10th Chemical Process Safety Sharing (CPSS)

Topic: Fire Water System For Highly Hazardous Chemicals Industrials

Presenter : Mr. Lursukd Nakharintr

E-mail: lursukd.n@pttgcgroup.com & lursukd.nn@gmail.com

Mobile: 081-578-1315

Company : PTT Global Company Limited

Contents

0. Brief history of speakers

WORK EXPERIENCE

Petroleum, Petrochemical and Chemical in 1988 - CURRENT

- Instrument Technician : TPI
- Operations : NPC
- Operations Support : NPC
- Maintenance Services : NPC
- Engineering and Project Management : NPC
- Maintenance Planning : NPC
- Process Safety Management : PTTCHEM
- Process Safety Engineering : GC

EDUCATION

- Diploma Certificate in Automotive technicians : Sisaket Technical College
- Higher Vocational Certificate in Automotive technicians : Ubon Ratchathani Technical College
- B.Sc. In Production Technology : Chachoengsao Teachers College
- B.Eng. in Mechanical Engineering : SWU
- M.Eng. in Mechanical Engineering : SWU
- Ph.D. in Mechanical Engineering : SWU

RESOLUTION

Take care of every life so that they can live up to the terms that the heavens preside over

Lursukd Nakharintr

CIRTIFICATES

- Certificate in Integrated Chemical Engineering : KMUTT
- Certificate in Fire Protection Engineering : KU
- Certificate in Process Safety Management Implement & Audits : PrimaTech & PI-II

1. Introduction (1/4)

Bussiness Growth

1. Introduction (2/4)

Safety Management Systems for Highly Hazardous Chemicals Industrials

- Personal Safety Management Systems : ISO 18001, ISO 45001 & Other

= How to keep workers safe at all time?

- Process Safety Management Systems : OSHA's PSM Standard, IEAT's PSM Standard & Other

= How to keep the process plants safe at all time?

1. Introduction (3/4)

1. Employee Participation

2. Process Safety Information

3. Process Hazard Analysis

4. Operating Procedures

5. Training

6. Contractors

7. Mechanical Integrity

8. Hot Work

9. Management of Change

10. Pre-Startup Safety Review

11. Incident Investigation

12. Emergency Planning and Response

13. Compliance Audits

14. Trade Secrets

IEAT's PSM Standard & OSHA's PSM Standard

1. Introduction (4/4)

1910.119(d) Process safety information.

1910.119(d)(3)(i)(H) Safety systems (e.g. interlocks, detection or suppression systems).

- Documentation of the design codes and standards to which the system was designed, constructed and installed is important because the codes and standards are subject to change.
- The design code information is often included in bid specifications provided by design and construction firms and may be given as Uniform Building Code (UBC) or Unified Facilities Criteria (UFC) requirements.
- The information may also be designed as build in accordance with industrials for different systems, such as the American Petroleum Institute (API) practices or International Institute of Ammonia Refrigeration (IIAR) standards or National Fire Protection Association (NFPA) standards.
- Recognized And Generally Accepted Good Engineering Practices (RAGAGEP)

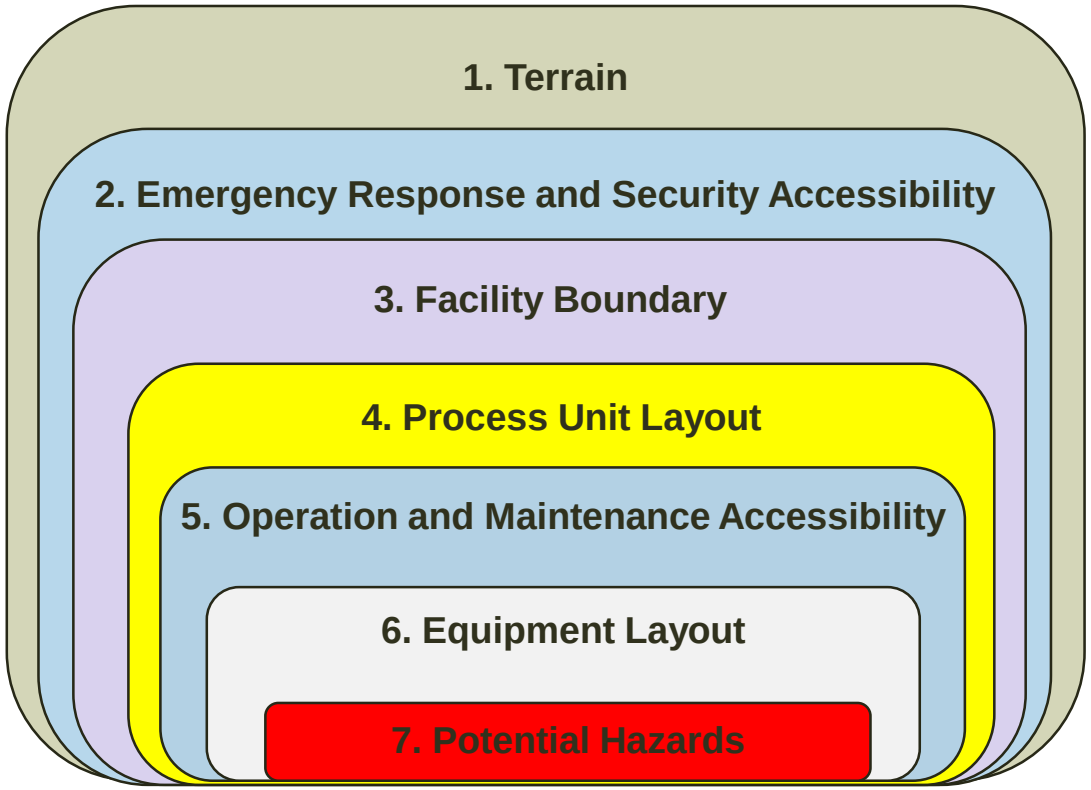
2. Facilities Siting Layout and Spacing (1/3)

