English version

ULTIMHEAT® MUSEUM

Jacques Jumeau

Technology of components used in heating.

Chapter 41

Table of time needed to heat a volume of liquid

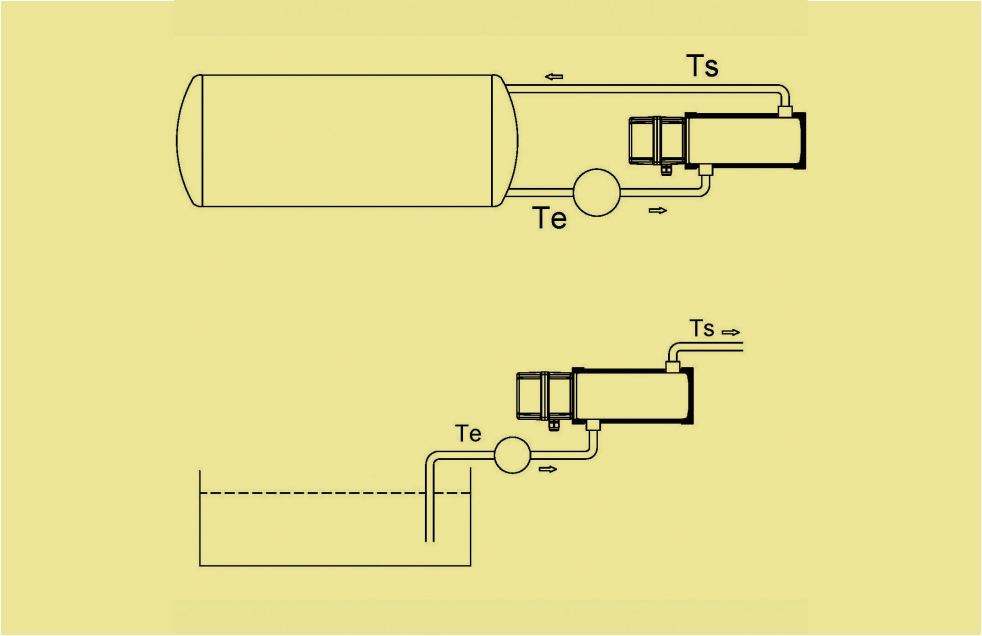

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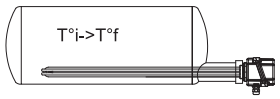
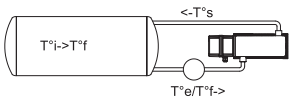
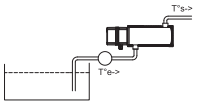
Table of time needed to heat a volume of liquid

A/ Use of immersion heaters to raise the temperature of liquid in tanks	B/ Using a circulation heater to raise the temperature of liquid in tanks	C/ Using a circulation heater to raise the temperature of a flow of liquid in a single pass
		
$P = \frac{V \times \rho \times Cp\,(T^\circ f - T^\circ i)}{3600 \times t}$	$\Delta T^\circ = \frac{P \times 3600}{Q \times \rho \times Cp}$	$P = \frac{Q \times \rho \times Cp\,(T^\circ s - T^\circ e)}{3600}$
With P= Heater output kW V=Volume of liquid in m3 ρ= Density in kg/ m3 Cp = Specific heat in kJ/kg°C Tf = Required temperature in °C Ti = Starting temperature in °C t = Required warm up time in hours	With P=Heater output kW Q =m3/hour ρ= Density in kg/ m3 Cp = Specific heat in kJ/kg°C	With P=Heater output kW Q = Flow rate in m3/hour ρ= Density in kg/ m3 Cp = Specific heat in kJ/kg°C Ts = Outlet temperature in °C Te = Inlet temperature in °C

Note: If the flow is in liters per minute divide by 1000 then multiplicate by 60 the resulting output P. These values must be increased to compensate heat losses and safety margin.

Temperature rise in °C per hour/ water volume/ power (For estimation only)

Power supply (KW)	**Heated Volume (L)**						
	3L (usual volume of a dia 125mm x 300mm tank)		**100L**	**200L**	**300L**	**500L**	**1000L**
	°C/h	°C/min*	°C/h	°C/h	°C/h	°C/h	°C/h
1	267	4	8.0	4.0	2.7	1.6	0.8
1.5	400	7	12.0	6.0	4.0	2.4	1.2
2	533	9	16.0	8.0	5.3	3.2	1.6
2.5	667	11	20.0	10.0	6.7	4.0	2.0
3	800	13	24.0	12.0	8.0	4.8	2.4
3.5	933	16	28.0	14.0	9.3	5.6	2.8
4	1067	18	32.0	16.0	10.7	6.4	3.2
4.5	1200	20	36.0	18.0	12.0	7.2	3.6
5	1333	22	40.0	20.0	13.3	8.0	4.0
5.5	1467	24	44.0	22.0	14.7	8.8	4.4
6	1600	27	48.0	24.0	16.0	9.6	4.8
6.5	1733	29	52.0	26.0	17.3	10.4	5.2
7	1867	31	56.0	28.0	18.7	11.2	5.6
8	2133	36	64.0	32.0	21.3	12.8	6.4
9	2400	40	72.0	36.0	24.0	14.4	7.2

* NB: For most of thermal safety devices, the maximum temperature rise they can control without thermal drift is 1°C per minute (60°C/h). Measuring a temperature rise inside a stainless steel pocket or on a stainless steel pipe or tank surface will add a temperature drift in measured values if temperature rise rate is higher than 0.5°C/min.