Engineering Building Services Induction Course

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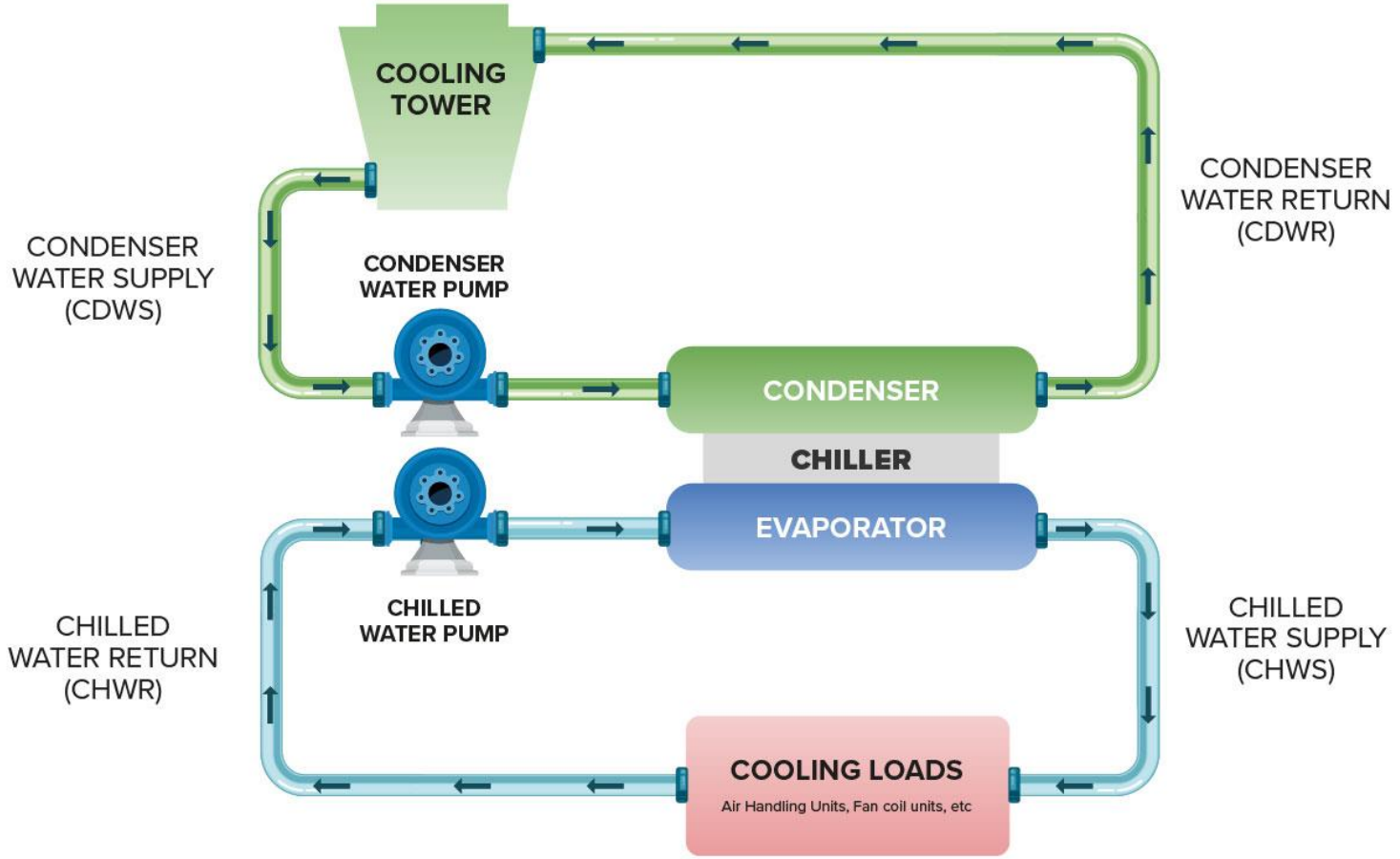
6. Fire Protection Systems
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1. Chilled water system

A chilled water system is a centralized HVAC (Heating, Ventilation, and Air Conditioning) system that uses chilled water to cool buildings or facilities. It involves a chiller that cools water, which is then circulated through a loop of piping to air handling units (AHUs) and fan coil units (FCUs). These units then cool the air and distribute it throughout the building.

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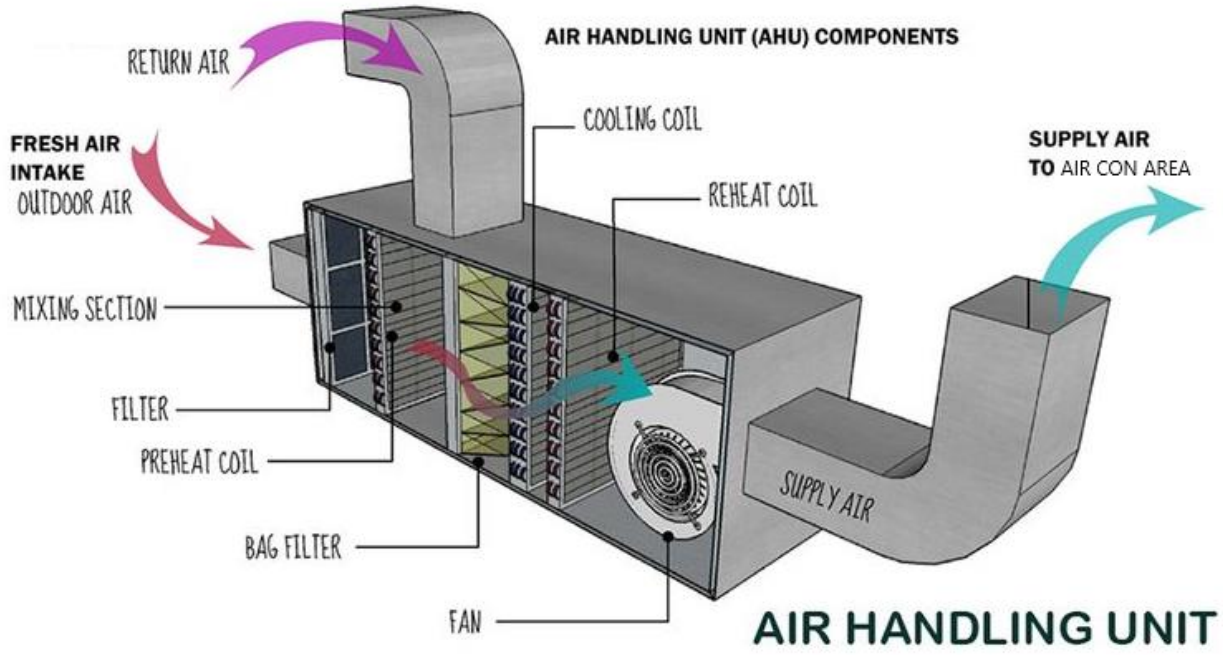


