

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™ steam trace tubing products are designed to provide even heating to the tube(s) throughout the entire length of product and to

obtain a thermal insulation configuration which will have the ultimate in efficiency and still produce a final product which is round and small enough to facilitate easy installation.

The product design consists of a process tube(s); a tracer tube(s); hydrophobic, inorganic, fibrous glass thermal insulation; and an outer covering of a smooth, continuously extruded, 105°C black polyvinylchloride jacket – 80 mills in thickness.

Performance Data

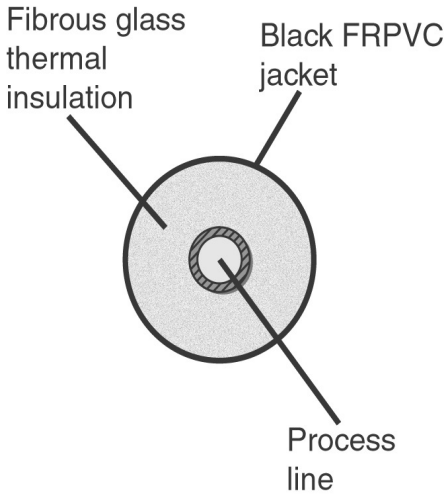
The performance data contained in this guide was generated by actual tests under laboratory conditions. Actual values will vary under differing field conditions.

Conversion Factors

MOLLIER CHART				Temperature Conversions											
1 BTU = 778.26 FT.LB., 1 KW.HR = 3412.75 BTU				C		F		C		F		C		F	
Absolute Pressure, Lb. Per Sq. In.	Saturation Temperature Deg. Fahr.	Absolute Pressure, Lb. Per Sq. In.	Saturation Temperature Deg. Fahr.	C	F	C	F	C	F	C	F	C	F	C	F
14.696	212.00	260	404.42	-40	-40	7.2	45	113.0	35.0	95	203.0				
16	216.32	280	411.05	-34	-30	7.8	46	114.8	35.6	96	204.8				
18	222.41	300	417.33			8.3	47	116.6	36.1	98	206.6				
20	227.96	325	424.74	-29	-20	8.9	48	118.4	36.7	98	208.4				
22	233.07	350	431.72	-23	-10	9.4	49	120.2	37.2	99	210.2				
				-17.8	0	32	50	122.0	38	100	212				
24	237.8	375	438.32	-17.2	1	33.8	51	123.8	43	100	230				
26	242.25	400	444.59	-16.7	2	35.6	52	125.6	49	120	248				
28	246.41	450	456.28	-16.1	3	37.4	53	127.4	54	130	266				
30	250.33	500	467.01	-15.6	4	39.2	54	129.2	60	140	284				
35	259.28	550	476.94												
				-15.0	5	41.0	55	131.0	66	150	302				
40	267.25	600	486.21	-14.4	6	42.8	56	132.8	71	160	320				
45	274.44	650	494.90	-13.9	7	44.6	57	134.6	77	170	338				
50	281.01	700	503.10	-13.3	8	46.4	58	136.4	82	180	356				
55	287.07	750	510.86	-12.8	9	48.2	59	138.2	88	190	374				
60	292.71	800	518.23												
				-12.2	10	50.0	60	140.0	93	200	392				
65	297.97	850	525.26	-11.7	11	51.8	61	141.8	99	210	410				
70	302.92	900	531.98	-11.1	12	53.6	62	143.6	100	212	413.6				
75	307.60	950	538.42	-10.6	13	55.4	63	145.4	104	220	428				
80	312.03	1000	544.61	-10.0	14	57.2	64	147.2	110	230	446				
85	316.25	1100	556.31												
				-9.4	15	59.0	65	149.0	116	240	464				
90	320.27	1200	567.22	-8.9	16	60.8	66	150.8	121	250	482				
95	324.12	1300	577.46	-8.3	17	62.6	67	152.8	127	260	500				
100	327.81	1400	587.10	-7.8	18	64.4	68	154.4	132	270	518				
112	334.77	1500	596.23	-7.2	19	66.2	69	156.2	138	280	536				
120	341.25	1600	604.90												
				-6.7	20	68.0	70	158.0	143	290	554				
130	347.32	1700	613.15	-6.1	21	69.8	71	159.8	149	300	572				
140	353.02	1800	621.02	-5.6	22	71.6	72	161.6	154	310	590				
150	358.42	1900	628.58	-5.0	23	73.4	73	163.4	160	320	608				
160	363.53	2000	635.82	-4.4	24	75.2	74	165.2	166	330	626				
170	368.41	2200	649.46												
				-3.9	25	77.0	75	167.0	171	340	644				
180	373.06	2400	662.12	-3.3	26	78.8	76	168.8	177	350	662				
190	377.51	2600	673.94	-2.8	27	80.6	77	170.6	182	360	680				
200	381.79	2800	684.99	-2.2	28	82.4	78	172.4	188	370	698				
220	389.86	3000	695.36	-1.7	29	84.2	79	174.2	193	380	716				
240	397.37	3206.2	705.40												
				-1.1	30	86.0	80	176.0	199	390	734				
				-0.6	31	87.8	81	177.8	204	400	752				
				0.0	32	89.6	82	179.6	210	410	770				
				0.6	33	91.4	83	181.4	216	420	788				
				1.1	34	93.2	84	183.2	221	430	806				
				1.7	35	95.0	85	185.0	227	440	824				
				2.2	36	96.8	86	186.0	232	450	842				
				2.8	37	98.6	87	188.6	238	460	860				
				3.3	38	100.4	88	190.4	243	470	878				
				3.9	39	102.2	89	192.2	249	480	896				
				4.4	40	104.0	90	194.0	254	490	914				
				5.0	41	105.8	91	195.8							
				5.6	42	107.6	92	197.6							
				6.1	43	109.4	93	199.4							
				6.7	44	111.2	94	201.2							

