DEPARTMENT OF CHEMICAL ENGINEERING

University of Engineering & Technology, Lahore

Chemical Engineering Thermodynamics Lab

Introduction

The application of thermodynamics to any real problem starts with the identification of a particular body of matter as a focus of attention. This body of matter is called system and the thermodynamic state of this system is defined by a few measurable macroscopic properties. In this lab there are equipments related to the basic laws and applications of thermodynamics like boiler, refrigeration unit, Joule-Thomson apparatus and Boyle`s law apparatus. This lab not only allows students to have a thorough understanding of these principles but also develops in them the basic requirement of a chemical engineer, i.e., to cope with the wide variety of problems such as calculation of heat and work requirement of physical and chemical processes.

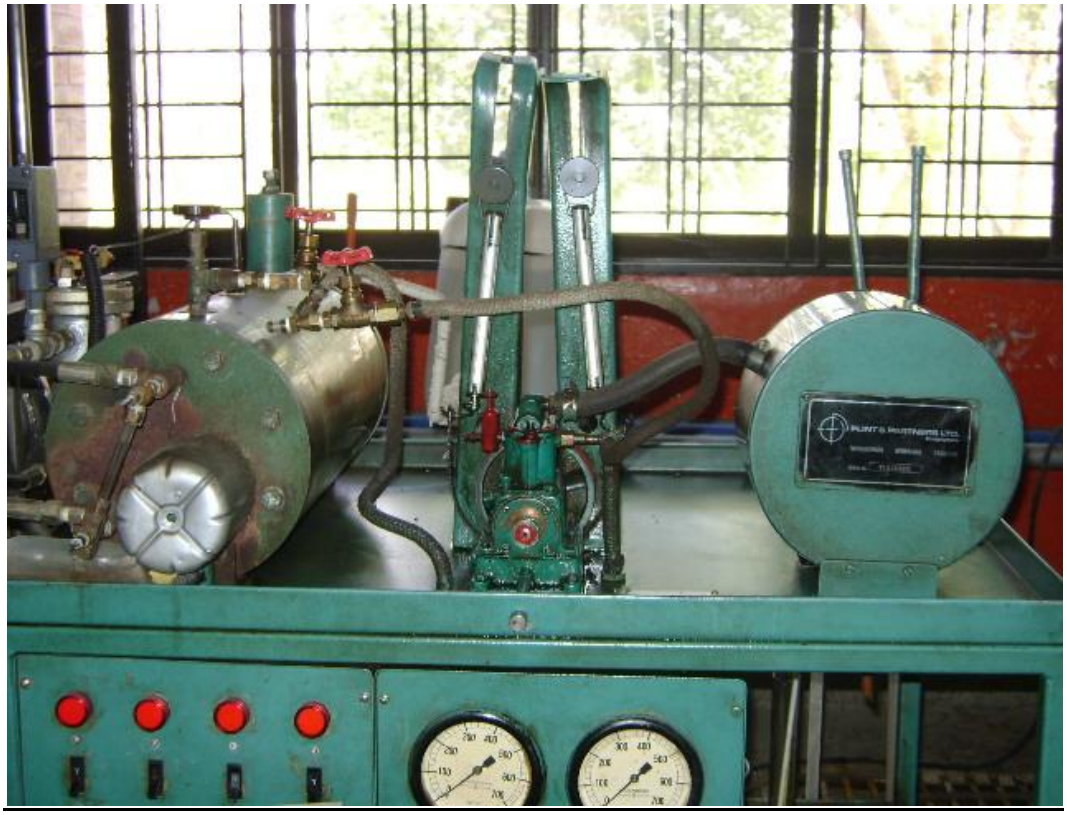
List of Equipment

1. Lab-scale Steam Power Plant
2. Lab-scale Refrigeration Unit.
3. Joule-Thomson Coefficient Apparatus.
4. Boyle-Marriott’s Law Apparatus

Details of Equipment

Lab-scale Steam Power Plant

Lab-scale steam power plant is very important for a chemical engineer because of the wide variety of applications in internal combustion engines, rocket engines, Otto engines, power plant engineering, and power engines and machines, and as a result offers numerous experiments. It helps students in familiarization with a steam power plant and its components, familiarization with simple feed-water treatment, starting/operating/running a steam power plant, familiarization with a closed steam-water circuit, and the determination of, among other items: boiler efficiency, mechanical/thermal efficiency of a turbine, condenser efficiency, and specific fuel consumption of the system.

