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

NIOEC SP

NIOEC SPECIFICATION FOR LAYOUT AND SPACING

SECONDE DITION
SEPTEMBER, 2015

THIS SPECIFICATION IS THE PROPERTY OF NATIONAL IRANIAN OIL ENGINEERING & CONSTRUCTION COMPANY. IT IS CONFIDENTIAL AND ALL RIGHTS RESERVED TO THE OWNER. NEITHER WHOLE NOR ANY PART OF THIS DOCUMENT MAY BE DISCLOSED TO ANY THIRD PARTY, REPRODUCED, STORED IN ANY RETRIEVAL SYSTEM OR TRANSMITTED IN ANY FORM OR BY ANY MEANS WITHOUT THE PRIOR WRITTEN CONSENT OF THE NATIONAL IRANIAN OIL ENGINEERING & CONSTRUCTION COMPANY.

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.

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INTRODUCTION

To satisfy the requirements of this NIOEC Specification, Iranian Petroleum Standard IPS-E-PR-190(1) (March 2009) with the modifications as specified herein after shall be strictly followed.

Articles 1 and 2 of this document replace entirely the related articles in the referenced IPS Standard.

1. SCOPE

This Specification covers the minimum requirements for engineering and design of plant layout and spacing of refinery/ oil plants, distribution depots, pump stations and pipelines to ensure safety and fire prevention together with ease of operation and maintenance.

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

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.

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 STD521	“Pressure-Relieving and Depressuring Systems”
API RP-505	“Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2”
API Std. 620	“Design and Construction of Large, Welded, Low-pressure Storage Tanks”
API Std. 650	“Welded Tanks for Oil Storage”

ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

“Boilers and Pressure Vessel Codes”
Section I, Power Boilers.
Section VIII, Pressure Vessels.

BS (BRITISH STANDARDS)

BS 4485	“Water Cooling Towers”
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IPS (IRANIAN PETROLEUM STANDARDS)

IPS-E-PR-190(1)	“Engineering Standard for Layout and Spacing”
IPS-E-PR-790	“Engineering Standard for Process Design of Cooling Towers”

NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)

NFPA 30 1989	“Flammable and Combustible Liquids Code”
NFPA 58	“Liquefied Petroleum Gas Code”

NIOEC SP (NIOEC SPECIFICATIONS)

NIOEC-SP-00-10	“NIOEC Specification for Units”
NIOEC-SP-00-66	“NIOEC Specification for Process Design of Liquid & Gas Transfer & Storage”
NIOEC-SP-10-06	“NIOEC Specification for Design of Roads & Asphaltic Concrete Paving”
NIOEC-SP-41-01	“NIOEC Specification for Storage Tanks-Field Erected”
NIOEC-SP-41-03	“NIOEC Specification for Pressure Vessels”
NIOEC-SP-47-28	“NIOEC Specification for Fire Water Equipment”
NIOEC-SP-47-36	“NIOEC Specification for Fire Fighting Sprinkler Systems”
NIOEC-SP-50-23	“NIOEC Specification for Pipe Support Element”
NIOEC-SP-60-00	“NIOEC Specification for General Design Philosophy for Electrical System”

NIOEC SD (NIOEC STANDARD DRAWINGS)

NIOEC-SD-5005	“NIOEC Standard Drawing for Typical Unit Plot Arrangement Pipe way Layout”
NIOEC-SD-5028	“NIOEC Standard Drawing for Pipe Line Spacing”

2.1. EQUIVALENT TO IPS STANDARDS

Substitute the following IPS Standards as referred to throughout IPS-E-PR-190(1) for the relevant NIOEC's Specifications as follows:

<u>IPS Standard</u>	<u>Relevant NIOEC Specification</u>
IPS-E-GN-100	NIOEC-SP-00-10
IPS-G-ME-100	NIOEC-SP-41-01
IPS-E-EL-110	NIOEC-SP-60-00
IPS-G-ME-110	NIOEC-SP-41-01
IPS-G-ME-120	NIOEC-SP-41-01
IPS-C-ME-130	NIOEC-SP-41-03
IPS-E-CE-160	NIOEC-SP-10-06
IPS-G-PI-280	NIOEC-SP-50-23

IPS-E-PR-360
IPS-E-SF-200
IPS-C-SF-550
IPS-D-PI-102
IPS-D-PI-103

NIOEC-SP-50-23
NIOEC-SP-00-66
NIOEC-SP-47-36
NIOEC-SD-5005
NIOEC-SD-5028

3. ADDENDUM TO IPS-E-PR-190 (1)

This addendum revises the below listed articles of the Standard IPS-E-PR-190(1) as follows:

3. DEFINITIONS AND TERMINOLOGY (Addition) (Add 3.18 to 3.23)

3.18. Diked Area

An area diked by dike walls to impound spillage.

3.19. Secondary or Intermediate Dikes

As for dike above, usually about 450mm in order to contain local spillage within a sub-area of the main diked area.

3.20. Tank Group

A number of tanks contained within a common dike

3.21. Small Tanks

A tank of 10 meters diameter or less and capacity of 8000 cubic meters of water or less is deemed to be a small tank.

3.22. Combustible Liquid.

Any liquid that has a closed cup flash point at or above 100°F (37.8°C) when handled below its flash point.

This category includes high flash stocks such as kerosene, some jet fuels, heating oils, heavy fuel oils, lubricating oils, transformer oils, and some asphalts.

