



8 Bartles Corner Road, Unit 104, Flemington, NJ 08822 • 908 788-5210 • Fax 908 788-5204

**Installation, Operation and
Maintenance Manual
For
The 2SPCP Tank Heating Controller
(Part#'s 2028742 & 2028742P)**

**Revision 1
July 30th, 2019**

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Chapter One

Overview

1.1 System Overview

The 2SPCP Controller (P/N 2028742 or 2028742P) is specifically designed for use on non-metallic tanks, lined tanks or tanks with heat sensitive contents in unclassified (non-

hazardous) areas. The controller consists of two electronic thermostats one for process control and the other for over-temperature protection. The process thermostat cycles the heating system on and off as needed to maintain the desired temperature. The over-temperature thermostat shuts off the heating system if the heater temperature reaches the over-temperature setting (150°F default setting) to protect the tank, liner or tank contents.

The controller enclosure is rated NEMA4X and is suitable for outdoor use. A power on light provides indication when the heaters are energized.

The 2SPCP controller is commonly used with tank heaters provided by HTD Heat Trace such as EGLX Tank Heating Panels, SilcoPad tank heating pads, SPX tank heating pads or special heaters such as heating cable.

1.2 Approval

The 2SPCP Controller (P/N 2028742 or 2028742P) is Intertek (ETL) approved to UL 508 and CSA C22.2 14 for use in the US and Canada. The controller is approved for use in unclassified (non-hazardous) locations.



Chapter Two

Controller Information

2.1 Controller Location

The 2SPCP is rated NEMA4X and suitable for outdoor installation. The controller should be located at a convenient height for temperature adjustment and out high traffic areas to minimize the possibility of physical damage. Where possible the controller should be mounted out of direct sunlight to provide maximum visibility for the heater on light.

2.2 Heater Wiring

Heater connections are routed into the controller via cord grips or conduit connections to maintain the NEMA4X enclosure rating. Any holes not used for heater connection must be sealed with a NEMA4X rated hole seal. See Chapter 3 section 3.1, 3 for additional details.

2.3 Temperature Settings

The 2SPCP controller has two electronic thermostats one for process temperature control and one for over temperature protection. The process thermostat should be set to the desired process temperature not to exceed 100°F. Contact HTD Heat Trace for applications with process settings above 100°F.

The over temperature setting protects the tank, tank liner or tank contents from high heater temperatures. If the heating pad reaches the over temperature setting the heating system is shut off to protect the tank or heat sensitive component. The over temperature thermostat is supplied factory locked to 150°F to cover most applications and can be adjusted to match the application. Consult HTD for over temperature settings above 150°F. Incorrect over-temperature setting can cause damage to the tank, tank liner, tank contents or heater. The over-temperature setting must not exceed the minimum of the following:

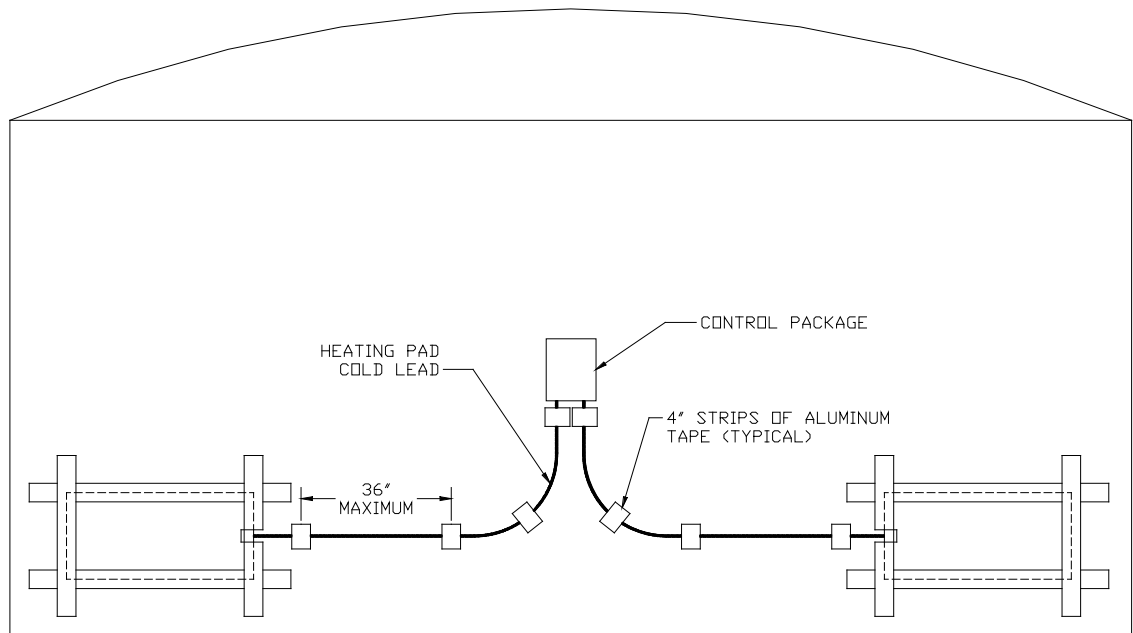
- a. Maximum tank wall or liner exposure temperature
- b. Maximum tank liner or tank contents exposure temperature
- c. Maximum heater exposure temperature

Chapter Three

Controller Installation, Heater Lead Routing & Sensor Location

3.1 Physical Installation

- 1) Mount the control package in the location determined during the heater installation.
- 2) Run the cold leads from each heater to a common point below the control package. Cold leads should be secured to the tank with 4" long strips of aluminum tape as shown in fig 1.



