# Engineering Standard

SAES-B-070 31 July, 2004

Fire and Safety Requirements for Bulk Plants,
Air Fueling and Sulfur Loading Facilities



## Saudi Aramco DeskTop Standards

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## 1 Scope

This Standard covers the minimum mandatory fire and safety requirements for bulk plants, onshore air fueling facilities, and sulfur handling facilities including truck and railroad tanker loading and unloading facilities, associated pumps, tank storage, and onshore components of marine terminals related to bulk plant operations. Automotive filling stations (see NFPA 30A) are not covered by this Standard.

## 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 the latest issue (including all revisions, addenda, and supplements) unless stated otherwise.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedure

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| *SAEP-302* | *Instructions for Obtaining a Waiver of a Mandatory Saudi Aramco Engineering Requirement* |

Saudi Aramco Engineering Standards

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| *SAES-B-005* | *Spacing and Diking for Atmospheric and Low-Pressure Tanks* |
| *SAES-B-006* | *Fireproofing for Plants* |
| *SAES-B-008* | *Restrictions to Use of Cellars, Pits, and Trenches* |
| *SAES-B-014* | *Safety Requirements for Plant and Operations Support Buildings* |

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|---|---|
| *SAES-B-017* | *Fire Water System Design* |
| *SAES-B-018* | *Air Foam Systems For Storage Tanks* |
| *SAES-B-019* | *Portable, Mobile and Special Fixed Firefighting Equipment* |
| *SAES-B-054* | *Access, Egress, and Materials Handling for Plant Facilities* |
| *SAES-B-055* | *Plant Layout* |
| *SAES-B-058* | *Emergency Shutdown, Isolation and Depressuring* |
| *SAES-B-067* | *Safety Identification and Safety Colors* |
| *SAES-B-068* | *Electrical Area Classification* |
| *SAES-B-069* | *Emergency Eyewashes And Showers* |
| *SAES-J-300* | *Level* |
| *SAES-J-601* | *Emergency Shutdown and Isolation Systems* |
| *SAES-L-460* | *Pipeline Crossings Under Roads And Railroads* |
| *SAES-P-104* | *Wiring Methods and Materials* |
| *SAES-P-111* | *Grounding* |
| *SAES-S-020* | *Industrial Drainage and Sewers* |
| *SAES-S-030* | *Storm Water Drainage Systems* |

3.2 Industry Codes and Standards

American Petroleum Institute

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|---|---|
| *API RP 1004* | *Bottom Loading and Vapor Recovery for MC-306 Tank Motor Vehicles* |
| *API RP 2003* | *Protection Against Ignitions Arising Out Of Static, Lightening, And Stray Currents* |

National Fire Protection Association

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|---|---|
| *NFPA 10* | *Portable Fire Extinguishers* |
| *NFPA 11* | *Low Expansion Foam* |
| *NFPA 16* | *Deluge Foam-Water Sprinkler and Spray Systems* |
| *NFPA 30* | *Flammable and Combustible Liquids Code* |
| *NFPA 30A* | *Motor Fuel Dispensing Facilities* |
| *NFPA 70* | *National Electrical Code* |

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| *NFPA 72* | *National Fire Alarm Code* |
| *NFPA 77* | *Static Electricity* |

## 4 Definitions

**Air Fueling Facilities:** Bulk receiving and storage facilities associated with supplying airport fuel operations.

**Bay:** One truck lane where a tanker truck parks during loading or unloading operations.

**Bay Island:** A raised area adjacent to loading/unloading bay(s), containing equipment such as flow control valves, meters, strainers, unloading pumps, vehicle access platforms, etc., related to the operation of the bay(s).

**Black Products:** Crude oil, bunker fuel, and asphalt.

**Bottom Loading System:** A system in which liquid products are loaded into a truck tank through one or more connections in the bottom of the tank.

**Bulk Plant:** A facility, whose primary function is to receive and store refined petroleum products in storage tanks for the primary purpose of distribution by tank truck, rail tank car, and pipeline.

**Queuing Area for Trucks To Be Loaded:** A clearly marked area near the entrance of a loading bay where the truck waits until permission is given to enter the bay for loading.

**External Floating Roof Tank:** Open-top tank with a roof that floats on the liquid, rising and falling with the liquid level.

**Fluoroprotein Foam:** A foam concentrate that is a combination of fluorocarbon surfactants and protein foam concentrates. Fluoroprotein foam is suitable for fighting fires on crude oils and hydrocarbon fuels, including gasoline-MTBE (methyl tertiary-butyl ether) blends.

**Liquefied Petroleum Gas (LPG):** Any material having a vapor pressure not exceeding that allowed for commercial propane that is composed predominantly of the following hydrocarbons, either by themselves or as mixtures: propane, propylene, butane (normal butane or isobutene), and butylenes. For properties, see Saudi Aramco Product Specifications for A-150 at **http://engsvcs.aramco.com.sa/lrdd/Product%20Specifications/List.htm**.