Chilled Water Chiller System

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1.1 Air Handling Unit

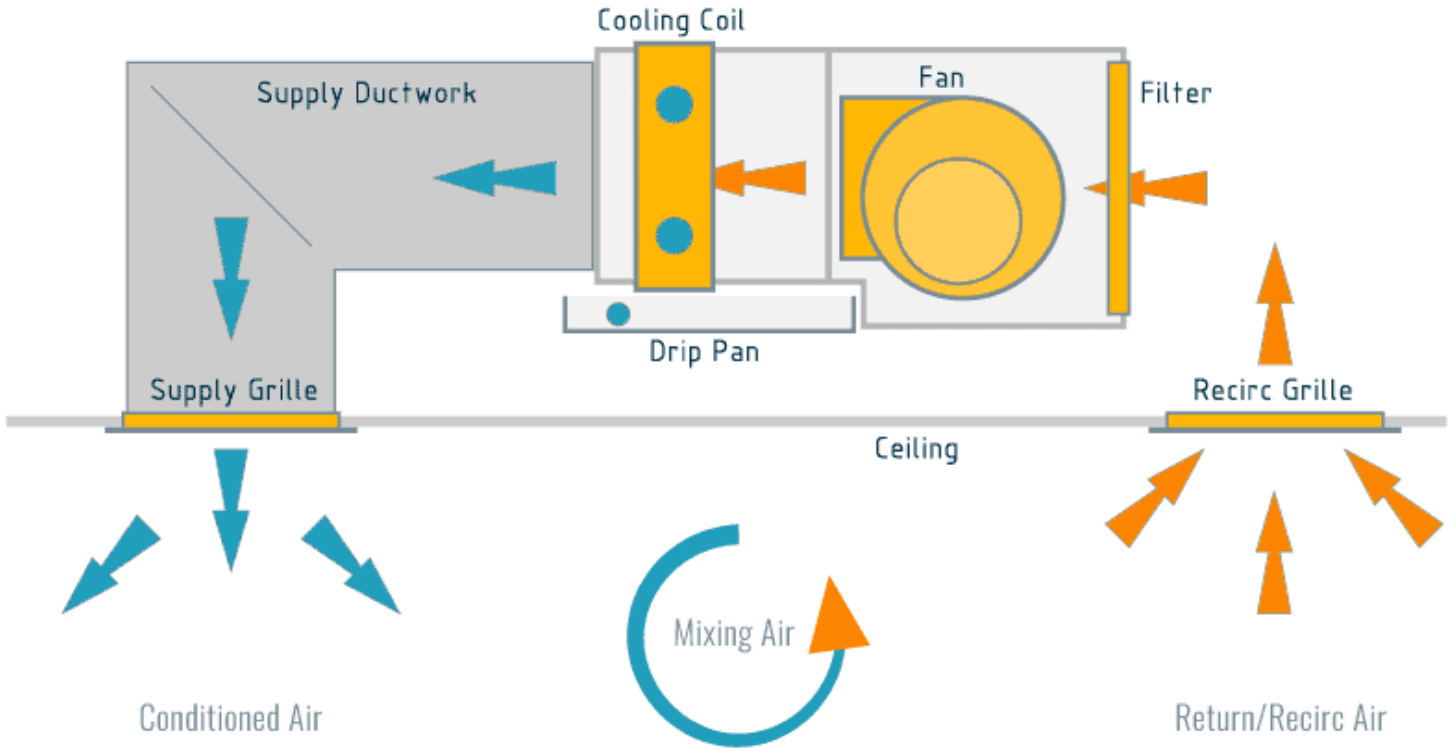
The air handling unit (AHU) is the heart of central air conditioning. It collects outside air and room air, removes dust and other particles from the collected air, adjusts the temperature and humidity and then supplies comfortable and refreshing air-conditioned air into the rooms through ducts.



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1.2 Fan Coil Unit

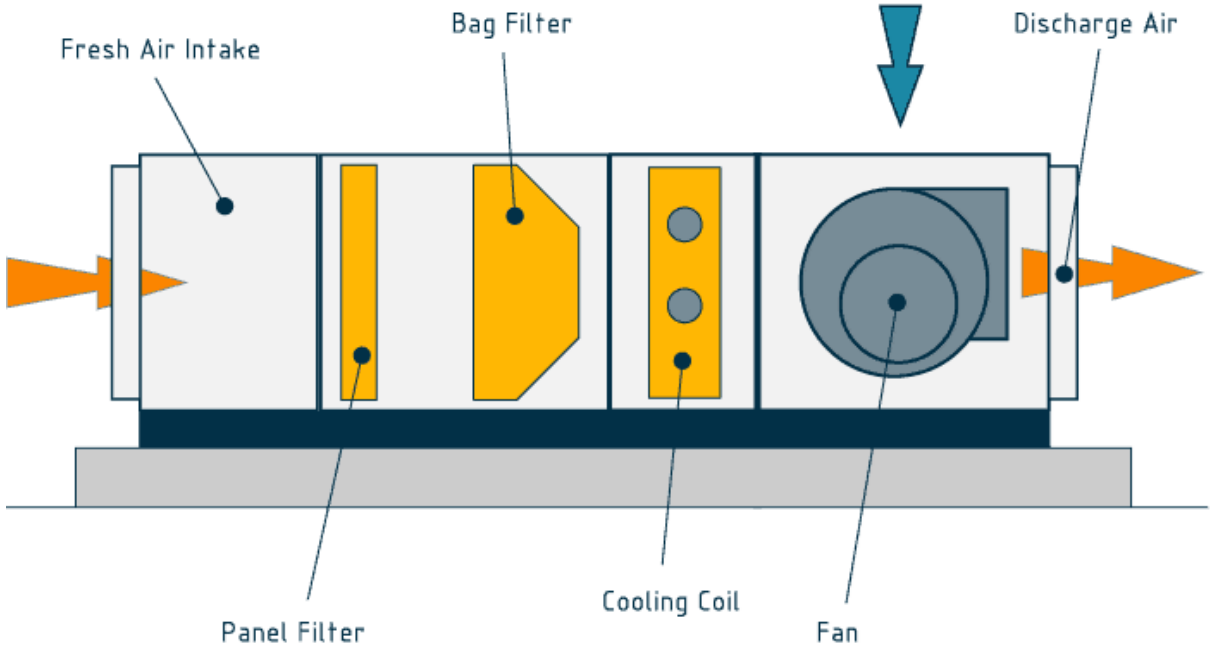
Fan coil units (FCU's) are small single units that condition air and move it to the space via minimal ductwork. They can be used to manage small loads [KW], usually located in single rooms, recirculating the air.



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1.3 Primary Air Handling Unit

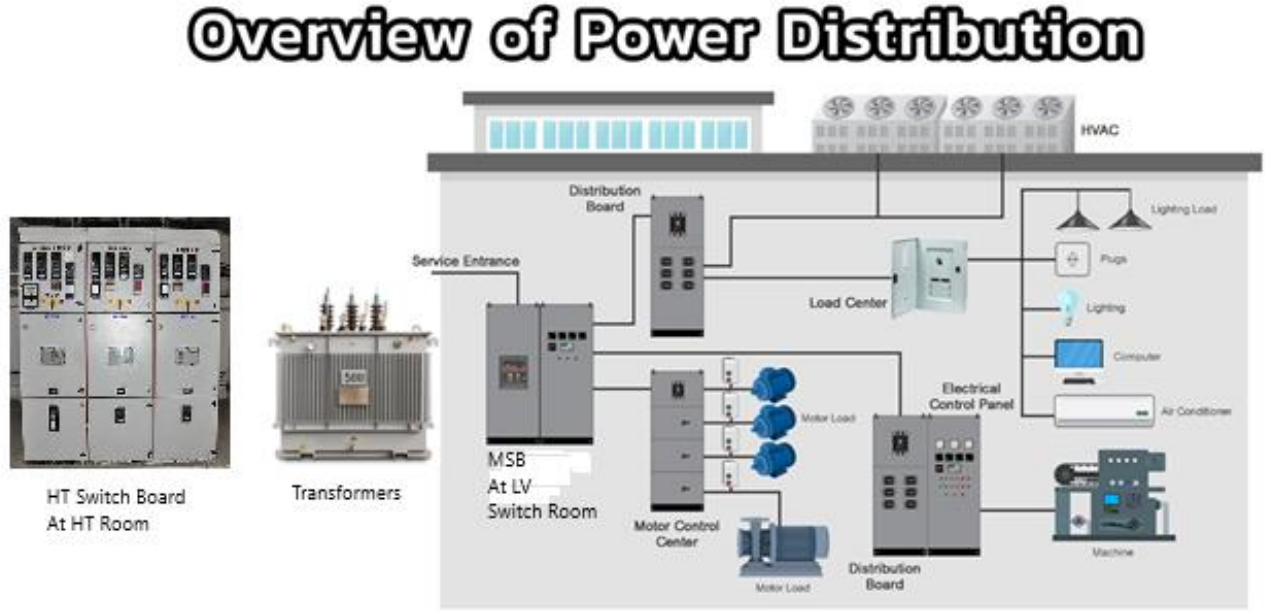
A Primary Air Handling Unit (PAHU) is a component in HVAC systems that primarily handles the initial processing of fresh air before it's delivered to other air handling units or fan coil units. It focuses on cleaning and sometimes pre-cooling the outdoor air, filtering it with a G4 filter, and may include a dehumidifier with a drainage system. PAUs are not standalone units and typically work in conjunction with other cooling equipment like Air Handling Units (AHU) or Fan Coil Units (FCU).



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2. Electrical System

An electrical distribution system is the final stage in delivering electricity from a power source to end-users, such as homes and businesses. It involves a network of components that step down the high-voltage electricity from transmission lines to lower voltages suitable for consumption. These components include transformers, substations, lines, poles, and other equipment.



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2.1 High Tension Switchboard

HT switchboards are designed to handle high voltage levels, typically above 1 kV, making them suitable for heavy industrial applications. LT switchboards, on the other hand, operate at lower voltage levels, usually below 1 kV, and are commonly used in commercial and residential setups.

