MANUAL

MOVABLE FIRE FIGHTING EQUIPMENT FOR ONSHORE APPLICATIONS

DEP 80.47.10.32-Gen.

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DESIGN AND ENGINEERING PRACTICE

PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of:

Shell International Oil Products B.V. (SIOP)
and
Shell International Exploration and Production B.V. (SIEP)
and
Shell International Chemicals B.V. (SIC)

The Hague, The Netherlands,

and other Service Companies.

They are based on the experience acquired during their involvement with the design, construction, operation and maintenance of processing units and facilities, and they are supplemented with the experience of Group Operating companies. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good design and engineering practice applied by Group companies operating an oil refinery, gas handling installation, chemical plant, oil and gas production facility, or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual operating companies to adapt the information set forth in DEPs to their own environment and requirements.

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NOTE: In addition to DEP publications there are Standard Specifications and Draft DEPs for Development (DDDs). DDDs generally introduce new procedures or techniques that will probably need updating as further experience develops during their use. The above requirements for distribution and use of DEPs are also applicable to Standard Specifications and DDDs. Standard Specifications and DDDs will gradually be replaced by DEPs.

TABLE OF CONTENTS

1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for various types of movable fire extinguishing equipment, for components used for hose systems, for movable foam generating and associated equipment, for personal protective equipment for fire fighters and for miscellaneous equipment associated with fire fighting operations.

This DEP is a revision of the DEP of the same number dated May 1984.

This DEP is applicable both to new onshore projects and to the modification and extension of existing onshore plants.

This DEP shall be used in conjunction with the following DEPs:

Fire-fighting agents	DEP 80.47.10.10-Gen.
Assessment of the fire safety of onshore installations	DEP 80.47.10.30-Gen.
Active fire protection systems and equipment for onshore facilities	DEP 80.47.10.31-Gen.
Fire-fighting vehicles and fire stations	DEP 80.47.10.33-Gen.

The appropriate NFPA codes shall be consulted for equipment not included in this DEP.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by SIOP and SIEP, the distribution of this document is confined to companies forming part of or managed by the Royal Dutch/Shell Group, and to Contractors and Manufacturers/Suppliers nominated by them (i.e. the distribution code is "F", as defined in DEP 00.00.05.05-Gen.).

This DEP is intended for use in oil refineries, chemical plants, gas plants, storage facilities, jetties, terminals, loading and unloading facilities, and onshore oil and gas production installations.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable as regards safety, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this document which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned with the object of obtaining agreement to follow this document as closely as possible.

Replacement by equipment described in this DEP shall be considered whenever the equipment is to be replaced. For extensions to existing installations, the Principal shall consider to specify the manufacturer and type of equipment in accordance with existing equipment and facilities.

1.3 DEFINITIONS AND ABBREVIATIONS

1.3.1 General definitions

The **Contractor** is the party which carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party which manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party which initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the

Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

aqueous film forming foam (AFFF): a synthetic foam consisting of fluorochemical and hydrocarbon surfactants combined with solvents.

assessment: the process of analysing and evaluating hazards. It involves both causal and consequence analysis and requires determination of likelihood and risk.

class A fires: according to CEN and NFPA fires in ordinary combustible materials such as wood, cloth, paper, rubber and many plastics.

class B fires: according to CEN fires in flammable liquids, oils, greases and tars.

class B fires: according to NFPA fires in flammable liquids, oils, greases, tars and flammable gases.

class C fires: according to CEN fires that involve flammable gases.

class C fires: according to NFPA fires that involve energised electrical equipment.

class D fires: according to CEN and NFPA fires in combustible metals, such as magnesium, sodium, potassium.

combustible product: a substance having a flash point > 37.8 °C. Other codes define it as a substance having a flash point > 61 °C. See also flammable product.

dry chemical: according to NFPA various mixtures of finely divided solid particles additionally treated to provide resistance to packing, moisture absorption and proper flow characteristics. These agents are non-conductors and are designed for extinguishment of Class A, B and C fires.

dry chemical powder: term used in DEPs for extinguishing agents used for the extinguishment of Class A, B, C and D fires.

dry powder: according to NFPA solid materials in powder or granular form designed to extinguish Class D fires.

fire area: a plant area where a sustained intense fire is considered credible. In line with API RP 521, a 2500 square feet (232 m^2) surface on fire can be assumed to be the maximum size of fire to be encountered.

fire incident: an event or chain of events which has caused or could have caused injury, damage to assets, the environment or third parties. A fire incident involves the release of a hazard.

fire risk: the product of the chance that a specified undesired fire incident will occur and the severity of the consequences of the event.

flammability: NFPA 704 defines flammability as the degree of susceptibility of materials to burning. NFPA 325 identifies the flammability rating of a large number of substances.

flammable product: according to NFPA a substance having a flash point below 37.8 °C and a maximum vapour pressure of 276 kPa (abs) at 37.8 °C. Other codes define it as a substance having a flash point below 61 °C. See also combustible product and flammability.

hazard: the potential to cause harm, including ill health and injury, damage to property, plant, products or the environment; production losses or increased liabilities.

l/min: liters per minute

master plan fire safety systems: a (set of) drawing(s) covering the entire installation (location) on which all fire, smoke and gas detection systems, active fire protection systems and fire-fighting equipment (fixed, mobile and portable) are indicated.

movable equipment: equipment that can be immediately moved to another location when

required.

portable equipment: movable equipment which can be hand carried by maximum two persons.

prevailing wind: the direction from which the wind is most likely to blow, based on local meteorological observations.

safe: a condition in which all hazards inherent in an operation have either been eliminated or are controlled so that their associated risks are both below a tolerable threshold and are reduced to a level which is as low as reasonably practicable.

trailer mounted equipment: movable equipment mounted on a trailer and intended to be moved to an other location by towing.

wheeled equipment: movable equipment equipped with wheels to improve its mobility. Suitable for hand pulling by one person.

1.3.3 Abbreviations

The following abbreviations are used in this DEP. Other abbreviations used in this DEP are defined at the first place of use:

AFFF	Aqueous Film Forming Foam
FAR	Field Auxiliary Room
FIT	First Intervention Team
HCM	Hazard Consequence Modelling
LNG	Liquefied Natural Gas
NFPA	National Fire Protection Association (USA)
UL	Underwriters Laboratories Inc.

2. GENERAL

Most fires in plants start small and are extinguished by personnel using an appropriate fire extinguisher. Provided all personnel dealing with hydrocarbons and ignition sources in a plant receive regular training to maintain their skill in controlling small fires, the number of small fires escalating into large fires can be kept low.

