

University of Idaho Department of Chemical Engineering  
 DOUBLE PIPE HEAT EXCHANGER Prediction Program Rel. 2/8/92  
 Ch. E. 434 Laboratory D. C. Drown

Date: Jan 29, 2009 Time: 23: 0:14

Input File Name: gl.dat

Start Iteration Loop  
 Flow = 3.000 GPM  
 Inlet Temperature = 19.50 C

Steam Temperature = 119.88 T Wall Guess = 95.00  
 T Out Guess = 71.00

Steam Pressure = 14.00 PSIG + Temperature = 247.797 Deg F  
 H Vaporization = 946.98 BTU/LB Density= 0.069775 LB/FT3  
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 14.00 PSIG + Temperature = 119.885 Deg C  
 H Vaporization = 2202774. J/Kg Density = 1.1177 Kg/M3  
 Fouling - Inside = .0000000 Outside = .0000000  
 Temperature Convergence to 0.010 Degrees

N	T Wall C	T Out C	Re No.	H Inside Watts / Sq. Meter	H Outside BTU / Sq. Feet	U
	Units = F	F				
1	61.8 143.3	26.0 78.8	41860.	23611. 4158.	10295. 1813.	5963. 1050.
	Dittus-Boelter T film Pr.33 = 4433. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 4158.					
	Nusselt Ent. = 5607.					
	Sieder-Tate = 4725.					
	Sleicher-Rouse = 4444.					
	Petukhov-Popov = 4682. T V					
	McAdams T bulk = 4054. 72.9 20.72					
	McAdams T film = 4924. 108.1					
2	64.9 148.8	32.3 90.1	46448.	24854. 4377.	10477. 1845.	6144. 1082.
	Dittus-Boelter T film Pr.33 = 4635. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 4377.					
	Nusselt Ent. = 5863.					
	Sieder-Tate = 4982.					
	Sleicher-Rouse = 4731.					
	Petukhov-Popov = 4916. T V					
	McAdams T bulk = 4338. 84.4 20.72					
	McAdams T film = 5135. 116.6					
3	68.0 154.4	38.3 101.0	51518.	26124. 4601.	10668. 1879.	6328. 1114.
	Dittus-Boelter T film Pr.33 = 4841. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 4601.					
	Nusselt Ent. = 6124.					
	Sieder-Tate = 5246.					

			Sleicher-Rouse =	5019.		
			Petukhov-Popov =	5149.	T	V
			McAdams T bulk =	4613.	95.5	20.72
			McAdams T film =	5341.	125.0	
4	71.1	44.1	57072.	27414.	10868.	6513.
	159.9	111.4		4828.	1914.	1147.
			Dittus-Boelter T film Pr.33 =	5050.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	4828.		
			Nusselt Ent. =	6388.		
			Sieder-Tate =	5512.		
			Sleicher-Rouse =	5304.		
			Petukhov-Popov =	5378.	T	V
			McAdams T bulk =	4877.	106.2	20.72
			McAdams T film =	5543.	133.1	
5	74.1	49.7	63092.	28714.	11076.	6700.
	165.5	121.5		5057.	1951.	1180.
			Dittus-Boelter T film Pr.33 =	5259.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	5057.		
			Nusselt Ent. =	6652.		
			Sieder-Tate =	5780.		
			Sleicher-Rouse =	5586.		
			Petukhov-Popov =	5600.	T	V
			McAdams T bulk =	5131.	116.4	20.72
			McAdams T film =	5738.	141.0	
6	77.2	55.0	69535.	30011.	11294.	6887.
	170.9	131.0		5286.	1989.	1213.
			Dittus-Boelter T film Pr.33 =	5465.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	5286.		
			Nusselt Ent. =	6914.		
			Sieder-Tate =	6046.		
			Sleicher-Rouse =	5859.		
			Petukhov-Popov =	5815.	T	V
			McAdams T bulk =	5374.	126.2	20.72
			McAdams T film =	5926.	148.6	

Flow Rate = 3.000 GPM Steam Pressure = 14.00 PSIG

Temperature IN = 19.5 Degrees C 67.1 F  
 Temperature OUT = 55.0 Degrees C 131.0 F  
 Steam Temperature = 119.9 Degrees C 247.8 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	61.8	143.3	26.0	78.8
23.333	64.9	148.8	32.3	90.1
35.000	68.0	154.4	38.3	101.0
46.667	71.1	159.9	44.1	111.4
58.333	74.1	165.5	49.7	121.5
70.000	77.2	170.9	55.0	131.0

