chain tensioning bolt finger-tight.
   d. Repeat the previous three steps for the lower chain.

9. Alternately and uniformly tighten the chain tensioning bolts until the spacers are just touching the mounting arms.

10. Place the loose ends of the upper chain over the top edge of the source mounting plate so they will not interfere with the source housing installation.

11. Position the source housing so its four mounting holes engage the four studs on the mounting plate. If necessary, use a lift, hoist, or other means to hold it in position.

12. Use the provided lock washers and nuts to secure the source housing.

Pipe Saddle (Cradle) Mount

A pipe saddle, or cradle, mount consists of two identical mounting plates that are bolted together on opposite sides of the process pipe.

Refer to drawing 85726N and follow the steps below to install a gauge head with a pipe saddle mount.

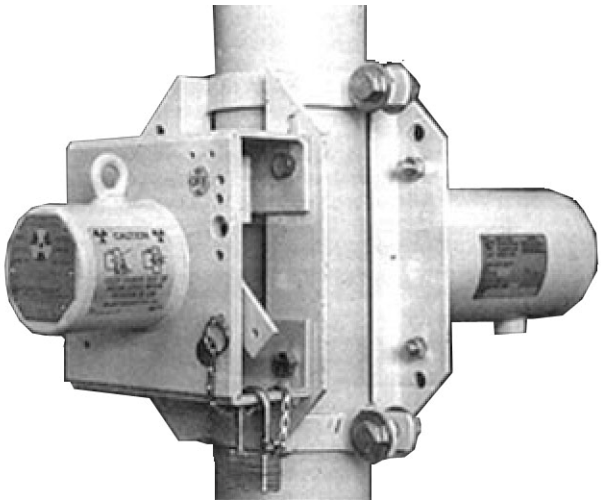

Figure 3–3. Pipe saddle mount

1. Assemble the two halves of the saddle mount onto the process pipe using the supplied nuts, bolts, and washers. Thread the nuts and bolts together, but do not tighten them.

2. Adjust the saddle mount halves so the mounting plates are parallel and even with each other. Then tighten the bolts evenly so the clamp ends are the same distance apart on both sides of the pipe.

3. Bolt the detector and source housings to the mounting plates on either side of the pipe saddle.

4. Tighten all bolts securely so the gauge head components cannot shift positions.

Pipe Spool Mount

A pipe spool is normally a 30” section of pipe with either mounting plates or a complete gauge head already installed. Often, a length of the required pipe is sent to Thermo Fisher to be converted into a pipe spool mount.

Caution Use correct pipe fitting techniques suitable for the pipe being used and the process material that the pipe will handle. ▲

1. Assemble the pipe spool into the existing pipe.
2. Position the source housing so its identification tag is upright.
3. If the detector and source housings are not already installed, bolt them to the mounting plates on either side of the pipe saddle.
4. Tighten all bolts securely.

Z-Pipe (Axial) Mount

A Z-pipe mount is used for small pipes, four inches in diameter or less. It uses a Z-shaped pipe section so the gamma rays can travel along the pipe’s axis for several inches. This lets the beam pass through more process material so the material’s density can be measured more reliably.

Depending on the application, the user typically fabricates the Z-pipe section and then either assembles it into the mounting fixture or sends it to Thermo Fisher for assembly.

Fabrication & Assembly

To fabricate the Z-pipe, refer to the drawing appropriate for your application:

- 861104: Z-pipe fabrication details, 1” to 3” pipes
- 864163: Z-pipe fabrication details, 4” pipes

Carefully note the tolerances for each dimension. Any variation in the Z-pipe dimensions, especially in the bracket placement, can lead to misalignment causing inaccurate readings or no readings at all.

Z-Pipe Installation

Refer to the dimensional drawing appropriate for your application:

- 866670: Z-pipe mount, 1” to 3” pipes
- 864163: Z-pipe mount, 4” pipes

Caution If a lead doughnut is provided with the mounting assembly, make sure its inside diameter matches the pipe’s outside diameter. While assembling the mount, clamp the doughnut to the axial portion of the Z-pipe (between the source and detector) as close to the center as possible. ▲

Warning If the process pipe is not strong enough to support the gauge head and mounting assembly, you must provide additional support for the gauge head. ▲

After the pipe and mount are assembled, install the gauge head as described earlier in “Pipe Spool Mount”, with the following additional notes:

- If the gauge is supplied with a large lead plate with a 1” to 2” hole in the center, the plate should be mounted between the detector and the mounting plate.
- If the gauge is supplied with a thin steel plate with a small lead disk, the plate should be mounted between the source housing and the mounting plate, with the disk towards the pipe (the disk should fit in the hole in the mounting plate).

System PCBs

This section provides general instructions on installing/replacing the PCBs in the DensityPRO system.

Warning Remove all power from the unit before servicing. Electrocution can result if power is present. ▲

Warning In hazardous locations, ensure that power is removed from the detector before removing the housing cover. Be sure that the housing cover has been replaced and the grounds are properly connected before reapplying power. ▲

Warning Close the shutter on the source housing before servicing the detector. ▲

To access the detector-transmitter electronics, follow the steps below.

1. Make sure all source shutters are in the OFF position.

2. Make sure all power to the gauge is turned off.

3. Remove the housing access cover:

   For the Model 9719A NEMA 4 housing, remove the bolts that secure the cover to the housing.

   For the Model 9720A explosion proof housing, loosen the screw on the cover retaining bracket and slide the bracket off of the housing cover. Unscrew the housing access cover (two lugs are provided on the top of the cover to aid in the removal of the cover).

4. Disconnect the plug-in screw terminals from the board connector. If the connector is tight, brace the board with your hand (but do not touch the circuit or components) and pull firmly but carefully. Lay the cables and connectors back over the edge of the housing so they will not be in the way when lifting the unit out of the housing.

5. Remove the screw that secures the unit in the housing. There will be a large plastic wire tie looped through the chassis of the detector. Pull on this loop to squeeze the triangle chassis together, allowing the detector to slide out of the housing smoothly. Slide the detector assembly up out of the housing, being careful to not snag the wiring, until it clears the housing. It is recommended that you take the detector to a clean, dry work place to change out the boards.

6. To remove a PCB, disconnect any cabling from it and remove the retaining screws holding the PCB to the aluminum chassis.

7. Place the new PCB onto the chassis and secure it with the removed retaining screws. Connect any cabling that was disconnected from the removed PCB, and reinstall the detector in the housing.

8. Reconnect the plug-in screw terminals to the board connectors, and replace the housing access cover.

9. Apply power to the unit.

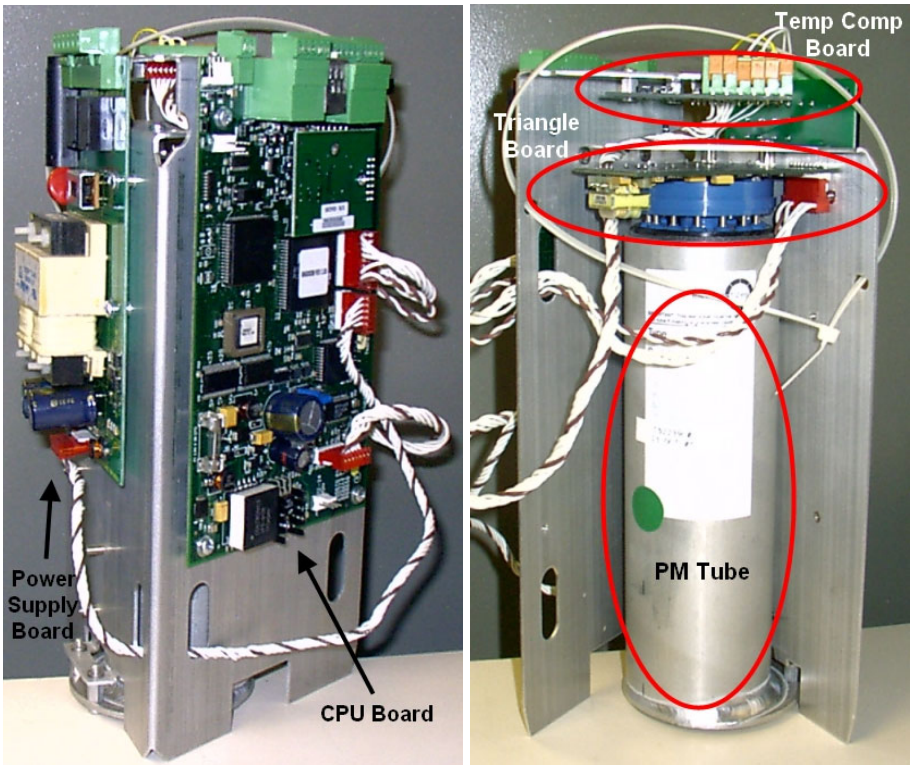

Figure 3–4.

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Chapter 4
Wiring

Wiring should be performed in the following order:

1. Connect the power supply to the gauge.

2. Connect the remote computer terminal or handheld terminal (HHT) to the gauge via the serial communication ports.

3. Optional wiring may include:
   a. HART communications
   b. FOUNDATION fieldbus communications
   c. 4–20 mA current output
   d. Relay output
   e. Contact closure input
   f. Remote display
   g. Flow sensor input (4–20 mA)
   h. Temperature compensation

Preparation

Review the following carefully prior to connecting any wiring.

Warning Remove all power from the unit before making any connections. Electrocution can result if power is present. ▲

Warning All wiring must be done by qualified individuals in accordance with applicable codes such as the NEC (National Electric Code) ANSI/NFPA 70 specifications or the Canadian Electrical Code Part 1. Only approved conduit, boxes, and fittings may be used. ▲

Warning Do not apply power to the unit in any hazardous area unless the safety ground is properly wired inside the unit and the cover is properly installed. ▲

Warning Connect the AC wiring Earth ground to the internal safety ground terminal as shown in the wiring diagram. Refer to "AC Power" if you need to change the AC supply voltage from 115 V to 230 V or vice versa. ▲

Warning For hazardous location installations, the cable entries must be sealed per the installation layout drawing (p/n 868580). For non-hazardous location installations, the cable entries into the enclosures must be sealed to prevent passage of gas or vapors. The surrounding atmosphere or liquids should not affect the sealing compound. The minimum thickness of the sealing compound should be 5/8" (16 mm). ▲

Warning If metal conduit is used, the conduit must be grounded. ▲

Warning Before wiring, verify that the source shutter is in the closed (OFF) position. ▲

General Wiring Procedures

The steps below provide general instructions for detector-transmitter wiring. For each cable to be connected, refer to the wiring label on the top of the chassis or to the installation wiring diagram. You will need a screwdriver with a 1/8" blade to connect the wires to the screw terminal connectors.

1. Make sure all source shutters are in the OFF position.

2. Make sure all power to the gauge is turned off.

3. Remove the housing access cover:

   For the Model 9719A NEMA 4 housing, remove the bolts that secure the cover to the housing.

   For the Model 9720A explosion proof housing, loosen the screw on the cover retaining bracket and slide the bracket off of the housing cover. Unscrew the housing access cover (two lugs are provided on the top of the cover to aid in the removal of the cover).

4. Remove the cable conduit plugs only from the holes that will be used. As shown in the installation layout drawing (p/n 868580), lay one conduit for the DC power input and signal cables and, if applicable, a second conduit for the AC power input and relays. Route the cables into the detector housing. Leave approximately 6" (150 mm) for strain relief.

5. Connect the cable to the appropriate connector as follows:

   a. Remove the screw terminal connector from the on-board connector. If the connector is tight, brace the board with your hand to remove the screw terminal connector, but be careful to not touch any circuit components.

   b. Loosen the terminal screws on the connector. Insert the wires into the connector and make connections as shown in the installation wiring drawing (p/n 868578) and as described in the remainder of this chapter.

   c. Tighten the terminal screws to secure the wires. Replace the connector on the board when all wires are secured.

6. Connect the ground line of the AC input power to the internal safety ground lug of the DensityPRO housing.

7. When DC input power is used, it is imperative that an Earth ground be connected to either the internal or external safety ground lug of the DensityPRO housing.

8. Secure the conduit, making sure it is completely sealed.

9. When the wiring is complete, replace the detector housing cover and secure the cover retaining bracket.

10. While the mounting hardware of the DensityPRO housing may provide an adequate earth ground, it is recommended that a true earth ground always be connected to the external safety ground lug of the housing.

Power Supply Wiring

The maximum input power requirement is 6 VA.

Note To meet the requirements of CSA 1010.1, an external switch or circuit breaker must be installed to allow the power source to be disconnected from the gauge. In addition, protective bonding (grounding) must always be provided, even if a DC power source is used. ▲

Protective Earth Grounding

The enclosure provides internal safety ground and external safety ground lugs (reference drawing 868578) for Safety Protective Earth Grounding. The external safety ground lug is used to connect the unit to Earth Ground. The internal safety ground lug is used to connect the AC power input ground line.

Safety Disconnecting Means Requirements

As a permanently connected equipment, the DensityPRO gauge requires a switch or circuit breaker as the means for disconnection. The customer needs to prepare the switch or circuit breaker according to the following requirements:

1. A switch or circuit breaker must be included in the building installation.

2. It must be in close proximity to the equipment (DensityPRO gauge) and within easy reach of the operator.

3. It must be marked as the disconnecting device for this equipment (DensityPRO gauge).

DC Power

The detectors are designed to operate on 24 Vdc (± 20%). The input connector for the DC source voltage wiring is located on the CPU board.

Note To meet the requirements of CSA 1010.1, the input DC terminals shall be supplied from an SELV (Safety Extra Low Voltage) source. ▲

Connections are shown in the table below.

Table 4–1. DC power wiring

User Power Supply (+24Vdc, 0..5 A)	Detector
+	J12 pin 2
-	J12 pin 1

AC Power

If the optional AC power board is installed, the gauge may be operated using either 115 or 230 Vac. The AC supply voltage is set by the 115/230 Vac selector switch located behind (below) the connectors on the top edge of the AC power board. To access the selector switch, it may be necessary to remove the screws that hold the detector-transmitter unit in the housing and lift the unit several inches out of the housing.

If both AC and DC input power are supplied to the detector, the detector will draw power from whichever source provides the higher DC voltage.

Caution Applying 230 Vac with the selector switch in the 115 Vac position will damage the equipment. ▲

Caution For reliable operation and to maintain safety approval, the F1 fuse on the AC power board must only be replaced with an approved fuse. Reference the installation wiring drawing (p/n 868578). ▲

Serial Communications

The gauge provides one RS232 single-drop and on RS485 multi-drop serial interface. Screw-terminal connectors for both ports are located on the CPU board.

The RS485 connector includes the +8 Vdc required to power the Thermo Scientific HHT as well as the +Data and –Data connections. An RJ-11 (phone jack) connector is also provided for the RS485 port. The HHT can be connected directly to the RJ-11 connector.

Both ports provide independent access to the measurement readings and software functions. Both ports are always active and can be used to display measurements. The setup menus, however, can only be accessed by one port at a time. For information on configuring communications, refer to the DensityPRO gauge user guide (p/n 717784).

RS485 Wiring

Connecting a PC serial port (COM) to the RS485 port on the gauge requires an RS485/RS232 converter (p/n 670045). Refer to installation wiring drawing (p/n 868578) and the RS485 installation wiring drawing (p/n 868519).

Make the RS485 connections as follows:

1. Connect +Data and –Data on the RS485 connector (J3) to the corresponding connections on the RS485/RS232 converter.

2. Connect the RS485/RS232 converter to the PC using a standard DB9 serial cable.

Initial Setup for Party-Line Communications

To communicate with multiple gauges via RS485 party-line, each unit must be assigned a unique unit identification number so it can be addressed individually. All gauges are assigned unit number 0 (zero) by default.

To assign a unique unit number to each gauge, you must be able to communicate with each one individually. Disconnect each gauge from the party-line in turn and communicate with the disconnected gauge directly. Alternatively, remove power from all gauges except one and assign a unit number to the powered gauge. Repeat this procedure for the remaining gauges.

If you have trouble using another device on the RS485 chain, verify that it is properly terminated for its position on the chain. To terminate a device, connect a 120 ohm resistor between its RS485 + / - data terminals. Never terminate more than the first and last device in the chain.

RS232 Wiring

The serial port on a PC (COM1 or COM2) can be connected directly to the gauge's RS232 port. This connection requires five wires: ground, TX, RX, RTS, and CTS. The RS232 port connector (J3) is located on the CPU board. Connections for standard DB9 and DB25 PC serial port connectors are listed in the table below.

Table 4–2. RS232 connections

DensityPRO Gauge J3 Connector	PC Serial Port DB9 Connector	PC Serial Port DB25 Connector
J3-2 RX	Pin 3	Pin 2
J3-3 TX	Pin 2	Pin 3
J3-4 RTS	Pin 8	Pin 5
J3-5 CTS	Pin 7	Pin 4
J3-6 GND	Pin 5	Pin 7

To communicate with the gauge from a PC requires that the PC be running the Thermo Scientific TMT Comm communication software or other terminal emulation software.