The need and extent of provision of movable fire-fighting equipment is determined during the fire safety assessment process. During this process the fire and release scenarios per plant area are determined. After fire prevention and fire protection measures are taken a residual fire risk remains. Depending on the extent and nature of that fire risk the appropriate extinguishing medium can be selected, refer to DEP 80.47.10.30-Gen. ‘Assessment of the fire safety of onshore installations’.

Movable fire-fighting equipment as applicable may have to be readily available in process and storage areas, on jetties, and in buildings, offices, laboratories and warehouses. Alternatively it may best be stored at 'Fire-points' or in the Fire Station.

Fire-fighting vehicles are equipped with selected types of portable fire-fighting equipment, refer to DEP 80.47.10.33-Gen. 'Fire-Fighting Vehicles and Fire Stations'.

For new projects, a drawing showing the location of all portable and movable fire-fighting equipment shall be prepared. A list shall be prepared which shall quantify and state the location of the various types of equipment, including hose boxes and fire points, and shall be approved by the Principal. This drawing together with drawings showing fire alarm call points, location of detection equipment, waterspray systems, fire water monitors, firewater distribution system, firewater pumps, foam systems and so on form the **master plan of fire safety systems**.

3. PORTABLE AND WHEELED EXTINGUISHERS

3.1 GENERAL REQUIREMENTS

Fire extinguishers shall be provided at every plant section in such numbers and in such locations that at least one extinguisher is readily accessible from any part of the facility.

Each extinguisher provided shall be of a type suitable for use in fighting a fire of the kind which is most likely to occur in the vicinity in which it is placed.

Portable extinguishers are intended to provide a 'first-aid' fire fighting facility for dealing with small outbreaks of fire. Wheeled extinguishers are of a larger capacity and are suitable to deal with larger fires.

Portable and wheeled fire extinguishers shall, as far as practicable, have a uniform method of operation.

Portable and wheeled fire extinguishers shall be available for immediate use. Brackets for hand-held extinguishers shall be of such a design that the extinguisher can be readily removed from the bracket.

The colour and marking of extinguishers should comply with local authority requirements. In the absence of local requirements a consistent colour coding shall be selected and applied.

3.1.1 Design

In the absence of statutory requirements and/or local standards, extinguishers shall be approved and tested in accordance with a specific design and performance standard such as EN 3, ISO/DIS 11601, the appropriate UL standard or another recognised standard approved by the Principal.

Extinguishers shall be suitable for long term exposure to the prevailing environmental conditions in the location of use. The bodies, brackets and other metal parts shall be treated by the manufacturer to ensure the required degree of corrosion resistance.

For new projects and to replace existing extinguishers preference shall be given to extinguishers of the stored pressure type. Sub-standard maintenance of a stored pressure extinguisher is self revealing.

Poor maintenance of a cartridge-type extinguisher only comes to light when the unit is being pressurised. This has caused fatalities in the past. Cartridge type extinguishers can however be safely used if the standard of maintenance is high.

The extinguisher shell shall have a large filling opening to allow quick recharging.

Components of extinguishers shall be made of metal or a suitable synthetic material. All metal components such as clips and clamps shall be of stainless steel or non-ferrous metal. The extinguisher should have a bottom skirt and shall be suitable for wall mounting.

The hoses shall be made of neoprene or an equivalent reinforced synthetic material and be of a quality which remains flexible under the prevailing environmental conditions.

All extinguishers shall be marked and painted in the colour prescribed by the local standard or alternatively as specified by the Principal. The marking should include a simple pictorial operating instruction, type of extinguishing agent used, capacity in kilograms, hazard identification and statement of type approval. The language used for nameplates shall be English unless otherwise specified.

3.1.2 Inspection, maintenance and care

All fire-fighting equipment needs regular inspection and maintenance. Fire extinguishers in particular require periodic attention to assure that the unit is fully charged and operable.

The efficiency of visual inspections is improved by using extinguishers equipped with seals, pressure gauges or other types of indicators.

Fire extinguishers shall be designed so that they can be readily maintained and serviced. This shall include easy removal and refitting of any parts which may require replacement.

Maintenance shall be carried out in accordance with local regulations when applicable. The frequency shall be never less than once a year to provide assurance that extinguishers will operate effectively and safely when required. Proper maintenance records shall be kept. See also EN 3 and NFPA 10.

Extinguishers should be protected from the weather while ensuring that they can still be used quickly in an emergency. For instance, this can be achieved by covering them with a disposable plastic bag, by protecting them under a durable canvas-type cover or by storing them in a dedicated box with perspex door.

3.1.3 Extinguisher rating systems

The rating of an extinguisher is an indication of its extinguishing performance when used by non-expert personnel. A number of rating systems are in use in the world. In the list below only the European CEN and the American UL ratings for class B fires are given.

3.1.3.1 CEN rating

This rating system is intended for small extinguishers only and is related to the duration of the discharge and the surface area of a heptane fire in a circular tray.

An extinguisher receives its rating when at least two test fires out of three are extinguished.

The lowest “B” rating extinguisher, i.e. 34B, can extinguish a 1.07 square metre fire.

The highest “B” rating extinguisher, i.e. 233B, can extinguish a 7.32 square metre fire.

3.1.3.2 UL rating

The UL 299 rating system is related to the duration of the discharge and the surface area of a heptane fire in a square tray.

The number designating the rating of the extinguisher represents the square feet of fire area that the non-expert operator can expect to extinguish. This is always 40 percent of the fire area the expert operator at UL must extinguish consistently.

A 40-B rating extinguisher, for example, will in the hands of the expert UL operator be able to extinguish a 100 square foot fire consistently. The non-expert operator can expect to extinguish a 40 square foot fire with the same extinguisher.

The lowest “B” rating extinguisher, i.e. 10-B, can in the hands on a non-expert extinguish a 0.93 square metre fire.

The highest “B” rating extinguisher, i.e. 640-B, can in the hands on a non-expert extinguish a 59.5 square metre fire.

3.2 TYPES OF EXTINGUISHERS

3.2.1 Dry chemical extinguishers

3.2.1.1 BC-type dry chemical powders are most effective in extinguishing hydrocarbon and other flammable product fires. They can be urea-based potassium bicarbonate (Monnex)-, sodium bicarbonate-, potassium bicarbonate- or potassium chloride-based powders.

In view of its large extinguishing power per unit weight Monnex is the preferred powder.

3.2.1.2 Multipurpose dry chemical powder, called ABC, can extinguish A-type fires (wood, paper, rubber) and to a lesser extent BC-type fires (hydrocarbons and flammables).