3.23. Flammable Liquid.

Any liquid that has a closed cup flash point below 100°F (37.8°C), and a Reid vapor pressure that does not exceed an absolute pressure of 40 psi (276 kPa) at 100°F (37.8°C), as determined by ASTM D 323 or any combustible liquid which has been heated above its flash point.

This category includes low flash stocks such as gasoline, some jet fuels, and oils stored at temperatures above their flash points.

5. UNITS (Substitution)

International system of units (SI) shall be used in accordance with NIOEC-SP-00-10, unless otherwise specified in this Specification.

7. BASIC CONSIDERATIONS

7.1. General (Mod.)

The plant layout shall be arranged for:

- a) Maximization of safety;
- b) Prevention of the spread of fire and also ease of firefighting;

- c) Easy operation and maintenance
- d) Economize project costs with consideration of future expansion.
- e) Consider future expansion.

8. PLANT LAYOUT

8.1. Area Arrangement (Substitution)

- a) The arrangement of units' areas, storage areas, buildings, and facilities for loading/unloading to be provided within the plant, shall be decided on the base of the following factors:
 - i. Initially, base site selection on exposure from uncontrollable factors, such as floods, earthquakes, tidal waves, subsidence, hurricanes, and adjacent oil and chemical plants.
 - ii. Soil characteristics.
 - iii. Main road or rail access ways.
 - iv. Location of pipelines to and from plant.
 - v. Direction of prevailing wind.
 - vi. Local law and regulation which may affect the location of units and storage facilities.
 - vii. Natural elevation for location of upstream/downstream units and equipment (such as feed and product storage tanks, waste water plant, oil/water separator, etc.).
 - viii. Escape route and muster area for emergency.
- b) The units shall be separated by roads. Major roads shall have minimum width of 10 m., with maximum length of 400 m. The minor roads shall have minimum width of 6 m. (Minor roads shall not be in an area classified as zone 0 or 1). A four meter patrol road inside of plant fence shall be considered.
- c) A plant may contain one or several process units. Where any unit processes flammable fluids and may be operated independently (i.e. one unit may be shut down with others in operation). The minimum spacing between equipment on the two adjacent units shall be at least 20 m.
- d) Security fence
 - i. All sites (plants or complex) shall be within a security fence.
 - ii. Any public building, such as administration office, restaurant, clinic, etc., shall be located outside of the process area boundary.
 - iii. Except for case (iv) the minimum space between security fence and units' boundary shall be 20 m, and between security fence and equipment shall be 30 m.
 - iv. In case of special units such as flammable material storage with vapor release and toxic materials, minimum space shall be at least 60 m from site boundaries adjacent to centers of population (such as domestic, work or leisure).
- e) Except where they are an integral part of a process unit, site utility units should be grouped together in one area.
- f) Fire water pumps and equipment shall be sufficiently remote from processing, storage and loading area, where a major fire could occur. Firefighting system shall be designed in accordance with NIOEC-SP-47-36.

- g) The waste water treatment facilities shall be located at the lowest points of plant/complex.
- h) Loading/unloading areas for road transport shall have adequate space to provide access for filling, parking and maneuvering. A drive through rack arrangement is preferred. The loading and unloading facilities should be downwind or crosswind from process units and sources of ignition, based on the direction of prevailing wind.
- i) Lay out the equipment within a unit in one of two general ways:
 - i. Use grouped layout, where similar equipment is grouped together to ease operation, maintenance and control.
 - ii. Use flow line layout, where equipment is arranged in a sequence similar to the process flow diagram.
- j) Sulphur recovery unit and sulphur loading area should be located close to product movement gate and away from process units, hazardous and populated areas. Equipment drawing air (e.g. air compressors, air blower, FD fan etc.) should be located away from Sulfur recovery unit/Sulfur handling facility. Minimum separation distance of 50 meters is recommended between sulfur storage/handling and any facility or boundary wall.
- k) Petroleum coke storage and handling facilities should be located as far as possible away from process units, air separation plants, populated and hazardous areas.

8.4. Layout of Control Room and Electrical Sub-Station

8.4.2(Add)

- f) Parking area to be considered for cars at each control room and substation / power house.

9. LAYOUT IN PROCESS UNITS (Addition) (Add. 9.1.6 to 9.1.11)

- 9.1.6. The process heaters should preferably be in the same line.
- 9.1.7. The processes involving hydrogen should preferably be in the same area.
- 9.1.8. The drawing shall be prepared in one of the following scales: 1:200, 1:500.
- 9.1.9. The drawing shall show the following items:
 - a) Conventional north.
 - b) Coordinates of battery limits and roads.
 - c) Symbols for equipment and coordinates of their centerlines.
 - d) Finished floor elevation.
 - e) Equipment index list.
- 9.1.10. The area of any unit shall not exceed 20,000 m², and the length of each side should not exceed 200 m.

Subdivide the overall site into general areas dedicated to process units, utilities, services and offices. Since each area or unit block generally has a rectangular shape, it is recommended to keep the maximum unit length and width to 180 m and 90 m (600 ft. and 300 ft.) respectively for firefighting purposes.
- 9.1.11. For units processing flammable fluids, the central control building shall be adjacent to a road. It shall not be located in any area classified as zone 0 to 1 (based on NIOEC-SP-60-00).

9.1.12. Provide at least two entrances to the plant for emergency vehicles to prevent the possibility of vehicles being blocked during an incident, e.g., open bridge, railway.

