

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: 23:19:30

Input File Name: g2.dat

Start Iteration Loop
 Flow = 3.000 GPM
 Inlet Temperature = 15.56 C

Steam Temperature = 106.88 T Wall Guess = 95.00
 T Out Guess = 71.00

Steam Pressure = 4.00 PSIG + Temperature = 224.395 Deg F
 H Vaporization = 962.40 BTU/LB Density= 0.046729 LB/FT3
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 4.00 PSIG + Temperature = 106.884 Deg C
 H Vaporization = 2238635. J/Kg Density = 0.7485 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	54.6 130.2	21.3 70.4	39117.	22819. 4019.	10213. 1799.	5857. 1031.
				Dittus-Boelter T film Pr.33 = 4193. BTU/Ft2 F		
				Dittus-Boelter T bulk Pr.4 = 4019.		
				Nusselt Ent. = 5304.		
				Sieder-Tate = 4499.		
				Sleicher-Rouse = 4272.		
				Petukhov-Popov = 4530. T V		
				McAdams T bulk = 3863. 65.2 20.72		
				McAdams T film = 4668. 97.7		
2	57.4 135.4	26.9 80.5	42820.	23881. 4206.	10414. 1834.	6029. 1062.
				Dittus-Boelter T film Pr.33 = 4365. BTU/Ft2 F		
				Dittus-Boelter T bulk Pr.4 = 4206.		
				Nusselt Ent. = 5521.		
				Sieder-Tate = 4718.		
				Sleicher-Rouse = 4520.		
				Petukhov-Popov = 4734. T V		
				McAdams T bulk = 4117. 75.5 20.72		
				McAdams T film = 4858. 105.4		
3	60.3 140.5	32.3 90.2	46851.	24960. 4396.	10624. 1871.	6205. 1093.
				Dittus-Boelter T film Pr.33 = 4539. BTU/Ft2 F		
				Dittus-Boelter T bulk Pr.4 = 4396.		
				Nusselt Ent. = 5742.		
				Sieder-Tate = 4942.		

			Sleicher-Rouse =	4769.		
			Petukhov-Popov =	4936.	T	V
			McAdams T bulk =	4362.	85.3	20.72
			McAdams T film =	5044.	112.9	
4	63.1	37.5	51212.	26052.	10844.	6383.
	145.5	99.5		4588.	1910.	1124.
			Dittus-Boelter T film Pr.33 =	4716.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	4588.		
			Nusselt Ent. =	5966.		
			Sieder-Tate =	5168.		
			Sleicher-Rouse =	5017.		
			Petukhov-Popov =	5136.	T	V
			McAdams T bulk =	4598.	94.9	20.72
			McAdams T film =	5225.	120.2	
5	65.8	42.5	55891.	27150.	11074.	6563.
	150.5	108.5		4782.	1950.	1156.
			Dittus-Boelter T film Pr.33 =	4894.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	4782.		
			Nusselt Ent. =	6191.		
			Sieder-Tate =	5395.		
			Sleicher-Rouse =	5262.		
			Petukhov-Popov =	5332.	T	V
			McAdams T bulk =	4824.	104.0	20.73
			McAdams T film =	5400.	127.3	
6	68.6	47.3	60868.	28247.	11314.	6746.
	155.4	117.1		4975.	1993.	1188.
			Dittus-Boelter T film Pr.33 =	5071.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	4975.		
			Nusselt Ent. =	6415.		
			Sieder-Tate =	5621.		
			Sleicher-Rouse =	5502.		
			Petukhov-Popov =	5522.	T	V
			McAdams T bulk =	5041.	112.8	20.73
			McAdams T film =	5569.	134.1	

Flow Rate = 3.000 GPM Steam Pressure = 4.00 PSIG

Temperature IN = 15.6 Degrees C 60.0 F
 Temperature OUT = 47.3 Degrees C 117.1 F
 Steam Temperature = 106.9 Degrees C 224.4 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	54.6	130.2	21.3	70.4
23.333	57.4	135.4	26.9	80.5
35.000	60.3	140.5	32.3	90.2
46.667	63.1	145.5	37.5	99.5
58.333	65.8	150.5	42.5	108.5
70.000	68.6	155.4	47.3	117.1

