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

NIOEC SP

NIOEC SPECIFICATION FOR CO2 FIRE EXTINGUISHING SYSTEM

SECOND EDITION

JULY, 2009

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 standard, Iranian petroleum standard IPS-E-SF-160 revised on December 2013 with the considerations as specified herein after shall be strictly followed.

Articles 1, 2 and 4 of this document replace entirely the related articles in the referenced IPS Standard.

1 SCOPE

This NIOEC Specification covers the minimum requirements for carbon dioxide systems, design and provision of piped supply of Carbon dioxide for the extinguishing of fire.

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

Throughout this Specification the following dated and undated standards/ codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this Specification.

For undated references, the latest edition of the referenced document (including any supplements and amendments) applies. For dated references, the edition cited applies.

The applicability of changes in dated references that occur after the cited date shall mutually be agreed upon by NIOEC and the Vendor/Contractor.

NIOEC-SP (NIOEC SPECIFICATIONS)

NIOEC-SP-00-10 “NIOEC Specification for Units”

NIOEC-SP-47-27 “NIOEC Specification for active fire protection design criteria”

IPS (IRANIAN PETROLEUM STANDARD)

IPS-E-SF-160 “CO₂ Gas Fire Extinguishing Systems”

BSI (BRITISH STANDARD INSTITUTION)

BS 5306- Part 4 “Fire Extinguishing Installations and Equipment on Premises - Part 4: Specification for Carbon Dioxide Systems”

NFPA (NATIONAL FIRE CODES)

NFPA 12 “Standard on Carbon Dioxide Extinguishing Systems”

2.1 Equivalent to IPS Standards

Substitute the following IPS Standards as referred to throughout IPS-E-SF-160 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-E-SF-140	NIOEC-SP-47-30
IPS-E-SF-160	NIOEC-SP-47-32
IPS-E-SF-200	NIOEC-SP-47-36
IPS-E-SF-220	NIOEC-SP-47-28
IPS-E-SF-240	NIOEC-SP-46-16
IPS-E-SF-280	NIOEC-SP-70-53

4 UNITS

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

ADDENDUM TO IPS-E-SF-160

This addendum revises the below listed articles of the referenced standard as follows:

6.2.1 Uses (Substitution)

Substitute (a) as follows:

- a) Examples of hazards that are successfully protected by total flooding systems include rooms (Trench or cable gallery of Control rooms, electrical substations, switch gear rooms and MCC room and cable gallery), vaults, enclosed machines (Turbine enclosure), ducts, ovens, containers, and the contents thereof. For more information about the places where CO₂ total flooding shall be used see NIOEC-SP-47-27.

(Addition)

6.1.3 The amount of the main supply of carbon dioxide in the system shall be at least sufficient for the largest single hazard protected or group of hazards that are to be protected simultaneously and 100% reserve cylinder shall be considered.

(Addition)

6.2.3 The design of the CO₂ system shall be in compliance with NFPA 12 or BS 5306 Part 4.

6.3.2.2 (Modification)

Modify the equation as follows:

$$X = 23.9 \times \frac{Q}{\sqrt{P}}$$

6.4 Actuation and Interlock (Addition)

6.4.1. All systems must be provided with emergency manual control, for use in the event of system failure (automatic operation, normal manual actuation, power, etc.), for instance a manual valve on the cylinder rack.

6.4.2. Operation of the CO₂ system shall be interlocked to shut-down the HVAC system and close dampers before discharge. Diesel engines and turbines shall as well be shut down prior to CO₂ release. Conversely doors shall not be locked while the CO₂ release system is operating.

6.4.3. Unless the persistence of power supply generates additional hazards, power supply shall not be switched off prior to CO₂ discharge. If de-energisation is required it shall take place before CO₂ release.

6.5 Air Tightness (Addition)

6.5.1. Rooms intended to be protected by CO2 total flooding shall be as tight as possible. Particular attention shall be paid to the air inlet/outlet dampers and air locks. A relative air tightness is necessary for the efficiency of extinguishing, but also for the safety of the personnel standing nearby the protected space.

6.5.2. Precautions must be taken especially for the total flooding of false floors when leakage to the room must be avoided. Mechanical fixing of the slabs and, possibly, When HVAC of the technical room is performed through the false floor, the dampers shall close prior to CO2 release in the false floor.

6.6 Instrumentation and Control (Addition)

6.6.1. Each extinguishing system may be controlled by a local control panel, possibly connected to the fire and gas panel or by fire and gas panel. This item shall be specified in the project by the client's approval.

6.6.2. The control system shall have the following functions:

- Initiation of the discharge signal following reception of the automatic fire detection or manual signal (the discharge shall be of the non-fail safe design i.e. energies to discharge, with line monitoring).
- Alarm display and control.
- Time delay (if any) before operation (this function could be replaced by a pneumatic delay system, directly on the CO2 discharge network).
- Operation of the interlocks (shutdown of HVAC system, closure of dampers, etc.).
- Permanent control of the system (supply failure, line monitoring, inhibition, etc.).
- Operating mode (maintenance override, test mode).