The most widely used 'ABC' powder is mono-ammonium phosphate-based. The disadvantage of this type of powder is that it leaves a glassy deposit on hot surfaces, making thorough cleaning and/or salvage necessary.

3.2.1.3 Portable extinguishers should be of the stored pressure type.

They shall incorporate a pressure gauge showing the normal, minimum and maximum allowable pressure. The gauge shall have a colour-coded pressure range and be located at

the top of the extinguisher.

3.2.1.4 Wheeled extinguishers are pressurised at the time of use. They shall be equipped with a rupture disc to prevent ingress of moisture into the dry chemical powder.

3.2.2 Carbon dioxide extinguishers

These extinguishers are constantly pressurised by CO_2 vapour pressure.

The body of the container shall be made of aluminium or steel, both protected externally with an epoxy paint system.

The design of all carbon dioxide extinguishers shall include a control device to enable the extinguisher discharge to be interrupted freely by the operator.

The discharge horn shall be of dielectric material.

3.2.3 Water extinguishers

Water extinguishers shall be of the stored pressure type. Various additives can be incorporated to allow low temperature operation, or to improve spread and penetration (wetting agents). They are only suitable for use on Class A fires.

They shall incorporate a pressure gauge showing the normal, minimum and maximum allowable pressure. The gauge shall have a colour-coded pressure range and be located at the top of the extinguisher.

3.2.4 Pre-mix foam extinguishers

These extinguishers shall be of the stored pressure type. The type of foam, suitable for the most likely kind of fire, shall be indicated on the extinguisher label. These extinguishers produce low expansion foam. Refer to DEP 80.47.10.10-Gen.

They shall incorporate a pressure gauge showing the normal, minimum and maximum allowable pressure. The gauge shall have a colour-coded pressure range and be located at the top of the extinguisher.

3.2.5 Foam spray extinguishers

These extinguishers shall be of the stored pressure type, containing a pre-mix of water and AFFF and equipped with a special nozzle. These extinguishers produce a finely divided foam spray.

They are particularly suitable for extinguishing the type of fires likely to occur in office spaces and are certified safe for the operator to use on typical electrical office equipment, including personal computers.

As a consequence of the fine spraying of the foam, the damage caused by the foam is slight.

They shall incorporate a pressure gauge showing the normal, minimum and maximum allowable pressure. The gauge shall have a colour-coded pressure range and be located at the top of the extinguisher.

3.2.6 Foam carts

Foam carts are self-contained foam production units equipped with an eductor, a foam branch pipe and interconnecting hoses. They need to be connected to a suitable pressurised water supply, can be operated by one person and have a considerable fire extinguishing power.

3.2.7 Steam lances

Steam can be used to smother small fires caused by leakage from pumps, coolers, columns, furnaces, heat exchangers and valve manifolds handling flammable products.

For details of a steam lance, see Standard Drawing S 88.005.

3.3 SELECTING THE TYPE OF EXTINGUISHER

Fire extinguishers are provided for the purpose of a first attack to small outbreaks of fire. They are installed to deal with the residual fire risk left after extensive fire prevention and fire protection measures have been taken.

3.3.1 BC-type dry chemical powder extinguishers

Dry chemical BC powder extinguishers are the recommended type of standard extinguisher for a petrochemical plant.

They shall be installed in all plant areas, on elevated floors in multi-storey structures, at rail and road loading/discharge facilities and at jetties.

For a typical onshore installation portable dry powder extinguishers with a capacity of about 9 kg and a minimum effective discharge time of 20 seconds (CEN rating 233B; UL rating 120-B) shall be used.

For a typical onshore installation wheeled units with filling weights ranging from 35 to 70 kg (UL rating 240-B) shall be used.

3.3.2 ABC-type dry chemical powder extinguishers

Dry chemical ABC powder extinguishers may be used in offices and stores to extinguish fires involving combustible materials such as wood and paper and flammable liquids. For this purpose 'ABC' powder shall be used.

The advantage of this type of extinguisher is its large extinguishing power compared to that of a water or foam/spray extinguisher. Disadvantages of ‘ABC’ powder are that it leaves a glassy deposit on hot surfaces which always makes thorough cleaning and/or salvage necessary after the event.

Portable ABC extinguishers have a slightly lower rating per unit weight than comparable BC extinguishers.

3.3.3 Carbon dioxide extinguishers

CO_2 extinguishers shall be used for fires on electrical and/or electronic equipment.

This is the recommended type of extinguisher for use in locations such as switch houses, computer rooms, control rooms with auxiliary equipment rooms, analyser buildings and laboratories and areas where food is handled.

For a typical onshore installation portable CO_2 extinguishers shall have a filling weight of about 5 kg (CEN rating 34B; UL rating 10-B).

3.3.4 Water extinguishers

Water extinguishers are particularly suitable for extinguishing smouldering fires of wood or paper. They shall not be used on electrical equipment and shall therefore only be installed in spaces where minimal electric equipment is present. Their use is restricted in areas where freezing can occur.

The capacity of portable water extinguishers shall be 9 litres of filling volume (CEN rating 13A; UL rating 2-A).

3.3.5 Pre-mix foam extinguishers

Pre-mix foam extinguishers can be used in locations where small hydrocarbon spill fires are the most likely fire to occur and where use of a dry chemical powder extinguisher would cause too much damage in addition to the fire damage. They have a limited extinguishing capacity

This type of extinguisher shall not be used on electrical fires. Their use is restricted in areas where freezing can occur.

The capacity of portable extinguishers shall be 9 litres of filling volume (CEN rating 144B; UL rating 20-B).

3.3.6 Foam spray extinguishers

Foam spray extinguishers are the recommended type of extinguisher for use in an office-type environment.

They are not suitable for areas where freezing can occur.

The capacity of these extinguishers is 9 kg filling weight (CEN rating 144B; UL rating 20-B).

3.3.7 Foam carts

Foam carts are easy and quick to operate, require minimal manpower and have a considerable fire extinguishing power. They shall be the main 'first-aid' fire fighting tool for larger spill fires in hydrocarbon processing units and on jetties.

The units can proportion up to 450 litres of foam solution per minute, which produces just over 2 cubic metres of low expansion foam per minute. At this flow rate they can operate for 9 minutes without refilling.

This is the recommended type of extinguisher for plant areas where spills of flammable products are likely to occur.

3.3.8 Steam lances

In process plant areas where small fires are likely to occur and where low pressure steam is available the provision of a number of 15 m length steam hoses with steam lances shall be considered. If required the hoses can be permanently connected to the LP steam utility connections.