9.5.4. Heat Exchangers (Sub 9.5.4.15&Mod9.5.4.18)

9.5.4.15. Air cooler shall not be located within 3 m horizontally from pumps on hydrocarbon service, to minimize the possibility of circulation of hot air.

9.5.4.18. Shell and tube heat exchangers shall be located collectively, at one point as far as possible, and their tube bundle pulling area shall be provided

9.5.5. Vessels and Drums (Addition) (Add. 9.5.5.5 to 9.5.5.12)

9.5.5.5. Piping to columns should drop or rise immediately after the nozzle and run parallel and close to the column. For ease of support a number of lines can be routed together, parallel in one plane.

9.5.5.6. If a tall slender vessel ($L/D > 10$) is susceptible to aerodynamic oscillations, the piping platforms and ladders of the top of the vessel shall be located such that the platform projected area against wind is kept at minimum.

9.5.5.7. Pressure vessels which are grouped together should have platforms and interconnecting walkways at the same elevation. The number of stairways and ladders to the platforms shall be sufficient to meet safety requirements.

9.5.5.8. In general, vessel orientation and piping shall be kept as uniform as possible in the arrangement of vessel components. For example, all ladders, manholes, platform, level transmitter, gage glasses, etc. ... should have a similar orientation throughout the entire plant, if possible.

9.5.5.9. All vertical vessel operating valves or equipment which must be manipulated or serviced during operation shall be accessible from ladders or platforms. Horizontal vessels 3.70m or less from grade to top of vessel will be serviced by portable ladder. Horizontal vessels having valves or equipment higher than 3.70 m above grade shall be provided with permanent ladder. Horizontal vessels with manholes, or control stations on top of the vessel higher than 3.7 m above grade shall also be provided with platform for access to these items.

9.5.5.10. Maximum length of ladders on vertical vessels shall be 9m, between landing platforms.

9.5.5.11. Manholes in both vertical and horizontal vessels will not require platforms when the centerline elevation is 4.5m or less from grade, unless a platform is required at manhole elevation for access to level instruments or other connection, in which case the platform should be extended to reach the manhole where this extension is 1.5 m or less.

9.5.5.12. Davits or trolley beams shall be provided on vessels over 9m (30 feet) height where the weight of removable internal and/or external equipment, such as relief valves, is greater than 90 kg (200 pounds). Also vessels with any type of packing (e.g. catalyst, desiccant, packing, etc.) shall be equipped with davits or trolley beams. Where lifting cannot be reasonably accomplished by a 1/2 ton chain block, a flame proof hoist shall be provided for each case.

9.5.5.13. Vessels shall be arranged in rows not more than two deeps. Every vessel shall be adjacent to a road or access way.

9.5.7.18. Spiral wound gaskets which are used on flanged connections to reciprocating compressors must have internal retaining rings, and used at raised face flanged connections only.

9.5.8. Storage vessels/tanks (Deletion)

10. LAYOUT OF PIPING

10.1. General (Mod 10.1.2, Sub 10.2.6)

10.1.2. Generally all process and utility piping should be installed aboveground (except cooling water supply and return and potable waterlines where technically and economically are justified to be underground).

10.2.6. (Substitution)

Pipe trenches close to process equipment should be avoided. Where it is not practicable to run pipe over rack, and trenches below paving level are unavoidable, such trench should be divided into sections about 10m min. length by fire break.

11. UTILITY LAYOUT AND SPACING (Mod. 11.1.3)

11.1.3 The cooling tower should be located to provide the least possible restriction to the free flow of air, and away from areas where drift or fogging might create a problem.

NFPA Code, Standard and Recommendation 214, Chapters 2 and 5 shall be considered for locating and spacing of cooling towers.

The direction of the prevailing wind shall be considered in selecting the location of cooling towers. The towers shall be located to minimize any nuisance, both within and outside the site, from the water blow-out, evaporation, drift and ice formation. The requirements of BS4485 shall be met.

12. OFFSITE FACILITIES (Substitute 12.2)

12.2. Tank Farm/Tankage Area (Substitution)

This article entirely replaces the article 12.2 of IPS-E-PR-190.

This section gives basic criteria for the spacing and dike capacities of storage tanks, storage spheres and cylinders.

12.2.1. General

12.2.1.1. Product storage tanks shall be located on the lee side of, and preferably down slope from the remainder of the plant.

12.2.2. Grouping and Spacing of Tanks

12.2.2.1. Tanks for the storage of the same products should be grouped together within a diked area, subject to the prescribed limitations of the dike capacity.

12.2.2.2. Unless otherwise approved by NIOEC, there shall be road on four sides of each diked area and roads shall be linked to minimize the effect if one road is cut off during the fire. Also there shall be at least one access road to diked area and two stairways from two opposite sides.

12.2.2.3. LPG or other liquefied flammable gases shall be stored remote from other products.

12.2.2.4. Intermediate and component tankage should be located in areas local to their respective units where possible so that lines can be kept to a minimum length.

12.2.2.5. Account shall be taken of the possibility of storing more than one class of material in certain tanks or of changing the tank service at some future date. Where future changes of

service of the storage tanks are anticipated, the layout and spacing should be for the most stringent case.

- 12.2.2.6. Wherever possible storage tanks should not be located on high ground overlooking the facilities. This prevents spillage of flammable liquid flowing downhill and endangering the operating plant.
- 12.2.2.7. Except for the tanks described in 12.2.2.8 arrange atmospheric storage tanks and pressure vessels in rows not more than two deep and adjacent to a road or access way for adequate firefighting accessibility.
- 12.2.2.8. Arrange floating roof tanks in excess of 50,000 m³ in a single row. If multiple rows are necessary, space tanks farther than one diameter apart.
- 12.2.2.9. For tanks containing liquid with flash point higher than 93°C and storing below its flash point, spacing is governed only by constructional and operational convenience and any number of tanks, regardless of total capacity may be grouped within a single dike.