1. GAPS Guidelines
   - GAP.2.5.2 : Oil and Chemical Plant Layout and Spacing

2. FM
   - FM LPDS 7-44 Spacing of Facilities in Outdoor Chemical Processing Plants

3. Process Industry Practices (PIP)
   - PIP PNE00003 : Process Unit and Offsites Layout Guide

4. Center for Chemical Process Safety : CCPS
   - Guidelines for Siting and Layout of Facilities

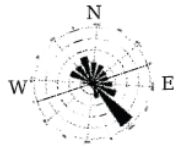


Siting and Layout Approach

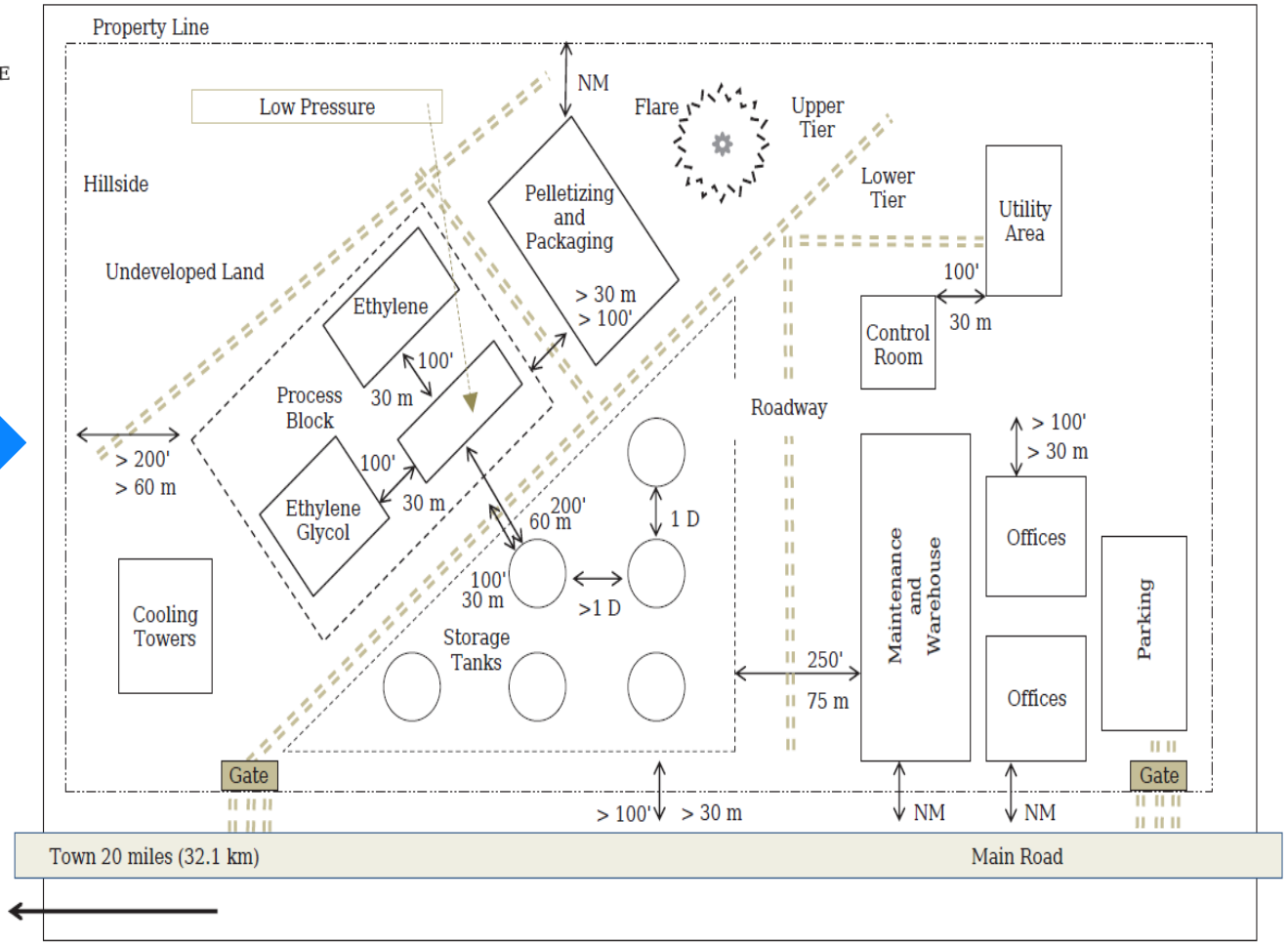
2. Facilities Siting Layout and Spacing (2/3)

