A.8.4 Part 4 : Fire Protection System Standard

SECTION 1
OBJECTIVE AND SCOPE

4.1 OBJECTIVE AND SCOPE4.1.1

OBJECTIVE

4.1.1.1 The standard addresses in this part is for design and building construction to provide safety for life, property, business, and environment

4.1.1.2 These fire protection systems covers electrical systems and mechanical systems that related to fire protection system.

4.1.2 SCOPE

4.1.2.1 The above safety objective is not limit to follow only this standard. The building standard, fire exit standard, management, including equipment maintenance, test, inspection, must be operated strictly.

4.1.2.2 The modification of building occupancy, type of building, including modification inside the building, shall be inspected, modified, and calculated a new engineering detail to relate the standard in this part.

SECTION 2
FIRE ALARM SYSTEM

4.2 FIRE ALARM SYSTEM

4.2.1 The purpose of fire alarm system is to warning, control evacuation, control device and machine within building and show result of fire.

4.2.2 All details of fire alarm system standard shall be follow the latest fire alarm system standard of Engineering Institute of Thailand.

SECTION 3
LIGHTNING SYSTEM

4.3 LIGHTNING SYSTEM

4.3.1 The purpose of lightning system is to protect of ignition heat from lightning that causes of fire around the area.

4.3.2 All details of lightning system standard shall follow the latest lightning system standard of Engineering Institute of Thailand.

SECTION 4
FIREMAN LIFT

4.4 FIREMAN LIFT

4.4.1 The purpose of fireman lift is to protect fireman from fire during operating inside building fire, including fire fighting, search and rescue action.

4.4.2 All details of fireman lift standard shall follow the latest mechanical transportation standard of Engineering Institute of Thailand.

SECTION 5
COMMUNICATION SYSTEM

4.5 COMMUNICATION SYSTEM

4.5.1 Objective

4.5.1.1 Emergency public address system is assigned to use for safety and efficiency evacuation management.

4.5.1.2 Emergency telephone system is assigned to use for cooperation during fire fighting, searching, and rescue.

4.5.2 The high-rise building and extra large building must provide an emergency public address system and an emergency telephone system.

4.5.3 The standard of emergency public address system and emergency telephone system shall follow the latest mechanical transportation standard of Engineering Institute of Thailand.

SECTION 6
EMERGENCY ELECTRICAL SYSTEM

4.6 EMERGENCY ELECTRICAL SYSTEM

4.6.1 The purpose of emergency electrical system is to continually supply electrical for building fire. The cause of normal electrical supply fails might occur from failure of main electricity or cutting electricity by fireman during operation.

4.6.2 All details of an emergency electrical system and power supply standard shall follow the latest installation of electrical standard of Engineering Institute of Thailand.

SECTION 7
EMERGENCY LIGHTING AND EXIT SIGN SYSTEM

4.7 EMERGENCY LIGHTING AND EXIT SIGN SYSTEM

4.7.1 The purpose of emergency lighting and exit sign system is to illuminate fire exit route and direction of fire exit route in order that occupants can evacuate from the building fire by themselves.

4.7.2 All details of emergency lighting and exit sign standard shall be follow the latest standard of emergency lighting and exit sign system of Engineering Institute of Thailand.

SECTION 8
SMOKE CONTROL SYSTEM

4.8 SMOKE CONTROL SYSTEM

4.8.1 The purpose of smoke control system is to protect or control smoke that affect to evacuated people, especially in fire exit route, meanwhile the system shall reduce hot heat inside the building fire and make vision clearly.

4.8.2 All details of smoke control system standard shall be follow the latest standard of smoke control system of mechanical system standard of Engineering Institute of Thailand.

SECTION 9
FIRE COMMAND CENTER

4.9 FIRE COMMAND CENTER

4.9.1 Objective

4.9.1.1 Fire command center assigns to be a center of communication between fireman and fireman incase of fire, fireman and tenant.

4.9.1.2 Fire command center assigns to be a center of communication between building safety officer and tenant to work together in normal case and fire case.

4.9.2 The high-rise building and extra large building must provide a fire command center.

4.9.3 The area of fire command center must locate on ground level or above ground floor level, not more than 1 floor, near fireman lift and fire pump room.

4.9.4 The enclosure of fire command center must be fire wall 2 hour fire rating and provide at least 1 door exit directly to public way.

4.9.5 Equipment inside fire command center must provide at least followings;

4.9.5.1 Annunciation panel of fire alarm system

4.9.5.2 Public address control panel

4.9.5.3 Fireman lift panel which shown position and direction of the lift

4.9.5.4 Annunciation and control panel of emergency smoke fans

4.9.5.5 Annunciation panel of valve status and flow switch status

4.9.5.6 Annunciation and control panel of door lock and magnetic door hold in fire exits

4.9.5.7 Annunciation panel of normal and emergency electrical source.

4.9.5.8 At least 1 direct phone line

4.9.5.9 Whole building key cabinet

4.9.6 Building layout plan for electrical system, mechanical system, fire protection system, and structural of building must keep inside fire command center at least 1 set for all time.

4.9.7 Log records and reports of building safety in building must collect and keep them inside the fire command center at least 1 set.

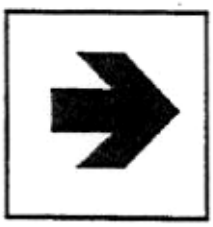
SECTION 10
FIRE EXIT AND FIRE EQUIPMENT SIGNAGE

4.10 FIRE EXIT AND FIRE EQUIPMENT SIGNAGE

4.10.1 The purpose of fire exit and fire equipment signage is to make people understand clearly and promptly in case of emergency, and also make the building use a same signage standard.

4.10.2 The types of signage and operation are followings

A. Fire exit		Green color background White color door Running person in green or black color	use for location of fire exit such as fire exit door
B. Fire exit		Green color background White color door Running person in green or black color	use for location of fire exit to fire exit
		White background Arrow in green or black color	
C. Fire exit for Disability Person		Green background White color door Running person in green o black color	use for location of fire exit for disability person
		International symbol for disability person	

D. Fire exit for Disability Person		Green background White color door Running person in green or black color	use for location of fire exit to fire exit for disability person
		International symbol for disability person	
		White background Arrow in green or black color	
E. Not a fire exit		Green background White color door Running person in green or black color Circle and cross line in red	use for not a fire exit door
F. Fire stair		White background Fire in red Running person in black	go down to stair for fire evacuation
G. Fire stair		White background Fire in red Running person in black	go up to stair for fire evacuation

H. Do not use Lift in case o fire		White background Fire in red Person in black Circle and cross line in red	do not use lift in case of fire
I. Do not smoke		White background Cigarette in black Circle and cross line in red	indicate area of smoke prohibit
J. Do not bonfir		White background Bonfire in black Circle and cross line in red	indicate area of bonfire prohibit
K. Connection for sprinkler system		Red background Picture in white	indicate location of fire department connection for sprinkler system
L. Connection for standpipe system		Red background Picture in white	indicate location of fire department connection for standpipe system
M. Connection for sprinkler system and standpipe system		Red background Picture in white	indicate location of fire department connection for sprinkler and standpipe system

N. Control valve for sprinkler system		Red background Picture in white	indicate location of control valve for sprinkler system
O. Switch board		Blue background Picture in white	indicate location of power supply and switch board
P. On-off valve for cooking gas		Red background Picture in white Letter “A” in red	indicate location of on-off valve for cooking gas
Q. Fire hose or fire hose connection		Red background Picture in white	indicate location of fire hose and hose connection
R. Portable Fire Extinguisher		Red background Picture in white	indicate location of portable fire extinguisher
S. Direction Arrow		Red or blue background Picture in white	indicate direction way to fire extinguisher and use together with fire extinguisher signage

S. Child care center		White background Picture in blue	indicate direction way to child care center

A.8.5 Part 5 : Fire Protection Standard

SECTION 1
GENERAL

5.1 OBJECTIVE AND SCOPE

5.1.1 Objective

Fire protection standard in this part is a important part of fire protection system in building. The design and installation work are proper that shall reduce the loss of tenant life and properties from fire.

5.1.2 Scope

To be information basis for design, installation, maintenance, inspection, and operation test of components relate to operation of fire protection system. To ensure that fire protection systems inside the building shall operate promptly.

SECTION 2
CLASSIFICATION OF OCCUPANCY

5.2 CLASSIFICATION OF OCCUPANCY

5.2.1 Classification of occupancy

5.2.1.1 Objective

Classification of occupancy means a classification of assembly occupancy, which has a similarity of utilization, without consideration in the type of construction to obtain the fire protection system according to a standard code.

5.2.1.2 Scope

The classification of occupancy shall classify the occupancy according to the application and utilization of combustible and flammable materials in the occupancies. Each occupancy shall be classified in accordance of the type and quantity of combustible materials storing in the occupancy.

5.2.1.3 Classification of occupancy shall be classified in 3 categories as the following:

5.2.1.1.1 Light hazard occupancy

5.2.1.1.2 Ordinary hazard occupancy

5.2.1.1.3 Extra hazard occupancy

5.2.1.4 Light hazard occupancy

- Residential
- Offices
- Restaurant (seating area)
- Theater and convention hall (exclude stage and prosceniums)
- Temple, and Church
- Club house
- School
- Institution
- Hospital
- Nursing and convalescent home
- Library (except large stack room)
- Museum

5.2.1.5 Ordinary hazard occupancy

Ordinary hazard occupancy shall be classified in 2 categories as the following:

5.2.1.5.1 Ordinary hazard occupancy Group 1

- Car park and showroom
- Electronic plant
- Beverage manufacturing
- Bakeries
- Laundries
- Canneries

- Glass and Glass products manufacturing
- Restaurant (service area)
- Daily foodstuff factory

5.2.1.5.2 Ordinary hazard occupancy Group 2

- Leather goods manufacturing
- Candy factory
- Textile manufacturing
- Tobacco product manufacturing
- Wood product assembly
- Printing and publishing factory
- Chemical plant
- Rice mill
- Machine shops
- Metal working
- Distilleries
- Tire manufacturing
- Wood machining
- Paper and pulp mills
- Paper product manufacturing
- Harbor and wharves
- Feed mills
- stages
- Post offices
- Mercantile
- Library (large stack room area)
- Dry cleaners

5.2.1.6 Extra hazard occupancy

Extra hazard occupancy shall be classified in 2 categories as the following:

5.2.1.6.1 Group 1

This group shall be deal with a low quantity of combustible liquid and flammable liquid.

- Aircraft hangar
- Combustible hydraulic fluid use area
- Die casting
- Metal extruding
- Plywood and particle board manufacturing
- Printing (using inks having flash point below than 37.9 degree of Celsius)
- Rubber industry
- Saw mill
- Textile factory, which has bleaching, dyeing, cotton and synthetic, and fur bleaching.
- Upholstering foam

5.2.1.6.2 Group 2

This group shall be contacted with combustible liquid and flammable liquid directly.

- Asphalt saturating
- Paint spraying
- Oil refinery
- Engine oil factory
- Occupancy which inject the combustible liquid.
- Open oil quenching
- Plastic processing
- Solvent cleaning
- Varnish and paint dipping

SECTION 3
STANDPIPE SYSTEM AND FIRE HOSE

5.3 STANDPIPE SYSTEM AND FIRE HOSE

5.3.1 Objective and Scope

5.3.1.1 Objective

Standpipe system is an arrangement of piping, valve, hose connection and allied equipment install in commercial building or residential building .The position of fire hose connection and fire hose cabinet shall be located where accessible and visible area which operators or fireman can easily access and convenient to connect hose for fire suppression in fired area. A suitable location is inside fire exit stairway. Standpipe system shall be the completed system when it has already been connected with water supply system such as water storage tank, fire pump, etc. The provision shall be adequate in water supply volume for operation of desire period of time.

5.3.1.2 Scope

The intention of this standard is to provide the suitable degree of protection from loss of life and property protection from fire through installation of standpipes system based on sound engineering principle.

5.3.2 Class of Standpipe System

Standpipe system and hose connection shall be classified in three classes depending on level usage as follow:

5.3.2.1 Class I standpipe system shall be provided with 65-mm.dia (2 ½ -inches) hose connection to supply water for use by fire department or those trained in handling heavy streams.

5.3.2.2 Class II standpipe system shall be provided with 25-mm. (1-inch) hose stations for use primarily by the building occupants during initial response.

5.3.2.3 Class III standpipe system shall be provided with 25-mm.(1-inch) hose station for use by building occupants and 65-mm.(2 ½-inches)hose connections for use by fire departments and those trained in handling heavy streams.

5.3.3 Provision of Standpipe system in Building

5.3.3.1 Class of standpipe system shall be provided for buildings or areas, which indicated on the table 5.3.1

5.3.4 Installation of Standpipe System

5.3.4.1 Piping Protection of Standpipe System

5.3.4.1.1 Standpipe system shall be installed where it is protected from mechanical and fire damage.

5.3.4.1.1 For buried pipes or pipes are run around corrosive condition, corrosion-resistant pipe or protective corrosion-resistive coating shall be used.

5.3.4.2 Valves

5.3.4.2.1 Connection point of standpipe system to water supply (except fire department connection) shall be provided with indicating-type valve and check valve located close to the supply, such as at storage tank, pump and connection from water work system.

5.3.4.2.2 Isolating valve shall be provided for standpipe to allow isolation of each standpipe that it is supplied from the same source.

5.3.4.2.3 For buried pipes the connection point of standpipe system to public water system shall be controlled by post indicator valve that it is located at least 12 meters (40feet) away from the. building protected.

Exception:

(1) In case of post indicator valve cannot be located at least 12 m. (40 ft.) away from the protected building; it shall be located where it is readily accessible in case of fire and not subject to damage.

(2) Where post indicator valve cannot be used; underground valves shall be permitted.

(3) Where the standpipes are supplied from a yard main or
header from another building; the connection point shall be provided with an indicating type valve located outside at the safe distance from building.

(4) In case of pressure in stand pipe system including measured pressure at discharge flange of fire pump (installed permanently) when the discharge valve is closed in position (shut-off pressure) is exceed 1206 Kpa (175 psi) valve in standpipe system shall be of heavy duty flanged type with approval listed type.

5.3.4.3 Not use

5.3.4.4 Fire Department Connection

5.3.4.4.1 At least one fire department connection shall be provided for standpipe class I and class III.

5.3.4.4.2 For low-rise building that standpipe system is separated in multi-zone; fire department connection shall be provided for each zone.

5.3.4.4.3 There shall be no shutoff valve between the fire department connection and standpipe system.

5.3.4.4.4 A check valve shall be provided for each fire department connection, where it join the standpipe system.

5.3.4.4.5 Fire department connection shall of quick coupling male thread with female thread cap and chain.

5.3.4.34.6 Fire department connection shall be located where readily accessible by local fireman, without interference from nearby objects and near public hydrant.

5.3.4.4.7 Each fire department connection shall be designated a sign having clear and legible letter size 50 mm (2 inches) in height for indicating type of standpipe system, such as "STANDPIPE" for the system that it is supplied standpipe only or "STANDPIPE AND AUTOMATIC SPRINKLER" for the system that it is supplied both standpipe and automatic sprinkler.

5.3.4.4.8 Where a fire department connection services only a portion of a building, a sign shall be attached indicating the portions of the building served.

5.3.5 Standpipe System Arrangement

The intention of standpipe system arrangement standard is for determination types of system; size and location of standpipe including water spray equipments; which it is combination of standpipe system and fire hose.

5.3.5.1 Types of Standpipe System

Standpipe system in a building shall be of the system as follow;

5.3.5.1.1 Automatic-wet system

This system is a standpipe system that it has water supply capable of water pressure and water flow rate for automatically supplying the system demand.

5.3.5.1.2 Manual-wet system

This standpipe system shall be connected to building cold water supply for the purpose of maintaining water within the system only. Because the building cold water supply does not have a water supply capable of pressure and flow rate of delivering to the system demand. Manual-wet standpipe system needs water from a fire department plumper (or the like) to increase the system pressure and flow rate to meet the system demand.

Exception: Manual-wet standpipe system shall not be permitted for using in high-rise buildings and class II or class III system

5.3.5.2 Combined Standpipe System

5.3.5.2.1 Combined standpipe system shall be used and combined with automatic water sprinkler system.

5.3.5.2.2 The required water supply of a building that it is provided automatic water sprinkler system all areas shall refer and determined by the description on item 5.3.7.3. Additional water supply for automatic water sprinkler system is not required for determination.

Exception: If required water supply for automatic water sprinkler system combined with fire hose system followed the requirement, which described on section 4 of automatic water sprinkler system is more than the required water supply described on the item 5.3.5.2.2, the greater figure shall be

considered and selected as criteria for determination of water supply system.

5.3.5.2.3 Required water supply for automatic water sprinkler system of a building that it is installed portion automatic water sprinkler system shall be included with the required water supply described on the item

5.3.5.2.4 Each connection pipes from a standpipe that it is a part of a combined system to a sprinkler system shall have an individual control valve of the same size as the connection pipe. Control valve shall be equipped with key lock or electrical signaling system that it is actuated when control valve is closed in position.

5.3.5.3 Size of standpipe and equipment's

5.3.5.3.1 Sizing and arrangement of standpipe class I and III shall be determined as follow:

(1) 5 For single standpipe system, a water supply pipe size shall be determined by based on the required water supply flow rate but does not less than 1893 liter/min. (500GPM).

(2) 6 For multi-standpipe system, a water supply main pipe that it is supply to all standpipes shall be determined by based on summation of water flow rate that feed to all standpipes as indicated on the table 5.3.2 and also sizing of each standpipe shall be determined by based on required water flow rate but does not less than 1893 liter/min. (500GPM).

5.3.5.3.2 A standpipe size that it is height does not exceed 30-meter (100 feet) shall not smaller than 100-mm. (4-inches).

5.3.5.3.3 A standpipe size that it is height exceed 30-meter (100 feet) shall not smaller than 150-mm. (6-inches).

5.3.5.3.4 Inlet pressure of a reducing equipment shall not exceed the working pressure rating of that pressure reducing equipment.

5.3.5.3.5 Working pressure rating of all pipes and accessories in the system shall not less than 175 psi.

5.3.5.3.6 Combined standpipe size shall not smaller than 150-mm. (6-inches) except automatic water sprinkler pipes in building which all pipes shall be determined by hydraulically calculation.