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 DOUBLE PIPE HEAT EXCHANGER Prediction Program Rel. 2/8/92
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Date: Jan 29, 2009 Time: 23:20: 5

Input from KEYBOARD for Case Number: 2

Start Iteration Loop
 Flow = 2.400 GPM
 Inlet Temperature = 15.56 C

Steam Temperature = 106.88 T Wall Guess = 68.00
 T Out Guess = 52.00

Steam Pressure = 4.00 PSIG + Temperature = 224.395 Deg F
 H Vaporization = 962.40 BTU/LB Density= 0.046729 LB/FT3
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 4.00 PSIG + Temperature = 106.884 Deg C
 H Vaporization = 2238635. J/Kg Density = 0.7485 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	59.4 138.9	22.4 72.3	31536.	19162. 3375.	10556. 1859.	5541. 976.
	Dittus-Boelter T film Pr.33 = 3600. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 3375.					
	Nusselt Ent. = 4554.					
	Sieder-Tate = 3823.					
	Sleicher-Rouse = 3559.					
	Petukhov-Popov = 3767. T V					
	McAdams T bulk = 3250. 66.1 16.57					
	McAdams T film = 4002. 102.5					
2	62.3 144.2	28.9 84.0	35085.	20213. 3560.	10784. 1899.	5738. 1010.
	Dittus-Boelter T film Pr.33 = 3767. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 3560.					
	Nusselt Ent. = 4765.					
	Sieder-Tate = 4039.					
	Sleicher-Rouse = 3803.					
	Petukhov-Popov = 3968. T V					
	McAdams T bulk = 3499. 78.1 16.57					
	McAdams T film = 4182. 111.2					
3	65.3 149.5	35.2 95.3	39004.	21284. 3748.	11027. 1942.	5938. 1046.
	Dittus-Boelter T film Pr.33 = 3936. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 3748.					
	Nusselt Ent. = 4980.					
	Sieder-Tate = 4259.					

			Sleicher-Rouse =	4047.		
			Petukhov-Popov =	4167.	T	V
			McAdams T bulk =	3737.	89.7	16.57
			McAdams T film =	4357.	119.6	
4	68.2	41.1	43289.	22367.	11285.	6142.
	154.8	106.1		3939.	1988.	1082.
			Dittus-Boelter T film Pr.33 =	4108.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	3939.		
			Nusselt Ent. =	5196.		
			Sieder-Tate =	4480.		
			Sleicher-Rouse =	4290.		
			Petukhov-Popov =	4362.	T	V
			McAdams T bulk =	3966.	100.7	16.58
			McAdams T film =	4526.	127.8	
5	71.2	46.8	47918.	23452.	11559.	6348.
	160.1	116.3		4130.	2036.	1118.
			Dittus-Boelter T film Pr.33 =	4278.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	4130.		
			Nusselt Ent. =	5412.		
			Sieder-Tate =	4702.		
			Sleicher-Rouse =	4527.		
			Petukhov-Popov =	4551.	T	V
			McAdams T bulk =	4183.	111.2	16.58
			McAdams T film =	4689.	135.6	
6	74.0	52.2	52851.	24529.	11850.	6556.
	165.2	125.9		4320.	2087.	1155.
			Dittus-Boelter T film Pr.33 =	4447.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	4320.		
			Nusselt Ent. =	5625.		
			Sieder-Tate =	4921.		
			Sleicher-Rouse =	4757.		
			Petukhov-Popov =	4733.	T	V
			McAdams T bulk =	4389.	121.1	16.58
			McAdams T film =	4845.	143.2	

Flow Rate = 2.400 GPM Steam Pressure = 4.00 PSIG

Temperature IN = 15.6 Degrees C 60.0 F
 Temperature OUT = 52.2 Degrees C 125.9 F
 Steam Temperature = 106.9 Degrees C 224.4 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	59.4	138.9	22.4	72.3
23.333	62.3	144.2	28.9	84.0
35.000	65.3	149.5	35.2	95.3
46.667	68.2	154.8	41.1	106.1
58.333	71.2	160.1	46.8	116.3
70.000	74.0	165.2	52.2	125.9

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 DOUBLE PIPE HEAT EXCHANGER Prediction Program Rel. 2/8/92
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Date: Jan 29, 2009 Time: 23:20:44