3.4 LOCATION / DISTRIBUTION OF EXTINGUISHERS

3.4.1 Process plant and storage/loading areas

3.4.1.1 Portable dry chemical extinguishers

This equipment should be distributed throughout the plant so that anywhere in the plant where there is flammable product, a person is not further away than 15 m from the nearest extinguisher. In this case hand-held extinguishers with a UL rating of 120-B or higher shall be used.

For fire-fighting at higher elevations in multi-storey structures, portable dry chemical extinguishers shall be provided at each level.

For compressors handling flammable gas, at least one extinguisher shall be provided within 5 m of the equipment at each floor level.

The distribution over the plant shall be logical and practical, so that extinguishers are available along all access routes.

3.4.1.2 Wheeled dry chemical extinguishers

Wheeled units shall be located in areas with a high fire risk where a hand extinguisher would not be expected to have sufficient capacity. The units shall also be distributed at ground level throughout process plants, loading/discharge facilities and jetties in addition to hand-held extinguishers. The travel distance to a wheeled unit should range between 30 m and 50 m depending on the expected fire hazard.

3.4.1.3 Foam carts

Foam carts shall be provided at grade in the vicinity of plant areas where larger spills of flammable products are likely to occur.

A firewater hydrant should be available within 50 metres distance.

3.4.1.4 Fire points

In conjunction with the distribution of extinguishers as described above fire points can be

created. For, say, each 1000 m^2 processing area an open shed may be provided which contains a selection of fire extinguishing equipment (large, small, dry chemical, foam, carbon dioxide, portable, wheeled). The advantages are that a relatively small number of fire point locations need to be remembered and that the best suited extinguishing medium is more likely to be selected.

Fire points shall only be provided in and around processing areas.

They shall be open for ease of accessibility and shall have a roof for weather protection.

Unless otherwise specified by the Principal each fire point shall contain:

- Four x 50 kg capacity, wheeled dry chemical powder units;
- Eight x 9 kg capacity, dry chemical powder hand extinguishers;
- One 120 dm^3 capacity foam cart.

3.4.2 Plant buildings

3.4.2.1 Laboratories

Work benches in laboratories shall be provided with a carbon dioxide extinguisher.

3.4.2.2 Analyser buildings and enclosed gas metering stations

Analyser buildings and gas metering stations shall have two carbon dioxide extinguishers positioned on the outside of the building near each entrance. Extinguishers may be required inside the building as well if the travel distance exceeds 20 m.

3.4.2.3 Product warehouses and flammables stores

Warehouses and enclosed flammables stores shall have two dry chemical ABC powder extinguishers positioned on the outside of the building near each entrance. Extinguishers may be required inside the building as well if the travel distance exceeds 20 m.

3.4.2.4 FARs, auxiliary rooms and switch houses

Rooms with electrical/electronic control equipment shall have two carbon dioxide extinguishers located on the outside of the room near each entrance. Additional extinguishers may be required inside the room as well if the travel distance exceeds 6 m.

3.4.3 Office buildings and general stores

The travel distance to extinguishers located in offices and stores shall not exceed 30 m. Depending on the fire hazard in the office space concerned a carbon dioxide extinguisher or a foam spray extinguisher shall be selected. For general fire fighting a hose reel shall be provided.

4. WATER-BASED MOVABLE EQUIPMENT

4.1 FIRE HOSES AND ASSOCIATED EQUIPMENT

4.1.1 Fire hoses

Fire hoses to be used in onshore plants shall have a diameter of 40 and 65 mm. They are typically 25 m long and fitted with a Storz, Instantaneous or other type of coupling.

The hoses shall be in accordance with BS 6391 type 3 (or equivalent) with couplings secured to the hoses with stainless steel binding wire. The hoses shall be suitable for a working pressure of 15 bar (ga) and a test pressure of 25 bar (ga).

For large capacity supply of fire water to monitors, to fixed or mobile equipment or to 40 mm handlines, 65 mm diameter hoses should be used to minimise pressure losses.

40 mm diameter hoses should be used for the last downstream section(s) of handlines. The reduced flow capacity results in a smaller reaction force to be coped with by the nozzle men; the less rigid pressurised hose will allow the nozzle men to manoeuvre it more easily.

Both 40 mm and 65 mm diameter hoses shall be equipped with the same size of coupling, normally the nominal 65 mm size.

4.1.2 Coupling types

When selecting the type of hydrant coupling, consideration shall be given to the coupling type in use by other fire brigades in the area. Alternatively, appropriate adapters shall be provided enabling interchange of equipment with the others.

Storz couplings should be used. Instantaneous couplings may be used with the approval of the Principal or shall be used where required by local authorities.

The number of types and sizes of couplings used at a site shall be kept to a minimum.

4.1.3 Hose interconnecting components

Hose interconnecting components such as collecting and dividing breechings and adapters are mainly used in major fire hose operations involving the plant fire brigade and are consequently part of the inventory of fire-fighting vehicles.

The need for these components shall be determined by the local fire fighting specialist. They shall be suitable for a working pressure of 15 bar (ga) and a test pressure of 25 bar (ga).

The material of construction shall have adequate corrosion resistance for the environmental conditions and fire water quality used.

Weight considerations may influence the material selection, as the total weight shall not exceed 30 kg.

4.1.4 Pressure reducers

If a pressure greater than 8 bar (ga) can be generated in the firewater main **and** it is unavoidable that firewater will be used for cleaning or other purposes, pressure reducers shall be installed between the hydrant valve and the consumer.

The objective of the reducer is to protect the branch pipe nozzle operator from the reaction of the hose and nozzle to the sudden increase of pressure in the firewater main.

This device is a self regulating flow limiter and shall be sized to control the flowing pressure to 7 bar (ga) for the hand-held branch pipe nozzle size adopted.

The reducer shall be constructed of metal with adequate corrosion resistance for the environmental conditions and fire water quality used.

4.2 WATER BRANCH PIPES AND MONITORS

4.2.1 Hand-held water branch pipes

The branch pipe :

- have either a separate shut-off valve and spray angle adjustment with clear marking of the setting;
- or shall be of the "close-fog-jet" type with a single control device with a clear marking of the setting.

The components upstream of and including the shut-off valve shall be suitable for a maximum pressure of 15 bar (ga).

The materials used for the branch pipe shall have adequate corrosion resistance for the environmental conditions and fire water quality used.

A nominal 500 l/min branch pipe when connected to a 40 mm hose with a 10 bar (ga) water supply pressure, can be easily and safely operated by one person.

Larger capacity hand-held branch pipes, up to 1000 l/min, should only be used when sufficient trained fire fighting manpower is available in the FIT.

