Saya akui bahawa saya telah membaca karya ini dan pada penerangan saya karya ini adalah memadai dari segi skop dan kualiti untuk tujuan penganugerahan Ijazah Sarjana Muda Kejuruteraan Mekanikal (Struktur dan Bahan)

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TEMPERATURE MEASURING APPARATUS

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Laporan ini diserahkan kepada Fakulti Kejuruteraan Mekanikal sebagai memenuhi sebahagian daripada syarat penganugerahan Ijazah Sarjana Muda Mekanikal (Struktur & Bahan)

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Saya akui laporan ini adalah hasil kerja saya sendiri kecuali ringkasan dan petikan yang tiap – tiap satunya saya jelaskan sumbernya

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ABSTRACT

The aim of this project is to develop an apparatus to measure temperature using thermocouple and RTD sensors. Instead of measure temperature, this project includes observation of temperature and characteristics of the temperature measuring equipment. This project is based on a dry-well concept that is a stable heat source which is widely used in laboratory environments for calibration of temperature sensors. There are several experiment conducted in this study such as a study of the characteristic of a soldering iron using thermocouple as a sensor (with digital multimeter and temperature meter) and temperature calibration from the apparatus that has been built to compare the result of thermocouple and RTD (PT100) sensor. The apparatus for this purpose was developed using CNC lathe, milling, bending and welding.

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LIST OF FIGURE AND DIAGRAM

CHAPTER 1
INTRODUCTION

1.1 Project title:

Temperature measuring apparatus

1.2 Project objective:

1. To develop an apparatus which are able to measure temperature.
2. Observation of temperature.
3. Study the characteristics of the temperature measuring equipment.

1.3 Project scope:

1. Study the characteristics of sensors in temperature measurement including structure, working principles, and output of the sensors.
2. Identifying the difference of the sensors that in temperature measurement.
3. Design a heat source in temperature measurement which able to calibrate temperature probes.
4. Study the required signal condition in temperature measurement.
5. Develop a simple signal condition for voltage type sensors and resistance type sensors in temperature measurement.
6. Measure the characteristic of the developed signal condition.

1.4 Application of temperature measurement:

1.4.1 Furnace

A furnace is a device used for heating. There are many types of furnaces provided. One of the furnace that was applied in industries are described below:

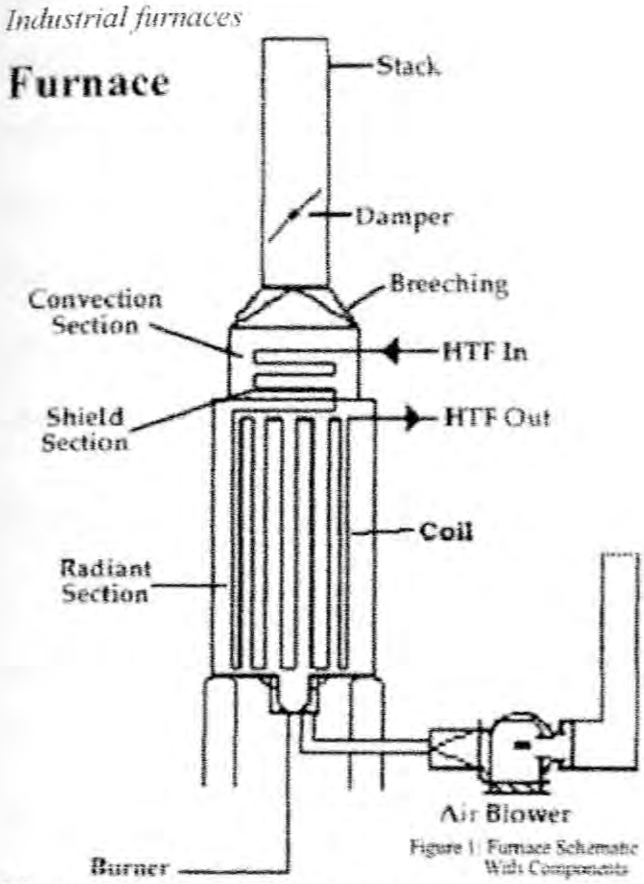

Figure 1.1 : Industrial furnace

A furnace or direct fired heater, is an equipment used to provide heat for a process or can serve as reactor which provides heats of reaction. Furnace designs vary as to its function, heating duty, type of fuel and method of introducing combustion air. However, all furnaces have some common features.

Fuel flows into the burner and is burnt with air provided from an air blower. There can be more than one burner in a particular furnace which can be arranged in cells which heat a particular set of tubes. Burners can also be floor mounted as in the picture, wall mounted or roof mounted depending on design. The flames heat up the tubes, which in turn heat the fluid inside in the first part of the furnace known as the radiant section. In the chamber where combustion takes place, known as the firebox, the heat is transferred mainly by radiation to tubes around the fire in the chamber. The heating fluid passes through the tubes and is thus heated to the desired temperature. The gases from the combustion are known as flue gas. After the flue gas leaves the firebox, most furnace designs include a convection section where more heat is recovered before venting to the atmosphere through the flue gas stack.

Radiant section

The radiant section is where the tubes receive almost all its heat by radiation from the flame. In a vertical, cylindrical furnace, the tubes are vertical. Tubes can be vertical or horizontal, placed along the refractory wall, in the middle, etc., or arranged in cells. Studs are used to hold the insulation together and on the wall of the furnace. They are placed about 1 ft (300 mm) apart in this picture of the inside of a furnace. The tubes, which are reddish brown from corrosion, are carbon steel tubes and run the height of the radiant section. The tubes are a distance away from the insulation so radiation can be reflected to the back of the tubes to maintain a rather uniform tube wall temperature. Tube guides at the top, middle and bottom hold the tubes in place.

