

VEREVLM - Filename: C:\Data\2003\4989Bdesn (March 26,2003 08:40)
(VEREVLM)

Job/Unit: P02-4989-B Design Case Rev 2/17.6 MMBTU/hr Preflash Reboiler
Customer: ABC E&C for XYZ Oil Company
Engineer: RJP Date: 14-Mar-2003

Fuel components:

C:00.00000	H2:00.38740	O2:00.00000	N2:00.04790
CO:00.00000	CO2:00.00000	CH4:00.27350	C2H6:00.08170
C2H4:00.03280	C3H8:00.06620	C3H6:00.01940	C4H10:00.00770
C4H8:00.05620	C5H12:00.01430	C6H14:00.01290	S:00.00000
H2S:00.00000			

Excess Air Fraction 0.15
Setting Loss Fraction (0.01 < SL < 0.06) 0.02
Assumed Stack Temp. in (DEG.F) 575
Moisture in the air 0.0059
Ambient Air Temp. in (DEG.F) 60
AIR ENTHALPY, BTU/LB-AIR , = 0

RADIANT SECTION INPUT

Average tube metal temperature, deg F, = 676
Number of radiant tubes, including roof tubes = 46
Effective tube length, ft, = 23
Tube outside diameter, inches, = 4.5
Tube pitch, inches, = 8

CONVECTION SECTION INPUT

Process Flow Rate (Lb/HR) = 96261
Process Temp. (Deg.F) -IN- = 420.7
Process Temp. (Deg.F) -OUT- = 640
Total Process Heat Absorbed (BTU/HR) = 1.7578E+07
Tube OUTSIDE DIA. (inches) = 4.5
Tube INSIDE DIA. (inches) = 4.026
Tube Pitch (inches) = 8
Tube Effective Length (FEET) = 10
Number of Tubes per Row = 4
Row Mult.(Bare tube ratio) = 1.6
Fouling Factor = 0.005
Thermal Conductivity of tube = 16
Inside Heat Transfer Coeff. = 218
Number of Bare Rows = 3
Number of Fin Combinations 2

FRN	K	RMU	FH	FFT	FT
1	16	0.8500	1.00	36	0.105
4	16	0.8500	1.00	42	0.105

SUMMARY OF CALCULATED RESULTS

I. RADIANT SECTION

A. SURFACE AREA, FT² , = 1246
B. AVERAGE FLUX RATE, BTU/HR-FT² , = 9,995
C. ABSORBED DUTY, MM BTU/HR , = 12.4585

II. CONVECTION SECTION

A. BARE TUBE SURFACE AREA, FT² , = 141.4
B. FIN TUBE SURFACE AREA, FT² , = 2193.9
C. TOTAL SURFACE AREA, FT² , = 2335.2
D. ABSORBED DUTY, MM BTU/HR , = 5
E. FLUE GAS PRESSURE DROP, INCHES H₂O = 0.2121

III. OVERALL PERFORMANCE

A. FLUE GAS SIDE

1. TEMPERATURE LEAVING RADIANT SECTION, DEG F , = 1465
2. TEMPERATURE LEAVING CONVECTION SECT, DEG F , = 577
3. FLUE GAS FLOW RATE, LB/HR , = 19450

B. PROCESS SIDE

1. TEMPERATURE ENTERING CONVECTION SECT, DEG F , = 421
2. TEMPERATURE LEAVING RADIANT SECTION, DEG F , = 640
3. PROCESS FLOW RATE, LB/HR , = 96261

C. TOTAL ABSORBED DUTY, MM BTU/HR , = 17.5790
D. TOTAL HEAT RELEASE, MM BTU/HR , = 20.6945
E. VOLUMETRIC HEAT RELAEASE = 1.2023E-02

F. OVERALL EFFICIENCY (LHV) , % , = 84.95

FUEL GAS/FLUE GAS OUTPUT

MOLECULAR WEIGHT OF FUEL GAS = 19.3584084795266
TOTAL HEATING VALUE, BTU/LB OF FUEL , = 20108.07
TOTAL HEATING VALUE, BTU/SCF , = 1027.07177054097

ACTUAL AIR REQ., Lb. AIR/Lb. FUEL 17.9022
CO2 FORMED , Lb CO2/Lb FUEL 2.6441
H2O FORMED , Lb H2O/Lb FUEL 1.9724
N2 FORMED , Lb N2 /Lb FUEL 13.7419
O2 FORMED , Lb O2 /Lb FUEL 0.5409
FLUE GAS FORMED , Lb/Lb FUEL 18.8993

TOTAL FUEL FIRING RATE, LB/HR , = 1,029
TOTAL FLUE GAS FLOW RATE, LB/HR , = 19,450

VERTICAL HEATER RADIANT SECTION CALCULATIONS

--
Flue gas temperature leaving rad. sect., deg F, = 1465
Calculated radiant absorption, BTU/HR, = 12,460,920
Calculated radiant flue gas heat transfer, BTU/HR, = 12,456,150
Average radiant heat absorption , BTU/HR = 12,458,530
Average radiant flux rate, MMBTU/HR-FT2, = 9,995
Total radiant surface area, ft2, = 1,246

tfga:1465.162 tfg2:1464.967

-
CONVECTION SECTION CALCULATION
ROW # 5

-

qfg 944975
q 950579.6
go 0.5862114
ho 74.75067
uo 41.09604
fa 9.216667
a 47.12389
lmtd 490.8484
tfg2 858.7861
t1x 440.1686 t2x 451.958
deltt 219.3 cp 0.8326845
pfr 96261 deltat 11.78934
wt 19450.49
qfgin 5209321
qfgout 4264346
de 6.847737
degof 4.014221

Temperature (deg F) at Fin row 2 (Set:2 Row:1 of 4)

process enter: 440 exit: 452
flue gas enter: 1024 exit: 859

Total heat absorbed this row, MM Btu/Hr, = 950,580

Flux Rate This Row, BTU/HR-FT², = 20,172

Flue Gas Pressure Drop, Inches H₂O , = 3.6004E-02

Maximum Tube Metal Temp., DEG F , = 694

Maximum Fin Tip Temp, DEG F , = 672

 TFG1:858.7861 TFG2:758.7861 T2X:440.1686
HOF1: 8.612432
EFF1: 1.063519