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Date: Jan 29, 2009 Time: 23: 0:48

Input from KEYBOARD for Case Number: 2

Start Iteration Loop  
 Flow = 2.800 GPM  
 Inlet Temperature = 19.50 C

Steam Temperature = 119.88 T Wall Guess = 77.00  
 T Out Guess = 59.00

Steam Pressure = 14.00 PSIG + Temperature = 247.797 Deg F  
 H Vaporization = 946.98 BTU/LB Density= 0.069775 LB/FT3  
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 14.00 PSIG + Temperature = 119.885 Deg C  
 H Vaporization = 2202774. J/Kg Density = 1.1177 Kg/M3  
 Fouling - Inside = .0000000 Outside = .0000000  
 Temperature Convergence to 0.010 Degrees

N	T Wall C	T Out C	Re No.	H Inside Watts / Sq. Meter	H Outside BTU / Sq. Feet	U
	Units = F	F				
1	63.4 146.1	26.3 79.4	39172.	22372. 3940.	10387. 1829.	5866. 1033.
				Dittus-Boelter T film Pr.33 = 4231. BTU/Ft2 F		
				Dittus-Boelter T bulk Pr.4 = 3940.		
				Nusselt Ent. = 5352.		
				Sieder-Tate = 4494.		
				Sleicher-Rouse = 4200.		
				Petukhov-Popov = 4423. T V		
				McAdams T bulk = 3843. 73.3 19.33		
				McAdams T film = 4696. 109.7		
2	66.5 151.7	32.9 91.3	43707.	23612. 4158.	10576. 1863.	6056. 1067.
				Dittus-Boelter T film Pr.33 = 4431. BTU/Ft2 F		
				Dittus-Boelter T bulk Pr.4 = 4158.		
				Nusselt Ent. = 5606.		
				Sieder-Tate = 4751.		
				Sleicher-Rouse = 4485.		
				Petukhov-Popov = 4656. T V		
				McAdams T bulk = 4126. 85.3 19.33		
				McAdams T film = 4903. 118.5		
3	69.7 157.4	39.3 102.7	48744.	24881. 4382.	10775. 1898.	6248. 1100.
				Dittus-Boelter T film Pr.33 = 4636. BTU/Ft2 F		
				Dittus-Boelter T bulk Pr.4 = 4382.		
				Nusselt Ent. = 5865.		
				Sieder-Tate = 5013.		

			Sleicher-Rouse =	4772.		
			Petukhov-Popov =	4888.	T	V
			McAdams T bulk =	4399.	97.0	19.34
			McAdams T film =	5106.	127.2	
4	72.8	45.3	54281.	26170.	10984.	6442.
	163.0	113.6		4609.	1934.	1135.
			Dittus-Boelter T film Pr.33 =	4843.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	4609.		
			Nusselt Ent. =	6126.		
			Sieder-Tate =	5278.		
			Sleicher-Rouse =	5056.		
			Petukhov-Popov =	5115.	T	V
			McAdams T bulk =	4661.	108.2	19.34
			McAdams T film =	5304.	135.6	
5	75.9	51.2	60297.	27467.	11203.	6637.
	168.7	124.1		4837.	1973.	1169.
			Dittus-Boelter T film Pr.33 =	5049.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	4837.		
			Nusselt Ent. =	6387.		
			Sieder-Tate =	5544.		
			Sleicher-Rouse =	5335.		
			Petukhov-Popov =	5335.	T	V
			McAdams T bulk =	4912.	118.8	19.34
			McAdams T film =	5495.	143.8	
6	79.0	56.7	66739.	28758.	11432.	6832.
	174.2	134.0		5065.	2013.	1203.
			Dittus-Boelter T film Pr.33 =	5252.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	5065.		
			Nusselt Ent. =	6644.		
			Sieder-Tate =	5808.		
			Sleicher-Rouse =	5604.		
			Petukhov-Popov =	5547.	T	V
			McAdams T bulk =	5151.	129.0	19.34
			McAdams T film =	5679.	151.6	

Flow Rate = 2.800 GPM Steam Pressure = 14.00 PSIG

Temperature IN = 19.5 Degrees C 67.1 F  
 Temperature OUT = 56.7 Degrees C 134.0 F  
 Steam Temperature = 119.9 Degrees C 247.8 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	63.4	146.1	26.3	79.4
23.333	66.5	151.7	32.9	91.3
35.000	69.7	157.4	39.3	102.7
46.667	72.8	163.0	45.3	113.6
58.333	75.9	168.7	51.2	124.1
70.000	79.0	174.2	56.7	134.0

