DEPARTMENT OF MECHANICAL & MANUFACTURING ENGINEERING TECHNOLOGY

Semester 391

Course Information					
Course Code:	**MME 237**	**Title:**	**Power Generation System**	**Section:**	**1**

Mini Project (Lab)	
Title:	**Rating and Selection of Major Power Plant Components**
Date Due:	**14th Oct 2018 (Week 7)**
Date Submitted:	**14th Oct 2018 (Week 7)**

Student's Information			
Name:	**Wadia Al-Dakhlan**	**I.D No. :**	**362900304**
Major:	**Mechanical Engineering Technology**		

Submitted To:	**Dr Ibrahim K. Rajab**

Marking Scheme					
Punctuality /Discipline	**Lab Performance**	**Procedure**	**Results and Discussion**	**Grammar/ Spelling**	**Total**
(0.5 mark)	**(1 marks)**	**(2 marks)**	**(1 marks)**	**(0.5 marks)**	**(5 marks)**

Select and rate the major components of a 1500 MW steam power plant.

We have a 1500 MW steam power plant and we have to calculate some requirements as shown below. Depending on the power of each requirement, we select the components such as turbine, condenser, pump and boiler.

- **Turbine Power (Pt)**
- **Condenser Power (Pc)**
- **Pump Power (Pp)**
- **Boiler Power (Pb)**

We got references about mechanical and turbine efficiencies. Also the P1 ,T1 and P2

Mechanical Efficiency = 96% to 98%

Turbine Efficiency = 90%

P1 = 175 bar

P2 = 0.1 bar

T1 = 510 C

Calculation:

- **Turbine**

  h1 = 3370 kJ/kg

  h2 = 2040 kJ/kg

  h1 and h2,, we took them from the h-s diagram

  Pt = 1500 / 96% = 1562.5 MW

  Pt = m (h1 – h2)

  Turbine efficiency = h1 – h2 / h1 – hs2 ,, 0.9 = 3370 – h2 / 3370 – 2040

  h2 = 2173 kJ/kg

  Mass Flow Rate (m) = 1562.5 x 1000 / 3370 – 2173

  m = 1305.3 kg/s

- **Condenser**

  h3 = hf at P2 “From Steam Table”

  h3 = 192 kJ/kg

  Pc = m (h2 – h3),, 1305.3 (2173 – 192)

  Pc = 2585799.3 KW

- **Pump**

  V= 0.001 m^3 / kg

  Pp = m v (P1 – P2),, 1305.3 x 0.001 (175 – 0.1) x 100

  Pp = 22829.7 KW

- **Boiler**

  h3 ≃ h4

  Pb = m (h1 – h4),, 1305.3 (3370 – 192)

  Pb = 4148243.4 KW

Select the components depending on the power values.

- **Turbine**

Figure 1.1: Steam Turbine

GE Company **Type: Arabelle steam turbines 2016**
Rated power kW: **Max.: 1,900,000 kW (2,583,280.19 hp)** **Min.: 700,000 kW (951,734.81 hp)**
Compact, powerful, efficient, and reliable
60% of the power comes from highly efficient single flow expansion
Standard interface/footprint for 50 and 60 Hz

- **Condenser**

Figure 1.2: Steam Condenser

Place of Origin: Shandong, China (Mainland) 2015
Power(KW): 2585800 KW
Voltage: 380/220 V
Brand Name: Pullylon
Tube material: Copper pipe
Structure: Tube Heat Exchanger

- **Pump**

Figure 1.3: Steam Pump

Place of Origin: Hebei, China (Mainland) **Brand Name: Tech-macro 2015**
Pressure: High Pressure
Power(KW): 1500 KW
Model Number: TL(R) Series
Inlet Diameter:16 ~ 47inches(400~1200mm) **Discharge Diameter: 14~39 inches(350 ~1000mm)** **Flow Capacity: 260 ~4900m³/h** **Head: 10~75m**

- **Boiler**

Figure 1.5: Steam Boiler

Sitong Boiler company **Type: Oil Water Tube Boiler 2014** **Model: SZS116-1.6/130/70-Y(Q)**
Capacity :10tph~50tph **Pressure :1.0 MPa~ 4.9 MPa** **Fuel :Heavy oil, diesel, natural gas, LPG, etc.**
Rated Power: 116 MW
Working Pressure: 1.6 MPa
Heating Area: 2058 m^3

Conclusion:

We have selected these components depending on their power value for generating 1500 MW. We have took one turbine and one condenser. Also, we have took two pumps to afford that huge amount of power we have calculated. We have took nine boilers also to afford the huge power. And we have searched for the components from the internet, we have saw many websites that give us different details with variety of boiler types. We have took the components that fit with us.

References:

1. Power Plant Engineering Textbook, Dr. P.C. Sharma, Ninth Edition, 2013

2. Power Generation Systems Handout, JIC, September 2015

3. http://www.codecogs.com/library/engineering/fluid_mechanics/machines/turbines/the-efficiency-of-turbines.php (Accessed: 12 October 2018)

4. https://turbine-efficiency.co.uk/ (Accessed: 13 October 2018)

5. https://www.ge.com/power/steam/steam-turbines (Accessed: 12 October 2018)

6. http://www.sitong-boiler.com/product/oil-gas-fired-boiler/szs-gas-oil-water-tube-boiler.html (Accessed: 11 October 2018)