5.3.5.3.7 Standpipe size of high-rise building shall be determined by hydraulically calculation.

5.3.5.4 A standpipe class II shall capable of delivery water flow rate does not less than 379 liter/min. (100 GPM). For single-standpipe or multi-standpipe, a main supply water pipe of all standpipe system shall be determined of capable supply water flow rate does not less than 379 litter/min (100 GPM).

5.3.5.4.1 A standpipe size that it is height not exceed 15-meter (50 feet) shall not smaller than 50-mm. (2-inches).

5.3.5.4.2 A standpipe size that it is height exceed 15-meter (50 feet) shall not smaller than 65-mm. (2 1/2-inches).

5.3.5.5 Determination of standpipe size or main supply water pipe size that they are related to water flow rate by piping arrangement method shall follow the table 5.3.3

5.3.6 Standpipe System Design

5.3.6.1 Pressure of standpipe system

5.3.6.1.1 Maximum pressure for each standpipe system zone shall not exceed 350 psi.

5.3.6.1.2 Working pressure of fire hose connection

(1) Class I standpipe system shall not less than 450 kPa (65 psi.)

(2) Pressure reducing equipments shall be provided for the system that pressure exceeding 690 kPa (100 psi).

5.3.6.2 Location of standpipe and fire hose connection

5.3.6.2.1 Class I

(1) To be provided inside of every fire exit stairway at each intermediate landing between floor levels or at landing of each floor.

(2) To be provided inside and outside at horizontal fire exit passageway.

(3) To be provided at vestibule area that is adjacent to the pressurized fire exit stairway.

(4) In case of standpipe and branch pipe cannot be installed inside fire exit stairway or vestibule, they can be installed inside the fire resistant wall which it is the equivalent fire resistant rate as vertical wall enclosure of the building.

Exception: Fire rated vertical wall enclosure are not necessary in case of automatic water sprinkler system has already been provided for the building.

(5) For the building that it is divided in many rooms, the location of standpipe shall accessible and convenient for connecting of fire hose and also injection distance shall cover all area in each room.

5.3.6.2.2 Class II

(1) To be provided near fire exit stairway where easily to be used of cover all areas of 30 m.(100 ft) hose length and injection distance shall not less than 6 m.(20 ft).

(2) Class II standpipe and branch pipe are not necessary to be install within enclosed fire resistant wall.

5.3.6.2.3 Class III

(1) Installation of class III standpipe and branch pipe shall follow the item 5.3.6.2.1 and 5.3.6.2.2.

5.3.6.3 Fire hose and equipments

5.3.6.3.1 Fire hose

The building that it is installed class II and class III standpipe system shall be provided with 25-mm. (1-inch) rigid fire hose 30 m. length (100 ft) or 40-mm (1 ½ inch) flexible fire hose 30 m. length (100 ft).

5.3.6.3.2 Hose Reel or Hose Rack

(1) 40-mm. (1 ½ inch) flexible fire hose in cabinet or in box or 25-mm (1 inch) rigid fire hose in hose reel shall be provided where it is convenient to pull out for using.

(2) Every location that it is provided fire hose both of hose rack or hose reel shall be equipped with a plate of picture or letter to show the procedure of equipments using. Letter and picture shall clear and not complicate with suitable size.

5.3.6.3.3 Hose Valve

(1) In case of system pressure is exceeding 700 kPa, pressure-reducing equipment shall be provided at fire hose valve class I for pressure controlling.

(2) Fire hose connection shall be of female thread quick coupling type with male thread cap end and a chain. Building fire hose shall be compatible with local fireman hose fitting.

5.3.7 Water Supply System

5.3.7.1 System Determination

Water supply source for fire suppression of standpipe system shall depending on factors as follows:

- Size of fire hose
- Water flow rate
- Duration time

All factors mention above is related to water storage volume, which shall affect to the building construction. So determination of water supply source for each building shall be considered and followed this standard.

5.3.7.2 Type of Water Supply System

5.3.7.2.1 Automatic standpipe system shall be connected with reliable water supply source. Although one water supply source is adequate but multi-water supplies source is more reliable than single source because it shall be capable to supply and feed to all areas of the building

5.3.7.2.2 Acceptable Water Supply System

(1) Public waterwork system that it is checked with adequate in pressure and supply flow rate all year round.

(2) Automatic fire pump, which connect to water source.

(3) Manual fire pumps use with pressure tank.

(4) Manual fire pump with remote starting panel for every fire hoses station.

(5) Pressure tank.

(6) Gravity tank.

5.3.7.2.3 Water Supply System for standpipe shall capable to supply for fire hose using in continuous time does not less than 30 minutes.

5.3.7.3 Water supply flow rate for standpipe.

5.3.7.3.3 Water supply flow rate for standpipe class I and class III.

(1) Water supply flow rate shall not less than 1893 liter/min (500gpm) through 30 minutes.

(2) For multi standpipes, water supply flow rate of first pipe shall not less than 1893 liter/min. (500gpm) and water supply flow rate of 946 liter/min. (250gpm) for each additional standpipe. In case of total water supply flow rate of standpipe is exceed 4731 liter/min. (1250 GPM), water supply flow rate of 4731 liter/min. and up can be used.

(3) Water supply system shall have adequate pressure to maintain the system pressure of 448 kPa. (65 psi) with water supply flow rate of 1893 liter/min. (500gpm) at the outlet of hydraulically most remote.

(4) In pipe sizing of standpipe system that they are determined by hydraulic calculation, the outlet of hydraulically most remote shall has pressure of 448 kPa. (65 psi) with water supply injection flow rate of 1893 liter/min. (500gpm).

5.3.7.3.4 Water supply flow rate for standpipe class II.

(1) Water supply flow rate shall not be less than 379 liter/min. (100gpm) for 40-mm (1 ½ inch) hose value and fire hose.

(2) For 25 mm (1 inch) hose valve and fire hose, water supply flow rate shall not less than 50 liter/min.

(3) Pressure at the outlet of hydraulically most remote shall not less than 448 kPa.(65 psi).

5.3.7.4 Zoned standpipe.

5.3.7.4.1 Separated fire pump shall be provided for each zone of standpipe system.

5.3.7.4.2 Fire pump for each zone shall not be arranged in series.

5.3.8 Water Piping System and Accessories

5.3.8.1 System connection

5.3.8.1.1 Connecting point of standpipe system to gravity tank of the building or pressure tank (install at top level or roof level) shall be connected at the highest point of standpipe system and pipe size shall not smaller than standpipe size.

Exception: In case of a water storage tank that supply water to standpipe of several buildings or several part of a building, connecting pipe to water storage tank can be connected to the system at the bottom of standpipe system.

5.3.8.1.2 For multi standpipe system in the same building or some part of a building, connecting pipe between each standpipe system shall be connected at the bottom of standpipe system.

5.3.8.1.3 In case of a standpipe system connect to several water storage tanks; standpipe system shall be connected at the top of the system.

5.3.8.1.4 Standpipe system shall be equipped with air relief device to protect air locking in piping system.

5.3.8.2 Water Pipes.

5.3.8.2.1 Water pipes used for standpipe system shall meet the product property requirement which indicated on the table 5.3.4 for chemical property, physical property, minimum pipe size and weight of water pipe; which they shall meet or equivalent with one of standard in the table.

5.3.8.2.2 Pipes used for standpipe system shall be operated at working pressure of not less than 1206 kPa. (175 psi).

5.3.8.3 Fitting.

5.3.8.3.1 Chemical properties, physical properties, size and weight of pipe fitting used for standpipe system shall conform or equivalent with one of product standard in the table 5.3.4 and 5.3.5.

5.3.8.3.2 In case of standpipe system pressure is exceed 1207 kPa. (175 psi); pipefitting shall be of extra heavy-pattern type.

Exception:

(1) Standard weight pattern cast iron fitting 50 mm (2 inches) in size . and smaller shall be permitted to using in the system that pressure does not exceed 2068 kPa. (300 psi).

(2) Standard weight pattern cast malleable-iron fitting 150 mm. (6 inches) in size and smaller shall be permitted to using in the system that pressure does not exceed 2068 kPa. (300 psi).

(3) Pipe connection fittings shall be of threaded type or flange type. Welded pipefittings are permitted only for certificated welding and conform to ANSI B 16.9, ANSI B 16.25 and ASTM A 234 standard.

(4) Expansion joint or flexible coupling shall be installed where necessary to protect damaged from non equivalent building subside.

5.3.8.3.3 Couplings fitting and unions fitting are not permitted for using of pipe; which are larger than 50 mm. (2 inches).

5.3.8.3.4 Pipe reducer shall be of one piece type

Exception: Hexagonal bushings reducer shall be used for special case that standard reducers cannot be used

5.3.8.4 Pipe Hanger

5.3.8.4.1 Pipe hanger and support shall be of approved type with capable of supported pipes weight and safety position.

5.3.8.4.2 The quantity of pipe hanger and support shall be provided adequate for vibration protection in piping system.

5.8.3.5 Pressure Gauge.

5.3.8.5.1 A listed 90 mm. (3 ½ inch) diameter pressure gauge shall be connect to each discharge pipe from fire pump, water pipe connect to public waterwork, pressure tank, air compressor of pressure tank and at the top point of each standpipe system.

5.3.8.5.2 For multi standpipe system, which connected together at the top point, shall be permitted to substituted for a pressure gauge.

5.3.8.5.3 Pressure gauge shall be installed on the upstream side for pressure reducer valve.

5.3.8.5.4 Working pressure of pressure gauge shall be not less than 1.5 times of operating pressure of the system and shall not less than 200 psi.

5.3.9 System Testing

System testing can be performed with hydrostatic test both during construction and after construction including the periodic test. Pipe cleaning and flushing shall be done after installation of fire pump or water supply pump.

5.3.9.1 Pipe Flushing

5.3.9.1.1 All pipes shall be flushed with water flow rate that indicated on the table 5.3.6 after installation.

5.3.9.1.2 Connection pipe of standpipe system or automatic sprinkler system to fire service main pipe that it is located outside the building shall be flushed cleaning before connecting.

5.3.9.1.3 Flushing of piping shall be performed to make sure that all accumulated debris and trash in the piping have been removed

5.3.9.1.4 Minimum required water flow rate for flushing shall not less than that indicated on the table 5.3.6 or flushing water velocity shall not less than 3m/s (10 ft/s)

5.3.9.2 Testing of piping system

5.3.9.2.1 New standpipe system shall be tested by hydrostatic test with pressure of 1378 kPa. (200 psi). Additional test pressure of 345 kPa. (50 psi) for the system that static pressure is exceed 934 kPa.

Testing period is 2 hours continuous and shall not appear water leakage.

5.3.9.2.2 Hydrostatic testing shall be performed at the lowest point of standpipe system or the lowest point of the testing zone.

5.3.9.2.3 Water leakage of new standpipe system during testing that it is conformed to item 5.3.9.2.1 shall not exceed 2 litre per hour per 100 no. of gaskets fittings (2 quart per hour).

5.3.9.2.4 Allowable increasing water leakage from a system shall be of 30 ml of 25 mm valve per hour for metal contacted surface valve.

5.3.9.2.5 Connecting pipe between fire hydrant and check valve shall be tested by hydrostatic test as item 5.3.9.2.1.

5.3.9.2.6 Connecting pipe between hydrant and check valve shall be flushed with water flow rate as indicated on the table 5.3.6 before it is connected with the system.

5.3.9.2.7 Portion of dry pipe in standpipe system of any piping system shall be tested with the increasing pressure of 345 kPa. (50 psi) above normal pressure every 5 years

5.3.9.2.8 Renovated of existing standpipe system including outside pipe and fire hydrant shall be tested as indicated it the item 5.3.9.2.1 and 5.3.9.2.2.

5.3.9.3 Periodic Testing

5.3.9.3.1 The authorized person shall regularly perform periodic testing of portion of standpipe system with responsibility.

5.3.9.3.2 Water level in a water storage tank shall be maintained at full level all time and if pressure tank are used the pressure in tank shall be maintained at 517kPa. (75 psi).

5.3.9.3.3 Main valve of automatic water supply shall be of normally in open position all time and it is regularly checked of no water leakage.

Table 5.3.1 Provision of Standpipe System Class

Building or covered area	Building without water sprinkler system		Building with water sprinkler system	
	Class of Standpipe System	Provision of Fire hose	Class of Standpipe System	Provision of Fire hose
1) High-rise building that exceeds 23 meters height.	-	-	Class III	Provide
2) Large area building that exceeds 4,000 sqm.	Class III	Provide	Class III	Provide Class III only
3) Four stories building and it is not defined as high-rise building. (Building height is less than 23 meters)	Class III	Provide	Class III	Provide

Table 5.3.2 Standpipe size and arrangement

No. of Standpipes	Water Flow Rate Liter/min (Gallon/min)	Main Pipe Size Diameter-mm. (inches)
1	1893 (500)	150 (6)
2	2893 (750)	150 (6)
3	3785 (1000)	200 (8)
4	4731 (1250)	200 (8)
5	5678 (1500)	250 (10)
6	6624 (1750)	250 (10)
7	7570 (2000)	250 (10)
8	8516 (2250)	250 (10)
9	9463 (2500)	300 (12)
10	10410 (2750)	300 (12)

Table 5.3.3 Standpipe and main pipe sizing table

Total Water Flow	The Longest distance to the last sprinkler head –mm (inch)		
Liter/min. (GPM)	< 15 m. (50 ft.)	15 m.(50 ft.) – 30 m.(100 ft.)	> 30 m. (100 ft.)
379(100)	50(2.0)	65(2.0)	80(3.0)
380(101) – 1893(500)	100(4.0)	100(4.0)	150(6.0)
1894(501) –2839(750)	125(5.0)	125(5.0)	150(6.0)
2840(751) – 4731(1250)	150(6.0)	150(6.0)	150(6.0)
4732(1251) and up	200(8.0)	200(8.0)	200(8.0)

Table 5.3.4 Water Pipe Fitting Standard

Piping Material	**Required Standard**
-Annealed steel pipe	AWWA C151
-Seamed steel pipe both of black steel pipe and galvanized steel pipe	ASTM A 135
-Seamed or seamless steel tube	ASTM A 53,ASTM A795
-Steel pipe	ANSI B 36.10
-Seamless copper pipe, type K, L or M	ASTM B 75, ASTM B 88, ASTM B 251

Table 5.3.5 Water Pipe Fitting Material Standard

Piping Fitting	Required Standard
1. **Cast iron** - Threaded fitting; which are operated at pressure 860 kPa. (125 psi) and 1723 kPa. (250 psi) - Flange connection pipe and fitting; which are operated at pressure 860 kPa. (125 psi) and 1723 kPa. (250 psi)	ANSI B16.4 ANSI B 16.1
2. **Malleable cast iron** - Threaded fitting operates at pressure 1034 kPa. (150 psi) and 2067 kPa. (300 psi)	ANSI B 16.3
3. Ductile cast iron - Seamed gray iron fitting size ∅80 mm. (3 inches) to ∅1200 mm. (48 inches)	AWWA C 110
4. Ductile iron - Welded fitting	ANSI B 16.9 ANSI B 16.25 ASTM A 234
5. Ductile iron flange	ANSI B 16.52
6. Extruded ductile iron fitting - Electromagnetic arc welded type (ERW), welding and threaded	ANSI B 16.11
7. Copper	ANSI B 16.22 ANSI B 16.18

Table 5.3.6 Water Flow Rate for Pipe Flushing

Pipe Size –mm (inch)	Water Flow Rate -liter/min (GPM)
100(4)	1476(390)
150(6)	3331(880)
200(8)	5905(1560)
250(10)	9235(2440)
300(12)	13323(3520)

