

NIOEC-SP-47-27(3)							
DOCUMENT CODE							NO. OF PAGES: 26
PLAN/PRJ/SUB	UNIT	PHASE	DISCIPLINE	DOCUMENT TYPE	SERIAL NO.	REV. NO.	DATE
NIOEC	000	EG	SF	SP	4727	A3	MARCH 2018



NATIONAL IRANIAN OIL REFINING & DISTRIBUTION COMPANY
NATIONAL IRANIAN OIL ENGINEERING
& CONSTRUCTION COMPANY

NIOEC SP

NIOEC SPECIFICATION FOR ACTIVE FIRE PROTECTION DESIGN CRITERIA

SECOND EDITION

MARCH, 2018

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IN THE NAME OF GOD**FOREWORD**

By their very nature, technical Specifications are continuously subject to modifications and revisions. To strengthen their merit and usefulness, continuous improvements, addendum, deletion of disparate information and consequently provision of updated revisions are to be made in order to ascertain that such Specifications meet the current requirements, inclusive of Iranian Petroleum Standards (IPS) and the recognized and acceptable national and international Standards, as well as the optimal codes and practices based on the accumulated in-house know-how and plant knowledge and experiences.

However, in reality, due to several reasons, not to mention the complexity of the matter, the ultimate goal of continuous direct embedment of the required changes on the relevant Specifications may be far reaching. Therefore, in the interim periods between the officially issued revisions, the required changes will appear in other documents related to the engineering and design work of the ongoing projects.

In response to the initiative of the Design and Engineering Directorate, and considering that the task of the execution of several important and mega projects for the realization of the new oil refineries, pipelines and oil terminals as well as improvements of the existing facilities, has been assigned to NIOEC, it was decided to update the NIOEC Specifications and to issue new official revisions.

The Design and Engineering Directorate was itself entrusted to carry out this important task, and as such by forming several special technical committees, working in close co-operation and cohesion and sharing their expertise and knowledge, the updated and revised NIOEC Specifications were successfully prepared and complied.

These Specifications are intended to be used for Oil Refineries, Distribution Depots, Oil Terminals, Pipelines and Pump Stations within NIOEC's projects, and have been proven to be of high value for such purposes. It must however be appreciated that these Specifications represent the minimum requirements and should in no way be interpreted as a restriction on the use of better procedures, engineering and design practices or materials.

We encourage and highly appreciate the users and other clear sighted and experts to send their comments on the Specifications to the Design and Engineering Director of NIOEC for evaluation and approval.

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NOTES:

- 1) THIS SHEET IS A RECORD OF ALL REVISIONS TO THIS SPECIFICATION.
- 2) WHEN APPROVED, EACH REVISION SHALL BE CONSIDERED AS A PART OF THE ORIGINAL DOCUMENT.
- 3) NUMBER OF PAGES EXCLUDES THIS SHEET AND THE COVER SHEET.

5					
4	MARCH, 2018	SH. GHASSEMI	SH. GHASSEMI	M.KAREGAR NAJAFI	A.ARMAN MOGHADAM
3	DECEMBER, 2014	SH. GHASSEMI	SH. GHASSEMI	M.KAREGAR NAJAFI	A.ARMAN MOGHADAM
2	OCTOBER, 2006	M.KHEZRI		M.R.FARZAM	M.A.A.SAJEDI
1	JULY, 2005	M.KHEZRI		M.R.FARZAM	M.A.A.SAJEDI
REV.	DATE	PREPARED	CHECKED	APPROVED	AUTHORIZED

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1. SCOPE

1.1. General

1.1.1. This Specification covers the minimum requirements for active fire protection design criteria to be employed for control of burning and extinguishing of fire in *refineries, pump stations, distribution depots and oil terminals*.

1.1.2. An approved altering and communicating system is required with fire detector systems for special risks.

1.1.3. Deviations from this specification will only be permitted on obtaining written approval from NIOEC.

1.1.4. Resolution on cases not explicitly stipulated in this Specification, or on cases where conflicts may arise among the requirements of the referenced/relevant IPS and the international standards, shall be made through written consent and approval of NIOEC.

