

**A Description of MEP Systems for Building Construction
Part 1. Mechanical System**

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A DESCRIPTION OF MEP SYSTEMS FOR BUILDING CONSTRUCTION

Part 1. Mechanical System

INTRODUCTION

MEP are essential elements for building construction. The “MEP” represents mechanical, electrical, and plumbing engineering systems. This paper presents a portion of a series of studies that demonstrate the MEP systems. This portion of study is to describe the mechanical engineering systems. The mechanical systems consist of various components such as a gate system and the HVAC equipment (heating, ventilation, and air conditioning equipment). The description of the mechanical systems is a presentation of the components and their functions for each of the above-listed mechanical systems. The objectives of this paper are listed below:

1. Provide a brief description of the process for building construction.
2. Specify the mechanical systems required for the building construction.
3. Describe the functions of the mechanical systems and their inter-relationships, if any.

In general, a building is designed for a specific purpose of operation. MEP engineering is associated with each component of the operation. Without MEP, a building is a simple structure, which cannot fit to the livable or operational conditions. As an element of MEP, mechanical systems play a significant role in the operation for a building (Reference 1, Wikipedia).

Machinery is also an important portion of the electrical and plumbing systems. Electrical wires transmit electricity for lighting and the operation of some machinery equipment. Plumbing system has a mechanical network which carries water and natural gas for various uses in the building. Automation has also become an important element for mechanical operation in a building. A remote control for door operations is a clear example. The use of a thermostat for heating and air conditioning control is now a typical arrangement.

This study is limited to the discussion of mechanical systems, including gate operation and air conditioning system. Both systems are closely associated with the building construction and operation. The following paragraph briefly describes the process of the building construction. Water, electricity, and natural gas are essential materials to be used in a building. They refer to a major portion of equipment for mechanical operations including, but not limited to, HVAC (heating, ventilation, and air conditioning) and gate operations. Together, the electrical and plumbing engineering are the other parts of MEP.

THE PROCESS OF BUILDING CONSTRUCTION

- Technical documents preparation: Prior issuance of invitation for bid for building construction, some technical documents must exist. These documents include mainly construction plans and the corresponding specifications, which are prepared by the selected engineering firm. Generally, the construction plans consist of site plans, structural plans, and the MEP plans.
- Permitting process: The owner or engineer of the project should submit sets of construction plans for permitting review. A general permit is issued when all plans are approved. Construction can begin following the approval.
- Scheduling and project management: Project schedule and management is set that the construction follows a specified time schedule and requirements of the construction plans. Construction inspection is an important element of the project management.
- Details of the site work: This may include a survey of the construction site, demolition and clearing, tree protection, site excavation, identification of utility lines, and the establishment of disposal sites and routes of transport.
- Construction of the building: The construction begins with the setting of foundation and footing. The other parts include framing of walls and trusses, and the insulation of dry walls and ceilings.
- Exterior and interior finishes: One of the exterior finishes is roofing work. Sidings are another protective element. Other exterior finishes include parking, driveways, walkways, fencing, landscaping, building trims, water and electricity accesses, and the drainage and its facilities. Interior finishes refer to walls, ceilings, trims, storage, cabinets, counter tops, storage spaces, and their paintings.
- Sites cleaning and final inspection: The last process of building construction is the cleaning of construction sites, both inside and outside areas. Then the final inspection and approval of the construction is required. A written approval of Certificate of Occupancy (CO) shall be issued that is the evidence of the final approval.

In general, the process of building construction, as described above, may consist of planning, design, drawing, permitting, land work, building installation, and sites refinement. MEP engineering is closely associated with each phase of the building construction. Mechanical systems, specifically, are the important elements of the MEP plan and tasks.

MECHANICAL SYSTEMS

Many fixtures and equipment in a building are related to mechanical systems. Gas, water, and electricity are often carried by the mechanical equipment. HVAC system is a typical mechanical system. Automated gates or doors are combined systems of mechanical and electrical services.