**Rack:** A group of contiguous loading/unloading bays.

**Marine Terminal:** A facility specifically designed to load or unload petroleum products from a ship or barge.

**Operations Center:** A building or room where truck loading and tank farm status is monitored via terminal management system (TMS) during receipt, storage and dispatch of hydrocarbon products. Operations centers, process interface buildings (PIBs), and other buildings at bulk plants are not considered control rooms, thus design requirements for control rooms do not apply.

**Parking Couplings:** Dummy couplings mounted on a bracket near the hose or loading arm to stage the loading arm or hose when not in use. This allows the hose or arm to be neatly stowed when not in use.

**Parking (Staging) Area for Trucks:** A parking area away from the loading operation where trucks can be parked during inspection or completion of paperwork.

**Roll Curb:** A slightly raised concrete curb used for drainage control at the ends of the bays and along the outer edges of the end bays. A paving high point may serve the same function. Roll curbs should have a gentle rise that is barely perceptible to the driver as the truck enters or leaves the bay.

**Swale:** A drainage course with gently sloped cross-section.

**Terminal Management System (TMS):** An integrated system of hardware and software components for the monitoring and control of plant operations and for local maintenance of the customer account/transaction database.

**Top Loading System:** A system in which liquid products are loaded via loading arms into a road or rail vehicle tank, through one or more openings in the top of the tank. Most of the Company's truck loading and unloading facilities in Saudi Arabia have been configured for bottom loading operations. A few top loading facilities still exist, primarily for loading hot asphalt or molten sulfur. Bottom loading systems are required for new facilities and facility upgrades except for hot asphalt or molten sulfur.

**White Products:** Jet fuel(s), kerosene, diesel, and gasoline petroleum products designed for use as fuels. For typical properties, see Saudi Aramco Product Specifications.

## 5 General Requirements

5.1 Layout, access, and spacing of these facilities and associated storage shall comply with SAES-B-005, SAES-B-014, SAES-B-054, SAES-B-055, and this Standard. Equipment separation distances are contained in Table 1 of this Standard.

5.2 Loading rack product groups shall be segregated by type as follows:

a) LPG
b) White Products
c) Black Products
d) Sulfur

5.3 Loading and unloading bays shall be drive-through.

5.4 A separate truck parking (staging) area for inspection of trucks and completion of paperwork shall be provided adjacent to the bulk plant truck entrance.

5.5 The minimum basic spacing for truck parking and queuing areas shall be 15 m from other facilities and 30 m from occupied buildings, such as the sales building.

5.6 Traffic patterns for trucks shall be designed as one-way through traffic. Entrance paths shall not cross exit paths. Counterflow lanes or mixed traffic patterns are prohibited.

5.7 Tank spacing for installation of new tanks at existing sites, change of tank product type, or storage tanks that are otherwise modified at existing locations shall require individual site review by the Chief Fire Prevention Engineer or his representative.

5.8 The maximum number of bays in any one rack shall not exceed six (6).

*Commentary Note:*

*For existing racks, this is not retroactive. However, adding additional bays to existing racks that would make them over the six-bay limit is prohibited. The maximum of 6 bays was selected because hydraulically, the spray system for a 6 bay rack matches the largest water demand for a medium risk area, 3000 gpm.*

5.9 The minimum separation distance between any two racks shall be 15 m. The distance shall be measured from the closest points of the two racks.

5.10 All equipment near a bay shall be protected from truck impact by curbing and other barriers as needed. Bay islands shall be raised and wide enough so that no equipment extends beyond the edge of the raised concrete pad. This includes loading/unloading arms in their retracted position and the low-level fire protection spray heads, see Section 6.5.

5.11 The minimum width of a loading or unloading bay shall be 5.1 m.

*Commentary Note:*

*The minimum lane width is based on the sum of the 2.6 m truck width, 1.5 m loading side spacing between the outermost side of the truck and curb, and 1 m*

*clear space on the other side of the truck. More space may be needed, depending on the loading/unloading equipment used and ergonomics.*

5.12 For loading bays, surfaces shall be constructed such that trucks are level.

5.13 Bay length shall be 19.2 m minimum between roll curbs.

*Commentary Note:*

*Bay length is based on an assessment of the length of trucks. Past surveys of truck dimensions showed that overall lengths of tractor and trailer ranged between 11 and 18 m. 19.2 meters is the dimension chosen by the Bulk Plant Standardization Project (2003).*

5.14 Bay island equipment shall allow drainage. The bay island shall be sloped to permit drainage of spills.

5.15 A full-cover canopy shall be installed over each rack, extending far enough forward beyond the roll curb containment area to allow foam fire protection to cover the full length of the tank of the truck. The canopy for a rack shall not be connected to the canopy of any other rack. The height of the canopy shall be kept at the lowest possible elevation that is allowed by bottom loading operations.