Cold Lead Routing

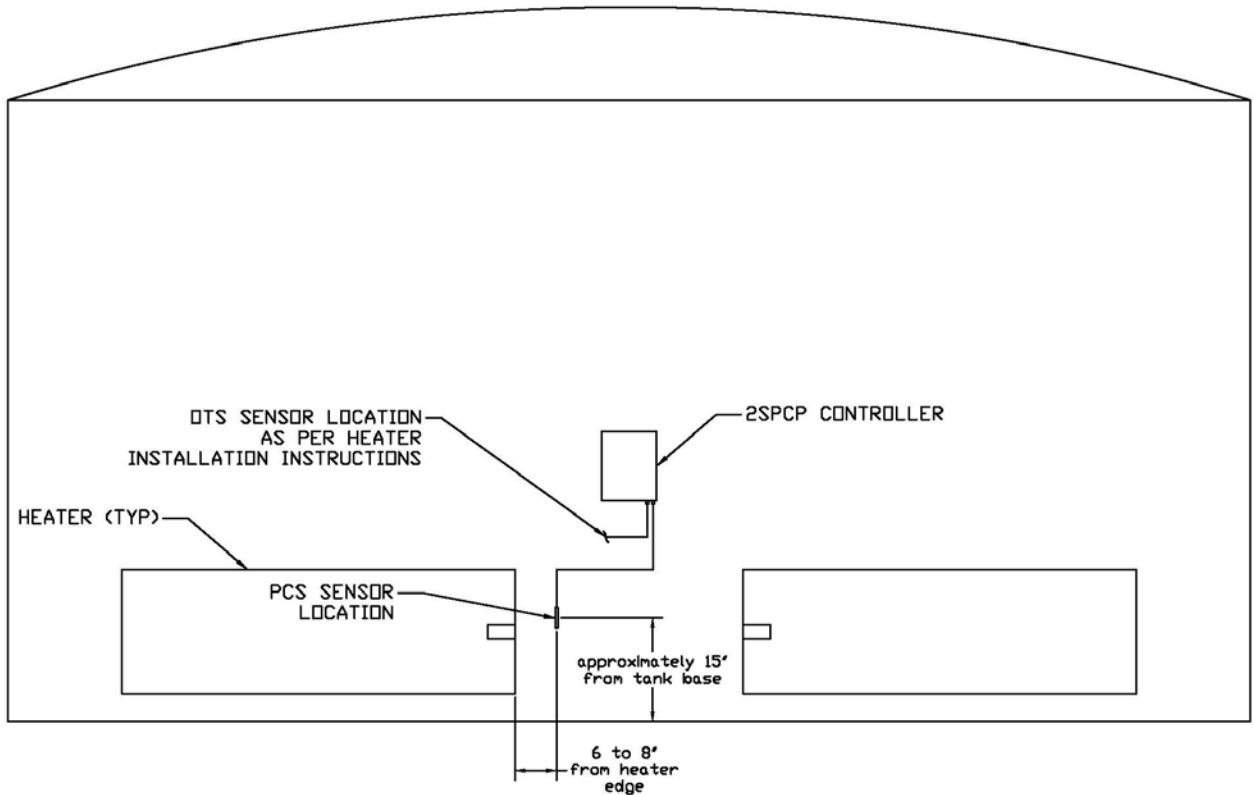
Figure 1

- 3) Install one NEMA4X rated cord grip fitting in the controller for each heater. Install the cord grip fitting into one of the holes on the base of control package. Controller part number 2028742 is provided with 6 each 1/2" NPT clearance holes and 2028742P with 3 each 1/2" NPT clearance holes. Seal any unused holes with a NEMA4X rated hole seal. For part number 2028742P additional holes can be added as necessary to accommodate a maximum of 6 heater cold leads. Holes for additional cord grips should only be added in the

bottom of the enclosure. Allow approximately 6” of cold lead for termination inside the control package. Cord grips and hole seals are available from HTD Heat Trace please call (908) 788-5210 option 1.

3.2 Sensor Location

- 1) The temperature sensor designated as “PCS” inside the control package must be located as per fig 2 and installed on the tank surface using aluminum tape.



Sensor Location
Figure 2

- 2) The temperature sensor that is designated “OTS” must be located as detailed in the specific heater installation instructions. Correct location of the OTS sensor is critical to safe heating system operation.
- 3) Route the thermocouple leads from the sensors as shown in fig 2 using 4” strips of aluminum tape. Excess thermocouple lead should be coiled neatly under the controller and protected.

Chapter Four

Heater Testing

Some testing requires exposure to electrically live components and should only be completed by an electrician or other qualified personnel.

4.1 Testing

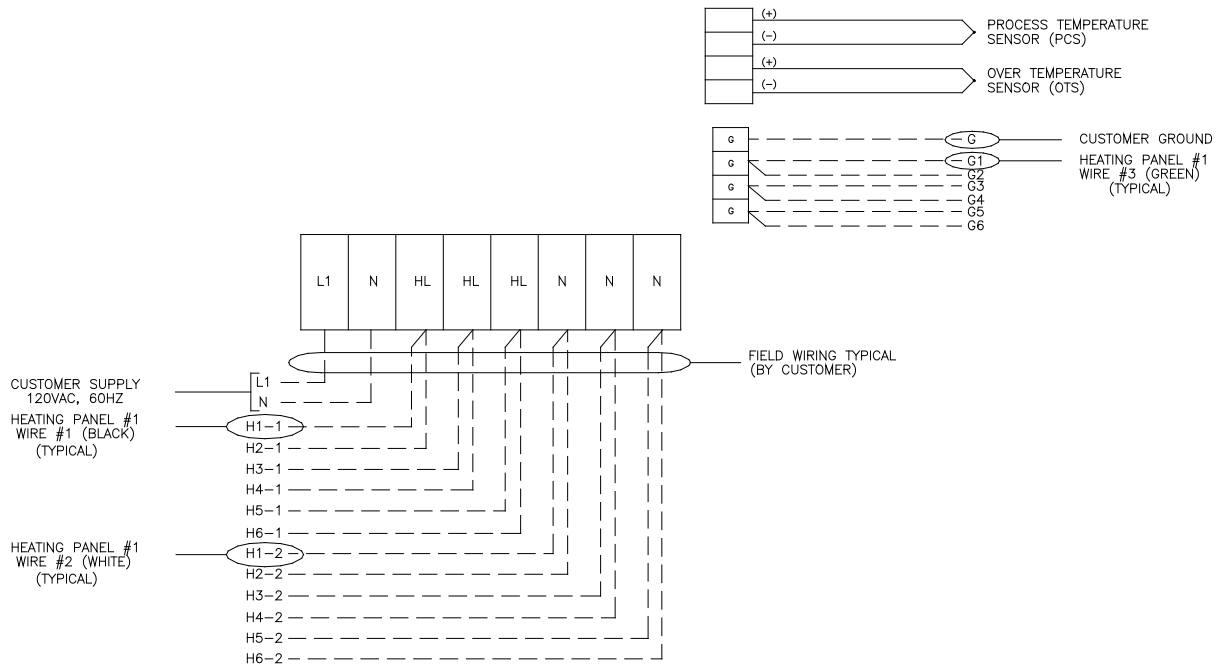
- 1) Complete testing of the heaters as per the appropriate installation instructions. Testing should include correct heater resistance and insulation resistance (IR) values $\geq 20\text{M}\Omega$. are acceptable
- 2) After successful heater testing connect the heaters as shown in Chapter 5, figure 3 on page 6.