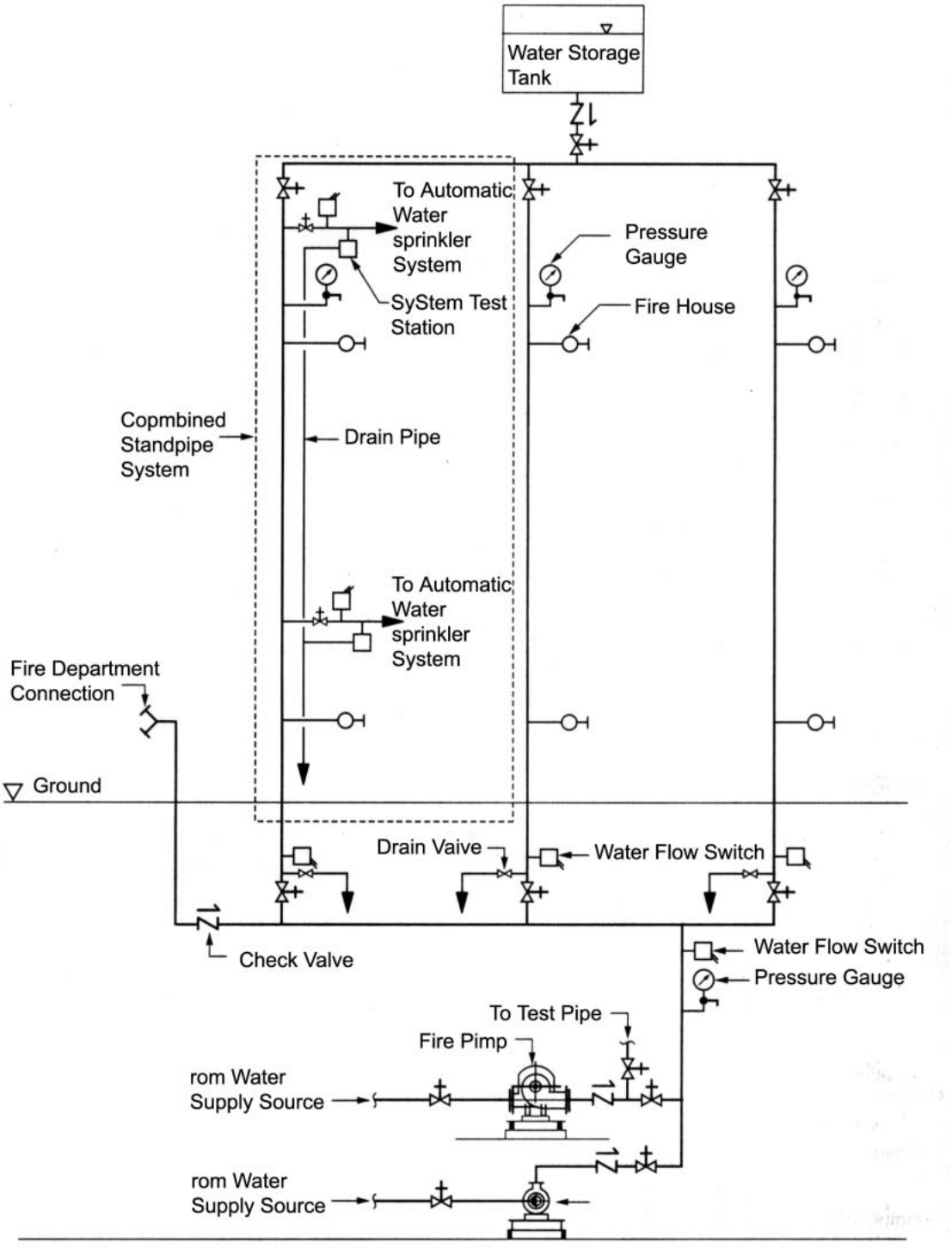


Figure 5.3.1 Diagram of Single Zone Standpipe System

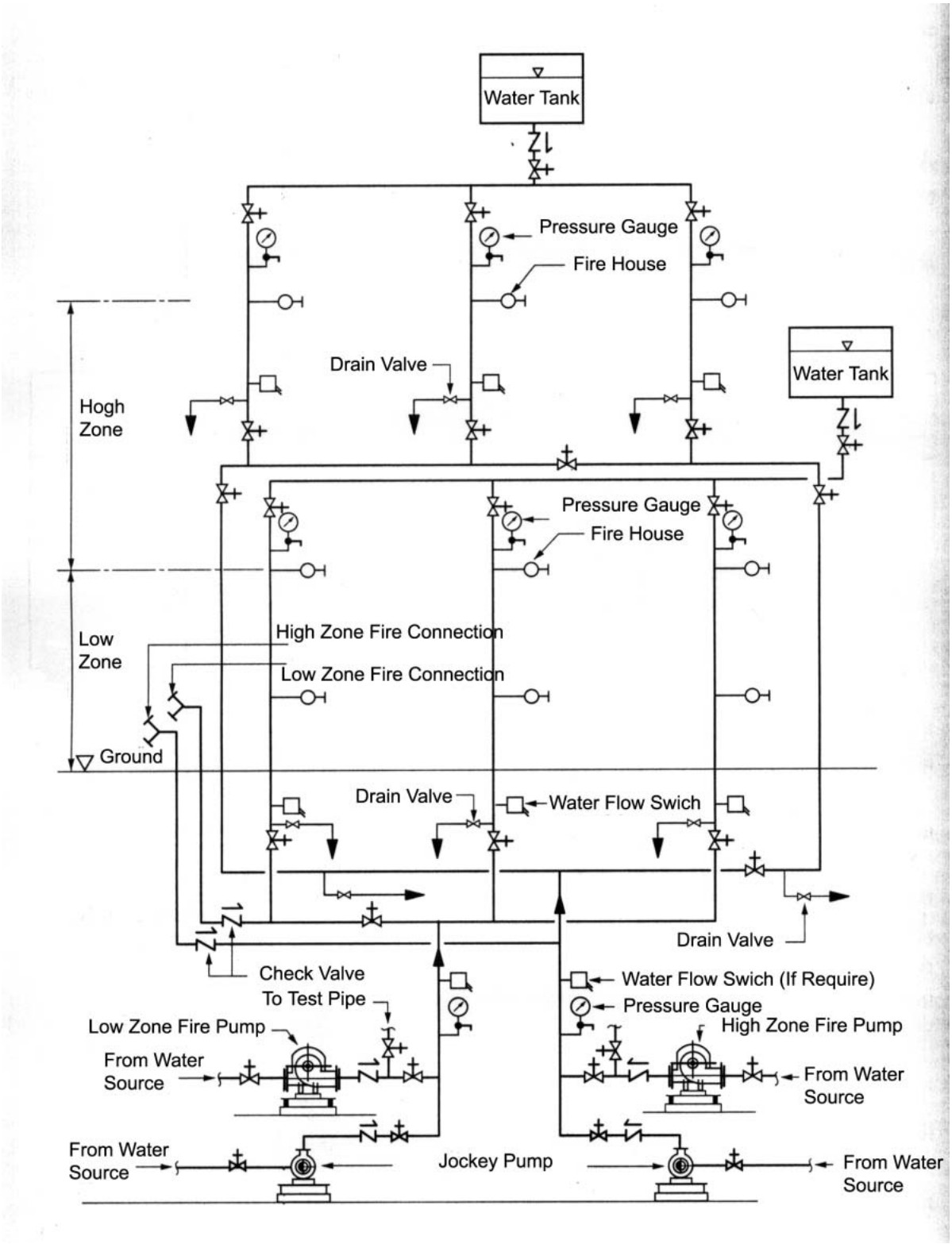


Figure 5.3.2 Diagram of Two Zone Standpipe System

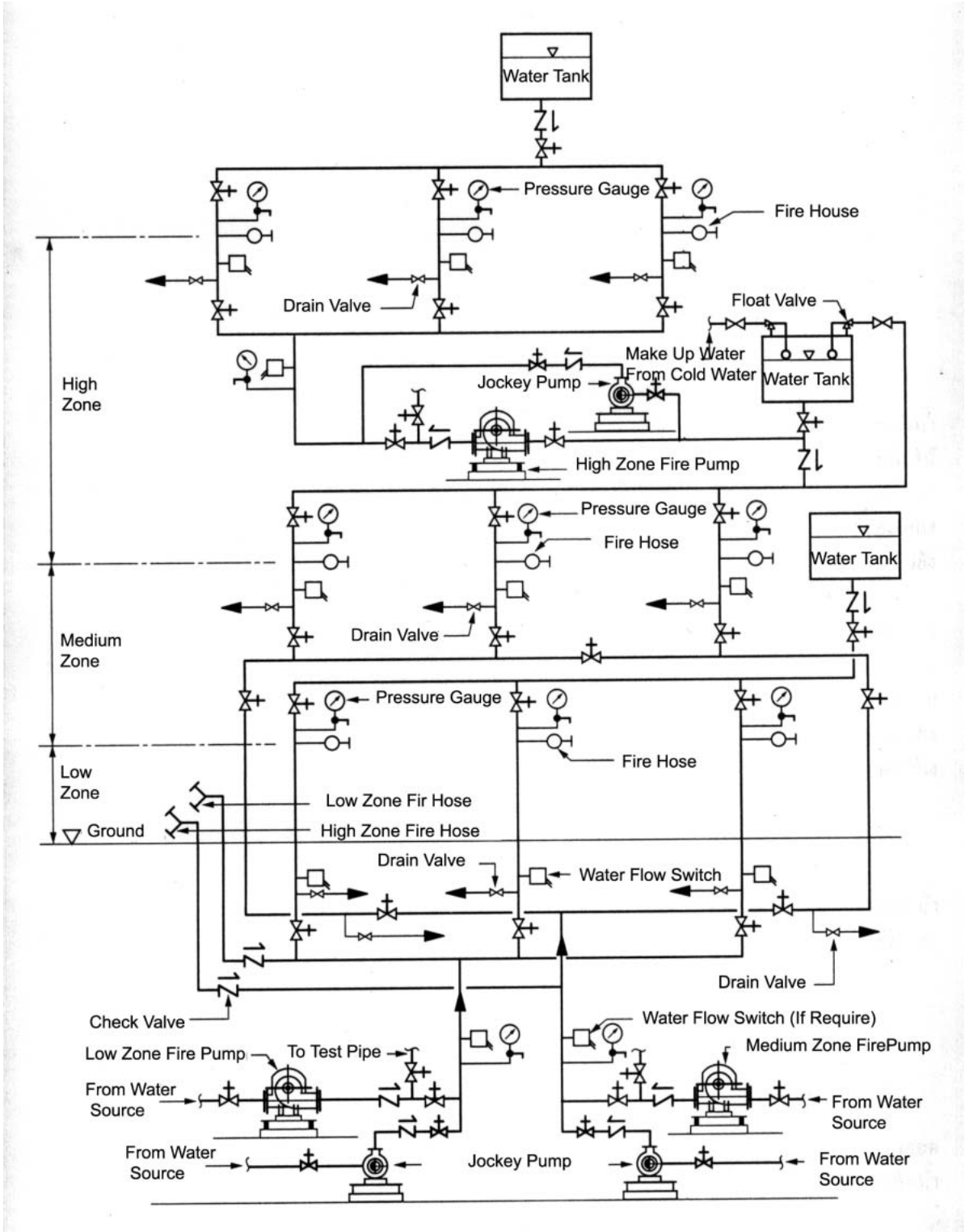


Figure 5.3.3 Diagram of Multi Zone Standpipe System

SECTION 4
AUTOMATIC SPRINKLER SYSTEM

5.4 AUTOMATIC SPRINKLER SYSTEM

5.4.1 OBJECTIVE AND SCOPE

5.4.1.1 Objective

The automatic sprinkler system in this standard propose design and installation of water supply system, piping system, control valve sprinkler and concerned equipment to provide a promptly extinguish a fire. The automatic sprinkler system is automatically fire suppression. It is extinction of fire at fire source which is quick-response to depress smoke and heat extension which is the effective and efficient system for life and property protection.

Nevertheless, the sprinkler able to be the complete system when achieve adequate capacity and pressure from water supply for extinguish a fire in time duration. Installation of detecting devices for position of control valve in the system and alarm devices are also considered. In additional, all equipment in the system have to be regular interval inspected and maintenance to provide ready system.

5.4.1.2 Scope

Purpose of this standard is to propose a minimum requirement of design, installation and testing of the sprinkler system which is provide proper fire protection system in building for life safety.

5.4.2 Type of System

5.4.2.1 Wet Pipe System

This system is the most reliable for installation of general building because it consists of water-filled pipes. When a fire occur, the nearest sprinkler shall break and immediately spray water for extinguish a fire that is quickly and efficient fire control.

5.4.1.2.1 Component of Wet Pipe System

(1) Automatic Sprinkler

The sprinkler is automatic sprinkler which connect to pipe above protection areas. When there is heat from fire more than temperature rating of that sprinkler it shall instantly break.

(2) Piping System

Branch lines which connect to sprinkler shall be water-filled pipe that always keep system working pressure

(3) Water Supply System

Apply a minimum system according to section 5.3.7.2.2 in this standard.

(4) Wet Pipe Alarm Valve

Wet pipe alarm valves which are alarm from water motor gong and signal to fire alarm system-shall install with pressure switch that already together install.

(5) Water Flow Switch

Install any one water flow switch with more than 20 sprinklers installed in the system and shall be installed minimum one water flow switch in building more one floor. If there are many zone in a floor have to install water flow switch in every zone. They shall be alarm when flow pass thru equipment equal or more than flow of water that occur from breaking of one smallest sprinkler in that zone.

(6) System Test Station

Install system test station equal to wet pipe alarm valve in the system. System test station shall install at the most remote branch line. The component of this system is orifice fitting same size to orifice of sprinkler.

(7) Floor Test Station

Installation of floor test station is to test water flow switch that able to work properly.

5.4.1.2.2 System Sizing

To sizing the system to alarm valve that control one system (one zone) depend on the maximum protection area limitations. To identify the maximum protection area limitations on each area or each floor supplied by any one system riser or any one combined system riser shall be as follow:

5.4.2.2 Dry Pipe System

The dry pipe system doesn't contain water in pipe. It suitable to be installed in the protection areas that at ordinary temperature lower than freezing point. Using dry pipe system is to protect the damage system due to freezing water in pipe.

5.4.2.2.1 Component of Dry Pipe System

(1) Automatic Sprinkler

The sprinkler is automatic sprinkler and shall instantly break when there is heat from fire more than

temperature rating of that sprinkler. But water shall not instantly flow until water full pipe.

(2) Piping System

Piping in the automatic sprinkler system doesn't contain water in pipe. Air or nitrogen gas shall be compressed in appropriate pressure in pipe instead of water.

(3) Water Supply System

Apply a minimum system according to section 5.3.7.2.2 in this standard.

(4) Dry Pipe Alarm Valve

Alarm valve in dry pipe system shall open to fill water in dry pipe when pressure of air or gas decrease from set point due to breaking sprinkler. Dry pipe alarm valve shall install equipment for signal to inspector system and also fire alarm system.

(5) System Test Station

Install system test station equal to wet pipe alarm valve in the system. System test station shall install at the most remote branch line. The component of this system is orifice fitting same size to orifice of sprinkler.

5.4.2.2.2 System Sizing

Volume of air or gas in piping system shall not be greater than 2,839 liter to any one alarm valve. Unless design system allow water flow from dry pipe alarm to system test station in not exceed 60 second.

5.4.2.3 Pre-Action System

This system appropriate for protection areas have to avoid deficient dynamics of piping system and automatic sprinkler system could cause severe damage to facilities or equipment.

5.4.2.3.1 Component of Dry Pipe System

(1) Automatic Sprinkler

The sprinkler shall be upright automatic sprinkler or pendent automatic sprinkler for return bend piping system installation. Otherwise the sprinkler shall be horizontal sidewall automatic sprinkler in case of there are no water fulfill at sprinkler and branch line.

(2) Piping System

Piping in the automatic sprinkler system is dry pipe and contain compressed air in pipe instead of water.

(3) Water Supply System

Apply a minimum system according to section 5.3.7.2.2 in this standard.

(4) Pre-Action Valves

Pre-Action Valve shall be able to work with equipment of electrical, pneumatic and hydraulic system and able to control by manual operate in case automatic system false.

(5) Fire Detection Devices

Fire detection device shall be installed in the same area of sprinkler system installation area to meet requirement of each equipment in the standard.

5.4.2.3.2 System Working

Able to control system working by any one following method:

(1) Control shall open to allow water from water supply flow to piping system when fire detective devices work in single interlock system.

(2) Control shall open to allow water from water supply flow to piping system when fire detective devices work in non interlock system.

(3) Control shall open to allow water from water supply flow to piping system when fire detective devices work in double interlock system.

5.4.2.3.3 System Sizing

(1) A number of automatic sprinkler not more than 1,000 sprinklers with one pre-action valve.

(2) To control system working following 5.4.2.3(3), volume of piping system shall not be greater than 2,839 litre to any one alarm valve. Unless design system allow water flow from dry pipe alarm to system test station in not exceed 60 second.

5.4.2.4 Deluge System

This system appropriate to installed in area of severe fuel hazard where fast-spreading fire can expected to occur. The system equipped with open sprinkler type or spray nozzle which discharge water from every open device that able to immediately suppressed a fire.

5.4.2.4.1 Component of Dry Pipe System

(1) Automatic Sprinkler

The sprinkler is open sprinkler or spray nozzle.

(2) Piping System

Piping in the automatic sprinkler system is dry pipe and not contain water in pipe and have pressure same as atmospheric pressure.

(3) Water Supply System

Apply a minimum system according to section 5.3.7.2.2 in this standard.

(4) Deluge Valve

Deluge Valve shall be able to work with equipment of electrical, pneumatic and hydraulic system and able to control by manual operate in case automatic system false.

(5) Fire Detection Devices

Fire detection device shall be installed in the same area of sprinkler system installation area to meet requirement of each equipment in the standard.

(6) Closed-Sprinkler System

Closed-sprinkler system shall be installed in the same area of automatic sprinkler system installation to cover protection areas and also connect piping to water control valve.

5.4.2.4.2 System Working

Able to control system working by any one following method:

(1) To allow water flow to piping system by fire detective devices.

(2) To allow water flow to piping system by closed-sprinkler.

5.4.2.4.3 System Sizing

All pipe sizing in the system shall obtained only by hydraulically calculated.

5.4.3 Material and Equipments

5.4.3.1 General

To provide correct and complete sprinkler system in material and equipment, system shall meet following requirement.

5.4.3.1.1 Material and equipment shall be certified by reliable institute.

Exception (1) Pipe, fitting and support hanger not necessary to be certified.

Exception (2) Equipment not concerned with system working such as drain valve, signboard not necessary to be certified.

5.4.3.1.2 Material and equipment in the system shall be resisted the their maximum working pressure and working pressure not less than 1,205 kPa (175 lb/in2)

5.4.3.2 Sprinkler

5.4.3.2.1 Sprinkler that install in the system shall be of new one and be one type which certified by reliable institute.

5.4.3.2.2 Sprinkler shall be selected type and correctly installed following the recommendation of manufacturer.

5.4.3.2.3 Unless otherwise specified, sprinkler install in general wet pipe system shall use standard orifice size not larger than 12.7 mm. (1/2 in).

5.4.3.2.4 Sprinkler shall be selected with proper temperature rating to area as specified in table 5.4.2

5.4.3.2.5 Sprinkler install in area could cause damage occur shall install with sprinkler guard.

5.4.3.3 Piping

5.4.3.3.1 Piping in sprinkler system shall be of standard in according to 5.3.8.2.

5.4.3.3.2 Joint installation in sprinkler could be welding, threaded fittings, by flange or mechanical joint.

5.4.3.3.3 For 8-inch diameter or larger pipe used schedule 30 (black steel) pipe or lower. For the smaller 8-inch diameter used schedule 40(black steel) pipe and cannot be threaded fittings and cut grooved fittings.

5.4.3.3.4 Welding in sprinkler system shall be welded in shop welding before install in area.

5.4.3.4 Fitting

5.4.3.4.1 Fittings in sprinkler system shall be of standard in according to 5.3.8.2.

5.4.3.4.2 In case of working pressure more than 12.1 bar (175 lb/in2) shall be extra heavy pattern fitting, unless the fitting can resist working pressure of system.

5.4.3.4.3 Treaded fittings can fit to less than 50 mm. diameter (2-inch).

5.4.3.5 Valves

5.4.3.5.1 Valves in sprinkler system shall be certified by reliable institute and be Indicating valves.

5.4.3.5.2 In case of working pressure more than 12.1 bar (175 lb/in2) shall select valve can resist working pressure consistent to pressure of valve.

5.4.3.5.3 Metal or plastic signboard shall be installed at control valve, drain valve and testing valve to reference location and status of valve.

5.4.3.6 Alarm valve

5.4.3.6.1 Alarm valve in sprinkler system shall be matched to types of system.

5.4.3.6.2 Alarm valve shall be installed in sprinkler system to alarm when there are water flow in piping system.

5.4.3.6.3 Alarm sound shall loud in 5 minute after water start to flow in the system.

5.4.3.6.4 Install alarm valve for more than 20 sprinklers install in the system.

5.4.3.7 Alarm Devices

5.4.3.7.1 Water Motor Gong

Water motor gong shall be installed in all sprinkler type which is alarm when fire occur. Pipe from alarm valve to water motor gong shall not longer than 22.6 m.(75 ft.) and above alarm not exceed 6.1 m.(20 ft.). Water drain from water motor gong shall be drained to appropriate drainage.