*Exception:*

*A full-cover canopy is not necessary for railroad tank-car racks. As a minimum, a canopy covering loading arms and rack metering equipment shall be provided.*

*Commentary:*

*Use of a canopy over the curbed area of the rack eliminates handling rainwater by the rack drain system thus significantly reducing the size of the oily water sewer. The canopy will also provide shelter for equipment and operators. Canopy separation is required to prevent a fire heat wave from traveling along the roof and potentially activating the adjacent rack's fire detection system. Canopy elevation should be kept to a minimum to reduce effects of wind on the foam spray system and improve the responsiveness of the heat detectors.*

5.16 The product headers shall be located outside the loading rack canopy. Tee connections with blind flanges shall be provided at spare bays.

5.17 Emergency eyewashes and showers shall be provided and shall meet location and spacing criteria in SAES-B-069.

5.18 A safe access platform to inspect the top of tank trucks is required for each facility location. The access platform shall have stairs and shall otherwise meet SAES-B-054.

*Commentary Note:*

*A safe access to the top of any tanker for an operator or inspector is required to verify the top hatch car-seal numbers and replace the car-seal if required.*

5.19 A truck overfill protection system shall be provided for all truck loading operations.

5.20 Loading/unloading arms or hoses shall be mounted so as not to trap the operator between the arms during hookup. Parking couplings shall be provided when the arms/hoses are not in service (See Figure 1).

*Commentary Note:*

*Being trapped between two loading arms during hook up prevents escape in case of an emergency.*

5.21 Combustible and toxic gas detectors are not required.

5.22 Design and operations of air fueling facilities shall meet the fire and safety requirements of the ExxonMobil Aviation Manual (AOSM), SAES-B-017, and this Standard.

5.23 Buildings shall meet SAES-B-014. Windows are allowed provided the window design will withstand any potential overpressures due to potential truck explosions per 5.8 b), SAES-B-14.

## 6 Fire Protection System

6.1 The fire water system shall meet the requirements of a medium-risk area per SAES-B-017 and SAES-B-019, Table 1, except as modified below.

6.2 Storage tank fire protection shall meet SAES-B-018.

6.3 The tank farm shall be provided with a hydrant loop with hydrant spacing that meets SAES-B-019, Table 1. The header capacity design basis shall be 3000 gpm (minimum).

6.4 Water spray system shall be provided for LPG loading/unloading facilities; foam is not required.

6.5 For other product loading/unloading facilities (not LPG and sulfur), a fixed foam-water spray system shall provide 100% coverage of the loading/unloading bay truck lanes and bay island loading/unloading equipment. The foam proportioning skid, associated deluge valves, and foam storage tank shall be one unit located inside a building or under a sunshade. The firefighting foam shall be specified by the General Supervisor, Planning and Technical Services Unit, Fire Protection Department.

6.5.1 Fixed foam-water fire protection systems shall be designed and installed in accordance with the requirements of NFPA 11, NFPA 16, SAES-B-017, and this Standard. Design, drawings, and hydraulic calculations shall be done by or directly supervised by a registered professional engineer in the specialty of fire protection who has at least five years of experience in foam fire-suppression and related system design. All drawings shall bear the seal of that registered engineer. Drawings and calculations shall be submitted to the Chief Fire Prevention Engineer (CFPE) or his representative for review.

6.5.2 Commissioning and testing procedures shall meet NFPA 16 requirements and shall otherwise be approved by the Chief Fire Prevention Engineer (CFPE), Loss Prevention Department and General Supervisor, Planning and Technical Services Unit, Fire Protection Department or their designated representatives. The percentage of foam concentrate in solution shall be measured and corrected until it meets the criteria per Chapter 5, NFPA 16. All tests shall be witnessed by designated representatives of the Loss Prevention and Fire Protection Departments. All test reports shall be provided to the CFPE and General Supervisor, Planning and Technical Services Unit, Fire Protection Department.

6.5.3 For calculating the hydraulic design of the piping system, the design pressure of the hydraulically most remote spray head in the system shall not be less than 30 psig.

6.5.4 Maximum allowable spacing between foam spray heads shall be 3 m (10 ft).

6.5.5 Activation of any one heat detector shall activate the foam system for the entire loading/unloading rack (see Section 7 for detector requirements). The foam spray system shall activate and deploy foam as one unit.

6.5.6 At least 3 low-level, directional, air-aspirated foam nozzles on the loading side of the truck lane, equally spaced along the side of the truck and approximately 1 m above the slab under the wheel shall be provided.

*Commentary Note:*

*The objective is to provide a continuous foam blanket under the truck trailer. Locate the spray heads with consideration that tires present a barrier. In truck bays, the first foam-water spray should be roughly opposite the forward-most trailer wheel (assuming double wheels), and the second spray about 3 meters forward of the first spray, so that the*

*sprays cover the loading connections. The third (rear-most) spray should be located about 3 meters from the first spray, in a position to cover the slab under any connections on the rear of the trailer as well as the catch basin. Sprays should point somewhat downward (perhaps 10 to 20 degrees from horizontal, depending on spray pattern), since the object is to put foam on the surface of the concrete under the bottom connections and continuing underneath the trailer. Ground sweep nozzles use approximately 16 gpm each, depending on the design of the nozzle specified.*

6.5.7 The foam systems shall be located near enough to loading/unloading areas or pumps to provide foam within one minute from activation of the hand station or heat detector.