Chapter Five

Connection

5.1 Heater Connection

- 1) Connect each heating pad into the heater terminal blocks as shown in figure 3.
3. Ensure all connections are tight.



Heater Connection

Figure 3

- 2) The black (hot) lead and the white (neutral) lead on each heater are connected using ring terminals. Factory installed ring terminals are provided with some heaters, otherwise the heater lead connection must be accomplished with ring or locking fork terminals for 16AWG wire and #6 screw. Connect ring terminals to designated terminal blocks as per wiring diagram in figure 3. The green (ground) lead should be connected to the grounding bar as per wiring diagram.
- 3) After connecting customer supply in Chapter 6, test the controller as shown on Chapter 8.

Chapter Six

Power Supply Connection

6.1 Power Supply Requirements

The required customer supply to the controller is 120 VAC, 60HZ, with the current sized to match the heating system. Heating systems range in size from 210 watts to 3,000 watts depending upon the heating system supplied. The controller is labeled “120VAC, 26A Service” reflecting the maximum rating of the controller. The incoming power supply should be sized to fit the specific heating system supplied.

US and Canadian Electric Codes require that all heat tracing systems have ground fault protection. Circuit breakers are commonly available to provide *equipment level* ground fault protection. Circuit breakers for protection of tank heating systems should be 30 mA ground fault trip units such as Square D series QO-EPD. *GFCI type breakers with a 5 mA ground fault are trip designed for personnel protection are not suitable for equipment protection and can cause nuisance tripping.*

Circuit Breaker Sizing Criteria:

1. Determine the power of the heating system.
2. Divide the heating system power by 120 VAC to determine the nominal current.
3. Size the circuit breaker at 125% of the heating load minimum or as required by voltage drop calculations.
4. Choose the circuit breaker that most closely matches the calculation, see example.

Example:

1. A heating system with 2 – SPX420 heating pads has a power of 840 watts.
2. By dividing the power by 120 VAC the nominal current is 7 A.
3. Sizing the circuit breaker at 125% requires a circuit breaker of 8.75 A or greater.
4. Pick the closest circuit breaker that is not less than 125% of the nominal load. The lowest commonly available circuit breaker trip setting is 15 A. Use a 15A, 120VAC, 30mA ground fault protected circuit breaker such as Square D part# QO115EPD.

6.2 Customer Connection

Each controller is provided with a cord grip for incoming power suitable for 10 AWG, SJO flexible cord. Suitability of flexible cord must be evaluated by the installer or end user based on the specific installation and all applicable codes. When using conduit connection for power supply the cord grip is removed and supply connection completed using conduit connections supplied by the end user or installer. Conduit is recommended where physical protection is needed and/or required by code.

Chapter Seven

Controller Operation

7.1 General Information

The type 2SPCP controller has two temperature settings. The PCS sensor is for control of the process temperature and the OTS for over temperature protection. The heating system is energized when the process temperature drops below the set point. The heating system stays energized until the process temperature exceeds the set point. In this manner the desired tank temperature is maintained by cycling the heating system on and off as required.

The OTS sensor shuts off the heating system if a heating pad temperature exceeds the over temperature thermostat setting. This protects the tank and/or tank contents from over temperature caused by upset conditions, such as low liquid level.

Heating system status indication is provided via the power on to heaters light. When heat is required and the heaters are energized the power on to heaters light is illuminated.

7.2 Temperature Settings

- 1) The PCS controller/thermostat is factory set to 60°F. This setting can be adjusted for the desired maintenance temperature of the specific application. The process knob in the 2SPCP is limited to a maximum of 100°F. Contact HTD Heat Trace for process settings in excess of 100°F.
- 2) The OTS thermostat is supplied factory locked to 150°F. This setting should not be adjusted without contacting HTD Heat Trace. *Incorrect OTS thermostat settings may result in damage to the tank/liner/tank contents or the ability of the heating system to maintain temperature.*

7.3 Heating System On/Off Indication

The 2SPCP controller is supplied with a “Power On to Heaters” indicating light. This light will stay illuminated only when the OTS thermostat is permitting safe operation of the system and the PCS thermostat is calling for heat. This light will not be illuminated when:

- a. The tank and tank contents have reached the desired maintenance temperature and the PCS controller is not calling for heat.
- b. The OTS controller has sensed unusually high heating pad temperatures and has switched off the heating system.
- c. There is no power to the system.
- d. The bulb inside the “Heat On” indicating light has failed and requires replacing.

Items “c” and “d” will require on site attention before safe operation of the system can resume.

Chapter Eight

Controller Testing and Setup

Some testing requires exposure to electrically live components and should only be completed by an electrician or other qualified personnel.

8.1 Customer Power

- 1) Turn on customer power to the heating system.
- 2) Verify 120 VAC is present between terminals L1 & N in the controller.
- 3) Correct power wiring if necessary.

8.2 Controller

- 1) Once presence of customer power is verified proceed to step 2.
- 2) Raise the process temperature setting until the “power on to heaters” light illuminates. Verify 120 VAC is present on HL & N.
- 3) Verify correct current out from the HL terminal determined by the total current for the system.
- 4) Decrease the process and verify 120 VAC is not present on HL & N.