The default communication settings for the RS232 and RS485 ports of the gauge and for the Thermo Scientific HHT are:

- 7 data bits
- even parity
- 1 stop bit
- 9600 baud data rate

Refer to the DensityPRO gauge user guide (p/n 717784) for additional details about configuring and using serial communications.

Optional Wiring

HART Communications

The HART communication protocol is supported over the 4–20 mA current output with an optional daughter board. You communicate with the gauge using the standard 275, 375, 475, or later field communicator from Emerson Electric Co. Refer to the DensityPRO / DensityPRO+ gauge with HART operation manual (p/n 717816).

FOUNDATION Fieldbus Communications

With FOUNDATION fieldbus, the DensityPRO gauge provides users with access to control or program parameters via a host system. The fieldbus connector is accessible from the faceplate of the gauge, and the only connections required for operation are to the H1 bus.

Refer to the DensityPRO gauge with FOUNDATION fieldbus application guide (p/n 717917) for specific wiring instructions.

Current Output

There are three configurations available for the 4–20 mA current output:

- Isolated, loop-powered (default)
- Non-isolated, self-powered
- Isolated, self-powered output (requires optional daughter board p/n 886595)

All configurations can drive a 700 ohm maximum load over the full current output range. The current output is programmable between 3.8 and 20.5 mA. The fault low condition for the current output is 3.6 mA or less, and the fault high condition is 20.8 mA or greater.

The default current output configuration is isolated, loop-powered. A jumper is placed across pins 4 and 5 of the J7 connector on the CPU board. Pins 6 and 7 of the J10 connector are for the 4–20 mA output connections.

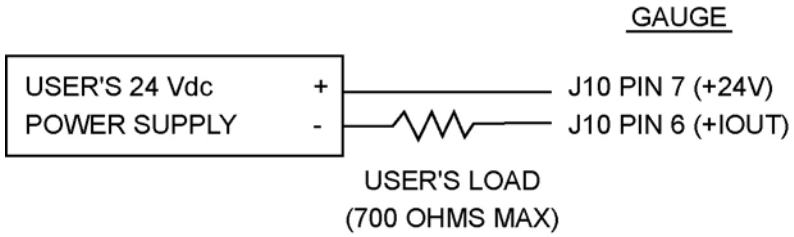

Figure 4–1. 4–20 mA loop powered configuration

To configure the current output as non-isolated, self-powered, move the jumper to pins 3 and 4 of the J7 connector. Pins 6 and 9 of the J10 connector are for the 4–20 mA output connections.

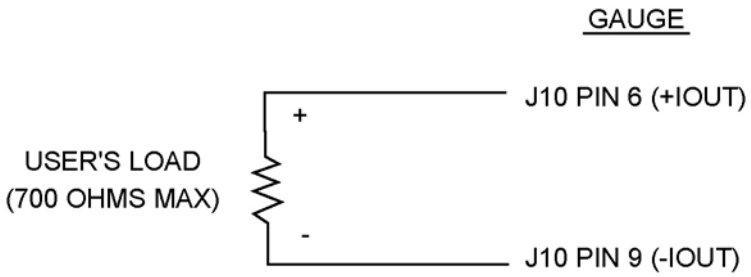

Figure 4–2. 4–20 mA non-isolated, self-powered configuration

To configure the current output as isolated, self-powered, an optional daughter board must be installed on the J7 connector (no jumpers used). Pins 6 and 8 of the J10 connector are for the 4–20 mA output connections.

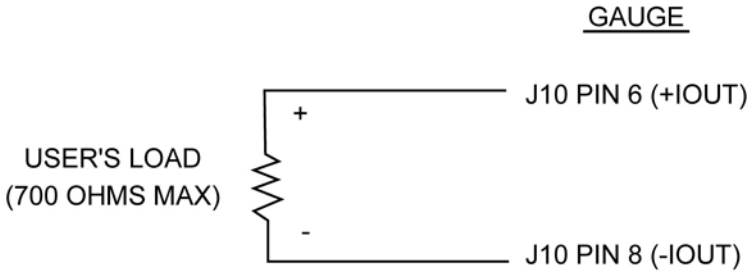

Figure 4–3. 4–20 mA isolated, self-powered configuration

Flow Input

The CPU board allows for a user-provided 4–20 mA flow (AUX) input (pins 1 and 2 of J10). Refer to the DensityPRO gauge user guide (p/n 717784) for details on how to configure the gauge to use the flow input signal.

Relays

Two relays can be provided as an option on the AC power/relay board. A factory-installed jumper across pins 4 and 5 of header J11 indicates to the gauge that the optional relays are installed. Refer to the installation wiring drawing (p/n 868578) and the wiring label on top of the detector-transmitter chassis for wiring details. The relays are Form C, SPDT isolated 8A at 220 Vac.

For instructions on how to configure relays to open or close on fault, warning, or process measurement alarms, refer to the DensityPRO gauge user guide (p/n 717784).

Contact Closure (Switch) Inputs

The contact closure inputs (J13) are dry contact inputs between ground and Switch 1 and ground and Switch 2. The gauge can be configured to execute a command or other function upon a user-provided contact opening or closing. Refer to the DensityPRO gauge user guide (p/n 717784) for details on assigning commands to the contact closure inputs.

Temperature Compensation

To use temperature compensation, the temperature compensation board (p/n 810138) must be installed on the DensityPRO detector chassis. Refer to Appendix E for installation instructions. The temperature compensation board is designed to use a 3-wire 100-ohm Platinum RTD. Connections are shown in the table below.

Table 4–3. Temperature compensation board connections

Wire	Terminal Connection
RTD	5
Two same color wires	3 and 4
Shield	6

Note Terminals 1 and 2 are not used. ▲

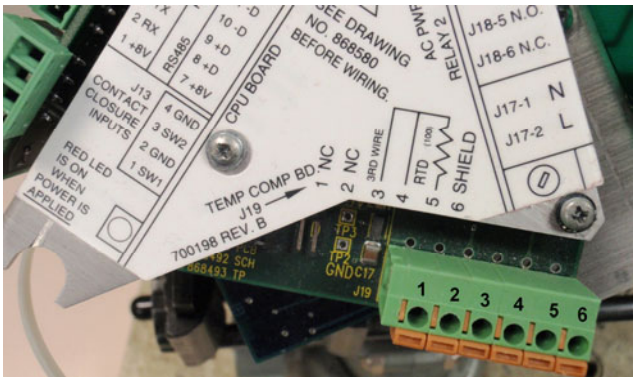

Figure 4–4.

Factory Wiring

The detector board (positioned horizontally under the top of the electronics chassis) mounts on the photomultiplier tube. A factory-installed cable connects the detector board to the J2 connector on the CPU board.

If the optional AC power board is installed, a factory-installed cable connects the J3 connector on the AC power board to the J9 connector on the CPU board.

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Chapter 5
Support

Contact Information

The local representative is your first contact for support and is well equipped to answer questions and provide application assistance. You can also contact Thermo Fisher directly.

Process Instruments		
1410 Gillingham Lane Sugar Land, TX 77478 USA +1 (800) 437-7979 +1 (713) 272-0404 direct +1 (713) 4573 fax	14 Gormley Industrial Avenue Gormley, Ontario L0H 1G0 CANADA +1 (905) 888-8808 +1 (905) 888-8828 fax	Unit 702-715, 7/F Tower West Yonghe Plaza No. 28 Andingmen East Street, Beijing 100007 CHINA +86 (10) 8419-3588 +86 (10) 8419-3580 fax
A-101, 1CC Trade Tower Senapati Bapat Road Pune 411 016 Maharashtra, INDIA +91 (20) 6626 7000 +91 (20) 6626 7001 fax	Ion Path, Road Three Winsford, Cheshire CW7 3GA UNITED KINGDOM +44 (0) 1606 548700 +44 (0) 1606 548711 fax	
www.thermoscientific.com		

Warranty

Thermo Scientific products are warranted to be free from defects in material and workmanship at the time of shipment and for one year thereafter. Any claimed defects in Thermo Scientific products must be reported within the warranty period. Thermo Fisher Scientific shall have the right to inspect such products at Buyer's plant or to require Buyer to return such products to Thermo Fisher plant.

In the event Thermo Fisher requests return of its products, Buyer shall ship with transportation charges paid by the Buyer to Thermo Fisher plant. Shipment of repaired or replacement goods from Thermo Fisher plant shall be F.O.B. Thermo Fisher plant. A quotation of proposed work will be sent to the customer. Thermo Fisher shall be liable only to replace or repair, at its option, free of charge, products which are found by Thermo Fisher to be defective in material or workmanship, and which are reported to Thermo Fisher within the warranty period as provided above. This right to replacement shall be Buyer's exclusive remedy against Thermo Fisher.

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Appendix A
Ordering Information

Table A–1. DensityPRO gamma density system

High Performance Input Power	
1	115/230 Vac, ± 10%, 50/60 Hz
2	24 Vdc
Region Requirement	
0	ROW
C	CE-EMC (when selected, no relays or local display)
Relays	
R	Two Form C relays, SPDT isolated 8A @ 220 Vac
N	No relay contacts
4–20 mA Output	
L	Isolated, loop-powered (Namur compliant, 700 ohm load maximum)
S	Isolated, self-powered (Namur compliant, 700 ohm load maximum)
Detector Approvals	
N4	Non-hazardous model 9719A, Type 4, CSA/C-US
XP	Hazardous model 9720A, XP – Class 1 Div. 1, CSA/C-US, Type 4, ATEX IP65
Detector Enclosure	
D	Dual chain mount
B	Base plate mount (required for pipe saddle or wall mount)
W	Base plate mount, water-cooled (pipe saddles required)
Mounting Hardware	
N0	No mounting hardware
DS	Dual chain, 2″ steel pipes (dual chain mount required)
DM	Dual chain, 2.5–18″ steel pipes (dual chain mount required)
DL	Dual chain 20–36″ steel pipes (dual chain mount required)
1.5	Pipe saddle for 1.5″ or 2.0″ pipes
XX	Pipe saddle for 3–16″ pipes. (Available pipe sizes in inches: 3, 4, 5, 6, 8, 10, 12, 14, and 16.)

XX	Pipe saddles for 18–42" pipes. (Available pipe sizes in inches: 18, 20, 22, 24, 26, 28, 30, 36, and 42.)
Backshield Option	
B	Detector with backshield (Model 9719A only)
N	No backshield
Temperature Compensation	
N	None
T	Temperature compensation board
R	Temperature compensation with RTD
Communications	
0	No selection
A	Thermo Scientific Model 9734 handheld terminal
E	HART communication module
F	Foundation fieldbus module
Optional Accessories	
L	Lg SS tag (3.3" x 2.5"), wired
R	RJ-11 modular connector jack
D	Thermo Scientific Model 9723 backlit LCD
T	Pipe tabs (pipe saddles only)

Table A–2. Spare parts

P/N	Description
886631	Complete electronics chassis
886670-2	CPU assembly
NDMI-PWR001	AC power supply assembly without relays
NDMI-PWR002	AC power supply assembly with relays
886595-1	Kit, 4–20 mA isolated, self-powered
885882-1	Backlit display PCB assembly (circuit board only)
886609	Temperature compensation circuitry assembly
OPR0101C	Complete electronics chassis with AC power supply, no relays
OPR0101D	Complete electronics chassis with AC power supply, with relays
DPROCBLKIT	Kit, complete set of DensityPRO connection cables (excluding those required for HART communication)

Appendix B
Specifications

Results may vary under different operating conditions.

Table B–1. Performance specifications

System performance	From ± 0.0001 gm/cc depending on application

Table B–2. Gamma ray source

Source type	Cs-137 or Co-60, both stainless steel doubly encapsulated
Size	10 to 10,000 mCi Cs-137 or 1,000 to 3,000 mCi Co-60
Source housing	Carbon steel or stainless steel, lead filled, polyurethane painted. Two-position shutter, locks in OFF (closed) position.

Table B–3. Integrated detector-transmitter

System architecture	Multiprocessor based electronics provides uninterrupted output during data entry and system interrogation. Surface mount technology provides high degree of reliability. All user data doubly stored in non-volatile memory with no battery backup required.
Detection type	PVT plastic scintillator with wide dynamic range. PVT resists shock and moisture damage.
Detector stabilization	Electronic control without heater stabilization for optimum performance
Enclosure construction	Carbon steel polyurethane painted
Approvals – Model 9719A	FMRC approved dust-ignition proof in Class II, Div. 1, Groups E, F, G; suitable for Class III, Div. 1 hazardous locations, indoor and outdoor NEMA 4. CSA approved dust-ignition proof in Class II, Div. 1, Groups E, F, G; suitable for Class III, Div. 1 hazardous locations, indoor and outdoor CSA ENCL 4.

Approvals – Model 9720A	FMRC approved explosion proof in Class I, Div. 1, Groups B, C, D; dust-ignition proof in Class II, Div. 1, Groups E, F, G; suitable for Class III, Div. 1 hazardous locations, indoor and outdoor NEMA 4. CSA approved explosion proof in Class I, Div. 1, Groups B, C, D; dust-ignition proof in Class II, Div. 1, Groups E, F, G; suitable for Class III, Div. 1 hazardous locations, indoor and outdoor CSA ENCL 4. CE-ATEX II 2 G Ex d IIC T5 Gb CE-EMC compliance contingent upon installation of EMC protection kit as illustrated on drawing 880100.
Power	115/230 Vac, ± 10%, 50/60 Hz or 24 Vdc
Operating temperature	-40°C to +60°C (-40°F to +140°F) ambient
CE-EMC surge protection board junction box	CE-ATEX II 2 G Ex d IIC T6 Gc -40°C <= Ta <= 60°C **Warning: Do not open when an explosive atmosphere may be present.**

Table B–4. Inputs and outputs

Inputs	Flow meter: 4–20 mA linear Dry contact closure Temperature compensation circuitry with 100 ohm platinum RTD, 2 or 3 wire
Current outputs	Three configurations available for the 4–20 mA current output: - Isolated, loop-powered (default) - Non-isolated, self-powered - Isolated, self-powered output (requires optional daughter board p/n 886595)
Serial outputs	RS485 half duplex RS232 full duplex Fieldbus: A Device Description (DD) for the DensityPRO gauge is available from the Fieldbus Foundation website. The DD is a DD4 that is interpreted by a host implementing DD Services 4.x or higher.
Contact closure (relay) outputs	Two optionally available Form C relays, SPDT isolated 8A @ 220 Vac.
Wiring entry	(2) 3/4 NPT female conduit ports. Use only suitably approved cable glands and blanking plugs.

Table B–5. Mounting hardware

Gamma ray source	Integral bolt-on bracket; compatible with chain or saddle mount
Integrated detector-transmitter	Dual chain universal mount, 2.5 to 36 in (63.5 to 914.4 mm) Pipe saddle mount, 2 to 42 in (50.8 to 1066.8 mm) Pipe saddle with tabs for mounting on insulated pipes Axial mount hardware for Z-pipe installations, 1 to 4 in (25.4 to 101.6 mm)

Table B–6. Optional Thermo Scientific Model 9723 display

Display	2-line x 16-character backlit LCD
Qualifications	CSA/C-US: Class I, Groups B, C, and D; Class II, Groups E, F, G; Class III; Type 4 Enclosure ATEX: II 2G Ex d IIC T6 (Tamb -40°C to +60°C) EN60079-0:2006 and EN60079-1:2007
Power	Display powered from electronics
Installation site	Maximum separation from electronics: 300 ft (91.4 m)

Table B–7. Programming options

Fieldbus host, such as National Instruments™ NI-FBUS Configurator	Provides the interface between the DensityPRO gauge and other devices on a FOUNDATION fieldbus network.
275/375/475/later field communicator from Emerson Electric Co	For gauge configuration and calibration. Communicates with any DensityPRO gauge via the current loop. BEL202FSK standard.
Thermo Scientific Model 9734 handheld terminal	For gauge configuration and calibration. Communicates with any DensityPRO gauge via RS485 connector. Provides upload / download of gauge configuration to / from PC via RS232 interface.
Comm PC interface software	For interfacing with up to 32 DensityPRO gauges over RS485.