6.5.8 The minimum basic fire spacing between a foam proportioning skid and any fire hazard is 15 m.

6.5.9 The foam concentrate supply system (also referred to as a foam skid) shall be an in-line balanced-pressure proportioning system with tank storage that meets SAES-B-017. The foam skid shall be configured to meet NFPA 16, Appendix A, Figure A2-4.2(e) or (g), In-line balanced-pressure proportioning systems.

6.5.10 All aspects of the foam skid design including component selection shall be approved by the registered professional engineer in charge of design of the overall system, the foam manufacturer supplying the foam, the Chief Fire Prevention Engineer, and the General Supervisor, Planning and Technical Services Unit, Fire Protection Department or their designated representatives.

6.5.11 A fire department connection on the outside of the foam skid building (header with multiple 2½ inch angle valves and one 5-inch connection) shall be provided on the supply side of the proportioner per NFPA 16. Configuration, number and type of fittings shall be approved by the General Supervisor, Technical Services Unit, Fire Protection Department or his designated representative.

6.5.12 The foam skid shall be UL listed for use with the specified type and manufacturer of foam selected by the Fire Protection Department.

6.5.13 Deluge valves shall be located at the foam supply skid inside the foam building.

6.6 No fire water monitors are required at loading bays or storage tanks.

6.7 Two (2) hose reels (water only ) shall be provided for each rack. The hose reels shall be located outside the roll curb.

6.8 Manual-actuating stations for the foam system shall be provided in the same locations and quantities as described in Section 11 for emergency isolation actuating buttons. If desired by the Proponent Operating Department, the ability to actuate individual foam systems shall also be installed in the operations center. Actuation of individual foam systems shall also be possible at the deluge valves.

6.9 For railroad tank-car racks handling flammable liquids, top loading racks shall be provided with foam-water sprays to protect the dome area and ground level, directional, air-aspirated foam nozzles for coverage underneath the tank car; bottom loading racks shall be provided with ground level, directional, air-aspirated foam nozzles for coverage underneath the tank car.

6.10 Product and pipeline shipping pumps shall be protected by fixed foam-water spray systems with a minimum water spray density of 0.34 $L/m^2s$ (0.5 $gpm/ft^2$). Actuation of the foam system for the entire pump station shall be by activation of any one heat detector in the station. In addition, manual-actuating stations shall be provided in the same locations and quantities as those provided for the emergency isolation actuating buttons as described in section 11.2. Actuation of the foam system will also be possible at the deluge valve; deluge valve shall be located at the foam skid.

a) If one pump area is separated by at least 15 m from another pump area, each area can be protected by its own foam system, actuation of which shall not result in actuation of any other foam system. Drainage shall be designed to prevent one pump area from being affected by a spill in another pump area.

b) Where water is not available, extra spacing shall be used between pumps or pump groups to allow deletion of a fixed fire extinguishing system, with concurrence by the Chief Fire Prevention Engineer.

6.11 The foam supply shall be sufficient for 20 minutes, based on the largest expected foam usage for one fire incident.

6.12 A sign shall be provided at each foam system manual-actuating station indicating the purpose and function of the station. Signs shall be readily identifiable and suitable for the area (i.e., areas subject to moisture and exterior atmospheric conditions). Signs shall be in both Arabic and English. Size of letters shall be not less than 13 mm.

6.13 Wind shall be taken into account when locating foam nozzles, i.e. by reducing overhead nozzles to the minimum height necessary.

6.14 Portable Firefighting Equipment

A 12.5 Kg BC type, like SAMS 21-102-820, standard stock dry chemical hand fire extinguisher shall be provided at each end of the loading/unloading bay. Pump areas, buildings, warehouses, etc., shall have extinguishers provided in quantities and locations to meet the requirements of SAES-B-019 and NFPA 10.

## 7 Fire Detection and Alarms

7.1 For loading and unloading racks where a fixed fire suppression system is required, a fire detection and alarm system shall be installed. It shall be a complete, supervised system, designed and installed in accordance with the requirements of NFPA 72 and SAES-B-014. Design, drawings, and hydraulic calculations shall be done by or directly supervised by a registered professional engineer in the specialty of fire protection who has at least five years of experience in foam fire-suppression and related system design. All drawings shall bear the seal of that registered engineer. The system's detailed design shall be reviewed by the Chief Fire Prevention Engineer or his representative.

7.2 Except as permitted by paragraph 14.6, loading/unloading racks and pump stations shall have hermetically-sealed, rate-compensated, fixed-temperature (with 107°C alarm point) heat detection. Cross-zoning is not required. At pump stations, one heat detector shall be positioned over each pump, unless the pumps are closer than 3 m apart, in which case detectors may be spaced less than 3 m intervals over the pumps.

