

GENERAL STANDARD

FOR

SAFETY AND FIRE TRAINING CENTERS,

FIRE STATION FACILITIES

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0. INTRODUCTION

Safety training is one of the important ways to motivate employees not only their contribution in accident and fire prevention but to promote their general knowledge and self-confidence. To implement this, a wide range of training program is needed which should incorporate facilities to be provided for this purpose.

Provision of facilities in fire stations is also required which is one of the major concern of I.O.G.P.* to protect employees properties from the risk and thread of fire in their residential and work places.

The equipment and facilities required should be envisaged by safety and fire and the management as an authorities to determine the needs as given in the Engineering Standard IPS-E-SF-520 and this Standard.

In designing and specifying materials and equipment for fire stations, factors such as hazards involved in the process of oil and gas refineries, petrochemical complexes, production units and pumping and compressor stations should be considered. Based on the information gained the size of building construction, facilities, equipment and emergency response team as well as future development can be anticipated.

* I.O.G.P. is Iranian Oil, Gas and Petrochemical.

1. SCOPE

The intend of this Standard is to provide design and construction of facilities required for the control of accidents and fires. This Standard is divided in two sections as follows:

Section 1: Safety and Fire Training Centers.

Section 2: Fire Station Facilities.

2. DEFINITIONS AND TERMINOLOGY

Recruit Training: Basic training for newly engaged fire fighters.

Whole time fire stations: Attended by professional fire fighters (24 hours service).

Retained Fire Stations: Unmanned fire station attended by plant employees in case of emergencies

3. UNITS

This Standard is based on International Systems of Units (SI), except where otherwise specified.

SECTION 1

4. SAFETY AND FIRE TRAINING CENTERS

4.1 Design and Construction

4.1.1 Assessment

In order to derive the maximum benefits from the resources available a comprehensive assessment of current and future needs must be made and the following subjects must be considered:

- Current and future needs.
- Facilities currently available.
- Adequate space required for indoor and outdoor training.

In design and construction of training facilities the following courses should be considered:

- Recruit training (basic course) for fire-fighters.
- Employees fire-fighting course.
- Motor vehicle accident prevention defensive driving course.
- First aid course.
- Environmental pollution and hygiene control.
- Special course for supervisors.
- Off the job safety course.

Note:

No restriction is made to include refresher courses.

4.2 Layout of Training Center

4.2.1 The following items are generally the building requirements:

- a)** Offices and administration facilities.
- b)** Conference and class rooms including exhibition and library.
- c)** Outdoors facilities for fire service practical training.

4.2.2 The following items should be considered in the planning:

- Weather condition: temperature, humidity, wind velocity, rain and snow.
- Ample space between classrooms and outdoor practical facilities in training ground.
- Location of heating and air conditioning equipment where regular maintenance can be easily performed. Avoid the installation of such units in classroom area.
- Space needed for visitors.
- Provision of storage for materials, equipment and fuel.
- Communication requirements.
- Dining room, wash-room, drinking water and pantry.
- Parking lot.

4.3 Location of Training Center

4.3.1 General

Some aspects to consider in determining the placement of the training facility are; site, water supply, environment, security, support services and access to utilities.

4.3.2 Site consideration

4.3.2.1 Proper drainage separated from oil installations drain system is a major consideration because of the use of large amounts of water for certain exercises. Also, effort should be made to ensure that drainage will be sufficient for variable weather conditions as well as future expansion.

4.3.2.2 The slope of the land may be advantageous for drainage but an excessive slope may be a negative safety factor for manpower and apparatus movement especially when the surface is wet.

4.3.2.3 The size of the site should be ample for planned buildings, parking, and future expansion. Allow adequate separation between buildings for safety.

4.3.3 Water supply

4.3.3.1 The maximum water supply required should be estimated so that an adequate system can be installed to deliver the necessary volume for training activities and domestic as well as off-shore desalinated water needs. A loop or grid system with properly placed valves would help to ensure an adequate water delivery. If possible, dead-end mains should be avoided.

4.3.3.2 Two delivery hydrants with capacity of 120 m³/h of water supply and two water monitors be installed preferably at up wind.

4.3.4 Usage guidelines

4.3.4.1 Rules should be developed regarding the use of the facility. The various components of the facility should be in use as much as possible. The needs of the prospective users will be fulfilled by proper scheduling.

4.3.4.2 Prevailing winds can be used to direct smoke away from neighbors. Shifting winds will have to be taken into consideration.

4.4 Administration and Classroom Building

4.4.1 Offices

Office space shall be provided for the head of training, instructors and clerical personnel. Additional spaces are required for store laboratory, visual devices and other material and equipment.

4.4.2 Conference room

A conference room for meetings, lectures and discussions with relative devices.

4.4.3 Classrooms

4.4.3.1 Classroom size should be based by the number of trainees and the type of training to be conducted. Minimum space shall be for 30 men.

4.4.3.2 The instructor should be able to control room condition and audio-visual equipment. Good lighting is a must and the use of both individual controls and rheostats should be considered to vary the illumination. A podium light and separate white board illumination can make a presentation in a darkened room more effective. Electrical outlets in the floor and the walls should be spaced to eliminate the use of extension cords. Before the sound system is installed, the installer should eliminate dead spaces in the room.

4.4.3.3 Classroom furniture has to be durable. Writing surfaces for use by the instructors and students should be provided. Folding tables, 45 cm wide, and stacking chairs permit greater flexibility in room utilization. Experience has shown that wider tables occupy space that can be better utilized.

4.4.3.4 To lessen classroom disturbance the following features must be considered; doors to the room should open and close quietly, sanitary and refreshment facilities should be close to the room, and ceiling height must permit the hanging of wall screens or the placement of portable screens for good viewing. The ceiling height should be a minimum of 300 cm as dictated by experience.

4.4.3.5 Central air conditioning system and heating units should be installed in the classroom because of the noise factor.

4.4.4 Audio-visual

4.4.4.1 To allow the instructor to take advantage of various media the following equipment shall be available:

- a) White board, magnetic board.
- b) Video with T.V monitor.
- c) Slide projector, recorder and video editing machine.

