



# Engineering Standard

SAES-B-019

15 March 2006

## Portable, Mobile and Special Fixed Firefighting Equipment

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## Saudi Aramco DeskTop Standards

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## 1 Scope

This Standard contains the minimum mandatory requirements for providing portable, mobile, and special fixed firefighting equipment for process, light industrial, and service facility areas. Table 1, "Occupancy and Protection Needs," summarizes fire protection equipment applications included in this Standard, as well as in SAES-B-017 and SAES-B-018.

*Exception:*

*Where this Standard is in conflict with specialized requirements for offshore platforms, covered in SAES-B-009; for piers, wharves, sea islands, in SAES-B-060; and bulk plants/air fueling operations, in SAES-B-070, those Standards shall govern.*

## 2 Conflicts and Deviations

- 2.1 Any conflicts between this Standard and other applicable Saudi Aramco Engineering Standards (SAESs), Saudi Aramco Materials System Specifications (SAMSSs), Saudi Aramco Standard Drawings (SASDs), or industry standards, codes, and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Loss Prevention Department of Saudi Aramco, Dhahran.
- 2.2 Direct all requests to deviate from the Standard in writing to the Company or Buyer Representative, who shall follow internal company procedure SAEP-302 and forward such requests to the Manager, Loss Prevention Department of Saudi Aramco, Dhahran.

## 3 References

All referenced Specifications, Standards, Codes, Forms, Drawings, and similar material shall be considered part of this Standard to the extent specified herein and shall be of the latest issue (including all revisions, addenda, and supplements) unless stated otherwise.

### 3.1 Saudi Aramco References

Saudi Aramco Engineering Procedure

*SAEP-302*

*Instructions for Obtaining a Waiver of a  
Mandatory Saudi Aramco Engineering  
Requirement*

Saudi Aramco Engineering Standards

*SAES-B-005*

*Spacing and Diking for Atmospheric and Low  
Pressure Tanks*

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<i>SAES-B-006</i>	<i>Fireproofing in Onshore Facilities</i>
<i>SAES-B-009</i>	<i>Fire Protection and Safety Requirements for Offshore Production Facilities</i>
<i>SAES-B-014</i>	<i>Safety Requirements for Plant and Operations Support Buildings</i>
<i>SAES-B-017</i>	<i>Fire Water System Design</i>
<i>SAES-B-018</i>	<i>Air Foam Systems for Storage Tanks</i>
<i>SAES-B-060</i>	<i>Fire Protection for Piers, Wharves and Sea Islands</i>
<i>SAES-B-070</i>	<i>Bulk Plants and Air Fueling Operations</i>
<i>SAES-M-100</i>	<i>Saudi Aramco Building Code</i>
<i>SAES-S-050</i>	<i>Sprinkler and Standpipe System Components in Buildings</i>

#### Saudi Aramco Materials System Specification

<i>21-SAMSS-011</i>	<i>Fluoroprotein Foam Concentrate for MTBE Hydrocarbon Fires</i>
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#### Saudi Aramco General Instructions

<i>GI-1781.001</i>	<i>Inspection, Test, and Maintenance of Fire Protection Equipment</i>
<i>GI-1782.001</i>	<i>Testing, Inspection and Maintenance of Fixed Fire Protection Systems</i>

### 3.2 Industry Codes and Standards

#### International Fire Code Institute

<i>UFC</i>	<i>Uniform Fire Code - 1994 Edition</i>
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#### National Fire Protection Association

<i>NFPA 1</i>	<i>Fire Prevention Code</i>
<i>NFPA 10</i>	<i>Portable Fire Extinguishers</i>
<i>NFPA 11C</i>	<i>Mobile Foam Apparatus</i>
<i>NFPA 12</i>	<i>Carbon Dioxide Extinguishing Systems</i>
<i>NFPA 12A</i>	<i>Halon 1301 Fire Extinguishing Systems</i>
<i>NFPA 17</i>	<i>Dry Chemical Fire Extinguishing Systems</i>

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<i>NFPA 17A</i>	<i>Wet Chemical Extinguishing Systems</i>
<i>NFPA 45</i>	<i>Fire Protection for Laboratories Using Chemicals</i>
<i>NFPA 1901</i>	<i>Pumper Fire Apparatus</i>
<i>NFPA 1961</i>	<i>Fire Hose</i>
<i>NFPA 1962</i>	<i>Care, Use, and Service Testing of Fire Hose Including Connections and Nozzles</i>
<i>NFPA 1963</i>	<i>Fire Hose Connections</i>
<i>NFPA 1964</i>	<i>Spray Nozzles (Shutoff and Tip)</i>

