

<b>PROJECT :</b>			<b>DATE :</b>	
<b>CLIENT:</b>			<b>BY :</b>	S.Rahimi
<b>PROJ. NO. :</b>			<b>REV :</b>	
<b>UNIT :</b>			<b>DOC NO.:</b>	

**Pipe Heat Gain/Loss Calculation (Stagnant flow)**

<b>Fluid Properties</b>	Time	3 AM	6 AM	9 AM	12 AM	3 PM	6 PM	9 PM	12 PM
Fluid Temperature	°C	35.62	33.91	33.30	34.36	36.89	39.02	39.17	37.68
Fluid Average Heat Capacity	KJ/kg K	1.009	1.009	1.009	1.009	1.009	1.009	1.009	1.009
Fluid Viscosity	Cp	1.97E-02	1.96E-02	1.96E-02	1.96E-02	1.97E-02	1.99E-02	1.99E-02	1.98E-02
Fluid Thermal Conductivity	W/m K	2.60E-02	2.59E-02	2.58E-02	2.59E-02	2.61E-02	2.62E-02	2.62E-02	2.61E-02
Fluid Density	kg/m3	11.334	11.397	11.419	11.380	11.288	11.211	11.205	11.259

**Pipe & Insulation Specifications**

Pipe Inside diameter (D1)	m	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
Pipe Thermal Conductivity	W/m K	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000
Insulation Thickness	m	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Insulation Thermal conductivity	W/m K	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021
Ambient Heat Transfer Coe. (Hout)	W/m <sup>2</sup> K	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000
Ambient Temperature	C	25.0	30.0	40.0	50.0	50.0	40.0	30.0	25.0

**Calculation Results**

Pipe Outside Diameter (D2)	m	0.089	0.089	0.089	0.089	0.089	0.089	0.089	0.089
Insulation Outside Dia.(D3)	m	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189
Nu	----	22.46	16.69	19.72	25.42	23.81	10.68	21.13	23.49
Inside Heat Transfer Coe.(Hin)	W/m <sup>2</sup> K	7.050	5.214	6.152	7.952	7.500	3.383	6.697	7.414
Pipe inside area (A1)	m <sup>2</sup>	5.200	5.200	5.200	5.200	5.200	5.200	5.200	5.200
Pipe outside area (A2)	m <sup>2</sup>	5.583	5.583	5.583	5.583	5.583	5.583	5.583	5.583
Insulation Outside Area (A3)	m <sup>2</sup>	11.863	11.863	11.863	11.863	11.863	11.863	11.863	11.863
R1 (pipe internal heat resistance)	K/W	2.73E-02	3.69E-02	3.13E-02	2.42E-02	2.56E-02	5.69E-02	2.87E-02	2.59E-02
R2 (pipe metal heat resistance)	K/W	3.14E-05	3.14E-05	3.14E-05	3.14E-05	3.14E-05	3.14E-05	3.14E-05	3.14E-05
R3 (insulation heat resistance)	K/W	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01
R4 (pipe external heat resistance)	K/W	1.69E-03	1.69E-03	1.69E-03	1.69E-03	1.69E-03	1.69E-03	1.69E-03	1.69E-03
Total Heat Resistance (Rt)	K/W	3.15E-01	3.24E-01	3.19E-01	3.12E-01	3.13E-01	3.44E-01	3.16E-01	3.13E-01
Overall Heat Transfer Coe. (Ht)	W/K	3.177	3.083	3.137	3.209	3.194	2.904	3.163	3.191

**Final Calculation**

Exposure Time	hr	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Pipe Surface Area	m <sup>2</sup>	5.583	5.583	5.583	5.583	5.583	5.583	5.583	5.583
Heat Gain	KJ	-2034	-727	1267	3026	2524	171	-1749	-2440
Mass of Entrapped Gas	kg	1178.7	1185.2	1187.5	1183.5	1173.9	1165.9	1165.3	1170.9
Fluid Temperature	C	33.91	33.30	34.36	36.89	39.02	39.17	37.68	35.62

**Notes**