Note that the spacing of the above mentioned tanks with other tanks is governed by the latter.
- 12.2.2.10. Above ground tank piping for any tank or group of tanks enclosed by a dike shall not run through other diked areas. This qualification does not apply to intermediate dikes of paired tanks.
- 12.2.2.11. Equipment such as pumps, filters and air cooled heat exchangers shall be located outside the diked area. Shell and tube exchangers and coolers integral with the piping system may be located within the diked area.
- 12.2.2.12. Small tanks may be sited together in groups, no group having an aggregate capacity of more than 8000 m³. Such group may be regarded as one tank.
- 12.2.2.13. Internal floating roof tanks shall be classified as floating roof tanks when pontoon internal floaters are provided. When plastic, aluminum or a steel pan are used in the construction of the internal floater, classify the tank as a fixed roof tank for spacing purposes.
- 12.2.2.14. Where fixed roof and floating roof tanks are adjacent, spacing shall be on the basis of tank(s) with the most stringent conditions.
- 12.2.2.15. For crude oil tanks with diameter less than 48 m, individual bounded compounds are not required, but for each crude oil tank with a diameter of 48 m or greater, a separate bounded compound shall be provided.
- 12.2.2.16. In no case shall the number of tanks in any bounded compound exceed 6.

12.2.3. Control of Spills from Aboveground Tanks

- 12.2.3.1. Every tank that contains liquid with flash point lower than 93°C or stored above flash point temperature shall be provided with means to prevent an accidental release of liquid from endangering important facilities and adjoining property or from reaching waterways. Such means shall meet the requirements of 12.2.3.4.
- 12.2.3.2. For tanks containing petroleum product with flash point higher than 93°C and stored below flash point temperature tankage where condition are such that any spillage or leakage could escape from the installation and cause damage to third party property drainage system, rivers or waterways a low wall 0.5 m in height, shall be constructed.
- 12.2.3.3. Drainage of spillage to a remote impounding area, is not allowed.

12.2.3.4. Impounding around Tanks by Diking:

Where diking around the tanks is required as per 12.2.3.1, such systems shall comply with the following:

- (A) A slope of not less than 1 percent away from the tank shall be provided for at least 15 m or to the dike base, whichever is less.
- (B) The volumetric capacity of the diked area shall not be less than the 100% of greatest amount of liquid that can be released from the largest tank within the diked area, assuming a full tank. To allow for volume occupied by tanks, the capacity of the diked area enclosing more than one tank shall be calculated after deducting the volume of the tanks, other than the largest tank, below the height of the dike.

Note: Where passive defense requirement is obligated, the related regulations shall be met.

- (C) Walls of the diked area shall be of earth, concrete, or solid masonry designed to be liquid tight and to withstand a full hydrostatic head. Earthen walls 0.9 m or more in height shall have a flat section at the top not less than 0.6 m wide. The slope of an earthen wall shall be consistent with the angle of repose of the material of which the wall is constructed.
- (D) The effective height of the dike used in calculating the capacity of the enclosure shall be the constructed height less an amount sufficient to allow for future consolidation, settlement and possible erosion of the fill.
- (E) The wall of the diked area shall be restricted to an average exterior height of 2 m (including free board, allowance for future consolidation, settlement and possible erosion) above grade. Where passive defense requirement is necessary, the dike wall height measured from outside may be increased up to 2.2 m.
- (F) When tanks are located on sloping terrain, portions of the dike may exceed the above-mentioned specified limits except for the side adjacent to the road or access way.
- (G) Where provision is made for draining water from diked areas, such drains shall be controlled to prevent liquids from entering natural water courses, public sewers, or public drains. Control of drainage shall be accessible under fire conditions from outside the dike.

12.2.4. Grouping and Spacing Atmospheric Storage Tanks

12.2.4.1. When grouping atmospheric storage tanks in a common dike area, maximum total tankage capacity shall be 60,000 m³ for fixed roof tanks and 120,000 m³ for floating roof tanks.

12.2.4.2. Separation distances between the nearest tanks located in separate dikes shall not be less than the diameter of the larger of the two tanks or 30 meters, whichever is more.