7.3 Actuation of a fire protection system shall activate emergency isolation as described in Section 6 above.

7.4 Audible and visual alarms shall be provided at loading and unloading rack areas and pump stations.

7.5 Detection and alarm panels shall be independent of panels of other types. It is permissible for detection and alarm panels to send signals to other types of panels or to the TMS.

7.6 Fire detection and alarm systems for buildings shall be provided when required to meet SAES-B-014 and shall be a complete, supervised system, designed and installed in accordance with the requirements of NFPA 72. Dispatch rooms or the operation center where plant workstations are located are not considered "control rooms" and shall not be treated as such, i.e., high-sensitivity smoke detection per SAES-B-014 is not required.

## 8 Drainage

8.1 Drain systems for facilities shall meet SAES-S-020. Storm water drainage in yard and parking areas shall meet SAES-S-030.

8.2 Custom design catch basins (per 4.9.4, SAES-S-020) shall be provided as needed.

8.2.1 Each bay's drainage (catch basin and branch piping) shall handle at least 3.3 L/s (1000 gpm) total flow. Minimum slope toward the catch basins shall be 15 mm/m. Maximum slope shall be 40 mm/m.

8.2.2 Catch basin design shall be approved by the Chairman of Plumbing & Utilities Standards Committee. Each rack shall be considered a separate risk area for purposes of drain system design.

8.2.3 For loading bays, catch basins shall be located at the entrance and exit of the bays. For offloading bays, the catch basins shall be located at the entrance of the bays. The catch basins shall be offset from the vehicle lane so that the truck does not drive over the catch basin.

8.2.4 Catch basins shall pass effluent into the oily water sewer system. Funnel connections shall pass effluent via a sealed catch basin into the oily water sewer system.

8.2.5 Drain laterals and headers serving loading/unloading racks shall be designed to drain at least the total design flow of the rack's fixed spray system plus 1.1 L/s (500 gpm) of product spill/hose stream allowance.

8.3 A reinforced concrete roll curb or high point (ridge line) for spill containment shall be installed surrounding each rack area.

8.3.1 If a roll curb is not installed for spill containment, the rack area high point ridge line shall be a minimum of 75 mm above surrounding grade (grade out beyond the rack area).

8.3.2 For roll curbs, the nominal size is 1.2 m wide (minimum) with a 75 mm height at the center, smoothly tapering to the edges.

8.4 Loading rack area paving shall be of reinforced concrete to allow wash down and the cleanup of spills. Slopes shall be a minimum of 1:65 (1.5%) and a maximum of 1:24 (4.0%).

8.5 The surface drainage outside of the rack area shall be sloped away from the rack area. Drainage patterns outside the rack area shall be designed with consideration for personnel escape routes. Drainage shall slope away from equipment and entrance/exit gates so that vehicles do not have to drive through spills or over catch basins.

8.6 Holding tanks or sumps shall be installed for site-specific wastewater handling, with sufficient retention time for primary separation. The tank or sump for the

loading area shall be sized to hold five (5) minutes of deluge system fire water plus 32 000 liters. Holding tanks serving only LPG facilities shall be sized per paragraph 14.4.

## 9 Electrical Area Classification, Wiring, Bonding and Grounding

9.1 Electrical area classifications shall meet SAES-B-068.

9.1.1 The entire 3-dimensional area within the rack curbs and the canopy shall be Class I, Zone 2 for the purposes of installing fixed electrical equipment such as lighting fixtures and instrumentation.

*Exception:*

*A diesel or sulfur loading rack shall be nonclassified.*

9.1.2 Wiring shall meet SAES-P-104.

9.2 Bonding, grounding, and other types of protection against ignitions arising out of static or stray electrical currents shall meet API RP 2003, SAES-P-111, NFPA 70 (see Article 250), NFPA 30 (see Section 5-6), and NFPA 77 (See Chapter 4).

*Commentary Note:*

*Static electricity charges can be created in fuel filters, in vehicle tanks during filling and in other locations of turbulent fuel flow because fuels are poor conductors. There are many design details to be aware of in design and operation of fuel distribution facilities to reduce the risk of ignition.*

9.3 Bonding and charge dissipation for bulk plant loading shall meet API RP 2003 requirements for intermediate vapor pressure fluids. Flow shall be controlled, providing a slow-flow start, intermediate increase to a maximum loading rate, and final slow-flow loading during a normal loading cycle.

9.3.1 Diesel, kerosene, jet fuel, gasoline, and naphtha shall be treated as intermediate vapor pressure fluids for the purposes of truck loading.

9.3.2 The slow-flow initial rate shall not exceed 1 m/s velocity in any part of the loading system until there is sufficient liquid level to submerge the liquid fill line by two fill line diameters above the inlet nozzle inside the truck as required by API RP 2003.