Input from KEYBOARD for Case Number: 3

Start Iteration Loop
 Flow = 1.800 GPM
 Inlet Temperature = 15.56 C

Steam Temperature = 106.88 T Wall Guess = 78.00
 T Out Guess = 55.00

Steam Pressure = 4.00 PSIG + Temperature = 224.395 Deg F
 H Vaporization = 962.40 BTU/LB Density= 0.046729 LB/FT3
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 4.00 PSIG + Temperature = 106.884 Deg C
 H Vaporization = 2238635. J/Kg Density = 0.7485 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	65.7 150.2	23.8 74.9	23916.	15306. 2696.	11058. 1947.	5090. 896.
	Dittus-Boelter T film Pr.33 = 2960. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 2696.					
	Nusselt Ent. = 3745.					
	Sieder-Tate = 3102.					
	Sleicher-Rouse = 2820.					
	Petukhov-Popov = 2976. T V					
	McAdams T bulk = 2603. 67.5 12.42					
	McAdams T film = 3282. 108.8					
2	68.7 155.6	31.7 89.1	27240.	16331. 2876.	11323. 1994.	5318. 937.
	Dittus-Boelter T film Pr.33 = 3118. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 2876.					
	Nusselt Ent. = 3945.					
	Sieder-Tate = 3310.					
	Sleicher-Rouse = 3055.					
	Petukhov-Popov = 3169. T V					
	McAdams T bulk = 2842. 82.0 12.42					
	McAdams T film = 3447. 118.8					
3	71.7 161.1	39.2 102.5	30982.	17377. 3060.	11614. 2045.	5551. 978.
	Dittus-Boelter T film Pr.33 = 3279. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 3060.					
	Nusselt Ent. = 4148.					
	Sieder-Tate = 3521.					

			Sleicher-Rouse =	3291.		
			Petukhov-Popov =	3361.	T	V
			McAdams T bulk =	3069.	95.8	12.43
			McAdams T film =	3606.	128.5	
4	74.8	46.2	35128.	18433.	11931.	5788.
	166.6	115.2		3246.	2101.	1019.
			Dittus-Boelter T film Pr.33 =	3439.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	3246.		
			Nusselt Ent. =	4351.		
			Sieder-Tate =	3734.		
			Sleicher-Rouse =	3522.		
			Petukhov-Popov =	3547.	T	V
			McAdams T bulk =	3284.	108.9	12.43
			McAdams T film =	3759.	137.7	
5	77.8	52.8	39632.	19483.	12277.	6028.
	172.0	127.0		3431.	2162.	1062.
			Dittus-Boelter T film Pr.33 =	3597.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	3431.		
			Nusselt Ent. =	4550.		
			Sieder-Tate =	3944.		
			Sleicher-Rouse =	3745.		
			Petukhov-Popov =	3725.	T	V
			McAdams T bulk =	3486.	121.1	12.43
			McAdams T film =	3904.	146.6	
6	80.7	58.9	44411.	20509.	12651.	6269.
	177.3	138.0		3612.	2228.	1104.
			Dittus-Boelter T film Pr.33 =	3749.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	3612.		
			Nusselt Ent. =	4742.		
			Sieder-Tate =	4148.		
			Sleicher-Rouse =	3957.		
			Petukhov-Popov =	3892.	T	V
			McAdams T bulk =	3674.	132.5	12.43
			McAdams T film =	4042.	154.9	

Flow Rate = 1.800 GPM Steam Pressure = 4.00 PSIG

Temperature IN = 15.6 Degrees C 60.0 F
 Temperature OUT = 58.9 Degrees C 138.0 F
 Steam Temperature = 106.9 Degrees C 224.4 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	65.7	150.2	23.8	74.9
23.333	68.7	155.6	31.7	89.1
35.000	71.7	161.1	39.2	102.5
46.667	74.8	166.6	46.2	115.2
58.333	77.8	172.0	52.8	127.0
70.000	80.7	177.3	58.9	138.0

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 DOUBLE PIPE HEAT EXCHANGER Prediction Program Rel. 2/8/92
 Ch. E. 434 Laboratory D. C. Drown