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Appendix C
Drawings

Note Information presented in this chapter has been regenerated from original drawings. Every effort is made to maintain document accuracy. However, in order to enhance legibility, the documents may have been restructured, and some information may have been intentionally excluded. Therefore, the drawings within this guide may not be an exact duplicate of the original drawings. ▲

Note Drawings in this manual are included for reference only and may not be the current version. Contact the factory if you need a copy of the latest revision. ▲

Table C–1. Installation layout & wiring diagrams

Table C–2. Mechanical – Detectors

Drawing #	Rev.	Description	Page
867467	B	Installation drawing, source/detector assembly dual chain mount, explosion proof housing	C–11
85726N	E	Installation drawing, gauge head, pipe saddle mount	C–12
861104	C	Fabrication details, 1" to 3" Z-pipe section	C–13
866670	B	Mounting dimensions, 1" to 3" Z-pipe mounting configuration	C–14
864163	A	Fabrication details, 4" Z-pipe section	C–15
866705	A	Mounting dimensions, 4" Z-pipe mounting configuration	C–16

Table C–3. Mechanical – Source heads

Drawing #	Rev.	Description	Page
864563	B	Mounting dimensions, 5200 source housing, 100 mCi or less	C–17
865453	C	Mounting dimensions, 5201 source housing, 100 mCi or less	C–18
865463	D	Mounting dimensions, 5202 source housing, 500 mCi or less	C–19
865474	C	Mounting dimensions, 5203 source housing, 2000 mCi or less	C–20
865484	C	Mounting dimensions, 5204 source housing, 8000 mCi or less	C–21

Table C–4. Source housing options

Drawing #	Rev.	Description	Page
866666	E	Mounting instructions, remote manual actuator, Models 5201–5204 source housings	C–22

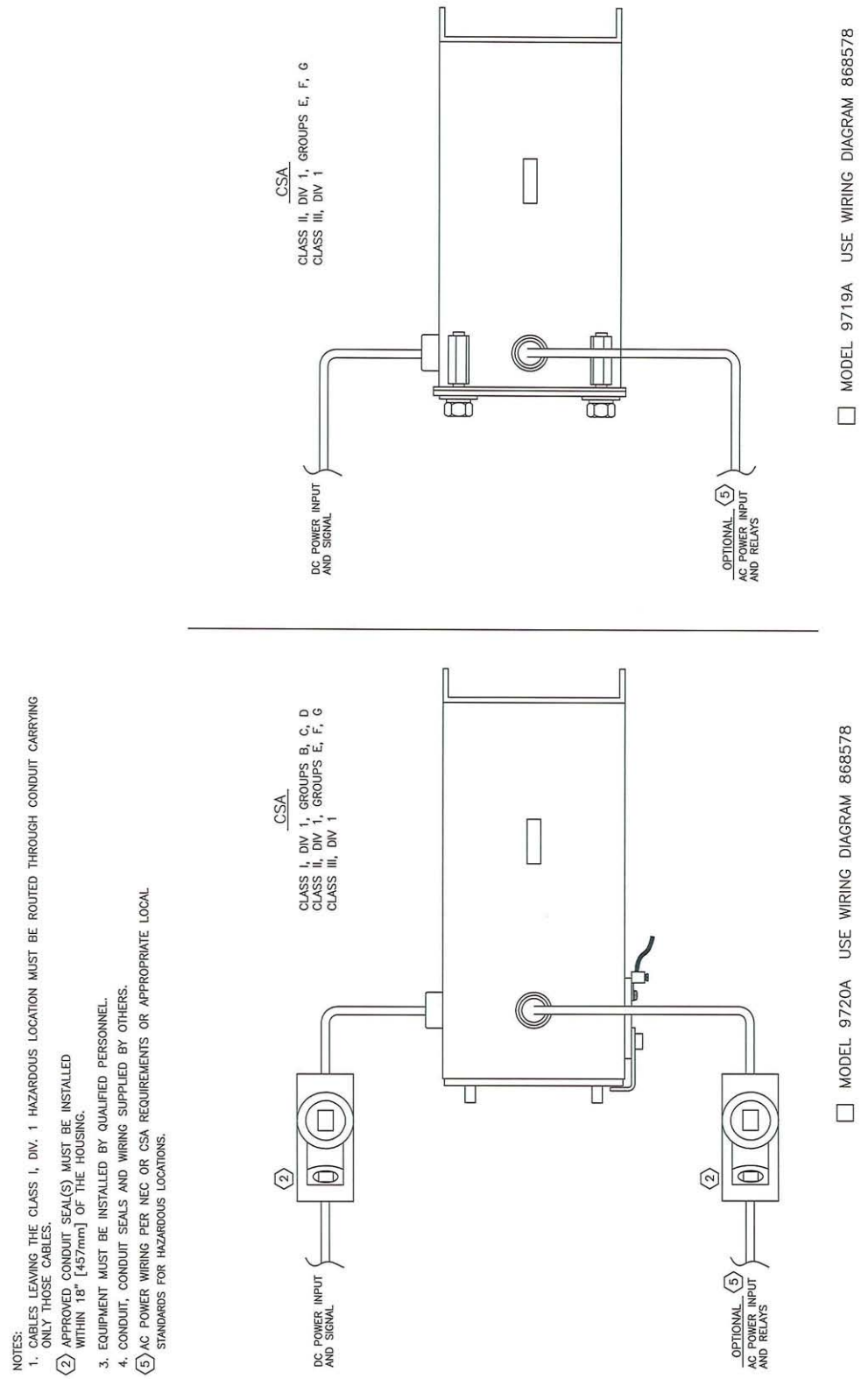
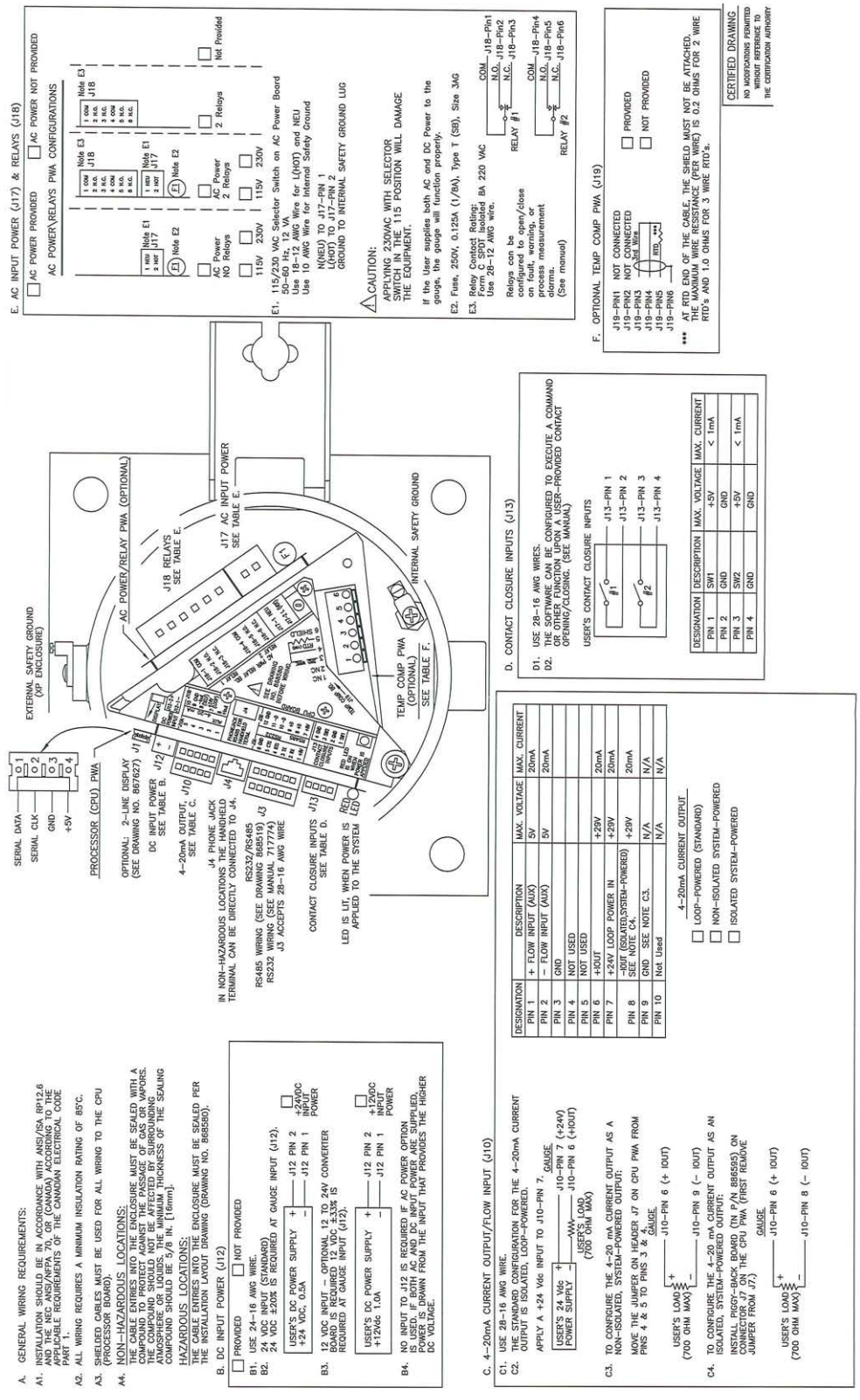


Figure C–1. 868580: Installation layout, DensityPRO system, Model 9719A/9720A (sheet 1 of 1)



DESIGNATION	DESCRIPTION	MAX. VOLTAGE	MAX. CURRENT
PIN 1	+ FLOW INPUT (AUX)	5V	20mA
PIN 2	– FLOW INPUT (AUX)	5V	20mA
PIN 3	GND		
PIN 4	NOT USED		
PIN 5	NOT USED		
PIN 6	+IOUT	+28V	20mA
PIN 7	+24V LOOP POWER IN	+28V	20mA
PIN 8	–IOUT (ISOLATED,SYSTEM–POWERED) SEE NOTE C4.	+28V	20mA
PIN 9	GND SEE NOTE C3.	N/A	N/A
PIN 10	Not Used	N/A	N/A

4–20mA CURRENT OUTPUT
☐ LOOP–POWERED (STANDARD)
☐ NON–ISOLATED SYSTEM–POWERED
☐ ISOLATED SYSTEM–POWERED

DESIGNATION	DESCRIPTION	MAX. VOLTAGE	MAX. CURRENT
PIN 1	SW1	+5V	< 1mA
PIN 2	GND	GND	
PIN 3	SW2	+5V	< 1mA
PIN 4	GND	GND	

Figure C–2. 868578: Installation wiring, DensityPRO system, Model 9719A/9720A (sheet 1 of 1)

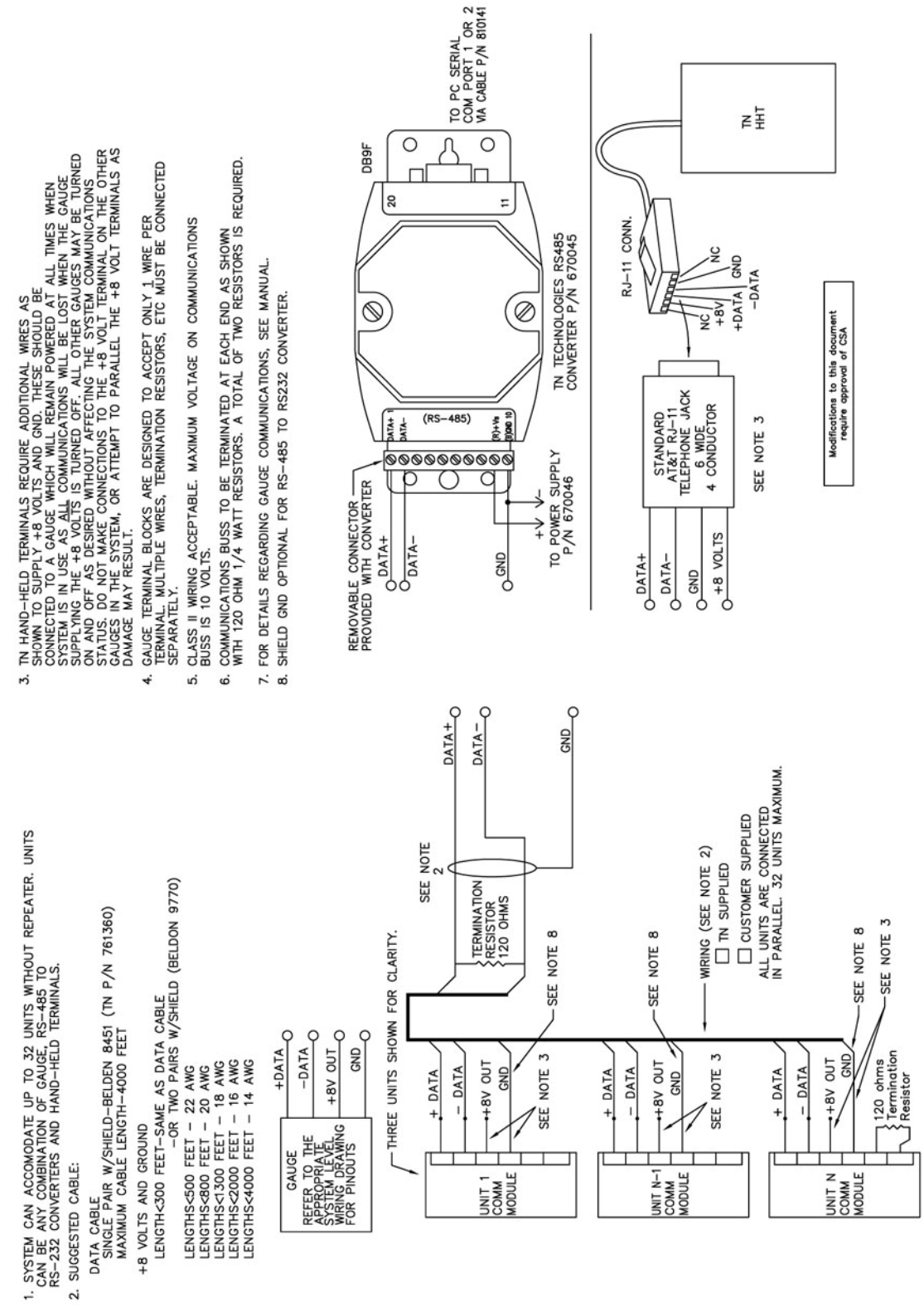


Figure C–3. 868519: RS485 installation and wiring (sheet 1 of 1)

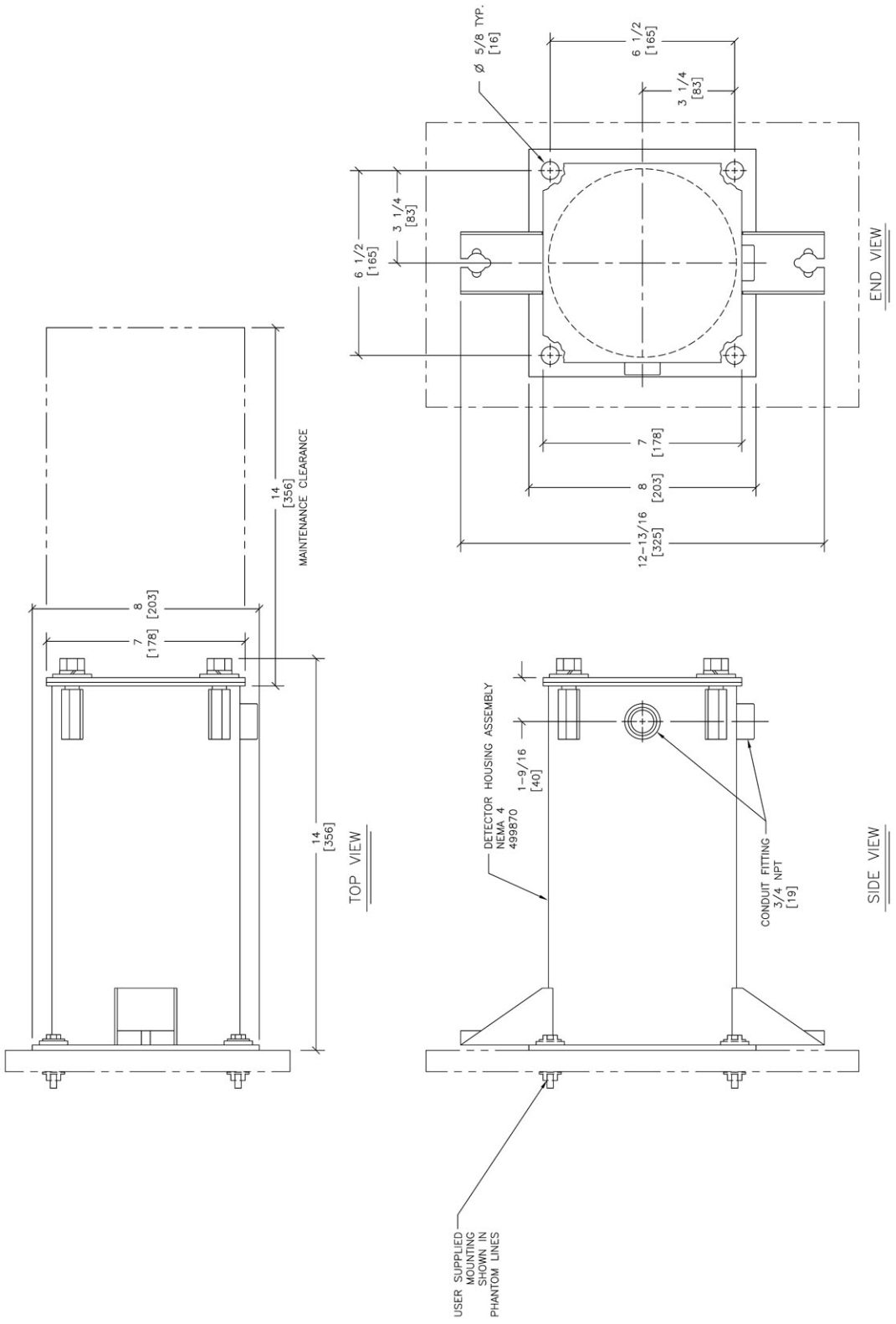


Figure C–4. 867468: Installation drawing, detector assembly, flat mount, NEMA 4 housing (sheet 1 of 1)