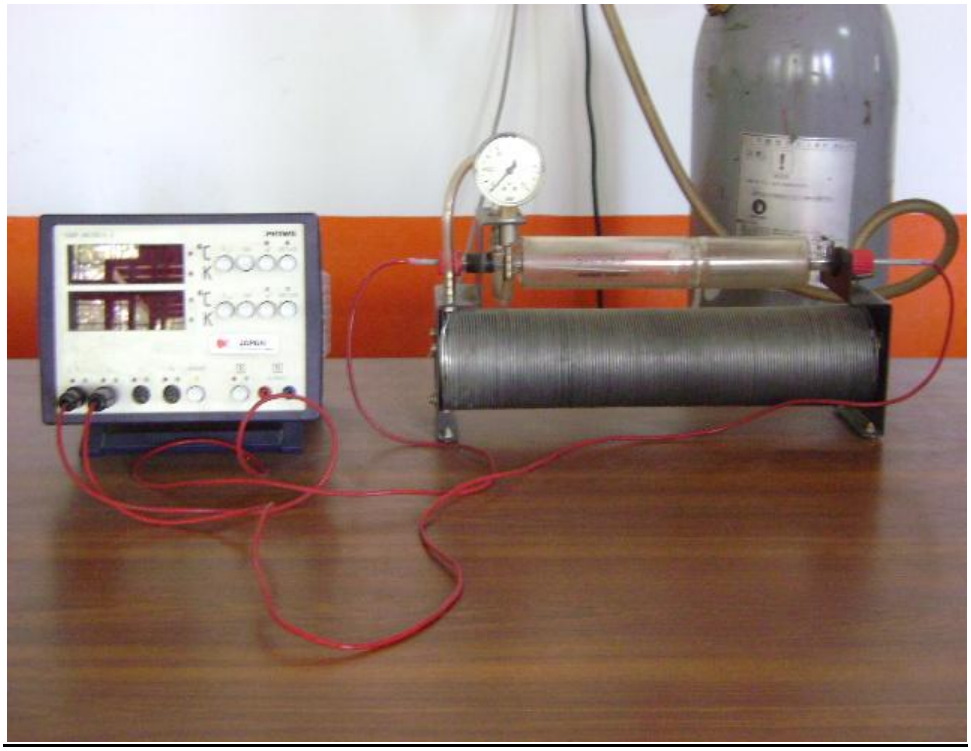


Lab-scale Refrigeration Unit

The vapor compression refrigeration cycle is used in many industrial, medical and domestic situations throughout the world. Air conditioning, food and medical preservation and transport all rely on the use of refrigeration plants. It is essential, therefore, to the student engineers intending to design and utilize such plants that they are fully aware of the parameters affecting the performance of vapor compression refrigeration cycle. This laboratory unit has been designed to allow students to fully investigate the performance of a vapor compression cycle under certain conditions of evaporator load and condenser pressure. All the relevant parameters are instrumented and unit is completely safe for use by the students.

Joule-Thomson Coefficient Apparatus

Joule-Thomson apparatus is a demonstration and practice unit for determining Joule-Thomson coefficient. With this, students are able to comprehend basic concepts of real and ideal gas, internal energy, Gay-Lussac theory, throttling process, Vander Waals equation, Vander Waals force, inverse Joule-Thomson effect, and inversion temperature. Joule-Thomson effect finds is applications in liquefaction of gases, production of dry ice and in petrochemical industry.



Boyle-Marriott's Law Apparatus

The experimental setup allows the gas laws of Boyle-Marriott, Gay-Lussac and Amonton to be worked out or demonstrated in a single operation as three variable quantities: volume, pressure, and temperature can be kept constant or be varied and measured as required.

List of Experiments

1. To examine the relation between temperature and pressure for saturated steam.
2. To produce energy balance for small steam plant.
3. To study the performance of small high-speed steam motor and compare it with the performance of an ideal engine working on Rankine cycle.
4. Calculate the coefficient of performance for the refrigeration machine and compare it with the coefficient of performance for the Carnot refrigeration cycle machine.
5. To study the rate of heat gained by calorimeter from the surroundings and its effect over the mean rate of heat extraction over the interval.
6. Study the operation of a vapor compression refrigeration unit. Calculate the mean rate of heat extraction over the interval, mass flow rate circulation of the refrigerant and capacity of refrigeration unit.
7. To prove Boyle-Marriott's law.
8. To determine Joule-Thomson coefficient of argon.