Al-Balqa’’a Applied University
Faculty Of Engineering Technology
Mechanical Department
Second Semester 2014
May 21, 2014

Training Report At:
PETRA Engineering Industries Company

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Submitted in Partial Fulfillment of the Requirement
for the Bachelor Degree of Science in Mechanical Engineering.
PETRA ENGINEERING INDUSTRIES Co.
TRAINING REPORT

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Chapter one | Introduction

1.1 | Overview

HVAC, Heating, ventilating, and air conditioning is based on inventions and discoveries made by Nikolay Lvov, Michael Faraday, Willis Carrier, Reuben Trane, James Joule, William Rankine, Sadi Carnot, and many others.

The invention of the components of HVAC systems went hand-in-hand with the industrial revolution, and new methods of modernization, higher efficiency, and system control are constantly introduced by companies and inventors worldwide. The three central functions of heating, ventilating, and air-conditioning are interrelated, especially with the need to provide thermal comfort and acceptable indoor air quality within reasonable installation, operation, and maintenance costs. HVAC systems can provide ventilation, reduce air infiltration, and maintain pressure relationships between spaces. The means of air delivery and removal from spaces is known as room air distribution.

The starting point in carrying out an estimate both for cooling and heating depends on the exterior climate and interior specified conditions. However before taking up the heat load calculation, it is necessary to find fresh air requirements for each area in detail, as pressurization is an important consideration.

In modern buildings the design, installation, and control systems of these functions are integrated into one or more HVAC systems. For very small buildings, contractors normally capacity engineer and select HVAC systems and equipment. For larger buildings, building services designers and engineers, such as mechanical, or building services engineers analyze, design, and specify the HVAC systems, and specialty mechanical contractors fabricate and commission them. Building permits and code-compliance inspections of the installations are normally required for all sizes of buildings.

Although HVAC is executed in individual buildings or other enclosed spaces, the equipment involved is in some cases an extension of a larger district heating (DH) or district cooling (DC) network, or a combined DHC network. In such cases, the operating and maintenance aspects are simplified and metering is necessary to bill for the energy that is consumed, and in some cases energy that is returned to the larger system.
(For example, in a DHC network at a given time a building may be utilizing chilled water for air conditioning, but the warm water it returns may be utilized by another building for heating or the overall DH portion of the DHC network, likely with energy added to boost the temperature.)

Basing HVAC on a larger network helps provide an economy of scale that is often not possible for individual buildings, for utilizing renewable energy sources such as solar heat, winter's cold, the cooling potential in some places of lakes or seawater for free cooling, and the enabling function of seasonal thermal energy storage.

The HVAC industry is a worldwide enterprise, with roles including operation and maintenance, system design and construction, equipment manufacturing and sales, and in education and research. The HVAC industry was historically regulated by the manufacturers of HVAC equipment, but regulating and standards organizations such as HARDI, ASHRAE, SMACNA, ACCA, Uniform Mechanical Code, International Mechanical Code, and AMCA have been established to support the industry and encourage high standards and achievement.

### 2.2 Training Information

**Period of time:** Between 1 Feb. and 6 May. Of 2014.

**Training hours:** 280 hours.

**Company:** PETRA For Engineering Industries Co.

**Branch:** After sales and showroom.

Marj Al-Hamam, Amman.

**Department:** Central systems, running and maintenance.

**Position:** A member of the team work consists of engineers and technicians.

**Nature of the training:** Days of training divided between the sites and main offices of department as schedule of projects and contractors.
Chapter two | Company Profile

2.1 | PETRA

**Petra Engineering Industries Co.** was founded in 1987 with a broad vision to produce a wide variety of HVAC equipment that meet a diversity of application requirements and to export to major worldwide markets. The execution of successful corporate and business strategies to this effect soon took Petra to great heights and enabled them to begin competing with long-established companies.

By 1994, Petra expanded its line of HVAC equipment utilizing some of the industries most advanced machinery and raw materials to achieve the highest quality standards. Their equipment was quickly gaining recognition in over 20 countries worldwide. To handle the increasing demand for their products, the facilities were expanded and the technology of the products was continually improved.

With advent of the new millennium, Petra was designing and manufacturing a large array of quality HVAC equipment to suit all commercial and industrial applications. Their strategic finesse and exceptional products enabled them to enter the US market. Being one of the most competitive and challenging markets, the US symbolized a major milestone of success for Petra. With dedicated drive, Petra continues to export to the US and over 50 countries worldwide.