6.6.3. The following information shall be available on the control panel (either local extinguishing panel or F&G panel):

- System on.
- System fault.
- System in test.
- Pre-discharge alarm (delay running).
- Discharge signal.
- System manually inhibited.

6.6.4. It shall be possible to test and initiate manually the CO2 discharge from the panel. A key operated mechanism shall be provided for inhibition. Key operated inhibition mechanism and manual actuation button shall also be provided in suitable location (near the door for example).

6.6.5. Alarms

Discharge, fault and inhibition shall initiate alarms in a permanently manned room. These alarms shall also activate a buzzer. The discharge alarm shall be initiated by a pressure switch located on the discharge network.

Each CO2 cylinder shall be equipped with a weighing system to give a local indication.

6.6.6. Power Source

CO2 systems shall be supplied by the essential network. Emergency power (1 charger + 1 set of batteries) shall be provided locally. The required autonomy is 1 hour.

6.6.7. Ventilation after Extinguishing

An efficient ventilation system (mobile or fixed) shall be provided to remove CO₂ gas after discharge. This system shall be designed to avoid polluting the HVAC system with CO₂ and creating hazardous atmosphere to the personnel.

6.6.8. Special Precautions for Electronic Material

Thermal shock, low temperatures and carbonic acid attack may have serious consequence for the electronic material installed in a technical room. Therefore the system design shall contemplate all suitable mitigating measures (cabinet temperature after CO₂ discharge, position and orientation of discharge nozzles, etc.) to avoid these inconveniences.

11 MANUAL HOSE REEL SYSTEMS (Deletion)**12 STANDPIPE SYSTEMS AND MOBILE SUPPLY (Deletion)****15 DETERMINATION OF CARBON DIOXIDE PIPE AND ORIFICE SIZE (Deletion)**

ENGINEERING STANDARD

FOR

CO2 GAS FIRE EXTINGUISHING SYSTEMS

ORIGINAL EDITION

AUG. 1993

This standard specification is reviewed and updated by the relevant technical committee on Feb. 1999(1), Aug. 2006(2) and Dec. 2013(3). The approved modifications are included in the present issue of IPS.

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 is based on internationally acceptable standards and includes 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.

The IPS is reviewed and up-dated approximately every five years. Each standards are subject to amendment or withdrawal, if required, thus the latest edition of IPS shall be applicable

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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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, National Petrochemical Company and National Iranian Oil Refinery And Distribution Company.

PURCHASER:

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

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.

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0. INTRODUCTION

"Fire Fighting and Fire Protection System" are broad and contain variable subjects of paramount importance, therefore a group of engineering standards are prepared to cover the subject.

This group includes the following standards:

STANDARD CODE	STANDARD TITLE
IPS-E-SF-120	"Engineering Standard for Off-Shore Installations Fire Fighting & Fire Protection"
IPS-E-SF-140	"Engineering Standard for Foam Generating and Proportionating Systems"
IPS-E-SF-160	"Engineering Standard for CO ₂ Gas Fire Extinguishing Systems"
IPS-E-SF-180	"Engineering Standard for Dry Chemical Fire Extinguishing Systems"
IPS-E-SF-200	"Engineering Standard for Fire Fighting Sprinkler Systems"
IPS-E-SF-220	"Engineering Standard for Fire Water Distribution and Storage Facilities"
IPS-E-SF-260	"Engineering Standard for Automatic Detectors and Fire Alarm Systems"
IPS-E-SF-300	"Engineering Standard for Application of Breathing Apparatus in Safety and Fire Fighting"
IPS-E-SF-340	"Engineering Standard for Fire Fighting Hose Box and or Shelter"

This Standard covers:

CO₂ Gas Fire Extinguishing Systems

1. SCOPE

This Standard covers the minimum requirements for carbon dioxide systems, which is concerned to design and provide a piping supply system for the extinction of fire.

Note 1:

This standard specification is reviewed and updated by the relevant technical committee on Feb. 1999. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No. 70 on Feb. 1999. These modifications are included in the present issue of IPS.

Note 2:

This standard specification is reviewed and updated by the relevant technical committee on Aug. 2006. The approved modifications by T.C. were sent to IPS users as amendment No. 2 by circular No. 303 on Aug. 2006. These modifications are included in the present issue of IPS.

Note 3:

This standard specification is reviewed and updated by the relevant technical committee on Dec. 2013. The approved modifications by T.C. were sent to IPS users as amendment No. 3 by circular No. 403 on Dec. 2013. These modifications are included in the present issue of IPS.

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.

BSI (BRITISH STANDARDS INSTITUTION)

BS 5306 (2012) "Fire Extinguishing Installations and Equipment on Premises
Part 4: Specification for Carbon Dioxide Systems"

NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)

NFPA 12 (2011) "Standard on Carbon Dioxide Extinguishing Systems"

3. DEFINITIONS AND TERMINOLOGY

3.1 Automatic/Manual to Manual Only ChangeOver Switch

Means of converting a fire extinguishing system from automatic/manual to manual only actuation or vice versa

Note:

This may be in the form of a manual switch on the control panel or other units, or a personnel door interlock.