Date: Jan 29, 2009 Time: 23:21: 4

Input from KEYBOARD for Case Number: 4

Start Iteration Loop
 Flow = 1.200 GPM
 Inlet Temperature = 15.56 C

Steam Temperature = 106.88 T Wall Guess = 82.00
 T Out Guess = 62.00

Steam Pressure = 4.00 PSIG + Temperature = 224.395 Deg F
 H Vaporization = 962.40 BTU/LB Density= 0.046729 LB/FT3
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 4.00 PSIG + Temperature = 106.884 Deg C
 H Vaporization = 2238635. J/Kg Density = 0.7485 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	74.3 165.8	26.1 79.0	16226.	11163. 1966.	11884. 2093.	4393. 774.
	Dittus-Boelter T film Pr.33 = 2246. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 1966.					
	Nusselt Ent. = 2841.					
	Sieder-Tate = 2309.					
	Sleicher-Rouse = 2041.					
	Petukhov-Popov = 2141. T V					
	McAdams T bulk = 1905. 69.5 8.28					
	McAdams T film = 2477. 117.7					
2	77.2 171.0	36.1 97.0	19183.	12123. 2135.	12208. 2150.	4663. 821.
	Dittus-Boelter T film Pr.33 = 2388. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 2135.					
	Nusselt Ent. = 3020.					
	Sieder-Tate = 2500.					
	Sleicher-Rouse = 2261.					
	Petukhov-Popov = 2321. T V					
	McAdams T bulk = 2125. 88.0 8.28					
	McAdams T film = 2618. 129.5					
3	80.2 176.4	45.4 113.7	22609.	13107. 2308.	12583. 2216.	4940. 870.
	Dittus-Boelter T film Pr.33 = 2530. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 2308.					
	Nusselt Ent. = 3201.					
	Sieder-Tate = 2694.					

			Sleicher-Rouse =	2478.		
			Petukhov-Popov =	2497.	T	V
			McAdams T bulk =	2331.	105.3	8.28
			McAdams T film =	2753.	140.9	
4	83.3	53.9	26460.	14092.	13013.	5220.
	181.9	129.0		2482.	2292.	919.
			Dittus-Boelter T film Pr.33 =	2670.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	2482.		
			Nusselt Ent. =	3377.		
			Sieder-Tate =	2887.		
			Sleicher-Rouse =	2688.		
			Petukhov-Popov =	2666.	T	V
			McAdams T bulk =	2521.	121.3	8.28
			McAdams T film =	2881.	151.6	
5	86.3	61.6	30624.	15050.	13501.	5499.
	187.3	142.9		2651.	2378.	969.
			Dittus-Boelter T film Pr.33 =	2801.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	2651.		
			Nusselt Ent. =	3544.		
			Sieder-Tate =	3072.		
			Sleicher-Rouse =	2883.		
			Petukhov-Popov =	2822.	T	V
			McAdams T bulk =	2696.	135.9	8.28
			McAdams T film =	3001.	161.6	
6	89.2	68.5	34923.	15948.	14054.	5775.
	192.5	155.4		2809.	2475.	1017.
			Dittus-Boelter T film Pr.33 =	2921.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	2809.		
			Nusselt Ent. =	3695.		
			Sieder-Tate =	3244.		
			Sleicher-Rouse =	3059.		
			Petukhov-Popov =	2960.	T	V
			McAdams T bulk =	2853.	149.1	8.28
			McAdams T film =	3111.	170.8	

Flow Rate = 1.200 GPM Steam Pressure = 4.00 PSIG

Temperature IN = 15.6 Degrees C 60.0 F
 Temperature OUT = 68.5 Degrees C 155.4 F
 Steam Temperature = 106.9 Degrees C 224.4 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	74.3	165.8	26.1	79.0
23.333	77.2	171.0	36.1	97.0
35.000	80.2	176.4	45.4	113.7
46.667	83.3	181.9	53.9	129.0
58.333	86.3	187.3	61.6	142.9
70.000	89.2	192.5	68.5	155.4