9.3.3 Maximum loading rate shall not produce a velocity of greater than 7 meters/second in any part of the loading system.

9.4 The use of below-grade cellars, pits, valve boxes, telecommunication service points and trenches shall meet SAES-B-008.

## 10 Instrumentation

10.1 Design and operations of bottom loading/unloading systems shall meet API RP 1004 and this Standard.

10.1.1 Connections for overfill protection and bonding cable sensors on the tank truck shall be via a multiple-pin plug that is specifically designed for that purpose.

10.1.2 A vapor motion sensing interlock system shall be provided for each bay to indicate that the vapor collection/disposal system is venting properly during operation (no flow shall stop loading). The vapor collection/disposal leg of each truck loading/unloading bay shall be vented individually.

*Commentary Notes:*

*For existing bulk plants, the vapor motion sensing system shall be retrofitted on all bays. Providing a switch at the end of the vapor hose is not acceptable. Switches are subject to breakage, are high-maintenance, are easily defeated, and do not assure that vapor is flowing.*

*For an example of a vapor sensing device, see Scully Signal Company website* www.scully.com*, Electronic Terminal Equipment; Scully vapor sensing system with explosion proof housing and indicator lamps.*

10.1.3 Vehicle drive-away protection shall be by drive-away air-brake interlock and traffic light.

10.2 Tankage receiving liquids shall have site-specific procedures in writing. Overfill protection shall be as follows:

10.2.1 A high-level pre-alarm that meets SAES-J-300 shall be installed on each tank. The alarm shall be designed to activate ten (10) minutes before a high-high level alarm is activated. Alarms shall be located where on-duty personnel can promptly react for diversion or shutdown.

10.2.2 Each tank filled by pipeline shall have an independent high-high-level detection system that shall automatically shut off or divert the incoming flow. The automation shall also automatically shut off loading pumps, i.e. during HHL detection while doing tank to tank product transfer and/or ship unloading, when needed. Design shall be approved by the Proponent Operating Department.

*Exception:*

*Tanks that are filled only by truck do not require automatic shut-off unless requested by the Proponent Operating Department. Having an operator check the tank level prior to filling should be adequate protection against overfilling by a truck. However, under certain circumstances it may be appropriate to have an automated shut-off valve, especially for multiple truck unloading operations.*

## 11 Emergency Shutdown (ESD) and Isolation

11.1 Emergency isolation of loading/unloading operations shall be actuated manually by actuating button, and automatically upon activation of the fire detection system. Emergency isolation design shall meet SAES-B-058 and SAES-J-601.

11.2 For loading operations, product pumps shall have individual suction Emergency Isolation Valves (EIVs).

11.3 All EIVs shall be single acting fail-closed valves unless otherwise approved by the Chief Fire Prevention Engineer or his representative.

11.4 Emergency Shutdown (ESD) Actuating Buttons - Location

11.4.1 Emergency shutdown actuating buttons shall be located at the ends of each loading/unloading bay island and mounted between 1.2 m and 1.5 m above grade.

11.4.2 For unloading bays, without a bay island, actuating buttons shall be located at locations specified by the Proponent Operating Department.

11.4.3 For pump stations, an actuating button shall be installed at grade and located at least 15 m from any fire-hazardous equipment such as pumps and at least 7.5 m beyond the edge of the fire-hazardous zone.

11.4.4 ESD actuation shall also be located in the operations center.

11.5 The emergency shutdown and isolation system shall function as described below.

11.5.1 The ESD actuating button in any loading or unloading bay shall cause total shutdown of the entire rack and any associated pumps, including their suction EIVs, supplying product to that rack. Where required by the Proponent Operating Department, additional hand-operated isolation valves shall be installed no closer than 15 m to the edge of the loading rack.

*Commentary Note:*

*In most cases, fuel to loading racks can be satisfactorily isolated by closing pump suction EIVs. However, in cases where the product pumps are far from loading racks, the Proponent Operating Department, at their discretion, may require valves as an additional means of isolating each rack.*

11.5.2 The ESD actuating button located at the pump station shall shut down the pumps and close the pump suction EIVs.

11.5.3 ESD actuating function shall be provided in the operations center.

11.5.4 Activation of an emergency-isolation actuating button shall not cause activation of any fire protection system at the respective area.

11.5.5 Panels for ESD systems shall be independent of other types of panels.

*Commentary Note:*

*The intent of this requirement is not to prohibit inputting of shutdown signals from other panels to the ESD panel, but to prohibit signals from other panels from overriding any shutdown function of the ESD panel.*

11.6 Actuation of the foam fire protection system shall cause automatic activation of the emergency isolation sequence described in section 11.5 for the respective area. Actuation of the foam fire protection system shall cause the emergency isolation to take place regardless of whether the foam system is initiated manually (by button) or automatically (by the heat detectors).