1.2. Exclusions

1.2.1. It is not the intention of this Specification to cover fire resistant construction, insulation or fireproofing, trenching or fire-walling, electric bonding or earthing, fire and gas detection systems, alarm and call points or general regulations affecting personnel or equipment.

2. REFERENCES

The following standards, codes, and specifications, to the extent specified hereinafter, shall constitute a part of this NIOEC Specification. Latest edition of the undated referenced documents and the cited edition of the dated references shall apply. The applicability of changes made to the dated references ,after the cited date shall be mutually agreed upon between NIOEC and the Vendor/Contractor.

API (AMERICAN PETROLEUM INSTITUTE)

API RP 2030	“Application of Fixed Water Spray Systems for Fire Protection in the Petroleum and Petrochemical Industries”
API PUBL 2510A	“Fire-Protection Considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities”

ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERING)

ASME B16.5	“Steel Pipe Flanges and Flange Fittings”
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BS (BRITISH STANDARD)

BS-336	“Specification for Fire Hose Couplings and Ancillary Equipment”
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IEEE (INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS)

IEEE 979	“Guide for Substation Fire Protection”
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IPS (IRANIAN PETROLEUM STANDARD)

IPS E-SF-520	“Engineering Standard for Fire Stations “
IPS-G-SF-100	“Engineering and Equipment Standard for Fire Fighting Trucks and Pumps”
IPS-G-SF-503	“General Standard for Delivery-Commissioning, Preventive Maintenance of Fire Fighting Trucks “
IPS-G-SF-540	“General Standard for Safety & Fire Training Centers Fire Station Facilities”

NIOEC-SP (NIOEC SPECIFICATIONS)

NIOEC-SP-00-10	“NIOEC Specification for Units”
NIOEC-SP-00-66	“NIOEC Specification for Liquid & Gas Transfer & Storage”
NIOEC-SP-46-16	“NIOEC Specification for Fire Water Pumps”
NIOEC-SP-47-28	“NIOEC Specification for Fire Water Distribution & Storage Facilities”
NIOEC-SP-47-29	“NIOEC Specification for Safety and Firefighting Equipment”
NIOEC-SP-47-32	“NIOEC Specification for CO ₂ Extinguishing System”
NIOEC-SP-50-01	“NIOEC Specification for General Piping, Process and Utility Design, Equipment Layout and Drawing Procedure”
NIOEC-SP-90-52	“NIOEC Specification for Packing and Packages”

NIOEC-SD (NIOEC STANDARD DRAWINGS)

NIOEC-SD- 5013-1/1	“Standard DWG Underground & Misc. Piping Details”
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NFPA (NATIONAL FIRE PROTECTION ASSOCIATION CODES)

NFPA 10	“Standard for Portable Fire Extinguishers”
NFPA 11	“Standard for Low-, Medium-, and High-Expansion Foam”
NFPA 12	“Standard on Carbon Dioxide Extinguishing Systems”
NFPA 14	“Standard for the Installation of Standpipe and Hose System”
NFPA 15	“Standard for Water Spray Fixed Systems for Fire Protection”
NFPA 20	“Standard for the Installation of Stationary Pumps for Fire Protection”
NFPA 24	“Standard for the Installation of Private Fire Service Mains and Their Appurtenances”
NFPA 25	“Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems”
NFPA 30	“Flammable and Combustible Liquids Code”
NFPA 2001	“Standard on Clean Agent Fire Extinguishing Systems”

3. UNITS

International System of Units (SI) shall be used in accordance with NIOEC-SP-00-10, unless otherwise specified.

4. DEFINITIONS AND TERMINOLOGY

Client: National Iranian Oil Engineering & Construction Company.

Purchaser: National Iranian Oil Engineering and Construction Company in cases where this Specification is part of direct order by NIOEC and contractor where this Specification is part of contract Documents.

Adjacent Tank(s): Adjacent tank(s) are defined as the tank(s) located in the same bund wall and/or affected by the radiation of the tank on fire resulted from consequence analysis.