12.2.4.3. Spacing of tanks shall be in accordance with Table 1.

Table 1: Spacing of Atmospheric Storage Tanks

Boundary line or other facility	Type of tank roof	Recommended minimum distance (1)(2)
Within a group of small tanks	Fixed or floating	Determined solely by construction/ maintenance/ operational convenience.
Between a group of small tanks and another group of small tanks	Fixed or floating	10 m minimum, otherwise determined by the size of the larger tanks (see below item)
Between adjacent individual tanks (other than small tanks)	Fixed	$\frac{1}{2}$ the diameter of the larger tank, but not less than 10 meter.
	Floating	$\frac{1}{3}$ the diameter of the larger tank, but not less than 10 meter.
Between a tank and the top of the inside the wall of its dike wall	Fixed or floating	Not less than half of the height of the tank.
Between any tank in a group of tanks and the inside top of the adjacent dike wall	Fixed or floating	Not less than 15 m
Property lines adjacent to land which is developed or can be built upon, public highways, main-line railroads, and manifolds located on marine piers.	Any type of tank containing flammable liquid or crude oil	60 m
	Combustible liquid in fixed roof tank	45 m
Between a tank and the battery limit of a process unit	Any type of tank containing flammable liquid or crude oil	45 m (3)
	Combustible liquid in fixed roof tank	$\frac{1}{2}$ tank diameter, but not less than 30 m, need not exceed 45 m(4)(5)
Building of high occupancy (offices, shops, labs, warehouses, etc.).	Any type of tank containing flammable liquid or crude oil	$1\frac{1}{2}$ tank diameter, but not less than 45 m, need not exceed 60 m.
	Combustible liquid in fixed roof tank	1 tank diameter, but not less than 30 m, need not exceed 45 m(5)
(1) The distance from property lines adjacent to land which is developed or can be built upon, public highways, or high occupancy buildings (such as laboratories, shops, offices) to centerline of peripheral dike wall surrounding the tank(s) shall not be less than 30 m at any point. (2) The minimum spacing between any dike and any critical area shall be 15 m unless otherwise specified by the Client. (3) Spacing may be reduced to 30 m for a tank or group of tanks meeting all of the following: (a) All tanks are an integral part of the given process operation. (b) Each tank is less than 15 m in diameter. (c) The total capacity of the group does not exceed 8,000 m³. (4) Spacing need not exceed 30 m provided that all of the following requirements are met: (a) The stock is stored at ambient temperature and the closed cup flash point is above 93 °C; or if heated, not above 93 °C and not within 28°C of its flash point. (b) The stock is not received directly from a process unit where upset conditions could lower its flash point below the limits of Subpar. a. above. (c) The total capacity of any tank does not exceed 32,000 m³ and the total capacity of any pair or group of tanks does not exceed 80,000 m³. (d) There are no tanks storing flammable liquids within the same pair or group. (5) Spacing need not exceed 15 m provided that all of the following requirements are met: (a) The requirements given in Note (3) Subpar. a. and b. above. (b) All tanks are an integral part of the given process operation. (c) Each tank is less than 15 m in diameter and the total capacity of a group of tanks does not exceed 8,000 m³. (d) There are no tanks storing flammable liquids within the same group.		

12.2.5. Grouping and Spacing LPG Pressure Storage Vessels

- 12.2.5.1.** Horizontal LPG tanks with capacities of 45 m³ or greater shall not be formed into groups of more than six tanks each. When multiple groups are required, each group shall be separated from adjacent groups by a minimum horizontal shell-to-shell distance of 15 meters.
- 12.2.5.2.** Horizontal vessels used to store LPG shall be oriented so that their longitudinal axes do not point towards other containers, process equipment, control rooms, loading or unloading facilities, or flammable or combustible liquid storage facilities located within the vicinity of the horizontal vessel.
- 12.2.5.3.** Spacing between two individual tanks shall be $\frac{1}{4}$ sum of diameters of 2 adjacent tanks, but not less than 1.5 meters.
- 12.2.5.4.** Spheres and spheroids shall be arranged in rows not more than two deeps. At least one side of every vessel shall be adjacent to a road or accessway.
- 12.2.5.5.** Pressure storage LPG tanks may not be provided with spill dikes. However, a dividing bond of 600 mm must be provided between each vessel. Such bunds must not be totally enclosed.
- 12.2.5.6.** Vessels shall be arranged into groups each having a maximum of six vessels. Capacity of each group shall be limited to 15000 m³.
- 12.2.5.7.** Any vessel in one group shall be separated from a vessel in another group by a minimum distance of 15 meters.
- 12.2.5.8.** Spheres and bullets shall be treated as separate groups with 15 meters separation distance between two groups.
- 12.2.5.9.** Pressure storage LPG tanks shall be located with respect to the important building, group of buildings, or line of adjoining property that can be built upon, in accordance with Table 2.

Table 2: Separation Distances between Containers and Important Buildings, and Line of Adjoining Property That Can Be Built Upon

Water Capacity per Container (m ³)	Distance for Aboveground Containers (m)
Less than 450	40
450 to 750	60
750 to 3800	90
More than 3800	120

- 12.2.5.10.** The distance from pressure storage tanks and other facilities shall be in accordance with Table 3.

Table 3: The Minimum Spacing from Vessels to Boundaries or Between Vessels and Other Facilities

Boundary Lines or Other Facilities	Minimum Spacing
Nearest process equipment in onsite unit or utility plant (or nearest unit limits if firm layout is not available)	60 m (1)
Flare or other equipment containing exposed flame	60 m
Ancillary equipment used solely for operation of the	Not less than 22.5 m from the vessel shell and

storage vessels (compressors, refrigeration unit, vaporizers, etc.)	not less than 7.5 m from the dike; and as required for maintenance
Atmospheric Storage Tanks containing flammable liquids	1 vessel diameter, but not less 30 m; need not exceed 60 m.
Atmospheric Storage Tanks containing combustible liquids	½ vessel diameter, but not less 30 m; need not exceed 45 m.
Note: (1) Distance from boundary line or facility to centerline of peripheral dike wall surrounding the storage vessel shall not be less than 30 m at any point.	

12.2.6. Grouping Refrigerated Storage (LPG products at low temperatures) Fixed Roof Tanks

12.2.6.1. No refrigerated LPG storage tank shall be located within a dike enclosing any other tank. Each refrigerated storage tank shall have an individual dike.

12.2.6.2. Double containment storage tanks do not require a dike except for local containment of leakage from pipework, valves etc.