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: 23:21:33

Input from KEYBOARD for Case Number: 5

Start Iteration Loop
 Flow = 0.900 GPM
 Inlet Temperature = 15.56 C

Steam Temperature = 106.88 T Wall Guess = 93.00
 T Out Guess = 72.00

Steam Pressure = 4.00 PSIG + Temperature = 224.395 Deg F
 H Vaporization = 962.40 BTU/LB Density= 0.046729 LB/FT3
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 4.00 PSIG + Temperature = 106.884 Deg C
 H Vaporization = 2238635. J/Kg Density = 0.7485 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	80.0 176.1	27.9 82.2	12334.	8927. 1572.	12559. 2212.	3880. 683.
			Dittus-Boelter T film Pr.33 =	1843.	BTU/Ft2 F	
			Dittus-Boelter T bulk Pr.4 =	1572.		
			Nusselt Ent. =	2331.		
			Sieder-Tate =	1870.		
			Sleicher-Rouse =	1632.		
			Petukhov-Popov =	1699.	T V	
			McAdams T bulk =	1528.	71.1 6.20	
			McAdams T film =	2023.	123.6	
2	82.7 180.9	39.4 102.9	15006.	9827. 1731.	12931. 2277.	4173. 735.
			Dittus-Boelter T film Pr.33 =	1971.	BTU/Ft2 F	
			Dittus-Boelter T bulk Pr.4 =	1731.		
			Nusselt Ent. =	2493.		
			Sieder-Tate =	2046.		
			Sleicher-Rouse =	1837.		
			Petukhov-Popov =	1866.	T V	
			McAdams T bulk =	1731.	92.6 6.21	
			McAdams T film =	2147.	136.7	
3	85.6 186.1	49.9 121.9	18164.	10749. 1893.	13383. 2357.	4474. 788.
			Dittus-Boelter T film Pr.33 =	2098.	BTU/Ft2 F	
			Dittus-Boelter T bulk Pr.4 =	1893.		
			Nusselt Ent. =	2655.		
			Sieder-Tate =	2225.		

			Sleicher-Rouse =	2038.		
			Petukhov-Popov =	2030.	T	V
			McAdams T bulk =	1918.	112.4	6.21
			McAdams T film =	2265.	149.2	
4	88.5	59.4	21729.	11661.	13922.	4775.
	191.3	139.0		2054.	2452.	841.
			Dittus-Boelter T film Pr.33 =	2220.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	2054.		
			Nusselt Ent. =	2808.		
			Sieder-Tate =	2399.		
			Sleicher-Rouse =	2228.		
			Petukhov-Popov =	2183.	T	V
			McAdams T bulk =	2089.	130.4	6.21
			McAdams T film =	2376.	160.9	
5	91.4	67.8	25517.	12524.	14560.	5072.
	196.5	154.1		2206.	2564.	893.
			Dittus-Boelter T film Pr.33 =	2329.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	2206.		
			Nusselt Ent. =	2946.		
			Sieder-Tate =	2562.		
			Sleicher-Rouse =	2399.		
			Petukhov-Popov =	2319.	T	V
			McAdams T bulk =	2241.	146.5	6.21
			McAdams T film =	2477.	171.5	
6	94.1	75.1	29268.	13295.	15306.	5358.
	201.4	167.2		2341.	2696.	944.
			Dittus-Boelter T film Pr.33 =	2422.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	2341.		
			Nusselt Ent. =	3064.		
			Sieder-Tate =	2706.		
			Sleicher-Rouse =	2543.		
			Petukhov-Popov =	2434.	T	V
			McAdams T bulk =	2375.	160.6	6.21
			McAdams T film =	2567.	181.0	

Flow Rate = 0.900 GPM Steam Pressure = 4.00 PSIG

Temperature IN = 15.6 Degrees C 60.0 F
 Temperature OUT = 75.1 Degrees C 167.2 F
 Steam Temperature = 106.9 Degrees C 224.4 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	80.0	176.1	27.9	82.2
23.333	82.7	180.9	39.4	102.9
35.000	85.6	186.1	49.9	121.9
46.667	88.5	191.3	59.4	139.0
58.333	91.4	196.5	67.8	154.1
70.000	94.1	201.4	75.1	167.2