4.4.4.2 To aid in the use of audio-visual equipment the following requirements are to be provided:

- a) Provide an extra electrical switch with a rheostat to control illumination.
- b) Place projector area near hallway so that the equipment can be easily moved.
- c) Provide heating, ventilation and air conditioning.
- d) Provide projectors with permanent remote control wire.
- e) Install electrical receptacles in the floor to eliminate the use of extension cord.

4.5 Building Maintenance

The material used should be easy to maintain. Durable material would cut down supply of replacement and cost.

4.6 Fire Fighting Training Ground

4.6.1 The training ground including recruit section should consist typically of an area of about 1000 m² located in a safe position away from plant and storage facilities.

4.6.2 A typical lay-out of a training ground is given in Appendix A. It consists of a concrete floor, sloping for drainage, surrounded by spillage walls of about 0.5 m high. The drain connection shall be provided with an isolating valve and a fire trap shall be installed in the drain pit located outside the spillage wall. For LNG/LPG plant training grounds, an additional sump of 3 × 3 m is required with a total depth of 1 m (including a wall), both sump and wall shall be lined with heat-resistant refractory bricks. Thermally insulated LNG/LPG filling and nitrogen cooling connections shall be installed for the simulation of LNG/LPG fires.

4.6.3 A fuel tank is installed outside the spillage wall at a safe distance to provide the 'mock-up' equipment with fuel for simulated plant equipment fires. The fuel tank may be pressurized with nitrogen to transfer the fuel to the equipment, or, when electrical power is available a pump can be used.

4.6.4 For refinery installations, the mock-up equipment indicated in the lay-out should be installed as a minimum.

4.6.5 Locations with special fire hazard, additional equipment for simulating fires may be required. If gas cylinders are used, they shall be included and stored on a concrete slab positioned outside the spillage wall at a safe distance, to feed gas to the mock-up equipment for simulated gas fire.

4.6.6 A branch from the fire-water main with a capacity of 120 m³/h shall run to the training ground. This branch shall be fitted with two-way hydrants, two water monitors and a full bore flushing connection for cleaning the branch line.

4.6.7 The area shall be accessible for a fire-fighting vehicle and, if the access road has a dead end a turn-around shall also be provided.

4.7 Other Requirements

4.7.1 The following spaces and facilities are generally required for recruit training (see Appendix B):

- a)** Ground for drill and practical exercises. The area shall be approximately of 30 × 20 m.
- b)** Water sump to be provided for pump test. The sump to be of minimum of 2 × 2 m and 3 meter deep. The level of water to be at 2 m but a slop ramp should be made with 4 m wide and one meter high. The pump testing area shall be fenced and the sump to be covered.
- c)** Construction of smoke building to acquaint the trainees with the skill and ability necessary for survival in an oxygen deficient atmosphere and learning to use breathing apparatus (Appendix B Fig. B.1). The smoke building shall have entry points and escape hatches and smoke used should be of a controlled combustion with minimum toxicity. Hay-Straw-Cardboard boxes or similar combustibles are considerably safer (see Appendix B Fig. B.2) Smoke Machine.
- d)** Floating roof oil storage tank fire. Fire is extinguished by:
 - 1)** Foam pourer.
 - 2)** Portable foam branch or fire extinguishers (Appendix B Fig. B.4).
- e)** A ladder training tower to be provided for ladder drill (Appendix B Fig. B.3).
- f)** Flammable liquid burn area (Appendix B Fig. B.5).

4.7.2 First aid

Safety should be the foremost consideration in facility design. Accidents and illnesses do occur; therefore, properly designed first aid room should be provided. Space should be provided so that temporary care can be administered to victims suffering from burns, cuts, cardiac distress, smoke inhalation, heat exhaustion, and other injuries or illnesses.

SECTION 2

5. FIRE STATION FACILITIES

5.1 General

This Section of standard covers the requirements for fire station buildings. Four Categories of A, B, C and D are given in Clause 5.2. The fire stations shall be built at safe locations away from any risk and as close as practicable to the fire control area where additional personnel are available.

5.2 Categories

Size of fire stations shall be categorized by company management and safety and fire authorities considering all risk factors such as:

- 1) Size of the area.
- 2) Combined fire and emergency factors.
- 3) Fire protection system installed.
- 4) Availability of employees trained in fire fighting operations.
- 5) Availability of other sources of help.
- 6) Fire prevention techniques, design and enforcement.

Categories of fire stations are as follows:

- | | | |
|----------|-------------------------|--|
| A | Large | For the areas such as combining refineries, process, chemical, gas treating plants, loading terminal, storage and other service facilities including industrial and residential areas. |
| B | Medium | The same as above classified as lower risk. |
| C | Sub-Fire Station | For the area of high risk with fire station of Category A but far away to reach within 10 minutes driving. |
| D | Retained | For the fire risk potential areas and plants covering approximately 2 to 5 km ² and located far away from any fire stations (selected employees are trained and assigned as volunteer fire fighters). |

5.2.1 Category A: Fire station

5.2.1.1 Parking bays

The fire station shall have six fire truck parking bays, for minimum of six fire trucks (three first aid emergency units and three auxiliary major emergency units). Fire fighting units may be selected from the following, depending on the risk factors. The station shall be designed and located such that future expansion of 25% will be possible:

- a) General purpose fire truck.
- b) Major fire truck.
- c) Dry powder or combined foam/dry powder truck.
- d) Foam or water tanker.
- e) Hydraulic platform (boom).
- f) Rescue tender.
- g) Fire extinguishing trailer.

- h) Equipment trailer.
- i) Foam/water monitor trailer.
- j) Emergency ambulance.