Institute of Electrical & Electronics Engineers

*IEEE 979*                      *Guide for Substation Fire Protection*

#### **4      Portable Extinguishers**

- 4.1      Portable hand and/or wheeled cart or skid type extinguishing units shall be provided for immediate use by operating personnel in all Saudi Aramco facilities for combating fires in their early stages. Types and sizes of portable extinguisher units to be provided in the various facility areas shall be as indicated in Table 1, as specified in other applicable Saudi Aramco Standards, and as determined by the Chief Fire Prevention Engineer or his representative.
- 4.2      All portable fire extinguishers shall be the same as extinguishers in Class 21 Saudi Aramco stock. Stock numbers are listed below. Extinguishers shall be maintainable by Saudi Aramco personnel with the existing tools and spare parts in the Saudi Aramco Materials System. All fire extinguishers shall be "listed", i.e., approved by a testing authority such as Underwriters Laboratories (UL) or Factory Mutual (FM) to certify performance.

*Exception:*

*Exceptions shall be only by approval of the Chief Fire Prevention Engineer and the General Supervisor, P&TS Div., Fire Protection Department.*

*Commentary Notes:*

*It is not intended that extinguishers be supplied directly from Saudi Aramco stock. However, prior to any outside purchase, the vendor data, including catalogs and data sheets, shall be reviewed and approved by the General Supervisor, P&TS Div., Fire Protection Department. Four types of extinguishers are commonly used:*

*Dry Chemical, Type BC: For use in general refinery and plant areas on Class B (flammable vapors and liquids) or on Class C (electrical) fires, specify the 12.2 kg (27 lb) hand type fire extinguisher found in SAMS 21-102-820. The extinguishing agent is potassium bicarbonate, commonly known as "Purple K". Also see SAMS 21-106-650 wheeled fire extinguisher.*

*Dry Chemical, Multipurpose: For extinguishing combustibles, flammable liquid, or electrical (Class A, B, and C) fires, for use in large (>930 m<sup>2</sup>) offices, schools, and other institutional type buildings and in combustible yard storage areas (refer to Table 1). This portable fire extinguisher can be found in SAMS 21-102-775. The extinguishing agent is monoammonium phosphate.*

*Carbon Dioxide, Type BC: For use in limited areas such as control rooms, laboratories, electrical substations, and similar facilities. CO<sub>2</sub> extinguishers, like SAMS 21-102-223, should be used where residue accumulation or cleanup may create a problem (e. g., in electrical/electronic equipment rooms and laboratories). Also see SAMS 21-106-690 for dual 23 kg (50 lb) cylinder units.*

*Pressurized Water: For use primarily in offices, warehouses, and other similar areas where only Class A (ordinary combustibles, i.e. paper and wood) fires are most likely to happen. This fire extinguisher can be found in SAMS 21-104-550.*

#### 4.3 Location

- 4.3.1 Generally, hand-type portable extinguishers in process plant areas shall be located at 30 m intervals.
- 4.3.2 Where extinguishers are protecting individual equipment, they shall be located at least 7.5 m from the equipment.
- 4.3.3 Placement of portable extinguishers in buildings shall comply with NFPA 10, Chapter 3 and Appendix E.
- 4.3.4 Dry chemical extinguishers shall be located on the building exterior of control buildings and electrical substations, near entrances.
- 4.3.5 Carbon dioxide (CO<sub>2</sub>) extinguishers shall be located inside control room buildings and electrical substations.
- 4.3.6 Pressurized water extinguishers shall be located in areas subject to Class A (wood, paper, cardboard) fires.

- 4.4 Hand-type portable extinguishers shall be mounted in easily accessible locations at grade or on first level operating decks near access stairs. Their locations shall be marked in red in a way that will attract attention, and otherwise meet the requirements of NFPA 1, Section 6-6 and NFPA 10, Chapter 3.

- 4.5 Extinguisher units weighing less than 18 kg shall be mounted so that the extinguisher top is not more than 1.5 m above the floor or deck level. Extinguisher units weighing over 18 kg shall be mounted so that extinguisher top is not more than 1.05 m above the floor or deck level.
- 4.6 Where two-wheeled, cart-type dry chemical, 68 kg size extinguisher units are specified in Table 1, they shall be covered with the manufacturer's cover or housed inside a roofed, noncombustible shed, with access door facing in the opposite direction of hydrocarbon handling equipment.
- 4.7 For maintenance and inspection of all portable extinguishers, see GI-1781.001; for fixed fire protection systems, see GI-1782.001.