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: 23:21:58

Input from KEYBOARD for Case Number: 6

Start Iteration Loop
 Flow = 0.500 GPM
 Inlet Temperature = 15.56 C

Steam Temperature = 106.88 T Wall Guess = 98.00
 T Out Guess = 82.00

Steam Pressure = 4.00 PSIG + Temperature = 224.395 Deg F
 H Vaporization = 962.40 BTU/LB Density = 0.046729 LB/FT3
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 4.00 PSIG + Temperature = 106.884 Deg C
 H Vaporization = 2238635. J/Kg Density = 0.7485 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	89.8 193.6	31.6 89.0	7053.	5657. 996.	14189. 2499.	2869. 505.
	Dittus-Boelter T film Pr.33 =			1218.	BTU/Ft2 F	
	Dittus-Boelter T bulk Pr.4 =			996.		
	Nusselt Ent. =			1541.		
	Sieder-Tate =			1206.		
	Sleicher-Rouse =			1053.		
	Petukhov-Popov =			1066.	T	V
	McAdams T bulk =			974.	74.5	3.44
	McAdams T film =			1324.	134.1	
2	91.9 197.5	46.3 115.4	9125.	6407. 1128.	14689. 2587.	3183. 561.
	Dittus-Boelter T film Pr.33 =			1317.	BTU/Ft2 F	
	Dittus-Boelter T bulk Pr.4 =			1128.		
	Nusselt Ent. =			1667.		
	Sieder-Tate =			1350.		
	Sleicher-Rouse =			1223.		
	Petukhov-Popov =			1204.	T	V
	McAdams T bulk =			1137.	102.2	3.44
	McAdams T film =			1418.	149.8	
3	94.3 201.8	59.3 138.7	11655.	7170. 1263.	15370. 2707.	3502. 617.
	Dittus-Boelter T film Pr.33 =			1412.	BTU/Ft2 F	
	Dittus-Boelter T bulk Pr.4 =			1263.		
	Nusselt Ent. =			1786.		
	Sieder-Tate =			1492.		

			Sleicher-Rouse =	1384.		
			Petukhov-Popov =	1336.	T	V
			McAdams T bulk =	1284.	127.0	3.45
			McAdams T film =	1504.	164.4	
4	96.8	70.3	14459.	7891.	16260.	3812.
	206.3	158.5		1390.	2864.	671.
			Dittus-Boelter T film Pr.33 =	1493.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	1390.		
			Nusselt Ent. =	1889.		
			Sieder-Tate =	1624.		
			Sleicher-Rouse =	1524.		
			Petukhov-Popov =	1453.	T	V
			McAdams T bulk =	1412.	148.6	3.45
			McAdams T film =	1582.	177.4	
5	99.2	79.3	17193.	8508.	17395.	4096.
	210.5	174.8		1498.	3064.	721.
			Dittus-Boelter T film Pr.33 =	1557.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	1498.		
			Nusselt Ent. =	1970.		
			Sieder-Tate =	1735.		
			Sleicher-Rouse =	1634.		
			Petukhov-Popov =	1545.	T	V
			McAdams T bulk =	1519.	166.7	3.45
			McAdams T film =	1648.	188.6	
6	101.2	86.5	19509.	8980.	18807.	4343.
	214.2	187.7		1581.	3312.	765.
			Dittus-Boelter T film Pr.33 =	1602.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	1581.		
			Nusselt Ent. =	2027.		
			Sieder-Tate =	1819.		
			Sleicher-Rouse =	1713.		
			Petukhov-Popov =	1612.	T	V
			McAdams T bulk =	1606.	181.3	3.45
			McAdams T film =	1703.	197.7	

Flow Rate = 0.500 GPM Steam Pressure = 4.00 PSIG

Temperature IN = 15.6 Degrees C 60.0 F
 Temperature OUT = 86.5 Degrees C 187.7 F
 Steam Temperature = 106.9 Degrees C 224.4 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	89.8	193.6	31.6	89.0
23.333	91.9	197.5	46.3	115.4
35.000	94.3	201.8	59.3	138.7
46.667	96.8	206.3	70.3	158.5
58.333	99.2	210.5	79.3	174.8
70.000	101.2	214.2	86.5	187.7

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 DOUBLE PIPE HEAT EXCHANGER Prediction Program Rel. 2/8/92
 Ch. E. 434 Laboratory D. C. Drown