Adjacent Sphere(s): Adjacent sphere(s) are defined as sphere(s) with shell to shell distance less than or equal to 30 m.

Control of Burning: Application of water spray to equipment or areas where a fire can occur to control the rate of burning and thereby limit the heat release from a fire until the fuel can be eliminated or extinguishment effected.

Combustible Liquid: Any liquid that has a closed-cup flash point at or above 37.8°C (100°F).

Density: The unit rate of water or water/foam application to an area or surface expressed in (L/min)/m².

Design Fire Water Demand: In refineries, the maximum figure for firewater demand resulted from investigation of the simultaneous occurrence of both process area and tankage area fires. In pump stations, distribution depots and oil terminals, the maximum figure for firewater demand resulted from investigation of occurrence of one major fire at tankage area.

Exposure Protection: Absorption of heat through application of water spray to equipment exposed to a fire, to limit surface temperature to a level that will minimize damage and prevent failure.

Fire Hazardous equipment: Equipment, which due to specific operating conditions, enhances a fire hazard higher than the fire potential equipment.

Fire hazardous equipment includes:

- Pumps handling flammable or combustible liquids or gases, close or above their auto-ignition point temperature.
- Compressors handling flammable gas; lube oil and associated appurtenance.
- Gas turbine enclosure.
- LPG pressure storage spheres, bullets and large separators.
- LPG truck loading area.
- Storage tank storing more than 190 m³ of flammable or combustible liquids (NFPA 30 Class I and II).
- Oil filled transformers.

Fire Potential equipment: Any equipment handling flammable or combustible products.

Flammable liquid: Any liquid that has a closed-cup flash point below 37.8°C (100°F) or heated above its flash point.

Flash Point: The minimum temperature of a liquid at which sufficient vapor is given off to form an ignitable mixture with the air near the surface of the liquid or within the vessel used.

Isolated Room: Room where personnel are not normally present and where access time for intervention would take more than 5 minutes.

Risk Area: An area that is physically separated from other areas by space, barriers, walls, or other means in order to contain fire within that area.

In general:

- In Process area each unit shall be considered a single risk area as confined by roads surrounding the same unit.
- In Tankage area each groups of adjacent bounds, as surrounded by common roads, shall be considered a single Risk Area.

5. DESCRIPTION OF SYSTEMS

5.1. General

5.1.1. Firefighting activities may be carried out on facilities on fire using monitors, hose reels, hydrant nozzles, foam system, fixed spray system, CO₂ system, portable fire extinguishers, steam extinguishing means, mobile firefighting equipment (fire trucks, mobile foam unit), etc.

5.1.2. Firefighting facilities can be categorized as below:

Fixed System: A fire protection system that is permanently installed and connected to a supply of extinguishing agent(s). These systems may be automatically or manually activated. A water spray system supplied directly by the plant fire water system or a gaseous clean agent system in a control room or computer room are examples of fixed systems found in refineries.

Semi-fixed System: A fire protection system that is permanently installed but not connected to a supply of extinguishing agent. These systems generally require personnel to manually connect an extinguishing agent supply to the system prior to use. One example is a tank foam system that terminates at a connection located at the dike wall.

Portable Equipment: Fire suppression equipment that must be moved to the site of the fire, manually assembled or positioned before being put into service. It is generally stored until needed at a location accessible to its intended users.

5.1.3. The following fire protection systems shall be provided:

- Fire water storage and fire water pumping/distribution systems (including outdoor water hydrants, fixed and portable water monitors and outdoor/indoor hose reels).
- Foam extinguishing system for tanks containing flammable and combustible liquids, as outlined in this specification.
- Fixed water cooling system for tanks containing hydrocarbons.
- Fixed water spray system for fire hazardous equipment.
- CF_3I extinguishing or similar systems for quick action fire suppression *in refineries* floating roof tanks.
- CO_2 /clean agent extinguishing system for unmanned technical rooms containing electrical equipment and turbine enclosures.
- Clean agent extinguishing system for manned technical rooms containing electrical equipment *in refineries* and process plants.
- Fire extinguishers and mobile foam units.
- Fire truck and its accessories.
- Fire training area including all facilities and connections.
- Safety and lifesaving equipment such as safety shower, eye-wash, breathing apparatus and safety sign.