12.2.6.3. Maximum total tankage capacity shall not be exceeded 60,000 m³. For minimum dike capacity see paragraph 12.2.3.4 (B).

12.2.6.4. The minimum distance between aboveground refrigerated LPG containers shall be one-half the diameter of the larger container.

12.2.6.5. Spacing of refrigerated LPG containers from occupied buildings, storage containers of flammable or combustible liquids, and lines of adjoining property that can be built upon shall be in accordance with Table 4 and Table 5.

Table 4: Minimum Distances for LPG Containers That Operate above 15 psi (103 kPa)

Water Capacity per Container (m ³)	Distance for Aboveground Containers (m)
Less than 450	40
450 to 750	60
750 to 3800	90
More than 3800	120

Table 5: Minimum Distances for LPG Containers That Operate below 15 psi (103 kPa)

Water Capacity per Container (m ³)	Distance for Aboveground Containers (m)
Less than 265	25
More than 265	30

12.2.6.6. The minimum recommended spacing of refrigerated LPG containers from process units, flare or other equipment containing exposed flame shall be 60 m. Distance from boundary line of such equipment to centerline of peripheral dike wall surrounding the storage vessel shall not be less than 30 m at any point.



IRANIAN PETROLEUM STANDARDS

استانداردهای نفت ایران

IPS

IPS-E-PR-190 (1)

ENGINEERING STANDARD
FOR
LAYOUT AND SPACING

FIRST REVISION

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استاندارد مهندسی
برای
جانمایی و فاصله گذاری

ویرایش اول

اسفند ۱۳۸۷

DEPUTY MINISTER
OF
ENGINEERING & LOCAL MANUFACTURING
RESEARCH & STANDARDS

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FOREWORD

The Iranian Petroleum Standards (IPS) reflect the views of the Iranian Ministry of Petroleum and are intended for use in the oil and gas production facilities, oil refineries, chemical and petrochemical plants, gas handling and processing installations and other such facilities.

IPS are based on internationally acceptable standards and include selections from the items stipulated in the referenced standards. They are also supplemented by additional requirements and/or modifications based on the experience acquired by the Iranian Petroleum Industry and the local market availability. The options which are not specified in the text of the standards are itemized in data sheet/s, so that, the user can select his appropriate preferences therein.

The IPS standards are therefore expected to be sufficiently flexible so that the users can adapt these standards to their requirements. However, they may not cover every requirement of each project. For such cases, an addendum to IPS Standard shall be prepared by the user which elaborates the particular requirements of the user. This addendum together with the relevant IPS shall form the job specification for the specific project or work.

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The users of IPS are therefore requested to send their views and comments, including any addendum prepared for particular cases to the following address. These comments and recommendations will be reviewed by the relevant technical committee and in case of approval will be incorporated in the next revision of the standard.

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پیش گفتار

استانداردهای نفت ایران (IPS) منعکس کننده دیدگاههای وزارت نفت ایران است و برای استفاده در تأسیسات تولید نفت و گاز، پالایشگاههای نفت، واحدهای شیمیایی و پتروشیمی، تأسیسات انتقال و فراورش گاز و سایر تأسیسات مشابه تهیه شده است.

استانداردهای نفت، براساس استانداردهای قابل قبول بین المللی تهیه شده و شامل گزیده‌هایی از استانداردهای مرجع در هر مورد می‌باشد. همچنین سایر الزامات و/ یا اصلاحات مورد نیاز براساس تجربیات صنعت نفت کشور و امکانات تأمین داخل در استانداردها گنجانده شده است. مواردی از گزینه‌های فنی که در متن استانداردها آورده نشده است در داده برگها بصورت شماره گذاری شده برای استفاده مناسب کاربران آورده شده است.

استانداردهای نفت، بشکلی کاملاً انعطاف پذیر تدوین شده است تا کاربران بتوانند نیازهای خود را با آنها منطبق نمایند. با این حال ممکن است در مواردی همه نیازهای پروژه ها را پوشش ندهند. در این گونه موارد باید الحاقیه‌ای که نیازهای خاص آنها را تأمین می‌نماید تهیه و پیوست نمایند. این الحاقیه همراه با استاندارد مربوطه، مشخصات فنی آن پروژه و یا کار خاص را تشکیل خواهند داد.

استانداردهای نفت تقریباً هر پنج سال یکبار مورد بررسی قرار گرفته و روزآمد می‌گردند. در این بررسی‌ها ممکن است استانداردی حذف و یا الحاقیه‌ای به آن اضافه شود و بنابراین همواره آخرین ویرایش آنها ملاک عمل می باشد.

از کاربران استاندارد، درخواست می‌شود نقطه نظرها و پیشنهادات اصلاحی و یا هرگونه الحاقیه‌ای که برای موارد خاص تهیه نموده‌اند، به نشانی زیر ارسال نمایند. نظرات و پیشنهادات دریافتی در کمیته‌های فنی مربوطه بررسی و در صورت تصویب در تجدید نظرهای بعدی استاندارد منعکس خواهد شد.

ایران، تهران، خیابان کریمخان زند، خردمند شمالی، کوچه چهاردهم، شماره ۱۹

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پست الکترونیک :

General Definitions:

Throughout this Standard the following definitions shall apply.

Company :

Refers to one of the related and/or affiliated companies of the Iranian Ministry of Petroleum such as National Iranian Oil Company, National Iranian Gas Company, and National Petrochemical Company etc.