Service Buildings	Motor Control Centers And Electrical Substations	Utilities Areas	Cooling Towers	Control Rooms	Compressor Buildings	Large Pump Houses	Process Units Moderate Hazard	Process Units Intermediate Hazard	Process Units High Hazard	Atmospheric Storage Tanks	Pressure Storage Tanks	Refrigerated Storage Tanks Dome Roof	Flares	Unloading And Loading Racks	Fire Water Pumps	Fire Stations
/																
/	/															
50	50	/														
50	50	100	50 ①													
/	/	100	100	/												
100	100	100	100	100	30											
100	100	100	100	100	30	30										
100	100	100	100	100	30	30	50									
200	100	100	100	200	50	50	100	100								
400	200	200	200	300	100	100	200	200	200							
250	250	250	250	250	250	250	250	300	350	*						
350	350	350	350	350	350	350	350	350	350	*	*					
350	350	350	350	350	350	350	350	350	350	*	*	*				
300 ②	300	300	300	300	300	300	300	300	300	300	400	400	/			
200	200	200	200	200	200	200	200	200	300	250	350	350	300	50		
50	50	50	50	50	200	200	200	300	300	350	350	350	300	200	/	
50	50	50	50	50	200	200	200	300	300	350	350	350	300	200	/	/

1 ft = 0.305 m
/ = no spacing requirements
* = spacing given in Table 3



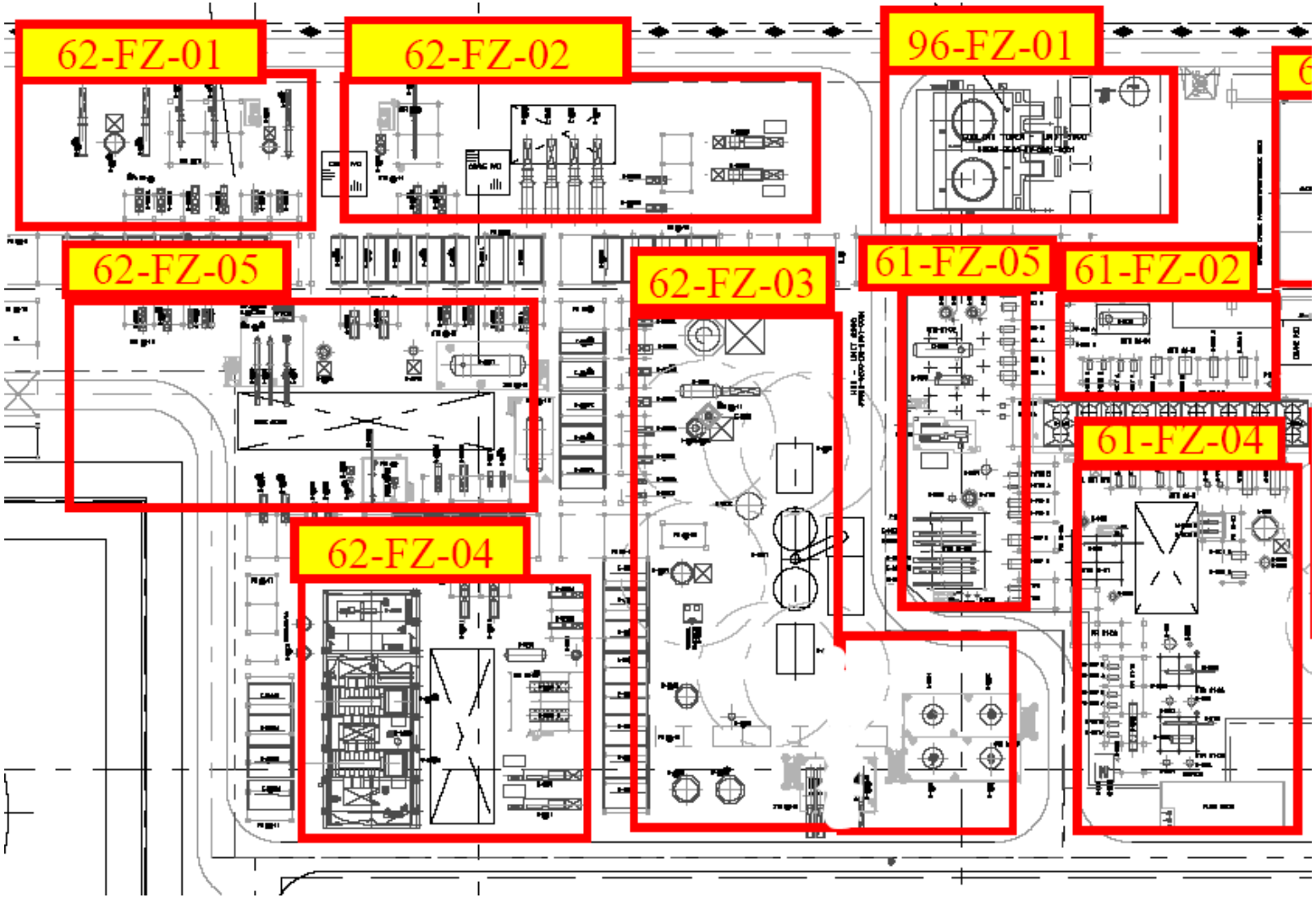
Wind Rose



2. Facilities Siting Layout and Spacing (3/3)

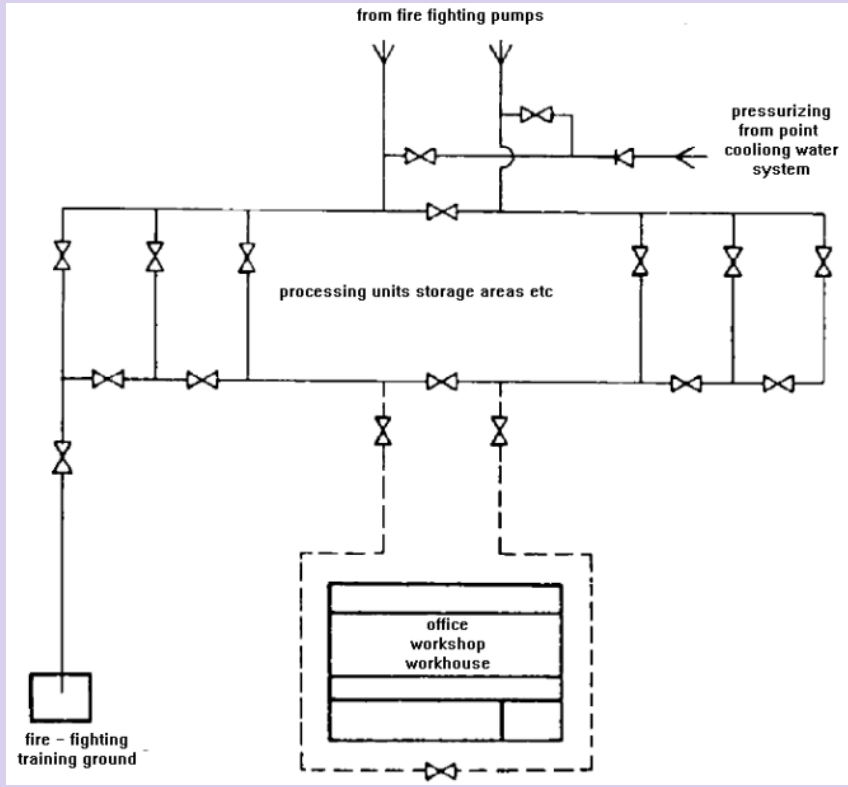
Fire Water System Development

1. Facilities Siting Layout and Spacing
2. Fire Zones
3. Fire Scenarios
4. Fire Water Duration
5. Fire Water Demand



3. Fire Water Supply System (1/10)

1. Water Resources (NFPA 22)	2. Pumps (NFPA 20)	3. Network Pipe & User (NFPA 24)

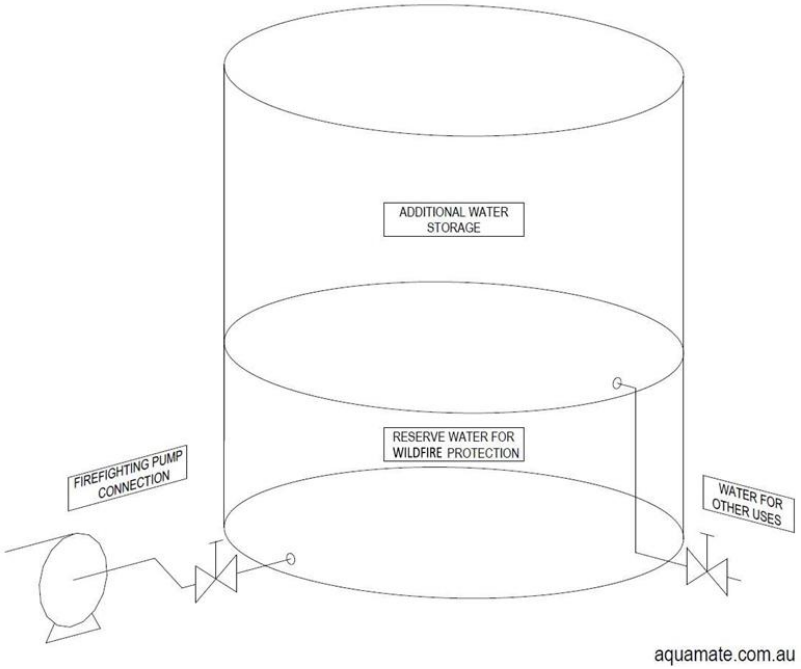


3. Fire Water Supply System (2/10)

1. Water Resources (NFPA 22: Standard for the Water Tanks for Private Fire Protection)

