

NIOEC-SP-30-01							
DOCUMENT CODE							NO. OF PAGES:33
PLAN/PRJ/SUB	UNIT	PHASE	DISCIPLINE	DOCUMENT TYPE	SERIAL NO.	REV. NO.	DATE
NIOEC	000	EG	HV	SP	3001	A0	MARCH, 2018



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

NIOEC SP

NIOEC SPECIFICATION
FOR

HVAC & PLUMBING SYSTEM DESIGN CRITERIA

FIRST 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.

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0	MARCH, 2018	K.BADRKHANI	A. KHANI POUR	M.R.FARZAM	M.KAREGARNAJAFI
REV.	DATE	PREPARED	CHECKED	APPROVED	AUTHORIZED

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1. SCOPE

The purpose of this specification is to define the basis of design of Heating, Ventilation, and Air Conditioning & Refrigerating (HVAC&R) and domestic hot and cold water systems, sewage and vent systems (Plumbing) for buildings and spaces used in refinery/ oil plant, distribution depots, pump stations and pipelines.

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 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.

ANSI/ASHRAE (AMERICAN NATIONAL STANDARD INSTITUTE / AMERICAN SOCIETY OF HEATING REFRIGERATING AND AIR CONDITIONING ENGINEERS, INC.)

ASHRAE "ASHRAE Handbook- Fundamentals / Application/ HVAC System & Equipment"

ANSI / ASHRAE 62 "Ventilation for Acceptable Indoor Air Quality"

CARRIER AIR CONDITIONING COMPANY

HANDBOOK "Handbook of Air Conditioning System Design"

EUROPEAN STANDARDS

EN 779 "Particulate Air Filter For General Ventilation"

INTERNATIONAL CODE COUNCIL

ICC "International Plumbing Code"

NATIONAL IRANIAN BUILDING REGULATIONS (NIBR)

Topic 14 "Mechanical Installation"

Topic 16 "Sanitary Installation"

Topic 18 "Insulation and Sound Adjustment"

Topic 19 "Energy Conservation"

NIOEC-SP (NIOEC SPECIFICATIONS)

NIOEC-SP-00-10 "NIOEC Specification for Units"

NIOEC-SP-30-02	“NIOEC Specification for HVAC Equipment Specification”
NIOEC-SP-30-03	“NIOEC Specification for Heating, Ventilation, Air Conditioning, Refrigerating and Pressurizing Systems”
NIOEC-SP-30-06	“NIOEC Specification for Installation of Heating, Ventilation, Air Conditioning, Refrigerating and Pressurizing Systems”

PLUMBING-HEATING-COOLING CONTRACTORS - NATIONAL ASSOCIATION

PHCC “National Standard Plumbing Code”

3. UNITS

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

4. PROJECT REFERENCED DOCUMENTS

Project reference documents of this specification shall be listed in this section by contractor.

5. SITE CONDITION

Table 1 shows a list of required information including site details and weather conditions. The weather conditions (for the last ten years) and the maximum rainfall per hour (for the last 30 years) shall be obtained from the local Meteorological Organization reports. Also the amount of dust shall be taken from the Air Quality Control Organization.

Table 1 - Site Location and Weather Conditions

Parameter	Value
Site Location	
Elevation (m)	
Longitude (deg.)	
Latitude (deg.)	
Ave. Dry Bulb Temperature in Summer (°C)	
Ave. Wet Bulb Temperature in Summer (°C)	
Ave. RH% in Summer (%)	
Ave. of Summer Daily Range Temperature (°C)	
Ave. Dry Bulb Temperature in Winter (°C)	
Ave. Wet Bulb Temperature in Winter (°C)	
Ave. RH% in Winter (%)	
Absolute Max. Temperature (°C)	
Design Solar Radiation Temperature (°C)	
Max. Wind Velocity / Direction (m/s)	
Max. (Design) Hourly Rainfall (mm)	

Note (1): Outdoor refrigeration equipment shall be designed to maintain design conditions with a 5°C above environment temperature. All outdoor equipment installed outdoor and exposed to direct sunlight shall be designed for environment atmosphere conditions, direct sun exposure of 85°C (Design Solar Radiation) and maximum relative humidity.