5.4.3.7.2 Water Flow Switch

(1) Install water flow switch in each floor and each zone.

(2) All of water flow switch shall signal location to annunciator board at fire command center of building to indicate area of fire.

(3) Paddle type of water flow switch except in wet pipe system only.

5.4.3.7.3 Pressure Switch

Install pressure switch ac auxiliary alarm device at all alarm valve in system.

5.4.3.8 Supervisory device

5.4.3.8.1 Install supervisory switch at valve in water supply system and control valve to inspect indicating valve.

5.4.3.8.2 All supervisory switch shall be able to signal malfunction to control room that always have operator.

5.4.4 Sprinkler System Installation

5.4.4.1 General Requirement

5.4.4.1.1 Sprinkler shall be thoroughly installed in building, except some area such as:

(1) The electrical room install only dry type. The wall is fire barrier for at least 2 hr. fire rating and isn't a storage.

(2) The parking building with opening above ground level, there are at least two opposite wall and space between the walls shall not be exceed 23 m.(75 ft.).There are opening area in each wall not less than 40% and minimum width of opening is 76 cm. (30 in.)

(3) The ceiling space which have noncombustible material or material with flammable spread rating less than 25 or material with heat rejection from surface and insulation not exceed 1,000 Btu/ft.

(4) The room or area that spray water could cause dangerous to life such as operating room and labour room.

5.4.4.1.2 Sprinkler shall be installed in the position that activation time and water distribution could cause efficient fire suppression.

5.4.4.1.3 The maximum protection areas with sprinkler shall not be exceeded area limitations of Table 5.4.3

5.4.4.1.4 Valve and essential accessories of system shall be convenient to working, inspection, test and maintenance.

5.4.4.2 Sprinkler Selection

5.4.4.2.1 The certified sprinkler shall be selected and installed to be consistent to regulation.

5.4.4.2.2 The upright sprinkler shall be installed with frame arm parallel to that branch line.

5.4.4.2.3 The upright and pendent sprinkler can install in all occupancy areas.

5.4.4.2.4 The sidewall sprinkler can install only in light hazard area and smooth flat ceiling.

5.4.4.2.5 The protection areas to sprinkler shall be set as following condition:

(1) The distance between sprinkler and next one on the same branch line called "S".

(2) The perpendicular distance from sprinkler to next branch line called "L".

(3) The protection areas for any one sprinkler = SxL.

5.4.4.3 Temperature Rating

5.4.4.3.1 Sprinkler install in building shall be selected the ordinary temperature rating.

Exception (1) In case of maximum ceiling-temperature exceed 38°C temperature rating of sprinkler shall be selected to be consistent to maximum ceiling-temperature as shown in table

5.4.4.3.2 In case sprinkler installed in particular area, the area shall be considered as follow table 5.4.4. to select temperature rating level.

5.4.4.4 Position of Deflectors

5.4.4.4.1 The deflector shall be installed parallel to ceiling or roof

5.4.4.5 Arrangement of Upright and Pendent Sprinkler

5.4.4.5.1 The maximum distance from sprinkler on the same branch line or maximum distance between branch lines shall be consistent to table 5.4.5

5.4.4.5.2 The distance of deflectors installed under ceiling of unobstructed structure shall be at least 25mm.(1 in.) from ceiling level and not exceed 300mm.(12 in.).

Exception: Special sprinkler shall be installed following the recommendation of manufacturer.

5.4.4.5.3 In case sprinkler installed at obstructed structure, deflector shall be installed under structure 25mm.(1 in.) to 150mm.(6 in.) and the maximum distance from ceiling level not exceed 559 mm.(22 in.).

5.4.4.6 Obstruction to Sprinkler Discharge

5.4.4.6.1 Obstruction at the ceiling

(1) Vertical Obstruction

The minimum distance from vertical obstruction shall be consistent to table 5.4.6 and figure 5.4.3.

(2) Horizontal Obstruction

The minimum distance from horizontal obstruction shall be consistent to table 5.4.7 and figure 5.4.4.

5.4.4.6.2 Obstruction Located Below Sprinkler

(1) Install sprinkler under duct and obstruction which is more than 1.20 m. width.

Exception: Sprinkler can install at ceiling if arrangement consistent to table 20.

(2) The distance from sprinkler to partition panel shall be consistent to table 5.4.8 and figure 5.4.5.

5.4.4.7 Arrangement of Sidewall Sprinkler

5.4.4.7.1 The sidewall sprinkler can install only in light hazard area and smooth flat ceiling

5.4.4.7.2 The protection areas to sidewall sprinkler shall be set as following condition:

(1) The distance of sidewall sprinkler along the wall called ”S”. The larger one between the distance measure to next sprinkler or twice of the distance measure to end wall shall be selected.

(2) The distance of sidewall sprinkler across the room called ”L”. The larger one between the distance measure from sidewall sprinkler to opposite wall or the distance measure from wall to room center in case install both sidewall sprinkler in the opposite wall shall be selected.

(3) The protection areas for any one sidewall sprinkler = SxL.

(4) The protection areas to sidewall sprinkler shall be considered as followed the recommendation of manufacturer.

5.4.4.7.3 Position of Deflection

(1) The distance from sidewall sprinkler to ceiling level shall be at least 100 mm. but not exceed 150 mm.

(2) The distance from sidewall sprinkler to wall shall be at least 100 mm.

(3) The position of deflection shall be considered as followed the recommendation of manufacturer.

5.4.5 Water Supply Requirement for Sprinkler System

5.4.5.1 Water Supply Requirement By Pipe Schedule Method

5.4.5.1.1 The sprinkler can install only in light hazard area or ordinary hazard area not exceed 465 m2(5000 ft.). In case install in area exceed

465 m2, pressure in table 5.4.9 shall not be less than 3.4 bar(50 lb/in2).

5.4.5.1.2 Water supply requirement and residual pressure shall be consistent to table 5.4.9.

5.4.5.1.3 Residual pressure in table 26 considered at the highest level of riser connect to the sprinkler.

5.4.5.2 Pipe Sizing By Pipe Schedule Method

5.4.5.2.1 Pipe schedule for light hazard occupancies shall be as followed:

(1) The sprinkler on each branch lines shall not be exceed 8 sprinklers.

(2) The installation of pipe and sprinkler above or below a ceiling , the pipe size to sprinkler for light hazard occupancies shall be consistent to table 5.4.10.

(3) The installation of pipe and sprinkler both above and below a ceiling, the pipe size to sprinkler for light hazard occupancies shall be consistent to table 5.4.11.

(4) In case of there are 9 sprinklers install on any branch lines, the last 2 sprinklers on the branch lines shall be 25 mm.(1 in.) diameter. And the next sprinkler on the branch lines shall be 32 mm.(1 ¼ in.) diameter and the next one shall be consistent to table 5.4.10.

(5) In case of there are 10 sprinklers install on any branch lines, the last 2 sprinklers on the branch lines shall be 25 mm.(1 in.) diameter. And the next sprinkler on the branch lines shall be 32 mm.(1 ¼ in.) diameter and the next one shall be consistent to table 5.4.10. But the branch lines after the tenth sprinkler shall be 65 mm.(2 ½ in.) diameter.

(6) The protection areas which is sprinkler system and there are total sprinkler more than 100 sprinklers without partition panel, main piping and branch line are sized in accordance with ordinary hazard pipe schedule.

5.4.5.2.2 Pipe schedule for ordinary hazard occupancies shall be as followed:

(1) The sprinkler on each branch lines shall not be exceed 8 sprinklers.

(2) The installation of pipe and sprinkler above or below a ceiling , the pipe size to sprinkler for ordinary hazard occupancies shall be consistent to table 5.4.12.

(3) The installation of pipe and sprinkler both above and below a ceiling, the pipe size to sprinkler for ordinary hazard occupancies shall be consistent to table 5.4.13.

(4) In case of there are 9 sprinklers install on any branch lines, the last two sprinklers on the branch lines shall be 25 mm.(1 in.) diameter. And the next sprinkler on the branch lines shall be 32 mm.(1 ¼ in.) diameter and the next one shall be consistent to table 5.4.12.

(5) In case of there are 10 sprinklers install on any branch lines, the last two sprinklers on the branch lines shall be 25 mm.(1 in.) diameter. And the next sprinkler on the branch lines shall be 32 mm.(1 ¼ in.) diameter and the next one shall be consistent to table 5.4.12. But the branch lines after the tenth sprinkler shall be 65 mm.(2 ½ in.) diameter.

5.4.5.3 Water Supply Requirement By Hydraulic Calculation Methods

5.4.5.3.1 Water supply requirement of sprinkler by using area/density curve shall be as followed:

(1) Set occupancies classification.

(2) From figure 5.4.6, find water density from area of sprinkler operation following occupancies classification which is according to:

Light hazard used area and density line 1.

Ordinary hazard-group 1 used area and density line 2.

Ordinary hazard-group 2 used area and density line 3.

Extra hazard-group 1 used area and density line 4.

Extra hazard-group 2 used area and density line 5.

(3) Minimum water supply requirement shall be summation of water calculated from 5.4.4.2 and water calculated from table 5.4.14.

(4) Duration of water supply requirement shall be in accordance with 5.4.14.

Installation of sprinkler system shown in figure 5.4.7 is ordinary hazard-group 2. Calculated a minimum flow and pressure of water at point A by using the following data:

1) Area 1,500 sqr.ft.

2) K value of sprinkler = 5.6

3) Black steel pipe schedule (C Value = 120)

From figure 5.4.7 :

S = Distance between sprinklers on a branch line equal to 3 m.(9.85 ft.)

L = Area per sprinkler equal to 10.80 m^2(117 ft^2)

Calculation:

Stage 1: Total sprinklers to calculate

$$= \frac{\text{Design area}}{\text{Area per sprinkler}}$$

= EQ\F(1\500ft^2, 117ft^2/sprinkler)

= 12.82, calculate 13

Stage 2: Find number of sprinkler on branch line

$$= \frac{1.2\sqrt{A}}{S}$$

Stage3 : Calculated initial water flow from sprinkler from equation:

$q = A_s\, d$

A_s = Area per sprinkler (117 ft^2)
d = Water density (0.2 gpm/ ft^2)
Then:
= q = 117(0.70)
= 23.40 gpm

Stage 4: Calculated operating pressure for initial water flow (Step 1).

$$P = \frac{Q^2}{K^2}$$

Where:
P = pressure at sprinkler
Q = flow in gpm
K = constant value, K = 5.6

Stage 5: Find internal diameter from table 5.14.15.

Stage 6: Find pipe length between sprinkler shown in figure 5.4.7.

Stage 7: Calculated friction loss by Hazen-William formula

$$P = \frac{4.5Q^{1.85}}{C^{1.85}d^{4.87}}$$

Where:
P = friction resistance in pounds pressure per square inch per foot of pipe
Q = flow in gpm
D = actual internal diameter of pipe in inches
C = friction loss coefficient.

Stage 8: From figure 3, achieve friction loss in pipe size 1-in. diameter and 9.85 ft. long with 23.40 gpm in step no.1

Stage 9: Calculated operating pressure for the second sprinkler (include pressure in step 4 and 8).

Stage 10: For step no.2 calculate water flow from the second sprinkler from formula in step no. 4 and calculate friction loss in pipe for the third, forth and fifth on the first line.

Stage 11: For step no.3 to5, repeat in stage 9 to 10, to achieve operating pressure at sprinkler, water flow and friction loss in pipe for the third, forth and fifth on the first line.

Stage 12: For step 7, calculate constant K value of the first branch line(constant K value of the first branch line equal to the second branch line).

Stage 13: For step 8, calculate water flow in the second branch line by using formula in stage 4.

Stage 14: For step 9 to 11, repeat stage 3 to 9 to calculate water flow in the third branch line.

Stage 15: For step 12, calculate friction loss to the same point with in step no. 8 to achieve pressure at the same point but different value. Adjust accumulated water flow of a smaller side from

Q2 = Q1*(P1/P2)

Stage 16: For step 13-14, find friction loss to point 'A' to achieve operating pressure and minimum water supply required in the system.

Table 5.4.1 The Maximum Protection Areas For One System Riser

Occupancy Area	Maximum protection areas m^2 (ft^2)
Light Hazard	52,000 (4831)
Ordinary hazard	52,000 (4831)
Extra hazard	
- Pipe Schedule	25,000 (2323)
- Hydraulically Calculated	40,000 (3716)

Table 5.4.2 Temperature Ratings, Classifications, and Color Codings

Maximum ceiling Temperature (°C)	Temperature Rating (°C)	Temperature Classification	Color Code	
			Fusible Type	Glass Bulb
38	57 to 77	Ordinary	Uncolored	Orange or red
66	79 to 107	Intermediate	White	Yellow or green
107	121 to 149	High	Blue	Blue
149	163 to 191	Extra high	Red	purple
191	204 to 246	Very extra high	Green	Black
246	260 to 302	Ultra high	Orange	Black

Table 5.4.3 Maximum Protection Areas and Sprinkler System

Construction Type	Occupancy Areas		
	Light Hazard m^2(ft^2)	Ordinary Hazard m^2(ft^2)	Extra Hazard m^2(ft^2)
Unobstructed	20.9 (225)	12.1 (130)	9.3 (100)
Noncombustible obstructed	18.6 (200)	12.1 (130)	9.3 (100)
Combustible obstructed	15.6 (168)	12.1 (130)	9.3 (100)

Table 5.4.4 Ratings of Sprinklers in Specified Locations

Location	Ordinary Degree Rating	Intermediate Degree Rating	High Degree Rating
Skylights	-	Glass or plastic	-
Attics Peaked roof: Metal or thin Boards, concealed or not Concealed, insulated or Uninsulated	Ventilated	Unventilated	-
Flat roof: Metal, not Concealed; insulated or uninsulated	Ventilated or unventilated	Note: For uninsulated roof, climate and occupancy	-
Flat roof: Metal, concealed, Insulated or uninsulated	Ventilated	Unventilated	-
Show windows	Ventilated	Unventilated	-

Note: A check of job condition by means of thermometers may be necessary.

Table 5.4.5 Protection Areas and Maximum Spacing (SSU/SSP)

Protection Areas	Maximum Spacing of sprinkler on the same branch line, m. (ft.)	Maximum Spacing of sprinkler on each branch line, m. (ft.)
Light Hazard	15	15
Ordinary Hazard	15	15
Extra Hazard	12	12

Note: The distance from sprinklers to wall shall be one-half of the allowable distance between sprinkler and not less than 100 mm.

Table 5.4.6 Minimum Horizontal Distance from Vertical Obstruction

Vertical Obstructed Size (a)	Minimum Horizontal Distance (b)
Less than 25 mm. 25 mm. – 50 mm. > 100mm.	150 mm. 300 mm. 600 mm.

Table 5.4.7 Position of Sprinklers to Avoid Obstructions to discharge

Distance from Sprinkler to Side of Obstruction (a)	Maximum Allowable Distance of Deflector above Bottom of Obstruction (mm.) (b)
Less than 300	0
> 300 to 600	25
> 600 to 750	50
> 750 to 900	75
> 900 to 1005	100
> 1005 to 1200	150
> 1200 to 1350	175
> 1350 to 1500	225
> 1500 to 1650	275
> 1650 to 1800	350

Table 5.4.8 Suspended or Floor Mounted Obstructions (Extended Coverage Sidewall Sprinklers)

Horizontal Distance (a)	Minimum Allowable Distance Below Deflector (b)
Less than 150	75
> 150 to 250	100
> 250 to 300	150
> 300 to 375	200
> 375 to 450	237
> 450 to 600	312
> 600 to 750	387
> 750	450

Table 5.4.9 Water Supply Requirements for Pipe Schedule Sprinkler Systems

Occupancy Classification	Minimum Residual Pressure Required (lb/in^2)	Acceptable Flow at Base of Riser LPM (gpm)	Duration in Minutes (min)
Light Hazard	103.5 (15)	1895-2840 (500-750)	30-60
Ordinary Hazard	138 (20)	3218-5680 (850-1500)	60-90
Extra Hazard	The appropriate water pressure and flow in system shall be calculated by hydraulic calculation method.		90-120

Table 5.4.10 Light Hazard Pipe Schedules

Pipe Size (mm.)	Maximum Sprinkler Install on Branch Line	
	Steel Pipe	Copper Pipe
25	2	2
32	3	3
40	5	5
50	10	12
65	30	40
80	60	65
100	See 5.4.2.1.2	See 5.4.2.1.2

Table 5.4.11 Number of Sprinklers above and below a Ceiling

Pipe Size (mm.)	Maximum Sprinkler Install on Branch Line	
	Steel Pipe	Copper Pipe
25	2	2
32	4	4
40	7	7
50	15	18
65	50	65

Table 5.4.12 Ordinary Hazard Pipe Schedule

Pipe Size (mm.)	Maximum Sprinkler Install on Branch Line	
	Steel Pipe	Copper Pipe
25	2	2
32	3	3
40	5	5
50	10	12
65	20(15)	25(20)
80	40(30)	45(35)
100	100	115
150	275	300
200	See 5.4.2.1.2	See 5.4.2.1.2

Table 5.4.13 Number of Sprinklers above and below a Ceiling

Pipe Size (mm.)	Maximum Sprinkler Install on Branch Line	
	Steel Pipe	Copper Pipe
25	2	2
32	4	4
40	7	7
50	15	18
65	30	40
80	60	65

Table 5.4.14 Hose Stream Demand and Water Supply Duration Requirements

Hazard Classification	Inside Hose (gpm)	Total Combined Inside And Outside Hose (gpm)	Duration in Minutes
Light	0, 50, or 100	100	30
Ordinary	0, 50, or 100	250	60-90
Extra Hazard	0, 50, or 100	500	90-120

Table 5.4.15 Equivalent Schedule 40 Steel Pipe Length Chart

Fittings and Valves	Fittings and Valves Expressed in Equivalent Feet of Pipe													
	¾ in.	1 in.	1 ¼ in.	1 ½ in.	2 in.	2 ½ in.	3 in.	3 ½ in.	4 in.	5 in.	6 in.	8 in.	10 in.	12 in.
45° Elbow	1	1	1	2	2	3	3	3	4	5	7	9	11	13
90° Standard elbow	2	2	3	4	5	6	7	8	10	12	14	18	22	27
90° Long turn elbow	1	2	2	2	3	4	5	5	6	8	9	13	16	18
Tee or cross (flow turned 90°)	4	5	6	8	10	12	15	17	20	25	30	35	60	60
Butterfly valve	-	-	-	-	6	7	10	-	12	9	10	12	21	21
Gate valve	-	-	-	-	1	1	1	1	2	2	3	4	6	6
Swing check	-	5	7	9	11	14	16	19	22	27	32	45	65	65

For SI Units: 1 in. = 25.4 mm.
1 ft. = 0.3048 m.