5.2.1.2 Lay-out

- The vehicles should be able to enter and leave the station parking bays at both sides, front and rear of the fire station.
- If the fire station is located at an authorized primary road, consideration should be given to the installation of traffic lights, operable from, and indicating when vehicles are leaving, the fire station.
- The entrance and exits should be closed by doors e.g. rolling shutters, counter weight, etc. designed for fast opening and constructed in such a way that the vehicles would be able to drive through without delay.
- Open parking (in fire stations without doors) may be considered when climatic conditions allow, but a disadvantage will be entry of unauthorized persons.
- In locations where freezing can occur, the parking places shall be protected accordingly.
- Each parking bay shall be equipped with an electrical connection and cable for battery charging, and when required for heater in the engine cooling system of the vehicle, the plugs to be pulled out of the sockets, when the fire truck drives away.
- The height above the parking places, including doors shall not be less than 5 m. A free space of 1.5 m should be available between each vehicle, between vehicle and wall and all doors. the width of vehicle is approximately 2.5 m.
- The length of a parking place should be based on the length of the longest fire-fighting vehicle pulling a mobile water/foam monitor which may be approximately 11 m.
- An inspection pit shall be available in the maintenance area of the fire station.
- Parking area shall be equipped with compressed air supply for pressurizing the brakes of the trucks when required.

5.2.1.3 Workshop-office and other facilities

The following facilities shall be available:

- Workshop laboratory containing work bench, fixed drilling and grinding machines with fire extinguishers testing equipment and tools for testing and servicing of other equipment such as breathing and emergency equipment.
- Storage for spare parts.
- Fire extinguishers filling station.
- Rooms for storage of CO₂, O₂, N₂ and transfer charging compressor. An air compressor shall also be provided in a separate room for charging cylinders of breathing apparatus.
- A fire fighting instruction room equipped with a white board-slide projector-video and other audio-visual media with screen. Sized for about 30 people. Alternatively where safety and fire training center is available, the training center shall be used for such purpose.
- Office accommodation for chief fire officer or head of safety and fire and staff administration shall suit the requirements.

- Lockers, rest room, dining room and other facilities for fire service personnel shall be provided.
- A control room with communication facilities and fire alarm annunciator incorporating with panels shall be provided.
- Provision of storage and loading for foam compound and other materials used during fire and emergencies.
- Hydrant(s) with a fresh water supply and facilities for flushing out of the piping systems of the fire-fighting vehicles shall be provided at the rear of the fire station together with hose cleaning equipment.
- Fire fighting training and exercise ground as specified in Appendix A. All fire station office buildings shall be provided with air conditioning systems.
- Drying room for drying fire hoses, clothing and other equipment.
- Fire fighters outfits for assigned assisting crew, if selected from plant employees.

5.2.2 Category B: Fire station

5.2.2.1 General

a) Depending on availability on site, fixed or portable fire fighting equipment, for Category B fire station (24 hours manned) 5 number of fire trucks and trailers, are the minimum requirements.

b) Types of trucks:

- 1) General purpose fire truck 1 unit.
- 2) Major fire truck 1 unit.
- 3) Auxiliary fire trucks and trailer 3 units.

5.2.2.2 Lay-out

a) The fire station shall be provided with parking accommodation of 5 bays including future expansion.

5.2.2.3 The following building spaces are required:

- Offices for fire master and his staff.
- Work bench, fire extinguishers and emergency equipment testing and servicing facilities.
- CO₂, N₂, O₂ transfer charging units and air compressor.
- Training room for 20 men.
- Accommodation for rest room, locker room, dining room and etc.
- Store room.
- Control room.
- Fire fighting training ground with selected suitable equipment from Appendices A and B.

5.2.2.4 Other facilities should be provided as follows:

- Alarm annunciator and communication system.
- Visual aids for training.
- Connections and cable for charging batteries together with heater in the engine cooling system for all fire trucks where required.
- Fire fighters outfit for assigned assisting crew if selected from plant workers or staff.
- Provisions for storage and loading of foam compound.
- Fire water hydrant with hose washing and cleaning rack.

5.2.3 Category C: Sub-fire station

5.2.3.1 For any fire risk area more than 10 minutes driving away from main fire station, a sub-fire station is required. Truck and crew shall attend to fight the fire before the main Fire Brigade's trucks and crews take over on their arrival.

5.2.3.2 Parking bays

The building should consist of 3 parking bays one of them with inspection pit, two fire trucks, 1 unit of general purpose and 1 unit of major fire trucks, the third unit selected from the list c, d and e of Clause 5.2.1.1.

5.2.3.3 The following are the station requirements:

- Parking bays shall be equipped with connections for battery chargers and engine heating system where required.
- The bays shall be of 11 m in length 4.5 m wide and not less than 5 m in height.
- Locker room, a work bench, hose cleaning and washing rack, rest room, dining room and drying room.
- Offices, communication and alarm annunciator.
- Store room for fire equipment and foam liquid compound.
- Fire water hydrant with fire hose washing and cleaning facility.

5.2.4 Category D: Retained fire station

5.2.4.1 Retained fire stations under control of area fire station Category A or B applies to those stations having three bays with 2 fire trucks selected for major emergencies and the manpower of 2 drivers for each shift. Another auxiliary fire truck may be used as spare.

5.2.4.2 In an outbreak of fire when the alarm is sounded the appropriate fire trucks will be driven by available drivers or reported for duty and retained selected trained personnel will be picked up on their way to the site of fire.

5.2.4.3 Retained fire stations can be totally unmanned. In that case available trained fire men will attend the fire station when alarm has been given. The crew and the truck will proceed to the scene of fire.

5.2.4.4 This system is entirely for major emergency cases. However assistance shall be given when needed.

5.2.4.5 Unmanned retained stations should be locked and will be opened only by means provided in main fire station or the keys left with selected persons. Retained personnel will usually report to the station for checking and inspection of fire equipment once a week.