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Input from KEYBOARD for Case Number: 3

Start Iteration Loop  
 Flow = 2.400 GPM  
 Inlet Temperature = 19.50 C

Steam Temperature = 119.88 T Wall Guess = 80.00  
 T Out Guess = 58.00

Steam Pressure = 14.00 PSIG + Temperature = 247.797 Deg F  
 H Vaporization = 946.98 BTU/LB Density= 0.069775 LB/FT3  
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 14.00 PSIG + Temperature = 119.885 Deg C  
 H Vaporization = 2202774. J/Kg Density = 1.1177 Kg/M3  
 Fouling - Inside = .0000000 Outside = .0000000  
 Temperature Convergence to 0.010 Degrees

N	T Wall C	T Out C	Re No.	H Inside Watts / Sq. Meter	H Outside BTU / Sq. Feet	U
	Units = F	F				
1	67.0 152.5	27.1 80.8	33785.	19836. 3494.	10604. 1868.	5640. 993.
	Dittus-Boelter T film Pr.33 = 3814. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 3494.					
	Nusselt Ent. = 4825.					
	Sieder-Tate = 4020.					
	Sleicher-Rouse = 3704.					
	Petukhov-Popov = 3897. T V					
	McAdams T bulk = 3411. 74.0 16.57					
	McAdams T film = 4224. 113.3					
2	70.2 158.3	34.5 94.1	38194.	21067. 3710.	10808. 1903.	5848. 1030.
	Dittus-Boelter T film Pr.33 = 4010. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 3710.					
	Nusselt Ent. = 5073.					
	Sieder-Tate = 4273.					
	Sleicher-Rouse = 3986.					
	Petukhov-Popov = 4127. T V					
	McAdams T bulk = 3690. 87.4 16.57					
	McAdams T film = 4424. 122.9					
3	73.4 164.1	41.5 106.7	43147.	22330. 3933.	11025. 1942.	6059. 1067.
	Dittus-Boelter T film Pr.33 = 4210. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 3933.					
	Nusselt Ent. = 5326.					
	Sieder-Tate = 4531.					

			Sleicher-Rouse =	4269.		
			Petukhov-Popov =	4355.	T	V
			McAdams T bulk =	3958.	100.4	16.57
			McAdams T film =	4618.	132.3	
4	76.6	48.2	48638.	23612.	11256.	6272.
	170.0	118.7		4158.	1982.	1105.
			Dittus-Boelter T film Pr.33 =	4412.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	4158.		
			Nusselt Ent. =	5581.		
			Sieder-Tate =	4792.		
			Sleicher-Rouse =	4548.		
			Petukhov-Popov =	4578.	T	V
			McAdams T bulk =	4214.	112.7	16.57
			McAdams T film =	4807.	141.4	
5	79.9	54.5	54632.	24898.	11500.	6487.
	175.8	130.2		4385.	2025.	1142.
			Dittus-Boelter T film Pr.33 =	4611.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	4385.		
			Nusselt Ent. =	5833.		
			Sieder-Tate =	5053.		
			Sleicher-Rouse =	4821.		
			Petukhov-Popov =	4793.	T	V
			McAdams T bulk =	4457.	124.5	16.57
			McAdams T film =	4988.	150.1	
6	83.1	60.5	61038.	26168.	11761.	6701.
	181.5	140.9		4609.	2071.	1180.
			Dittus-Boelter T film Pr.33 =	4804.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	4609.		
			Nusselt Ent. =	6077.		
			Sieder-Tate =	5309.		
			Sleicher-Rouse =	5081.		
			Petukhov-Popov =	4996.	T	V
			McAdams T bulk =	4687.	135.5	16.57
			McAdams T film =	5163.	158.5	

Flow Rate = 2.400 GPM Steam Pressure = 14.00 PSIG

Temperature IN = 19.5 Degrees C 67.1 F  
 Temperature OUT = 60.5 Degrees C 140.9 F  
 Steam Temperature = 119.9 Degrees C 247.8 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	67.0	152.5	27.1	80.8
23.333	70.2	158.3	34.5	94.1
35.000	73.4	164.1	41.5	106.7
46.667	76.6	170.0	48.2	118.7
58.333	79.9	175.8	54.5	130.2
70.000	83.1	181.5	60.5	140.9