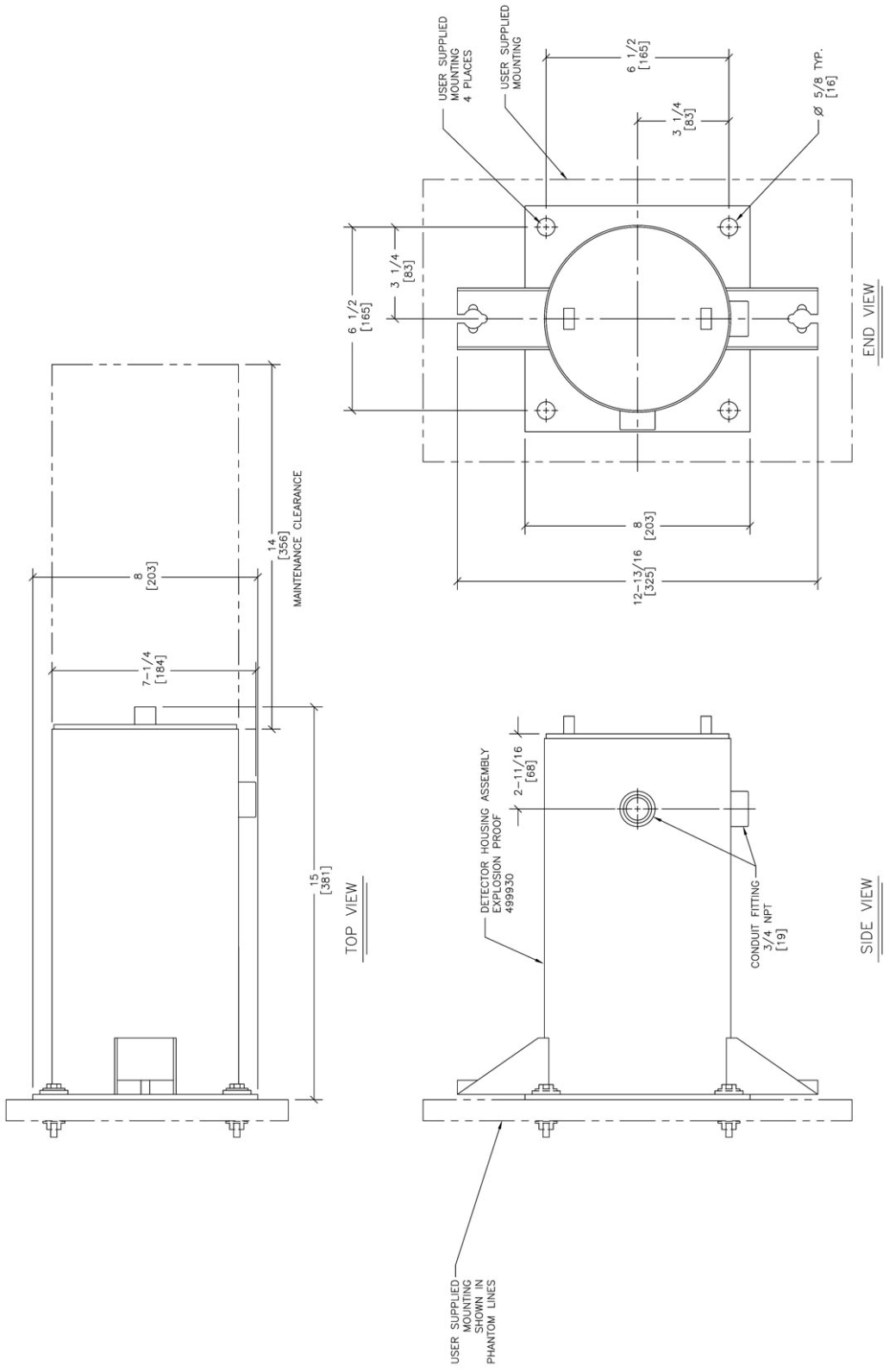


Figure C–5. 867469: Installation drawing, detector assembly, flat mount, explosion proof housing (sheet 1 of 1)

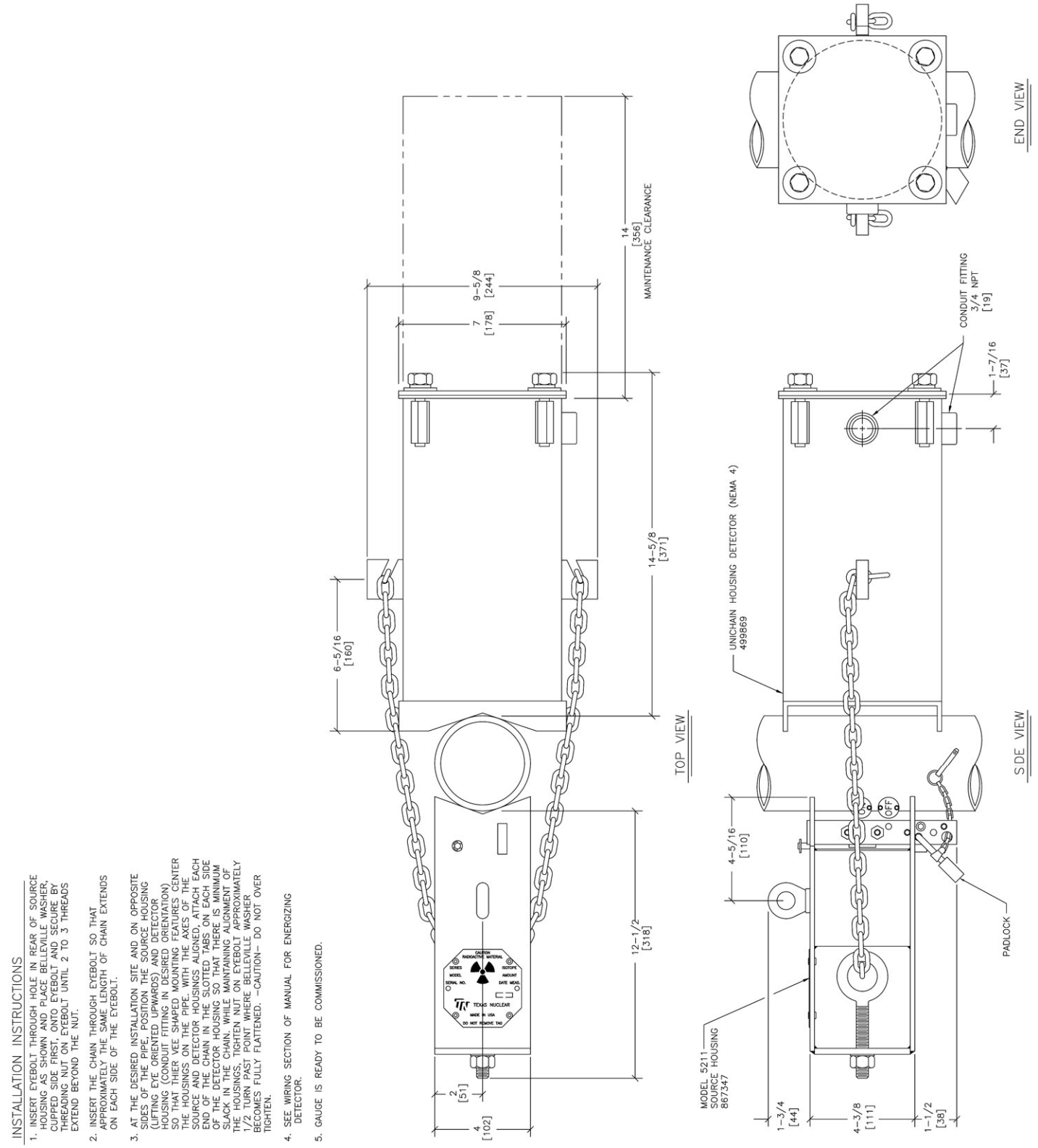


Figure C–6. 867456: Installation drawing, source/detector assembly single chain mount, NEMA 4 housing (sheet 1 of 1)

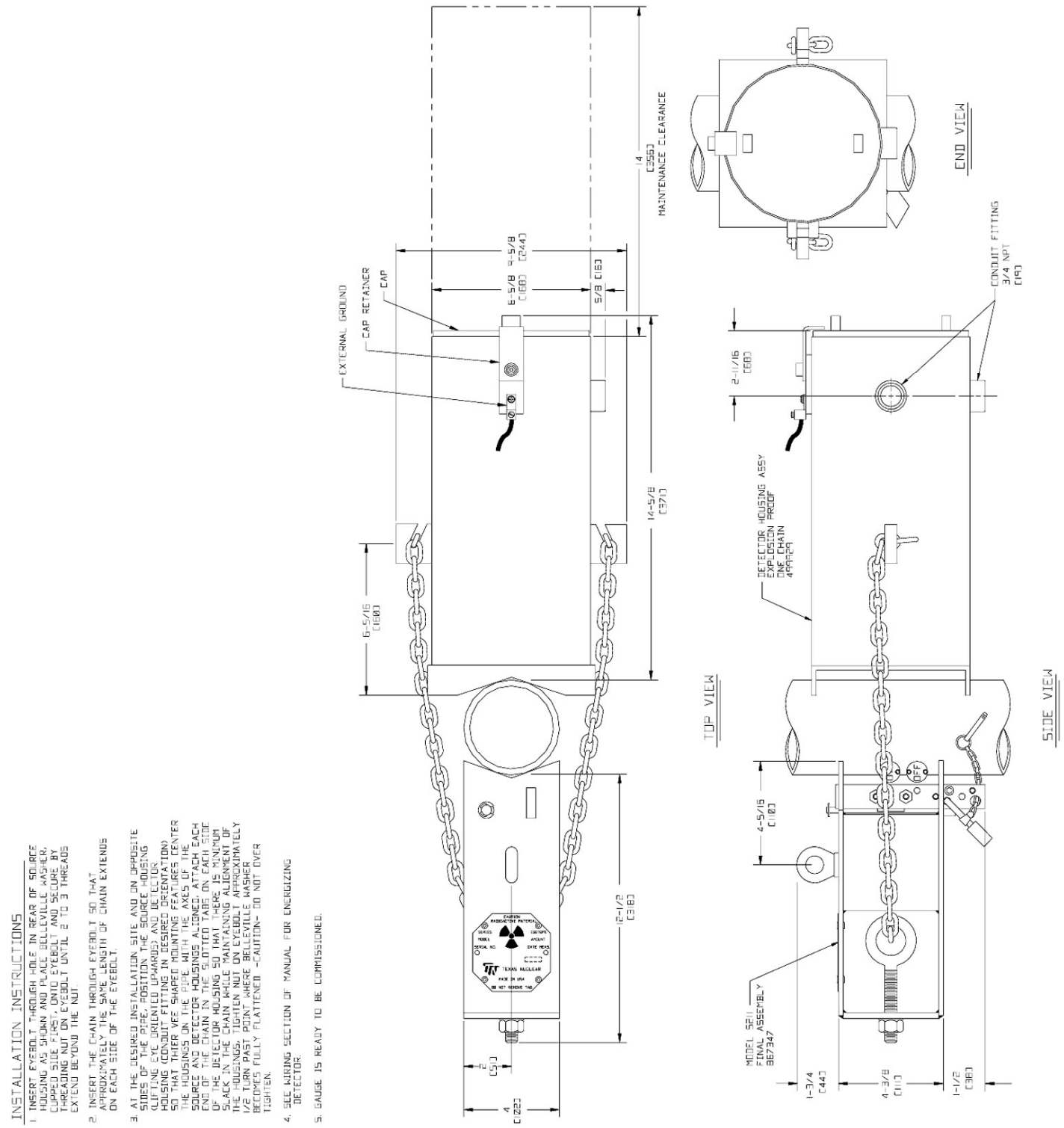


Figure C–7. 867465: Installation drawing, source/detector assembly single chain mount, explosion proof housing (sheet 1 of 1)

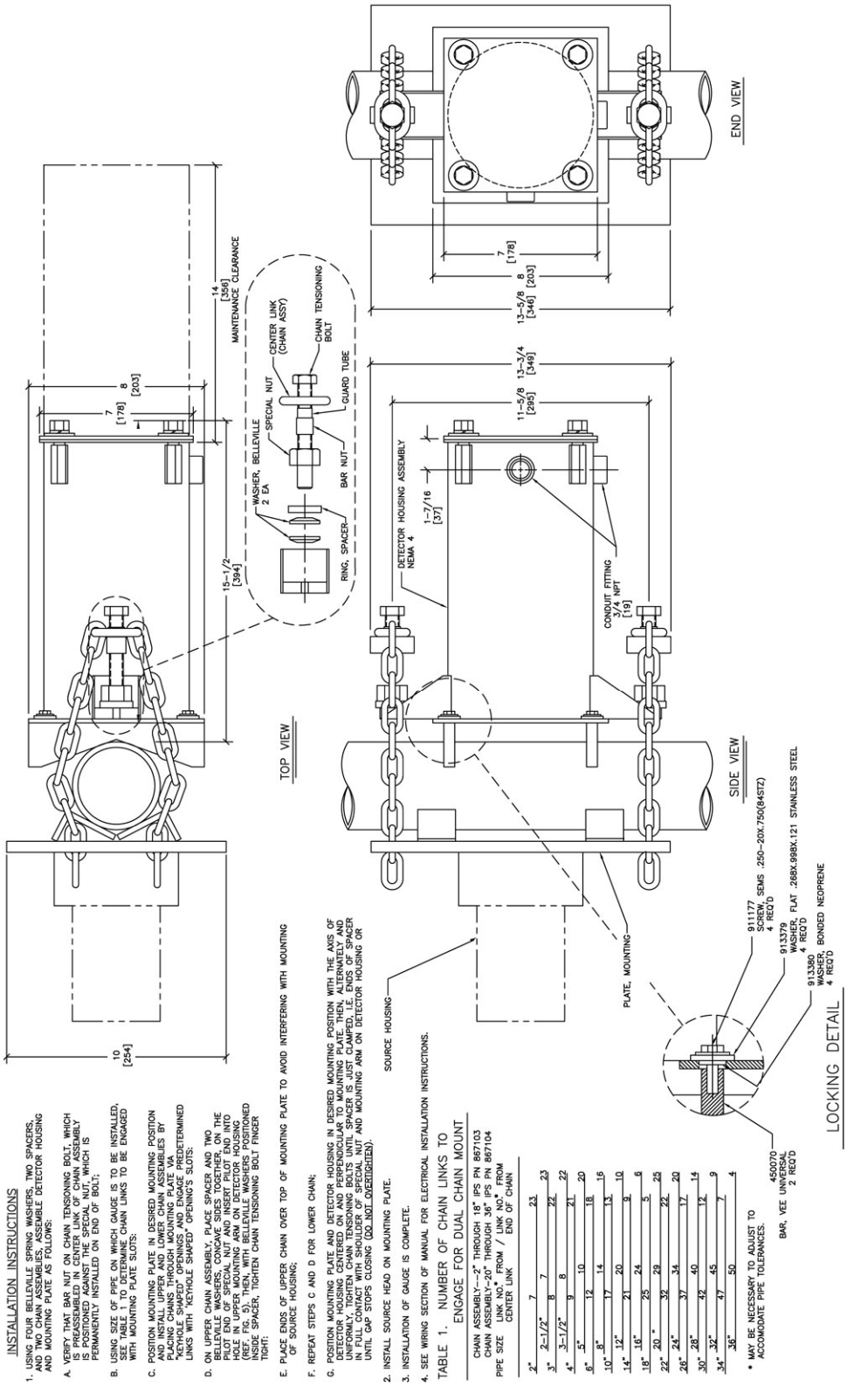


Figure C–8. 867466: Installation drawing, source/detector assembly dual chain mount, NEMA 4 housing (sheet 1 of 1)

