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ABSTRACT

This project deals with study, design, construction and installation of Vacuum laboratory apparatus including preparation of lab manual for Vacuum Laboratory which is being set up under Refrigeration and Cryogenic Engineering Centre in NIT Rourkela.

The Vacuum laboratory, a part of first year M.Tech (Cryogenics and Vacuum Technology) curriculum in Mechanical department, consists of twelve experiments in which six experiments will be designed and installed under this project. The proposed laboratory will help both the graduate and under graduate students of our institute to conduct different experiments under vacuum environment.

Two experiments using rotary pump [1] namely; Pumping speed measurement and conductance measurement of different piping analogy need to be set up. For which we designed a vacuum chamber [3] with suitable capacity first, decided pump down time allowable to get ultimate vacuum level of a rotary pump in accordance with the total lab hrs assigned to each sessions, and finally we calculated pumping speed [2] required for the pump. The same rotary pump set up will be used for conductance measurement too, but with different piping analogy. Conductance of each pipe is calculated using relations and are compared with experimental results in series and parallel connections.

For high vacuum application a turbo-molecular pump [4] experimental set up is designed. Pumping speed calculation as well as leak detection test may be carried out in this set up. For roughing and backing, a suitable rotary pump is fitted with this pump.

Since Mass spectroscopic leak detection [5] is most commonly used leak detection method in vacuum systems, we proposed one MSLD with turbo-molecular pump. Bill of material for the turbo pump is also prepared and handed over to department.

Oil-free vacuum atmosphere can also be created in our lab by using sorption pump [6] for medium range vacuum applications. A small capacity sorption pump's design is carried out and drawings are prepared.

Keywords: *Cryogenics, Turbo-molecular pump, Sorption Pump, Mass spectroscopy*

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