Note (2): The cooling/heating design dry bulb temperatures shall be calculated as follows:

- Cooling design dry bulb temperature: The average monthly maximum temperature for summer over the last 10 years.
- Heating design dry bulb temperature: The average monthly minimum temperature for winter over the last 10 years.

Note (3): The cooling/heating design relative humidities shall be calculated as follows:

- Cooling design relative humidity: The average monthly minimum relative humidity for summer over the last 10 years.
- Heating design relative humidity: The average monthly maximum relative humidity for winter over the last 10 years.

Note (4): The summer daily range temperature shall be calculated as follows:

-The average of the difference between daily maximum and minimum dry bulb temperatures in hottest month of summer over the last 10 years.

6. BUILDING LIST

The buildings of the project shall be listed in this section by contractor.

7. INDOOR DESIGN CONDITION

Air conditioning system & airflow ventilation rate shall be sufficient to satisfy not only air change specification, but also to maintain overpressure, temperature, relative humidity specifications. It shall be also capable to avoid wind penetration in order to meet the requirements of a conditioned space with simultaneous control of temperature, humidity, cleanliness, contamination and air distribution. Indoor design conditions and air change rate for specific areas shall be followed in appendices 1, 2.

8. CALCULATION

8.1. Calculation Method

The applicable software for design of HVAC system shall be used (similar to carrier E20 and HAP load calculation).

8.2. Heat Gain from People

Heat gain from people shall be taken in cooling load calculations according to codes and standards and represents the rate at which latent and sensible Heat are given off by human beings in different states of activity (As ASHRAE Fundamental, 18.4).

Table 2 - Heat Gain from People

Degree of Activity	Sensible Heat Gain (W/ Person)	Latent Heat Gain (W/ Person)
Seated at Rest	67	35
Office Work	70	60
Sedentary Work	80	80
Medium Work	90	130
Heavy Work	155	270

*Based on ASHRAE Fundamental 2009, 18.4

8.3. Occupancy

Occupancy numbers shall be confirmed during detail engineering and the values shall be confirmed with architectural drawings.

8.4. Heat Gain from Lighting

Heat gain from lighting shall be taken between 10 ~ 20 W/m² and according to the assumptions of the “electrical” lighting design.

8.5. Heat Gain from Equipment

Heat gain from equipment shall be specified by **related discipline** (Electrical & Instrument, Etc), which distinguished by its manufacturer and shall be taken into account in the HVAC calculations.

Table 3 - Heat Gain from Equipment

Area	Sensible Heat Loss (KW)
Control Room	
Instrument Technical Room	
Switchgear Room	
VFD Room	
Cable Gallery	
Battery Room	
UPS Room	
Printer Room & Telecom Room	
Electrical Room	
Offices	

The above heat dissipation shall be checked according to the final heat dissipation from vendor in detail design.

8.6. Air Flow Quantity Calculations

For airflow quantity calculations, the following items shall take into account:

- ❖ The minimum outdoor air changes as per table and as determined by room occupancy and equipment requirements
- ❖ The exhaust air requirements due to equipment and in particular to provide sufficient dilution of hydrogen vapors in battery rooms
- ❖ Required over-pressurization
- ❖ Total heat gains

8.7. Fresh Air Make-Up Calculation

Make-up air quantity shall take into account:

- ❖ The minimum fresh air quantity in respect with rooms occupancy and equipment requirements
- ❖ The exhaust air requirement
- ❖ The indoor overpressure with respect to outdoor, where applicable
- ❖ For others rooms the minimum fresh air quantity shall conform to requirements indicated in table for spaces which two or three parameter are listed, fresh air shall be calculated regarding to which is greater.

8.8. Pressurization

Control room, M.V, L.V room, UPS room, Cable gallery, Instrument room and shall be maintained at positive pressure of 50 Pa to ensure that dirt, dust and gas are not ingresses in to the internal environment. Battery room's pressure shall be relatively lower than adjacent rooms.

Pressure control of spaces requires controlling the direction of airflow between adjacent spaces with various levels of cleanliness. This is equivalent to controlling the relative pressures between the spaces. Pressurization resists infiltration of unfiltered external sources of dirt.