11.7 A sign shall be provided at each ESD actuating button indicating the purpose and function of the actuating button. Signs shall be readily identifiable and suitable for the area (i.e., areas subject to moisture and exterior atmospheric conditions). Signs shall be in both Arabic and English. The size of letters shall be not less than 13 mm.

11.8 For fireproofing requirements of emergency isolation system components, refer to SAES-B-006.

## 12 Product Pumps

12.1 The product pumps shall be segregated by product.

In order to reduce the potential for loss of all pumps in any one incident, each product group shall be separated from pumps of another product group. Surface drainage from one product group shall not go to the catch basin(s) of another product group. Catch basins, sloping of slabs, and curbing shall be designed to prevent:

a) Surface drainage from one product group approaching within 3 m of another product group, and

b) Surface drainage from one pump area approaching within 3 m of another pump area.

12.2 Loading pumps shall be located a minimum distance of 15 m from loading racks.

12.3 Pump emergency isolation valves (EIVs) shall be power-operated, regardless of size and pressure rating. The EIVs shall be fail-closed.

12.4 Unloading pumps and associated suction piping shall be at an elevation and of a design so that removal of all the tanker contents is possible and the suction requirements of the pump are met.

## 13 Tankage and Piping

13.1 The product piping shall have bypass capability to enable product transfer from one tank to another same-service tank during an emergency or a T&I.

13.2 Piping shall be designed in accordance with SAES-L-Series Standards. All hydrocarbon piping shall be aboveground.

13.2.1 Buried hydrocarbon piping shall be allowed only at road, fence, and dike crossings. Road crossings shall meet SAES-L-460.

13.2.2 All metal parts in contact with aviation fuels shall be free of zinc, cadmium, copper, and their alloys.

13.3 For product storage tanks at air fueling terminals, elevated tank withdrawal (floating suction) and downstream filtration shall be provided.

13.4 Safety-identification of piping, storage tanks, and other equipment shall meet SAES-B-067.

13.5 All aboveground interconnecting piping and supports shall be protected from vehicle contact by using curbs, posts, or bumpers.

13.6 Fireproofing per SAES-B-006 is not required for loading/unloading canopy supports, rack supports, or pipe supports.

13.7 The canopy structure may be used to support fire protection piping, equipment, and aboveground ancillary piping.

13.8 Piping with a drip leg shall be provided for vapor collection/disposal to a vent that is located in a safe position. The vapor collection/disposal leg of each truck loading/unloading bay shall be vented individually. The vent shall terminate a minimum of 3.6 m above ground. A vent outlet that is located within a horizontal distance of 7.5 m of any canopy shall terminate at least 1.5 m or more above the canopy elevation.

*Exception:*

*Top loading operations, sulfur loading or hot tar loading, do not require vents.*

## 14 LPG

14.1 LPG facilities shall be reviewed on a case-by-case basis by the Operating and Loss Prevention Departments. Fire protection requirements are similar to Section 6 of this Standard except that fixed water spray systems shall be provided rather than foam systems and the low-level directional foam nozzles are not required.

14.2 LPG loading/unloading bays shall have a minimum separation of 30 m from bays of other products. The distance shall be measured from the nearest edges of the bays.

14.3 Listed break away fittings and dry couplers shall be provided.

14.4 LPG truck loading/unloading facilities shall have industrial drain holding tanks or sumps sized to hold at least five (5) minutes of deluge system fire water.

*Commentary Note:*

*The intent is to provide holding capacity only for fire water, since any spilled LPG will mostly vaporize. Sealed catch basins are required.*

14.5 Tank car/tank truck loading and unloading of LPG shall be via a closed system.

14.6 Fire detection at LPG facilities can be either by hermetically-sealed, rate-compensated, fixed-temperature heat detectors or combined ultraviolet (UV) / infrared (IR) detectors. Detectors shall be cross zone such that two detectors units must detect fire in order to activate the fire protection system. Fire detection shall meet NFPA 72.

*Commentary:*

*The intent is to keep the truck tank cool until the source of fuel can be isolated, not to put out the gas fire.*

14.7 Combustible and toxic gas detectors are not required.

## 15 Sulfur

15.1 Provide hose reels, and hydrants to meet SAES-B-017. Placement shall be approved by the Proponent Operating and Loss Prevention Departments. A spray system is not required for loading/unloading bays.

15.2 Surface drainage shall be provided. Sump or holding tanks shall be sized to hold at least five (5) minutes of fire water. If catch basins are used, the design shall provide adequate number of clean-outs as catch basin and piping could be plugged with product.