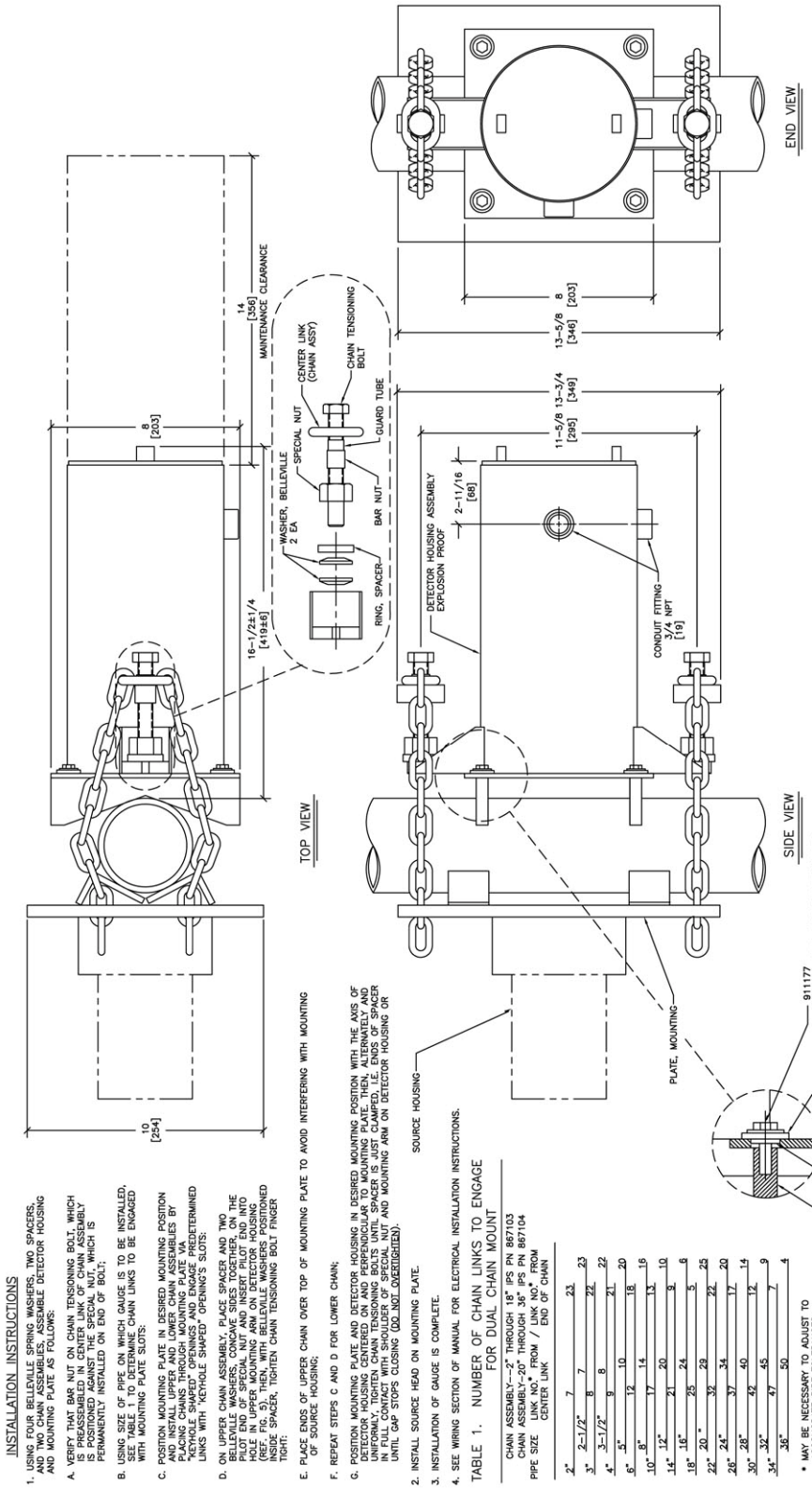


Figure C–9. 867467: Installation drawing, source/detector assembly dual chain mount, explosion proof housing (sheet 1 of 1)

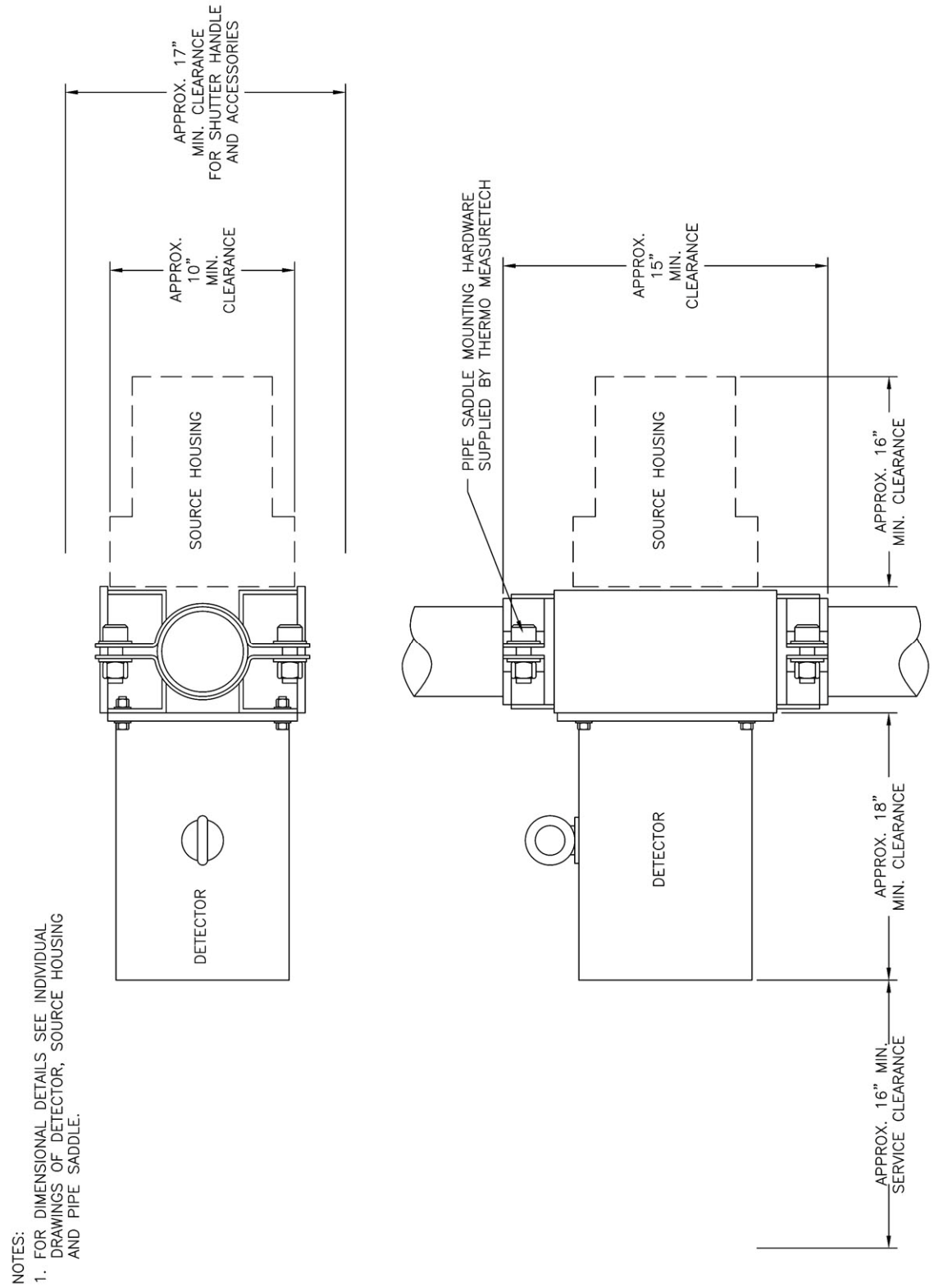


Figure C–10. 85726N: Installation drawing, gauge head, pipe saddle mount (sheet 1 of 1)

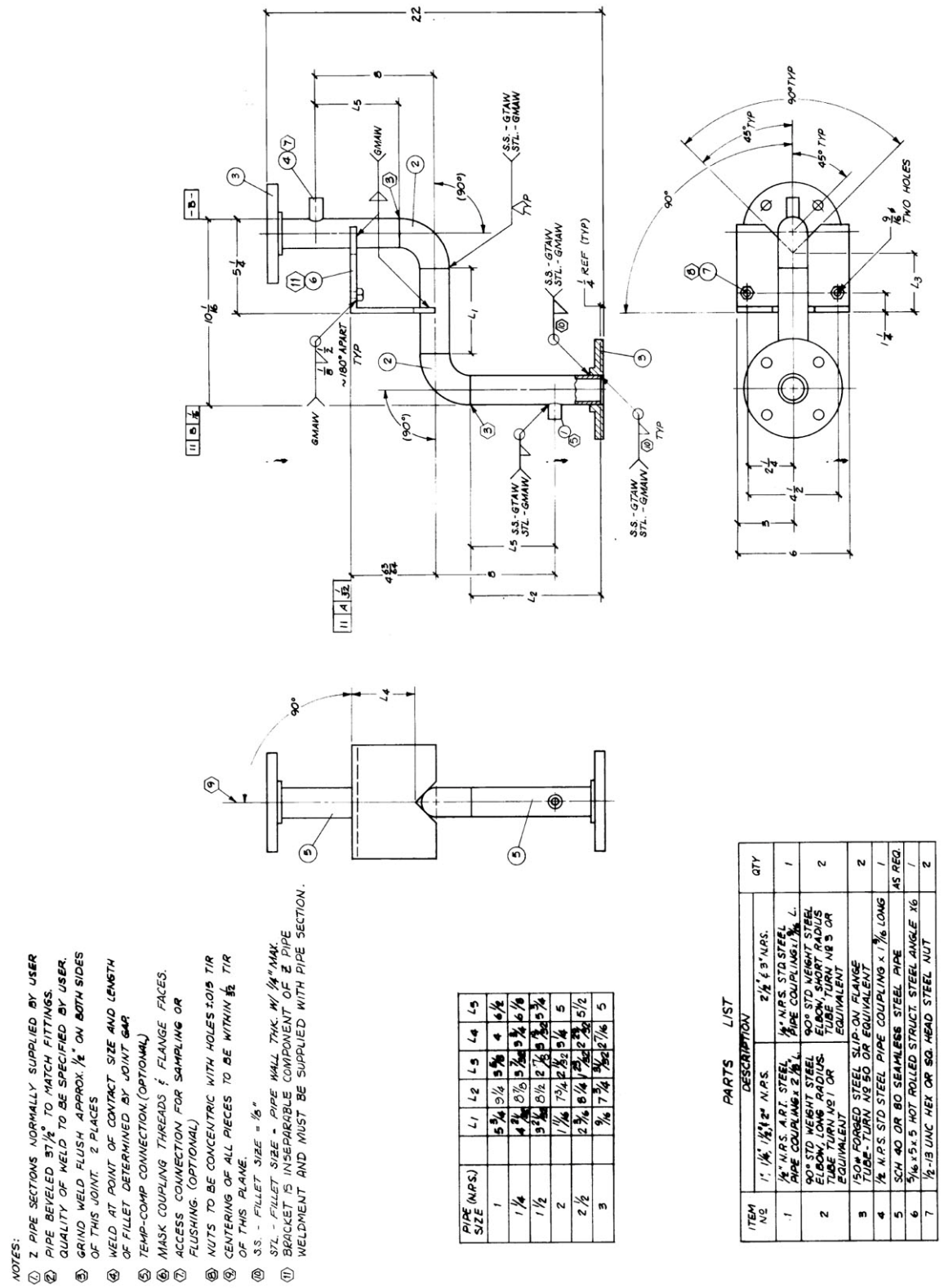
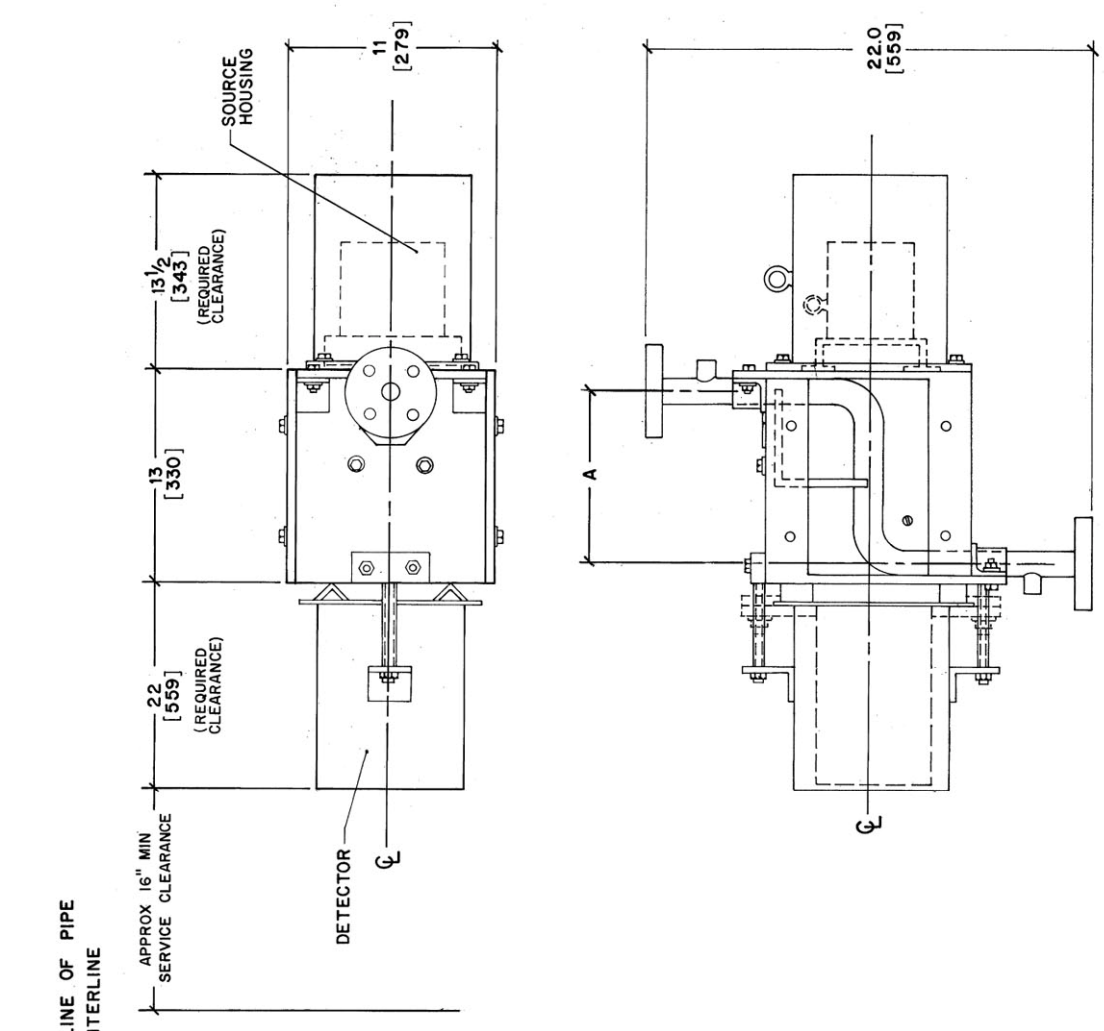


Figure C–11. 861104: Fabrication details, 1" to 3" Z-pipe section (sheet 1 of 1)



NOTES

UNIT MUST BE MOUNTED SUCH THAT CENTERLINE OF PIPE IS EXACTLY COAXIAL (±1/8) [3.175] WITH CENTERLINE OF DETECTOR.

