HEAT TRANSFER ANALYSIS ABOUT TUBES
PLUGGED EFFECT ON HEAT EXCHANGER MCR
COMPRESSOR INTERCOOLER G4-E-5A/B
PERFORMANCE
(CASE STUDY IN PT BADAK NGL BONTANG)

Name : Findra Satria W.
Student Reg. No. : 2104.100.056
Majoring : Energy Conversion
Advisor : Dr. Eng., Ir. Prabowo, M.Eng

ABSTRACT

Heat exchanger (HE) is one of the equipments that apply the laws of thermodynamics and heat transfer. One of the companies that use heat exchangers is the natural gas liquefaction company, PT Badak NGL Bontang. One of heat exchangers operated is MCR Compressor Intercooler. This heat exchanger used to cool the refrigerant. Refrigerant used at this point is called Multi-Component Refrigerant or abbreviated as MCR, that is managed to liquefy the natural gas. MCR flows in the shell side, while the cooling fluid of seawater flows in the tube side. The leakage of the tubes that leads to plugging or replacement (retubing) is due to the vibration, corrosion and erosion. The purpose of this final project is to redesign the heat exchanger MCR Compressor Intercooler G4-E-5A/B in PT. Badak NGL Bontang by replacing the type of existing baffle with other types of baffle, single segmental, and to analyze the influence of tube plugging on heat exchanger performance.

Redesign process done by the use of Microsoft Excel 2007 software. The inputs are inlet and outlet temperature
of hot fluid, outlet temperature of cold fluid, mass flow rate of each fluid and fraction of plugged tubes. This calculation used several scheme that arranged in a procedure. The first step is to calculate the heat transfer from hot fluid to cold fluid, employing the thermodynamic law. The second step is to calculate the heat transfer area, using the logarithmic mean temperature difference method. The third step is to calculate heat transfer coefficient and pressure drop in shell side, by the Delaware method. The fourth step is to calculate heat transfer coefficient and pressure drop in tube side using the heat transfer concept. The last step is to calculate the performance of heat exchanger using NTU-ε method. To optimize the design result, only baffle cut 20 until 30% of shell diameter and baffle spacing 35 and 45% of shell diameter employed.

Outputs of the calculations are the principal dimensions of heat exchanger, the TEMA sheet and the performances including its graphs. Furthermore, this calculation outputs the variation of effectiveness in the result of increasing or decreasing of the number of plugged tube. Finally, we can make conclusion about the effect of tube plugging on heat exchanger performance using effectiveness and pressure drop as the parameters. The optimum design result obtained by employing baffle cut of 20% of shell diameter and baffle spacing of 45% of shell diameter that comes to the value of $U = 598.84 \text{ W/m}^2\text{K}$ and $\Delta P_{\text{shell}} = 1.00 \text{ kg/cm}^2$.

Key words: redesign, Single Segmental Baffle, Delaware Method, plugging percentage, overall heat transfer coefficient, heat exchanger performance