4.2.2 Portable water monitors

Portable monitors are typically used to provide back-up for fixed systems, for protection of process equipment which is not protected by fixed systems and to relieve personnel undertaking prolonged and arduous fire fighting operations.

After being placed in position and directed they shall be capable of being left unattended in operation during the incident. They shall be equipped with suitable feet to permit safe operation on concrete paving. The monitor shall be of such a design that the hydraulic forces, including the pressure shock at the start, are balanced.

Each water inlet to the unit shall be equipped with a spring loaded non-return valve to ensure continued operation in case a supply hose fails.

Portable monitors shall be equipped with a nozzle with an adjustable stream pattern.

At 7 bar (ga) inlet pressure the water jet at 30° elevation shall reach 50 m. The footprint shall be 4 m x 6 m. 80 percent of the total water flow shall reach the footprint.

At 7 bar (ga) inlet pressure the water fog at 30° elevation and 30° nozzle position shall reach 18 m. The footprint shall be 7 m x 8 m. 80 percent of the total water flow shall reach the footprint.

Since portable monitors often have to be transported over obstacles and sometimes over considerable distances they shall not be heavier than 30 kg. It shall be possible for two fire fighters to place a monitor into position.

The materials of construction shall have adequate corrosion resistance for the environmental conditions and fire water quality used. Weight considerations may influence the material selection.

The monitors shall have a horizontal traverse of 180° and a vertical elevation of 30° minimum and 80° maximum. It shall be possible to lock the traverse and elevation in any chosen position.

The capacity of the monitors should be typically 2000 l/min, at a working pressure of 10 bar (ga). They shall not have a shut-off facility. The maximum operating pressure shall be 15 bar (ga).

4.2.3 Wheeled water monitors

Wheeled monitors shall be designed for mobility and shall be of the hand pulling type, able to be manoeuvred by one man over uneven terrain. They shall be equipped with two or four solid rubber wheels and be provided with a facility to store two fire hoses.

After being placed in position and directed, they shall be capable of being left unattended in

operation during the incident. They shall be equipped with lockable wheels and/or adjustable drop-legs to permit safe operation on concrete paving. The monitor shall be of such a design that the hydraulic forces, including the pressure shock at the start, are balanced.

Each water inlet to the unit shall be equipped with a spring loaded non-return valve to ensure continued operation in case a supply hose fails.

Wheeled monitors shall be equipped with a nozzle with an adjustable stream pattern.

At 7 bar (ga) inlet pressure the water jet at 30° elevation shall reach 50 m. The footprint shall be 4 m x 6 m. 80 percent of the total water flow shall reach the footprint.

At 7 bar (ga) inlet pressure the water fog at 30° elevation and 30° nozzle position shall reach 18 m. The footprint shall be 7 m x 8 m. 80 percent of the total water flow shall reach the footprint.

The materials of construction shall have adequate corrosion resistance for the environmental conditions and fire water quality used.

The monitors shall have a vertical elevation of 30° minimum and 80° maximum. It shall be possible to lock the elevation in any chosen position.

The capacity of the monitors should be typically 2000 l/min, at a working pressure of 10 bar (ga). They shall not have a shut-off facility. The maximum operating pressure shall be 15 bar (ga).

4.2.4 Trailer type water monitors

Trailer type water monitors should be considered for locations where there may be a need for water monitors to be deployed anywhere on site.

They shall be equipped with two or four pneumatic wheels, a height-adjustable small front steering wheel, a towing pole, suspension, a mechanical hand brake, an overrun brake, drop-legs, road illumination, reflectors and an open storage locker with four fire hoses.

After being placed in position and directed they shall be capable of being left unattended in operation during the incident. The adjustable drop-legs shall permit safe operation on concrete paving. The monitor will be of such a design that the hydraulic forces, including the pressure shock at the start, are balanced.

Each water inlet to the unit shall be equipped with a spring loaded non-return valve to ensure continued operation in case a supply hose fails.

This type of monitors shall be equipped with a nozzle with an adjustable stream pattern.

At 7 bar (ga) inlet pressure the water jet at 30° elevation shall reach 50 m. The footprint shall be 4 m x 6 m. 80 percent of the total water flow shall reach the footprint.

At 7 bar (ga) inlet pressure the water fog at 30° elevation and 30° nozzle position shall reach 18 m. The footprint shall be 7 m x 8 m. 80 percent of the total water flow shall reach the footprint.

The materials of construction shall have adequate corrosion resistance for the environmental conditions and fire water quality used.

The monitors shall have a horizontal traverse of 180° and a vertical elevation of 30° minimum and 80° maximum. It shall be possible to lock the traverse and elevation in any chosen position.

The capacity of the monitors should be typically 2000 l/min, at a working pressure of 10 bar (ga). They shall not have a shut-off facility. The maximum operating pressure shall be 15 bar (ga).

Note: A number of Manufacturers market combined water and foam monitors on trailers. A two-way valve directs the flow to either the water nozzle or the foam barrel.

5. FOAM-BASED MOVABLE EQUIPMENT

5.1 IN-LINE FOAM INDUCTORS

If there is a need for producing foam and a fire fighting vehicle, a foam station or a foam cart is not available, the use of in-line foam inductors shall be considered.

Their basic function is to proportion foam concentrate with water. They shall be equipped with a foam pick-up tube, a filter element and a 1.5 m long hose.

In-line foam inductors may take suction from 25 litre cans, 200 litre drums or larger containers. Higher capacity inductors may consequently require a lot of can or drum handling.

Firewater of about 10 bar is required for in-line inductors to perform well. Another pre-requisite for good performance is that the capacity of the inductor shall match that of the connected foam application device.

5.2 LOW EXPANSION FOAM EQUIPMENT

5.2.1 Hand-held low expansion foam branch pipes

Foam branch pipes shall be specified for use with premix foam solution. The foam branch pipes receive the ready made foam solution either from a fire-fighting vehicle, from an in-line variable foam inductor, or from a fixed foam station.

Foam branch pipes produce aspirated foam with an expansion factor of between 6 and 8.

The materials of construction shall have adequate corrosion resistance for the environmental conditions, the foam solution concerned and the fire water quality used.

The most commonly applied hand-held foam branch pipes have capacities of around 500 l/min foam solution at a working pressure of 7 bar (ga). At that pressure the reach shall be more than 25 m.

5.2.2 Portable low expansion foam monitors

These monitors are typically used to cover large areas with foam during fires or hydrocarbon spills in plants.

After being placed in position and directed by fire fighters they shall be capable of being left unattended in operation during the incident. They shall be equipped with suitable feet to permit safe operation on concrete paving. The monitor shall be of such a design that the hydraulic forces, including the pressure shock at the start, are balanced.