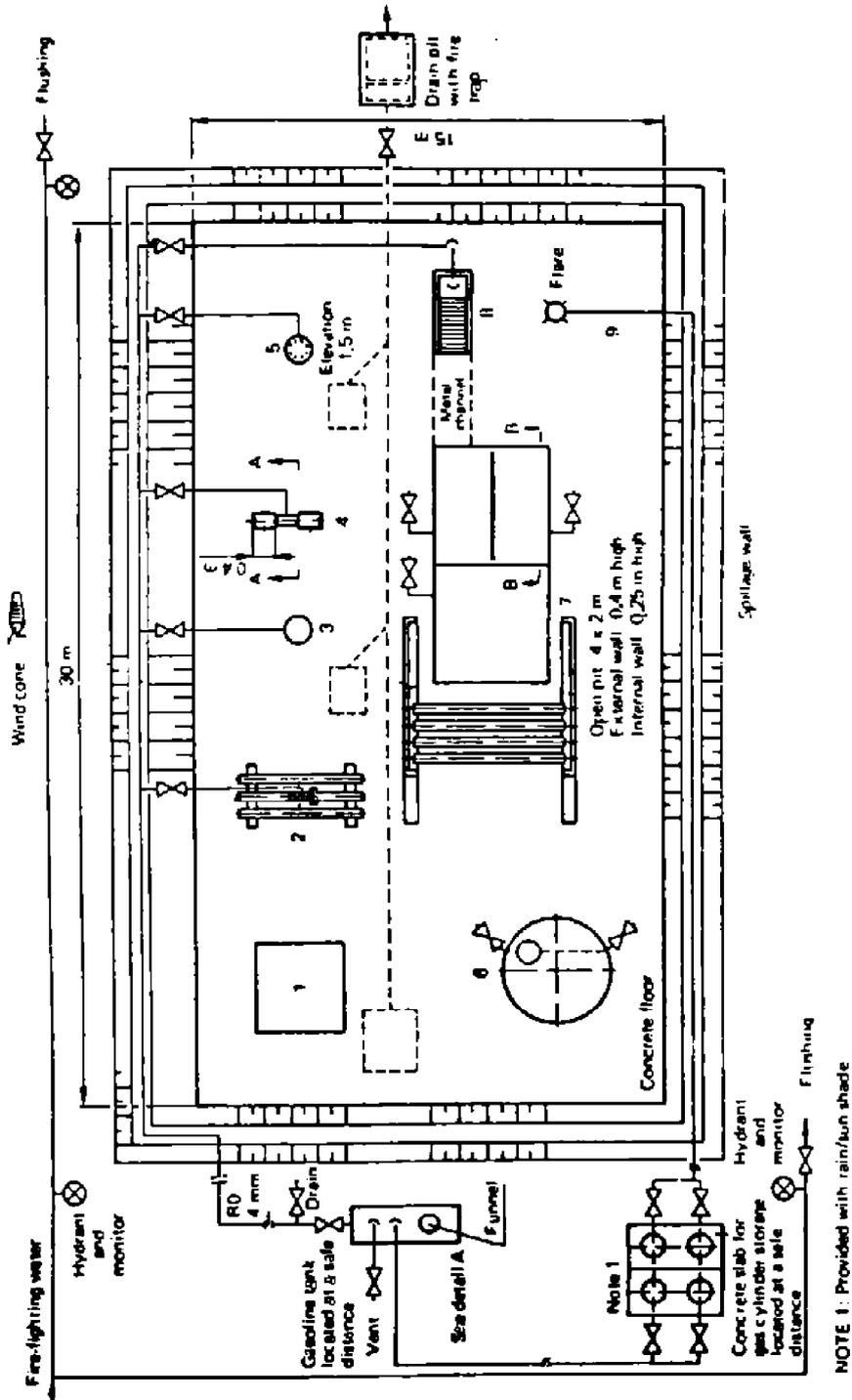
5.2.4.6 Requirements for this type of station are as follows:

- Locker room for outfits.
- Direct communication with main fire station.
- Alarm annunciator.
- Store room.
- Hose wash and cleaning facility.
- Office.
- Work bench.

APPENDICES

APPENDIX A

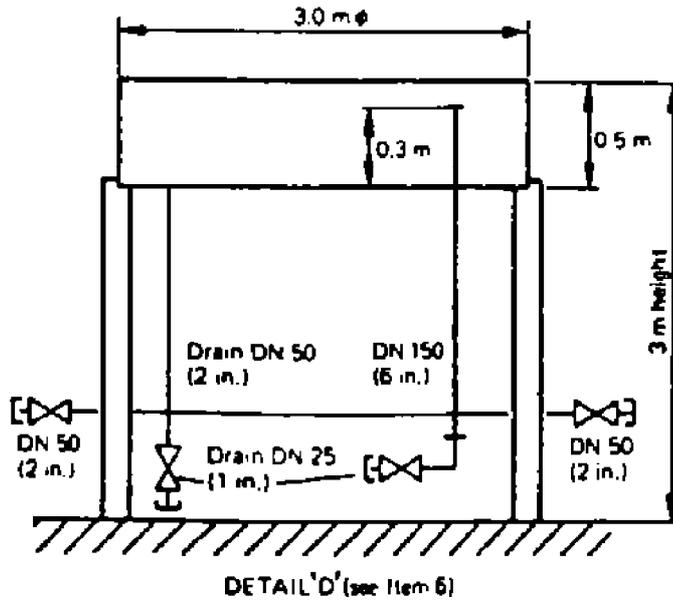
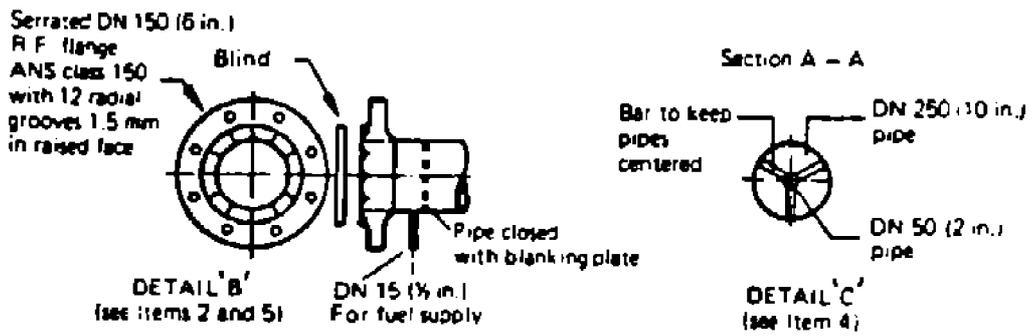
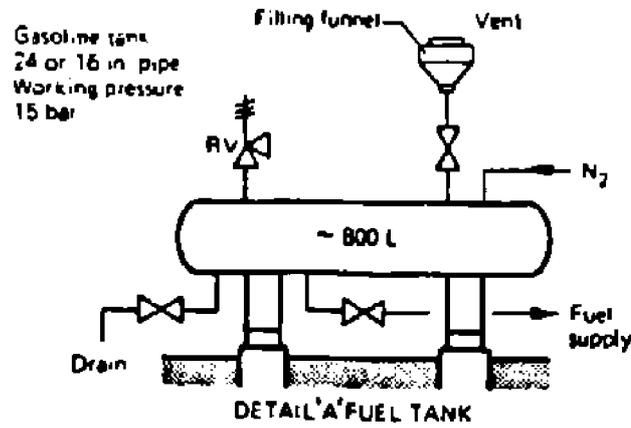
TYPICAL LAY-OUT OF FIRE-FIGHTING TRAINING GROUND AND EQUIPMENT