## 5 Foam-Generating Equipment

- 5.1 Fluoroprotein foam shall meet 21-SAMSS-011 for all onshore applications, unless alternate foams are approved by the Chief Fire Prevention Engineer and the General Supervisor, P&TS Div., Fire Protection Department.

*Commentary Note:*

*The foams provided in SAMS 21-111-510 can be used for all onshore applications, including kerosene, aviation fuel, MTBE-gasoline blends, and neat MTBE.*

- 5.2 Where large quantities of foam extinguishing agent are needed, as in high risk hydrocarbon process plant areas and large tank farms, a 95 L/s combination water/foam mobile truck meeting NFPA 1901 and NFPA 11C shall be made available for firefighting purposes.
  - 5.3 Where lesser amounts of foam are usually needed, such as standby first aid protection during maintenance and repair operations to hydrocarbon handling equipment, the 4-wheeled combination light water/dry chemical, trailer mounted extinguishing units may be provided with concurrence from the Chief Fire Prevention Engineer. If water is available at the facility, fluoroprotein foam concentrate in 20 L or 210 L containers can be effectively used with foam monitors or playpipes equipped with pickup tubes.
  - 5.4 For the protection of oil loading piers, platforms, sea islands, oil tankers, and other craft in harbor, offshore producing operations and associated cargo piers, refer to SAES-B-060 and SAES-B-009 for details. Firefighting tug boats and other selected launches equipped with foam monitor and tank systems shall be available to supplement installed systems facilities for firefighting purposes.
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## 6 Special Fixed Extinguishing Equipment

- 6.1 Fixed wet chemical, dry chemical, carbon dioxide (CO<sub>2</sub>), Halon 1301, or other fire-extinguishing systems shall be installed for the protection of certain enclosed areas such as kitchen exhaust hood and vent systems and associated cooking appliances, gas turbine enclosures, in special labs and chemical storage rooms, communications rooms in critical communications facilities, computer rooms in central computer facilities, in rotating power generating equipment enclosures, and in other specific situations as required by Saudi Aramco Engineering Standards such as SAES-B-014 and SAES-M-100. Where fixed extinguishing systems are required to protect enclosures of rotating equipment, those systems shall be furnished by the equipment vendor, where practicable. These systems shall have 100% spare agent cylinders readily available.
- 6.2 CO<sub>2</sub> systems shall be designed and installed in accordance with NFPA 12 and are prohibited for normally manned areas. In addition, an alarm warning device shall be provided to activate 30 seconds prior to any discharge of CO<sub>2</sub> into the area. Lock-out devices to disarm the CO<sub>2</sub> system when personnel are present shall be installed unless the omission is approved by the Chief Fire Prevention Engineer. Enclosed rooms shall have an exterior exit door equipped with panic hardware. Air-moving power and fire dampers in the HVAC system shall shut down upon system actuation.
- 6.3 If a dry chemical system is specified, it shall be designed and installed in accordance with NFPA 17.
- 6.4 Wet chemical extinguishing systems shall be installed per NFPA 17A for kitchen exhaust and vent systems and other applications as requested by the Chief Fire Prevention Engineer or his representative. See Table 1, Note G.
- 6.5 New applications of Halon 1301 shall be reviewed and approved by the Chief Fire Prevention Engineer. Where approved, Halon 1301 systems shall be designed and installed per NFPA 12A.

*Commentary Note:*

*Use of new Halon systems is still allowed on a very limited basis, if approved by the Chief Fire Prevention Engineer. Use of new gaseous type suppression systems such as FM200 is not allowed due to the uncertainty of benefits and the additional warehouse, maintenance, and training costs of adding a new type of system. See SAES-B-014 for fire prevention alternatives.*