2.2 Transformer

A 22kV to 400V transformer operates on the principle of electromagnetic induction, converting high-voltage AC power into lower-voltage AC power.

2.3 Low Tension Switchboard

LT switchboard is mainly responsible for the distribution of electricity throughout the system and controls the motors whenever required. It comes in different shapes and sizes and helps an uninterrupted electric power supply.

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2.4 Low Tension Switchboard

An electrical sub-board, also known as a sub-distribution board (SDB), is a smaller electrical panel that receives power from a main distribution board (MDB) and then distributes it to specific areas or circuits within a building. It's essentially a secondary distribution point, often used in larger or multi-story buildings to manage electrical power to different zones.

2.5 Distribution Board

An electrical distribution board (DB) is the central hub in an electrical system that takes the main power supply and distributes it to various circuits within a building or facility such as socket outlets, lighting and other appliances. It houses protective devices like circuit breakers or fuses MCB and RCCB that safeguard each circuit from overloads or faults, ensuring safe and efficient power distribution.

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3. Generator System

Generator systems can be crucial in building design for backup power, particularly during outages or for construction sites. These systems can be designed to provide continuous power to essential systems like lighting, Fire Protection Systems and critical equipment, ensuring operational continuity.

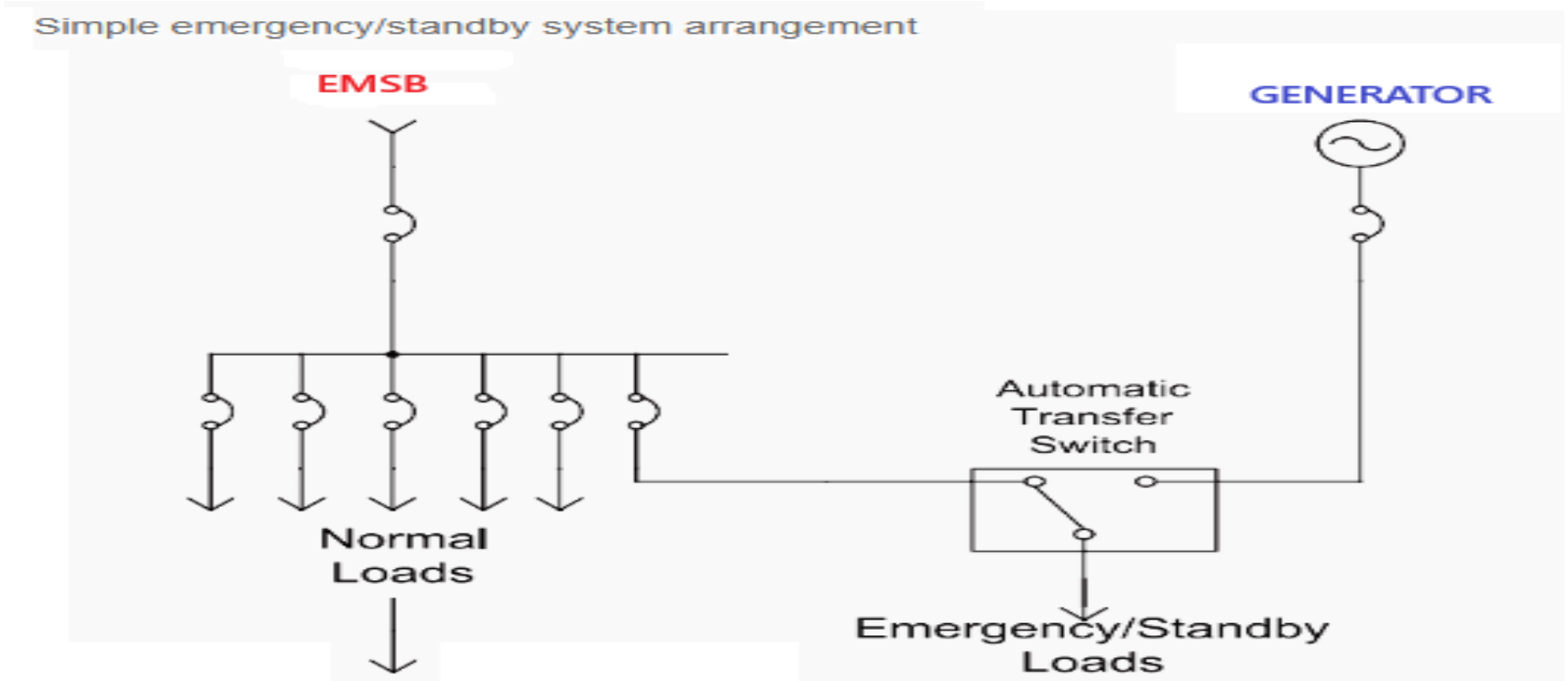


Generator Set



Generator Control and monitor screen

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The generator supply to:

1. Lightings such as common corridor, staircase light & exist lights.
2. Fire Command Centre.
3. Fire Protection Equipment such as sprinkler pump, jockey pump, wet riser pump, carpark fans, smoke extraction fans, smoke curtain, fire shuttle etc.
4. Data Centre
5. Fireman Lift

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4. Cold Water System (Domestic Water System)

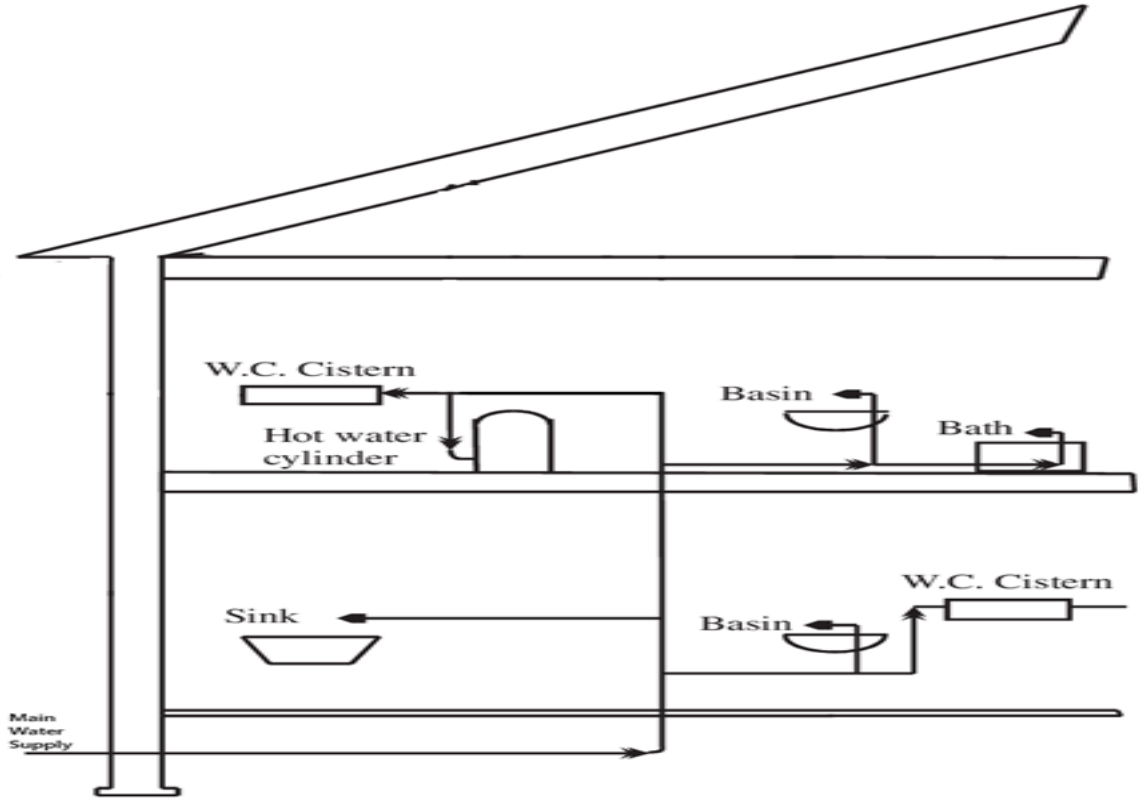
A cold water system refers to the infrastructure that supplies cold water to a building or home, typically from a water main or a storage tank. This system includes pipes, fittings, and often a storage tank (like a cistern) depending on the type of system. There are two main types distribution: direct and indirect systems.

4.1 Direct System

In a direct system, cold water is supplied directly from the main water supply to all fixtures without any intermediate storage. This is common in areas with reliable and consistent water pressure from the main supply.