8.3 Setup

- 1) After testing proper operation of the heating system and controller complete the following two steps.
- 2) Set the Process Temperature knob to the desired tank maintenance temperature.
- 3) Verify proper setting of the over temperature setting as per section Chapter 2, Section 2.3 on page 2.

Chapter Nine

System Maintenance

Maintenance Schedule

Procedure	Frequency*	Recommendations
Voltage Check (voltmeter)	Every 6 Months	a) Reduced voltages should be evaluated to determine decreased power levels and the potential impact on the performance of the tank heating system. b) Operating voltages above 130 VAC are not acceptable. De-energize the system and investigate cause of over-voltage. Do not re-energize the system until the cause of excess voltage is eliminated.
Current Check (ammeter)	Every 6 Months	Verify correct current draw based on the size of the heating system.
Functional Check	Every 6 Months	Verify the controller is working correctly by adjusting the process temperature setting to turn on and off the heating system. Verify the heating system turns on and off by looking at the power on to heaters light and using a voltmeter to see correct applied voltage.

Table 1

*Inspection frequency should be evaluated based on the process type. Freeze protection systems for example may only require inspection once a year prior to freezing temperatures in the fall. Process critical systems should be inspected more frequently.

Chapter Ten

Troubleshooting and Spare Parts

10.1 Troubleshooting Guide

Problem	Probable Cause	Possible Solution
Heaters do not energize	<ul style="list-style-type: none"> a. No incoming power b. Blown fuse c. Incorrect Heater Connections d. Failed SSR e. Failed or damaged Thermocouple f. Failed Temperature Controller 	<ul style="list-style-type: none"> Switch on/reset Replace Correct wiring Replace Replace Replace
“Power on to Heaters” light does not illuminate	<ul style="list-style-type: none"> a. Heating not required to maintain temp. b. No incoming power c. Blown fuse d. Incorrect temp. controller settings e. Burnt out light bulb f. Failed or damaged Thermocouple g. Failed Temperature Controller 	<ul style="list-style-type: none"> Heat not required Switch on/reset Replace fuse Correct settings Replace bulb Repair wiring Replace
Low tank Temp.	<ul style="list-style-type: none"> a. No incoming power b. Blown fuse c. Incorrect temp. controller settings d. Low incoming product temp. e. Damaged/missing thermal insulation f. Low tank liquid level g. Damaged/failed heating pad h. Incorrect heater connections i. Failed SSR j. Failed or damaged Thermocouple k. Failed Temperature Controller l. Maintenance temp. too high 	<ul style="list-style-type: none"> Switch on/reset Replace fuse Correct temp. controller settings Wait for product heat up (can take a very long time) Repair or replace insulation Fill Tank Repair or replace Correct wiring Replace Replace Replace Lower process temp. setting
High Tank Temp.	<ul style="list-style-type: none"> a. Incorrect temp. settings b. Failed SSR 	<ul style="list-style-type: none"> Correct Replace
Customer supplied breaker trips	<ul style="list-style-type: none"> a. Damaged wiring b. Damaged heater c. Incorrect heater connection 	<ul style="list-style-type: none"> Repair or replace Repair replace Correct wiring

Table 2

10.2 Spare Parts List

<u>HTD Part#</u>	<u>Item</u>
H01020	2SPCP Fuse
H05703	4 pt Power Terminal
H01038	Thermocouple Terminals
H01010	Thermocouple
H01034 H01072 H01036	Heater Cord grip (including sealing ring and nut)
H01024 H01071 H01037	Thermocouple Cord grip (including sealing ring and nut)
H01035 H01072 H01036	Customer Power Cord grip (including sealing ring and nut)
H05834A	LED Light Bulb 120 VAC
H05834	22mm Replacement Light Assembly
H01009	Silcopad Cold Lead
H05120	Thermostat, Hazardous Rated, N7, N9, 480VAC, 22A, 10' Bulb and capillary.
G2028742	2SPCP Sub-plate assembly with plate mounted components including thermostats, SSR & terminal blocks

Table 3

Chapter Eleven

Component Details

11.1 Components

A detailed controller parts list can be seen on drawing 2028742 shown in Appendix A. This list includes HTD part numbers used to order spare components. Most common spare parts are listed in Chapter 10, table 3.

11.2 Replacing Components

WARNING!!!!

The interior of the controller must not be accessed while energized. Remove power to the control panel using the customer supplied disconnect switch or circuit breaker.

Replacement of components or panel repair should only be attempted by qualified personnel. *Incorrect wiring can cause injury to personnel and/or damage to components, heaters and/or the tank. If there are any questions or concerns contact HTD Heat Trace before commencing any work.*

To replace a component it is first necessary to note all the wiring connections and the corresponding location on the component. All these connections can also be seen on the associated drawings. Disconnect the wires and remove the component from the sub-panel or front door. Care must be taken to make sure that the mounting screws and washers do not fall into other components.

Mount the new component and reconnect the wires. Vacuum any debris out of the enclosure especially around the new component. Double-check the wire connections to insure they are correct. Close the enclosure and energize the controller. Test the operation of the new component to insure it functions correctly.

Chapter Twelve

HTD Heat Trace Contact Information

12.1 General Contact Information

HTD Heat Trace can be contacted via any of the methods listed below:

Mail and Physical Address

HTD Heat Trace, Inc.
8 Bartles Corner Rd, Unit 104
Flemington, NJ 08822

Phone

Telephone: (908) 788-5210
Fax: (908) 788-5204

E-mail: support@htdheattrace.com
Website: www.htdheattrace.com

12.2 Technical Support

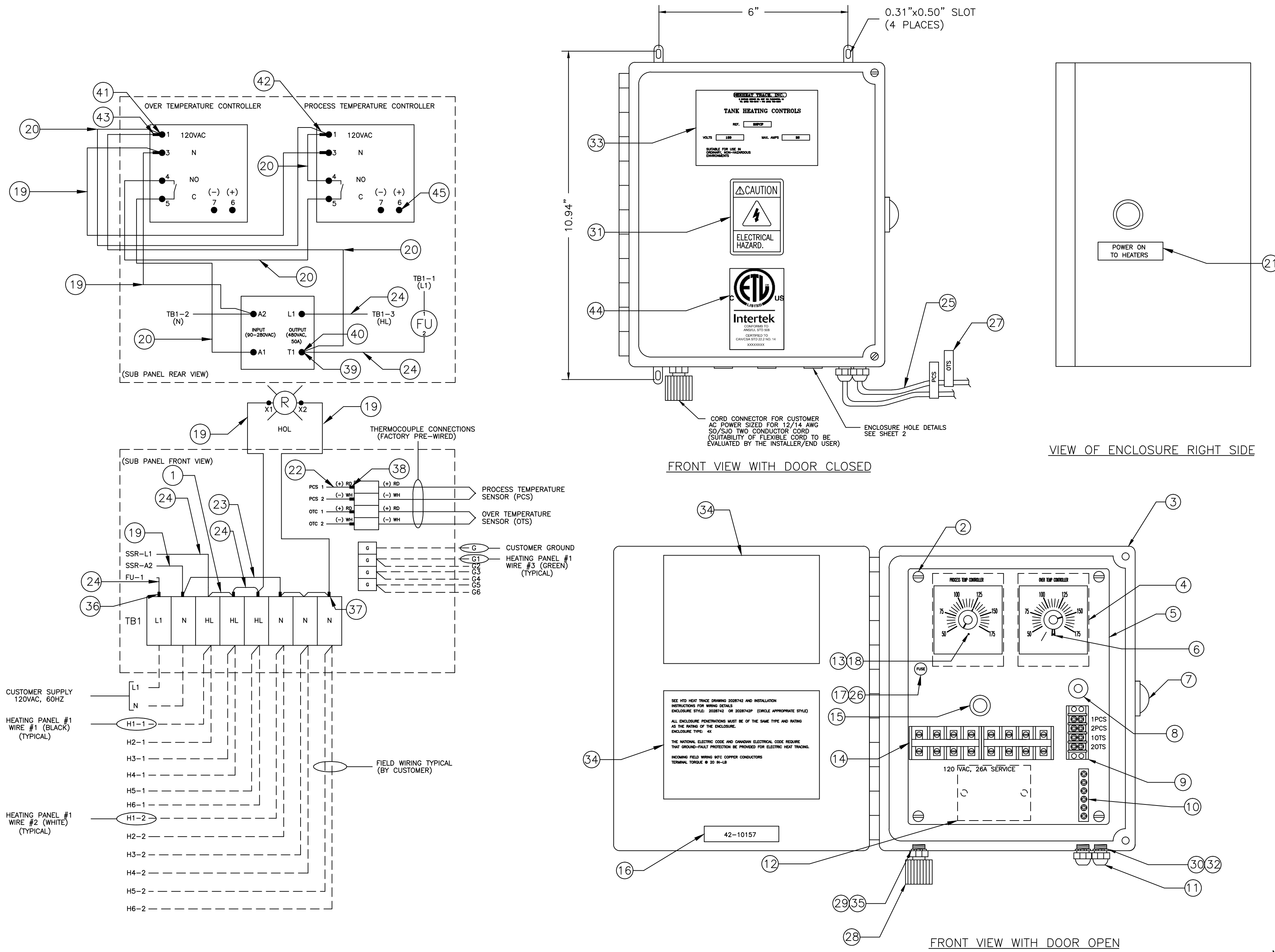
Technical support is available from 8:00 am to 4:30 PM eastern time Monday through Friday at (908) 788-5210 option 2.



8 Bartles Corner Road, Unit 104, Flemington, NJ 08822 • 908 788-5210 • Fax 908 788-5204

Appendix A

REVISIONS			
REV	DESCRIPTION	APPROVED	DATE
-	INITIAL RELEASE	SRB	5/10/00
A	ITEM #35	SRB	6/23/01
B	PAGE 2 ADDED	SRB	10/20/03
C	ITEM 4, 7, 16, 34 DESC. MODIFIED	SRB	2/23/10
D	ADDITIONAL DETAIL ADDED	SRB	7/17/14
E	INSTRUCTION LABEL P/N, ETL LABEL	SRB	9/26/14



NOTES:

- PROCESS TEMPERATURE SETTING LIMITED TO 100°F, CONSULT HTD PRIOR TO REMOVING PROCESS LIMIT.
- OVER TEMPERATURE SETTING PROVIDED LOCKED AT 150°F. IN NO CASE SHOULD THIS SETTING EXCEED THE MINIMUM OF THE FOLLOWING:
 - MAXIMUM TANK WALL EXPOSURE TEMPERATURE
 - MAXIMUM TANK CONTENTS EXPOSURE TEMPERATURE
 - MAXIMUM HEATER EXPOSURE TEMPERATURE
- PROCESS T-STAT FACTORY SET AT 60°F, OVERTEMP T-STAT FACTORY SET AT 150°F
- SEE SHEET 2 FOR ENCLOSURE STYLE DETAILS.
- CONTROLLER AVAILABLE IN 2 ENCLOSURE STYLES 2028742 & 2028742P AS SHOWN ON SHEET 2. ENCLOSURE STYLE MARKED ON ITEM #34 (LOWER) BY CIRCLING THE APPROPRIATE ENCLOSURE STYLE.