(to be continued)

APPENDIX A (continued)

EQUIPMENT DETAILS



Pan filled with water just below top of DN 150 (6 in.) pipe. Pipe and top layer filled with fuel

DN 50 (2 in.) connection for sub-surface system. Miniature foam maker

(to be continued)

APPENDIX A (continued)

The fire-fighting training ground shall have the following installations:

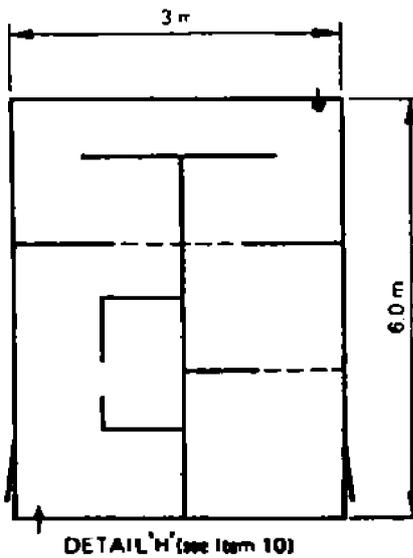
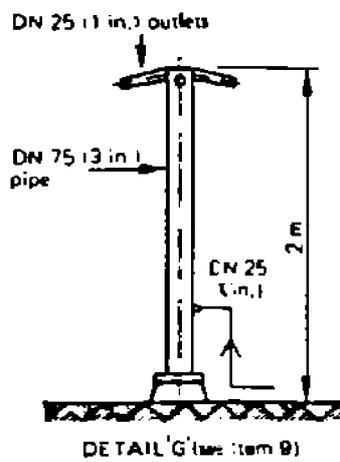
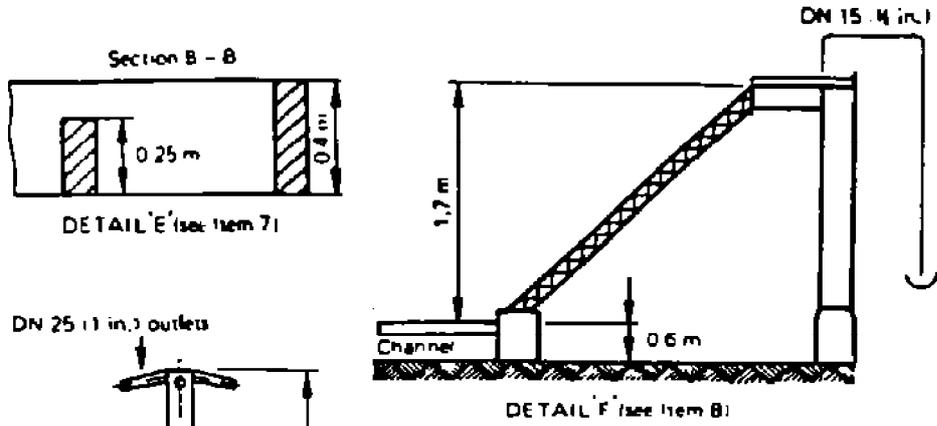
Item 1	Open concrete pit 3 × 3 m for Class 'A' fire exercises.		
Item 2	Pipe support, at elevation 0.5 m carrying: - Two pieces of DN 150 (6 in. N.b.*) pipe 1.8 m long with open ends. - A centre pipe with a DN 150 (6 in. N.b.) serrated blind flange and a gasoline partition.	See Detail	B
Item 3	Vertical pump.		
Item 4	Horizontal pump. Both Items 3 and 4, Simulate a pump unit with a leaking seal. For more advanced training, the exercise can involve a fire on two adjacent pumps.	See Detail	C
Item 5	Vertical flange and blind.	See Detail	B
Item 6	Open tank fire with a sub-surface injection system and access from two sides. The simulation can be either a tank with a diameter of 3 m or an elevated pan at a height of 3 m with a depth of 0.5 m. The fuel pipe has a diameter of 150 mm (6 inch) with 2 connections of 50 mm (2 inch) for sub-surface foam application.	See Detail	D
Item 7	Open pit of 4 × 2 m with partition walls, approximately 0.4 m deep. Incorporating a pipe rack for 4 pcs of DN 100 (4 inch) pipes with open ends. The pipes can be removed via a ramp rack. Each section of the pit shall be drained separately. The pit or the smaller section of the pit may be used for powder extinguishing and the whole pit for foam extinguishing. A removable channel can connect the pit to the stairs of Item 8 for a full scale exercise in 'running' fires, i.e. via the stairs into the full size pit.	See Detail	E
Item 8	Stairs, allow fuel release on the top platform of the staircase via non-perforated steps of checker plate to the ground or to the pit of Item 7, to create a cascade fire.	See Detail	F
Item 9	Flare or Christmas tree for simulating gas fires.	See Detail	G
Item 10	Smoke house allowing changing patterns in the exercises (see also Appendix B Fig. B.1).	See Detail	H
Item 11	20/30 cm Dia pipe, the gas supply connected through a venture oil/gas mixed and ignited with pizzo electric ignitor to assemble flame propagation into pipe. The gas/oil mixture adjusted to rich/lean and mid point and effect shown.	See Detail	I

* N.b. is Nominal bore.