Table 5.4.16 Steel Pipe Dimension

Nominal Pipe Size			Schedule 10				Schedule 30				Schedule 40			
	Outside Diameter		Inside Diameter		Wall Thickness[2]		Inside Diameter		Wall Thickness		Inside Diameter		Wall Thickness	
in.	in.	(mm.)	in.	(mm.)	in.	(mm.)	in.	(mm.)	in.	(mm.)	in.	(mm.)	in.	(mm.)
1	1.315	(33.4)	1.097	(27.9)	.109	(2.8)	-	-	-	-	1.049	(26.6)	0.133	(3.4)
1 ¼	1.660	(42.2)	1.442	(36.6)	.109	(2.8)	-	-	-	-	1.380	(35.1)	0.140	(3.6)
1 ½	1.900	(48.3)	1.682	(42.7)	.109	(2.8)	-	-	-	-	1.610	(40.9)	0.145	(3.7)
2	2.375	(60.3)	2.157	(54.8)	.109	(2.8)	-	-	-	-	2.067	(52.5)	0.154	(3.9)
2 ½	2.875	(73.0)	2.635	(66.9)	.120	(3.0)	-	-	-	-	2.469	(62.7)	0.203	(5.2)
3	3.500	(88.9)	3.260	(82.8)	.120	(3.0)	-	-	-	-	3.068	(77.9)	0.216	(5.5)
3 ½	4.000	(101.6)	3.760	(95.5)	.120	(3.0)	-	-	-	-	3.548	(90.1)	0.226	(5.7)
4	4.500	(114.3)	4.260	(108.2)	.120	(3.0)	-	-	-	-	4.026	(102.3)	0.237	(6.0)
5	5.563	(141.3)	5.295	(134.5)	.134	(3.4)	-	-	-	-	5.047	(128.2)	0.258	(6.6)
6	6.625	(168.3)	6.357	(161.5)	.134	(3.4)	-	-	-	-	6.065	(154.1)	0.280	(7.1)
8	8.625	(219.1)	8.249	(209.5)	.188	(4.8)	8.071	(205.0)	0.277	(7.0)	-	-	-	-
10	10.750	(273.1)	10.37	(263.4)	.188	(4.8)	10.14	(257.6)	0.307	(7.8)	-	-	-	-

Table 5.4.17 Hazen-Williams C Values

Pipe or Tube	C Value
Unlined cast or ductile iron	100
Black steel (dry systems including preaction)	100
Black steel (wet systems including deluge)	120
Galvanized (all)	120
Plastic (listed)-all	150
Cement lined cast or ductile iron	140
Copper tube or stainless steel	150

Table 5.4.18 Example of Hydraulic Calculation for Sprinkler System.

Hydraulic Calculation Sheet										
Ordinary Hazard Group 2										
Density = 0.2 gpm/sq.ft.				Area Application = 1500 sq.ft			Maximum Coverage per Sprinkler = 130 sq.ft			
Step No.	**Nozzle Ident. and Location**		**Flow in gpm**	**Pipe Size in.**	**Pipe Fitting and Devices**	**Equiv. Pipe Length**	**Friction Loss p.s.i. Foot**	**Pressure Summary**	**Normal Pressure**	**Density = 0.15 k = 5.6**
1	#1	BL-1	q	1		L 9.85	C = 120	P_t 17.46	P_t	q = 117 x 0.2
						F 0.00	(Formula)	P_e	P_v	= 23.40 gpm
			Q 23.40			T 9.85	0.174	P_f 1.71	P_n	Pt = $(q/k)^2$ (from Formular 4)
2	#2		q 24.52	1		L 9.85		P_t 19.17	P_t	q = $KPt^{1/2}$ (from Formular 5)
						F 0.00		P_e	P_v	= 24.52 gpm
			Q 47.92			T 9.85	0.655	P_f 6.45	P_n	
3	#3		q 28.35	1 ¼		L 9.85		P_t 25.63	P_t	q = $KPt^{1/2}$
						F 0.00		P_e	P_v	= 28.35 gpm
			Q 76.27			T 9.85	0.407	P_f 4.01	P_n	
4	#4		q 30.49	1 ½		L 9.85		P_t 29.64	P_t	q = $KPt^{1/2}$
						F 0.00		P_e	P_v	= 30.49 gpm
			Q 106.76			T 9.85	0.358	P_f 3.53	P_n	
5	#5		q 32.25	1 ½	IT = 8	L 4.93		P_t 33.17	P_t	q = $KPt^{1/2}$ (from Formular 5)
						F 8.00		P_e	P_v	= 32.25 gpm
			Q 139.01			T 12.93	0.584	P_f 7.54	P_n	
6		BL-1 RN	q	2	IT = 10	L 0.99		P_t 40.71	P_t	
						F 10.00		P_e 0.43	P_v	
			Q 139.01			T 10.99	0.173	P_f 1.90	P_n	
7		BL-1 RN TO BL-2 RN	q	2		L 11.90		P_t 43.04	P_t	K = $Q/Pt^{1/2}$
						F 0.00		P_e	P_v	= 21.19 gpm
			Q 139.01			T 11.90	0.173	P_f 2.06	P_n	
8		BL- RN TO BL-3 RN	q 142.29	2 ½		L 11.90		P_t 45.10	P_t	q = $KPt^{1/2}$
						F 0.00		P_e	P_v	= 142.29 gpm
			Q 281.30			T 11.90	0.268	P_f 3.19	P_n	
								P_t 48.29	Use for correction Q at BL-3	

Step No.	Nozzle Ident. and Location	Flow in gpm	Pipe Size in.	Pipe Fitting and Devices	Equiv. Pipe Length	Friction Loss p.s.i. Foot	Pressure Summary	Normal Pressure	Density = 0.15 k = 5.6
9	#1	BL-1	1 ¼		L 9.85	C = 120	P_t 17.46	P_t	q = 117 x 0.2
		q			F 0.00	(Formula)	P_e	P_v	= 23.40 gpm
		Q 23.40			T 9.85	0.046	P_f 0.45	P_n	
10	#2		1 ½		L 9.85		P_t 17.91	P_t	$q = KPt^{1/2}$
		q 23.70			F 0.00		P_e	P_v	= 23.70 gpm
		Q 47.10			T 9.85	0.079	P_f 0.78	P_n	
11	#3		1 ½	IT = 8	L 4.93		P_t 18.69	P_t	$q = KPt^{1/2}$
		q 24.21			F 8.00		P_e	P_v	= 24.21 gpm
		Q 71.31			T 12.93	0.170	P_f 2.19	P_n	
12		BL-3 RN	2	IT = 10	L 0.99		P_t 20.88	P_t	
		q			F 10.00		P_e 0.43	P_v	
		Q 71.31			T 10.99	0.050	P_f 0.55	P_n	
		Qadj 105.97					**Pt 21.86**		
NOTE : CORRECTION Q AT #1, #2, #3 BL-3 Q, P_t at STEP 12 = Q_1, Pt_1 and P_t at STEP 8 = Pt_2									**Qadj = $Q_1(Pt_2/Pt_1)^{1/2}$** = 105.97 gpm
13		BL-3 RN	3		L 23.63		P_t 48.29	P_t	
		TO			F 0.00		P_e	P_v	
		CM q 105.97 Q 387.27			T 23.63	0.168	P_f 3.97	P_n	
14		CM	4		L 586.00		P_t 52.26	P_t	
		TO			F 0.00		P_e	P_v	
		Point' A' Q 387.27			T 586.00	0.045	P_f 26.22	P_n	
							P_t 78.48		

Note:
L = Pipe Length (ft.)
F = Fitting Equilalent Length, ft. (from table 3)
T =Total Pipe Lenght, ft. (T = L + F)
Pt = Total Pressure Require, psi.
Pe = Differential Pressure in Elevation, psi.
Pf = Friction Loss Pressure in Pipe Lenght, psi. (Pf = T x Friction Loss per Foot)
Pv = Not Used
Pn = Not Used
1 psi = 6.895 kpa
1 ft. = 0.304 m.
gpm. = 3.785 Litre/min

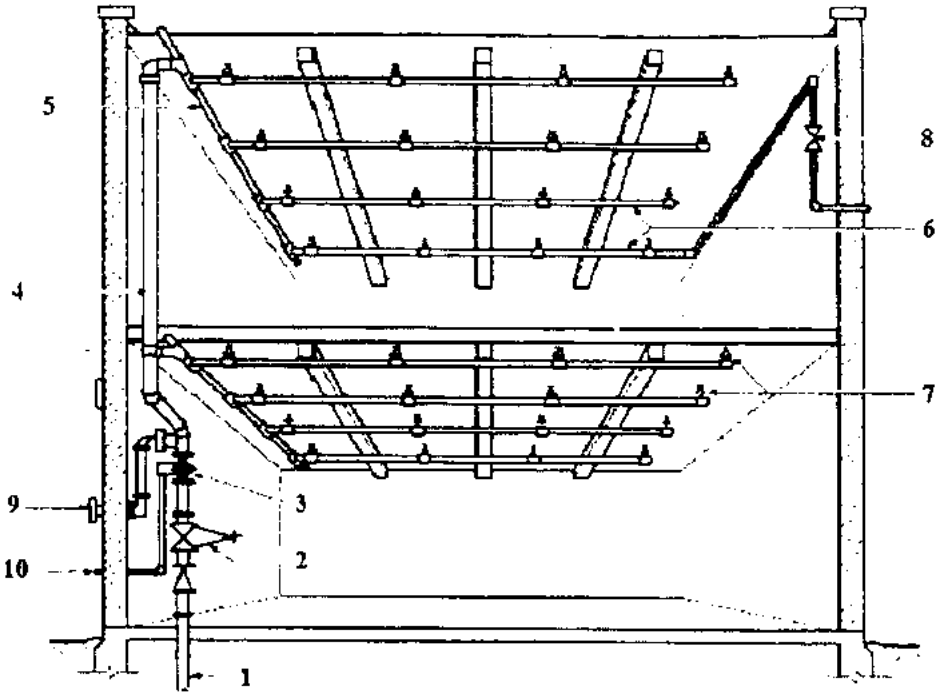


Figure 5.4.1 Example of wet pipe system.

1. Water Supply
2. Control Valve
3. Alarm Valve
4. Riser
5. Cross Main
6. Branch Lines
7. Automatic Sprinklers
8. System Test Station
9. Fire Department Connection
10. Main Drain Connection

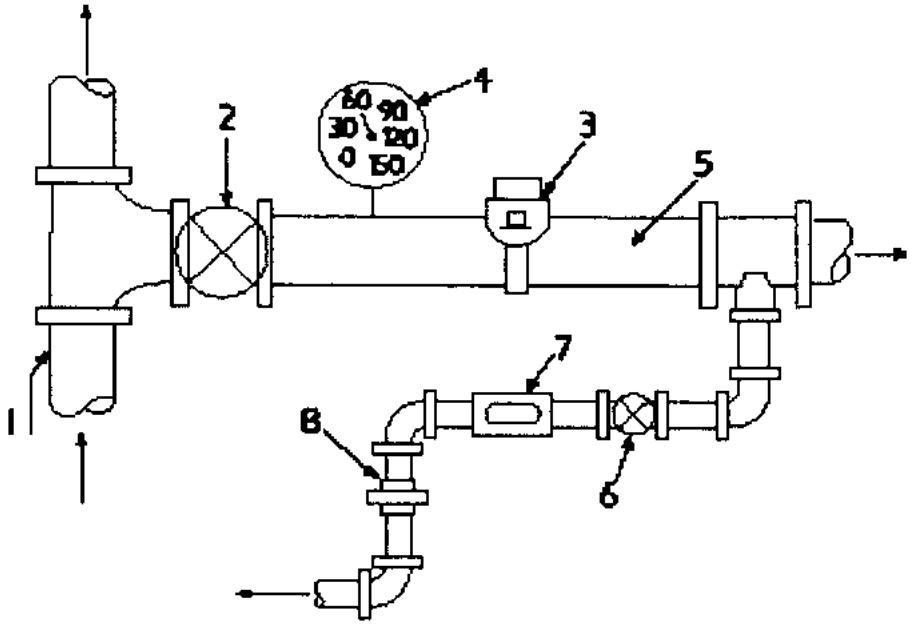


Figure 5.4.2 Floor test station.

1. Riser
2. Control Valve with Indicating
3. Water Flow Detecting Device
4. Pressure Gauges
5. Cross Main
6. Test Valve
7. Sight Glass
8. Union with Orifice same size to Orifice Sprinkler

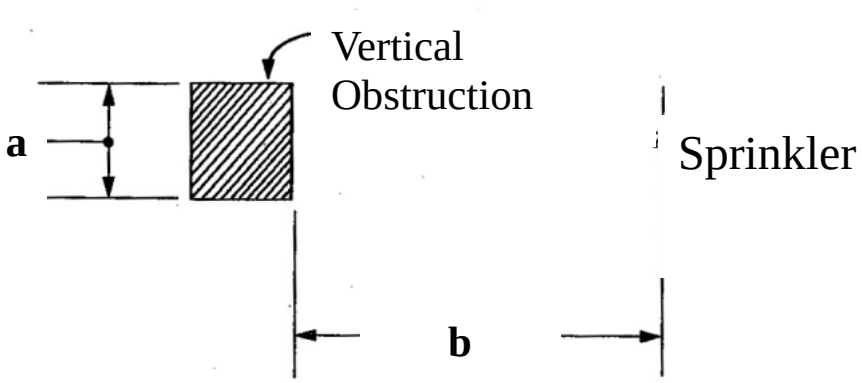


Figure 5.4.3 Distance from vertical obstruction to sprinkler.

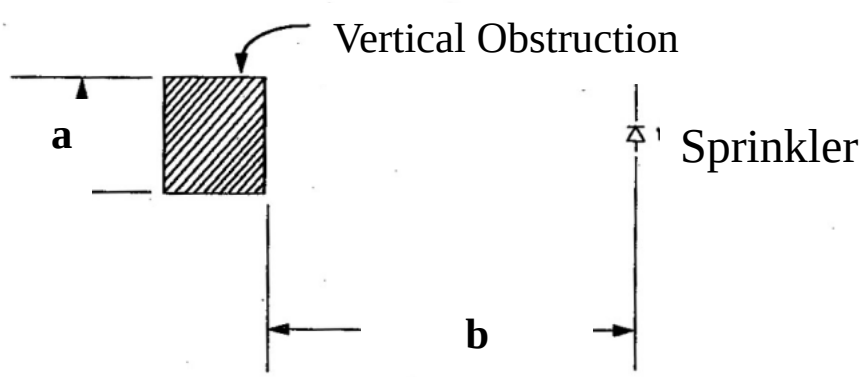


Figure 5.4.4 Position of sprinkler to avoid obstructions to discharge.

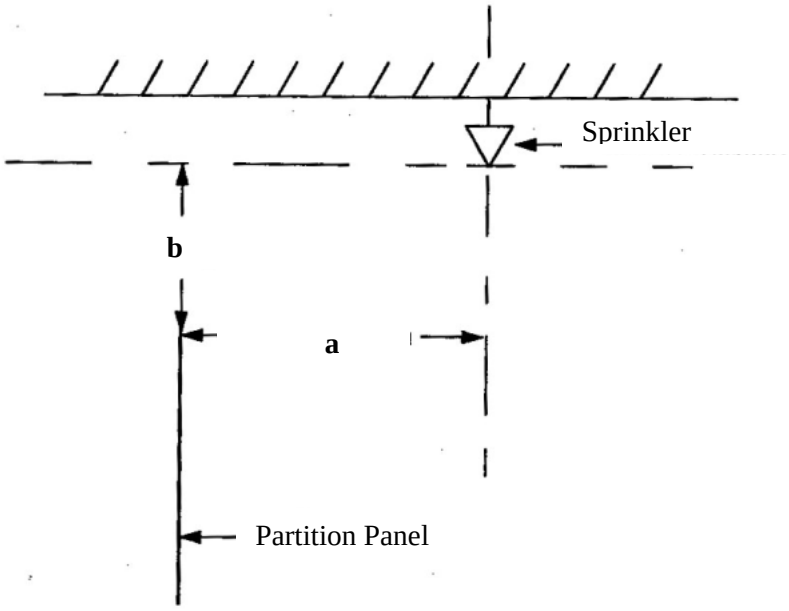


Figure 5.4.5 Installation of sprinkler for partition panel.

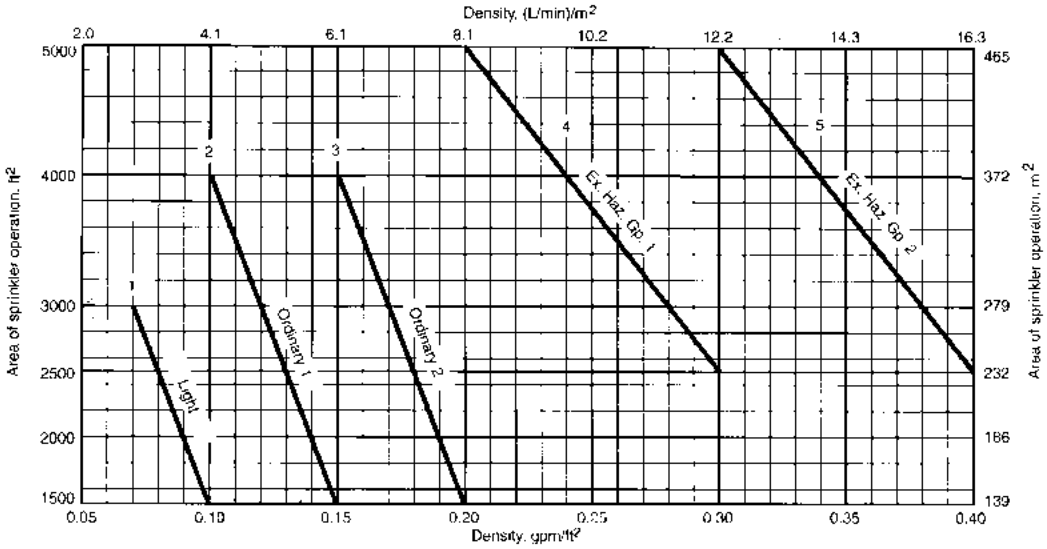


Figure 5.4.6 Guide for determining density/area of sprinkler operation, and water supply requirements for hydraulically designed sprinkler system.