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4.1 Direct System



Direct System Diagram

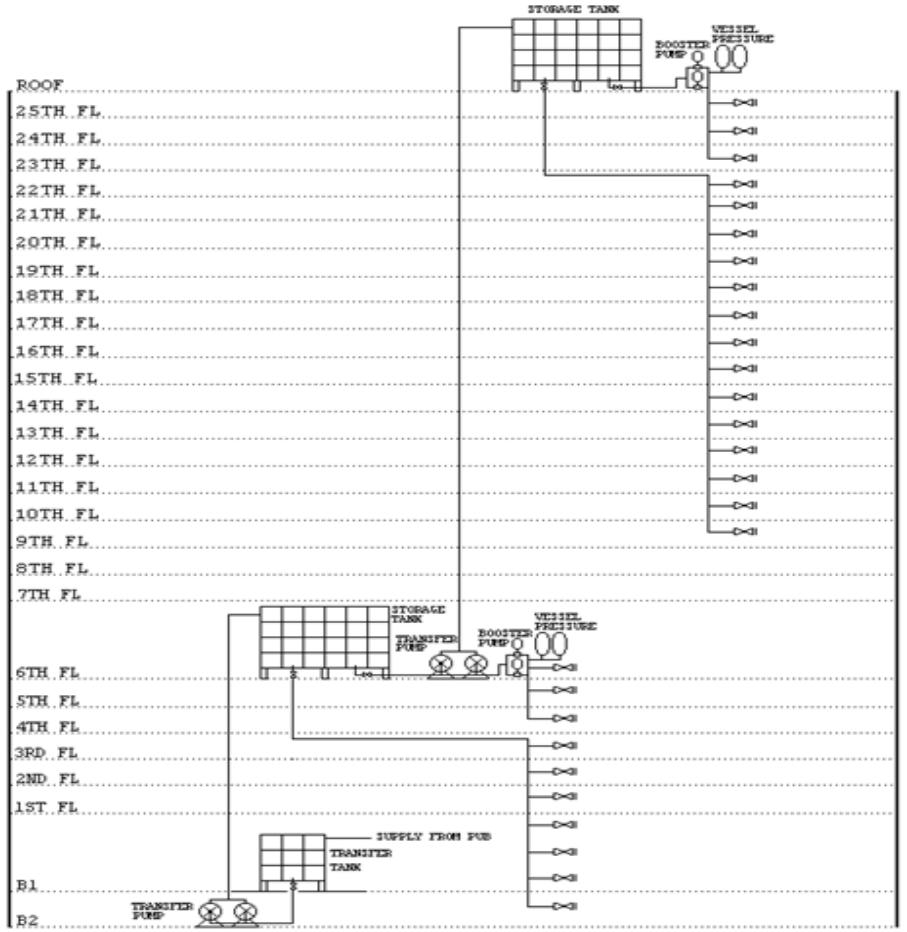
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4.2 Indirect System

In an indirect system, the water enters the building and is directed to a storage tank (like a cistern), and then distributed to the various fixtures from the tank. This is often used in areas where water pressure is not always consistent, or where there may be intermittent water supply.

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4.2 Indirect System



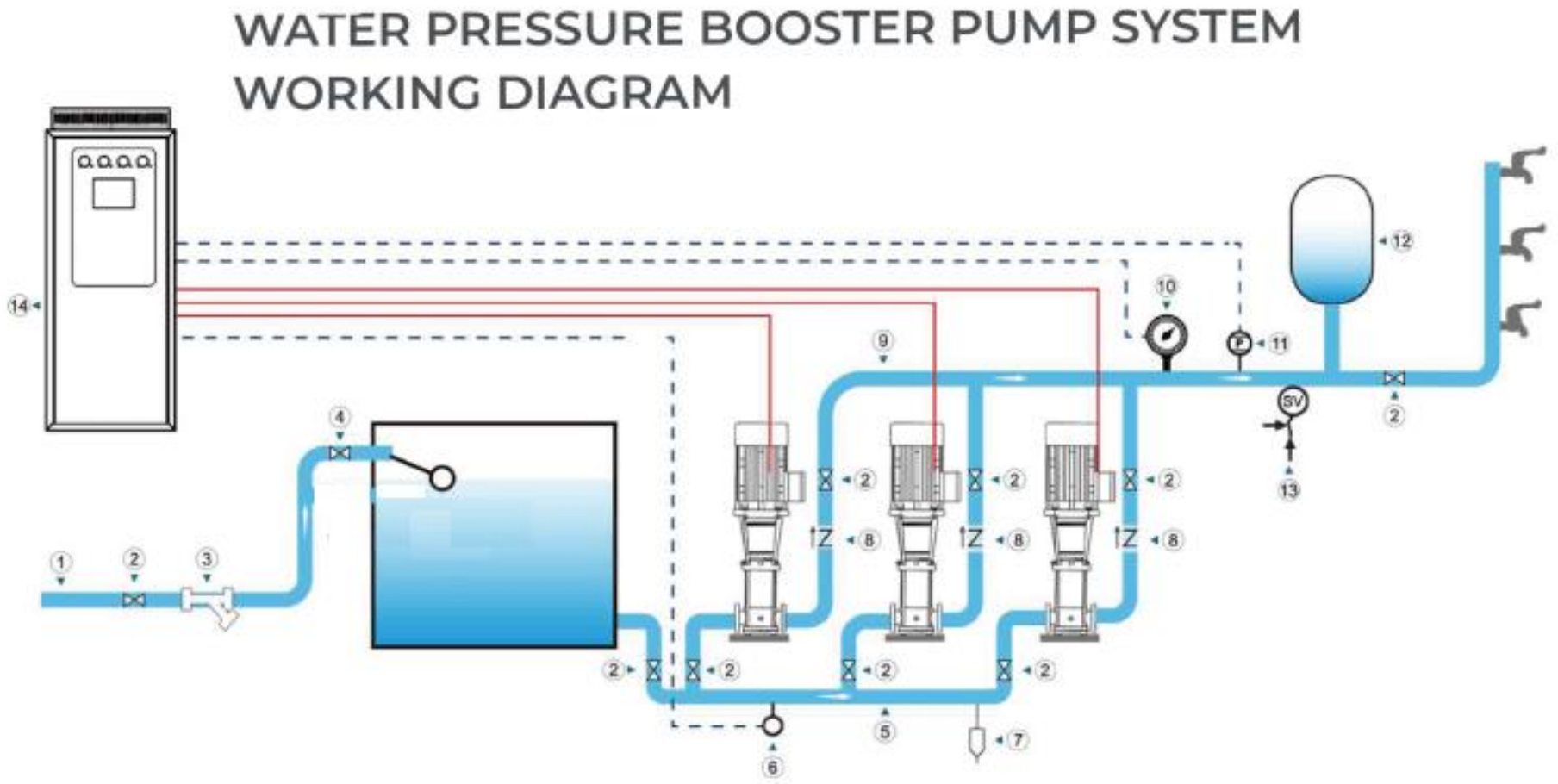
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4.3 Booster Pump System

A booster pump system is a device used to increase water pressure within a plumbing system, ensuring adequate flow to all outlets, especially in areas with low or fluctuating water pressure. It's commonly used in residential, commercial, and industrial settings to address issues like low pressure in high-rise buildings or large facilities.

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4.3 Booster Pump System



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4.3 Booster Pump System

SN.	Name	SN.	Name	SN.	Name
1	Main water supply pipe	6	Liquid level sensor (Optional)	11	Pressure sensor
2	Valve	7	Automatic exhaust valve	12	Pressure tank
3	Y Strainer	8	Check valve	13	Pressure relief valve (Optional)
4	Float remote control valve	9	Outlet manifold	14	Control cabinet
5	Inlet manifold	10	Electric contact pressure gauge		