(to be continued)

APPENDIX A (continued)

EQUIPMENT DETAILS



Item (II) Flame Propagation

Partition walls.
Movable to simulate
different situations.
Height of ceiling 3 m min.

Ignitor

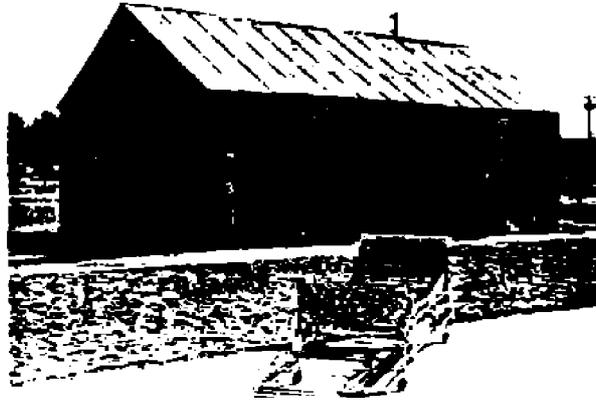
Venturi

Flow Pressure
Regular

10 MM Gas Fire

Detail 'I'

**APPENDIX B
RECRUIT TRAINING EXERCISE FACILITIES**



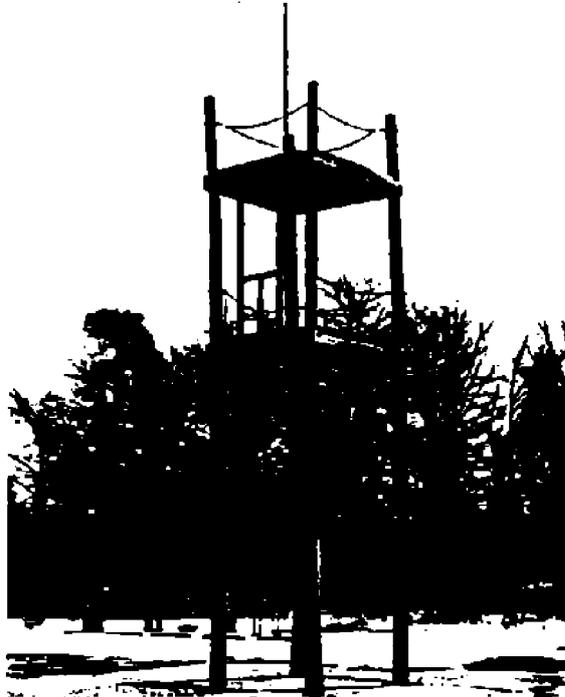
**SMOKE BUILDING
Fig. B.1**



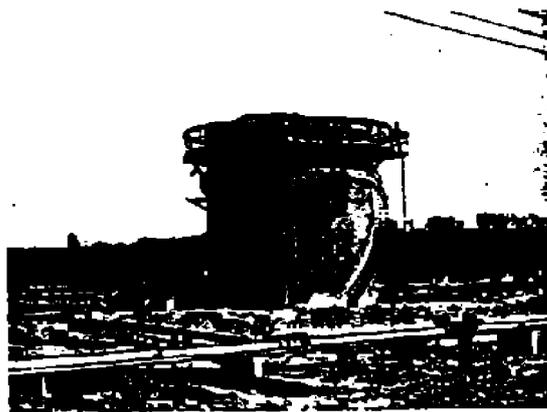
**SMOKEMAKING MACHINE-VERY SIMPLE 55-GAL (209-L) DRUM WITH HINGED DOOR
HALF AND SMOKE PIPE TO ROOMS ON VARIOUS FLOORS**

Fig. B.2

(to be continued)

APPENDIX B (continued)

LADDER TRAINING TOWER
Fig. B.3



VERTICAL "FLOATING ROOF" FUEL STORAGE TANK FIRE
Fig. B.4

(to be continued)

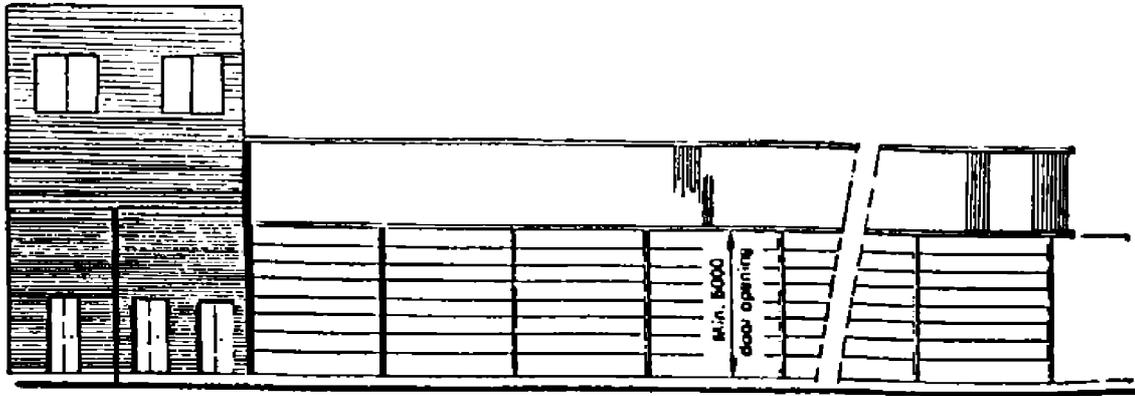
APPENDIX B (continued)