Purchaser :

Means the "Company" Where this standard is part of direct purchaser order by the "Company", and the "Contractor" where this Standard is a part of contract document.

Vendor And Supplier:

Refers to firm or person who will supply and/or fabricate the equipment or material.

Contractor:

Refers to the persons, firm or company whose tender has been accepted by the company,

Executor :

Executor is the party which carries out all or part of construction and/or commissioning for the project.

Inspector :

The Inspector referred to in this Standard is a person/persons or a body appointed in writing by the company for the inspection of fabrication and installation work

Shall:

Is used where a provision is mandatory.

Should

Is used where a provision is advisory only.

Will:

Is normally used in connection with the action by the "Company" rather than by a contractor, supplier or vendor.

May:

Is used where a provision is completely discretionary.

تعاریف عمومی:

در این استاندارد تعاریف زیر به کار می رود.

شرکت:

به شرکت های اصلی و وابسته وزارت نفت مثل شرکت ملی نفت ایران، شرکت ملی گاز ایران، شرکت ملی صنایع پتروشیمی و غیره اطلاق میشود.

خریدار:

یعنی شرکتی که این استاندارد بخشی از مدارک سفارش خرید مستقیم آن "شرکت" میباشد و یا "پیمانکاری" که این استاندارد بخشی از مدارک قرارداد آن است .

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به موسسه و یا شخصی گفته می شود که تجهیزات و کالاهای مورد لزوم صنعت را تامین مینماید .

پیمانکار:

به شخص، موسسه و یا شرکتی گفته میشود که پیشنهادش برای مناقصه و یا مزایده پذیرفته شده و با او قرارداد منعقد گردیده است

مجری:

مجری به گروهی اطلاق می شود که تمام یا قسمتی از کارهای اجرائی و یا راه اندازی پروژه را انجام دهد.

بازرس:

در این استاندارد بازرس به فرد یا گروهی اطلاق می شود که کتباً توسط کارفرما برای بازرسی ساخت و نصب تجهیزات معرفی شده باشد.

باید:

برای کاری که انجام آن اجباری است استفاده میشود.

توصیه:

برای کاری که ضرورت انجام آن توصیه میشود.

ترجیح:

معمولاً در جایی استفاده میشود که انجام کار مطابق با نظر "شرکت" ترجیح داده میشود.

ممکن است :

برای کاری که انجام آن اختیاری میباشد .

ENGINEERING STANDARD

FOR

LAYOUT AND SPACING

FIRST REVISION

MARCH 2009

استاندارد مهندسی

برای

جانمایی و فاصله گذاری

ویرایش اول

اسفند ۱۳۸۷

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این استاندارد متعلق به وزارت نفت ایران است. تمام حقوق آن متعلق به مالک آن بوده و نباید بدون رضایت کتبی وزارت نفت ایران، تمام یا بخشی از این استاندارد، به هر شکل یا وسیله از جمله تکثیر، ذخیره سازی، انتقال، یا روش دیگری در اختیار افراد ثالث قرار گیرد.

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غیر تبریدی تا مرزهای آن و دیگر
تأسیسات ۷۲

+ - مقدمه

0. INTRODUCTION

The Standard practice Manuals titled as "Fundamental Requirements for the Project Design and Engineering" is intended for convenience of use and a pattern of follow-up and also a guidance.

These Standard Engineering Practice Manuals, also indicate the check points to be considered by the process engineers for assurance of fulfillment of prerequisites at any stage in the implementation of process projects.

It should be noted that these Iranian Petroleum Standards (IPS), as Practice Manuals do not profess to cover all stages involved in every process project, but they effect the stages that exist in general in process projects of oil, gas and Petrochemical Industries of Iran.

These preparation stages describe the following three main phases which can be distinguished in every project & include, but not be limited to :

Phase I) Basic Design Stages (Containing Seven Standards)

Phase II) Detailed Design, Engineering and Procurement Stages (Containing Two Standards)

Phase III) Start-Up Sequence and General Commissioning Procedures (Containing two Standards)

The process engineering standards of this group include the following 11 Standards:

I) Manuals Of Phase I (Numbers 1 - 7)

IPS-E-PR-150	Basic Design Package
IPS-E-PR-170	Process Flow Diagram
IPS-E-PR-190	Layout and Spacing
IPS-E-PR-200	Basic Engineering Design Data
IPS-E-PR-230	Piping & Instrumentation Diagrams (P & IDs)
IPS-E-PR-250	Performance Guarantee
IPS-E-PR-308	Numbering System

کتابچه های کاربردی استاندارد شده با عنوان "الزامات بنیادی برای طراحی پروژه و مهندسی" با هدف سهولت در استفاده و ارائه الگوی پی گیری و رهنمود میباشد.

کتابچه های کاربردی استاندارد شده مهندسی، نقاط بررسی که بایستی توسط مهندسین فرآیند برای اطمینان از تکمیل پیش نیازهای هر مرحله از اجرای پروژه های فرآیندی باید در نظر گرفته شوند را نیز مشخص می کنند.

قابل ذکر است که استانداردهای نفت ایران (IPS) به عنوان کتابچه های کاربردی استاندارد شده، ادعای در برگیری کلیه مراحل مورد نیاز در هر پروژه فرآیندی را ندارد اما به طور کلی در مراحل کنونی انجام پروژه های فرآیندی نفت، گاز و صنایع پتروشیمی ایران موثر هستند.