Each foam solution inlet to the unit shall be equipped with a spring loaded non-return valve to ensure continued operation in case a supply hose fails.

Foam monitors shall be specified for use with premix foam solution. The monitor receives the ready made foam solution either from a fire-fighting vehicle, from an in-line variable foam inductor, or from a fixed foam station.

Portable monitors shall be of the aspirated type and produce foam with an expansion factor of between 6 and 8.

The barrel should be equipped with an adjustable "blabbermouth" spray device.

At 7 bar (ga) inlet pressure the foam jet at 30° elevation shall reach 50 m. The footprint shall be 4 m x 6 m. 80 percent of the total foam flow shall reach the footprint.

Since portable monitors often have to be transported over obstacles and sometimes over considerable distances they shall not be heavier than 30 kg. It shall be possible for two fire fighters to place a monitor into position.

The materials of construction shall have adequate corrosion resistance for the environmental conditions, the foam solution concerned and the fire water quality used. Weight considerations may influence the material selection.

The monitors shall have a horizontal traverse of 180° and a vertical elevation of 30°

minimum and 80° maximum. It shall be possible to lock the traverse and elevation in any chosen position.

The capacity of the monitors should be typically 2000 l/min, at a working pressure of 10 bar (ga). They shall not have a shut-off facility. The maximum operating pressure shall be 15 bar (ga).

5.2.3 Tripod mounted low expansion foam monitors

These monitors are typically used to deliver foam onto large tanks.

After being placed in position by fire fighters they shall be capable of being left unattended in operation during the incident. They shall be equipped with suitable feet to permit safe operation on concrete paving. The monitor shall be of such a design that the hydraulic forces, including the pressure shock at the start, are balanced.

Each foam solution inlet to the unit shall be equipped with a spring loaded non-return valve to ensure continued operation in case a supply hose fails.

Foam monitors shall be specified for use with premix foam solution. The monitor receives the ready made foam solution either from a fire-fighting vehicle, from an in-line variable foam inductor, or from a fixed foam station.

This type of monitor shall be of the aspirated type and produce foam with an expansion factor of between 6 and 8.

In view of its intended use the reach shall be as large as possible. There is thus no need for an adjustable "blabbermouth" spray device on the barrel.

At 7 bar (ga) inlet pressure the foam jet at 30° elevation shall reach 50 m. The footprint shall be 4 m x 6 m. 80 percent of the total foam flow shall reach the footprint.

The materials of construction shall have adequate corrosion resistance for the environmental conditions, the foam solution concerned and the fire water quality used. Weight considerations may influence the material selection.

Once put into operation neither the horizontal traverse nor the vertical elevation can be subsequently adjusted. This is a major drawback of this type of monitor.

The capacity of the monitors should be typically 3000 l/min, at a working pressure of 10 bar (ga). They shall not have a shut-off facility. The maximum operating pressure shall be 15 bar (ga).

5.2.4 Trailer type low expansion foam monitors

Trailer type foam monitors should be considered for locations where there may be a need for very large capacity low expansion foam monitors for deployment anywhere on site.

They shall be equipped with two or four pneumatic wheels, a height-adjustable small front steering wheel, a towing pole, suspension, a mechanical hand brake, an overrun brake, drop-legs, road illumination, reflectors and an open storage locker with four fire hoses.

After being placed in position and directed they shall be capable of being left unattended in operation during the incident. The adjustable drop-legs shall permit safe operation on concrete paving. The monitor shall be of such a design that the hydraulic forces, including the pressure shock at the start, are balanced.

Each foam solution inlet to the unit shall be equipped with a spring loaded non-return valve to ensure continued operation in case a supply hose fails.

Foam monitors shall be specified for use with premix foam solution. The monitor receives the ready made foam solution either from a fire-fighting vehicle, from an in-line variable foam inductor, or from a fixed foam station.

The monitors shall be of the aspirated type and produce foam with an expansion factor of between 6 and 8.

The barrel should be equipped with an adjustable "blabbermouth" spray device.

At 7 bar (ga) inlet pressure the foam jet at 30° elevation shall reach 50 m. The footprint shall

be 4 m x 6 m. 80 percent of the total foam flow shall reach the footprint.

The materials of construction shall have adequate corrosion resistance for the environmental conditions, the foam solution concerned and the fire water quality used. Weight considerations may influence the material selection.

The monitors shall have a horizontal traverse of 180° and a vertical elevation of 30° minimum and 80° maximum. It shall be possible to lock the traverse and elevation in any chosen position.

The capacity of the monitors should be typically 4000 l/min, at a working pressure of 10 bar (ga). They shall not have a shut-off facility. The maximum operating pressure shall be 15 bar (ga).

5.2.5 High back-pressure low-expansion foam generators

Under circumstances where it is not possible to generate expanded foam at the location where it has to be applied and where the back pressure on the generator exceeds 2 bar, high back pressure foam generators (HBPG) shall be used. The maximum allowable back pressure shall not exceed 40 percent of the inlet pressure.

This type of equipment is used to aspirate air into the foam solution. The aspirated foam (expansion ratio between 1:3 and 1:4) is further transported through the piped system to the location where the expanded foam is ultimately released.

In hydrocarbon processing plants they are used for the generation and supply of foam to either subsurface or semi-subsurface foam injection systems on fixed roof storage tanks. They may also be used to supply foam to rim seal foam pourers on floating roof tanks.

A high inlet pressure is required for foam generation by this type of equipment, since the pressure loss over the high back pressure foam generator is relatively high. However the pressure loss across the generator should not exceed 70% of the inlet pressure.

The capacity of the generator shall be matched to that of the foam inlet device concerned to ensure proper operation.

The materials of construction shall have adequate corrosion resistance for the environmental conditions, the foam solution concerned and the fire water quality used.

It is recommended to standardise on one size of HBPG (typically 900 l/min) and to use multiples, if required.

5.3 MEDIUM EXPANSION FOAM EQUIPMENT

5.3.1 Hand-held medium expansion foam branch pipes

In cases where fire-fighting access is poor (e.g. complex hydrocarbon containing equipment in a pit) and where the use of conventional fire fighting methods are not likely to be successful, the use of medium expanded foam to smother the fire should be considered.

Hand-held medium expansion foam generators shall be specified for use with premix foam solution. Foam concentrate normally used for low expansion foam generating equipment is also suitable for generating medium expansion foam. The foam branch pipes receive the ready made foam solution either from a fire-fighting vehicle, from an in-line variable foam inductor, or from a fixed foam station.

Foam branch pipes produce aspirated foam with an expansion factor of about 50.

