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

NIOEC SP

NIOEC SPECIFICATION FOR NOISE CONTROL AND VIBRATION

FIRST EDITION

JULY, 2005

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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.

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INTRODUCTION

To satisfy the requirements of this NIOEC Specification, Iranian petroleum standard IPS-G-SF-900(1), February 2015 with the consideration as specified herein after shall be strictly followed.

Articles 0 through 4 of this document replace entirely the related articles in the referenced IPS Standard.

1. SCOPE

This Specification defines the procedures for noise control of plant and equipment. It specifies how to derive maximum allowable noise levels for equipment installed in oil refineries and distribution depots. It applies equally to design and construction of new plants and to modification of existing plants.

This Specification is not considered suitable for reference in requisitions of individual equipment. The actual noise limits for the equipment under consideration shall be specified in the equipment requisitions under guidance of the management and appropriate medical and safety authorities.

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.

IPS (IRANIAN PETROLEUM STANDARD)

IPS-G-SF-900(1)	"General standard for Noise control and Vibration"
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NIOEC-SP (NIOEC SPECIFICATIONS)

NIOEC-SP-00-10	"NIOEC Specification for Units"
NIOEC-SP-46-00	"NIOEC Specification for Pumps, Drivers and

BSI (BRITISH STANDARD INSTITUTION)

BS 3593	"Recommendation on Preferred Frequencies for Acoustical Measurements"
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ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

ISO 3864	"Safety Colors and Safety Signs"
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3. UNITS

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

4. DEFINITIONS & TERMINOLOGY

dB (A) is unit of sound level which is a logarithmic summation of a spectrum whose SPL values have been weighted in manner corresponding to a 40 phon equal loudness contour for pure tones.

Sound pressure (P) is a periodic fluctuation of pressure about atmospheric pressure in the presence of a sound wave.

Sound power (PA) is the total energy in watts available for setting a sound patch into vibration.

An octave is a band in which the highest frequency is twice the lowest frequency.

5. MODIFICATION TO IPS-G-SF-900 (01)

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

6.3. (Add.)

Noise control measures applied to equipment (such as acoustic enclosures and acoustic insulation) shall not interfere with the operation and running maintenance of the equipment. They shall, where appropriate be constructed so that they can be dismantled and re-assembled at site without affecting their acoustic properties. They shall not also interfere with emergency fire fighting in the unit.

14.2. (Mod.)

Add the following term at the end of paragraph:

Equipment shall be properly designed and fabricated to limit “Sound Pressure Level” for the general working area to requirements of paragraph 6.2 of NIOEC-SP-46-00.

14.3.6. (Add.)

The following equipment has been individuated as the critical individual items giving fundamental contribution to the noise level of the plant.

The here below specified noise limits for these critical individual items are considered to be satisfactory in respect to the noise limits for the complete plant.

The noise limits are shown both in dB(A) (global value) and by equivalent ISO NR (Noise Rating) curves.

Equipment	Applicable Location	Sound Pressure Level (Spl) Limit	ISO Nr Curve
Compressors	1 MT from Equipment	94 dB(A)	89
Steam Turbines	1 MT from Equipment	90 dB(A)	85
Fire Heaters	Under the burner floor in the noisiest point and on the walkways	94 dB(A)	89
Electric motors	1 MT from Equipment	90 dB(A)	85
Air cooled exchanger.	1 MT below fans or nearest walkway	90 dB(A)	85
Control valves	1 MT from Equipment	92 dB(A)	87
Pumps	1 MT from Equipment	90 dB(A)	85
Ejectors	1 MT from Equipment	90 dB(A)	85
Fans	1 MT from Equipment	92 dB(A)	87
Boiler	1 MT from Burners	92 dB(A)	87
Other noisy equipment	1 MT from Equipment	92 dB(A)	87

The above specified noise limit values are to be considered consistent with the following prescriptions.

14.3.7. (Add.)

The above specified noise limits of each critical individual items of equipment will be part of the specification of that equipment and the manufactures will be required to supply satisfactory evidence that this equipment meets the noise limits as required in the specification. For this purpose the equipment manufacturers shall submit filled-in equipment noise data sheets, as per attached sample.

Equipment manufacturers shall advise about the following:

- Noise levels of standard equipment.
- Description of specific designs or acoustic measures proposed to reduce noise level within the specified limits (if required)
- Added cost of special design or acoustic treatment proposed (if required)
- Added cost to conduct a noise level test of the equipment proposed, furnishing results of subject tests.