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Input from KEYBOARD for Case Number: 4

Start Iteration Loop  
 Flow = 2.000 GPM  
 Inlet Temperature = 19.50 C

Steam Temperature = 119.88 T Wall Guess = 85.00  
 T Out Guess = 63.00

Steam Pressure = 14.00 PSIG + Temperature = 247.797 Deg F  
 H Vaporization = 946.98 BTU/LB Density= 0.069775 LB/FT3  
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 14.00 PSIG + Temperature = 119.885 Deg C  
 H Vaporization = 2202774. J/Kg Density = 1.1177 Kg/M3  
 Fouling - Inside = .0000000 Outside = .0000000  
 Temperature Convergence to 0.010 Degrees

N	T Wall C	T Out C	Re No.	H Inside Watts / Sq. Meter	H Outside BTU / Sq. Feet	U
	Units = F	F				
1	71.3 160.3	28.2 82.7	28378.	17210. 3031.	10880. 1916.	5353. 943.
	Dittus-Boelter T film Pr.33 = 3375. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 3031.					
	Nusselt Ent. = 4270.					
	Sieder-Tate = 3524.					
	Sleicher-Rouse = 3196.					
	Petukhov-Popov = 3356. T V					
	McAdams T bulk = 2964. 74.9 13.80					
	McAdams T film = 3727. 117.6					
2	74.5 166.1	36.4 97.6	32623.	18424. 3245.	11101. 1955.	5585. 984.
	Dittus-Boelter T film Pr.33 = 3565. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 3245.					
	Nusselt Ent. = 4510.					
	Sieder-Tate = 3771.					
	Sleicher-Rouse = 3473.					
	Petukhov-Popov = 3582. T V					
	McAdams T bulk = 3237. 90.1 13.80					
	McAdams T film = 3916. 128.1					
3	77.8 172.1	44.3 111.8	37464.	19673. 3465.	11341. 1997.	5819. 1025.
	Dittus-Boelter T film Pr.33 = 3758. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 3465.					
	Nusselt Ent. = 4754.					
	Sieder-Tate = 4024.					

			Sleicher-Rouse =	3750.		
			Petukhov-Popov =	3806.	T	V
			McAdams T bulk =	3497.	104.7	13.80
			McAdams T film =	4100.	138.4	
4	81.1	51.7	42878.	20939.	11602.	6056.
	178.1	125.1		3688.	2043.	1067.
			Dittus-Boelter T film Pr.33 =	3951.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	3688.		
			Nusselt Ent. =	4998.		
			Sieder-Tate =	4278.		
			Sleicher-Rouse =	4023.		
			Petukhov-Popov =	4022.	T	V
			McAdams T bulk =	3744.	118.4	13.81
			McAdams T film =	4277.	148.3	
5	84.5	58.7	48799.	22200.	11884.	6293.
	184.1	137.7		3910.	2093.	1108.
			Dittus-Boelter T film Pr.33 =	4139.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	3910.		
			Nusselt Ent. =	5236.		
			Sieder-Tate =	4529.		
			Sleicher-Rouse =	4286.		
			Petukhov-Popov =	4229.	T	V
			McAdams T bulk =	3976.	131.4	13.81
			McAdams T film =	4447.	157.7	
6	87.8	65.2	55092.	23428.	12188.	6529.
	190.0	149.4		4126.	2147.	1150.
			Dittus-Boelter T film Pr.33 =	4317.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	4126.		
			Nusselt Ent. =	5462.		
			Sieder-Tate =	4772.		
			Sleicher-Rouse =	4533.		
			Petukhov-Popov =	4419.	T	V
			McAdams T bulk =	4194.	143.6	13.81
			McAdams T film =	4609.	166.8	

Flow Rate = 2.000 GPM Steam Pressure = 14.00 PSIG

Temperature IN = 19.5 Degrees C 67.1 F  
 Temperature OUT = 65.2 Degrees C 149.4 F  
 Steam Temperature = 119.9 Degrees C 247.8 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	71.3	160.3	28.2	82.7
23.333	74.5	166.1	36.4	97.6
35.000	77.8	172.1	44.3	111.8
46.667	81.1	178.1	51.7	125.1
58.333	84.5	184.1	58.7	137.7
70.000	87.8	190.0	65.2	149.4

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 Ch. E. 434 Laboratory D. C. Drown