To convert from PSI to Bar multiply by .0690
 To convert from feet to Meters multiply by .3048
 To convert from inches to Centimeter multiply by 2.54
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2200
Pre-Insulated Tubing



Principal of Operation

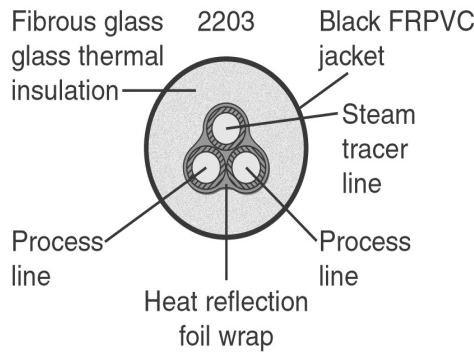
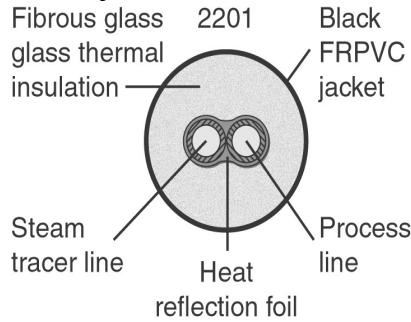
Unitherm 2200 pre-insulated tubing is a thermally insulated steam, gas or liquid transportation line. It is comprised of a process tube; hydrophobic inorganic fibrous glass thermal insulation; and weather protective black 105°C PVC jacket. This energy efficient surface temperatures of 140°F (60°C) or lower at 80°F (26°C) ambient conditions, while transporting 400°F (204°C) 232.6 PSIG saturated steam. The compact design, thermal efficiency and rugged jacket provide an insulated product with low heat loss, zero maintenance, employee protection and saves up to 50% on installation cost. Alternate jacket materials available for special applications.