Example of Hydraulic Calculation for Sprinkler System.

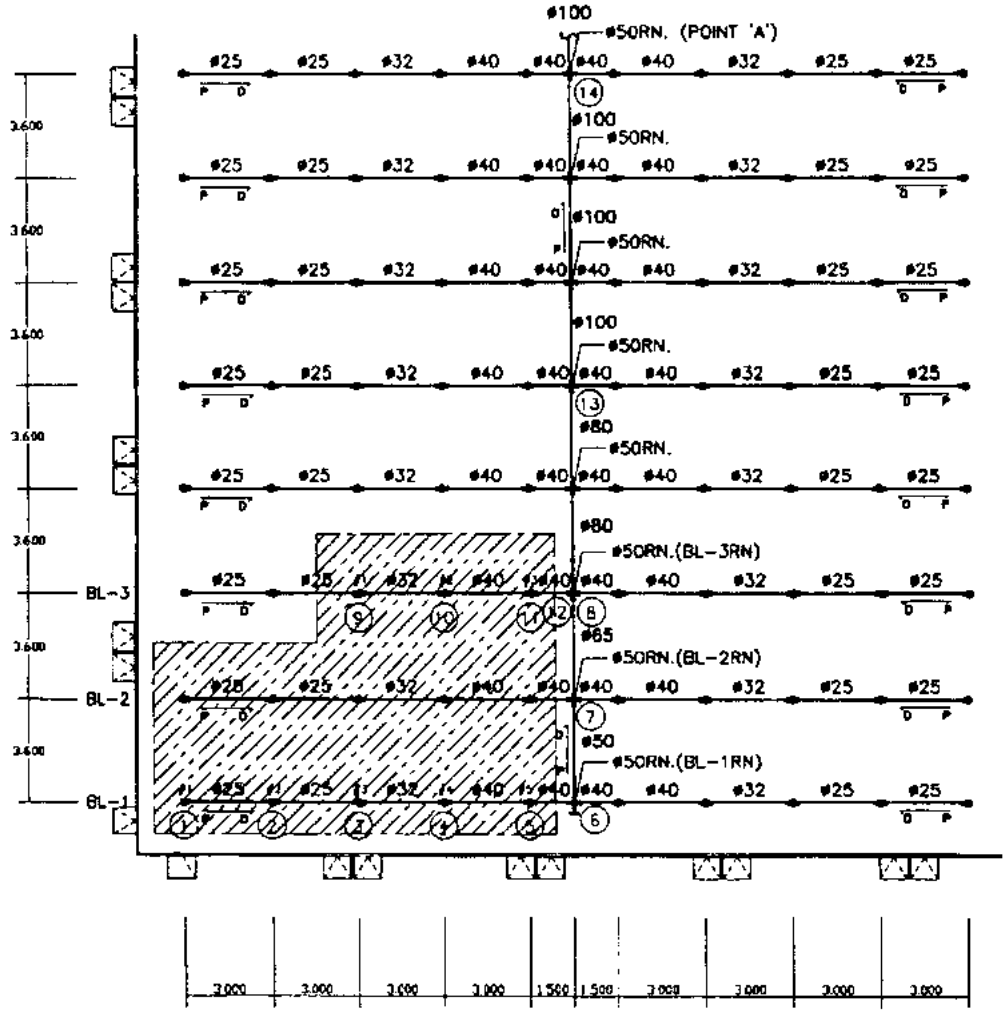


Figure 5.4.7 Plan for sprinkler system.

SECTION 5
INSTALLATION OF PRIVATE FIRE SERVICE MAINS AND THEIR APPURTENANCES

5.5 INSTALLATION OF PRIVATE FIRE SERVICE MAINS AND THEIR APPURTENANCES

5.5.1 General

5.5.1.1 Objective

This standard establishes the minimum requirement for Installation of private fire service mains and their appurtenances supplying automatic sprinkler systems, Water Spray Fixed Systems, Foam Systems, Private Hydrants, Monitor Nozzle and Fore Hose Cabinet and Accessories for fire protection purpose only.

5.5.1.2 Scope

The scope of this standard is to provide reasonable degree of protection for life and property from fire through installation requirement for fire service main systems base on sound engineering principle, test data, field experience. This standard include demanding of installation yard piping and hydrant. This pipe will complete when connect all system to water supplies system (such as water storage tank, fire pump) to supply adequate water.

5.5.2 Hydrant

5.5.2.1 General

5.5.2.1.1 A diameter of hydrant connection with the water supplies system shall be no less than 150 mm. (6 inches) with or without shut-off valve at the connection.

5.5.2.1.2 Hydrant shall be wet-barrel type.

5.5.2.1.3 The Number of Hose Outlet shall not be less than 1.

5.5.2.1.4 Connection shall be Female Instantaneous outlet connection with caps and chain.

5.5.2.1.5 A diameter of control valve shall be 65 mm. (2 inches) at fire hose connection.

5.5.2.2 Fire hydrants Location

5.5.2.2.1 Fire Hydrant shall be placed at least 12m. (50 feet) from building protected.

5.5.2.2.2 If the distance of Fire Hydrants (in 5.5.2.1) can not be perform, the position shall be installed near the fireproof wall or staircase or building corner that will not be damaged or ruined by fire.

5.5.2.2.3 Distance between each Fire Hydrants shall be no longer than 150m. (500 feet) in length.

5.5.2.3 Fire hydrant installation

5.5.2.3.1 Fire Hydrants shall be strongly set on slab

5.5.2.3.2 Height of Fire Hydrant shall not less than 0.60 m. (2 Feet) measuring from the ground level to center of hydrant connection.

5.5.2.3.3 Fire Hydrant shall be protected if subject to mechanical damage.

5.5.2.3.4 Fire Hydrant connection shall be tested not less than once a year.

5.5.3 Hose house

5.5.3.1 General

5.5.3.1.1 Fire Hose shall be provided sufficiently by conform the number of staff and fireman.

5.5.3.1.2 The quantity of fire hose will depend upon the number and location of hydrant relative to protect property, the extent of hazard and fire-fighting capabilities of the potential user.

5.5.3.1.3 The quantity and type of fire hose cabinet (5.3.1.2) and accessories shall be approved by the authority having jurisdiction.

5.5.3.1.4 Fire Hose and accessories shall be readily accessible and plainly indicated so as to be visible at a distance.

5.5.3.1.5 Both sides of fire hose connection shall be instantaneous coupling.

5.5.3.2 Location and construction of cabinet

5.5.3.2.1 Hose house shall be located over the hydrant or immediately nearby.

5.5.3.2.2 Hose house shall be designed to withstand the exposure conditions. The hose house shall be constructed with proper ventilation, and coated with weatherproof painted.

5.5.3.3 Size and Arrangement

5.5.3.3.1 The hose house shall be of a size and arrangement to provide shelves or rack for the hose and equipment.

5.5.3.3.2 The hose house shall be equipped with fire fighting equipment as the following:

(1) 65 mm. (2inchs) diameter fire Hose Reel with instantaneous coupling

(2) Fire fighting axe

(3) 2 adjustable spray-solid stream nozzle for each size of hose provided.

5.5.3.3.3 The use of hydrant and hose for purpose other than fire related services shall be prohibited.

5.5.4 Fire Department Connections

5.5.4.1 Fire department connection used for supply water from private fire service main to automatic sprinkler system, standpipe or part of system for fire fighting purpose. This connection shall be used as an auxiliary water supplies source only.

5.5.4.2 Shall be permitted to have more than one fire department connection

5.5.4.3 Shall not be permitted to have shut-off valve in fire department connection system

5.5.4.4 Fire department connection shall have a check valve installed near each fire department connection as much as possible.

5.5.4.5 Fire department connection shall be a male instantaneous inlet with caps and chains.

5.5.4.5 Fire Department Connection shall be installed close to the road, easy to access free of obstruction from any fences or others.

5.5.4.6 Fire department connection shall have a pressed steel plate with a font of 50mm. (2 inches) height or more.

5.5.5 Control Valve

5.5.5.1 Type of control valve

5.5.5.1.1 Control valve shall be the indicating type valve, which has a build-in open-close position indicator.

5.5.5.1.2 Inside screw-type gate valve allow using in hydrant only.

5.5.5.2 Control valve for water supply system

5.5.5.2.1 At least one control valve shall be installed in each source of water supply except fire department connections.

5.5.5.2.2 Where more than one source of water supply a check valve shall be installed in each connection.

5.5.5.2.3 In the discharge pipe from pressure tank or gravity tank of less than 56 m3 (15,000 gallon) capacity no control valve need be installed on tank side of check valve.

5.5.5.2.4 Where gravity tank located on a tower in the yard (outside the building)the control valve on the tank side of check valve shall be outside screw and yoke or indicating valve; the other shall be either an outside screw and yoke or indicating valve.

5.5.5.2.5 Where the gravity tank is located on the building, both control valves shall be outside yoke or indicating valve.

5.5.5.2.6 When a pump is located in a combustible pump house or exposed to danger from fire or falling wall, either check valve in the connection shall be located in the pit or control valve shall be of the post indicator valve type located a safe distance outside buildings.

5.5.5.2.7 Control valve for automatic sprinkler system shall be located where readily accessible and free of obstruction.

5.5.5.3 Post Indicator valve

5.5.5.3.1 Every connection from private fire service main to the building shall be provided with post indicating valve.

5.5.5.3.2 Post indicating valves shall be located not less than 12 m (50 feet), When post indicator valves cannot be placed at the distance, they shall be permitted to be located closer.

5.5.5.3.3 Indicator position of post indicator valve shall be above the ground with 0.90 m. (3 feet) height, and have protection mechanical damage.

5.5.5.4 Valve in pits

5.5.5.4.1 Where it impractical to provide a post indicator valve, valves shall be permitted to be placed in pit.

5.5.5.4.2 Valve pit shall be adequate size and readily accessible for in inspection, operation, testing, maintenance. They shall be constructed and arranged to properly protect the accumulation of water.

5.5.5.4.3 The location of valve pit shall have clearly marked so as to be visible at a distance.

5.5.5.5 Sectional Valves

5.5.5.5.1 Large private fire service main systems shall have sectional controlling valves at appropriate point in order to permit sectionalizing system in the event of break, or for the making of repairs or extensions.

5.5.5.5.2 In the case of pipe are lied under building, valve shall be provided in both sides or in the case pipe are lied in cross, valve shall be provided 4 side.

5.5.5.6 Identifying

Identification Sign shall be provides at each valve to indicate its function and what it controls.

5.5.6 Fire protection piping system

The installation of private fire service mains and their appurtenances standard also include underground pipes, above ground pipes, hydrant, position and installation, fire hose cabinet and its installation that will be described as the following:

5.5.6.1 Type of pipes

The type and class of buried pipe for a particular installation shall be determined through consideration of soil condition corrosion according standard.

5.5.6.1.1 Pipes and fitting shall be tested and recommend to use as fire protection pipes as the following:

(1) Cast Iron pipe and ductile iron that coat with or without cement coating.

(2) Rock wool cement pipe

(3) Steel pipe

(4) Copper pipe

(5) Fiber glass- Epoxy pipe

(6) Polyethylene plastic

(7) Polypropylene plastic

5.5.6.1.2 Pipe and fitting shall be conformed to one of the following standard:

(1) AWWA or

(2) ASTM

5.5.6.2 Pipe size

5.5.6.2.1 The diameter of all private service mains shall not less than 150 mm. (6 inches).

5.5.6.2.2 In case of pipe connected as a close loop system with high pressure, the pipe diameter shall be as indicate in 5.6.2.3.

5.5.6.2.3 The diameter of private service main shall be 200 mm. (8 inches) or larger, when they are applied in the following conditions.

(1) Pipe installed as a dead end main (one direction flow) that supply to only one, hydrant or pipe length longer than 150 m. (500 feet)

(2) Pipe installed as two directional flow and supply to 2 of hydrants or pipe length longer than 550 m. (1,500 feet)

(3) Pipe installed as 5.6.2.3 (2) and supply to 3 of hydrants and pipe length longer than 300 m (1,000 feet) or supply water for 4 of hydrant at one time.

5.5.6.2.4 Pipe, that connect to standpipe system not smaller than 50 mm-diameter

5.5.6.3 Pipe coating

Steel pipe shall be protected from corrosion by coating when the installation completes.

5.5.7 Pipe installation Standard

5.5.7.1 Depth of buried underground pipe

5.5.7.1.1 Underground pipe shall be buried at least 0.8 m. (260 feet) from ground level to top of pipe.

5.5.7.1.2 Underground pipe that buried under driveway shall be buried at least 0.90 m (3 feet) and at least 1.20 m (5 feet) for buried under railroad tracks.

5.5.7.1.3 Depth of underground pipe in 5.7.1.1 and 5.7.1.2, shall be measured from top of pipe to finished grade and due consideration shall always be given to future or final grade and nature of soil.

5.5.7.2 Mechanical damage protection

5.5.7.2.1 Pipe shall not be run under building

Exception When absolutely necessary to run pipe under building, special precautions shall be taken which include arching the foundation walls over the pipe, running pipe in covered trenches, and providing valve to isolate section of pipe under building.

5.5.7.2.2 In no case shall the pipe be used for grounding of electrical service

5.5.7.3 Above ground pipe installation

Consideration for installed a pipe above ground is soil condition that effect to corrosion and lifetime of pipes. Pipe routing shall be safe from physical damage and may be installed with isolation strong support or sleeper.

5.5.8 Testing

Testing stand for piping shall be tested with the water pressure during installation and post installation. Including the cleaning after pump installation finished.

5.5.8.1 Cleaning and Flushing

5.5.8.1.1 Piping system shall be flushed with specification water flow rate.

5.5.8.1.2 Piping system that connects from private fire mains to standpipe or automatic sprinkler system shall be flushed before connection is made.

5.5.8.1.3 Piping system shall be thoroughly flushed with water until it run clear.

5.5.8.1.4 Minimum flow rate required for flushing shall be no less than identified in table, water velocity shall be no less than 3 m/s (10 feet per second).

5.5.8.2 Pipe testing

5.5.8.2.1 A ll new private fire service main shall be tested hydrostatically at not less than 1378 kPa (200 psi) pressure for two hours, or at 335 kPa (50 psi) in excess of maximum static pressure when the maximum static pressure is in excess of 1,033 kPa (150 psi)

5.5.8.2.2 Water leakage allowance conforming to standard 5.3.9.2.3

5.5.8.3 Commissioning and test Run

5.5.8.3.1 Each hydrant shall be fully open and closer under system water pressure test after installation. Where fire pump are available, this shall be done with the fire pump running.

5.5.8.3.2 All control valves shall be fully closed and opened under system water pressure.

Table 5.5.1 Water Flow Rate Required for Pipe Flushing

Pipe Size millimeters (inches)	Water Flow Rate at Top of Pipe Millimeters
100(4)	1,576(390)
150(6)	3,331 (880)
200(8)	5,905(1,560)
250(10)	9,235(2,550)
300(12)	13,323(3,250)

SECTION 6
FIRE PROTECTION EQUIPMENT

5.6 FIRE PROTECTION EQUIPMENT

5.6.1 General

5.6.1.1 Objective

This standard deal with the procedure for selecting and assigning the fire protection equipment for a building or structure, or a portion of a building or structure. This section also describes the correct installation and employment method that served the propose of the equipment.

5.6.1.2 Scope

This standard deal with the personal fire protection equipment that are used for training person such as fire hose, fire hose connection, fire department connection and accessories.

5.6.2 Fire protection equipment

5.6.2.1 Fire hose reels

Fire hose reels shall be delivered as complete set readied for installation. The reels shall be constructed and assembled according to EN 671-1 or authorize national standard. The reels shall be constructed of a steel wheel painted with red polyester powder-coated for rolling the red rubber hose. The hose connected to the hydrant pipe shall be constructed of the synthetic rubber that reinforced with woven fiber and coated with thermal plastic polymer.

The specifications and compositions of fire hose reels shall be described as following:

5.6.2.1.1 Control valve shall be opened and closed manually.

5.6.2.1.2 The complete set of rubber hose, hydrant pipe, and control valve shall be withstood the testing pressure of 2,068 kPa (300 psi).

5.6.2.1.3 Rubber hose shall be withstood the working pressure of 1,517 kPa (200 psi) and the bursting pressure of 4,826 kPa (700 psi).

5.6.2.1.4 Plastic nozzle shall be adjustable (jet/spray/shut-off nozzle).

5.6.2.2 Fire hose racks

5.6.2.2.1 Fire hose shall be constructed of white polyester synthetic rubber, and connected to the PVC/Nitrile rubber lined.

5.6.2.2.2 The specifications of fire hose shall be described as following:

(1) Highly thermal resistant

(2) Oil and chemical resistant

(3) No maintenance – no need for drying after usage that means the hose shall be no effected by any kinds of fungi, no decomposed and water proof.

(4) Scratch resistant

(5) Weather proof

5.6.2.2.3 Fire hose for main fire riser piping shall be a nominal diameter of 40 mm. (1 ½ inch), and 65 mm. (2 ½ inch), and the length of 15 m. (50 ft.), 23 m. (75 ft.), 30 m. (100 ft.), and 45 m. (150 ft.). Normally length of the hose shall be 30 m. (100 ft.). The fire hose shall be withstood the bursting pressure of 3,447 kPa (500 psi).

5.6.2.2.4 Fire hose shall has 2 kinds of utilization as following:

(1) Hang with the rack. This kind of utilization shall be constructed of the hose installed in fire hose cabinet permanently, a control valve installed at the inlet, the hose folded in the rack, and another side of the hose constructed of a adjustable nozzle. When unfold the hose, the length of rubber hose slipped off and fallen down shall be equal to the pull down length. Normally, shall select a nominal diameter of 40 mm. (1 ½ inch) fire hose for non-training fire extinguisher.

(2) Fold the hose. This type shall be constructed of male instantaneous coupling at one side of the hose, and female instantaneous coupling at another side.

5.6.2.3 Fire hose nozzles

Fire hose nozzle shall be instantaneous coupling type. The nozzle shall be an adjustable and constructed of light-weight metal such as cast aluminum, brass, or gun metal.

5.6.2.4 Fire hose connection

Fire hose connection shall be a female instantaneous coupling type. Instantaneous coupling with a standard diameter of 65 mm. (2 ½ inch) can be connected to all hydrants, standpipes system, and fire department connection. All fittings shall be permanently installed to hose valve. Furthermore, all 65 mm. (2 ½ inch) diameters of hose connections shall be equipped with cap and chains.