Convection section

The convection section is located above the radiant section where it is cooler to recover additional heat. Heat transfer takes place by convection here and the tubes are finned to increase heat transfer. The first two tube rows as seen in the picture below are in the bottom of the convection section and at the top of the radiant section. This area of bare tubes (without fins) are known as the shield section, so named because they are still exposed to plenty of radiation from the firebox and shield the convection section tubes, which are normally of less resistant material from the high temperatures in the firebox. These tubes may be of the same material as the radiant coil tubes. The area of the radiant section just before flue gas enters the shield section and into the convection section called the bridgezone. Crossover is the term used to describe the tube that connects from the convection section outlet to the radiant section inlet. The crossover piping is normally located outside so that the temperature can be monitored and the efficiency of the convection section can be calculated. The sightglass at the top allows personnel to see the flame shape and pattern from above and visually inspect if flame impingement is occurring. Flame impingement happens when the flame touches the tubes and causes small isolated spots of very high temperature.

Burner

The burner in a vertical, cylindrical furnace as above, is located in the floor and fires upward. The burner tile is made of high temperature refractory and is where the flame is contained in. Air registers are devices with movable flaps or vanes that control the shape and pattern of the flame, whether it spreads out or even swirls around. Flames should not spread out too much, as this will cause flame impingement. Air registers can be classified as primary, secondary and if applicable, tertiary, depending on when their air is introduced. The primary air register supplies primary air, which is the first to be introduced in the burner. Secondary air is added to supplement primary air. Burners may include a premixer to mix the air and fuel for better combustion before introducing into the burner. Notice that in the picture of the floor of the furnace, it is a different material from that of the wall. It is made of hard castable refractory known as kastolite so the floor can be walked on during maintenance. The brown dust on the floor is soot from the flame and rust from the tube.

The pilot flame here is lit by an ignition transformer. The pilot flame in turn lights up the main flame. The pilot flame uses natural gas while the main flame can use both diesel and natural gas.

Sootblower

Sootblowers utilize flowing media such as water, air or steam to remove deposits from boiler tubes. There are several different types of sootblowers used. Wall blowers are used for furnace walls and have a very short lance with a nozzle at the tip. The lance has holes drilled into it at intervals so that when it is turned on, it rotates and cleans the deposits from the wall in a circular pattern. After it has turned a predetermined number of rounds, the sootblowing is completed and stops. Below is a convection section sootblower utilizing medium pressure (10-12bar) steam.

Stack

The flue gas stack is a cylindrical structure at the top of all the heat transfer chambers. The breeching directly below it collects the flue gas and brings it up high into the atmosphere where it will not endanger personnel.

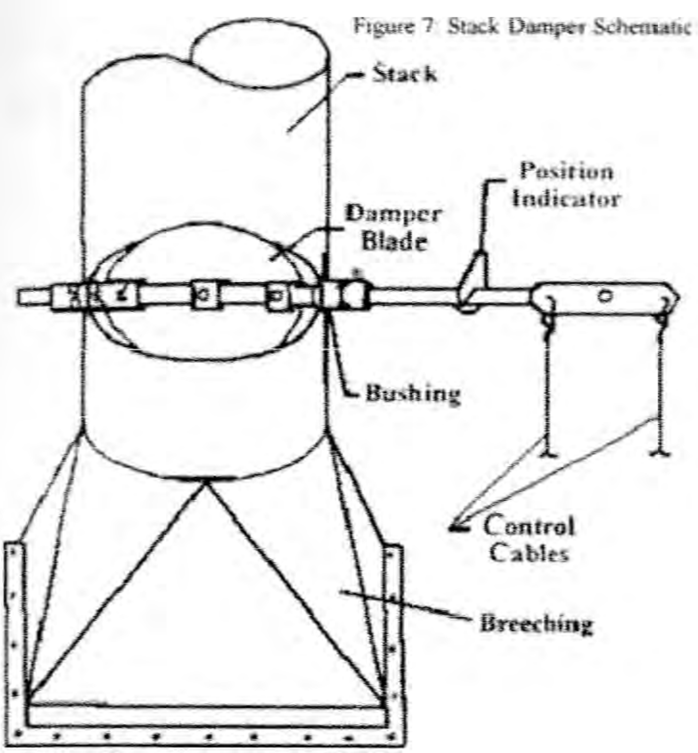

Figure 1.2 : Stack damper

The stack damper contained within works like a butterfly valve and regulates draft in the furnace, which is what pulls the flue gas through the convection section. The stack damper also regulates the heat lost through the stack. As the damper closes, the amount of heat escaping the furnace through the stack decreases, but the pressure or draft in the furnace increases which poses risks to those working around it if there are air leakages and the flames can then escape out of the firebox.

Insulation

Insulation is an important part of the furnace because it prevents excessive heat loss. Refractory materials such as firebrick, castable refractories and ceramic fibre, are used for insulation. The floor of the furnace is normally castable since it has to be hard enough to walk on during maintenance. Ceramic fibre is commonly used for the roof and wall of the furnace and is graded by its density and then its maximum temperature rating.

CHAPTER 2
STUDY BACKGROUND