Equipment manufacturers shall consider and make recommendations regarding the use of special features or alternate solution whenever noise level reduction cannot be achieved without excessive cost.

The equipment manufacturers shall furnish all data and/or calculations to prove sound levels obtained by modifications to standard equipment. Manufacturers shall specify the codes and testing methods used to evaluate his equipment. For particularly noisy equipment, manufacturers shall provide a noise levels exceed the guaranteed level, manufacturer shall make necessary alterations to reduce noise level(s) to the guaranteed value(s). These alterations shall be at manufacturer expense.

14.3.8. (Add.)

For the application of the permissible noise limits specified in the following paragraph 14.3.6 it is clarified that the restricted areas of the plant are those areas where personnel do

not spend more than 2 hours per day in their normal duties such as areas of intermittent attendance, service passageways and areas subject to occasional maintenance during operation.

It only applies at and beyond 1 meter from the surface of equipment.

An example the following areas of Refinery Plant are considered restricted areas:

- Compressor area (excluding local control room)
- Operating platforms of furnaces
- Operating platform of air coolers
- Steam turbine generator
- Large capacity pumps (e.g. cooling water pumps)
- Any area within 3 meters from noisy equipment.

GENERAL STANDARD

FOR

NOISE CONTROL AND VIBRATION

FIRST EDITION

FEBRUARY 2015

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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 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

Noise can disturb human's work, rest, sleep and communication, it can damage hearing. Vibration can cause long-term painful damage to hands and fingers, painful and disabling disorders of the blood vessels, nerves and joints and the risks of back and muscle pain.

Indeed the most important issue is industrial noise problem and a need for noise and vibration control and hearing conservation programs.

This Standard provides guidelines comprising:

- a) Brief explanation of the principle and essential standards for noise emitted by machineries and equipment.
- b) Brief explanation of the principle underlying standards for noise in workplace areas, and noise control procedures in plants/complexes, offices, conference rooms, etc.
- c) Brief explanation of the principle for vibration control.

If there is some non-conformity through legislative requirement which has been approved by Iranian governmental organization such as Department of Environment and Health Ministry, the performance criteria shall be consider base on the above legislative mentioned. Then the following references shall be considered:

"Human's Environmental Laws, Regulations, Criteria and Standards", section 3.8 & 3.9, page 183, by Department of Environment of Iran, first edition, 1391.

This Standard is prepared in two Parts:

- Part 1 Noise Control**
- Part 2 Vibration Control**

In this standard, some of the subjects are adapted from the following specifications and handbooks:

- TLVs® and BEIs®
Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents AND Biological Exposure Indices. Defining the Science of Occupational and Environmental Health® 2010
- GS-EP-ENV-500A "TOTAL GENERAL SPECIFICATION ENVIRONMENT (Noise abatement in production units)"
- OSHA 3074
- Industrial Noise Control fundamentals and application, by Lewis H. Bel
- ROYAL DUTCH/SHELL STANDARDS
 - DEP 31.46.00.31-Gen. "Acoustic Insulation for Pipes, Valves and Flanges"
 - DEP 31.10.00.94-Gen. "Data/Requisition Sheet for Equipment Noise Limitation"
 - DEP 31.10.00.95-Gen. "Data/Requisition Sheet for Vent/Blow-Down/Air-Flow/In-Line Silencers"
 - DEP 31.10.00.96-Gen. "Data/Requisition Sheet for Rotating Equipment Acoustic Enclosures"

1. SCOPE

This Standard defines the standard limits and procedures for noise and vibration control of plant and equipment. It specifies how to derive maximum allowable noise and vibration levels for equipment installed in oil refineries, chemical plants, gas plants and, where applicable, in exploration and production facilities and supply/marketing installations.

It applies equally to design and construction of new plants and to modification of existing plants.

This Standard is not considered suitable for reference in requisitions of individual equipment. The actual noise and vibration limits for the equipment under consideration shall be specified in the equipment requisitions under guidance of the management and appropriate occupational health and safety authorities.

Part 1 of this Standard also deals with the particular requirements for installing the acoustic insulation and is intended for the noise control engineer to consider the acoustic design of the plant.

Part 2 of this Standard defines the vibration control of particular equipment.

Under no circumstances in this standard, noise limit values shall not be exceeded of standard value in Iran -Occupational & Environmental Health Center, Ministry of Health & Medical Education and Iran- Department Of the Environment (DOE).

Note 1:

This standard specification is reviewed and updated by the relevant technical committee on Jan. 2005. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No 252 on Jan. 2005. These modifications are included in the present issue of IPS.