General Requirements

1. Fire water tank types
2. Fire water tank materials
3. Sizing of fire water tank
4. Net capacity of fire water tank
5. Fire water tank vent
6. Filling of fire water tank
7. Discharge pipe sizing of fire water tank
8. Fire water tank overflow
9. Fire water tank drain
10. Anti-vortex plate assembly
11. Connections for use other



4.2.1.4 The water supply shall be capable of filling the minimum required fire protection volume within the tank in a maximum of 8 hours.

14.1.7.1.1* Pipe used for other than fire protection purposes shall be entirely separate from fire-service pipes and shall extend to an elevation inside the tank above that required for fire protection

3. Fire Water Supply System (3/10)

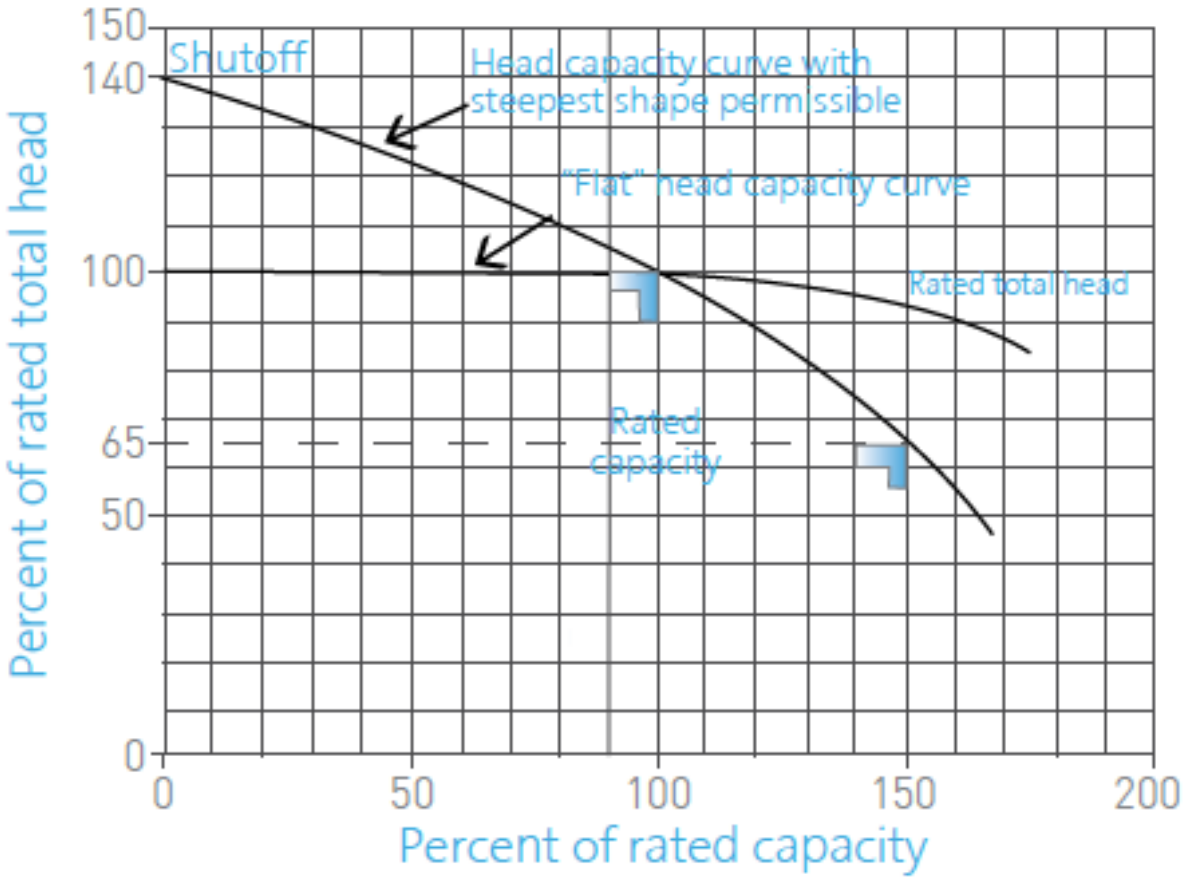
1. Pumps (NFPA 20: Standard for Installation of Stationary Pumps for Fire Protection)