How to Specify

Example: 2200-41A49

Unitherm pre-insulated line; (1) 1 1/2" O.D. x .049" wall #122 copper process line; hydrophobic inorganic fibrous glass thermal insulation; 105°C black PVC jacket; MTR* = 400°F

2201/2203
Heavy Steam Trace Tubing



Principal of Operation

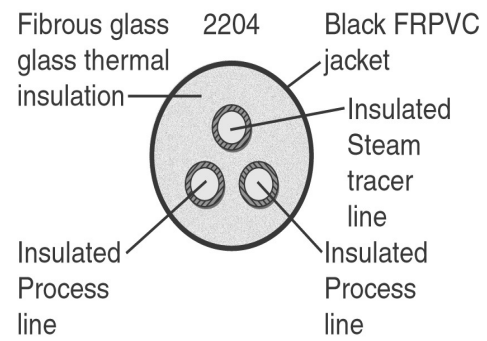
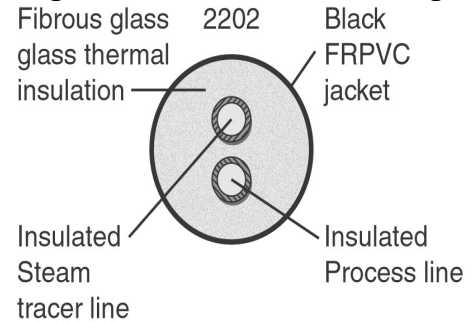
Unitherm 2201/2203 pre-insulated steam trace consists of single and multiple process lines; single tracer line; hydrophobic inorganic fibrous glass thermal insulation; and a black 105°C PVC jacket. It is designed for **heavy** tracing of process, sampling and impulse lines to help prevent freezing, to decrease fluid viscosity and protect against low temperature degradation. This highly efficient, compact product is designed to limit the jacket to a nominal surface temperature of 140°F (60°C) or lower at 80°F (26°C) ambient conditions, with tracer temperatures at 400°F (204°C) 232.6 PSIG saturated steam. Alternate jacket materials available for special applications.

How to Specify

Example: 2201-20A21

Unitherm steam trace tubing (1) 1 1/4" O.D. x .035" wall 316-Welded S/S process tube; (1) 1 1/4" O.D. x .035" wall #122 copper tracer line; hydrophobic inorganic fibrous glass thermal insulation; 105°C black PVC jacket; MTR* = 400°F

2202/2204
Light Steam Trace Tubing



Principal of Operation

Unitherm 2202/2204 pre-insulated steam trace consists of single and multiple process lines; single tracer line; hydrophobic inorganic fibrous glass thermal insulation; and a black 105°C PVC jacket. It is designed for **heavy** tracing of process, sampling and impulse lines to help prevent freezing, to decrease fluid viscosity and protect against low temperature degradation. This highly efficient, compact product is designed to limit the jacket to a nominal surface temperature of 140°F (60°C) or lower at 80°F (26°C) ambient conditions, with tracer temperatures at 400°F (204°C) 232.6 PSIG saturated steam. Higher temperatures designs for tracing applications up to 1000°F are available.

How to Specify

Example: 2202-20A21

Unitherm steam trace tubing (1) 1 1/4" O.D. x .035" wall 316-Welded S/S process tube; (1) 1 1/4" O.D. x .035" wall #122 copper tracer line; hydrophobic inorganic fibrous glass thermal insulation; 105°C black PVC jacket; MTR* = 400°F

Instructions for use of Performance Curves for 2201 Family

2201-	20A21	30A21	40A21	30A31	40A31
Temperature	1.00	.995	.990	1.058	1.040
Distance	1.00	.853	.760	2.086	2.049

The following graphs are plots of the process tube temperature versus run length for various steam pressure and ambient temperature conditions.

The graphs are used to determine:

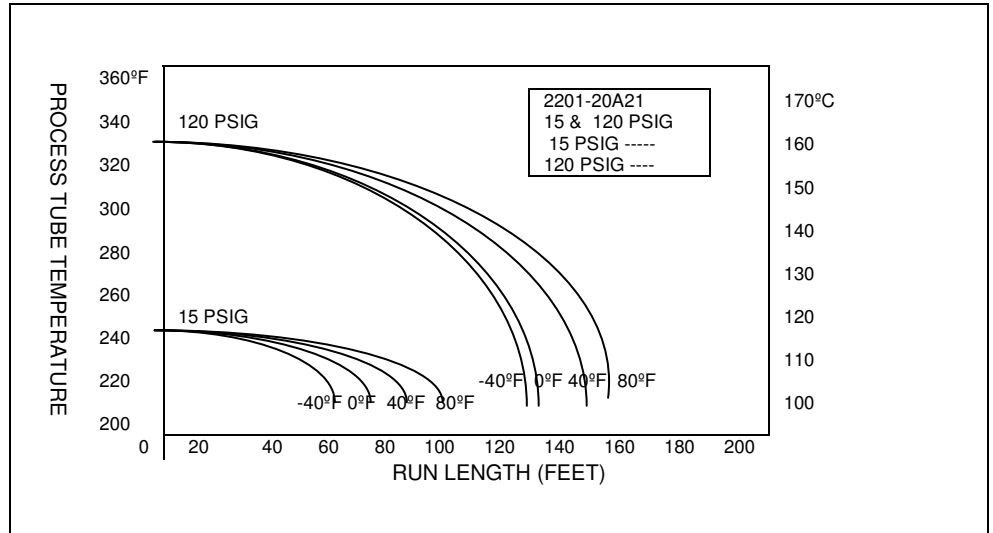
- 1 Maximum run length to maintain a given temperature:

Locate the minimum allowable process tube temperature on the Y-axis. Draw a line horizontally to intersect the lowest expected ambient. Drop a line vertically to intersect the X-axis. The point of intersection is the maximum run length to maintain a given temperature.

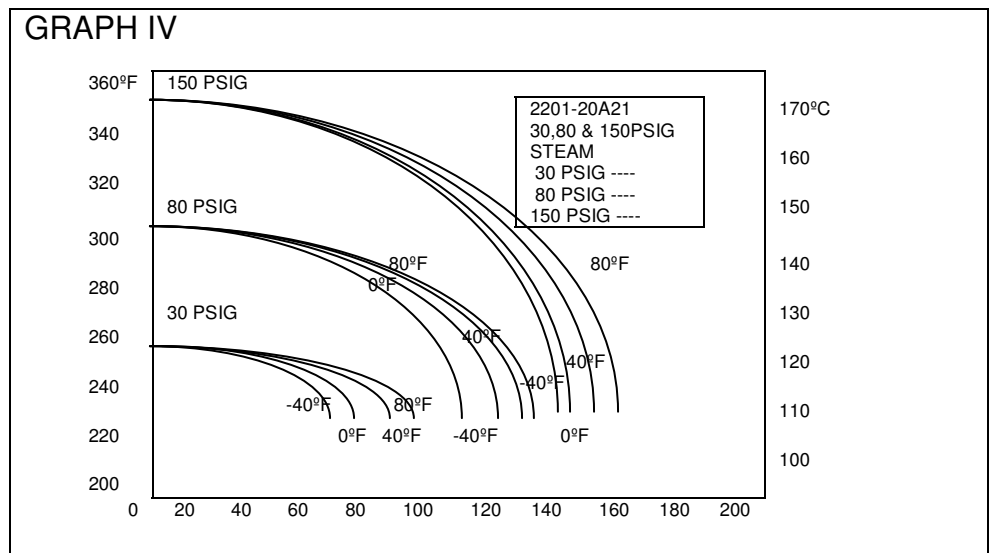
- 2 The graphs are for one product in a family.

For other specific products in the same family, take the given value from the graph and multiply by the factors given in the table at the top of each page.

GRAPH III



GRAPH IV



Instructions for use of Performance Curves for 2203 Family

2203-	30B31	40B31
Temperature	1.00	.969
Distance	1.00	.902

The following graphs are plots of the process tube temperature versus run length for various steam pressure and ambient temperature conditions.