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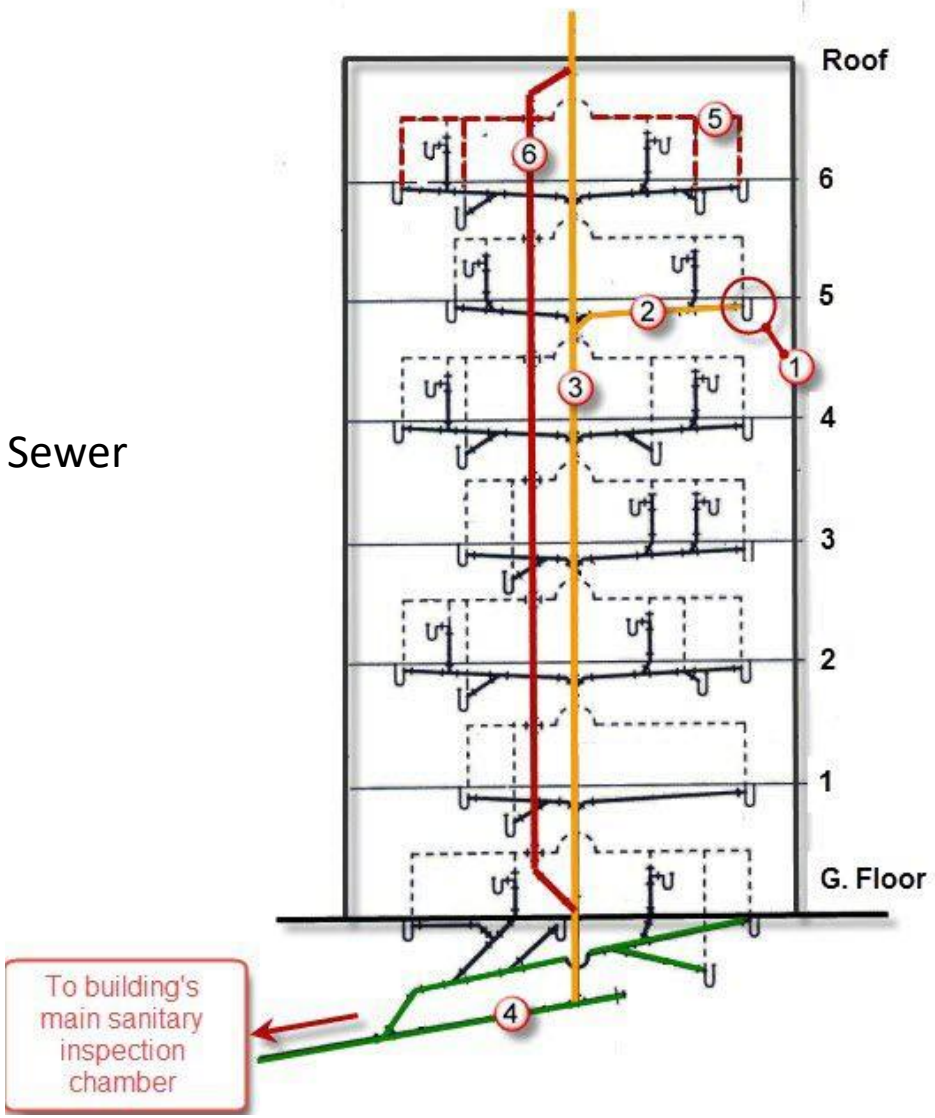
5. Sanitary System

A building's sanitary system, also known as the sanitary drainage system, is designed to safely remove wastewater and sewage from the building, ensuring hygiene and preventing the spread of diseases. It primarily consists of pipes and fixtures that carry wastewater from toilets, sinks, showers, and other fixtures to a central drainage point, which then connects to a larger sewer system

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5. Sanitary System

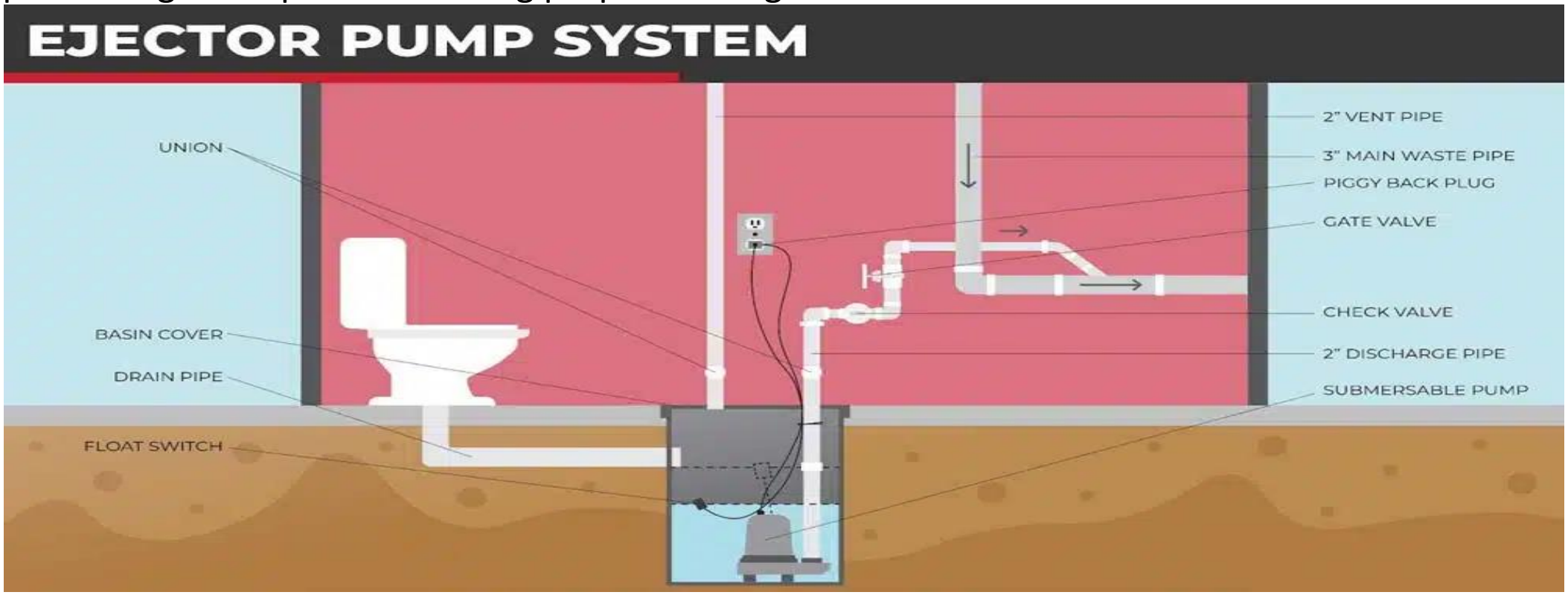
Building Sanitary and Sewer System



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5.1 Ejector Pump System

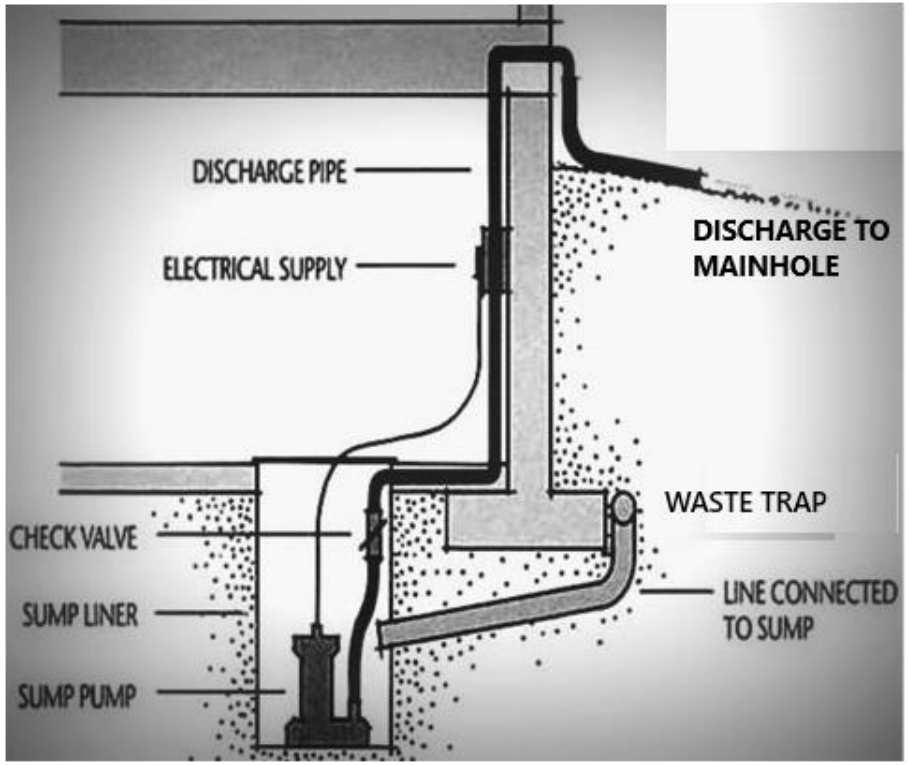
An ejector pump system in a building is a crucial plumbing component used to pump sewage and wastewater upwards from areas below the main sewer line, typically in basements or lower levels. These systems are necessary when gravity alone cannot efficiently transport waste to the sewer, preventing backups and ensuring proper drainage.