45	4	H01008	FLAG TERMINAL 1/4", 16-22 AWG
44	1	H03009	ETL APPROVAL LABEL
43	3	H01095	INSULATED FLAG TERMINAL 1/4", 16 AWG
42	8	H01007	FLAG TERMINAL 1/4", 14-16AWG
41	3	H01200	INS. DBL PIGGYBACK DISC, 14-16AWG
40	1	H01067	RING TERMINAL 16AWG, #10 SCREW, PVC
39	1	NIP405	RING TERMINAL 10AWG, #10 SCREW, PVC
38	8	H01055	RING TERMINAL 16AWG, #4 SCREW, PVC
37	4	H01057	RING TERMINAL 16AWG, #8 SCREW, PVC
36	5	H01062	RING TERMINAL 10AWG, #8 SCREW, PVC
35	1	H01072	1/2" SEALING RING
34	2	SPECIAL	HEATER LIST LABEL
33	1	H01074	GENERAL 2SPCP LABEL
32	2	H01071	3/8" SEALING RING
31	1	H01040	ELECTRICAL CAUTION LABEL
30	2	H01037	3/8" NPT LOCKNUT, NONMETALLIC
29	1	H01036	1/2" NPT LOCKNUT, NONMETALLIC
28	1	H01035	CORD CONNECTOR STRAIGHT
27	2	L008	T/C SENSOR LABEL (PTS)
26	1	H01020	FUSE 250VAC,30A 1/4" x 1 1/4"
25	2	H01010	TYPE "J" T/C 3/16"x2" LONG,W/10' TEFLON/SS BRAID WITH TEFLON JACKET
24	AS REQD	NIP017	WIRE 10AWG, STRANDED, BLACK, MTW/TEW, 105°C
23	AS REQD	NIP020	WIRE 10AWG, STRANDED, WHITE MTW/TEW, 105°C
22	AS REQD	H01014	TYPE "J" T/C EXTENSION WIRE
21	1	H01043	POWER ON TO HEATERS LABEL
20	1	NIP008A	WIRE 16AWG, BK, STR, MTW/TEW, 105°F
19	1	NIP016	WIRE 16AWG, WH, STR, MTW/TEW, 105°F
18	1	H01048	PROCESS CONTROLLER KNOB LIMIT
17	1	H01019	FUSE HOLDER PANEL MOUNT 1/4"x1 1/4"
16	1	L005	SERIAL # LABEL
15	1	H01021	HOLE BUSHING 1/2"
14	2	H05703	4 PT TERMINAL BOARDS 30A,600VAC
13	2	NIP502	#2-56 ROUND HEAD SCREW
12	1	H01013	SSR 50A,480VAC max,90-280VAC
11	2	H01024	LIQUID TIGHT FITTING 3/16"
10	1	H01063	GROUND BUS
9	1	H01038	TERMINAL BOARD 150V,15A,150°C
8	1	H01022	HOLE BUSHING 1/4"
7	1	H05834	N4X PILOT LIGHT 22mm, 120VAC, RED
6	1	H01046	OVER TEMPERATURE LIMIT KNOB LOCK
5	1	H01016	10x8 PANEL WITH LEGENDS
4	2	H05220A	ELECTRONIC T-STAT 50-175°F, TYPE "J",
3	1	H05501	10x8x6 NEMA4X FIBERGLASS ENCLOSURE
2	4	H01003	HEX SPACER #10-32x1.5"
1	3	H05706	TERMINAL BLOCK JUMPERS