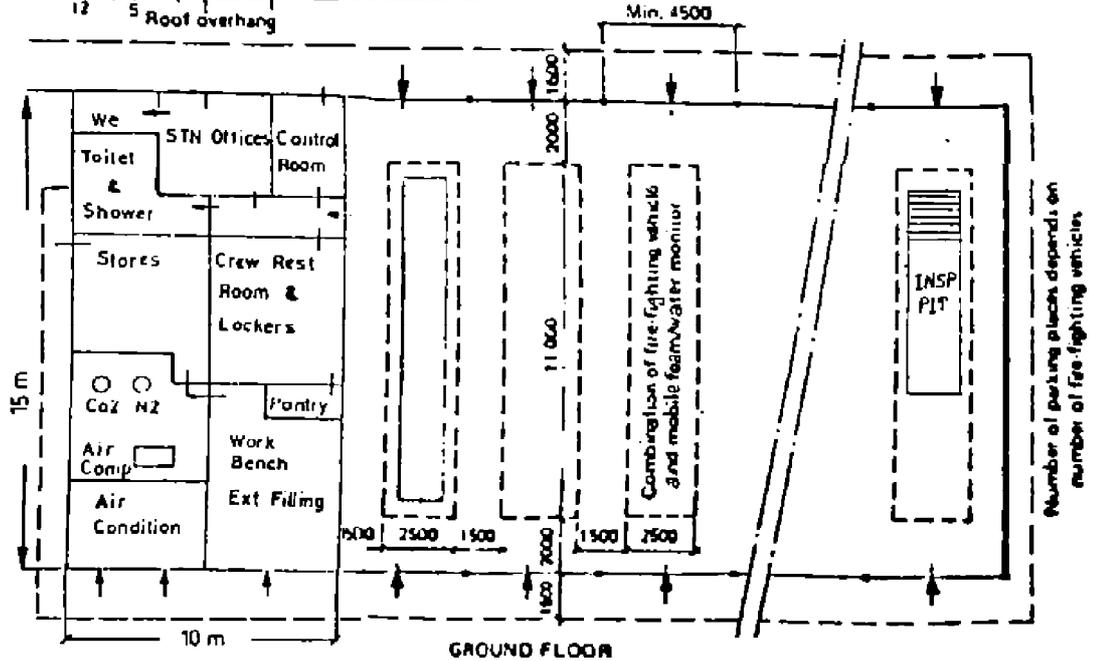
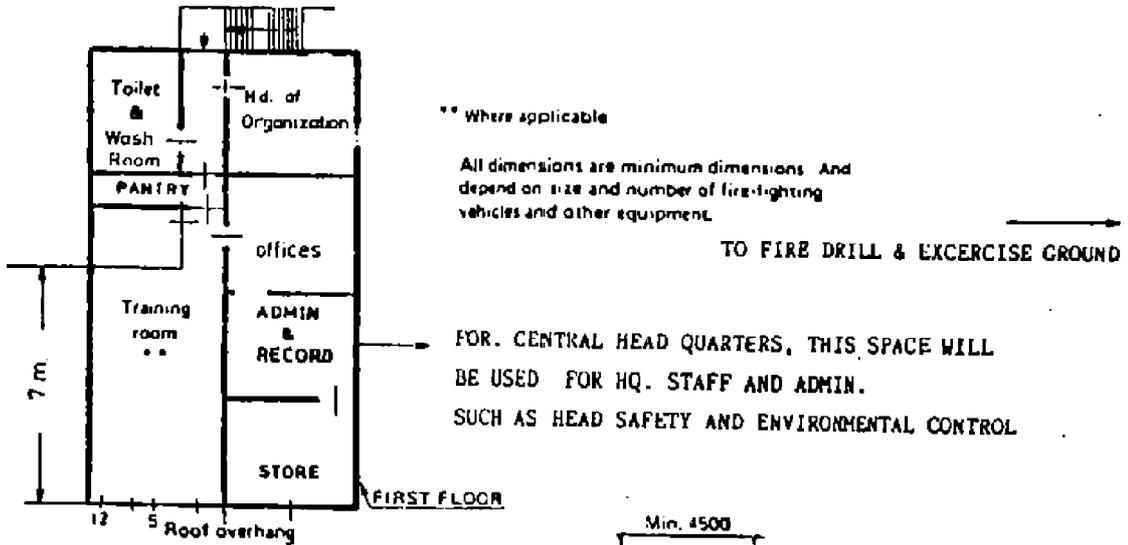
FLAMMABLE LIQUID BURN AREA
Fig. B.5

Area includes cross pit, oval pit, square pit, electrical transformers, baffled pit, running spill area, drum pit, vertical tank, horizontal tank.

APPENDIX C.1
 TYPICAL LAY-OUT OF FIRE STATION LARGE-SIZE REFINERY
 AND PLANTS (CATEGORY A)

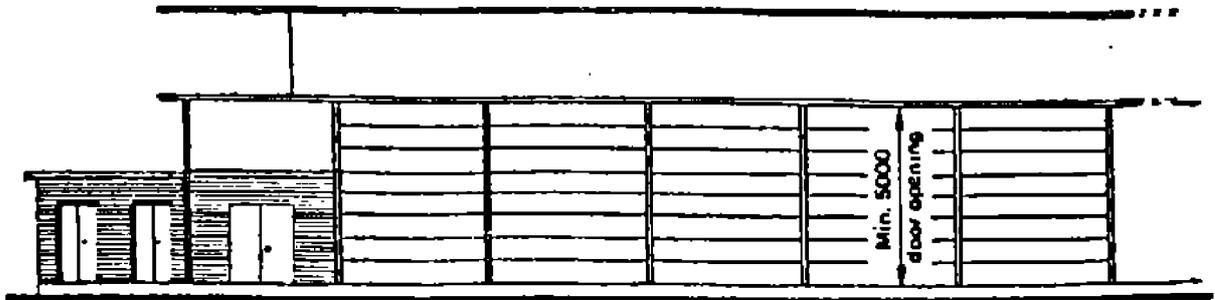


ELEVATION



(to be continued)