8.9. Heat Transmission Coefficients (U Values)

The heat transmission coefficients shall be calculated according to ASHRAE calculation method and architectural specification. Heat transmission coefficients at walls, roofs with adequate thermal insulation shall be considered as a basis for cooling & heating loads calculations. Heat transfer coefficient shall be extracted from public material property which has been issued by public reference such as NIBR, topic 19.

8.10. Safety Factor

For all cooling and heating calculation, the following safety factor shall be considered:

- ✓ Sensible cooling: 10%
- ✓ Latent cooling: 10%
- ✓ Heating: 10%

8.11. Infiltration

❖ Crack Method

According to the wind speed in the area where the building is located and the type of windows and doors, the total amount of air infiltration can be calculated by the following formula:

$$V = L \times q$$

V = Air Infiltration (cfm)

L = Crack dimension (Ft)

q = cfm per linear foot of crack According to the following table:

Table 4 – Casement Type Window on Windward side

Type of Casement Window & Typical Crack Size		cfm per Linear Foot of Crack					
		Wind Velocity (mph)					
		5	10	15	20	25	30
Rolled Section – Steel Sash							
Industrial Pivoted	1/16" Crack	0.87	1.08	2.90	4.10	5.10	6.20
Architectural projected	1/32" Crack	0.25	0.60	1.03	1.43	1.86	2.30
Architectural projected	1/64" Crack	0.33	0.87	1.47	1.93	2.5	3.00
Residential Casement	1/64" Crack	0.10	0.30	0.55	0.78	1.00	1.23
Residential Casement	1/32" Crack	0.23	0.53	0.87	1.27	1.67	2.10
Heavy Casement Section Projected	1/64" Crack	0.50	0.17	0.30	0.43	0.58	0.80
Heavy Casement Section Projected	1/32" Crack	0.13	0.40	0.63	0.90	1.20	1.53
Hollow Metal – Vertically Pivoted		0.50	1.46	2.40	3.10	3.70	4.00

*Based on Carrier Handbook

Table 5 – Doors on Windward Side

Type of Casement Window & Typical Crack Size		cfm per Linear Foot of Crack					
		Wind Velocity (mph)					
		5	10	15	20	25	30
Glass Door							
Good installation	1/8" Crack	3.20	6.40	9.60	13.00	16.00	19.0
Average Installation	3/16" Crack	4.80	10.00	14.00	20.00	24.00	29.0
Poor Installation	1/4" Crack	6.40	13.00	19.00	26.00	26.00	38.0
Ordinary Wood or Metal							
Well fitted – W.Strip		0.45	0.60	0.90	1.30	1.70	2.10
Well fitted – No W.Strip		0.90	1.20	1.80	2.60	3.30	4.20
Poorly fitted – No W.Strip		0.90	2.30	3.70	5.20	6.60	8.40
Factory Door	1/8" Crack	3.20	6.40	9.60	13.00	16.00	19.0

*Based on Carrier Handbook

8.12. Noise Level

The maximum sound pressure levels generated by HVAC systems at 1 m above the floor and horizontally distance of 1 m from any in operation equipment or air intake/outlet shall meet the following requirements:

Table 6 – Noise Level

Area Description	Max. Allowable Sound Pressure Level (dB)
HVAC Rooms	70
Electrical Substations, Electrical Rooms, Switchgear Rooms	60
Battery Rooms	60
Instrument Technical Rooms and Other Technical Rooms, without Occupancy	60
Kitchen / Pantry	60
Toilets and Lockers	55
Instrument Rooms and Other Technical Rooms with Occupancy (Control Rooms)	50
Laboratory	50
Offices/ Meeting Rooms/ Prayer Rooms/ Conference Rooms	45

For the outdoor installed equipment, sound pressure level up to 85db is accepted at the horizontally distance of 1m from in-operation equipment.

9. OVERCAPACITY AND STANDBY EQUIPMENT

9.1. Standby Equipment

In order to ensure continuous operation , HVAC cooling equipment for all sensitive areas such as Substation, Control, telecom buildings, ... shall be duplicated (duty/stand by, with an automatic change-over).

Table 7 – Stand by Equipment

Building Name	HVAC System	Redundancy
Control & ITR	Air Handling Unit (for Control Room & Offices)	100%
	Air Cooled Condensing Unit(for Control Room & Offices)	100%
	Air Handling Unit (for ITR)	100%