Date: Jan 29, 2009 Time: 23: 2:39

Input from KEYBOARD for Case Number: 5

Start Iteration Loop  
 Flow = 1.600 GPM  
 Inlet Temperature = 19.50 C

Steam Temperature = 119.88 T Wall Guess = 90.00  
 T Out Guess = 68.00

Steam Pressure = 14.00 PSIG + Temperature = 247.797 Deg F  
 H Vaporization = 946.98 BTU/LB Density= 0.069775 LB/FT3  
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 14.00 PSIG + Temperature = 119.885 Deg C  
 H Vaporization = 2202774. J/Kg Density = 1.1177 Kg/M3  
 Fouling - Inside = .0000000 Outside = .0000000  
 Temperature Convergence to 0.010 Degrees

N	T Wall C	T Out C	Re No.	H Inside Watts / Sq. Meter	H Outside BTU / Sq. Feet	U
	Units = F	F				
1	76.5 169.7	29.5 85.1	22941.	14470. 2548.	11246. 1981.	4980. 877.
	Dittus-Boelter T film Pr.33 = 2907. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 2548.					
	Nusselt Ent. = 3677.					
	Sieder-Tate = 2999.					
	Sleicher-Rouse = 2673.					
	Petukhov-Popov = 2799. T V					
	McAdams T bulk = 2497. 76.1 11.04					
	McAdams T film = 3197. 122.9					
2	79.7 175.5	39.0 102.2	26968.	15654. 2757.	11489. 2023.	5240. 923.
	Dittus-Boelter T film Pr.33 = 3087. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 2757.					
	Nusselt Ent. = 3905.					
	Sieder-Tate = 3237.					
	Sleicher-Rouse = 2943.					
	Petukhov-Popov = 3018. T V					
	McAdams T bulk = 2760. 93.7 11.04					
	McAdams T film = 3372. 134.6					
3	83.1 181.5	48.0 118.3	31639.	16875. 2972.	11762. 2071.	5503. 969.
	Dittus-Boelter T film Pr.33 = 3269. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 2972.					
	Nusselt Ent. = 4136.					
	Sieder-Tate = 3480.					

			Sleicher-Rouse =	3212.		
			Petukhov-Popov =	3234.	T	V
			McAdams T bulk =	3008.	110.3	11.04
			McAdams T film =	3541.	145.9	
4	86.5	56.3	36918.	18107.	12066.	5769.
	187.7	133.4		3189.	2125.	1016.
			Dittus-Boelter T film Pr.33 =	3449.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	3189.		
			Nusselt Ent. =	4363.		
			Sieder-Tate =	3722.		
			Sleicher-Rouse =	3475.		
			Petukhov-Popov =	3441.	T	V
			McAdams T bulk =	3242.	125.9	11.04
			McAdams T film =	3704.	156.8	
5	89.9	64.1	42678.	19319.	12405.	6034.
	193.8	147.3		3402.	2185.	1063.
			Dittus-Boelter T film Pr.33 =	3619.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	3402.		
			Nusselt Ent. =	4579.		
			Sieder-Tate =	3958.		
			Sleicher-Rouse =	3723.		
			Petukhov-Popov =	3633.	T	V
			McAdams T bulk =	3459.	140.4	11.04
			McAdams T film =	3859.	167.1	
6	93.3	71.2	48697.	20471.	12780.	6294.
	199.9	160.1		3605.	2251.	1109.
			Dittus-Boelter T film Pr.33 =	3775.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	3605.		
			Nusselt Ent. =	4775.		
			Sieder-Tate =	4180.		
			Sleicher-Rouse =	3950.		
			Petukhov-Popov =	3806.	T	V
			McAdams T bulk =	3660.	153.7	11.05
			McAdams T film =	4005.	176.8	

Flow Rate = 1.600 GPM Steam Pressure = 14.00 PSIG

Temperature IN = 19.5 Degrees C 67.1 F  
 Temperature OUT = 71.2 Degrees C 160.1 F  
 Steam Temperature = 119.9 Degrees C 247.8 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	76.5	169.7	29.5	85.1
23.333	79.7	175.5	39.0	102.2
35.000	83.1	181.5	48.0	118.3
46.667	86.5	187.7	56.3	133.4
58.333	89.9	193.8	64.1	147.3
70.000	93.3	199.9	71.2	160.1

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Input from KEYBOARD for Case Number: 6