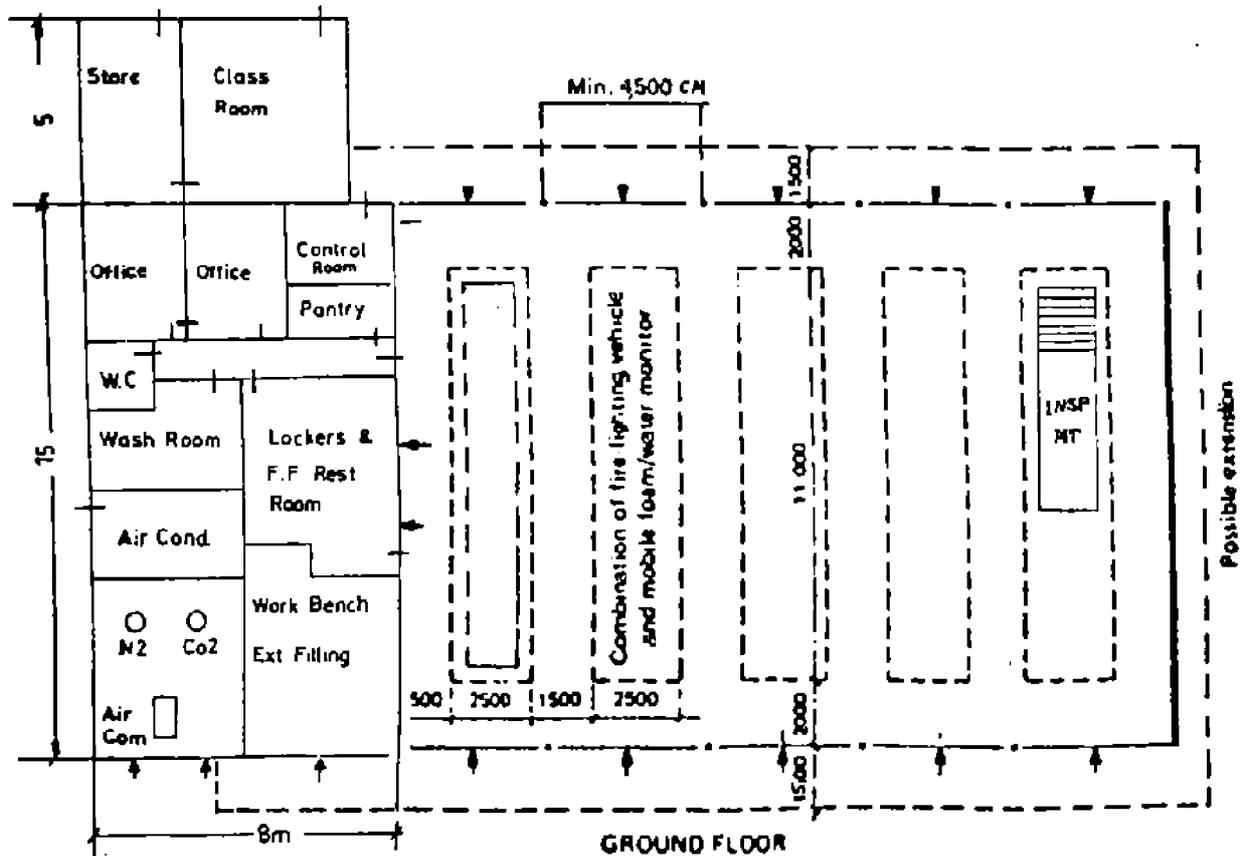
APPENDIX C.2 (continued)
 TYPICAL LAY-OUT OF FIRE STATION
 MEDIUM-SIZE PLANT (CATEGORY B)



ELEVATION

All dimensions are minimum dimensions depend on size and number of fire-fighting vehicles and other equipment.

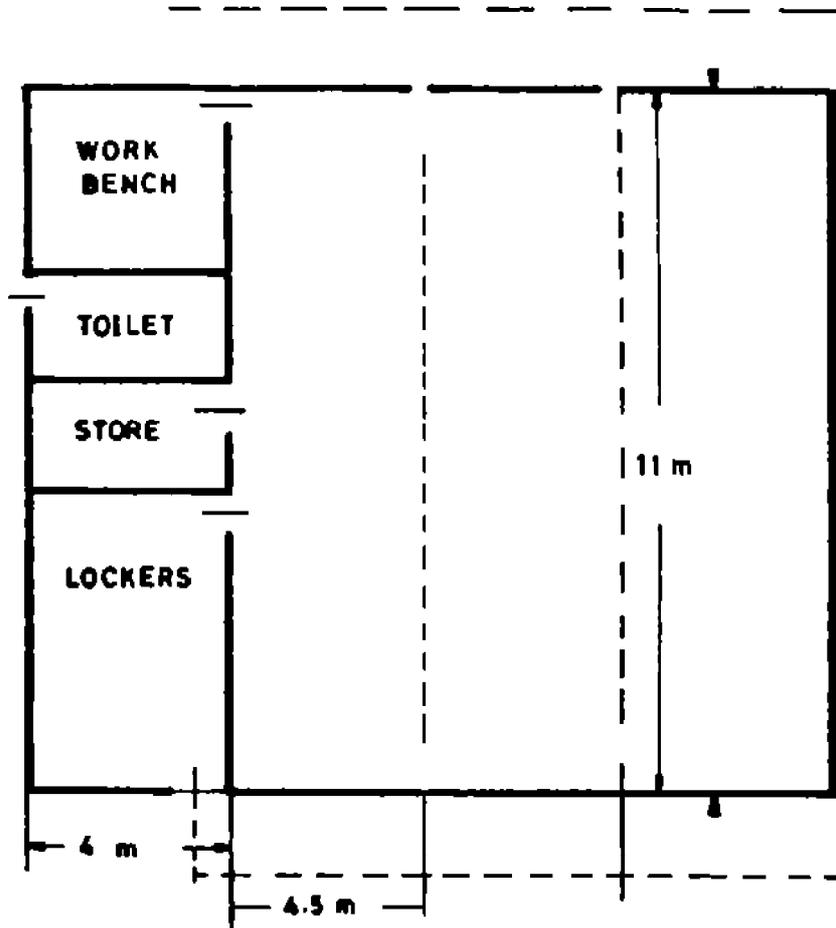
1. Fire fighting exercise and Demonstration yard.
2. Drill yard and parking.



GROUND FLOOR

(to be continued)

APPENDIX C.3
TYPICAL LAY-OUT OF SUB OR RETAINED FIRE STATIONS (CATEGORY C AND D)



TYPICAL LAY-OUT OF SUB AND
RETAINED FIRE STATIONS