## 7 Hose, Hose Nozzles and Couplings

- 7.1 Single synthetic jacket, rubber-lined 1½-inch hose in 15 m lengths, with combination nozzles, racks, spanner wrenches, and adapter fittings shall be provided for onshore and offshore GOSPs, piers and sea islands, and onshore and offshore drilling rigs. On firefighting trucks and tug boats, a similar type of hose shall be provided, except that hose shall have 3-inch x 2½-inch couplings for suction needs. For tugboat onboard firefighting, 1½-inch hose shall be used. The fire hose and its care and maintenance shall meet NFPA 1961 and NFPA 1962.
- 7.2 Special lightweight alloy, plastic, or brass nozzles of the combination stream/fog types shall be provided as specified. A minimum discharge pressure of 345 kPa<sub>(ga)</sub> (50 psig) at nozzle outlet is required to obtain an effective water spray or steam application. All fire hose nozzles shall be listed to meet NFPA 1964.
- 7.3 For all pin-rack hose cabinets, nozzle SAMS 21-176-975 (1½-inch polycarbonate) shall be used.
- 7.4 For all other hose reel applications at onshore and offshore GOSPs, piers and sea islands, and onshore and offshore drilling rigs, nozzle SAMS 21-176-620 (1½-inch brass) shall be used.
- 7.5 Couplings for hose, nozzles, and adapter connections shall be screw-threaded in accordance with USA standard fire hose (NH) thread specified in NFPA 1963.

### *Exceptions for Section 7:*

*Exceptions shall be by approval of the Chief Fire Prevention Engineer and the General Supervisor, P&TS Div., Fire Protection Department.*

### **Revision Summary**

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| 15 March 2006 | Revised the "Next Planned Update". Reaffirmed the contents of the document and reissued with no other changes. |
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**Table 1 - Occupancy and Protection Needs**

	Live Hose Reel Stations	Fire Hose Cabinet, with nominal 38mm (1.5 inch) Flat Folding Hose	9.5 L (2.5 Gal) Hand Extingui- sher Pressure Water Type	4.5 KG (10 lb.) Hand Type CO2 Extingui- sher (Note A)	12.2 Kg (27 lb.) Hand Type Dry Chemical Extingui- sher (Note B)	68 kg (150 lb.) Wheeled Type Dry Chemical Extingui- sher (Note B)	11.4 Kg (25 lb.) Multi- Purpose Dry Chemical Extingui- sher	Hydrant Type 509- E	Hydrant Type 509- G or K	Maximum hydrant spacing meters (feet)	Water Demand - L/s (GPM) at 550 kPa (ga) (80 PSIG)	Fixed Fire Water Monitor	Fixed Water Spray, Deluge Systems; Building Sprinkler Systems	Wet Chemical (Kitchen)	Air- Foam System
Residential (Single Unit Buildings)								◆		120 (400) (C)	31.5 (500) (D)				
Residential (Apartment Type)		◆	◆	◆				◆		90 (300) (C)	31.5 (500) (D)		◆ (E)		
Auto Repair Shop	◆		◆	◆			◆	◆		90 (300) (C)	31.5 (500) (D)		◆ (F)		
Large Offices, Schools, Hospitals, Club Houses, Dining Halls, Theaters, Marine Observation Towers, and Similar Buildings		◆	◆	◆			◆	◆		90 (300) (C)	63 (1000) (D)		◆ (E)	◆ (G)	
Labs (Note H)	◆	◆	◆	◆	◆				◆ (I)	90 (300)	(J)		◆ (E)		
Industrial Shops and Storage Warehouses	◆		◆	◆	◆				◆ (I)	90 (300)	(J)		◆ (E,F,K)		
Combustible Yard Storage	◆						◆		◆ (I)	90 (300)	63 (1000)				
Refinery, Processing Units, Crude Stabilizer	◆				◆	◆			◆ (L)	60 (200)	(J)	◆	◆ (M)		
Gas Treating, LPG Fractionation, and NGL Processing Plants	◆				◆	◆			◆ (L)	60 (200)	(J)	◆	◆ (M)		
Gas injection	◆				◆	◆			◆ (L)	60 (200)	(J)	◆			
GOSPs (Onshore)	◆			◆	◆	◆		◆	◆ (I)	60 (200)	(J)	◆			
GOSPs (Offshore)	◆			◆	◆	◆	◆	◆		45 (150)	(J)		◆ (N)		◆ (O)
LPG Refrigeration Plants	◆				◆	◆			◆ (L)	60 (200)	(J)	◆			
Tank Farm - Dome Roof Tanks (LPG)									◆ (P)	90 (300)	(J)	◆	◆ (Q)		
Tank Farm - External Floating Roof Tanks (Crude & Products with flash point equal to or less than 130 deg F.)									◆ (P)	90 (300)	(J)				◆ (O)
Tank Farm - Cone Roof Tanks (Combustible liquids; flash point over 130 deg F.); Internal Floating Roof Tanks									◆ (F)	90 (300)	(J)				
Shipping Pumps, Booster Pumps, and Compressors (except for LPG)	◆				◆	◆			◆ (L)	60 (200)	(J)	◆ (R)			◆ (S)
Oil Water Separators and Waste Disposal	◆				◆				◆ (I)	90 (300)	63 (1000)				
LPG Loading Racks, LPG Shipping Pumps, Booster Pumps, and Compressors (Note T)	◆				◆	◆			◆ (L)	60 (200)	(J)	◆	◆		
Boilers and Power Houses	◆		◆	◆	◆				◆ (L)	90 (300)	63 (1000)				
Petroleum Product Loading Racks for Tank Trucks (excluding LPG)	◆			◆	◆	◆			◆ (I)	60 (200)	63 (1000)	◆			◆ (X)
Electrical Substations				◆	◆				◆ (L)	90 (300)	31.5 (500)		(V)		
Drilling Rigs (Land)	◆			◆	◆	◆					15.7 (250)				
Hangars and Remote Air Strips	◆ (U)			◆	◆	◆	◆		◆ (I,U)	60 (200) (C,U)	31.5 (500) (D)		◆ (W)		◆ (W)
Communications Relay Stations			◆	◆											
Construction Camp Residential Buildings	◆		◆	◆			◆			120 (400) (C)	31.5 (500)		◆ (E)		
Construction Camp Dining, Recreation and Similar Large Buildings	◆		◆	◆			◆			120 (400) (C)	31.5 (500)		◆ (E)	◆ (G)	
Cooling Tower	◆		◆	◆			◆	◆		90 (300)	31.5 (500)		◆		
Mosque / Mussallas		◆	◆	◆				◆		90 (300)	31.5 (500)		◆ (E)		