5.6.2.5 Pressure regulating devices

Pressure regulating devices for fire hose shall be designed to withstand the working pressure as the following:

5.6.2.5.1 When operating water pressure exceed 690 kPa (100 psi), pressure regulating valve shall be used for resident or non-training fire extinguisher in order to reduce the water pressure lower than 690 kPa (100 psi).

5.6.2.5.2 When static pressure of hose connection exceeds 1,206 kPa (175 psi), pressure regulating valve shall be used in order to reduce both of static pressure and water pressure lower than 690 kPa (100 psi) for resident or non-training fire extinguisher (small fire hose), and 1,206 kPa (175 psi) for 65 mm. fire hose connection (large fire hose).

5.6.2.6 Fire department connection

Fire department connection shall have at least 2 way outlet connections with build-in check valve. The outlet connection shall be a male instantaneous connection, including caps and chains which made of aluminum, or cast brass, or gun metal. The nominal diameter of fire department connection shall be 65 mm. (2 ½ inch) equipped with a check valve in the pipe line.

SECTION 7
FIRE PUMPS AND INSTALLATION

5.7 FIRE PUMPS AND INSTALLATION

5.7.1 Objective and Scope

5.7.1.1 Objective.

This standard for the installation of fire pumps deals with the type of fire pumps, standard and operation. It includes the selection and installation of fire pumps supplying water for building or private residence.

5.7.1.2 Scope.

The scope of this standard is to provide a reasonable degree of protection for life and property from fire through installation requirements for fire pumps based upon sound engineering principles and field experience. It includes single stage and multistage centrifugal fire pumps of horizontal or vertical shaft design, installation and maintenance of these pumps and associated equipment.

5.7.2 Rated Pump Capacities.

Fire pumps shall have the following rated capacities in liters per minute (Gallons per minute) and are rated at net pressures of 276 Kilopascals (40 Pounds-force per square inch absolute) or more. Pump for rating over 18,925 LPM (5,000 GPM) are subject to individual review.

5.7.3 Pipe sizes and piping accessories of fire pumps.

Pipe sizes and piping accessories of fire pumps shall not be less than that given in table 5.7.2

5.7.4 The horizontal centrifugal pumps

5.7.4.1 Type and operation

Horizontal centrifugal pumps shall be of SPLIT-CASE or END SUCTION or IN-LINE that they shall have specification of the following :

5.7.4.1.1 Single stage close-coupled vertical in-line pumps shall furnish capacity under 2,839 Liters per minute (750 Gallons per Minute).

5.7.4.1.2 Single stage end suction pumps shall furnish capacity under 1,892 Liters per minute (750 Gallons per Minute).

5.7.4.1.3 Horizontal centrifugal pumps shall not be used where water level or source of tank below pumps casing.

5.7.4.2 Characteristics

Pumps shall furnish not less than 150 percent of rated capacity at not less than 65 percent of total rated head. The shutoff head shall not exceed 140 percent of rated head.

Pumps shall be the best quality, precision-manufactured from the best material and shall be designed in accordance with engineering standard. Each pump shall be hydrostatically tested by the manufacturer for a period of time not less than 1.5 times the head capabilities of the maximum diameter impeller for the casing at shutoff, plus the manufacturer's maximum allowable suction head but in no case less than 1,723 Kilopascals (250 Pounds-force per square inch absolute)

5.7.4.3 Fittings.

The following fittings shall be required for attachment to the pump.

5.7.4.3.1 Automatic air release, Float type and not less than 12.7 mm. (1/2 inches). (Split-case pumps only)

5.7.4.3.2 Circulation relief valve shall provide to prevent the pump from overheating when operating with no discharge.

5.7.4.3.3 A pressure gauge having a dial not less than 90 mm. (3 ½ inches) in diameter shall be connected near the discharge casting with a 6.25 mm.(1/4 inches) gauge valve. The dial shall indicate pressure to at least 2 times the rated working pressure of the pump but not less than 1,379 Kilopascals. (200 Pounds-force per square inch absolute)

5.7.4.3.4 A compound pressure and vacuum gauge having a dial not less than 90 mm. (3 ½ inches) in diameter shall be connected to the suction pipe near the pump with a 6.25 mm. (1/4 inches) gauge valve.

5.7.4.3.5 Eccentric tapered reducer at suction inlet.

5.7.4.3.6 Relief valve shall be set to prevent pressure on the fire protection system greater than it

can with-stand for fire pumps that have variable speed driver such as diesel engine.

5.7.4.3.7 Hose valve manifold with hose valves shall be installed outside of pump room and shall be used test pump.

5.7.4.3.8 Flow measuring device.

5.7.4.4 Foundation and Installation.

5.7.4.4.1 The pump and driver shall be mounted on a common base plate and connected by a flexible coupling.

5.7.4.4.2 The base plate, with pump and driver mounted on it, shall be set level on the foundation.

5.7.5 Vertical shaft centrifugal pumps.

5.7.5.1 Type and Operation

The vertical shaft centrifugal pump shall be used in case source below pump. The source may be water tank, pond, river or other. Pump shall have impellers and casing which a column pipe shall be in water and driver shall be on the foundation above water, Impellers casing also serves as a support for the shaft and bearings.

5.7.5.2 Characteristics

Pump shall be furnish not less than 150 percent of rated capacity at a total head of not less than 65 percent of the total rated head. The total shutoff head shall not exceed 140 percent of total rated head.

This pumps shall be installed when the pumping water level not exceeds 61 meters from the surface of the ground when pumping at 150 percent of rated capacity. The water supply shall be clean enough to be not cause of pump damage . The minimum level water means the level water above the second impeller from the bottom of the pump. Pumps shall be the best quality, precision-manufactured from the best material and shall be designed in accordance with engineering standard. The pumps shall be tested by hydrostatic test at 1.5 times of working pressure.

5.7.5.3 Fitting

The following fitting shall be required for attachment to the pump.

5.7.5.3.1 A 40 mm.(1 ½ inches) pipe size or lager automatic air release valve shall be provided to vent air from the column and the discharge head upon the starting of the pump. This valve will also admit air to the column to dissipate the vacuum there upon stopping of the pump.

5.7.5.3.2 Water level detector.

5.7.5.3.3 A pressure gauge having a dial not less than 90 mm. (3 ½ inches) in diameter shall be connected near the discharge casting with a 6.25 mm.(1/4 inches) gauge valve. The dial shall indicate pressure to at least 2 times the rated working pressure of the pump but not less than 1,379 Kilopascals. (200 Pounds-force per square inch absolute)

5.7.5.3.4 Relief valve shall be set to prevent pressure on the fire protection system greater than it can with-stand.

5.7.5.3.5 Hose valve head with hose valves shall be installed outside of pump room and shall be used test pump.

5.7.5.3.6 Flow measuring device.

5.7.5.4 Foundation and installation

Casing material should be of cast-iron, impellers should be of cast-bronze or cast-iron and shaft should be of stainless steel, shaft brushing should be of cast-bronze.

5.7.5.4.1 The foundation for vertical pumps shall be provided to firmly with anchor bolt on the concrete foundation.

5.7.5.4.2 The top of the foundation shall be carefully leveled to permit the pump for alignment of the shaft.

5.7.5.5 Driver.

5.7.5.5.1 Motor of electric pump shall be of direct drive with vertical shaft.

5.7.5.5.2 Diesel engine pumps shall be driven by gear drives and

5.7.6 The fire pump control system.

The fire pump control system has 2 system :

- Manual Control
- Automatic Control

The fire pump control system shall have manual control and automatic control in the same controller.

In case of building and huge enterprise always use the automatic control, maintain the pressure in water pipe line and ready to use all the time. Automatic control shall be combine of switching to automatic control the fire pump and guaranteed by reliable laboratory.

5.7.6.1 Electric drive controllers

Controllers shall have the following accessories :

5.7.6.1.1 Voltage Surge Arrester

5.7.6.1.2 Isolating Switch

5.7.6.1.3 Circuit Breaker

5.7.6.1.4 Locked Rotor Overcurrent Protection

5.7.6.1.5 Motor Starter

5.7.6.1.6 Alarm and Signal Devices on Controller

(1) Power Available Lamp

(2) Phase Lamp

5.7.6.1.7 Alarm and Signal Devices Remote From Controller

(1) Motor Running

(2) Loss of Line Power

(3) Phase Reversal

5.7.6.2 Diesel engine drive controllers

Controllers shall have the following accessories :

5.7.6.2.1 Alarm and signal Devices on controller

(1) Low Oil Pressure

(2) High Engine Jacket Coolant Temperature

(3) Start engine problem

(4) Failure of Engine to Start Automatically

(5) Shutdown from Overspeed

(6) Battery Failure

5.7.6.2.2 Alarm and signal device remote from controller

(1) Engine Running

(2) Position of Controller Main Switch

(3) Trouble on the Controller or Engine

5.7.7 Driver for fire pump

Driver for fire pump has 2 types by the following :

- Electric Motor Drive

- Diesel Engine Drive

5.7.7.1 Electric motor drive

The fire pump with electrical motor driven shall be supply from the separated generator apart from the others, if possible shall be directed from the source supply. Size and dimension of electrical accessories shall be along with technical standard. And the isolating switch shall have the appropriate Interrupting Capacity with the motor drive. Starter shall has starting torque and non overloading type. Power supply and wiring route for motor pump shall be in safety fire area.

5.7.7.2 Diesel engine drive

Selection of diesel engine driven fire pump equipment for each situation shall be based on careful consideration of the following factors: most reliable type of control, fuel supply, installation and the starting and running operation of the diesel engine.

Engine cooling system may be one type of the followings :

5.7.7.2.1 Closed-circuit type, with heat exchanger water cooled

5.7.7.2.2 Closed-circuit type, radiator water cooled

Instrumentation and control engine shall have the following accessories :

(1) Governor

(2) Overspeed Shutdown Device

(3) Tachometer

(4) Oil Pressure Gauge

(5) Temperature Gauge

(6) Instrument Panel

(7) Automatic Controller Wiring

(8) Main Battery Contactors

Diesel fuel supply tanks shall be located above ground and shall have a capacity to run engine minimum 8 hours.

5.7.8 Jockey Pump

Jockey pump is a small water pump which is installed to compensate leaking and shall be working automatically by pressure switch like the fire pump.

5.7.9 Fire Pump Room

5.7.9.1 Fire pump room shall be located on ground floor or the area which protect the accumulation of water and air flow condition and easy for fire fighter to access.

5.7.9.2 Fire pump room, inside the building, shall durable 2 hours in case of fire. And durable 1 hour for the room, that is protected by sprinkler.

5.7.9.3 fire pump room shall install emergency lighting with 2 hours power supply. Battery supply from fire pump engine is prohibit.

5.7.10 Fire Pump Installation

5.7.11 Fire Pump Control System

Fire pumps maintain pressure by pressure switch

5.7.11.1 Jockey Pump

(1) Stop operating at the pressure of zero flow rate of fire pump.

(2) Start operating is setup at the lower stop pressure 10 ponds per square inch

5.7.11.2 Fire Pump

(1) Start operating pressure of the first fire pump is setup at lower start operating pressure of jockey pump 5 ponds per square inch

(2) For the next fire pump, if have fire pumps more than one, starting operating every 10 ponds per square inch reducing.

(3) Stop fire pumps operating with manual stop

5.7.12 Fire Pump Testing

After we finished installation, we shall test run the fire pump and compound accessories and make a report which is certified by the area government officer or mechanical engineer and the report shall have contents as follow :

1. Starting Current
2. Working Current
3. Discharge Pressure
4. Suction Pressure
5. Flow rate
6. RPM Engine
7. Result of Engine Start System
8. Result of Engine Protection System such as alarm when overheat, over RPM of engine and under low oil limit
9. Water pressure at automatic relief valve working

Remark

a. Contents in 1 and 2 are for electrical motor drive pump.

b. Contents in 6, 7 and 8 are for diesel drive pump.

5.7.13 Fire Pump Maintenance

Person who maintain the system shall be keen on fire pump system, get responsibility to run test, check and repair the fire pump and all accessories if required which make the fire pump ready to work all available.

- The diesel engine drive fire pump should has run test once a week
- The electric motor drive fire pump should has run test once in a month

Table 5.7.1 Rated Pump Capacities.

liters per minute (Gallons per minute)	liters per minute (Gallons per minute)	liters per minute (Gallons per minute)
1. 95(25)	8. 1514(400)	15. 7570(2000)
2. 189(50)	9. 1703(450)	16. 9462(2500)
3. 379(100)	10. 1892(500)	17. 11355(3000)
4. 568(150)	11. 2839(750)	18. 13247(3500)
5. 757(200)	12. 3785(1000)	19. 15140(4000)
6. 946(250)	13. 4731(1250)	20. 17032(4500)
7. 1136(300)	14. 5677(1500)	21. 18925(5000)

Table 5.7.2 Pipe Sizes And Piping Accessories Of Fire Pumps

Pump Rating L/min (gpm)	Suction mm.(in.)	Discharge mm.(in.)	Relief Valve mm.(in.)	Relief Valve Discharge mm.(in.)	Meter Device mm.(in.)	No. and Size of Hose Valves mm.(in.)	Hose Header Supply mm.(in.)
95(25)	25(1)	25(1)	20(3/4)	25(1)	32(11/4)	1-40(11/2)	25(1)
189(50)	40(11/2)	32(11/4)	32(11/4)	40(11/2)	50(2)	1-40(11/2)	40(11/2)
379(100)	50(2)	50(2)	40(11/2)	50(2)	65(21/2)	1-65(21/2)	65(21/2)
568(150)	65(21/2)	65(21/2)	50(2)	65(21/2)	75(3)	1-65(21/2)	65(21/2)
757(200)	75(3)	75(3)	50(2)	65(21/2)	75(3)	1-65(21/2)	65(21/2)
946(250)	90(31/2)	75(3)	20(2)	65(21/2)	90(31/2)	1-65(21/2)	75(3)
1136(300)	100(4)	100(4)	65(21/2)	90(31/2)	90(31/2)	1-65(21/2)	75(3)
1514(400)	100(4)	100(4)	75(3)	125(5)	100(4)	2-65(21/2)	100(4)
1703(450)	125(5)	125(5)	75(3)	125(5)	100(4)	2-65(21/2)	100(4)
1892(500)	125(5)	125(5)	75(3)	125(5)	125(5)	2-65(21/2)	100(4)
2839(750)	150(6)	150(6)	100(4)	150(6)	125(5)	3-65(21/2)	150(6)
3785(1000)	200(8)	150(6)	100(4)	200(8)	150(6)	4-65(21/2)	150(6)
4731(1250)	200(8)	200(8)	150(6)	200(8)	150(6)	6-65(21/2)	200(8)
5677(1500)	200(8)	200(8)	150(6)	200(8)	200(8)	6-65(21/2)	200(8)
7570(2000)	250(10)	250(10)	150(6)	250(10)	200(8)	6-65(21/2)	200(8)
9462(2500)	250(10)	250(10)	150(6)	250(10)	200(8)	8-65(21/2)	250(10)
11355(3000)	300(12)	300(12)	200(8)	300(12)	200(8)	12-65(21/2)	250(10)
13247(3500)	300(12)	300(12)	200(8)	300(12)	250(10)	12-65(21/2)	300(12)
15140(4000)	350(14)	300(12)	200(8)	350(14)	250(10)	16-65(21/2)	300(12)
17032(4500)	400(16)	350(14)	200(8)	350(14)	250(10)	16-65(21/2)	300(12)
18925(5000)	400(16)	350(14)	200(8)	350(14)	250(10)	20-65(21/2)	300(12)

* Flanged connection sizes of pumps may by less than pipe sizes

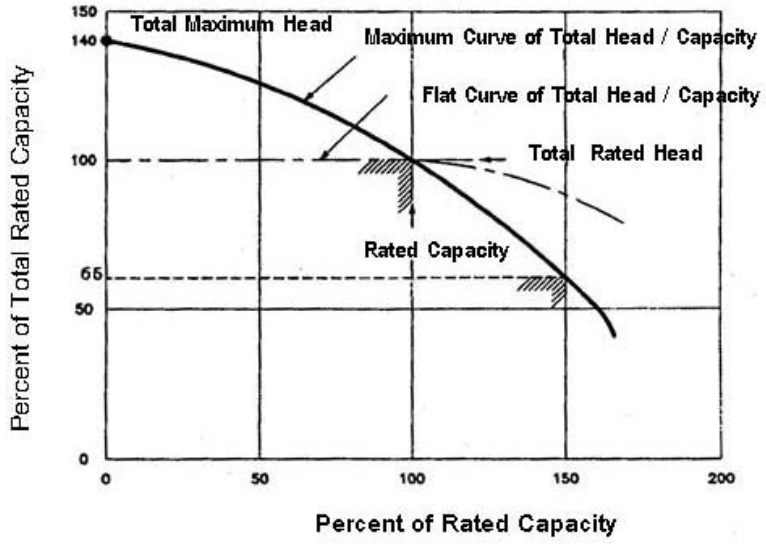


Figure 5.7.1 Pump Characteristic Curves

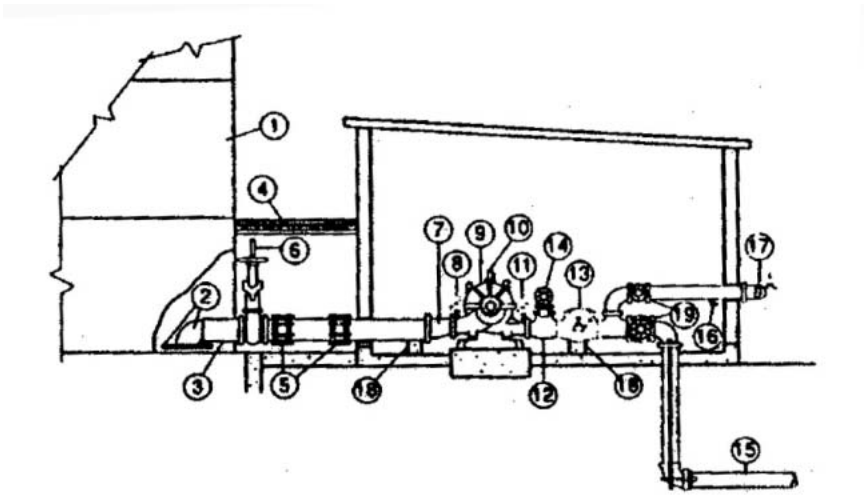


Figure 5.7.2 Horizontal Centrifugal Pumps Installation

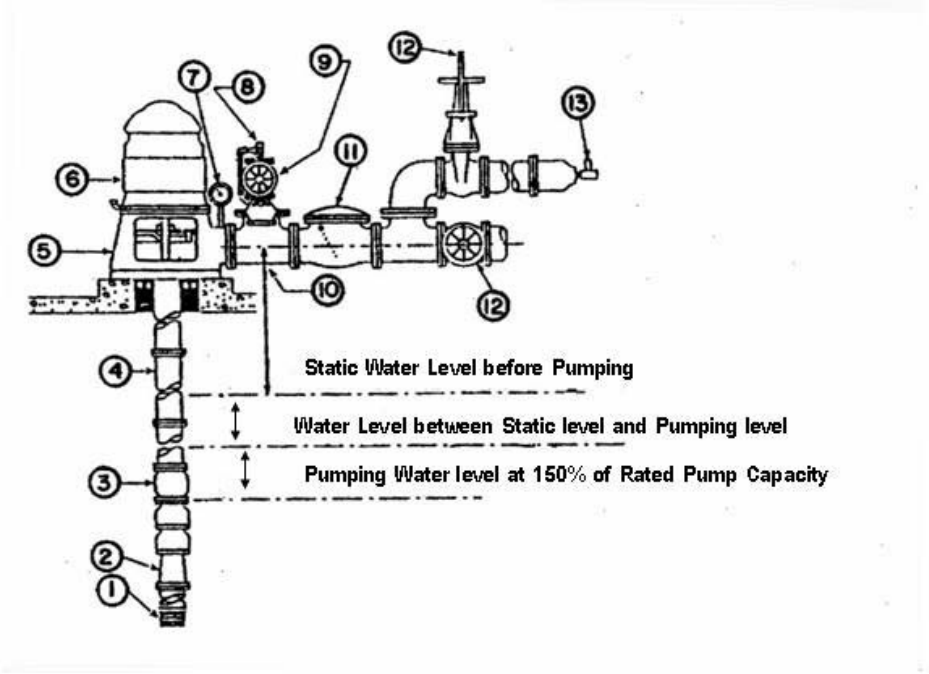


Figure 5.7.3 Vertical Centrifugal Pumps Installation

1 Basket Suction Strainer
2 Suction Nozzle
3 Pump Bowl Assembly
4 Column Pipe
5 Discharge Head
6 Hollow Shaft Electric Motor
7 Discharge Gauge
8 Air Release Valve
9 Relief Valve
10 Discharge Tee
11 Discharge Check Valve
12 Hose Connection indicating Valve
13 Hose Valve Preferable Located Outside