(1) HVAC Equipment

HVAC equipment consists of ventilation, air conditioner, and the gas forced air furnace (Reference 2, Gee Heating & Air Services). These equipment make the air warmer or cooler that creates a comfortable temperature for people in the building.

Ventilation is a mechanical system which brings in fresh air and remove contaminated air out of the building. This system consists of a fan and duct to guide air into the building. An exhaust fan is used to push air out of the building.

The gas forced air furnace system has five components, which include a furnace, a blower, a filter, the evaporator coil, the air handling unit, and the air supply and return duct. The blower delivers the current of hot air from furnace to the evaporator, passing through the filter. The hot air is cooling when it is in contact with the coil of the evaporator. The heat of the hot air is transmitted to the refrigerant inside the tubes of the evaporator. The heated refrigerant is then dissipated to the space through the air handling unit and a network of air ducts.

The central air conditioning system (AC) has an outdoor unit which consists of several component (Reference 3, Carrier Global). These include a fan, a compressor, and the condenser coil. This coil is composed of the refrigerant-filled tubing system. A fan is on top of the tubing system and the tubing compressor. AC also has an inside unit which houses a fan and the evaporator coil. There is copper tubing allowing refrigerant to flow between indoor and outdoor units. A thermostat placed inside to control system operation.

(2) AC System Operation

- AC is operated using a specified refrigerant. The refrigerant circulates around the components of AC units. The compressor and condenser units are located outside while the evaporator, blower or fan, and the dock work are placed in the building.
- The refrigerant is a warm gas when it enters the compressor. Following the compression, the refrigerant flows passing through the condenser coil next to the compressor. The dissipated heat during compression is removed by the fan located on top of the compressor and condenser.
- The evaporator is located inside a living space, which receives refrigerant from the condenser coil through a copper tubing and an expansion device. The refrigerant in the evaporator is now a cold liquid.
- The warm air inside the building or living space is cooled down when the heat in the air is absorbed by the evaporator coil, which receive cold refrigerant from the condenser.
- The refrigerant in the evaporator becomes warm by absorbing the heat dissipated from the living space. Then the warmed gas of refrigerant travels back to the compressor.
- A thermostat is set in the living space to monitor and control the temperature of the indoor air. The thermostat is also connected to different units of the AC system.

Figure 1 presents a flow chart to identify the AC system operation. Figure 2 presents a flow chart to identify the gate system operation.

(2) Gate System Operation

Gate operation for a building may be a combination of activities originated from the mechanical and electrical sources. The gate machine is connected to an electric source, which can be a battery package or the electricity from a building.

The machinery for a gate normally consists of a circuit control board, a relay, and an electrical motor. A sensor is placed to respond to a transmitter or remote control (reference 4, All-O-Matic). The sensor sends a signal to the relay device, which further starts the operation in the control board. The control board sends electricity to the motor, and in turn, the motor runs to move the gate through a mechanism. The circuit control board also controls the timing and speed of the gate operation.