Today, Petra Engineering Industries Co. is a market leader as a designer and manufacturer of sophisticated, high quality commercial and industrial HVAC equipment. The company has grown significantly and today has a facility that is over 300,000 m2 with more than 1500 highly competent technical and managerial employees, and to cope with the increasing demands for Petra’s products Worldwide, Petra has embarked on an expansion program to build a 200,000 m2 production facility at Mafraq – Jordan and a 30,000 m2 facility in Saudi Arabia.

Petra will persevere in doing the utmost in terms of innovation and quality achievements to continue providing its customers throughout the world with the comfort and value they expect.
Figure (2.1) | Engineering Building – PETRA Jordan.

**Mission:**
Petra engineering industries design and manufacture high quality HVAC equipment in accordance with globally recognized standards. Petra’s HVAC equipment offer comprehensive solution with the highest level of comfort and luxury for its customers in all its markets.

Petra’s commitment towards its employees is to build and improve their capacities, competence and skills to ensure the highest competitive advantage that meets and exceeds the expectations of all its customers and employees.

**Vision:**
To be one of the World’s leading manufacturers of internationally recognized high quality HVAC equipment in terms of sales and market share and providing innovation and comprehensive HVAC solutions, which will become the most preferred choice of customers by the year 2015.
Values:
Petra is committed to support its vision by following the below values:
• Innovation and Excellence.
• First-class excellence by adopting TQM.
• Investment in human capital.
• Teamwork.
• Recognizing the value of our employees.
• Working closely with our customers
• Treating our customers and employees with respect and courtesy

Production Facilities:
Petra’s HVAC products are designed and developed on site through the various design departments which coordinate their efforts and know-how to produce state of the art technology in accordance with various international HVAC standards.

Petra’s Design Facilities include :
• Unit Construction and Design.
• Electrical Control Design.
• Refrigeration Design.
• Heat Exchanger Design.
• Technical Design.
• Turnkey System Design.
• Applied System Design.
• Industrial Equipment Design.
2.2 | Products

- **Air handlers (AHU’s):**
  Is a device used to condition and circulate air as part of a heating, ventilating, and air-conditioning (HVAC) systems and it’s constructed around a framing system with metal in fill panels as required to suit the configuration of the components.

- **Chillers:**
  A machine that removes heat from a liquid via a vapor-compression or absorption refrigeration cycle. This liquid can then be circulated through a heat exchanger to cool air or equipment as required.
• **Dry cooler units:**
  It’s the same with chiller but designed to work under all normal conditions.

![Dry cooler unit](image1.png)

Figure (2.4) | Dry cooler unit.

• **Exhaust fans:**
  The exhaust fan series includes the Smart and Full Duty models. These units are used to remove exhaust air from areas such as restrooms, kitchens, restaurants, hospitals, and factories.

![Exhaust fan](image2.png)

Figure (2.5) | Exhaust fan.

• **Fan coil units:**
  is a simple device consisting of a heating or cooling coil and fan. It is part of an HVAC system found in residential, commercial, and industrial buildings.

![Fan Coil](image3.png)

Figure (2.6) | Fan Coil.
• Packages:

Figure (2.7) | Package unit.

• Split units.

Figure (2.8) | Duct split units.
- PETRA systems for energy saving.
- Computer and server room units.

### 2.3 | Area of business

Around the whole world and the offices of PETRA in many countries in the middle East and Europe and USA.
Chapter three | Training

3.1 | Objectives

There are several purposes can be obtained from the training in PETRA company and after completing the trainee will be able to:

- Identify the common tools and work procedures required to work safely and effectively with repairing the HVAC systems.
- Describe the basic theory of the refrigeration cycle and explain the basic scientific principles that apply on HVAC equipments.
- Identify standard refrigerants used in common commercial applications.
- Describe the basic components present in heating and cooling systems.
- Understand the importance of good working in projects, communication practices and improving personality skills.

3.2 | Nature of the training

At the beginning of the training day at 7.30 am each of engineers and technicians meet in the offices and get the feedback, problems and reports of the day before, after that each team get the tasks schedule of projects and clients they have to visit in the day, Each team take the required tools from the warehouse equipment of the company and move to start the tour around the sites and with arriving to the site the technician start check on devices of PETRA and write his notes about each and arrange with senior engineer in the offices what the procedures required to repair it and tell the contractor by E-Mail if it’s needed, then he write the report of the site and going to another one until complete the tour around all sites.
During 35 days of training I have visited around 50 projects and sites and learned about many of PETRA’s products like a chillers, AHU’s, fan coils, cassette and packages, and I have got a valuable knowledge about the HVAC systems in Jordan and the world and how installation the air conditioning systems in the project and how it’s differs from one to another as the activity of the projects.

