

## IN-LINE HEATING OF LIQUIDS BY DIRECT CONTACT STEAM INJECTION

ELMRIDGE "TLH" Series Liqui-Jet Line-Type Heaters are a highly efficient and economical means of heating small to large volumes of liquids 'in-line.' The liquid to be heated is accelerated through a specially designed narrow-angle full-cone converging nozzle where it emerges at high velocity as a multitude of liquid droplets. These liquid droplets provide a considerably larger surface area upon which steam can condense than a solid stream of liquid of equal volume flowrate would provide. Steam is introduced into the liquid flow through the annular orifice formed by the outside of the liquid nozzle and the inlet to the diffuser section of the heater. Note that steam hammer is much less likely to occur in a heater of this style. Temperature rise versus water and steam flowrates for standard models are shown below, and special units are also available to meet your specifications. Standard materials of construction are Bronze / Brass, Cast Iron / Steel, and 316L Stainless Steel. Other materials are available upon request. Threaded, Flanged, or Sanitary Connections.



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**Table 1**

Approximate Temperature Rise (Deg. F), for a TLH5  
Liqui-Jet Line-Type Heater using Water & Dry Sat. Steam  
(Discharge Pressure at or above Steam Pressure)

Steam Press. (psig)	Inlet Water Pressure (psig)									Steam Consumed (lb/hr)
	20	30	40	50	60	80	100	120	140	
5	73	61	53	48	44	39	35	32	30	435
10	77	65	56	51	47	41	37	34	32	463
15	104	88	75	68	63	55	50	46	42	623
20	124	104	90	81	75	66	59	55	50	741
25	139	117	101	92	85	74	67	61	57	834
30	153	129	111	101	93	82	73	67	62	917
35	170	144	124	112	103	91	82	75	69	1019
40	190	161	138	125	116	101	91	84	78	1141
50	**	187	161	146	135	118	106	97	90	1325
60	**	**	181	164	152	133	120	110	102	1493
70	**	**	**	189	175	153	138	127	117	1723
80	**	**	**	**	195	171	154	141	131	1923
90	**	**	**	**	**	188	169	155	144	2110
100	**	**	**	**	**	**	181	167	154	2268
<b>Inlet Water Flowrate (usgpm)</b>	12.0	14.2	16.5	18.2	19.7	22.5	25.0	27.2	29.4	

\*\* - Uncondensed Steam may exit heater

**Table 2 Capacity Factors**

Model	TLH1	TLH2	TLH3	TLH4	TLH5	TLH6	TLH7	TLH8	TLH9	TLH10	TLH11	TLH12	TLH13	TLH14	TLH15	TLH16
Capacity Factor	0.091	0.165	0.30	0.55	1.00	1.80	2.64	3.88	5.70	8.38	12.3	18.1	26.5	39.0	57.3	84.1

**HEATING LIQUIDS**

**APPLICATION EXAMPLES**

EXAMPLE 1:

It is required to provide 42.5 usgpm of water to a process at 135 Deg. F. Plant water is available at 60 psig with a minimum temperature of 55 Deg. F. Steam is available at 40 psig.

1. From table TLH-1, the TLH5 Liqui-Jet Line-Type Heater operating with 60 psig water has a flowrate of 19.7 usgpm.

2. The required water flowrate is 42.5 usgpm, therefore the required Capacity Factor is:

$$42.5 / 19.7 = 2.16$$

3. The TLH7 Line-Type Heater with a Capacity Factor of 2.64 should be used. If the water flowrate is to be throttled, the required inlet pressure is approx:

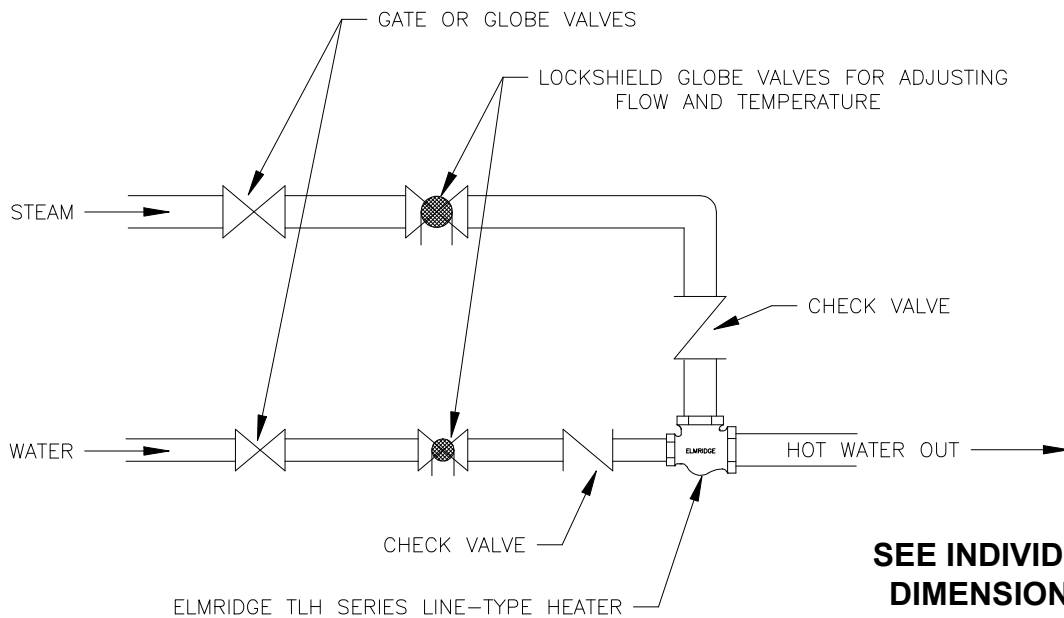
$$(42.5 / (19.7 \times 2.64))^2 \times 60 = 40 \text{ psig}$$

4. The required temperature rise is:

$$135 - 55 = 80 \text{ Deg. F}$$

5. From table TLH-1, for a TLH5 Line-Type Heater running with 40 psig water, the inlet steam pressure required to achieve a temperature rise of 80 Deg. F is approximately 20 psig. The steam consumption of the TLH7 at 20 psig is:

$$741 \times 2.64 = 1956 \text{ lb/hr}$$



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