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**Table 1 - Occupancy and Protection Needs (Cont'd)**

- Notes: Table 1 and the notes below are part of this Standard and shall be considered mandatory. This Table is general in nature and does not necessarily include all fire protection systems for all facilities. Refer to the body of SAES-B-019 and related Standards SAES-B-017 and SAES-B-018 for more information.
- A. Normally for indoor use. Nonmetal horns shall be provided on carbon dioxide extinguishers.
  - B. For hydrocarbon plant areas, SAMS 21-102-820, a type BC extinguisher.
  - C. If the hose stream is intended to be taken direct from hydrant (no mobile pumper available), spacing shall be 45 m (150 ft) and residual pressure shall be 550 kPa<sub>(ga)</sub> (80 psi).
  - D. Minimum residual pressure shall be 138 kPa<sub>(ga)</sub> (20 psi) and minimum hydrant spacing 45 m (150 ft).
  - E. SAES-M-100 and SAES-S-050 shall be followed in specifying what buildings (depending on occupancy and use) shall require sprinklers and how sprinkler systems are to be installed in those buildings.
  - F. If cutting and welding take place inside building.
  - G. For vent hood and duct systems in kitchens, a wet chemical extinguishing system per NFPA 17A shall be installed.
  - H. Refer to NFPA 45.
  - I. Type 509-G hydrant.
  - J. Refer to SAES-B-017 for water needs and residual pressure requirements.
  - K. High piled combustible storage shall comply with UFC, Table 81-A.
  - L. Use type G or K type hydrant, depending on risk area (See SAES-B-017).
  - M. Required only for pumps and other fire hazardous equipment located under fin-fan coolers. To determine what is fire hazardous equipment, refer to SAES-B-006.
  - N. Over shipping pumps, hydrocarbon process vessels and incoming crude manifold.
  - O. Refer to SAES-B-005 and SAES-B-018 for details on minimum tank size and other requirements. For offshore requirements, refer to SAES-B-009.
  - P. Type 509-K hydrant.
  - Q. Pressure storage vessels, refrigerated tanks, spheres and spheroids, as required by SAES-B-017.
  - R. For process plants, only monitor coverage is required. If monitor coverage is not acceptable due to shelters or other obstructions, then a fixed water spray system shall be installed on that equipment, per SAES-B-017.
  - S. For pumps, required only for refined product pumps per SAES-B-070. For compressors, refer to SAES-B-017.
  - T. Refer to SAES-B-070, Section 15 for fire suppression requirements.
  - U. Hose reel stations and hydrants located at the hangar facilities.
  - V. A possible design alternative for oil-filled transformers that are inadequately separated from substation buildings and from each other as required in ASME/IEEE 979. Also see SAES-B-014.
  - W. Depending on occupancy and use. Fixed system not required if hanger is used for parking aircraft only.
  - X. Refer to SAES-B-070, Section 12 for fire suppression requirements.