4. General Requirements

4.1 Pumps
4.2 Approval Required
4.3 Pump Operation
4.4 Fire Pump Unit Performance
4.5 Certified Shop Test
4.6 Liquid Supplies
4.7 Pumps, Drivers, and Controllers
4.8 Self-Regulating Variable Speed Fire Pump Units
4.9 Multistage Multiport Pump
4.10 Centrifugal Fire Pump Capacities
4.11 Nameplate
4.12 Pressure Gauges
4.13 Circulation Relief Valve
4.14 Equipment Protection
4.15 Pipe and Fittings
4.16 Suction Pipe and Fittings
4.17 Discharge Pipe and Fittings
4.18 Valve Supervision
4.19 Protection of Piping Against Damage Due to Movement
4.20 Relief Valves for Centrifugal Pumps
4.21 Pumps Arranged in Series
4.22 Water Flow Test Devices
4.23 Steam Power Supply Dependability
4.24 Shop Tests
4.25 Pump Shaft Rotation
4.26 Other Signals
4.27 Pressure Maintenance (Jockey or Make-Up) Pumps
4.28 Summary of Centrifugal Fire Pump
4.27 Pressure Maintenance (Jockey or Make-Up) Pumps
4.28 Summary of Centrifugal Fire Pump Data
4.29 Backflow Preventers and Check Valves
4.30 Earthquake Protection
4.31 Packaged Fire Pump Assemblies
4.32 Pressure Actuated Controller Pressure Sensing Lines
4.33 Break Tanks
4.34 Field Acceptance Test of Pump Units
4.35 Automated Inspection, Testing, and Distance Monitoring of Devices, Meters, and Equipment

3. Fire Water Supply System (4/10)

1. Pumps (NFPA 20: Standard for Installation of Stationary Pumps for Fire Protection)



The grate of fire pump curve at 100% capacity

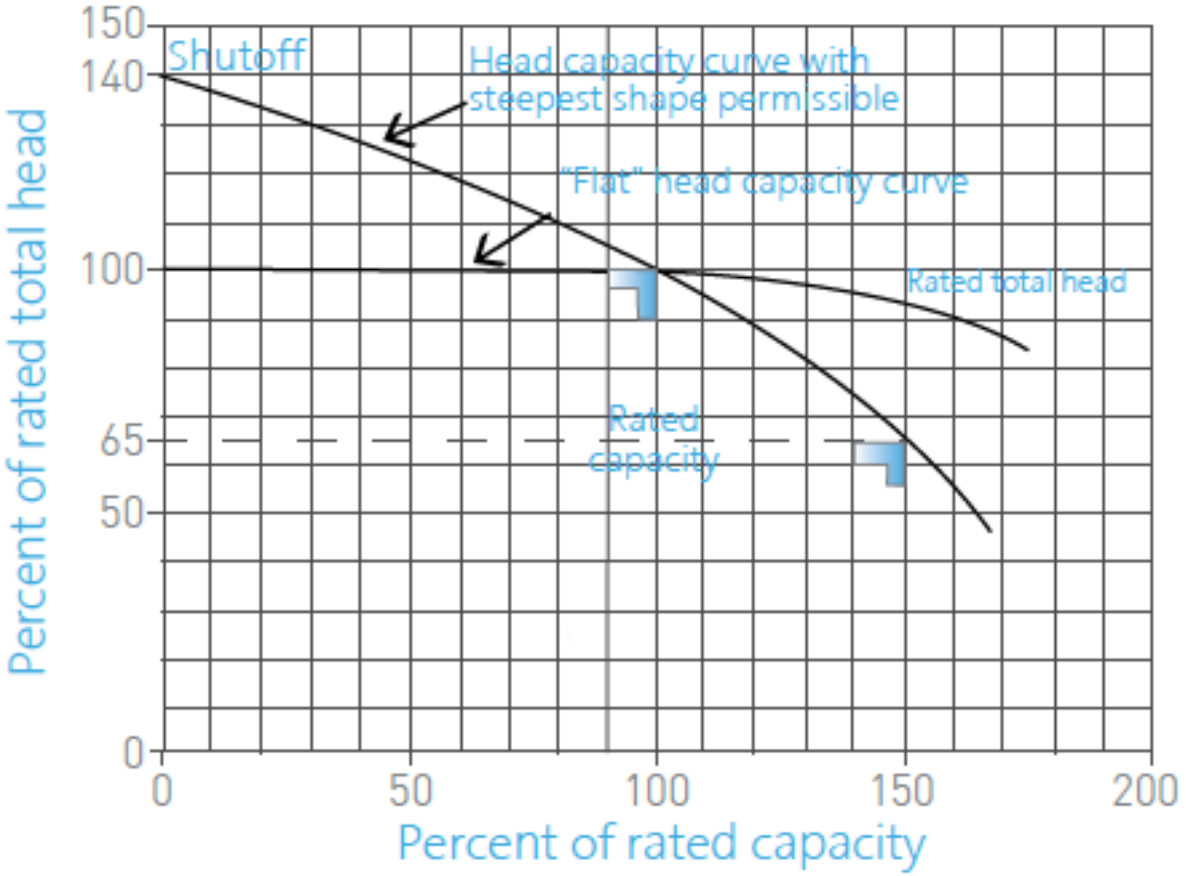
A.14.1.1 The suction piping to a fire pump needs to be adequately flushed to make sure stones, silt, and other debris will not enter the pump or the fire protection system. The flow rates in Table 14.1.1.1 are the minimum recommended, which will produce a **velocity of approximately 15 ft/sec (4.6 m/sec).**