TABLE I

CK	PIPE SIZE IN	PIPE MOUNT	A IN	A MM
	1	5558	8 3/4	222.3
	1¼	5559	8 13/32	213.4
	1½	5560	8 5/32	207.3
	2	5561	7 11/16	195.2
	2½	5562	7 3/16	182.5
	3	5563	6 9/16	166.6

Figure C–12. 866670: Mounting dimensions, 1" to 3" Z-pipe mounting configuration (sheet 1 of 1)

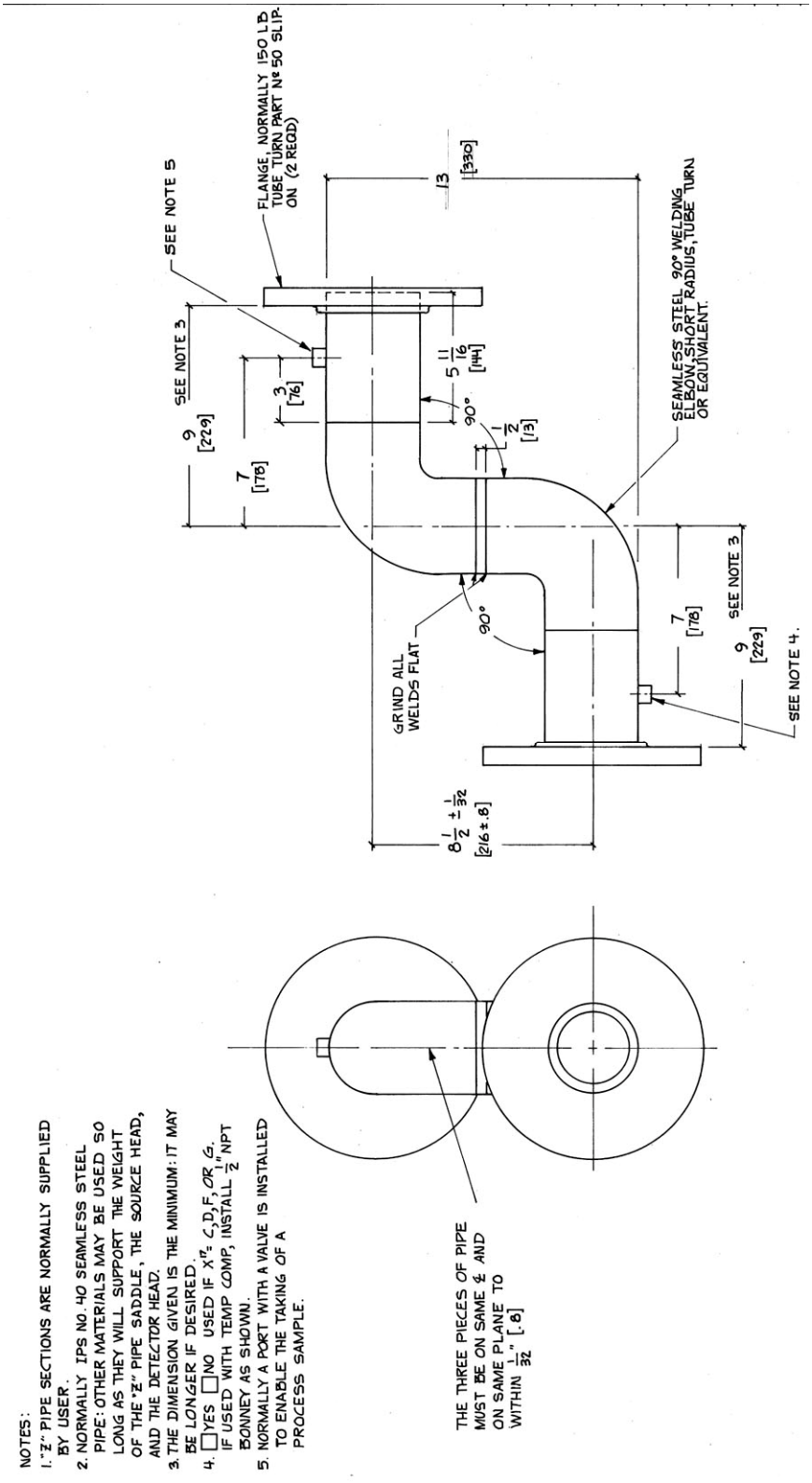


Figure C–13. 864163: Fabrication details, 4" Z-pipe section (sheet 1 of 1)

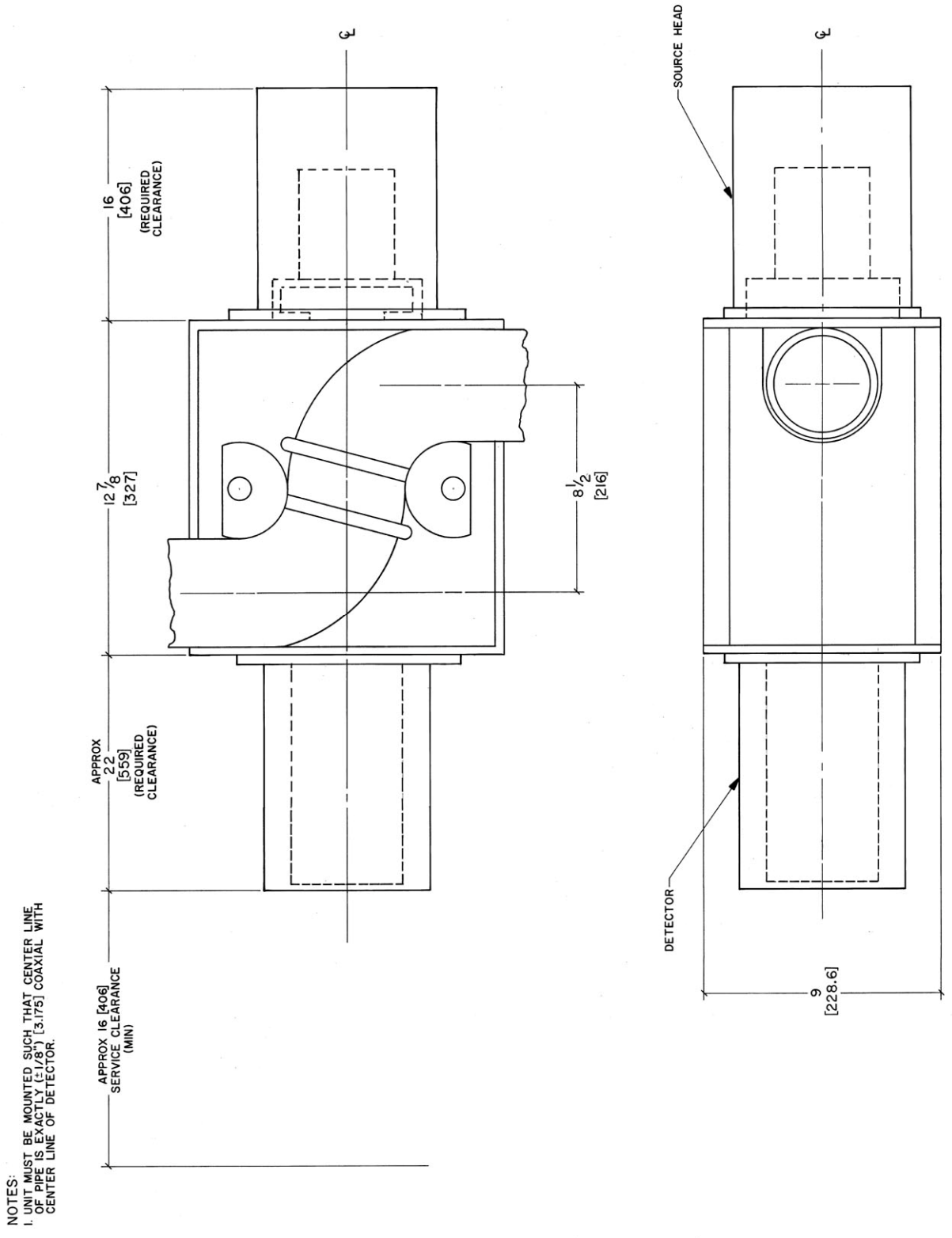


Figure C–14. 866705: Mounting dimensions, 4" Z-pipe mounting configuration (sheet 1 of 1)

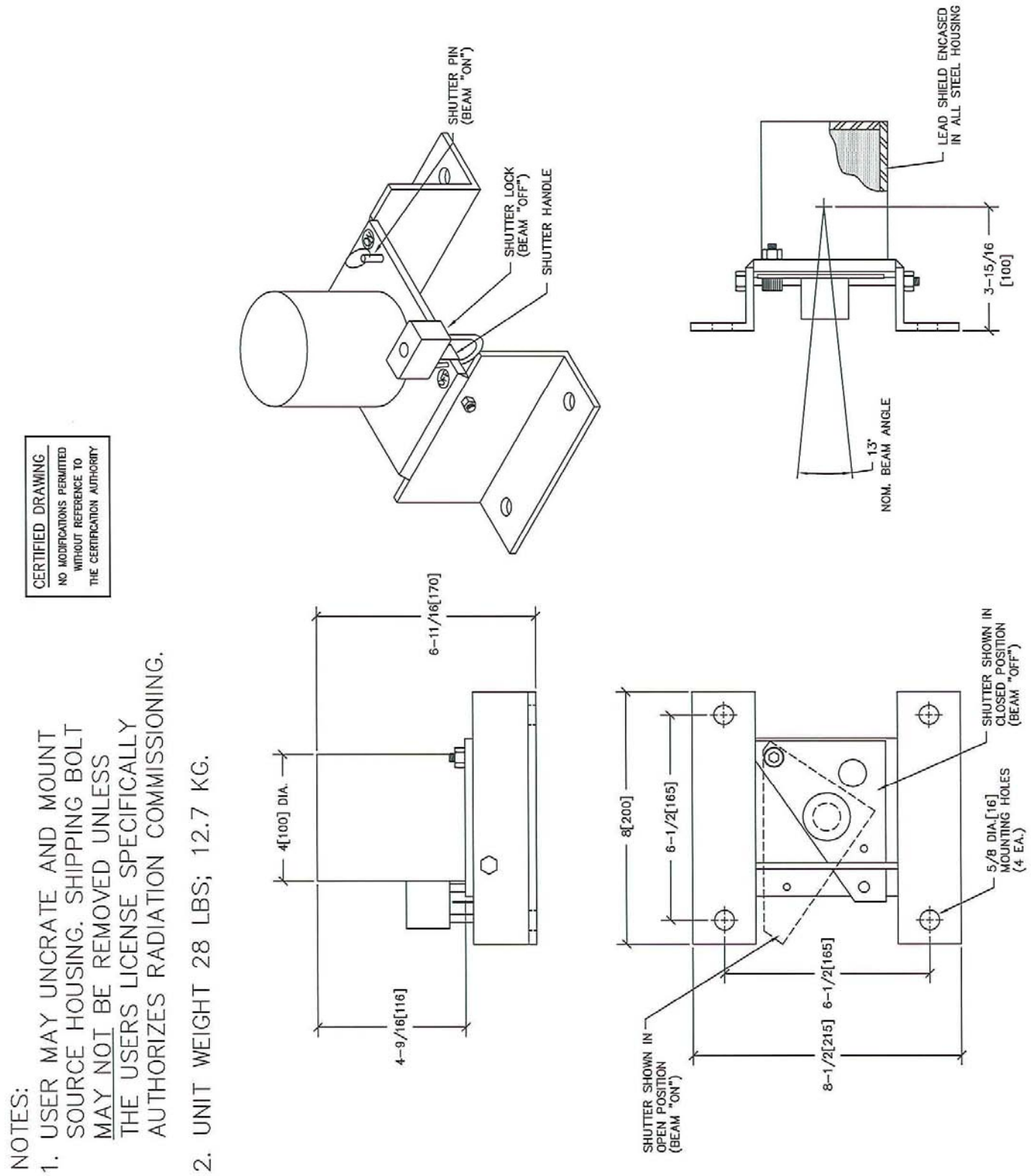


Figure C–15. 864563: Mounting dimensions, 5200 source housing, 100 mCi or less (sheet 1 of 1)

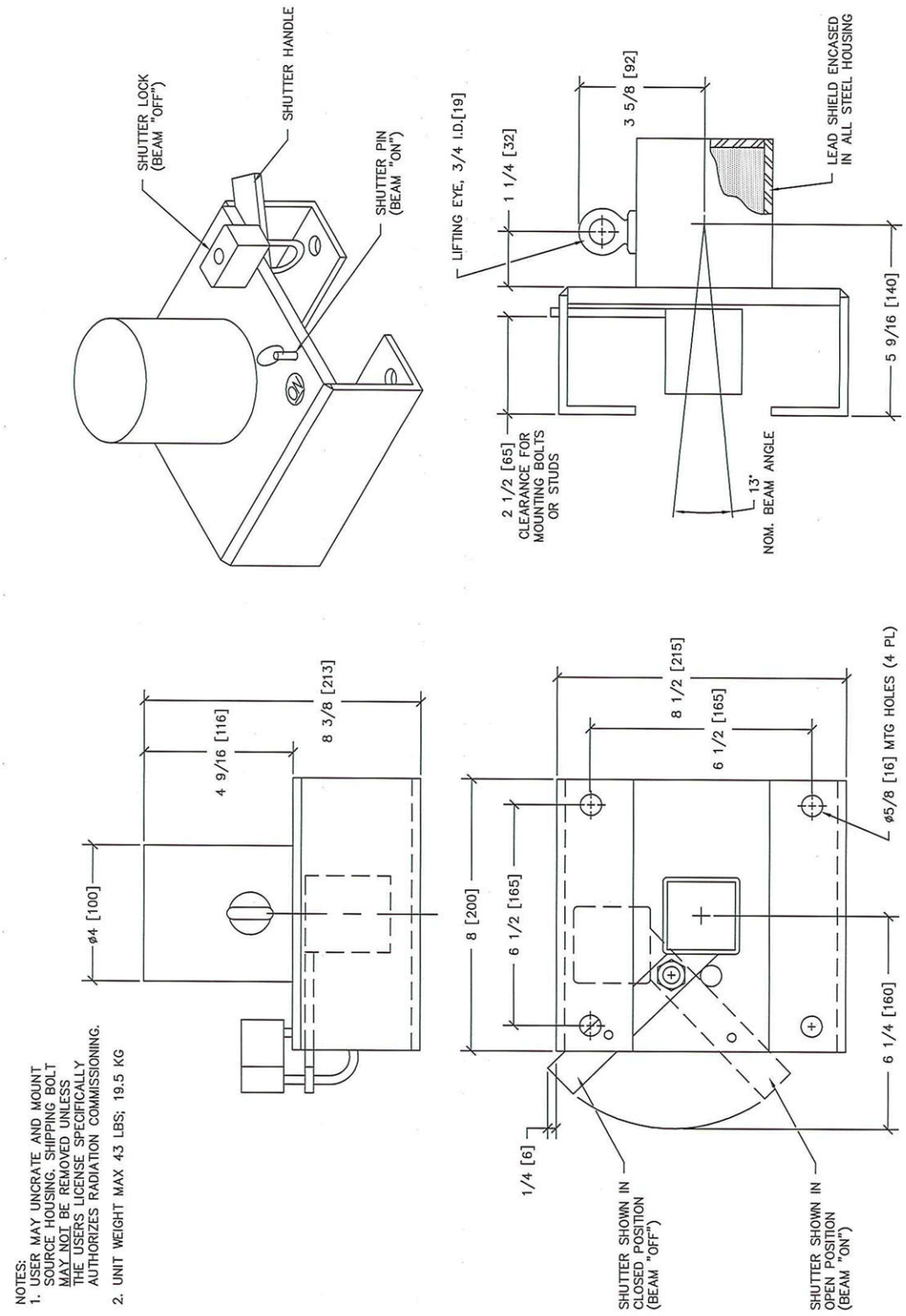


Figure C–16. 865453: Mounting dimensions, 5201 source housing, 100 mCi or less (sheet 1 of 1)

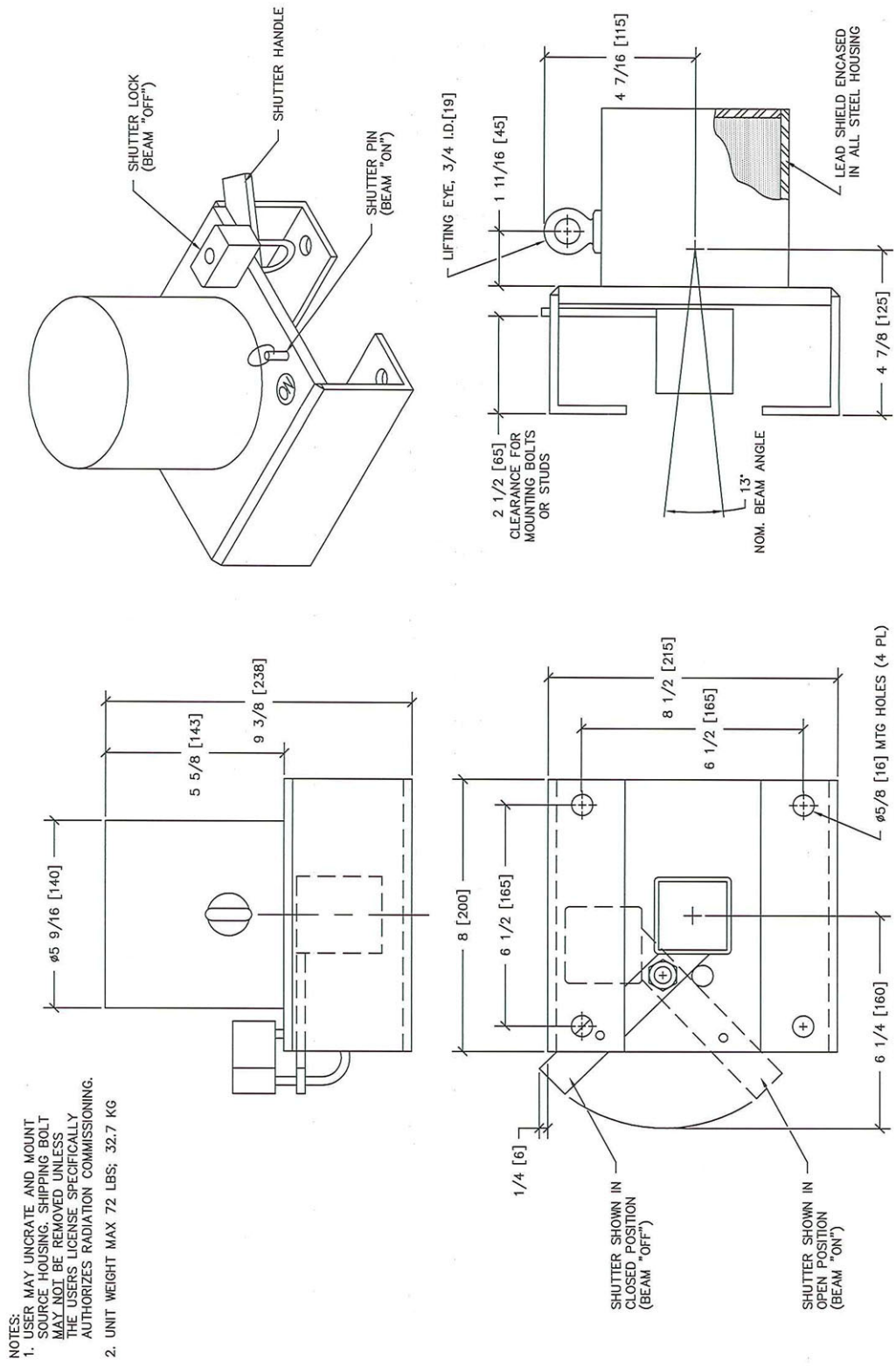


Figure C–17. 865463: Mounting dimensions, 5202 source housing, 500 mCi or less (sheet 1 of 1)