The branch pipe shall be of the constant flow type and shall be equipped with a shut-off valve.

The materials of construction shall have adequate corrosion resistance for the environmental conditions, the foam solution concerned and fire water quality used.

The most commonly applied hand-held foam branch pipes have capacities of around 500 l/min foam solution at a working pressure of 7 bar (ga). At that pressure the reach shall be at least 8 m.

5.4 MEDIUM TO HIGH EXPANSION FOAM EQUIPMENT

5.4.1 Medium to high expansion foam generators

Fixed medium to high expansion (between 1:250 and 1:500) foam generators can be used to control LNG fires.

Because of the very limited reach of this foam, the generators are not safely accessible during a fire or a major spill. They are consequently not considered a movable device.

5.5 HIGH EXPANSION FOAM EQUIPMENT

5.5.1 High expansion foam generators

High expansion (between 1:500 and 1:1000) foam generators can be used to control fires in enclosed spaces like warehouses, tunnels, ships' holds and basements.

Controlling these types of fires is beyond the normal duties of a typical hydrocarbon processing plant fire brigade.

The use of mobile high expansion foam generators shall therefore be left to specialist fire fighters, like the municipal fire brigades.

6. LOCATION / DISTRIBUTION OF WATER- AND FOAM-BASED MOVABLES

Lining up the components of water-and foam-based movables requires considerable time and manpower. In hydrocarbon processing installations with low operating manpower levels, the use of this type of labour intensive water-and foam-based equipment for first-aid fire fighting is therefore no longer considered a feasible option.

Only fire protection and fire fighting equipment which can be quickly deployed shall be used for this purpose.

The further fighting of larger fires shall be left to the FIT and/or other fire-brigades.

6.1 FOAM CARTS

Foam carts are self contained foam production units, are easy and quick to operate, require minimal manpower and have a considerable fire extinguishing power.

They need to be connected to a suitable pressurised water supply, can be operated by one person and have a considerable fire extinguishing power.

This is the recommended type of foam producing movable for plant areas where spills of flammable products are likely to occur.

Foam carts shall be provided at grade in the vicinity of plant areas where larger spills of flammable products are likely to occur.

A firewater hydrant should be available within 50 metres distance.

They shall be protected against the weather, e.g. by storing them under a durable canvas-type cover.

6.2 HOSES / MONITORS / FOAM GENERATORS

6.2.1 Movables located in the plant

Wheeled water monitors are typically provided in plants to protect process equipment which is not protected by fixed systems. They are easy and quick to operate, require minimal manpower and are a very flexible means of protection. Once installed, they relieve manpower.

They shall be protected against the weather, e.g. by storing them under a durable canvas-type cover.

6.2.2 Movables located on board fire fighting vehicles

Fire hoses and associated equipment, hand-held water- and foam-branch pipes, portable water- and foam-monitors as well as tripod mounted foam monitors shall be carried on board the fire fighting vehicles.

Spares shall be stored in the fire station.

6.2.3 Movables located in the fire station

Trailer-type water- and foam-monitors are typically stationed in the fire station and are towed by a vehicle to the location where they are to be deployed.

In locations where there is an obvious need for a trailer type foam monitor but no obvious need for a trailer type water monitor, the use of the foam monitor for water as well should be considered. A foam monitor used in water service will give at least the same volumetric throwing capacity as a water monitor, but has limited control over the jet and thus less throwing distance.

Combined water and foam monitors are also available on trailers, using a two-way valve to direct the flow to either the water nozzle or the foam barrel.

6.3 HOSE BOXES

Only in exceptional cases shall hose boxes be provided in plant areas. If a plant or external fire brigade is not available or if response by the fire brigade is expected to be too slow and if fire control/extinguishing capacity cannot be provided by other means, the provision of horse boxes may be required.

When hose boxes are provided they shall typically contain 2 standard length fire-water hoses, 1 water branch pipe, 1 foam branch pipe with a built-in inductor, 40 litres foam compound in containers and 2 coupling spanners. They shall be positioned near hydrants in the vicinity of areas where fires may occur. Hose boxes may be up to 150 m apart.

Hose boxes shall be made of materials with adequate corrosion resistance for the environmental conditions. The hose box shall be closed by a door or a cover which can be removed by one person. The door or cover shall be sealed with a lead seal or similar device making pilfering or tampering evident but still making it possible to easily open the box if required.

7. MISCELLANEOUS

7.1 FIRE PROTECTIVE CLOTHING

Plant personnel who actually fight the fire shall be equipped with appropriate personal protective equipment.

For hygiene reasons it should be considered to provide all potential fire fighters with their own protective equipment. The alternative is to clean all Personal Protective Equipment (PPE) thoroughly after each use.

See also the PPE Guide issued by the Shell HSE Committee.

7.1.1 Body protection

A one piece or two piece suit shall provide protection against radiated heat and flame lick. The suit shall be designed for extended periods close to heat sources without hazard to the wearer. In the design of the suit a balance shall be found between the protection against external heat and the ventilation the suit provides to dispose of excess body heat. It shall be designed to be worn with a fire helmet with visor.

The jacket shall have a high collar to protect the chin, neck and throat. The length of the jacket shall be adequate to prevent access of flame between jacket and trousers.

The trousers shall be provided with adjustable braces. The leg length shall be sufficient for the trouser leg bottoms to fit over boots.

The suit shall be lined with non-flammable material. It shall be inherently flameproof and shall meet EN 469, BS 6249 Index B, NFPA 1971 or equivalent. The suit shall be tested in accordance with BS 6249 or equivalent.

7.1.2 Hand and arm protection

Fire-fighter's gloves shall protect the hand and arms. The design shall incorporate gauntlets, giving a minimum overall length from finger tip to cuff of 30 cm.

The material shall be inherently fireproof, shall conform to BS 3120 or equivalent and shall have been tested in accordance with EN 659, BS 3119 or equivalent.

7.1.3 Foot protection

Fire-fighter's boots shall protect the feet against the various hazards which may be encountered during fire fighting operations.

The design shall include a steel toe cap, a steel plate inner sole and a non-conductive sole with adequate tread to give good grip. Boots shall be conform NFPA 1971 or equivalent.

7.1.4 Head protection

Fire-fighter's helmets shall be manufactured from glass reinforced plastic or other approved material with impact and bump resistance conforming to BS 5240, NFPA 1971 or equivalent. The resistance to elevated temperatures shall conform to BS 3864 or equivalent.

The helmet shall be equipped with a clear transparent full face pivoted visor of the tilt-up/tilt-down type.