If the flow rate cannot be achieved with the existing water supply, a supplemental source such as a fire department pumper could be necessary. The procedure is to be performed, witnessed, and signed off before connection to the suction piping is completed.

A.4.17.6 The discharge pipe size should be such that, with the pump(s) operating at 150 percent of rated capacity, **the velocity in the discharge pipe does not exceed 20 ft/sec (6.1 m/sec).**

3. Fire Water Supply System (5/10)

1. Pumps (NFPA 20: Standard for Installation of Stationary Pumps for Fire Protection)



The grate of fire pump curve at 150% capacity

1. User required
   a. Handheld grip nozzle (6-7 Bar)
   b. Delude valve inlet pressure (Water spray & Sprinkler 5-6 Bar)

2. 50% capacity for supplement firefighting

3. Fire Water Supply System (6/10)

3. Network Pipe & User (NFPA 24: Standard for Installation of Private Fire Service Mains and Their Appurtenances

Scope

1. This standard shall cover the minimum requirements for the installation of private fire service mains and their appurtenances supplying the following:
    1. Automatic sprinkler systems
    2. Open sprinkler systems
    3. Water spray fixed systems
    4. Foam systems
    5. Private hydrants
    6. Monitor nozzles or standpipe systems with reference to water supplies
    7. Hose houses
2. This standard shall apply to combined service mains used to carry water for fire service and other uses.

Scope

3. This standard shall not apply to the following situations:
    1. Mains under the control of a water utility
    2. Mains providing fire protection and/or domestic water that are privately owned but are operated as a water utility
4. This standard shall not apply to underground mains
serving sprinkler systems designed and installed in accordance with NFPA 13R that are under 4 in. (102 mm) in size.
5. This standard shall not apply to underground mains serving sprinkler systems designed and installed in accordance with NFPA 13D.

3. Fire Water Supply System (7/10)

3. Network Pipe & User (NFPA 24: Standard for Installation of Private Fire Service Mains and Their Appurtenances

General Requirements

1. Water Supplies
2. Valves
3. Hydrants
4. Hose Houses and Equipment
5. Master Streams (monitor nozzles, hydrant-mounted monitor nozzles, and similar master stream equipment)
6. Underground Piping
7. Hydraulic Calculations
8. Aboveground Pipe and Fittings
9. Sizes of Aboveground and Buried Pipe
10. System Inspection, Testing, and Maintenance

3. Fire Water Supply System (8/10)

3. Network Pipe & User (NFPA 24: Standard for Installation of Private Fire Service Mains and Their Appurtenances

Purpose

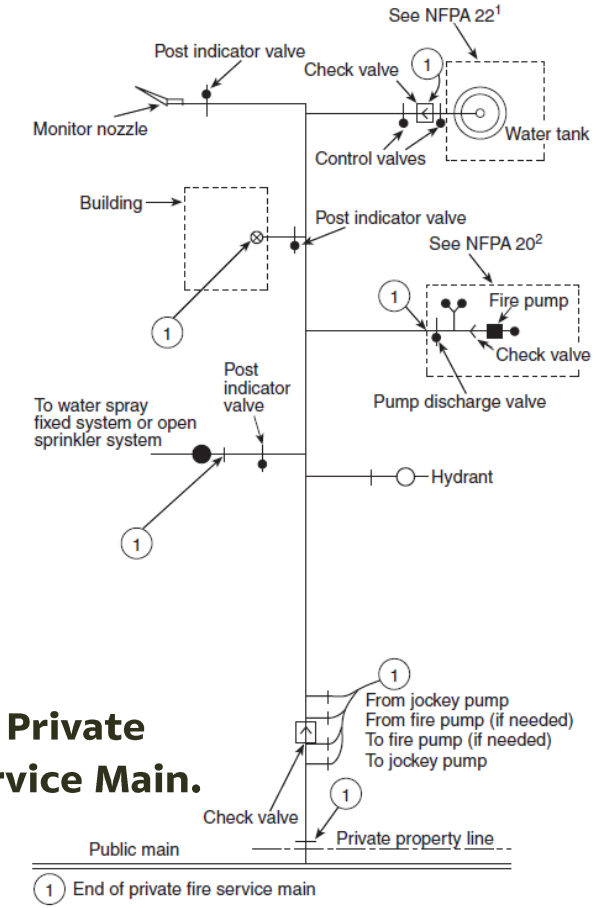
The purpose of this standard shall be to provide a reasonable degree of protection for life and property from fire through installation requirements for private fire service main systems based on sound engineering principles, test data, and field experience.