مراحل انجام پروژه سه فاز اصلی زیر را دارد که قابل تفکیک در هر پروژه ای بوده اما به آن محدود نمیگردد:

فاز I) مراحل طراحی پایه (شامل هفت استاندارد)

فاز II) مراحل طراحی تفصیلی، مهندسی و خرید (شامل دو استاندارد)

فاز III) دستورالعملهای ترتیب مراحل راه اندازی و راه اندازی عمومی (شامل دو استاندارد)

استانداردهای مهندسی فرآیند در این گروه شامل یازده استاندارد زیر میباشد:

I) کتابچه های راهنمای فاز I (شماره های ۱ تا ۷)

IPS-E-PR-150	بسته طراحی پایه
IPS-E-PR-170	نمودار جریان فرآیند
IPS-E-PR-190	جانمایی و فاصله گذاری
IPS-E-PR-200	داده های طراحی مهندسی پایه
IPS-E-PR-230	نمودارهای لوله کشی و ابزار دقیق (P&IDs)
IPS-E-PR-250	ضمانت کارآیی
IPS-E-PR-308	روش شماره گذاری

II) Manuals Of Phase II (Numbers 8 & 9)

[IPS-E-PR-260](#) Detailed Design, Engineering and Procurement

[IPS-E-PR-300](#) Plant Technical and Equipment Manuals (Engineering Dossiers)

III) Manuals Of Phase III (Numbers 10 & 11)

[IPS-E-PR-280](#) Start-Up Sequence and General Commissioning Procedures

[IPS-E-PR-290](#) Plant Operating Manuals

This Engineering Standard Specification covers:

" Layout And Spacing "

II (کتابچه های فاز II (شماره های ۸ و ۹)

[IPS-E-PR-260](#) طراحی تفصیلی، مهندسی و خرید

[IPS-E-PR-300](#) کتابچه های فنی کارخانه و تجهیزات (پرونده های مهندسی)

III (کتابهای راهنمای فاز III (شماره های ۱۰ و ۱۱)

[IPS-E-PR-280](#) دستورالعملهای ترتیب مراحل راه اندازی و راه اندازی عمومی

[IPS-E-PR-290](#) کتابچه های عملیاتی کارخانه

موضوع این استاندارد مشخصات مهندسی عبارت است از:

"جانمایی و فاصله گذاری"

1. SCOPE

1.1 This Standard Specification covers the basic requirements of the plant layout and spacing of oil & gas refineries, petrochemical and similar chemical plants to ensure safety and fire prevention together with ease of operation and maintenance.

Note 1:

This standard specification is reviewed and updated by the relevant technical committee on June 2002, as amendment No. 1 by circular No. 170.

Note 2:

This bilingual standard is a revised version of the standard specification by the relevant technical committee on March 2009, which is issued as revision (1). Revision (0) of the said standard specification is withdrawn.

Note 3:

In case of conflict between Farsi and English languages, English language shall govern.

2. REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

API (AMERICAN PETROLEUM INSTITUTE)

RP-500	Recommended Practice for Classification of Location for Electrical Installation at Petroleum Facilities, Classified as Class 1.Division 1 and Division 2.
RP 521	Guide for Pressure-Relieving and Depressuring Systems
API Std. 620	Design and Construction of Large, Welded, Low Pressure Storage Tanks

۱- دامنه کاربرد

۱-۱ در این مشخصات فنی استاندارد کلیه الزامات اولیه جانمایی واحدهای صنعتی و فاصله گذاری در پالایشگاههای نفت و گاز، پتروشیمی و کارخانجات شیمیایی مشابه جهت حصول اطمینان از ایمنی و جلوگیری از آتش سوزی به همراه سهولت در انجام عملیات و تعمیرات ارائه میگردد.

یادآوری ۱:

این استاندارد در خرداد ماه سال ۱۳۸۱ توسط کمیته فنی مربوطه بررسی و موارد تأیید شده به عنوان اصلاحیه شماره ۱ طی بخشنامه شماره ۱۷۰ ابلاغ گردید.

یادآوری ۲:

این استاندارد دو زبانه، نسخه بازنگری شده استاندارد فوق می باشد که در اسفند ماه سال ۱۳۸۷ توسط کمیته فنی مربوطه تأیید و به عنوان ویرایش (۱) ارائه می گردد. از این پس ویرایش (۰) این استاندارد منسوخ می باشد.

یادآوری ۳:

در صورت اختلاف بین متن فارسی و انگلیسی، متن انگلیسی ملاک می باشد.

۲- مراجع

در این استاندارد به آیین نامه ها و استانداردهای تاریخ دار و بدون تاریخ زیر اشاره شده است. این مراجع، تا حدی که در این استاندارد مورد استفاده قرار گرفته اند، بخشی از این استاندارد محسوب می شوند. در مراجع تاریخ دار، ویرایش گفته شده ملاک بوده و تغییراتی که بعد از تاریخ ویرایش در آنها داده شده است، پس از توافق بین کارفرما و فروشنده قابل اجرا می باشد. در مراجع بدون تاریخ، آخرین ویرایش آنها به انضمام کلیه اصلاحات و پیوست های آن ملاک عمل می باشند.

API (موسسه نفت آمریکا)

RP-500	پیشنهاد عملی برای طبقه بندی محل های نصب تجهیزات برقی در تاسیسات نفتی طبق طبقه بندی کلاس ۱ بخش ۱ و بخش ۲
RP 521	راهنمای فشار زدایی و سیستمهای تخلیه فشار
API Std.620	طراحی و ساخت مخازن ذخیره بزرگ، جوشکاری شده، تحت فشار پایین