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5.2 Sump Pump System

A sump pump system in a building typically consists of a sump pit, a sump pump, and a discharge line. The sump pit, usually located in the basement or crawlspace, collects water that seeps in through the foundation. The sump pump then pumps this water out of the pit and into a discharge line, which carries it away from the building.



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5.3 Grease System

The primary purpose of grease trap regulations in Singapore is to prevent fats, oils, and greases (FOG) from entering the public sewer system. This is crucial for maintaining the integrity of the sewer infrastructure, preventing blockages, and ensuring proper wastewater treatment.

How does a grease trap function? (refer to below Diagram)

Step 1: Coarse solids in used water are removed when the water passes through the screen chamber.

Step 2: Smaller solids in used water are further removed at the strainer bucket.

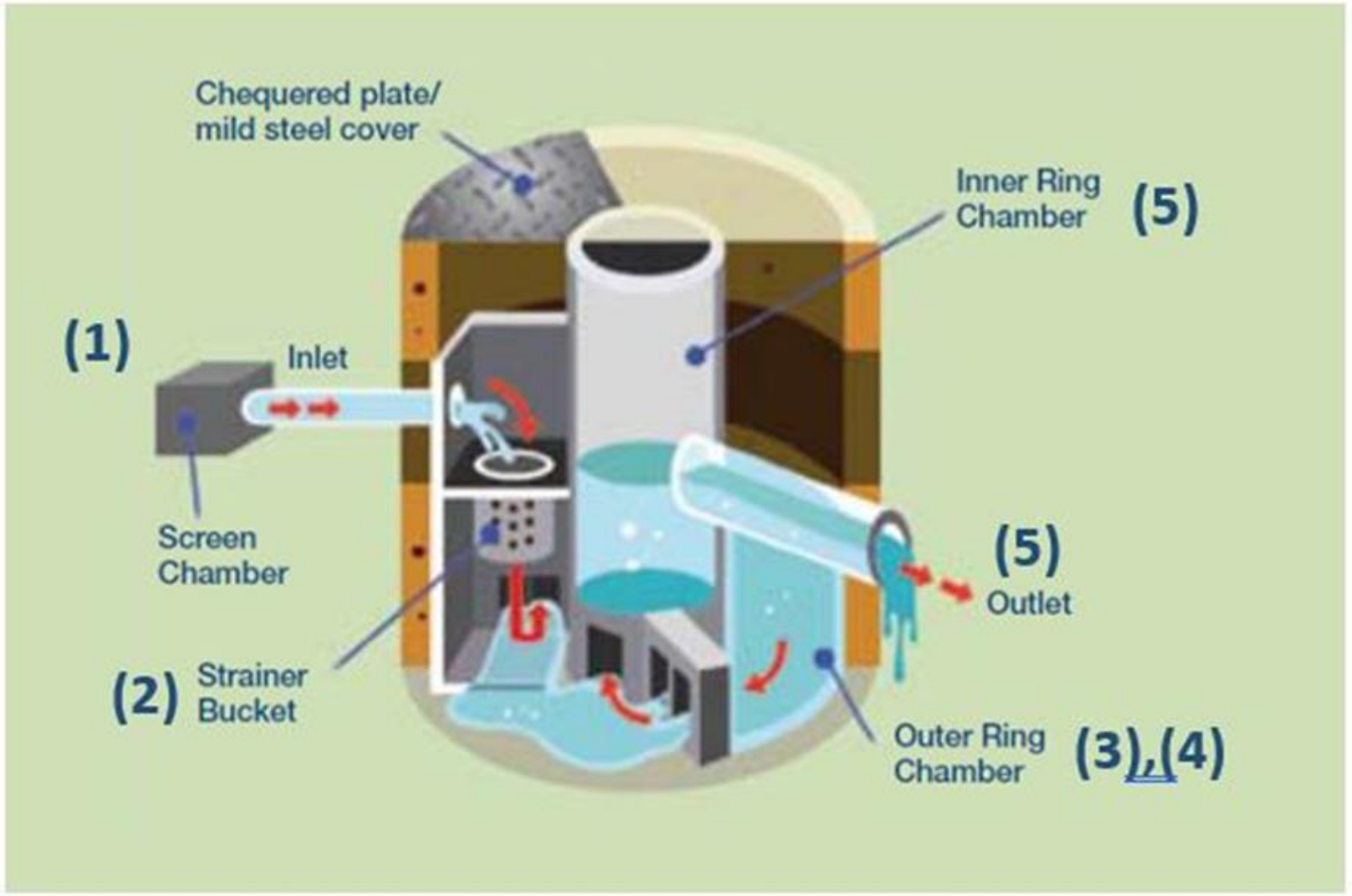
Step 3: Less dense fat, grease, and oil in used water are separated as the water enters and circulates around the outer ring chamber.

Step 4: Denser remnant solids sink to the bottom of the outer ring.

Step 5: Used water enters the inner ring chamber where it is discharged into the sewer via the outlet pipe through water displacement.

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5.3 Grease System



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6. Fire Protection Systems

The two main types of fire alarm systems are conventional and addressable. The various components that make up these systems are either automatic or manual.

6.1 Conventional Fire Alarm Systems

These systems are the most basic, using a simple, hardwired network where all devices (detectors, pull stations) are connected to a central control panel via the same circuit. When an alarm is triggered, the control panel indicates only the zone where the alarm originated, not the specific device.

6.2 Addressable Fire Alarm Systems

Unlike conventional systems, addressable systems can pinpoint the exact location of the triggered device within the system, providing more precise information to the control panel. They use a loop network where each device has a unique address, allowing for better troubleshooting and maintenance.

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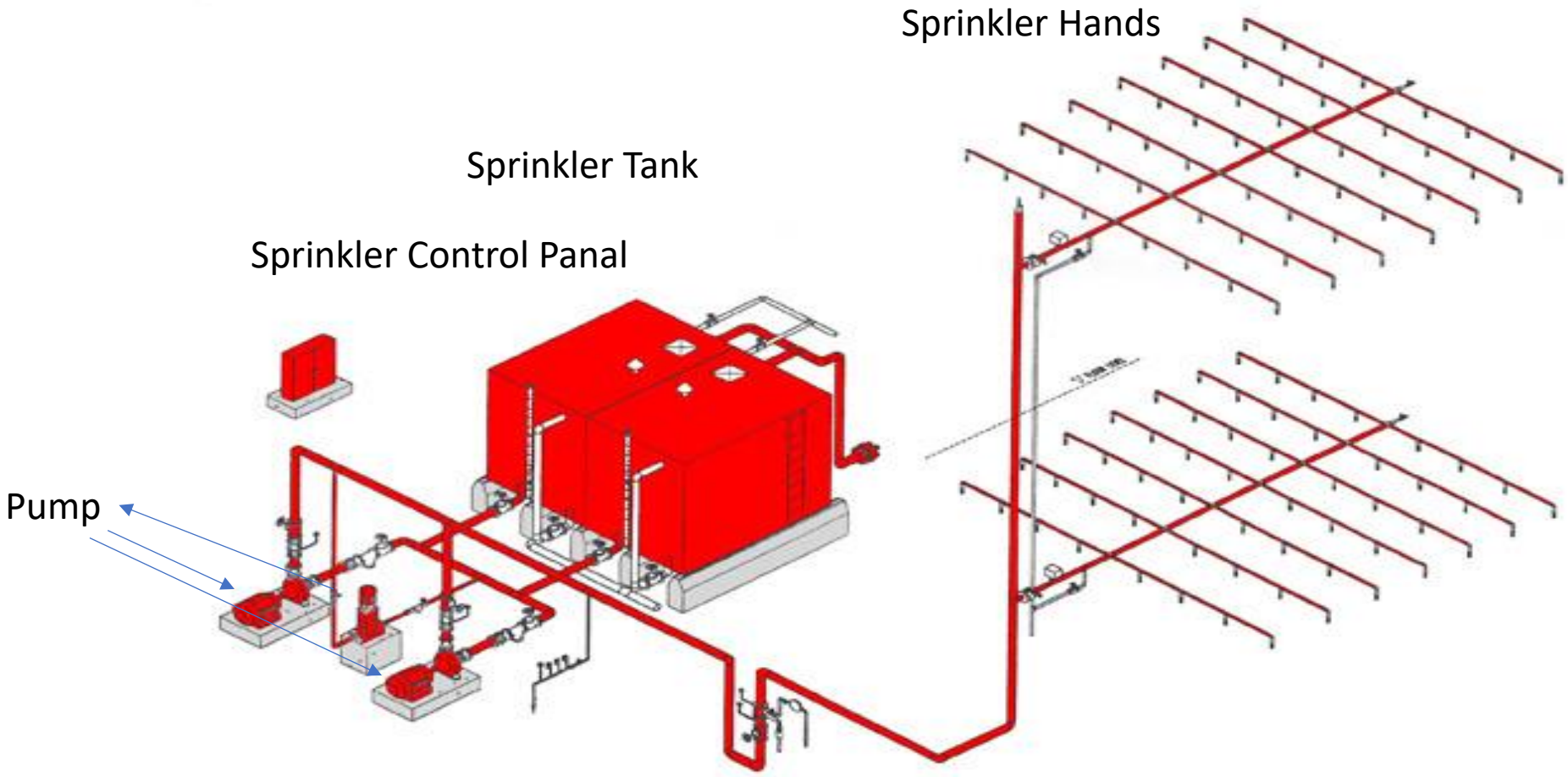
6.3 Fire sprinkler systems

Fire sprinkler systems in Singapore are crucial fire safety measures, designed to quickly suppress fires and protect lives and property. These systems are required in many buildings, especially in commercial and industrial settings.