The graphs are used to determine:

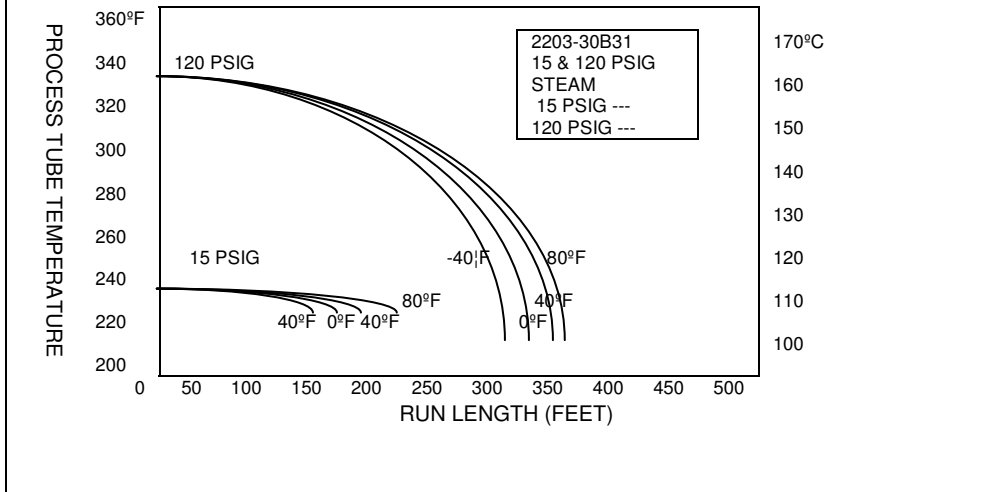
- Maximum run length to maintain a given temperature:

Locate the minimum allowable process tube temperature on the Y-axis. Draw a line horizontally to intersect the lowest expected ambient. Drop a line vertically to intersect the X-axis. The point of intersection is the maximum run length to maintain a given temperature.

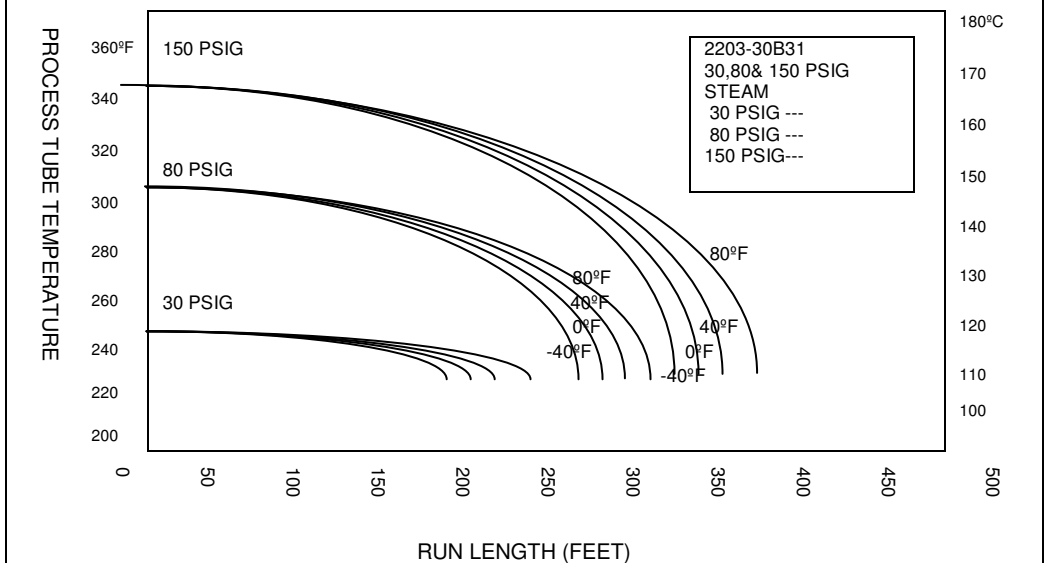
- The graphs are for one product in a family.

For other specific products in the same family, take the given value from the graph and multiply by the factors given in the table at the top of each page.

GRAPH V



GRAPH VI



Instructions for use of Performance Curves for 2202 Family

2202-	20A21	30A21	40A21	40A31
Temperature	1.00	.995		
Distance	1.00	.853		

The following graphs are plots of the process tube temperature versus run length for various steam pressure and ambient temperature conditions.