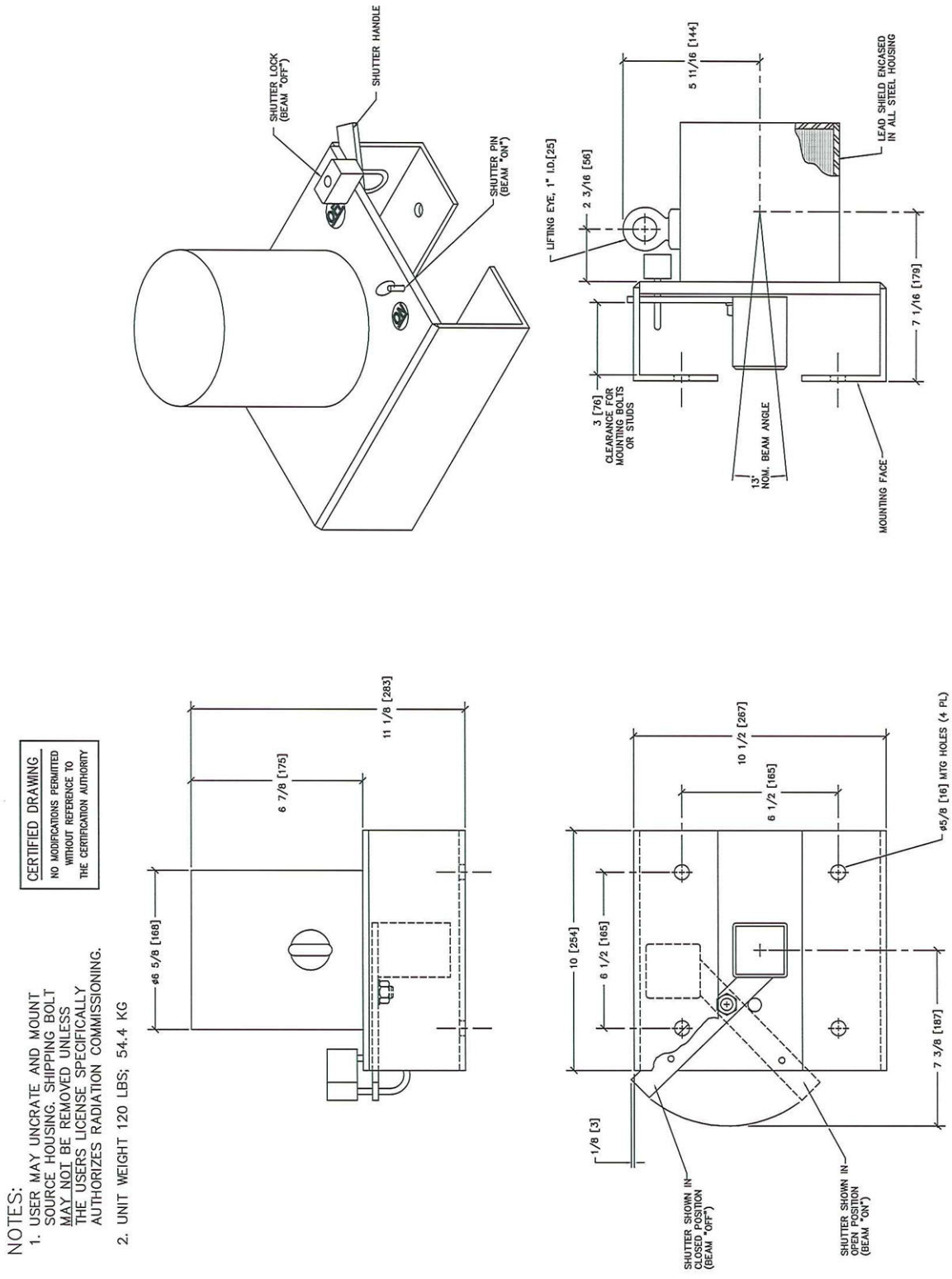


Figure C–18. 865474: Mounting dimensions, 5203 source housing, 2000 mCi or less (sheet 1 of 1)

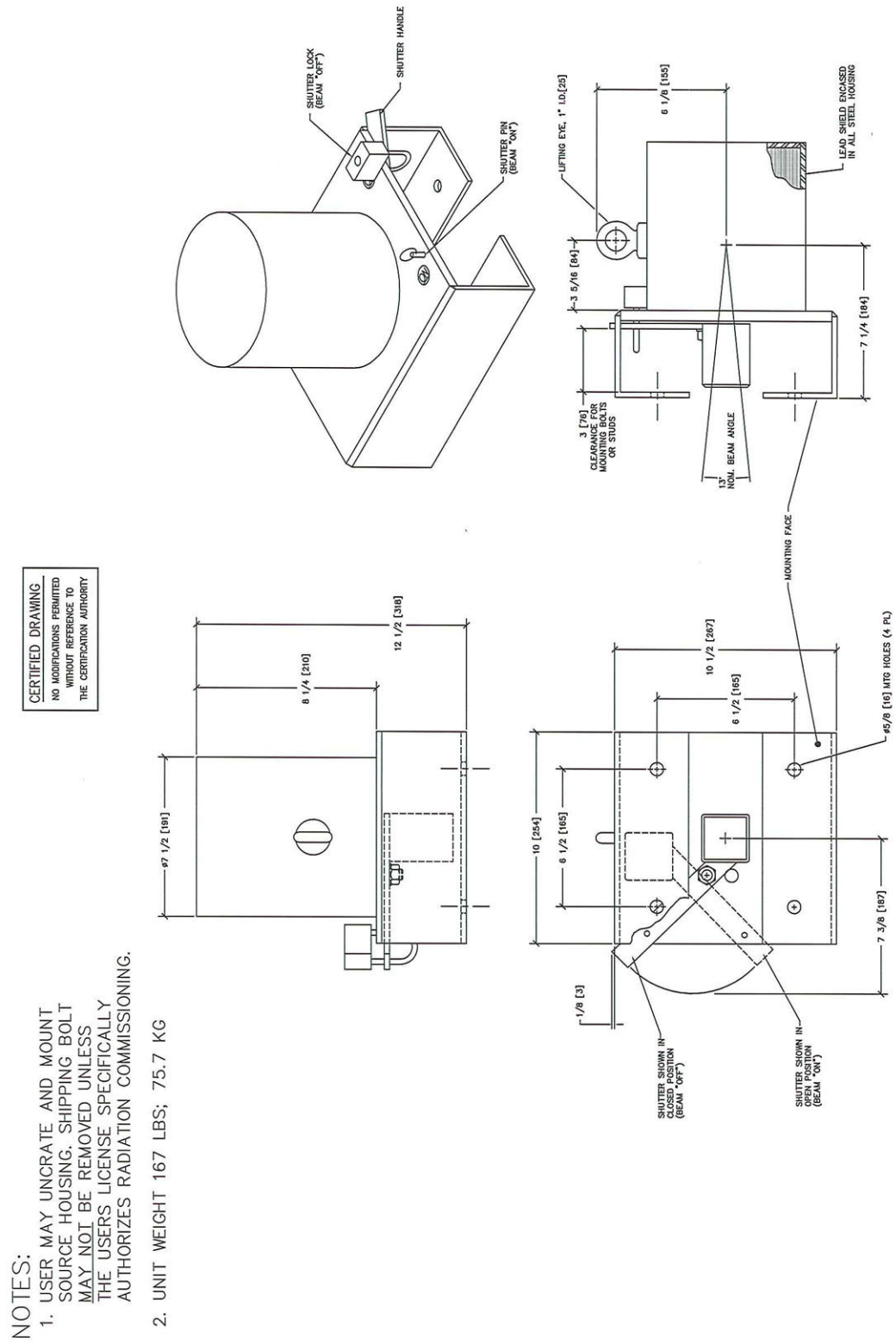


Figure C–19. 865484: Mounting dimensions, 5204 source housing, 8000 mCi or less (sheet 1 of 1)

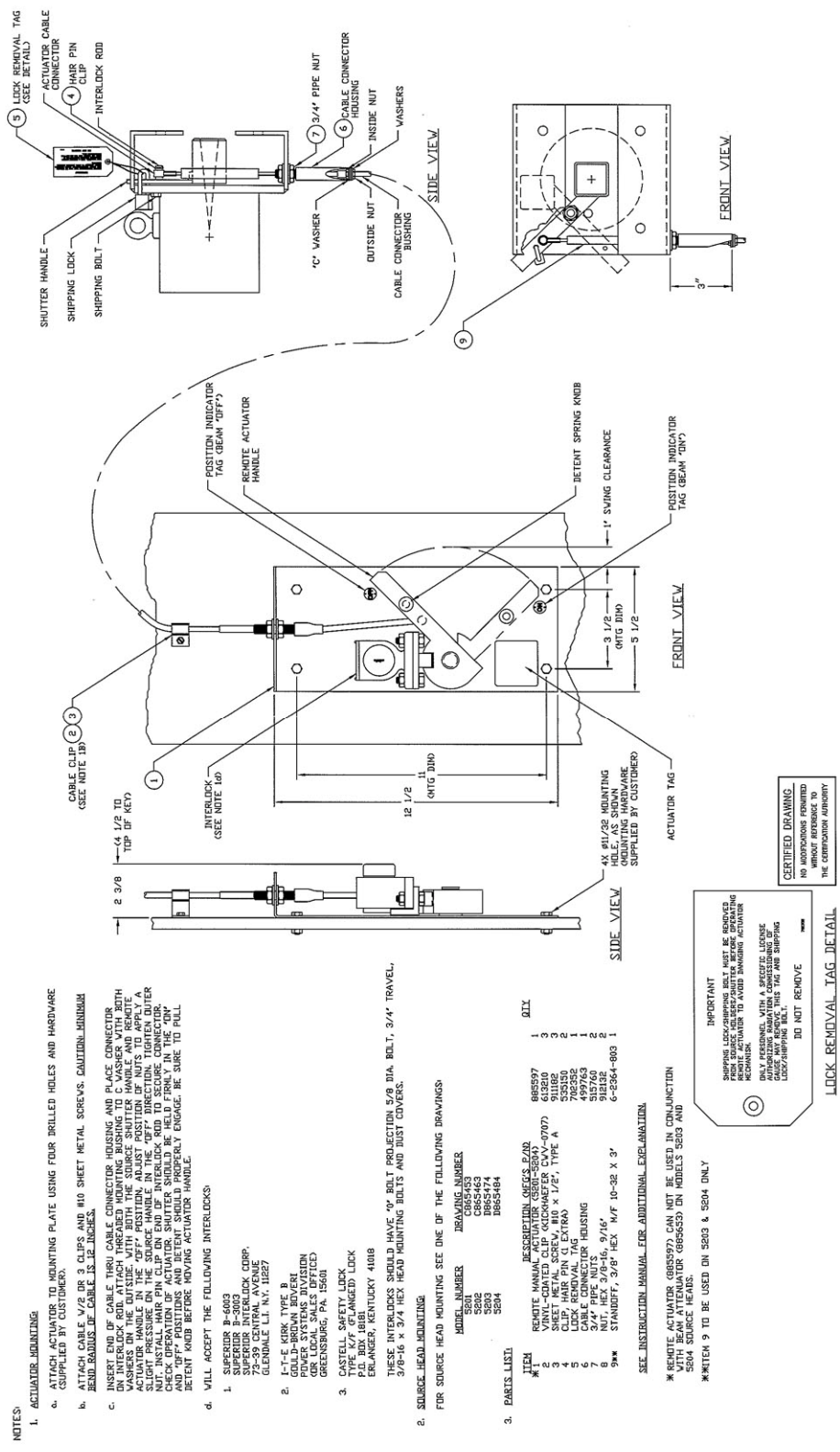


Figure C–20. 866666: Mounting instructions, remote manual actuator, Models 5201–5204 source housings (sheet 1 of 1)

Appendix D
Installing the CE-EMC Protection Board

Purpose

To eliminate the possibility of unwanted electromagnetic signals either going from Thermo Scientific equipment into the customer's equipment or from the customer's equipment into the Thermo Scientific equipment and for protection from high voltage spikes caused by lightning, an EMC protection system has been developed for the Thermo Scientific DensityPRO gauge. This procedure provides the necessary information and instruction to perform installation of the EMC protection system properly.

Procedure

The EMC protection kit comes in four configurations:

- DC power without FOUNDATION fieldbus, p/n 886792
- DC power with FOUNDATION fieldbus, p/n 886793 (see note at end of appendix)
- AC power without FOUNDATION fieldbus, p/n 886794
- AC power with FOUNDATION fieldbus, p/n 886795 (see note at end of appendix)

The installation is the same for all four kits, except for the addition of the new AC power supply board.

As shown in Figure D–1 and Figure D–2 below, the DC kit comes with the following:

- A mounting bracket to attach the EMC board housing assembly to the detector housing
- An explosion proof housing for the EMC protection board
- The EMC protection board installed in the housing
- The wires that run from the EMC protection board to the DensityPRO detector and terminate at the EMC protection board end

The wires from the EMC protection board to the detector are run through the connection fittings at the factory so that the cable gland between the EMC board housing and the detector housing can be factory sealed (see Figure D–1). There are 14 wires in total: two for DC power and 12 for input/output or communication wiring.

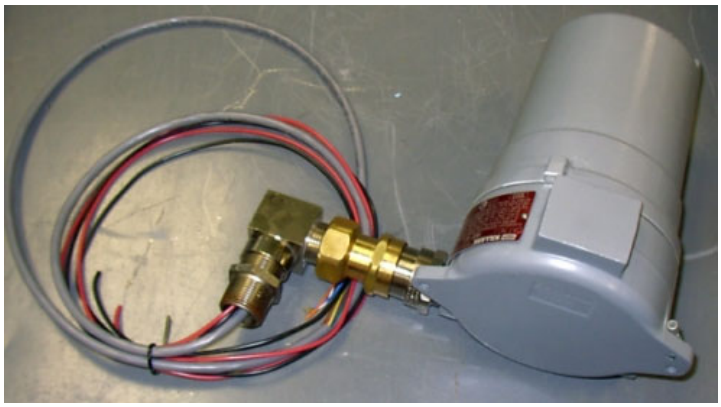


Figure D–1.

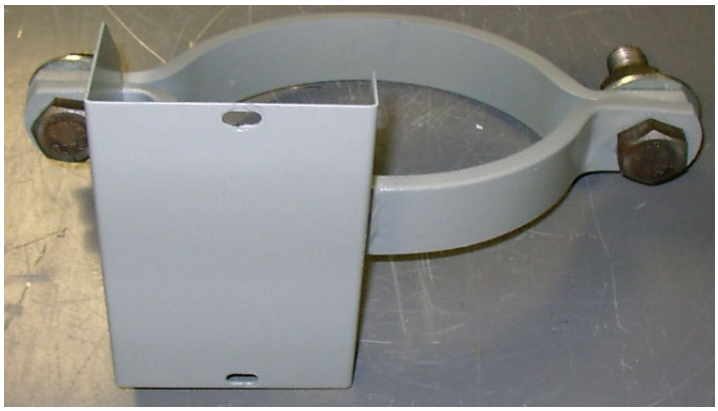


Figure D–2.

Reference Figure D–3 and install this assembly as follows:

1. Mount the bracket assembly to the detector housing.

2. Make sure the flat mounting plate for the EMC board housing is on the same side of the detector housing that has the conduit fitting that is perpendicular to the mounting tabs of the detector housing.

Wiring Installation

With the lid of the detector housing removed, run the wires through the conduit fitting on the housing. Continue with the installation as follows:

1. Apply the appropriate thread sealant for the class area that the detector is installed into to the fitting threads of the EMC assembly.

2. Screw the EMC assembly onto the detector housing approximately six to seven rotations until the connection is tight and the mounting holes of the EMC board housing align with the holes in the mounting plate of the bracket assembly.

3. Be sure to rotate the wires that are inserted into the detector housing as the EMC assembly is rotated to keep from damaging the wires.

