Class: 3rd stage

Subject: thermodynamics

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(Thermodynamic Lab3)

Experiment No. 2

(The relationship between pressure and temperature)

Prepared by

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Number of experiment: Experiment Number Two.

Name of experiment: The relationship between pressure and temperature.

Purpose of experiment: Study the relationship between pressure and temperature of saturated steam.

Used equipment: As shown in Figure (1), the used equipment in this experiment are:

1. Boiler consisting of sealed airtight vessel which is mounted on a self-opening valve if the pressure inside the boiler increases to a certain amount.
2. Thermometer and pressure gauge which are used to measure temperature and pressure inside the vessel.
3. Electric heater which is used for heating the boiler.

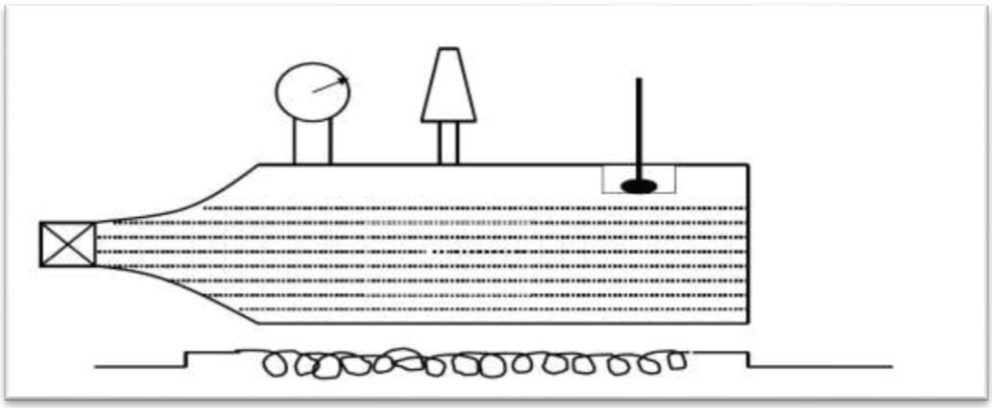

Fig (1) : Boiler.

Theory

Compounds are pure substances formed when two or more distinct elements are combined chemically with a fixed ratio of its atoms and they can be broken down into separate elements using chemical methods, such as water.

When the water is heated, the temperature is gradually increased. This heat is called sensible heat. When heating continues, the temperature continues to rise to a certain amount then stabilize.

The water starts to boil and converts from liquid to vapor, during transition operation both temperature and pressure remain constant. This heat required to convert water from liquid to vapor without changing the temperature is called latent heat of evaporation, so water here has two phases at same temperature and pressure and any addition of thermal energy results in a phase transition only.

In this point, the temperature is called saturation temperature which is the temperature for a corresponding saturation pressure at which a liquid boils into its vapor phase. The liquid can be said to be saturated with thermal energy.

Procedure

1. Open safety valve and fill the boiler with water into about two thirds.
2. Heat the water until it begins to boil and expels the air from the boiler.
3. Close the safety valve and control the tie well to avoid vapor leakage.
4. Connect the thermometer in its designated position.
5. Keep heating until the pressure reaches 8 bar where heating is stopped, record time with pressure and temperature.
6. Record the time with pressure and temperature while cooling until the pressure reaches 1 bar.
7. Make a table of readings as below.

NO	P	T	Time
1	1	65	5 min
2	5	80	10 min
3	8	105	15 min

Warning

Do not open the safety valve as long as the pressure inside the container above the atmospheric pressure.

Discussion and questions:

1- What is the purpose of valve safety?
2- Why the boiler is loaded into about two thirds of water?
3- Define sensible heat and latent heat.
4- Explain all three phases that pass the water.
5- Draw the relationship between the saturation pressure and temperature that obtained from the experiment.
6- Draw the relationship between the saturation pressure and temperature that obtained from the steamtable.
7- Compare between the curves that obtained from experiment and simulation.