Note 2:

This is a revised version of this standard, which is issued as revision (1)-2015. Revision (0)-1997 of the said standard specification is withdrawn.

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)

API RP 521	"Guide for Pressure Relief and Depressuring Systems"
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BSI (BRITISH STANDARD INSTITUTION)

BS 4142	"Method of Rating and Assessing, Industrial and Commercial Sound"
BS 5378	"Sign & Symbols"
BS EN ISO 266	"Acoustics-Preferred Frequencies"
BS EN ISO 7010	"Graphical Symbols — Safety Colours and Safety Signs — Registered Safety Signs"
BS EN ISO 11202	"Acoustics-Noise Emitted by Machinery and Equipment- Determination of Emission Sound Pressure Levels at a Work

Station and at Other Specified Positions Applying
Approximate Environmental Corrections"

EEMUA (THE ENGINEERING EQUIPMENT AND MATERIALS USERS ASSOCIATION)

EEMUA Publication

No. 140

"Noise Procedure Specification"

Note:

Formerly OCMA Specification NWG-1, 2nd revision of March 1980.

EEMUA Publication

No. 161

"Guide to the Selection and Assessment of Silencers"

IPS (IRANIAN PETROLEUM STANDARDS)

[IPS-M-SF-325](#)

"Material and Equipment Standard for Personnel Safety
and Fire Fighters Protective Equipment"

ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

ISO 7010

"Graphical Symbols — Safety Colours and Safety Signs
— Registered Safety Signs"

ISO 266

"Acoustics Preferred Frequencies for Measurements"

ISO 1683

"Acoustics-Preferred Reference Quantities for Acoustic
Levels"

ISO 15664

"Acoustics –Noise Control Design Procedures for
Open Plant"

ISO 9612

"Acoustics- Determination of Occupational Noise Exposure
- Engineering Method"

3. DEFINITIONS AND TERMINOLOGY

3.1 Band

A band is a range of frequencies determined by the highest and the lowest frequencies in the range. Frequencies are measured in Hertz (cycles/second).

3.2 Decibel

One decibel is one tenth of one bel, the decibel (dB) is a Logarithmic_unit used to express the ratio between two values of a physical quantity, often /Power_ (physics) or /Intensity_ (physics). One of these quantities is often a reference value, and in this case the decibel can be used to express the absolute level of the physical quantity, as in the case Sound_pressure.

3.3 Impulsive noise

When a noise contains significant irregularities, such as bangs, clanks, or thumps, or if the noise is only existent momentarily and is of a character to attract attention, then it shall be considered as impulsive for the purpose of this specification.

3.4 Intermittent Noise

Noise whose level abruptly drops to the level of the background noise several times during the period of observation.

(ISO 12001: 1996 ; Definition 3.19.2)

3.5 Intensity

Intensity of sound is measured in watts per square meter .it is heard as loudness, which can be perceived differently depending on the individual and his or her distance from the source, and characteristics of the surrounding space. OSHA(MANUAL CONTROL NOISE)

3.6 Machine

Any sound source of which the acoustical characteristics are to be measured.

3.7 Narrow band noise

When the noise from a source contains a pure tone or narrow-band component which is noticeable to the ear as a noise of distinguishable pitch, and which represents a dominant feature of the total source noise, then the source noise shall be regarded as containing narrow-band noise for the purpose of this specification.

Note:

Where there is doubt about the subjective assessment of narrow-band noise it shall be resolved by narrow-band analysis, using an instrument with a band width not more than 10 Hz or 1%, whichever is the less (See Appendix E of EEMUA 140).

Noise

Noise is any undesired sound; and by extension, noise is any unwanted disturbance within a useful frequency band.

3.8 Octave bands

A type of frequency band, are a convenient way to measure and describe the various frequencies that are part of a sound .A frequency band is said to be an octave in width when its upper Band-edge frequency, f_2 , is twice the lower band-edge frequency, f_1 : $f_2 = 2 f_1$.

3.9 Path Treatment

One step in the noise-control hierarchy is to determine ways to treat the sound transmission path. Typical path treatments include adding sound-absorption materials to the room or equipment surfaces, installing sound transmission loss materials between the source and receiver(s).

3.10 Reference surface

Is the smallest possible imaginary parallel-piped enclosing the source and terminating on the ground (excluding reentrant sections and minor protruberances which are not significant emitters of noise).

3.11 Sound and decibels

Sound is a disturbance which propagates through a medium having the properties of inertia (mass) and elasticity. The medium by which audible sound is transmitted is air. For definition of Decibels refer to the heading of definition and terminology.