Date: Jan 29, 2009 Time: 23:22:22

Input from KEYBOARD for Case Number: 7

Start Iteration Loop
 Flow = 0.350 GPM
 Inlet Temperature = 15.56 C

Steam Temperature = 106.88 T Wall Guess = 105.00
 T Out Guess = 92.00

Steam Pressure = 4.00 PSIG + Temperature = 224.395 Deg F
 H Vaporization = 962.40 BTU/LB Density= 0.046729 LB/FT3
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 4.00 PSIG + Temperature = 106.884 Deg C
 H Vaporization = 2238635. J/Kg Density = 0.7485 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	94.3 201.7	33.9 93.1	5026.	4290. 755.	15360. 2705.	2325. 409.
	Dittus-Boelter T film Pr.33 = 940. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 755.					
	Nusselt Ent. = 1190.					
	Sieder-Tate = 920.					
	Sleicher-Rouse = 818.					
	Petukhov-Popov = 806. T V					
	McAdams T bulk = 741. 76.5 2.41					
	McAdams T film = 1018. 139.1					
2	96.1 204.9	50.5 122.8	6750.	4941. 870.	15972. 2813.	2630. 463.
	Dittus-Boelter T film Pr.33 = 1024. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 870.					
	Nusselt Ent. = 1295.					
	Sieder-Tate = 1043.					
	Sleicher-Rouse = 964.					
	Petukhov-Popov = 926. T V					
	McAdams T bulk = 880. 107.9 2.41					
	McAdams T film = 1095. 156.4					
3	98.1 208.7	64.6 148.3	8883.	5599. 986.	16856. 2969.	2939. 518.
	Dittus-Boelter T film Pr.33 = 1099. BTU/Ft2 F					
	Dittus-Boelter T bulk Pr.4 = 986.					
	Nusselt Ent. = 1390.					
	Sieder-Tate = 1164.					

			Sleicher-Rouse =	1098.		
			Petukhov-Popov =	1039.	T	V
			McAdams T bulk =	1003.	135.6	2.41
			McAdams T film =	1165.	172.1	
4	100.3	76.2	11165.	6191.	18077.	3227.
	212.5	169.1		1090.	3184.	568.
			Dittus-Boelter T film Pr.33 =	1159.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	1090.		
			Nusselt Ent. =	1466.		
			Sieder-Tate =	1271.		
			Sleicher-Rouse =	1207.		
			Petukhov-Popov =	1133.	T	V
			McAdams T bulk =	1106.	158.7	2.41
			McAdams T film =	1225.	185.6	
5	102.2	85.1	13200.	6653.	19692.	3472.
	215.9	185.2		1172.	3468.	612.
			Dittus-Boelter T film Pr.33 =	1201.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	1172.		
			Nusselt Ent. =	1519.		
			Sieder-Tate =	1352.		
			Sleicher-Rouse =	1283.		
			Petukhov-Popov =	1201.	T	V
			McAdams T bulk =	1188.	177.2	2.41
			McAdams T film =	1274.	196.6	
6	103.7	91.8	14707.	6965.	21750.	3666.
	218.7	197.2		1227.	3830.	646.
			Dittus-Boelter T film Pr.33 =	1227.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	1227.		
			Nusselt Ent. =	1552.		
			Sieder-Tate =	1406.		
			Sleicher-Rouse =	1330.		
			Petukhov-Popov =	1245.	T	V
			McAdams T bulk =	1251.	191.2	2.42
			McAdams T film =	1312.	205.0	

Flow Rate = 0.350 GPM Steam Pressure = 4.00 PSIG

Temperature IN = 15.6 Degrees C 60.0 F
 Temperature OUT = 91.8 Degrees C 197.2 F
 Steam Temperature = 106.9 Degrees C 224.4 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	94.3	201.7	33.9	93.1
23.333	96.1	204.9	50.5	122.8
35.000	98.1	208.7	64.6	148.3
46.667	100.3	212.5	76.2	169.1
58.333	102.2	215.9	85.1	185.2
70.000	103.7	218.7	91.8	197.2

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 DOUBLE PIPE HEAT EXCHANGER Prediction Program Rel. 2/8/92
 Ch. E. 434 Laboratory D. C. Drown