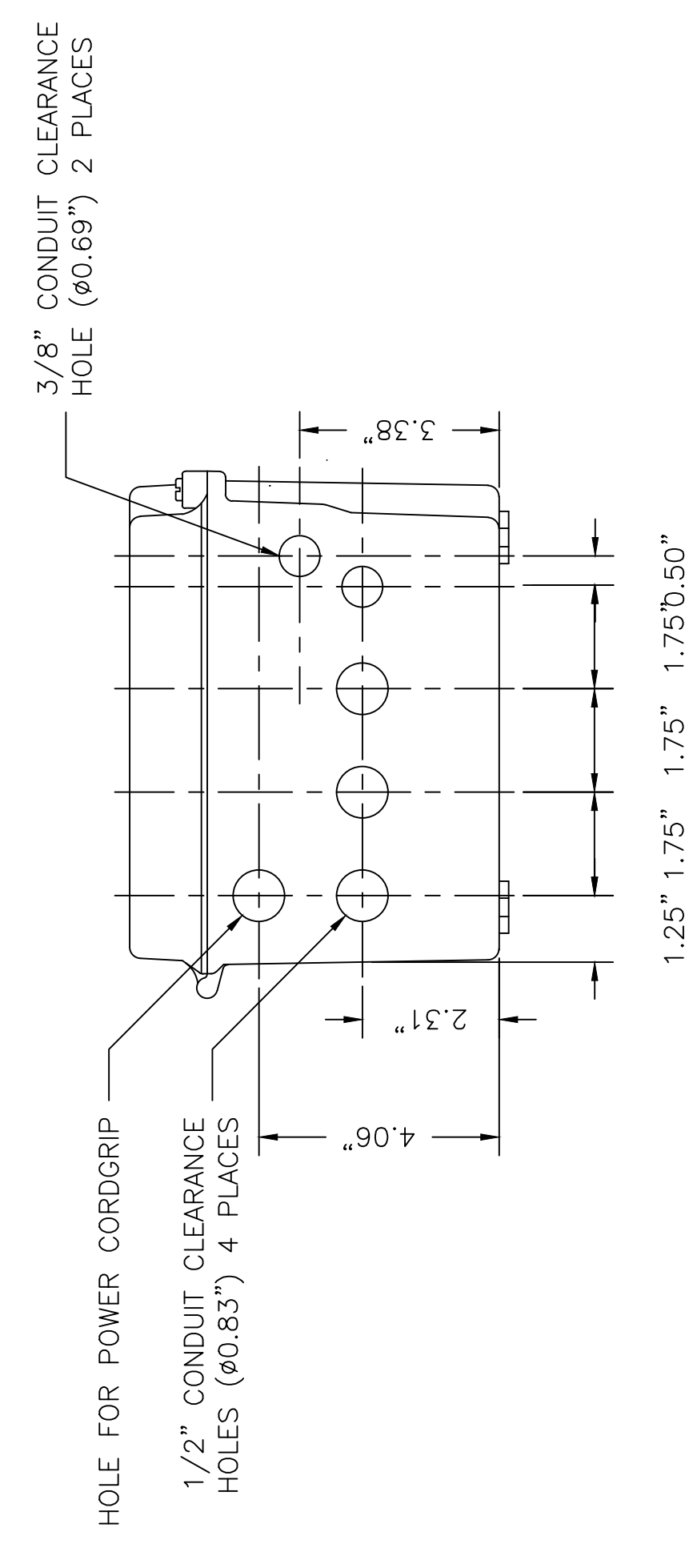
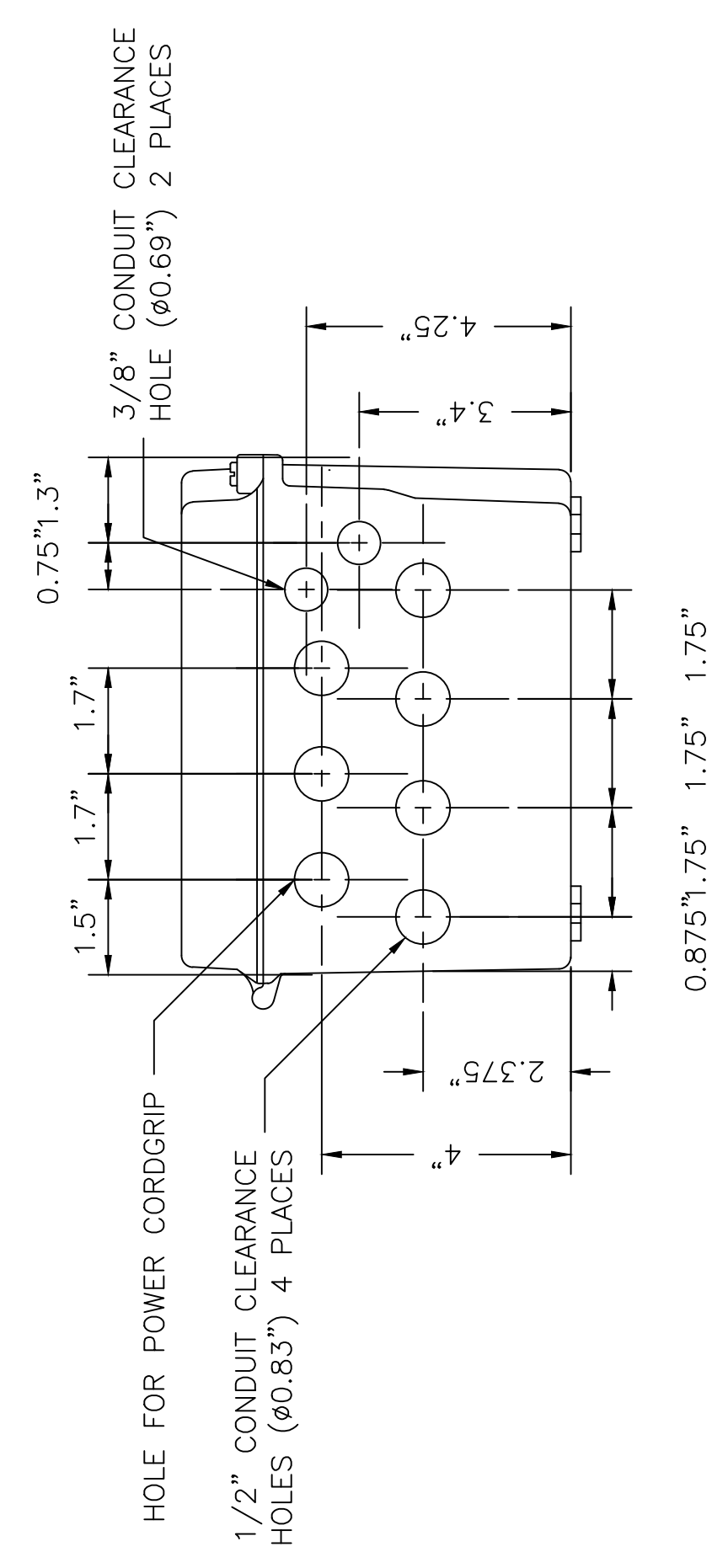
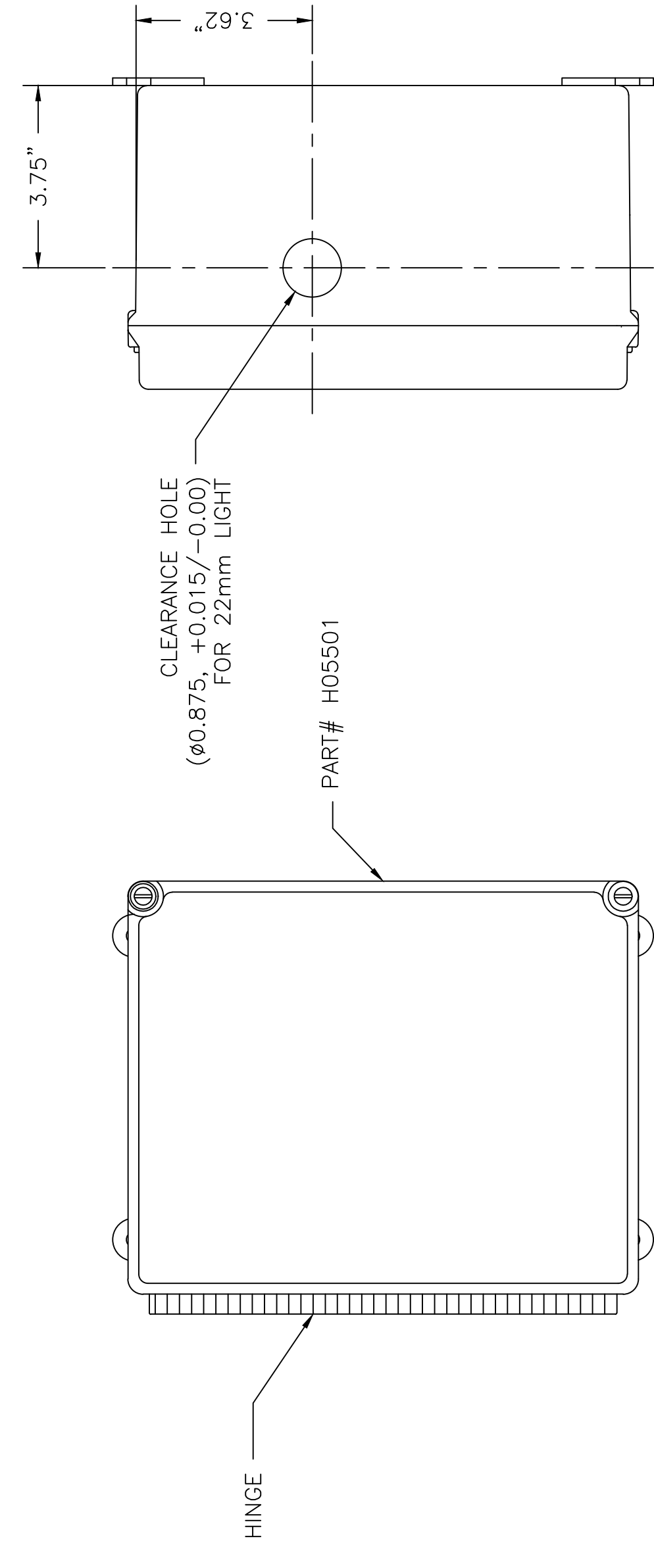
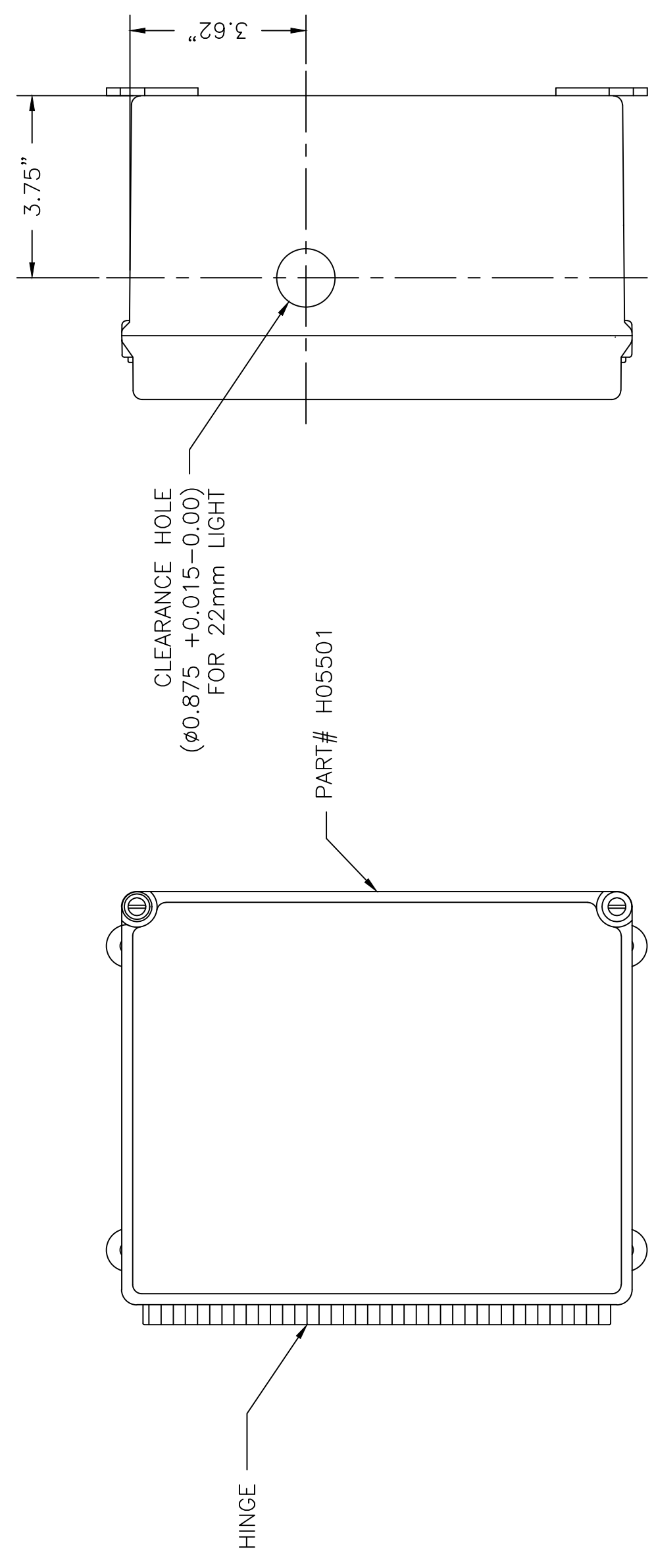
MODEL	ITEM	QTY	PART NO.	DESCRIPTION
SIGNATURES DATE				
OWN:	SRB		5/10/00	
APVD:				
QA:				
DIMENSIONS ARE IN INCHES TOLERANCES UNLESS SPECIFIED OTHERWISE:				
2 PL ±0.05	FRACTION ±1/32			
3 PL ±0.020	ANGLE ±1.0°			
SCALE: NONE	FILE: 2028742RE			SHEET 1 OF 2