Start Iteration Loop  
 Flow = 1.200 GPM  
 Inlet Temperature = 19.50 C

Steam Temperature = 119.88 T Wall Guess = 95.00  
 T Out Guess = 75.00

Steam Pressure = 14.00 PSIG + Temperature = 247.797 Deg F  
 H Vaporization = 946.98 BTU/LB Density= 0.069775 LB/FT3  
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 14.00 PSIG + Temperature = 119.885 Deg C  
 H Vaporization = 2202774. J/Kg Density = 1.1177 Kg/M3  
 Fouling - Inside = .0000000 Outside = .0000000  
 Temperature Convergence to 0.010 Degrees

N	T Wall C	T Out C	Re No.	H Inside Watts / Sq. Meter	H Outside BTU / Sq. Feet	U
	Units = F	F				
1	83.1 181.6	31.4 88.5	17459.	11576. 2039.	11765. 2072.	4474. 788.
	Dittus-Boelter T film Pr.33 = 2396. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 2039.					
	Nusselt Ent. = 3030.					
	Sieder-Tate = 2432.					
	Sleicher-Rouse = 2134.					
	Petukhov-Popov = 2219. T V					
	McAdams T bulk = 2003. 77.8 8.27					
	McAdams T film = 2619. 129.7					
2	86.2 187.2	42.6 108.6	21173.	12707. 2238.	12040. 2120.	4768. 840.
	Dittus-Boelter T film Pr.33 = 2561. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 2238.					
	Nusselt Ent. = 3240.					
	Sieder-Tate = 2656.					
	Sleicher-Rouse = 2392.					
	Petukhov-Popov = 2426. T V					
	McAdams T bulk = 2249. 98.5 8.27					
	McAdams T film = 2776. 142.9					
3	89.5 193.1	53.0 127.3	25585.	13875. 2444.	12365. 2178.	5068. 892.
	Dittus-Boelter T film Pr.33 = 2727. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 2444.					
	Nusselt Ent. = 3450.					
	Sieder-Tate = 2883.					

			Sleicher-Rouse =	2649.			
			Petukhov-Popov =	2629.	T	V	
			McAdams T bulk =	2481.	118.0	8.28	
			McAdams T film =	2927.	155.6		
4	93.0	62.5	30607.	15043.	12743.		5368.
	199.3	144.5		2649.	2244.		945.
			Dittus-Boelter T film Pr.33 =	2885.	BTU/Ft2	F	
			Dittus-Boelter T bulk Pr.4 =	2649.			
			Nusselt Ent. =	3649.			
			Sieder-Tate =	3106.			
			Sleicher-Rouse =	2894.			
			Petukhov-Popov =	2820.	T	V	
			McAdams T bulk =	2694.	135.9	8.28	
			McAdams T film =	3071.	167.6		
5	96.4	71.1	36005.	16159.	13181.		5662.
	205.5	160.1		2846.	2321.		997.
			Dittus-Boelter T film Pr.33 =	3027.	BTU/Ft2	F	
			Dittus-Boelter T bulk Pr.4 =	2846.			
			Nusselt Ent. =	3829.			
			Sieder-Tate =	3317.			
			Sleicher-Rouse =	3116.			
			Petukhov-Popov =	2991.	T	V	
			McAdams T bulk =	2889.	152.3	8.28	
			McAdams T film =	3205.	178.9		
6	99.8	78.8	41398.	17165.	13687.		5945.
	211.6	173.9		3023.	2411.		1047.
			Dittus-Boelter T film Pr.33 =	3146.	BTU/Ft2	F	
			Dittus-Boelter T bulk Pr.4 =	3023.			
			Nusselt Ent. =	3980.			
			Sieder-Tate =	3503.			
			Sleicher-Rouse =	3307.			
			Petukhov-Popov =	3135.	T	V	
			McAdams T bulk =	3064.	167.0	8.28	
			McAdams T film =	3329.	189.3		

Flow Rate = 1.200 GPM Steam Pressure = 14.00 PSIG

Temperature IN = 19.5 Degrees C 67.1 F  
 Temperature OUT = 78.8 Degrees C 173.9 F  
 Steam Temperature = 119.9 Degrees C 247.8 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	83.1	181.6	31.4	88.5
23.333	86.2	187.2	42.6	108.6
35.000	89.5	193.1	53.0	127.3
46.667	93.0	199.3	62.5	144.5
58.333	96.4	205.5	71.1	160.1
70.000	99.8	211.6	78.8	173.9

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Input from KEYBOARD for Case Number: 7

