UNITHERM™ | Engineering Design Guide For Steam Electric Products

- **Parallel Circuit Constant Power Density (CPD) Heater 2252 / 2262**

- **Parallel Circuit Self-Regulating (SR) Heater 2256 / 2266**

Preface

This Engineering Design Guide is directed to the design engineer as a guide for the use of Unitherm products and accessories in a heat traced system.

Product Design Specifications

Unitherm electric trace tubing products are designed to provide even heating to the tube (s) through-out the entire length of product and to obtain a thermal insulation configuration which will have the ultimate in efficiency and still produces a final product which is round and small enough to facilitate easy installation**.**

The product design consists of a process tube (s), an electric heating element, moisture resistant, non-wicking, inorganic fibrous glass thermal insulation, and an outer covering of a smooth, continuously extruded 105ºC black polyvinylchoride.

Performance Data

The performance data contained in this guide was generated by actual tests under laboratory conditions. Actual values will vary under differing field conditions.

Temperature Conversions

C		F	C		F	C		F
-40	-40	-40	7.2	45	113.0	35.0	95	203.0
-34	-30	-22	7.8	46	114.8	35.6	96	204.8
			8.3	47	116.6	36.1	98	206.6
-29	-20	-4	8.9	48	118.4	36.7	98	208.4
-23	-10	14	9.4	49	120.2	37.2	99	210.2
-17.8	0	32	10.0	50	122.0	38	100	212
-17.2	1	33.8	10.6	51	123.8	43	100	230
-16.7	2	35.6	11.1	52	125.6	49	120	248
-16.1	3	37.4	11.7	53	127.4	54	130	266
-15.6	4	39.2	12.2	54	129.2	60	140	284
-15.0	5	41.0	12.8	55	131.0	66	150	302
-14.4	6	42.8	13.3	56	132.8	71	160	320
-13.9	7	44.6	13.9	57	134.6	77	170	338
-13.3	8	46.4	14.4	58	136.4	82	180	356
-12.8	9	48.2	15.0	59	138.2	88	190	374
-12.2	10	50.0	15.6	60	140.0	93	200	392
-11.7	11	51.8	16.1	61	141.8	99	210	410
-11.1	12	53.6	16.7	62	143.6	100	212	413.6
-10.6	13	55.4	17.2	63	145.4	104	220	428
-10.0	14	57.2	17.8	64	147.2	110	230	446
-9.4	15	59.0	18.3	65	149.0	116	240	464
-8.9	16	60.8	18.9	66	150.8	121	250	482
-8.3	17	62.6	19.4	67	152.8	127	260	500
-7.8	18	64.4	20.0	68	154.4	132	270	518
-7.2	19	66.2	69	69	156.2	138	280	536
-6.7	2.0	68.0	21.1	70	158.0	143	290	554
-6.1	21	69.8	21.7	71	159.8	149	300	572
-5.6	22	71.6	22.2	72	161.6	154	310	590
-5.0	23	73.4	22.8	73	163.4	160	320	608
-4.4	24	75.2	23.3	74	165.2	166	330	626
-3.9	25	77.0	23.9	75	167.0	171	340	644
-3.3	26	78.8	24.4	76	168.8	177	350	662
-2.8	27	80.6	25.0	77	170.6	182	360	680
-2.2	28	82.4	25.6	78	172.4	188	370	698
-1.7	29	84.2	26.1	79	174.2	193	380	716
-1.1	30	86.0	26.7	80	176.0	199	390	734
-0.6	31	87.8	27.2	81	177.8	204	400	752
0.0	32	89.6	27.8	82	179.6	210	410	770
0.6	33	91.4	28.3	83	181.4	216	420	788
1.1	34	93.2	28.9	84	183.2	221	430	806
1.7	35	95.0	29.4	85	185.0	227	440	824
2.2	36	96.8	30.0	86	186.0	232	450	842
2.8	37	98.6	30.6	87	188.6	238	460	860
3.3	38	100.4	31.1	88	190.4	243	470	878
3.9	39	102.2	31.7	89	192.2	249	480	896
4.4	40	104.0	32.2	90	194.0	254	490	914
5.0	41	105.8	32.8	91	195.8			
5.6	42	107.6	33.3	92	197.6			
6.1	43	109.4	33.9	93	199.4			
6.7	44	111.2	34.4	94	201.2			

To convert from PSI	to Bar	multiply by .0690
To convert from Feet	to Meters	multiply by .3048
To convert from Inch	to Centimeters	multiply by 2.54
To convert from Volts/Foot	to Volts/Meter	multiply by 3.281
To convert from Watt/Foot	to Watts/Meter	multiply by 3.281
To convert from Amps/Foot	to Amps/ Meter	multiply by 3.281

UNITHERM ™ 2252/2262 Parallel Circuit Heating

Principal of Operation

Unitherm 2252/2262 CPD electric trace tubing system is comprised of tinned copper braided Constant Power Density heating element, single or dual process tube (s), a heat reflecting foil wrap, moisture resistant, non-wicking, inorganic, fibrous glass thermal insulation, and a 105ºC black flame retardant PVC jacket. This unique Constant Power Density heating element allows for a wide range of temperature maintenance applications. The standard product is available from (240ºF @ 80ºF ambient) with 11.4 Watt/foot @ 120 VAC heating element. Designs are Factory Mutual approved for Class 1, Division 2, Groups B, C & D hazardous locations.