In each site I tried to be an active member in the team and work with them in check and repair the devices to get the maximum knowledge can the trainee get in the condition of work, and they entrusted me to take a repairing missions and it’s done as well as needed like pipe gas welding and install software on the control unit of the devices and meet with projects managers to talk about operation of PETRA products in addition to writing the reports of many sites.

It was a good practical experience and communication skills I have got from the training period and motivate me to improve a lot of aspects in my personality especially how to acting as an engineer and how to contact the contractors by the name of company.

In the following, let me show an examples of sites have visited and how to deal with the device in each site:

1) **Grand Criminal Court – Al Jwaideh:**

   After check on the devices of cassette type found that the problem is vibrations in the supply and return pipes of boilers and leak in the main supply pipe, then we arrange with contractor to repair connections of the network and told him that PETRA not responsible about this problem because the it’s causes from the construction of the building, then wrote the report of the site and sent it to main offices.

2) **Security and Crisis Management center - Amman:**

   Install new software on seven Chillers (special design) and check the operation condition of each and the BMS building system, in addition check on the control plates of three devices of package and found that there’s a leak in the ferion gas pipe line in one of them, then wrote the report of the site and sent it to main offices.
3) **Station Of Disi’s Water pumps project - Airport road:**

   Explain the principle of work of PETRA devices in the station for the site senior engineer of GAMA (the contractor) and this mission entrusted for me from the manager engineer of our department, and check the operation conditions of each devices and reset the set point, then wrote the report of the site and send it to main offices.

4) **IKEA Project – Airport road:**

   Edit operation of control system and reset the frequencies of AHUs in the project because after checked on each, found that there’s a fake fire alarm from BMS building system and check the operation conditions of all devices, then wrote the report of the site and send it to main offices.

5) **King Hussein Business Park (KHBP) – Amman:**

   Check on the devices of computers and servers room and found that the filters of condenser are very dusty and that led to make a freeze on the compressor and internal pipes of the device, then we told the technician of the building to clean or change the filters and wrote the report of the site and send it to main offices.

6) **Advanced Petrochemical Company – sahaab:**

   Check the power connection on the package device and install the filters of supply and return air flow and after that operate the package and write the check list of the warranty, then wrote the report of the site and send it to main offices.

7) **Al-Hijaz Towers for commercial services – Amman:**

   Check on the problem noted by the technicians of the building and it was no heating air in one of the offices and found that there’s a motor of supply duct in the fan coil is off, then told them and arrange with our offices to send a price offer of changing the motor by E-Mail and we wrote the report of the site and send it to main offices.
8) ZAIN Jordan for communication Company – Amman:
   Checked on the devices of computers and servers room and found that there’s one of the devices has a low pressure of ferion gas and determined the reason to the leak found in one of the pipes, told our offices about the problem to tell another department called maintenance contract to repair it because there’s an agreement between ZAIN and PETRA, then wrote the report of the site and send it to main offices.

9) King’s Academy – Ma’daba:
   The team of maintenance asked to explain how to operate the chillers and how to reset the set point of water temperature and we told them about the steps and check on the operation of the system, then wrote the report of the site and send it to main offices.

10) Polivard Project – Abdali project:
   The contractor asked for training from PETRA engineers to the operator company before running the project and how to operate the AHUs in the project and we met them in the main offices of the contractor and talked about the HVAC systems in the project and answer about question they asked, then we moved to a tour with them in the site and checked the devices, Finally we wrote the report of the site and send it to main offices.
CHAPTER FOUR | Discussion and recommendation

4.1 | Discussion
After complete training with Petra I have realized that the HVAC systems are the main component of any building and worldwide and studying the designing of systems and calculate the cooling and heating loads for the projects are very important for the mechanical student and engineer, in addition to improve the personality and communication skills and how it’s act in your position in the company and society.

Also, depending on many project I have visited found that the reasons of breakdown of any device is neglect the maintenance from the team work of the building or damage in a part of pipe during construction lead to leak in it or something like that which turn it off.

4.2 | Recommendation
I recommend PETRA company and especially the central department to improve the skills of technicians and engineers by courses of English, HVAC systems, and how to working safely and it’s a good features leads to get the company vision, In addition to increase the number of technicians in the department to keep up with requirements of the world.

Also, I recommend the management to the general following points:

1) Keeping on touch with all technicians and their requirements.
2) Working well with engineers to improve the competency of staff.
3) Coordinate with the universities in Jordan to sharing the knowledge between students and company.
4) Arrange a courses of HVAC systems for the local community.
5) Arrangement with the vocational training centers to employ the largest possible number of technicians.