5.2. Water for Fire Protection

5.2.1. Water is used universally as a fire-fighting agent. It serves as a cooling, quenching, smothering, emulsifying, diluting, and displacing agent. Also it is used for foam generation and propagation systems.

The fire water system shall provide water for firefighting and fire protection for the process units, utility area, tankage area, buildings, other off-site areas, etc. Water shall be available for Foam systems and also, for the cooling of equipment and structures near a fire. Water for firefighting shall be provided by an independent main fire ring fed by the fire pumps and normally cross connected to the Refinery cooling water system. A dedicated water storage system shall be provided for firewater applications. Firewater shall not be used or share with process or potable water.

5.2.2. As a part of design criteria, firefighting system including water storage, piping distribution and pumping facilities shall be sized adequately and designed for:

- Fighting two major fires *in refineries*; one of them occurring at process area (defined as an area in which the fire can be confined without significant danger of the fire spreading to an adjacent area), the other at tankage area.
- Fighting one major fire *in pump stations, distribution depots and oil terminals*.

5.3. Foam for Fire Protection

5.3.1. Foam is generally used for fire suppression in tankage area. See section 7 for more detail.

5.3.2. Also foam can be used for supplementary protection in process area or tankage area by using equipment such as mobile foam unit or monitors having the opportunity to apply foam.

5.3.3. Foam can also be used in floating roof tanks as a quick action fire suppression system. In this case foam solution stored in pressurized vessels is installed on the roof of floating roof tanks and will be activated by fusible plugs. This system is an alternative system to that described in 5.5.1 and may be used upon Client's approval. In this case the effect of the weight of this system on the roof of the tank shall be considered.

5.4. Gaseous Extinguishing System

5.4.1. In *refineries* and process plants gaseous extinguishing system shall be selected as follows:

- Fixed automatic clean agent extinguishing system for manned rooms such as Engineering, Auxiliary, Control Room and cable gallery in control buildings.
- Fixed automatic CO₂/clean agent extinguishing system for Isolated rooms such as battery room, UPS room, Cable gallery and switch gear room in substation buildings.
- Adequate wheeled and portable CO₂ extinguishers also shall be provided for supplementary protection.

5.4.2. In *pump stations, distribution depots* and *oil terminals* gaseous extinguishing system shall be selected as follows:

- Where substation is separated from control building, and is an unmanned and isolated room, its rooms shall be protected by fixed automatic CO₂/clean agent extinguishing system. Also adequate wheeled and portable CO₂ extinguishers shall be provided for supplementary protection.
- Where substation is located in the control building and is not an isolated room; it shall be protected by adequate wheeled and portable CO₂ extinguishers.
- Cable galleries and cable trenched of all technical rooms (Control room, substation and ...) shall be protected by fixed automatic CO₂/clean agent extinguishing system.
- Battery room if located in manned area shall be protected by adequate portable CO₂ extinguishers.

5.5. Other Gaseous Fire Suppression Systems

5.5.1. Fire suppression systems using CF₃I is used in tankage area of *refineries* for floating roof tanks. See clause 8.2 for more detail.

5.5.2. Portable CO₂ extinguishers shall be used in enclosed areas only for electrical fires. They may be used for primary protections or supplementary protection some of them are as below:

- In technical rooms such as control room, that is protected by total flooding system, as supplementary protection.
- In technical rooms such as control room, that is not protected by total flooding system, as primary protection.
- In non-technical buildings such as administration building, workshop, restaurant, warehouse ... for suppression of fires in electrical equipment such as computer, electric panel, hood of kitchen ... as primary protection.

5.5.3. Steam system: Snuffing steam shall be made available at furnace header boxes, fire boxes and hydrocarbon PSVs open to atmosphere.

5.6. Summary

5.6.1. Table A1 in the appendix A and Table B1 in the appendix B are provided as guideline for selection of appropriate fire extinguishing agent and fire extinguishing system.