Features

- CPD (Constant Power Density heating element
- Pre-insulated and prefabricated for fast, easy installation.
- Consistent and predictable thermal characteristics.
- Maintenance free
- Class I, Division 2 design.

Applications

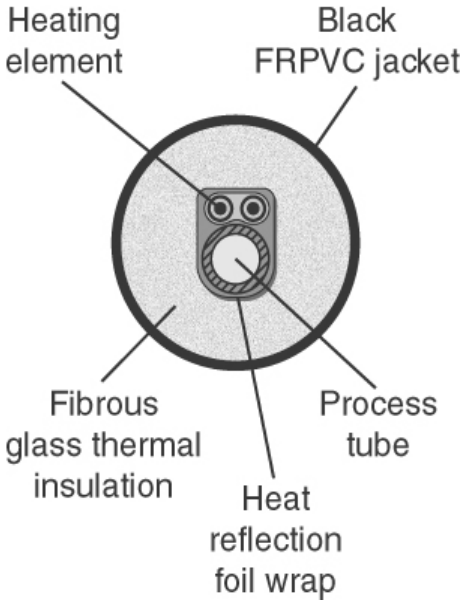
- Stack gas sampling lines
- Analyzer and instrument lines
- Small diameter process lines
- Impulse lines

How to Specify Example: 2252-20A14

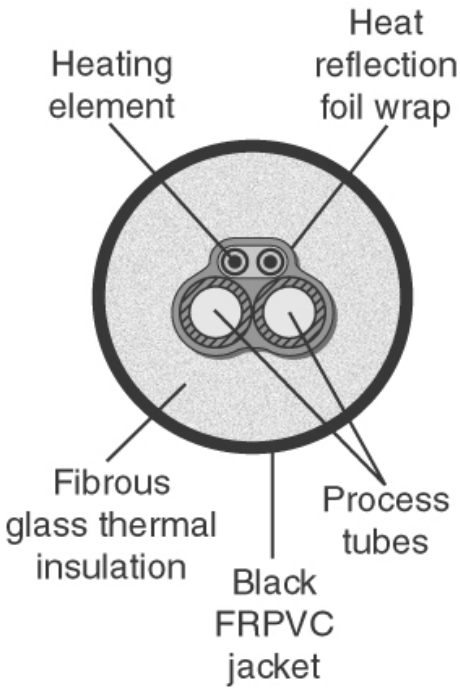
Unitherm CPD electric trace tubing (1) 1/4“ O.D. x .035” wall 316-Welded S/S tube; 11.4 W/ft @ 120 VAC CPD tinned copper braided heating element; moisture resistant, non-wicking, inorganic fibrous glass thermal insulation; 105ºC black PVC jacket; MTR**= 400ºF

- *Maximum Temperature Rating is the design condition for which this product is manufactured. Temperatures in excess of this rating may result in deterioration of the components or changes in the operational characteristics.