Start Iteration Loop  
 Flow = 0.800 GPM  
 Inlet Temperature = 19.50 C

Steam Temperature = 119.88 T Wall Guess = 102.00  
 T Out Guess = 82.00

Steam Pressure = 14.00 PSIG + Temperature = 247.797 Deg F  
 H Vaporization = 946.98 BTU/LB Density= 0.069775 LB/FT3  
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 14.00 PSIG + Temperature = 119.885 Deg C  
 H Vaporization = 2202774. J/Kg Density = 1.1177 Kg/M3  
 Fouling - Inside = .0000000 Outside = .0000000  
 Temperature Convergence to 0.010 Degrees

N	T Wall C	T Out C	Re No.	H Inside Watts / Sq. Meter	H Outside BTU / Sq. Feet	U
	Units = F	F				
1	91.7 197.0	34.2 93.6	11900.	8459. 1490.	12598. 2219.	3745. 659.
	Dittus-Boelter T film Pr.33 = 1817. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 1490.					
	Nusselt Ent. = 2299.					
	Sieder-Tate = 1804.					
	Sleicher-Rouse = 1575.					
	Petukhov-Popov = 1605. T V					
	McAdams T bulk = 1469. 80.3 5.51					
	McAdams T film = 1969. 138.7					
2	94.5 202.0	47.9 118.2	15135.	9490. 1671.	12928. 2277.	4078. 718.
	Dittus-Boelter T film Pr.33 = 1960. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 1671.					
	Nusselt Ent. = 2479.					
	Sieder-Tate = 2002.					
	Sleicher-Rouse = 1812.					
	Petukhov-Popov = 1792. T V					
	McAdams T bulk = 1688. 105.9 5.51					
	McAdams T film = 2101. 154.0					
3	97.6 207.7	60.3 140.6	19096.	10556. 1859.	13352. 2352.	4418. 778.
	Dittus-Boelter T film Pr.33 = 2097. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 1859.					
	Nusselt Ent. = 2653.					
	Sieder-Tate = 2203.					

			Sleicher-Rouse =	2043.			
			Petukhov-Popov =	1973.	T	V	
			McAdams T bulk =	1891.	129.4	5.51	
			McAdams T film =	2226.	168.5		
4	100.9	71.4	23580.	11589.	13887.		4752.
	213.7	160.5		2041.	2446.		837.
			Dittus-Boelter T film Pr.33 =	2218.	BTU/Ft2	F	
			Dittus-Boelter T bulk Pr.4 =	2041.			
			Nusselt Ent. =	2806.			
			Sieder-Tate =	2393.			
			Sleicher-Rouse =	2252.			
			Petukhov-Popov =	2136.	T	V	
			McAdams T bulk =	2073.	150.5	5.52	
			McAdams T film =	2344.	182.1		
5	104.2	80.9	28116.	12507.	14547.		5066.
	219.6	177.7		2203.	2562.		892.
			Dittus-Boelter T film Pr.33 =	2314.	BTU/Ft2	F	
			Dittus-Boelter T bulk Pr.4 =	2203.			
			Nusselt Ent. =	2927.			
			Sieder-Tate =	2558.			
			Sleicher-Rouse =	2422.			
			Petukhov-Popov =	2270.	T	V	
			McAdams T bulk =	2233.	169.1	5.52	
			McAdams T film =	2450.	194.4		
6	107.4	89.0	32120.	13236.	15351.		5348.
	225.3	192.2		2331.	2704.		942.
			Dittus-Boelter T film Pr.33 =	2381.	BTU/Ft2	F	
			Dittus-Boelter T bulk Pr.4 =	2331.			
			Nusselt Ent. =	3011.			
			Sieder-Tate =	2685.			
			Sleicher-Rouse =	2548.			
			Petukhov-Popov =	2369.	T	V	
			McAdams T bulk =	2370.	185.0	5.52	
			McAdams T film =	2543.	205.1		

Flow Rate = 0.800 GPM Steam Pressure = 14.00 PSIG

Temperature IN = 19.5 Degrees C 67.1 F  
 Temperature OUT = 89.0 Degrees C 192.2 F  
 Steam Temperature = 119.9 Degrees C 247.8 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	91.7	197.0	34.2	93.6
23.333	94.5	202.0	47.9	118.2
35.000	97.6	207.7	60.3	140.6
46.667	100.9	213.7	71.4	160.5
58.333	104.2	219.6	80.9	177.7
70.000	107.4	225.3	89.0	192.2

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Input from KEYBOARD for Case Number: 8

