


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

### External Force Convection Heat Transfer Coefficient

<b>System Input Data</b>		
Pipe/Vessel Diameter	m	0.3
Wall Temperature	C	200
Fluid Temperature	C	0
Fluid Velocity	m/s	5

<b>Fluid Input Data</b>		
Film Temperature (Tf)	C	100
Fluid Density at Tf	kg/m <sup>3</sup>	1.026604
Fluid Cp at Tf	j/kgC	1005.986
Fluid Viscosity at Tf	kg/ms	2.22E-05
Fluid Conductivity at Tf	w/mC	2.96E-02

<b>Calculation Results</b>		
Dynamic Viscosity	m <sup>2</sup> /s	2.16E-05
Re	----	6.93E+04
C	----	0.0266
n	----	0.805
Pr	----	0.754
Nu	----	191.0
<b>Heat Transfer Coefficient</b>	<b>w/m<sup>2</sup>C</b>	<b>18.86</b>
<b>Heat Transfer Coefficient</b>	<b>w/m<sup>2</sup>C</b>	<b>17.12</b>

<b>Notes</b>

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### Internal Force Convection Heat Transfer Coefficient

<b>System Input Data</b>		
Pipe/Vessel Diameter	m	1
Wall Temperature	C	90
Fluid Temperature	C	50
Fluid Velocity	m/s	1

<b>Fluid Input Data</b>		
Film Temperature (Tf)	C	70
Fluid Density at Tf	kg/m <sup>3</sup>	978
Fluid Cp at Tf	J/kgC	4174.0
Fluid Viscosity at Tf	kg/ms	4.00E-04
Fluid Viscosity at Fluid Tem.	kg/ms	5.55E-04
Fluid Viscosity at Wall Tem.	kg/ms	2.81E-04
Fluid Conductivity at Tf	w/mC	0.664

<b>Calculation Results</b>		
Dynamic Viscosity	m <sup>2</sup> /s	4.09E-07
Re	----	2.45E+06
Friction factor	----	0.0218
Pr	----	2.514
Nu	----	11062.1
<b>Heat Transfer Coefficient</b>	<b>w/m<sup>2</sup>C</b>	<b>7345.24</b>

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### External Free Convection Heat Transfer Coefficient

<b>System Input Data</b>		
Pipe/Vessel Orientation	---	ver
Pipe/Vessel Diameter	m	0.5
Pipe/Vessel Length	m	3
Wall Temperature	C	593
Fluid Temperature	C	0

<b>Fluid Input Data</b>		
Film Temperature (Tf)	C	297
Fluid Density at Tf	kg/m <sup>3</sup>	0.338
Fluid Cp at Tf	J/kgC	3149.0
Fluid Viscosity at Tf	kg/ms	1.87E-05
Fluid Conductivity at Tf	w/mC	0.080

<b>Calculation Results</b>		
Heat Transfer dimension	m	3
C	----	0.1
m	----	0.3333
B	1/K	1.76E-03
Gr	---	9.03E+10
Pr	----	0.740
Gr Pr	----	6.68E+10
Nu	----	405.492
<b>Heat Transfer Coefficient</b>	<b>w/m<sup>2</sup>C</b>	<b>10.75</b>

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### Internal Free Convection Heat Transfer Coefficient (Gas)

<b>System Input Data</b>		
Pipe/Vessel Orientation	---	hor
Pipe/Vessel Diameter	m	0.025
Pipe/Vessel Length	m	2
Wall Temperature	C	400
Gas Temperature	C	235.7

<b>Fluid Input Data</b>		
Film Temperature (Tf)	C	318
Gas Density at Tf	kg/m <sup>3</sup>	6.74
Gas Cp at Tf	J/kgC	2840
Gas Viscosity at Tf	kg/ms	1.75E-05
Gas Conductivity at Tf	w/mC	6.42E-02

<b>Calculation Results</b>		
heat Transfer dimension	m	0.025
C	----	0.061
n	----	0.333
m	----	0
B	1/K	1.69E-03
Gr	---	6.32E+06
Pr	----	0.774
Gr Pr	----	4.89E+06
Nu	----	10.304
<b>Heat Transfer Coefficient</b>	<b>w/m<sup>2</sup>C</b>	<b>26.46</b>

#### Notes

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### Internal Free Convection Heat Transfer Coefficient (Liquid)

<b>System Input Data</b>		
Pipe/Vessel Orientation	---	hor
Pipe/Vessel Diameter	m	0.01
Pipe/Vessel Length	m	0.5
Wall Temperature	C	37
Liquid Temperature	C	26.6

<b>Fluid Input Data</b>		
Film Temperature (Tf)	C	32
Liquid Density at Tf	kg/m <sup>3</sup>	994
Liquid Cp at Tf	J/kgC	4174
Liquid Viscosity at Tf	kg/ms	7.65E-04
Liquid Conductivity at Tf	w/mC	0.62

<b>Calculation Results</b>		
Heat Transfer dimension	m	0.01
C	----	0.13
n	----	0.3
m	----	0
B	1/K	2.92E-04
Gr	---	5.02E+04
Pr	----	5.125
Gr Pr	----	2.57E+05
Nu	----	5.460
<b>Heat Transfer Coefficient</b>	<b>w/m<sup>2</sup>C</b>	<b>340.13</b>

<b>Notes</b>