Equivalency

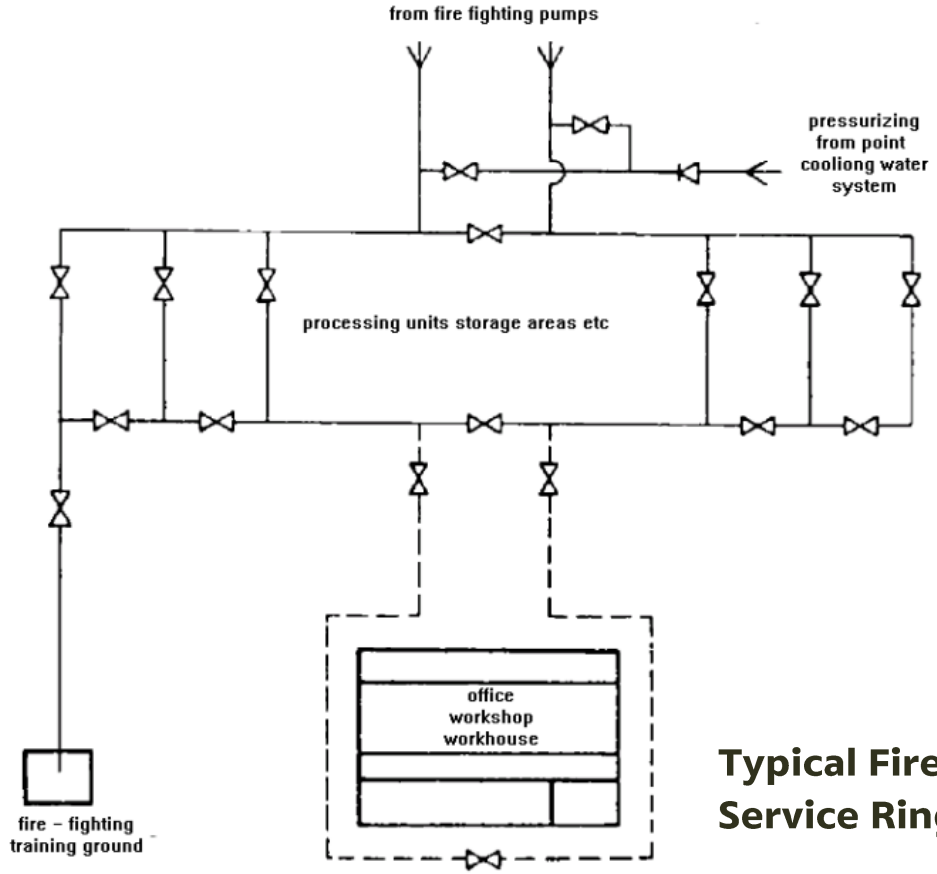
Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard. Technical documentation shall be submitted to the **authority having jurisdiction** to demonstrate equivalency. The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

3. Fire Water Supply System (9/10)

3. Network Pipe & User (NFPA 24: Standard for Installation of Private Fire Service Mains and Their Appurtenances



Typical Private Fire Service Main.



Typical Fire Water Service Ring Main.

3. Fire Water Supply System (10/10)

3. Network Pipe & User (NFPA 24: Standard for Installation of Private Fire Service Mains and Their Appurtenances

12.2 Protection of Piping.

12.2.1 Aboveground piping for private fire service mains shall not pass through hazardous areas and shall be located so that it is protected from mechanical and fire damage.

12.2.2 Aboveground piping shall be permitted to be located in hazardous areas protected by an automatic sprinkler system.

4. Engineer and Responsibilities (1/2)

Authority	Agency	Responsibilities
1. AHJ : Authority Having Jurisdiction	DIW, IEAT, Municipality & Subdistrict Administrative Organization	• Supervise in accordance with the law
2. Technical Authority in Law	Council of Engineers Thailand	• Design, Assembly, Production, Inspection, Testing, Installation, Commissioning, Delivery according to Standards & Law • Operate Plant & Machine according to the design • Maintenance planning, Inspection & Testing according to Standards & Law
3. Technical Authority in Jobs	Company	• Design, Assembly, Production, Inspection, Testing, Installation, Commissioning, Delivery according to Standards & Law • Operate Plant & Machine according to the design • Maintenance planning, Inspection & Testing according to Standards & Law

4. Engineer and Responsibilities (2/2)

Thank you for your attention