7.2 SELF CONTAINED BREATHING APPARATUS

For fire fighting operations inside buildings or confined spaces or in toxic atmospheres respiratory protection shall be provided to the fire fighters.

Self contained breathing apparatus shall provide 30 to 45 minutes nominal protection.

The design of the apparatus shall enable the wearer to breathe air on demand from a high pressure air cylinder via a demand valve connected to the face mask. The exhaled air shall pass from the face-mask through a non-return valve to the atmosphere.

The apparatus shall be designed and constructed to prevent ingress of the external atmosphere, within the limits set out in BS 4667. It shall operate on Automatic Positive Pressure mode.

The design shall conform to EN 137 or an equivalent standard approved by the Principal.

The total mass of the apparatus should not exceed 16 kg.

The storage capacity of the compressed air cylinder(s) attached to the apparatus and carried by the wearer shall be 1800 litres of free air, which is sufficient for 45 minutes based on an estimated consumption of 40 litres per minute.

There shall be an audible warning when 80% of the usable capacity has been consumed.

Lightweight composite cylinders of a spun metal/carbon fibre type may be used only if approved by local regulations.

7.3 SAFETY SHOWERS / EYE WASH STATIONS / JUMP PITS

Safety showers are preferred over jump pits in view of the hygiene problems with jump pits.

Safety showers shall be provided in areas where flammable products are handled and personnel may be exposed to the released product (on fire). They shall not be farther away than 30 m from the potential hazard.

For situations where personnel can be exposed to corrosive materials, safety showers shall be combined with eye wash stations.

Safety showers and eye wash stations shall be supplied with clean fresh water with a temperature between 15 and 36 °C.

Water supply to the safety shower shall be activated by a pull-rod or a step-on platform. For the safety shower, approximately 190 litres per minute at 4 bar (g) shall be supplied.

If the supply pressure may fluctuate widely the water supply to the eye wash shall be provided with a regulating valve. The eye wash station shall use nozzles which aerate the water. Water supply to the eye wash station shall be activated by a hand or elbow operated spring loaded quarter turn valve. The water rate for the eye wash station shall be approximately 30 litres per minute.

The safety shower shall be fitted with a device which is activated when the shower is being used and which will raise an alarm in the control room.

7.4 HOSE REELS

Firewater hose reels are intended for indoor use. They are simple to use and can, if required, be immediately used as they are permanently connected to a domestic water source. The inlet valve to the hose shall be clearly marked.

The hose reel shall not be connected to the fire water system in view of the possibility of large pressure fluctuations and surges.

Hose reels shall be installed in corridors near entrances, positioned such that each individual space in the building is well within reach of one or more nozzles.

Hoses should be ¾ " diameter with a length of 20 m. The nozzle shall be a combination nozzle adjustable from shut-off through spray to jet. The minimum reach in jet mode shall be 10 m.

See EN 671 for details on hose reels.

7.5 MOVABLE DIESEL DRIVEN GENERATOR SETS AND FLOOD LIGHTS

For sites which are not adequately illuminated the provision of movable power generator units shall be considered, providing power for emergency lighting of the working area at the scene of the fire.

Each unit shall include at least 4 telescopic lamp posts and heavy duty tripods to reach a

height of 2.5 m, with explosion proof lamp fittings each of 1000 W.

The generator shall have a continuous operational capacity of 10 kW, be equipped with explosion proof sockets, a spark arrestor in the exhaust and an automatic shutdown valve in the air intake of the diesel engine for protection against flammable gas clouds.

See also DEP 33.65.11.31-Gen.

7.6 MOVABLE DIESEL DRIVEN PUMPS

Portable lightweight pumping units shall be considered for process plants where the plant drainage system has insufficient capacity to handle the normal firewater water quantities used in the event of a fire.

Pumping units shall comply with the specifications given in DEP 80.47.10.33-Gen. Pumps portable by two persons typically have a capacity of 2500 l/min at a discharge pressure of 7 bar (ga), with a suction lift of 3 m of water.

8. REFERENCES

In this DEP, reference is made to the following publications:

NOTE: Unless specifically designated by date the latest issue of each publication shall be used (together with any amendments/supplements/revisions thereto).

SHELL STANDARDS

Index to DEP publications and standard specifications	DEP 00.00.05.05-Gen.
Index to standard drawings	DEP 00.00.06.06-Gen.
Skid mounted package unit generators	DEP 33.65.11.31-Gen.
Fire fighting agents	DEP 80.47.10.10-Gen.
Assessment of the fire safety of onshore installations	DEP 80.47.10.30-Gen.
Active fire protection systems and equipment for onshore facilities	DEP 80.47.10.31-Gen.
Fire-fighting vehicles and fire stations	DEP 80.47.10.33-Gen.
Personal Protective Equipment Guide	Shell HSE Committee

STANDARD DRAWINGS

NOTE: The latest edition of Standard Drawings can be found in DEP 00.00.06.06-Gen.

Steam lance	S 88.005

AMERICAN STANDARDS

Guide for pressure-relieving and depressuring systems	API RP 521

Issued by:
American Petroleum Institute
Publication and Distribution Section
2101 L Street N.W.
Washington, D.C. 2003J
USA.

Standard for portable fire extinguishers	NFPA 10
Protective ensemble for structural fire fighting	NFPA 1971

Issued by:
National Fire Protection Association
Batterymarch Park, Quincy, MA 02269
USA.

BRITISH STANDARDS

Method of test for flame proof materials	BS 3119
Performance requirement of flame proof material for clothing	BS 3120
Firemen's helmets	BS 3864
Open circuit breathing apparatus	BS 4667
General purpose industrial safety helmets	BS 5240
Materials and material assemblies used in clothing for protection against heat and flame	BS 6249

Fire hoses	BS 6391

Issued by:
British Standards Institution
389 Chiswick High Road
London W4 4AL
England, United Kingdom.

EUROPEAN STANDARDS

Portable fire extinguishers	EN 3
Respiratory protective devices; self-contained open-circuit compressed air breathing apparatus; requirements, testing, marking	EN 137
Protective clothing for firefighters - Requirements and test methods for protective clothing for firefighting	EN 469
Protective gloves for firefighters	EN 659
Fixed firefighting systems - Hose systems	EN 671

Issued by:
Secrétariat Central
Rue de Stassart 36
B-1050 Brussels
Belgium.

Copies can also be obtained from national standards organizations

INTERNATIONAL STANDARDS

Fire protection equipment - Wheeled extinguishers - Performance and construction requirements	ISO/DIS 11601

Issued by:
International Organisation for Standardisation
1, Rue de Varembé
CH-1211 Geneva 20
Switzerland.

Copies can also be obtained from national standards organizations.