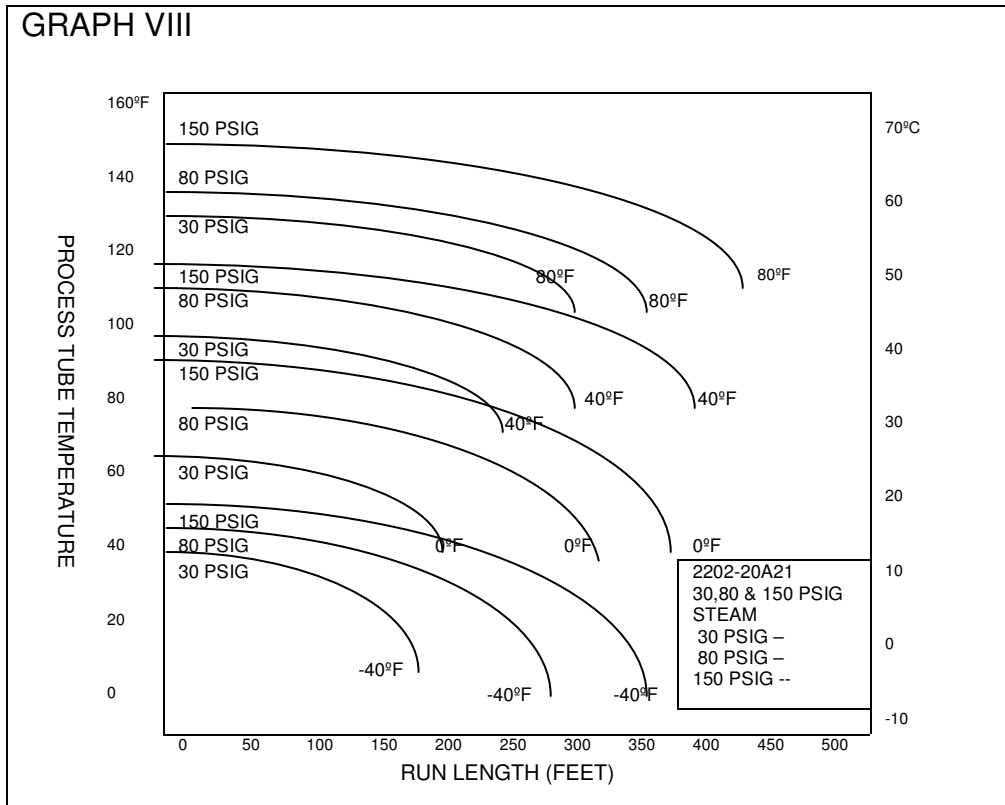
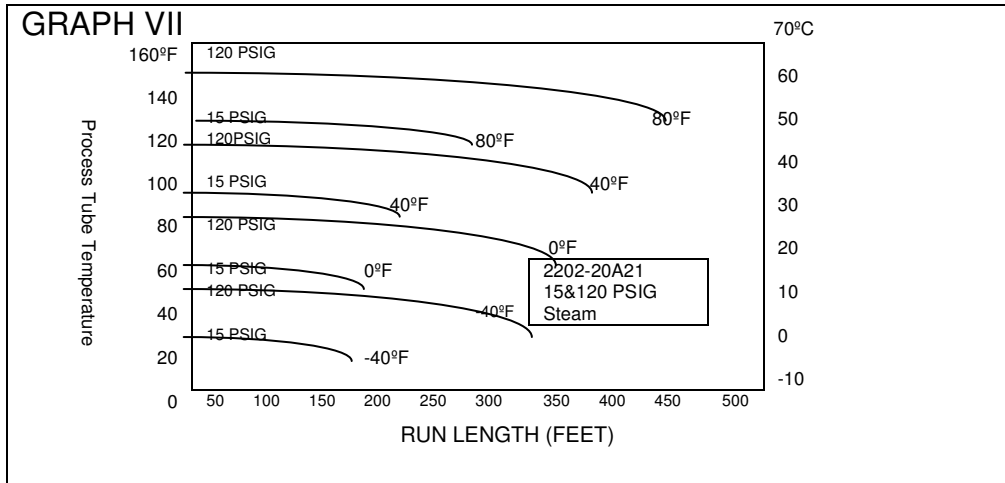
The graphs are used to determine:

- 1 Maximum run length to maintain a given temperature:

Locate the minimum allowable process tube temperature on the Y-axis. Draw a line horizontally to intersect the lowest expected ambient. Drop a line vertically to intersect the X-axis. The point of intersection is the maximum run length to maintain a given temperature.