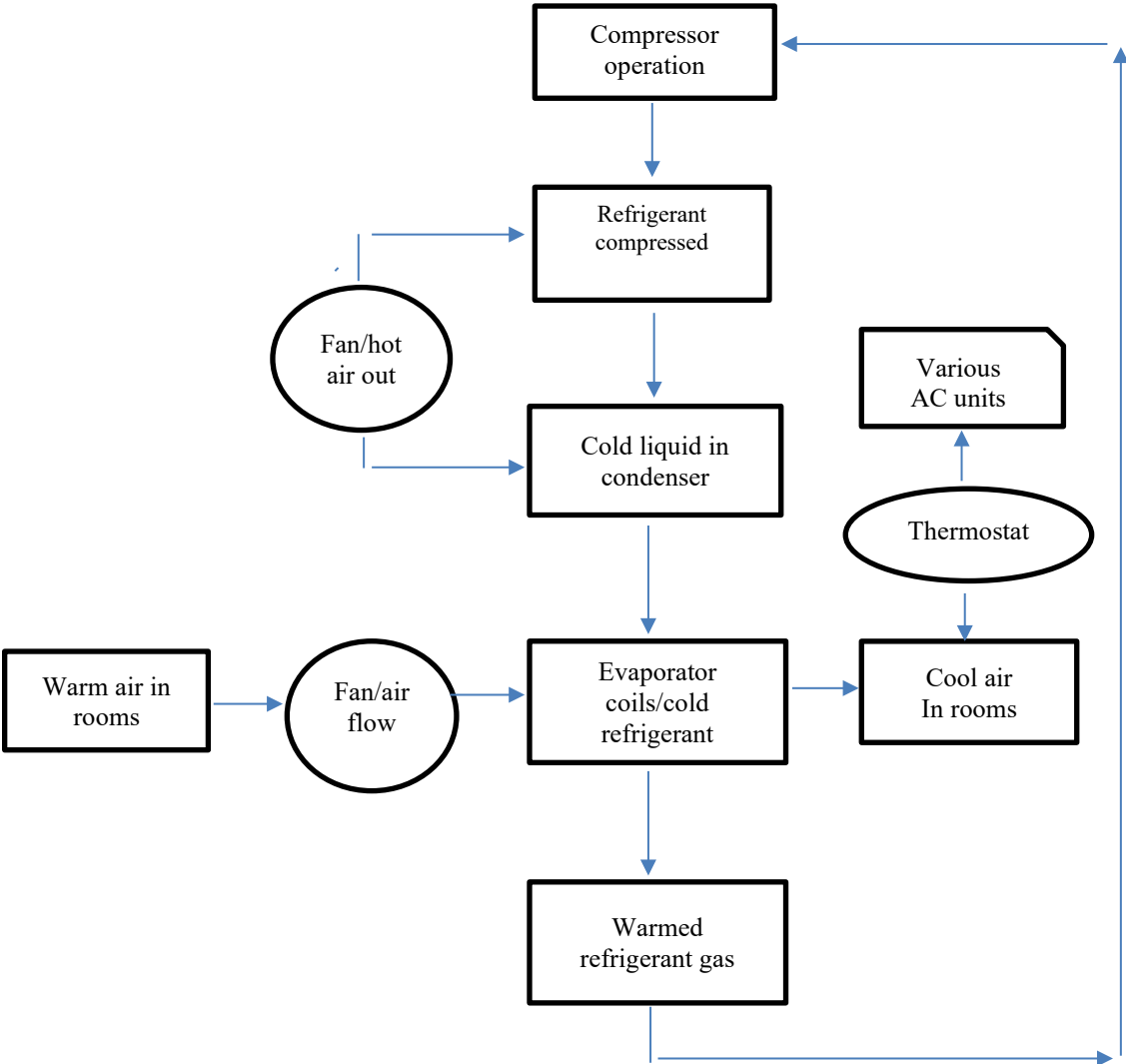


Figure 1. A flow chart for AC system operation

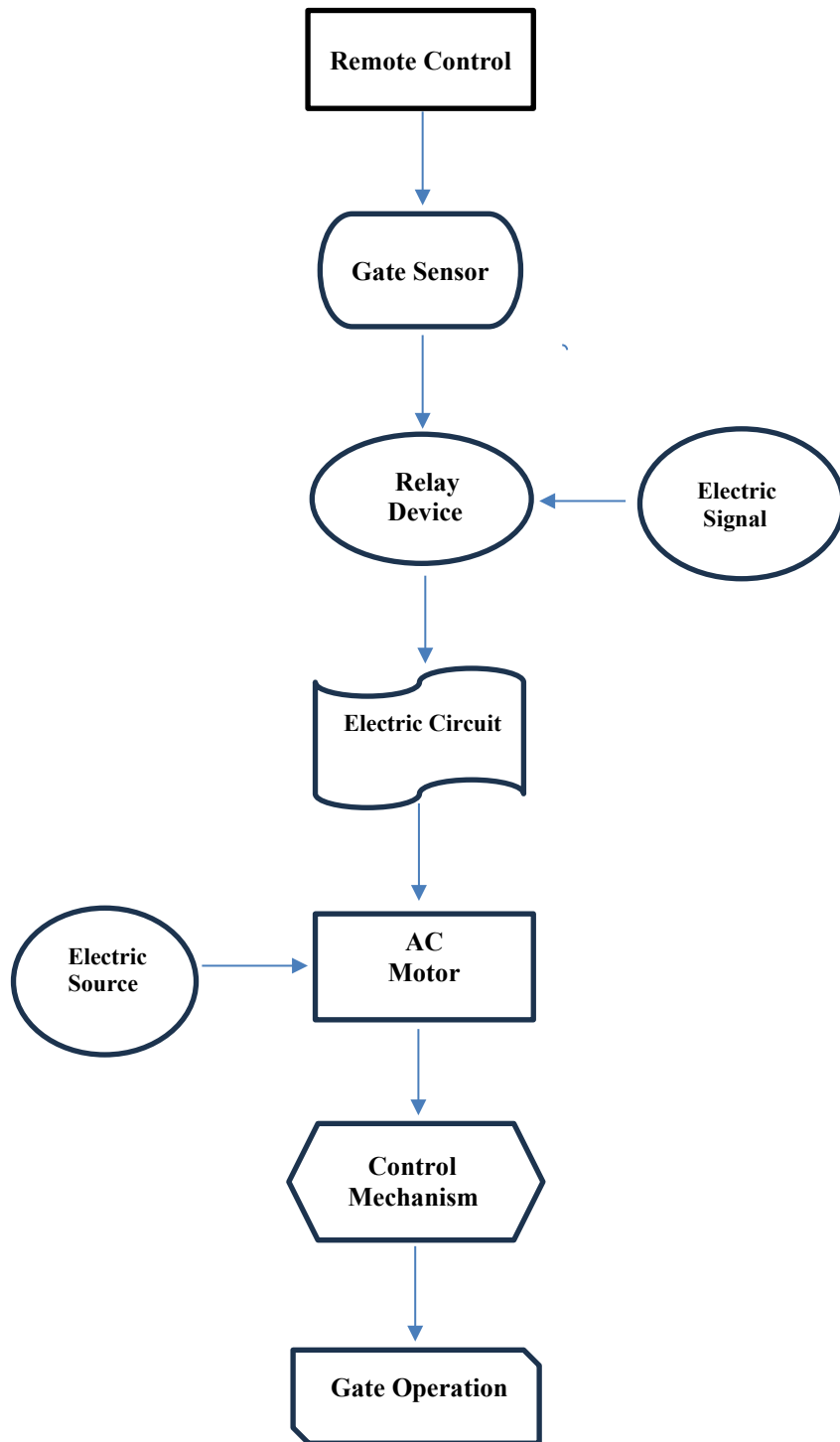


Figure 2. A flow chart for gate system operation
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CONCLUSION

This paper has identified the process of the building construction. MEP systems are closely associated with each element of the process. The MEP systems represent mechanical, electrical, and plumbing engineering structures. This paper is a study of the mechanical systems that the structures and operations of a few mechanical systems are described.

The common mechanical systems for building construction consist of HVAC equipment (heating, ventilation, and air conditioning equipment), elevator, and automated gate or door systems. This study discussed machineries including a gate system and the air conditioning system (AC system). The gate system has a machinery box which is equipped with a relay device, a circuit control board, and an electrically-operated motor. Normally, the circuit board and the associated motor are the essential elements for a gate system. The essential elements of an AC system are the compressor, converter, and the evaporator coil that control the operation of the AC system.

This study provides basic knowledge of the mechanical systems for building construction. The study identifies the structures and their operations of the mechanical systems. In this regard, the main purpose of the presentation is to communicate with Asian contractors about basic knowledge in mechanical systems for building construction and maintenance.

Contractors who read this paper might be benefitted in working with the planning, operation, and purchase of the mechanical systems.

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