# Sample Output of the Designed Code

**Design parameters of a Shell & Tube Heat Exchanger**

```
Hot Fluid: Heavy Naphtha
Cold Fluid: Water
Enter the mass flow rate of Heavy Naptha in kg/s(if you want to enter in
1.5+0.03*G format enter 'G'): G
Group Number: 10
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Mass Flow Rate of Heavy Naptha: 1.8 kg/s
Please input the following values in degree Celsius.
Initial Temperature of the Hot Fluid: 75
Desired Final Temperature of the Hot Fluid: 50
Coolant initial temperature: 30
Coolant final temperature: 40

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Caloric Fraction of Hot Fluid: 0.4461
Caloric Temperature Of Hot Fluid: 61.1526 C
Caloric Fraction of Cold Fluid: 0.3880
Caloric Temperature Of Cold Fluid: 33.8799 C

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```

**Properties of the Fluids at Tc**

```
Hot Fluid: Heavy Naptha
Specific heat Capacity of Hot Fluid: 2021.8692 J/kg·K
Viscosity of Hot Fluid: 0.7986604421489953 cP
Denisty of Hot Fluid: 791.3870 kg/m³
Thermal Conductivity of Hot Fluid: 0.1500 W/m·K

Cold Fluid: Water
Specific Heat Capacity of Water: 4177.9149 J/kg·K
Viscosity of Cold Fluid: 0.7355 cP
Denisty of Cold Fluid: 994.3996 kg/m³
Thermal Conductivity of Cold Fluid: 0.5980 W/m·K

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```

**Enthalpy Heat Balance**

Heat Rate:  90984.1130 J/kg·s
Mass Flow Rate of Water: 2.1777 kg/s

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**LMTD and LMTD Correction Factor**

LMTD considering counter-current flow: 26.8041 C
R: 2.5 S: 0.2222222222222222
LMTD correction Factor for 1 shell pass and 2 or more tube passes
Ft = 0.9380
LMTD correction Factor for 2 shell pass and 4 or more tube passes
Ft = 0.9853
1-2 Heat Exchanger is the better option. As Ft>=0.9. The code will proceed calculating parameters for 1-2 HE.

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**Shell Side and Tube Side Parameters**

Iteration 0
U(assumed): 496.8480 W/m²·K
Area: 7.2836 m²
Required number of Tubes: 15
Standard Number of tubes: 16
Ds_sq:0.2032 m

Tube Side Fluid: Heavy Naptha
Tube Side Reynolds Number (Re|tube): 21077.6381
Tube Side Heat Transfer Coefficient (ho):1190.0611 W/m²·K

Shell Side Fluid: Water
Shell Side Reynolds Number (Re|shell): 18021.4340
Shell Side Heat Transfer Coefficient (ho):  1032.9353 W/m²·K

Ucal: 272.4837 W/m²·K
Relative error =  45.1575 %
Since the relative error is >5% we proceed to do further iterations

Iteration  1
Required number of Tubes: 28
Standard Number of tubes: 32
Ds_sq:0.2540 m

Tube Side Reynolds Number (Re|tube): 10538.8190
Tube Side Heat Transfer Coefficient (hi):683.5106 W/m²·K

Shell Side Reynolds Number (Re|shell): 11533.7178
Shell Side Heat Transfer Coefficient (ho):  1036.4583 W/m²·K
Ucal: 209.4789 W/m²·K
Relative error =  23.1224 %

Iteration  2
Required number of Tubes: 36
Standard Number of tubes: 45
Ds_sq:0.3048 m

Tube Side Reynolds Number (Re|tube): 7494.2713
Tube Side Heat Transfer Coefficient (hi):520.3496 W/m²·K
Shell Side Reynolds Number (Re|shell): 8009.5262
Shell Side Heat Transfer Coefficient (ho):  853.4208 W/m²·K
Ucal: 172.5257 W/m²·K
Relative error =  17.6405 %

Iteration  3
Required number of Tubes: 44
Standard Number of tubes: 45
Ds_sq:0.3048 m

Tube Side Reynolds Number (Re|tube): 7494.2713
Tube Side Heat Transfer Coefficient (hi):520.3496 W/m²·K
Shell Side Reynolds Number (Re|shell): 8009.5262
Shell Side Heat Transfer Coefficient (ho):  853.4208 W/m²·K
Ucal: 172.5257 W/m²·K
Relative error =  0.0000 %

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**Pressure Drop and Overdesign**

Tube side velocity: 0.4444 m/s
Friction Factor: 0.04268
delta Pf:1194.9110 Pa , delta_Pr: 0.101798 Pa
Tube Side Pressure Drop: 0.1733 psi ( 1195.0128 Pa )
Required Number of Tubes: 44
Standard Number of Tubes: 45
%Overdesign: 2.2727 %

**Design is acceptable and cost-effective**