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6.3 Fire sprinkler systems



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6.4 Wet Riser Systems

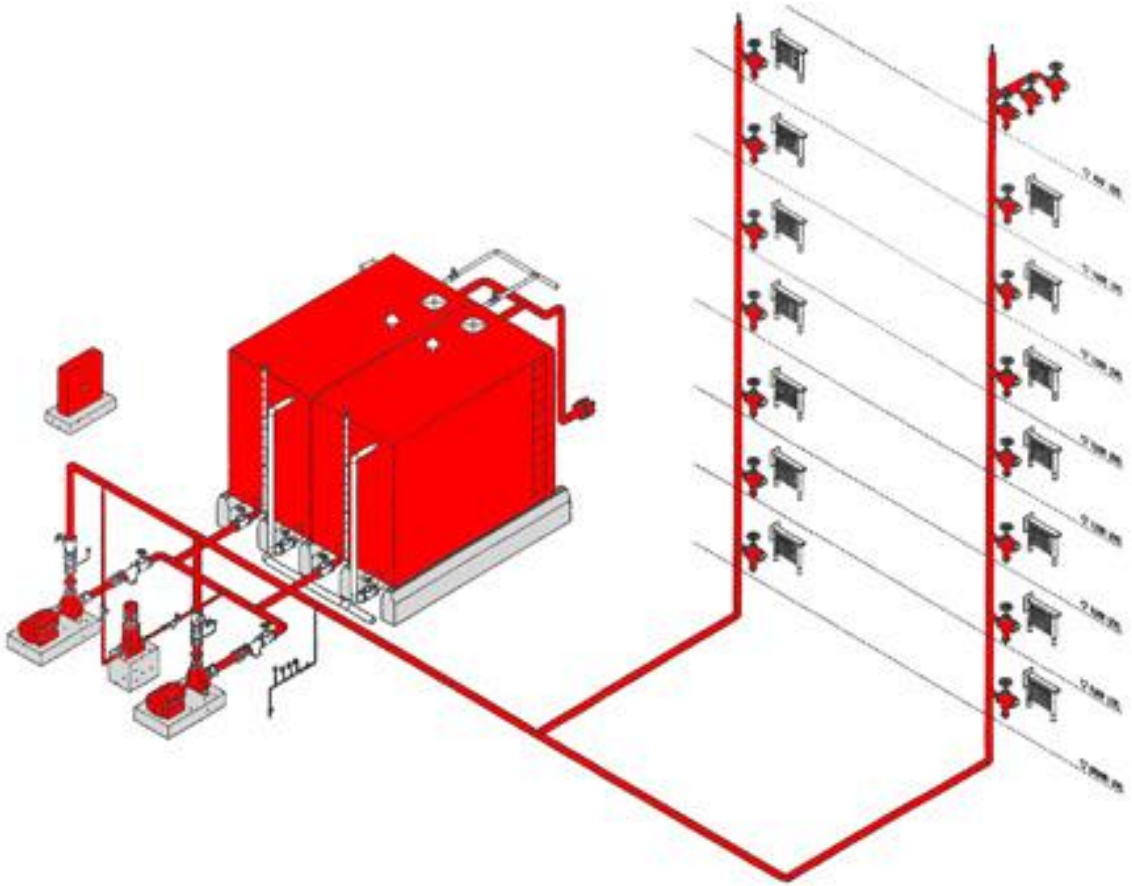
A wet riser system is a fire-fighting system in buildings, especially tall ones, that consists of a permanently water-filled pipe that runs vertically through the building. This system allows firefighters to easily access water at various levels to combat fires. Lifts & Escalators.



Wet Riser Landing Valve

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6.4 Wet Riser Systems



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6.5 Hose reel Systems

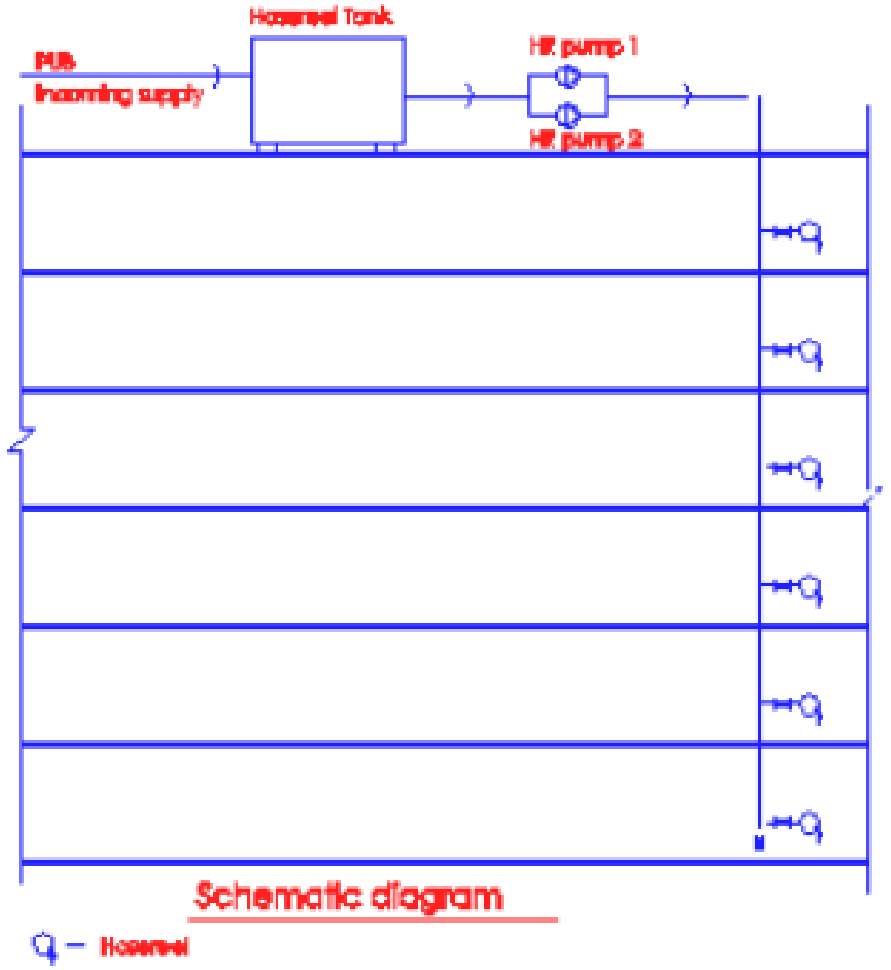
Fire Hose Reels are permanently connected to a water supply and consist of a main turn-on/off valve, a hose guide, and a control nozzle. The control nozzle attached to the end of the hose enables the operator to control the direction and flow of water to the fire.