- 2 The graphs are for one product in a family.

For other specific products in the same family, take the given value from the graph and multiply by the factors given in the table at the top of each page.



Instructions for use of Performance Curves for 2204 Family

2204-	30B31	40B31
Temperature	1.00	.980
Distance	1.00	.900

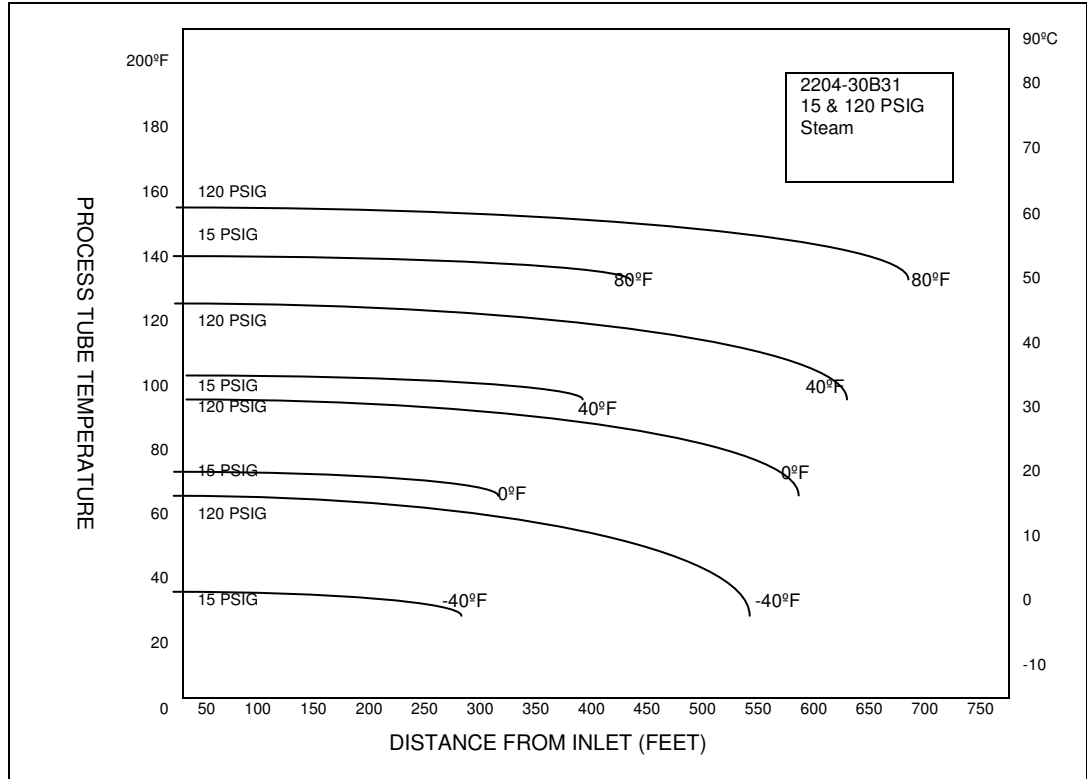
GRAPH IX

The following graphs are plots of the process tube temperature versus run length for various steam pressure and ambient temperature conditions.

The graphs are used to determine:

- Maximum run length to maintain a given temperature:

Locate the minimum allowable process tube temperature on the Y-axis. Draw a line horizontally to intersect the lowest expected ambient. Drop a line vertically to intersect the X-axis. The point of intersection is the maximum run length to maintain a given temperature.



- The graphs are for one product in a family.

For other specific products in the same family, take the given value from the graph and multiply by the factors given in the table at the top of each page.

GRAPH X