15.3 Sulfur truck loading/unloading water drainage patterns shall accommodate the weigh scales as needed.

15.4 Combustible and toxic gas detectors are not required.

**Revision Summary**

31 July, 2004 Major revision.

## Table 1 - Minimum Required Equipment Separation Distances

| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | LPG Racks | 15 | 30 | 30 | 30 | 30 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| 2 | Loading Racks | | 15 | 15 | 15 | 15 | 15 | 30 | 30 | 30 | 30 | 60 | 7.5 |
| 3 | Unloading Racks | | | 15 | 15 | 15 | See para. 12.2 | 39 | 39 | 39 | 39 | 60 | 7.5 |
| 4 | Product Tanks | | | | 7.5 | 7.5 | 30 | 30 | 30 | 30 | 30 | Refer to SAES-B-055 | 15 |
| 5 | Loading Pumps | | | | | See para. 12.1 | See para. 12.1 | 30 | 30 | 30 | 30 | 30 | 7.5 |
| 6 | Unloading Pumps | | | | | | Refer to SAES-B-055 | 30 | 30 | 30 | 30 | 30 | 7.5 |
| 7 | Fire Water Pumps | | | | | | | Refer to SAES-B-055 | 7.5 | 7.5 | 7.5 | 60 | 7.5 |
| 8 | Admin. Office, Operations Center | | | | | | | | Refer to SAES-B-055 | 7.5 | 7.5 | 60 | 7.5 |
| 9 | Ware-house, Service Bldg. | | | | | | | | | Refer to SAES-B-055 | 7.5 | 60 | 7.5 |
| 10 | Sales Office Computer Room | | | | | | | | | | Refer to SAES-B-055 | 60 | 7.5 |
| 11 | LPG Tanks | | | | | | | | | | | Refer to SAES-B-055 | 60 |
| 12 | Property Lines | | | | | | | | | | | | No spacing require-ments |

**Figure 1 – Arm Configuration to Avoid Trap**

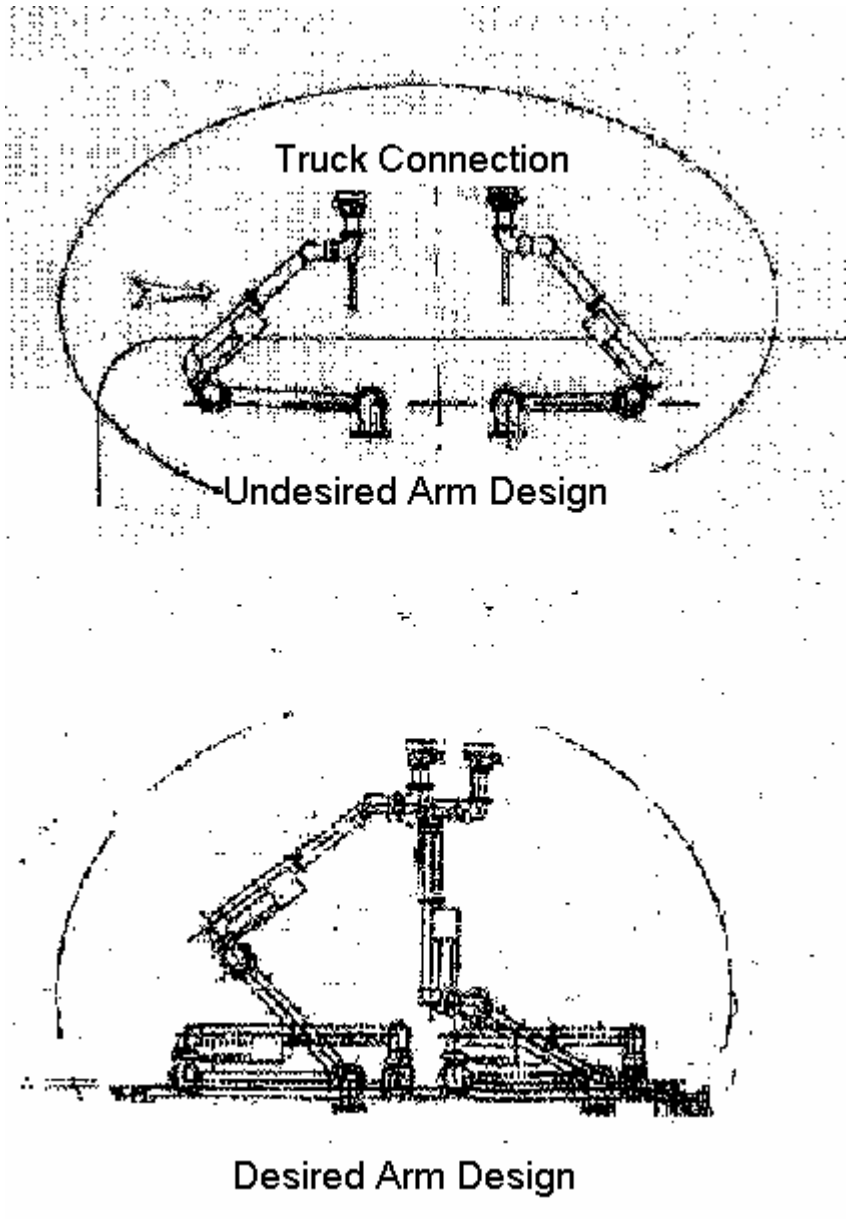

**Figure 2 - Tank Truck Bay Layout - Typical**