Date: Jan 29, 2009 Time: 23:23:36

Input from KEYBOARD for Case Number: 8

Start Iteration Loop
 Flow = 0.250 GPM
 Inlet Temperature = 15.56 C

Steam Temperature = 106.88 T Wall Guess = 104.00
 T Out Guess = 95.00

Steam Pressure = 4.00 PSIG + Temperature = 224.395 Deg F
 H Vaporization = 962.40 BTU/LB Density= 0.046729 LB/FT3
 Barometric Pressure = 14.6960 PSIA

Steam Pressure = 4.00 PSIG + Temperature = 106.884 Deg C
 H Vaporization = 2238635. J/Kg Density = 0.7485 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	97.6 207.7	36.1 96.9	3650.	3304. 582.	16612. 2926.	1878. 331.
	Dittus-Boelter T film Pr.33 =			733.	BTU/Ft2 F	
	Dittus-Boelter T bulk Pr.4 =			582.		
	Nusselt Ent. =			928.		
	Sieder-Tate =			711.		
	Sleicher-Rouse =			650.		
	Petukhov-Popov =			621.	T	V
	McAdams T bulk =			572.	78.5	1.72
	McAdams T film =			790.	143.1	
2	99.1 210.4	54.2 129.6	5077.	3866. 681.	17353. 3056.	2164. 381.
	Dittus-Boelter T film Pr.33 =			802.	BTU/Ft2 F	
	Dittus-Boelter T bulk Pr.4 =			681.		
	Nusselt Ent. =			1015.		
	Sieder-Tate =			816.		
	Sleicher-Rouse =			774.		
	Petukhov-Popov =			724.	T	V
	McAdams T bulk =			690.	113.3	1.72
	McAdams T film =			854.	161.8	
3	100.8 213.5	69.4 156.8	6846.	4423. 779.	18493. 3257.	2450. 431.
	Dittus-Boelter T film Pr.33 =			862.	BTU/Ft2 F	
	Dittus-Boelter T bulk Pr.4 =			779.		
	Nusselt Ent. =			1090.		
	Sieder-Tate =			918.		

			Sleicher-Rouse =	884.		
			Petukhov-Popov =	820.	T	V
			McAdams T bulk =	792.	143.2	1.72
			McAdams T film =	911.	178.4	
4	102.6	81.1	8647.	4897.	20134.	2702.
	216.6	178.0		862.	3546.	476.
			Dittus-Boelter T film Pr.33 =	905.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	862.		
			Nusselt Ent. =	1145.		
			Sieder-Tate =	1001.		
			Sleicher-Rouse =	965.		
			Petukhov-Popov =	895.	T	V
			McAdams T bulk =	874.	167.4	1.72
			McAdams T film =	958.	192.0	
5	104.1	89.6	10089.	5231.	22370.	2899.
	219.3	193.4		921.	3940.	510.
			Dittus-Boelter T film Pr.33 =	932.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	921.		
			Nusselt Ent. =	1179.		
			Sieder-Tate =	1059.		
			Sleicher-Rouse =	1016.		
			Petukhov-Popov =	944.	T	V
			McAdams T bulk =	937.	185.7	1.73
			McAdams T film =	994.	202.5	
6	105.1	95.6	11016.	5428.	25252.	3038.
	221.3	204.1		956.	4447.	535.
			Dittus-Boelter T film Pr.33 =	946.	BTU/Ft2	F
			Dittus-Boelter T bulk Pr.4 =	956.		
			Nusselt Ent. =	1197.		
			Sieder-Tate =	1093.		
			Sleicher-Rouse =	1043.		
			Petukhov-Popov =	971.	T	V
			McAdams T bulk =	982.	198.7	1.73
			McAdams T film =	1020.	210.0	

Flow Rate = 0.250 GPM Steam Pressure = 4.00 PSIG

Temperature IN = 15.6 Degrees C 60.0 F
 Temperature OUT = 95.6 Degrees C 204.1 F
 Steam Temperature = 106.9 Degrees C 224.4 F

Length Inches	Wall Temp.		Temp. Water Out	
	C	F	C	F
11.667	97.6	207.7	36.1	96.9
23.333	99.1	210.4	54.2	129.6
35.000	100.8	213.5	69.4	156.8
46.667	102.6	216.6	81.1	178.0
58.333	104.1	219.3	89.6	193.4
70.000	105.1	221.3	95.6	204.1