HTD HEAT TRACE, INC.
FLEMINGTON, NJ

TITLE: TYPE 2SPCP UNCLASSIFIED (NON-HAZARDOUS) AREA CONTROLLER
120 VAC, 26 A MAXIMUM

CONTRACT NUMBER: NONE
DRAWING NUMBER: 2028742
REV: E

REVISIONS			
REV	DESCRIPTION	APPROVED	DATE
-	INITIAL RELEASE	SRB	5/10/00
D	ADDITIONAL DETAIL ADDED	SRB	7/17/14
E	INSTRUCTION LABEL P/N, ETL LABEL	SRB	9/26/14



DRILLING FOR ENCLOSURE STYLE
2028742

DRILLING FOR ENCLOSURE STYLE
2028742P

MODEL	ITEM	QTY	PART NO.	DESCRIPTION
SIGNATURES	DATE	HTD HTD HEAT TRACE, INC.		
DWN: SRB	5/10/00	WHITEHOUSE, NJ 08888		
APP'D:		TITLE		
OK		TYPE 2SPCP UNCLASSIFIED (NON-HAZARDOUS)		
DIMENSIONS ARE IN INCHES		AREA CONTROLLER		
UNLESS OTHERWISE SPECIFIED		120 VAC, 26 A MAXIMUM		
2 PL ±0.05 FRACTION #1/32		DRAWING NUMBER		
3 PL ±0.020 ANGLE ±1.0°		2028742P2		
SCALE:	NONE	FILE:	2028742P2RE	SHEET 2 OF 2

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