2252
Single Tube



2262
Dual Tube



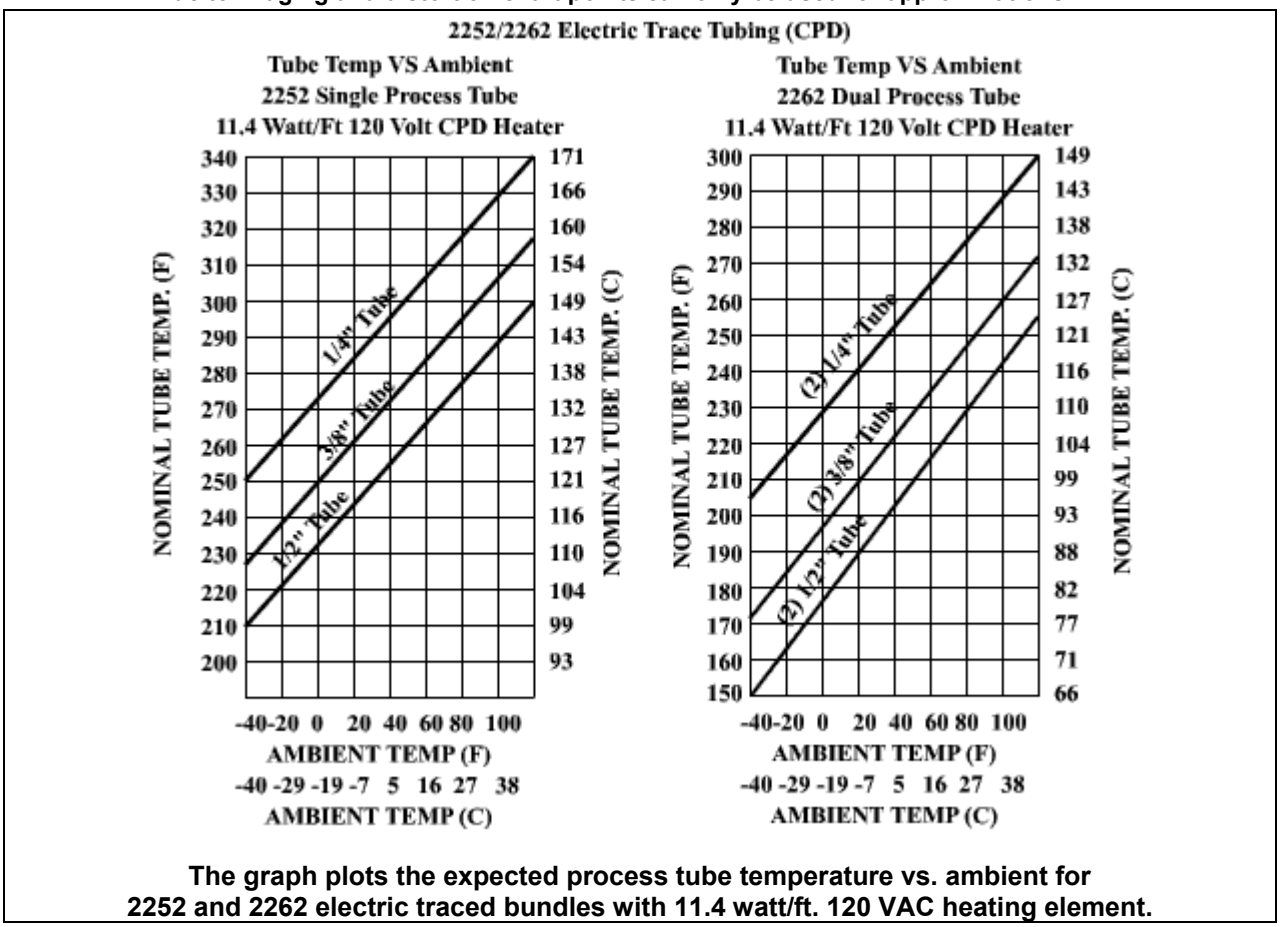
Electrical Specifications

The heating element is a constant power density heater composed of two parallel standard nickel-plated copper bus wire, with spiral wound grids of high resistance nickel-chromium wire with alternating bus contacts at fixed intervals to form a chain of parallel grids of equal resistance, therefore, producing equal power output in each grid. The heating element Factory Mutual approved use in Class I, Division 2, Groups B, C & D; Class II, Division 2, Groups F & G, Class III, Division 2 areas when enclosed in a metallic braid and used with Unitherm accessories and kits. Factory mutual approvals require the use of Unitherm accessories.

Bus Wires….	12 AWG standard nickel-plated copper
Operating Voltage……..	120 to 277 VAC depending upon heater rating
Heating Wire.	Solid Nichrome Wire
Temperature Rating ……..	450ºF (232ºC)
Electrical Insulation….	PFA Fluoropolymer
Bus Contact Interval…….	24 Inches
Maximum Current…….	25 amps (rated ampacity of bus wires per NEC article 310)

Performance Curves 2252/2262

Due to imaging and distortion chart points can only be used for approximations.



The graph plots the expected process tube temperature vs. ambient for 2252 and 2262 electric traced bundles with 11.4 watt/ft. 120 VAC heating element.

Power & Control Methods for UNITHERM 2252/2262 Bundles

Unitherm generally recommends the use of a temperature controller or thermostat with 2252 and 2262 series bundles. Application of full line voltage without the use of a controller will result in wide variations in the process tube temperature, as seen in the graphs above.
The user must be certain that the fluctuations in process tube temperature will not affect the process or alter the analysis due to viscosity changes, condensation, boil-off, or other variations in the process fluid.

Temperature Controllers

When fine control of process tube temperature is required, UNITHERM recommends the use of an electronic temperature controller. These controllers use the output of a customer installed temperature sensor (thermocouple or RTD) to control the power to the CPD heating element. Electronic temperature controllers can generally maintain the process tube temperature within a few degrees. The UNITHERM series 80 electronic temperature controller is ideally suited for this purpose. For further information see the section on controllers in the catalog.

Thermostats

Thermostats are useful when the customer wishes to maintain the process within a wide range of temperatures (usually +10ºF), or if a high or low limit set-point is desired.
UNITHERM offers a line of ambient and line sensing thermostats of general purpose or hazardous locations. Details of these thermostats are in the Accessories section of this catalog.