Instruction to use hosereel

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6.5 Hose reel Systems



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6.6 Dry Riser Systems

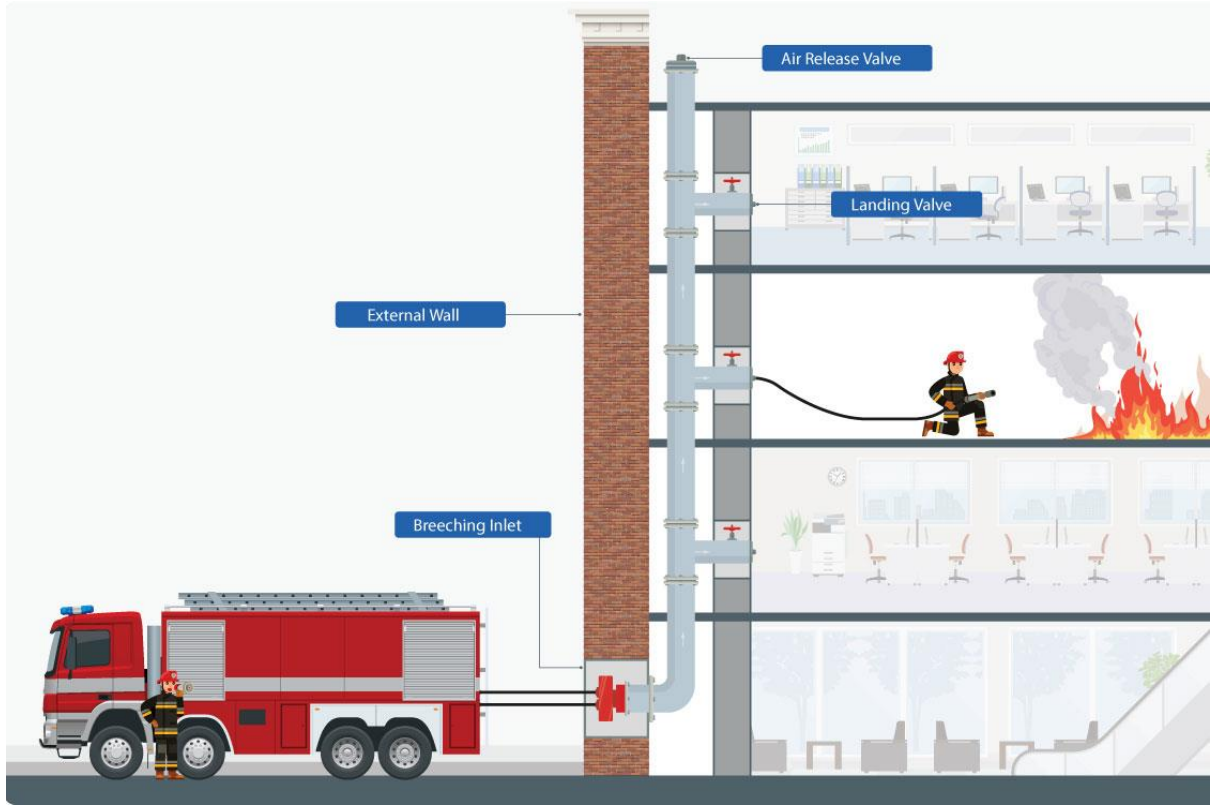
A dry riser system is a fixed fire-fighting system within a building that allows firefighters to access water on different floors without needing to carry long hoses upstairs. It consists of a vertical pipe network with inlets on the ground level and outlets on various floors. When a fire occurs, firefighters connect a pump and hose to the inlet, charge the system with water, and then use the outlets on the affected floor to suppress the fire.



Dry Outlet Landing Valve

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6.6 Dry Riser Systems



Landing Valves are valves that provide hose connections to supply water for use by fire departments and those trained in handling heavy fire streams.

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6.7 Fire Extinguishers

There are 5 main types of fire extinguishers: water, foam, dry powder, carbon dioxide (CO2), and wet chemical. Each type is designed to effectively extinguish different types of fires.

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6.7 Fire Extinguishers



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6.7 Fire Extinguishers



Fire Type		Fire Extinguisher Type: Powder	Foam	CO^2	Water	Wet Chemical
CLASS A	**Solids** (e.g. wood, plastic, paper)	✓	✓	✗	✓	✗
CLASS B	**Flammable Liquids** (e.g. solvents, paint, fuels)	✓	✓	✓	✗	✗
CLASS C	**Gases** (e.g. butane, propane, LPG)	✓	✗	✗	✗	✗
CLASS D	**Metals** (e.g. lithium, magnesium)	✓	✗	✗	✗	✗
ELECTRICAL	**Equipment** (e.g. computers, servers, TVs)	✓	✗	✓	✗	✗
CLASS F	**Cooking Oils** (e.g. cooking fat, olive oil)	✗	✗	✗	✗	✓
Some examples of businesses that may need this extinguisher		Outdoor locations, garages, welding workshops, forecourts.	Schools, offices, hotels, shops, hospitals, apartments.	Offices, server rooms.	Schools, hospitals, shops, apartment blocks.	Kitchens, canteens, restaurants.

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6.7 Fire Extinguishers

Before you can decide on the right type of fire extinguisher(s) for your business, you first need to understand how fire is classified. This should help you to better calculate the fire risks for your business.

Class A – Solids –This could be wood, plastic, paper, fabrics, soft furnishings, fixtures, or fittings.

Class B – Flammable liquids – There is a whole range of items that fit within this category, including solvents, paints, cleaning fluids, and fuels.

Class C – Gases – Flammable gasses include butane, propane, methane, and LPG.

Class D – Metals – Although you might not consider metal as a fire risk, some are surprisingly combustible (sodium, for instance). Most metals also make very good conductors.

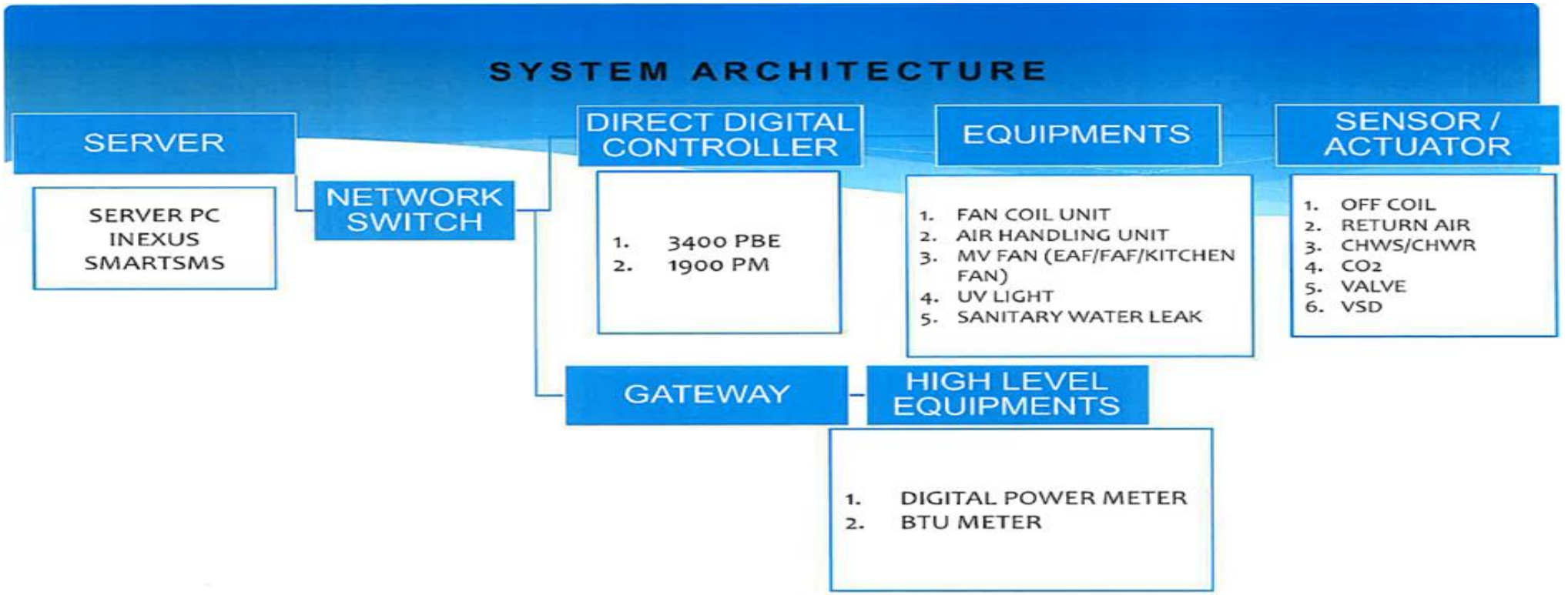
Electrical – Because electrical fires can easily fall within many of the other classes, they don’t really get their own full class. But electrical fires usually refer to wiring and equipment such as computers, televisions, and routers.

Class F – Cooking fats and oils – This is fairly self-explanatory and relates to things like chip pan fires.

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7. Building Management Systems (BMS)

Building Management Systems (BMS), also known as Building Automation Systems (BAS), are computer-based systems installed in buildings to control and monitor the building's mechanical and electrical equipment, details see below diagram:



End