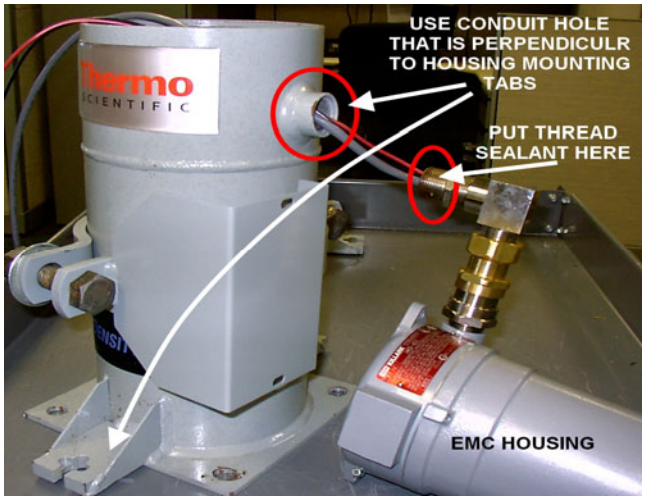


Figure D–3.

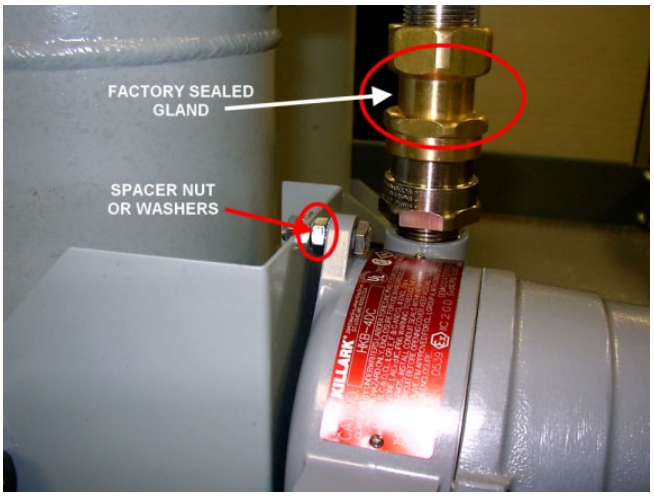


Figure D–4.

Due to variances in components, extra nuts and washers have been included in the kit to use as spacers between the EMC board enclosure and the mounting plate as seen in Figure D–4. When the EMC assembly conduit fitting is threaded into the detector housing so that the connection is secure, use the extra nuts and washers to fill in any gap that may still exist and tighten the mounting bolts.

Once the EMC protection assembly is installed, it should look like Figure D–5.

Figure D–5.

If this is an AC kit, it will include a new AC power supply that must be installed on the detector. To do this:

1. Remove the detector assembly from the housing, unplug the cable at the bottom of the PCB going to the CPU and remove the four screws holding the power supply to the detector chassis (shown in Figure D–6).

2. Install the new power supply (p/n 886783) onto the detector chassis, using the four screws removed earlier.

3. Re-install the detector into the housing.

Figure D–6. AC power supply

Remove the screw on cover from the EMC protection board housing to expose the EMC protection board, as shown below. Remove the two mounting screws and lift the EMC protection board out of the housing.

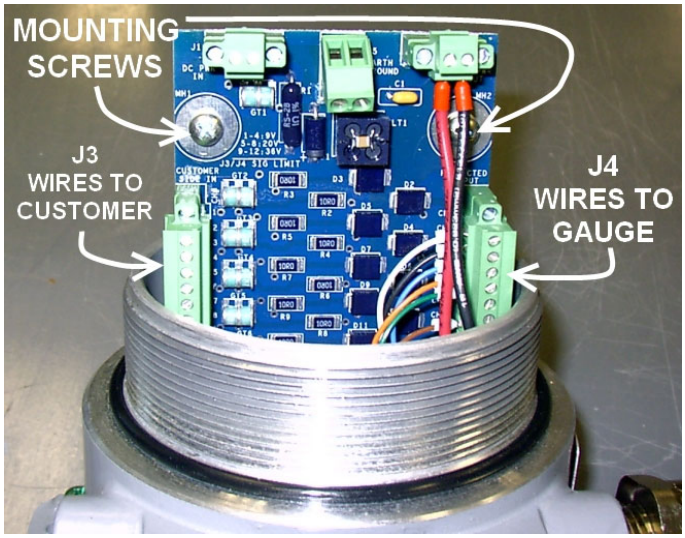


Figure D–7. EMC protection board

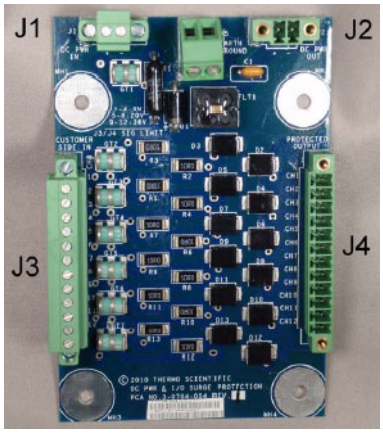


Figure D–8. Connectors on the EMC protection board

The connectors shown in Figure D–8 are described below:

- The connections on the **J4** connector are to be wired to the **detector**.
- The connections on the **J3** connector are to be wired to the **customer's system**.
- **J1** is for **incoming 24 Vdc power.**
- **J2** is for the **filtered 24 Vdc power to go to the detector** (if the detector is DC powered).
- **J5** must be connected to **Earth Ground**.

Note There must be less than 1 ohm resistance from the J5 terminal to true earth ground. ▲

The J2 connector has been pre-wired at the factory with two 18 ga. wires, which should only be used only for a 24 Vdc output if the detector is DC powered. The RED wire is for positive side of the 24 Vdc input and the BLACK wire is for the negative side of the 24 Vdc output.

The J4 connector has been pre-wired at the factory with twelve 22 ga. wires, which should be used only for signal wiring such as RS232, RS485, 4–20 mA current output, and 9723 local display. Connections 1 through 4 are limited to 9 Vdc, connections 5 through 8 are limited to 20 Vdc, and connections 9 through 12 are limited to 36 Vdc.

Warning Do not exceed the voltage limitations of the individual connections or damage will occur to the EMC protection board. ▲

The wiring color code for the factory installed signal cable is shown in the table below.

Table D–1. Wiring color code for connector J4

Terminal	Color
1	White
2	Black
3	Blue
4	Brown
5	Green
6	Gray
7	Orange
8	Purple
9	Red
10	Pink
11	Tan
12	Yellow

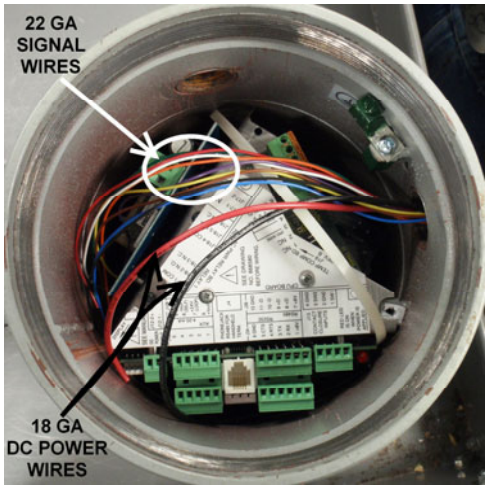


Figure D–9.

Note Any wires that are not used should be taped off to avoid shorting out the detector. (It is recommended that you do NOT cut the unused wires, as you may need them in the future.) ▲

Note The above figure shows the wires running into the enclosure. Actual connections are not shown as they will vary. The figure is for reference only. ▲

Due to the voltage limitations of the individual terminals, the RS485, the Thermo Scientific Model 9723 local display, the RTD input, and the contact closure inputs can be on any of the 12 terminals. The RS232 can be on terminals 5 through 12, and the 4–20 mA current output and input must be on terminals 9 through 12.

Note If the FOUNDATION fieldbus option has been selected, the fieldbus output must be run on terminals 1 and 2 of J3 and J4 for the fieldbus to operate properly. ▲

Appendix E
Replacing the CPU PROM & HART PROM

Note This appendix applies only to DensityPRO systems that have the HART communication option installed and have CPU software prior to version 5.13 or HART board software prior to 1.13. ▲

Purpose

Software has been released for DensityPRO systems with the HART communication option installed. This software prevents any communication conflict that may have previously occurred when both the HART option and the Thermo Scientific Model 9734 handheld terminal were used. The software upgrade requires an upgrade of the gauge CPU PROM and the HART board PROM as well. This appendix provides the instructions for doing so.

Note You will need CPU PROM 595027 and HART PROM 595025 to perform this procedure. ▲

Procedure

Warning **The product's installation and operation must comply with the product's safety certification as well as meet local codes and regulations.** Contact Thermo Fisher Scientific with any questions. ▲

Warning Ensure that power is off and the area is non-hazardous before performing this procedure. ▲

Warning Close the shutter on the source housing before performing this procedure. ▲

1. Remove the chassis from the housing so you can access the electronics.

2. Locate the HART board. It is mounted just below the power supply board on the gauge chassis. The HART PROM is installed in a socket on the HART board (Figure E–1).

Figure E–1. Location of the HART PROM

3. Remove the PROM from the HART board.

Caution It is strongly recommended that you use a PROM extraction tool like the one shown in Figure E–2 to remove the PROM from its socket. These can usually be purchased from the local electronics supply store. Failure to use the proper tool can result in damage to the PROM socket, which would require replacement of the board. ▲

Figure E–2. Prom extraction tool

In critical situations, a small bladed screwdriver or curved tip tweezers can be used if an extraction tool is not available. There are slots in two corners of the PROM socket (Figure E–3). These slots can be used to extract the PROM using the extraction tool or one of the other tools. Carefully pry up on each slotted corner a little at a time, going back and forth to extract the PROM evenly out of the socket.

Caution Be very careful not to crack or otherwise damage the socket! ▲

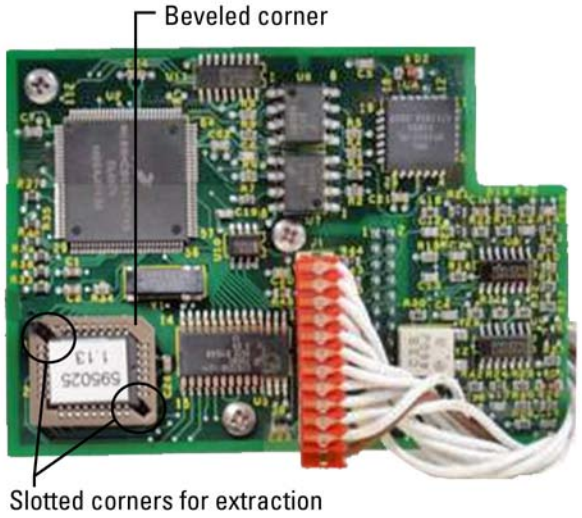


Figure E–3. Extraction notches

4. Align the replacement PROM on the socket so that the beveled corner of the PROM matches the beveled corner of the socket shown in Figure E–3. Gently push down on the PROM until it snaps into place in the socket. **If it becomes misaligned or difficult to push, stop and start over.** Once the PROM snaps into the socket, it is installed.

5. Locate the CPU PROM on the CPU board. Remove the PROM using the same method you used to remove the HART PROM.

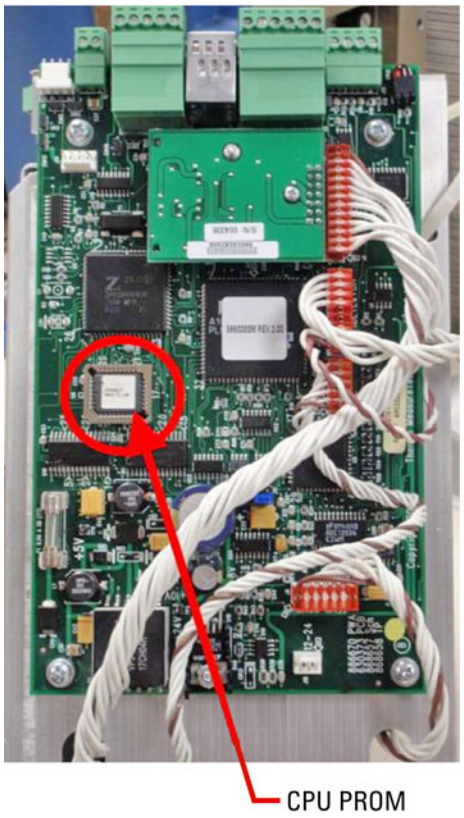


Figure E–4. Location of the CPU PROM

6. Align the replacement PROM on the socket so that the beveled corner of the PROM matches the beveled corner of the socket. Gently push down on the PROM until it snaps into place in the socket. **If it becomes misaligned or difficult to push, stop and start over.** Once the PROM snaps into the socket, it is installed.

7. Install the chassis back into the housing.

8. Once installation is complete, you will need to erase memory, reconfigure the gauge, and recalibrate. These procedures can be found in the DensityPRO gauge user guide (p/n 717784).

Appendix F
Installing the Temperature Compensation Board

Purpose

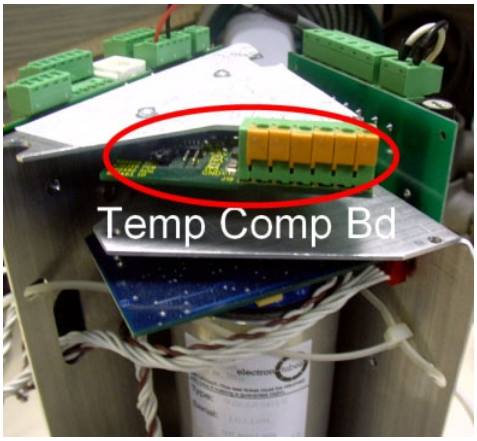
A change in process temperature causes a change in the density. In some cases, only density changes caused by other process conditions need to be seen, and thus temperature compensation is used.

To use temperature compensation, the temperature compensation board (p/n 810138) must be installed on the DensityPRO detector chassis. A Thermowell RTD must be installed in the process pipe and connected to the temperature compensation board.

This appendix provides instructions on how to install and wire the temperature compensation board.

Procedure

To install the temperature compensation board, mount it in the space in the middle of the triangle shaped chassis (Figure F–1) and secure it with the three screws supplied with the board (Figure F–2).



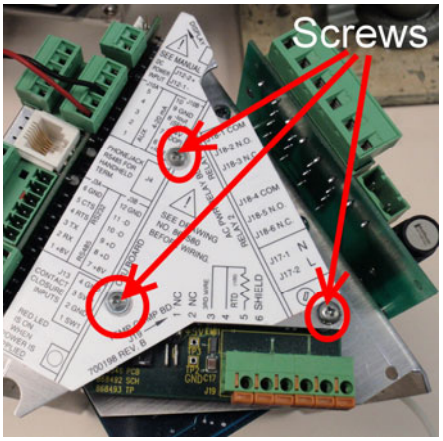


Figure F–1. (left) and Figure F–2. (right)

Use the supplied cable to connect the temperature compensation board to the J8 on the CPU board, as shown in Figure F–3. This cable supplies power to the board and takes the temperature signal to the CPU.

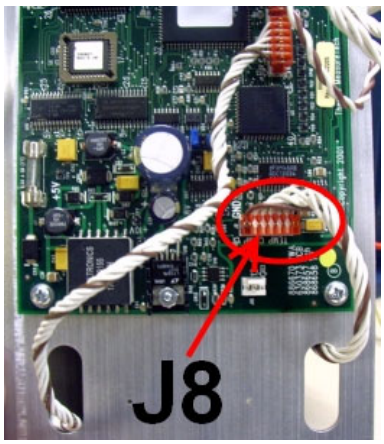


Figure F–3.

The temperature compensation board is designed to use a 3-wire 100-ohm Platinum RTD. Connections are shown in the table below.

Table F–1. Temperature compensation board connections

Cable Wire	Connection
Temp	Terminal 5
Two same color wires	Terminals 3 and 4
Shield	Terminal 6

Note Terminals 1 and 2 are not used. ▲

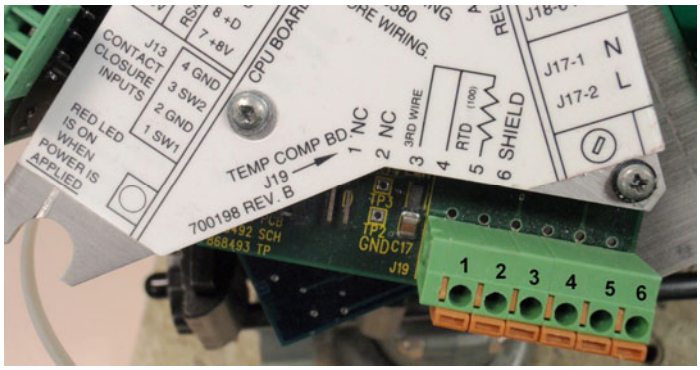


Figure F–4.

The gauge is now ready to be programmed for temperature compensation. For programming instructions, refer to the DensityPRO gauge user guide (p/n 717784).

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