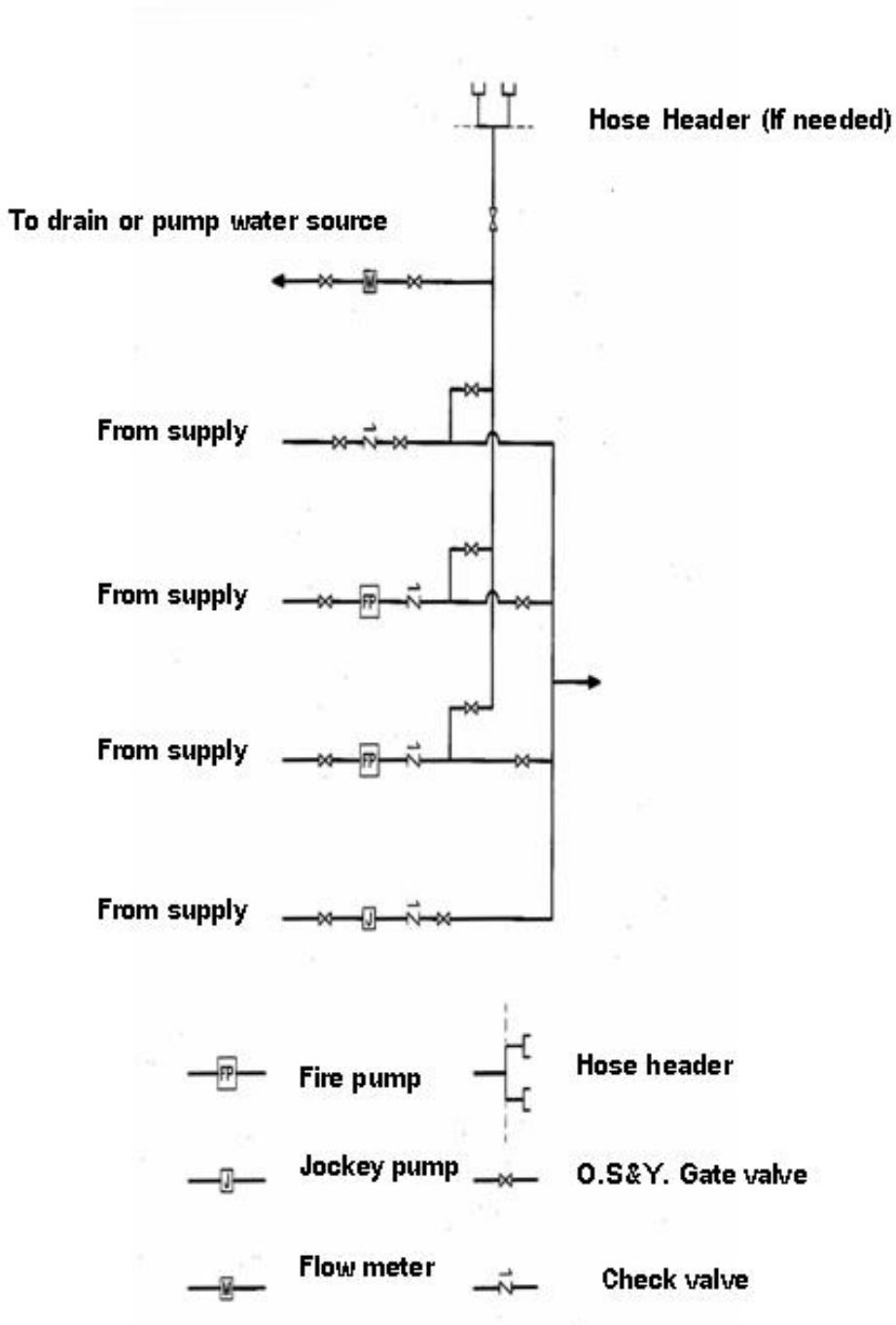


Figure 5.7.4 Fire Pumps Floor Plan

SECTION 8
PORTABLE FIRE EXTINGUISHERS AND INSTALLATION

5.8 PORTABLE FIRE EXTINGUISHERS AND INSTALLATION

5.8.1 General

5.8.1.1 Objective

The provisions of this standard apply to selection and testing of portable extinguishing equipment. Portable extinguishers are intended as a first line of defense to cope with fires of limited size. They are needed even though the property is equipped with automatic sprinkles, standpipe and hose.

5.8.1.2 Scope

This standard is prepared for the use and guidance of persons charged with selecting, installing and maintaining portable fire extinguishing equipment.

5.8.2 Fire ratings and classification.

5.8.2.1 Fire ratings

Fire ratings are 4 classes, the following :

5.8.2.1.1 Class A

Class A fires are fires in ordinary combustible materials, such as wood, cloth, paper, rubber, and many plastics.

5.8.2.1.2 Class B

Class B fires are fires in flammable liquids, oils, greases, oil base paints, tars and flammable gases.

5.8.2.1.3 Class C

Class C fires are fires in electrical equipment, short-circuit

5.8.2.1.4 Class D

Class D fires are fires in combustible metals, such as magnesium, zirconium, sodium, lithium, and potassium.

5.8.2.2 Classification

Portable fire extinguishers are classified for use on certain classes of fires and rated for relative extinguishing effectiveness at a temperature of plus 210C by testing laboratories. This is based upon the preceding classification of fires and the fire-extinguishment potentials as determined by fire tests.

5.8.3 Instruction of portable fire extinguishers installation

5.8.3.1 General

5.8.3.1.1 Numbers of fire extinguishers for classes of fire shall have enough for the number which mentioned in 5.8.3.2, 5.8.3.3 or 5.8.3.5

5.8.3.1.2 The selection of fire extinguisher shall be determined by character of the fire anticipated such as : class A for combustible materials, and class B for flammable liquids or class C in electrical room.

5.8.3.1.3 Fire extinguisher installation area, shall be illustrated and easy to bring to use. Fire pump shall not be installed over 1.5 meters form floor to head of fire pump.

5.8.3.1.4 Weight of overall portable fire extinguishers should be 4.5 kilogram and shall not exceed 18.14 kilogram (except for wheel type)

5.8.3.1.5 Rating of portable fire extinguishers are under standard testing of USA's Under Writer's Laboratories Inc. and shall be tested by reliable institute or lasted industrial standard for portable fire extinguishers (dry comical)

5.8.3.1.6 Each portable fire extinguisher's body shall be made of steel or cast iron which high pressure durable with high quality accessories and specific design for portable fire extinguishers.

Test of extinguisher's body and accessories by Hydrostatic Testing at manufactory and periodical testing to ensure that it's safety to use.

5.8.3.2 Size of fire extinguishers Class A and installation

Size of portable fire extinguishers shall not smaller than ability and the way to approached that mentioned.

Shall have at least one portable fire extinguisher in each floor in case of the area is less than mentioned.

5.8.3.3 Size of fire extinguishers Class B and installation

Size of portable fire extinguishers shall not smaller than ability and the way to approached that mentioned.

Use of two lower or higher ability that mentioned in the table to substitution.

Three foam fire extinguisher size 9.46 liters (2.50 gallons) for building or area coverage dangerous protection.

Three AFFF fire extinguishers size 9.46 liters (2.50 gallons) for building or area coverage most dangerous protection.

In case of fire extinguishers that's higher ability which is mentioned in the table below, distance approach shall reduce to 15 meters (50 foots)

5.8.3.4 Size of fire extinguishers Class C and installation

Portable fire extinguishers Class C suitable for fires in electrical equipment with non conducting chemical and this will include fire either directly involving or surrounding electrical equipment.

5.8.3.5 Size of fire extinguishers Class D and installation

Chemical for Portable fire extinguishers Class D suitable for fires combustible metals

Fire extinguisher for such fire should be located no more than 23 meters (75 foots) from hazard and size determination shall be on the basis of the specific combustible metal, its physical particle size, area to be covered and recommendations by extinguisher of fire manufacture on data from control tests conducted.

Table 5.8.1 Kind of Extinguishing Materials for type of Fire

Extinguishing Materials	Type of fire			
	Class A	Class B	Class C	Class D
Water	X			
Soda-Acid	X			
Foam	X	X		
Aqueous Film Forming Foam (AFFF)	X	X		
Dry Chemical type ABC	X	X	X	
Dry Chemical (Potassium Bicarbonate)		X	X	
Carbon Dioxide		X	X	
Fire Extinguishers (Special type 1)				X

Table 5.8.2 Fire extinguishers and accessories pressure testing

Type of fire extinguishers	Pressure testing Kilopascal (Ponds per square inch)
- Water, Soda-Acid and others which has normal pressure not exceed 1344 Kilopascal (195 Pounds per square inch)	2,413 (350)
- Carbon Dioxide	20,679 (3,000)
- Dry Chemical Extinguisher Hose	2,068 (300)
- Carbon Dioxide Extinguisher Hose	8,616 (1,250)

Table 5.8.3 Area coverage of each fire extinguisher

UL rating of portable fire extinguisher (Class A)	Area Coverage Light hazard Square meter (sqf.)	Area Coverage Ordinary hazard Square meter (sqf.)	Area Coverage Extra hazard Square meter (sqf.)
1A	-	-	-
2A	557 (6,000)	280 (3,000)	-
3A	836 (9,000)	418 (4,500)	-
4A	1,045 (11,250)	557 (6,000)	372 (4,000)
6A	1,045 (11,250)	836 (9,000)	557 (6,000)
10A	1,045 (11,250)	1,045 (11,250)	930 (10,000)
20A	1,045 (11,250)	1,045 (11,250)	1,045 (11,250)
30A	1,045 (11,250)	1,045 (11,250)	1,045 (11,250)
40A	1,045 (11,250)	1,045 (11,250)	1,045 (11,250)

Remark Maximum of Distance to approach not exceed 23 meters

Table 5.8.4 Size of fire extinguishers Class B and installation

Area coverage	**Ability as of Fire extinguishers**	**Maximum of Distance approach meter (foot)**
Area coverage dangerous	50B	9.00 (30)
	10B	15.00(50)
Area coverage more dangerous	10B	9.00 (30)
	20B	15.00 (50)
Area coverage most dangerous	40B	9.00 (30)
	80B	15.00 (50)

SECTION 9
INSPECTION AND TEST OF FIRE PROTECTION EQUIPMENT

5.9 INSPECTION AND TEST OF FIRE PROTECTION EQUIPMENT

5.9.1 General

5.9.1.1 Objective

This standard deal with the procedure for testing the fire protection equipment for a building or structure, or a portion of a building or structure. The testing ensure that all fire protection equipment are in readiness condition and can be used instantaneously in an emergency.

5.9.1.2 Scope

This standard deals with the appropriated preparation to limit the risk of life and property losses from fire by inspecting and maintaining theoretically of all fire protection equipment in a building or structure.

5.9.2 Testing of fire protection equipments of a building or structure, or a portion of a building or structure

5.9.2.1 Portable fire extinguisher

5.9.2.1.1 Monthly inspection

(1) Type of portable fire extinguisher

(2) Obstruction and installation of portable fire extinguisher

(3) Pressure of portable fire extinguisher tank

(4) Condition and Damage of portable fire extinguisher

5.9.2.1.2 Testing

Portable fire extinguisher shall be tested by hydrostatic test no less than once in 5 years to determine the prompt of extinguisher.

5.9.2.2 Fire pump

5.9.2.2.1 Diesel engine fire pump

(1) Diesel engine shall be started not less than once a week and run for no less than 30 minutes to attain normal running temperature. The engine shall run smoothly at rated speed. Inspect the performance of fire pump and control unit.

(2) Batteries

(3) Lubrication system

(4) Lubrication oil and fuel oil system

(5) Engine oil shall be changed frequently according to the recommendation of manufacturer, but the change shall be no less than once a year.

(6) Solid electrolyte of batteries shall be flooded with acid and distilled water.

(7) For an automatic operation fire pump, the controlled circuit shall control the pump operation through solenoid valves.

5.9.2.2.2 Electrical engine fire pump

(1) Electrical engine shall be started no less than once a week.

5.9.2.3 Fire department connection

5.9.2.3.1 Location of fire department connection shall be readily accessible and plainly indicated so as to be visible at a distance.

5.9.2.3.2 Fire department connection shall be inspected not less than once a week.

5.9.2.3.3 Visual inspection of fire department connection shall include the following issues as minimum. The caps and chains shall be existed. The connection shall be in good conditions. And the check valve shall be in good conditions and no water leakage.

5.9.2.4 Hydrants

5.9.2.4.1 Inspection of hydrants

(1) Public hydrants near the building shall be in good conditions and ready to use.

(2) Hydrants installed in the building shall be inspected not less than once a month. The hydrants shall be readily accessible and plainly indicated so as to be visible at a distance. Furthermore, a cover shall be closed orderly.

5.9.2.4.2 Maintenance of hydrants

(1) Lubricate the hydrants not less than twice a year.

5.9.2.4.3 Testing of hydrant

(1) Hydrants shall be test not less than once a year by opening and closing the cover to assure the water flow.

5.9.2.5 Water tank

5.9.2.5.1 Level of water in the storage tank shall be inspected not less than once a month.

5.9.2.5.2 The general conditions of water tank shall be inspected.

5.9.2.6 Hose and hose station

5.9.2.6.1 Hose station shall be inspected not less than once a month to assure that all equipment is existence and is readily accessible.

5.9.2.6.2 Hose racks or hose reels and hose nozzle shall be in good conditions.

5.9.2.6.3 Control valve shall be in good conditions and no water leakage.

5.9.2.7 Automatic sprinklers

5.9.2.7.1 Sprinklers shall be visual inspected frequently. The sprinkler shall be no corroded, painted, and damaged.

5.9.2.7.2 The exchange of damaged sprinklers at site shall be concerned of the following:

(1) Type of sprinkler

(2) Size of the sprinkler

(3) Working temperature

(4) Coating

(5) Formation of sprinkler deflector such as pendent sprinkler, upright sprinkler, Sidewall sprinkler, and etc.

5.9.2.7.3 Sprinklers used for longer than 50 years shall be sampling randomly, and testing at laboratory. After that the sampling and testing shall be repeated every 10 years.

5.9.2.7.4 Sprinkler subject to mechanical damage shall be protected with sprinkler guards.

5.9.2.7.5 A supply of spare sprinkler (never fewer than 6) shall be maintained on the premises so that any sprinklers that have operated or been damaged in any way can be promptly replaced. The sprinklers shall be kept in an enclosure box to avoid moisture, dust, corrosion, and temperature exceeded 38 degree of Celsius (100 degree Fahrenheit).

5.9.2.7.6 The stock of spare sprinkler shall include all type and ratings installed and shall be as following:

(1) For systems having less than 300 sprinklers, not less than 6 sprinkler.

(2) For systems with 300 to 1,000 sprinklers, not less than 12 sprinkler.

(3) For systems with more than 1,000 sprinklers, not less than 24 sprinkler.

Table 5.9.1 Conclusion of inspection, test, and maintenance of fire protection equipment

Fire protection equipment	Method	Duration
1. Fire pumps		
- Diesel engine	- operating test	Weekly
- Electrical engine	- operating test	Monthly
- Pump	- flow rate test	Yearly
2. Fire department connections		
- Fire department connections	- inspection	Monthly
3. Hydrants		
- Hydrants	- inspection	Monthly
	- test (open/close)	Yearly
	- maintenance	Twice a year
4. Water tank		
- Level of water	- inspection	Monthly
- Tank conditions	- inspection	Twice a year
5. Hose and hose station		
- hose and accessory	- inspection	Monthly
6. Sprinkler system		
- Main drain	- flow test	Every 3 months
- Pressure gauge	- pressure test	Every 5 years
- Sprinkler	- test	Every 50 years
- Flow signal	- test	Every 3 months
- pipe cleaning	- test	5 years
- Control valve	- seal inspection	Weekly
	- valve lock equipment inspection	Monthly
	- on/off switch inspection	yearly