Start Iteration Loop  
 Flow = 0.650 GPM  
 Inlet Temperature = 19.50 C

Steam Temperature = 119.88 T Wall Guess = 110.00  
 T Out Guess = 95.00

Steam Pressure = 14.00 PSIG + Temperature = 247.797 Deg F  
 H Vaporization = 946.98 BTU/LB Density= 0.069775 LB/FT3  
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 14.00 PSIG + Temperature = 119.885 Deg C  
 H Vaporization = 2202774. J/Kg Density = 1.1177 Kg/M3  
 Fouling - Inside = .0000000 Outside = .0000000  
 Temperature Convergence to 0.010 Degrees

N	T Wall C	T Out C	Re No.	H Inside Watts / Sq. Meter	H Outside BTU / Sq. Feet	U
	Units = F	F				
1	95.6 204.1	35.7 96.3	9785.	7206. 1269.	13076. 2303.	3380. 595.
			Dittus-Boelter T film Pr.33 =	1574.	BTU/Ft2 F	
			Dittus-Boelter T bulk Pr.4 =	1269.		
			Nusselt Ent. =	1991.		
			Sieder-Tate =	1544.		
			Sleicher-Rouse =	1358.		
			Petukhov-Popov =	1362.	T V	
			McAdams T bulk =	1253.	81.7 4.48	
			McAdams T film =	1698.	142.9	
2	98.2 208.8	50.7 123.2	12765.	8177. 1440.	13441. 2367.	3726. 656.
			Dittus-Boelter T film Pr.33 =	1704.	BTU/Ft2 F	
			Dittus-Boelter T bulk Pr.4 =	1440.		
			Nusselt Ent. =	2155.		
			Sieder-Tate =	1729.		
			Sleicher-Rouse =	1581.		
			Petukhov-Popov =	1538.	T V	
			McAdams T bulk =	1458.	109.7 4.48	
			McAdams T film =	1817.	159.3	
3	101.2 214.2	64.1 147.4	16462.	9179. 1617.	13936. 2454.	4079. 718.
			Dittus-Boelter T film Pr.33 =	1825.	BTU/Ft2 F	
			Dittus-Boelter T bulk Pr.4 =	1617.		
			Nusselt Ent. =	2309.		
			Sieder-Tate =	1915.		

			Sleicher-Rouse =	1795.		
			Petukhov-Popov =	1706.	T	V
			McAdams T bulk =	1644.	135.3	4.48
			McAdams T film =	1930.	174.8	
4	104.4	75.8	20584.	10126.	14582.	4420.
	219.9	168.5		1783.	2568.	778.
			Dittus-Boelter T film Pr.33 =	1927.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	1783.		
			Nusselt Ent. =	2437.		
			Sieder-Tate =	2086.		
			Sleicher-Rouse =	1980.		
			Petukhov-Popov =	1853.	T	V
			McAdams T bulk =	1809.	158.0	4.48
			McAdams T film =	2034.	188.9	
5	107.6	85.7	24542.	10921.	15409.	4729.
	225.6	186.2		1923.	2714.	833.
			Dittus-Boelter T film Pr.33 =	2000.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	1923.		
			Nusselt Ent. =	2530.		
			Sieder-Tate =	2225.		
			Sleicher-Rouse =	2120.		
			Petukhov-Popov =	1966.	T	V
			McAdams T bulk =	1951.	177.4	4.48
			McAdams T film =	2126.	201.5	
6	110.5	93.7	27708.	11495.	16439.	4992.
	230.8	200.7		2025.	2895.	879.
			Dittus-Boelter T film Pr.33 =	2043.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	2025.		
			Nusselt Ent. =	2585.		
			Sieder-Tate =	2323.		
			Sleicher-Rouse =	2211.		
			Petukhov-Popov =	2042.	T	V
			McAdams T bulk =	2069.	193.4	4.49
			McAdams T film =	2205.	212.1	

Flow Rate = 0.650 GPM Steam Pressure = 14.00 PSIG

Temperature IN = 19.5 Degrees C 67.1 F  
 Temperature OUT = 93.7 Degrees C 200.7 F  
 Steam Temperature = 119.9 Degrees C 247.8 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	95.6	204.1	35.7	96.3
23.333	98.2	208.8	50.7	123.2
35.000	101.2	214.2	64.1	147.4
46.667	104.4	219.9	75.8	168.5
58.333	107.6	225.6	85.7	186.2
70.000	110.5	230.8	93.7	200.7