



NATIONAL PETROCHEMICAL COMPANY
STANDARDS

ENGINEERING STANDARD
FOR
HEATING, VENTILLATION AND AIR CONDITIONING

NPCS-ES-ME-01

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1 SCOPE

- 1.1 The content of this engineering standard is to prescribe the minimum design requirements of heating, ventilation and air conditioning systems for buildings used in petrochemical complexes.
- 1.2 The purpose of this standard is to define the constraints and minimum requirements that shall be considered during the engineering activities by design engineer.

2 STANDARDS AND CODES

All procedures and specification shall comply with the following standards and codes:

- ARI 210-81 Unitary Air-Conditioning Equipment.
- ASHRAE 52-76 Method of Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- ANSI/UL 900-82 Test Performance of Air Filter Units.
- BS 2831 Methods of Test for Air Filters Used in Air Conditioning and General Ventilation.
- ARI 680-80 Air Filter Equipment.
- ASHRAE 30-78 Methods of Testing for Rating Liquid Chilling Packages.
- ARI 435-81 Application of Central Station Air-Handling Unit.
- ARI 560-82 Absorption Water Chilling Packages.
- ARI 550-83 Centrifugal Water Chilling Packages.

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- ANSI/ARI 590-81 Reciprocating Water Chilling Packages.
- ANSI/ASHRAE 55-81 Thermal Environmental Conditions for Human Occupancy.
- ASHRAE 23-78 Methods of Testing for Rating for Positive Displacement Refrigerant Compressors.
- ASHRAE C1-75 NFPA 70 National Electric Code.
- ANSI/ASHRAE 51-1985 t Laboratory Methods of Testing Fans for Rating.
- ANSI/AMCA 210-85
- TEMA Standards for Tubular Exchanger Manufacturers Association.
- ARI 610-82 Central System Humidifier.
- AMCA 500-83 Test Method for Louvers, Dampers, and Shutters.
- ASHRAE 70-72 Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
- ANSI A 13.1-81 Scheme for the Identification of Piping System.
- ANSI B 31.5-74 Refrigeration Piping.
- NFPA 204 M Guide for Smoke and Heat Venting.
- ASHRAE 62-1989 Ventilation for Acceptable Indoor Air Quality.
- ASHRAE 71-73 Method of Testing for Rating Unit Ventilators.
- BS 5720-1979 Mechanical Ventilation and Air Conditioning in Buildings.
- NFPA 90A-1981 Installation of Air Conditioning and Ventilating Systems.

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3 DESIGN CONDITIONS

- 3.1 The average of maximum temperatures of the 18 hottest days during the summer should be selected as the outdoor design temperature for the cooling load calculation in residential and commercial buildings.
- 3.2 The average of minimum temperatures of the 18 coldest days during the winter should be selected as the outdoor design temperature for the heating load calculation in residential and commercial buildings.
- 3.3 The average of relative humidity of the 18 hottest days during the summer at design time should be selected as the outdoor design humidity for the cooling load calculation.
- 3.4 The selection of outdoor design temperature and humidity for the industrial and other special buildings is subject to various parameters such as economical aspects, energy available and type of building.
- 3.5 The indoor design condition for residential, commercial and public buildings is selected according to comfort condition specified in section 4.
- 3.6 The selection of indoor design conditions for the industrial and other special buildings is subject to various parameters such as economical aspects, energy available and type of building.

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COMFORT CONDITIONS

4.1

Table 1 shows the comfort conditions during winter and summer at the various relative humidity for residential and commercial applications. The temperature range are appropriate for current seasonal clothing habits in Iran.

TABLE 1
COMFORT CONDITION

RELATIVE HUMIDITY %	TEMPERATURE	
	WINTER	SUMMER
20		23 - 27
30	21 - 24	23 - 27
40	20 - 24	23 - 26
50	20 - 23	23 - 26
60	20 - 23	22 - 26
70	20 - 23	

4.2

Thermal comfort conditions must be fairly uniform over the body to prevent the local discomfort. The radiant temperature asymmetry should be less than 5°C in the vertical direction and 10°C in the horizontal direction. The vertical temperature difference between head and foot should not exceed 3°C.

4.3

For practical application of comfort conditions, the effective temperature should be considered. The effective temperature is a function of personal activity, air temperature, relative humidity, air movement, and clothing insulation. The calculation of the effective temperature from the mentioned parameters has been described in the ASHRAE Handbook, Fundamental Volume, chapter 8.

4.4

Chapters 1 to 7 of ASHRAE Handbook, Application Volume describe in detail comfort conditions in various occupancies.



5 VENTILATION

- 5.1 ASHRAE Ventilation Standard 62-89 defines minimum outdoor air supply rate for various types of occupancy.
- 5.2 Several techniques are possible to achieve the ventilation specified in the standards:
- a) Forced ventilation that afford automatic control.
 - b) Natural ventilation with manual control.
 - cl Infiltration, an uncertain ventilation strategy commonly used by default in small structures.
- 5.3 In most cases infiltration and natural ventilation meet the ventilation requirements. If the infiltration and natural ventilation rates do not satisfy the ventilation requirements, mechanical ventilation should be provided. Local ventilation may be required in places requiring relatively large amount of ventilation rate.
- 5.4 In structures conditioned by once through all air system, like air coolers, the rate of supply air often exceeds the ventilation required. In this case proper arrangement of air flow through the structure achieves the local ventilation in the places requiring large amount of supply air.
- 5.5 Make-up or fresh air inlet shall be located in an acceptable area to avoid contamination of make-up air.
- 5.6 Calculation of the infiltration and natural ventilation rates described in the ASHRAE Handbook, Fundamental Volume, chapter 22.

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6 LOAD CALCULATIONS

The heating and cooling load should be calculated for cold and hot seasons respectively.

6.1: HEATING LOAD

6.1.1 The following activities should be performed for heating load calculation:

- a) Select outdoor design weather condition: temperature, wind direction and velocity.
- b) Select indoor design condition during the coldest weather.
- c) Estimate temperature in adjacent unheated spaces.
- d) Compute heat transfer coefficients for outside walls and glass, for inside walls, nonbasement floor and ceilings if there are next to unheated spaces, and the roof if it is next to heated spaces.
- e) Determine net area of outside wall, glass and roof next to heated spaces as well as any cold walls, floors, or ceilings next to unheated spaces. These determination can be made from building plans or from actual building, using inside dimensions.

6.1.2 The heating load consists of the following items which should be calculated.

- a) Heat transmission loss from each kind of wall, glass, floor, ceiling, and roof in the building.
- b) Heat transmission loss from the basement or grade-level slab floor.
- c) Energy associated with infiltration of cold air around outside doors, windows and other openings. This value depend on kind or width of crack, wind speed and the temperature difference between indoor and outdoor air.

5.1.3 When positive ventilation using outdoor air is provided by an air-heating or air-conditioning unit, the energy required to warm the outdoor air to the space temperature must be provided by the unit.

5.1.4 If mechanical exhaust from the space is provided in an amount to the outdoor air drawn in by the unit, the unit must also provide for natural infiltration losses.

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- 6.1.5 If no mechanical exhaust is used and the outdoor air supply equals or exceeds the amount of natural infiltration that can occur without ventilation, some reduction in infiltration may occur.
- 6.1.6 In buildings with a sizeable and reasonably steady internal heat release from sources other than the heating system, this heat release under the design condition should be calculated and deducted from the heat losses.
- 6.1.7 The pick-up loads that may be required in intermittently heated buildings or in buildings using night thermostat setback should be considered. Pick-up loads frequently require an increase in heating equipment capacity to bring the temperature of structure, air and material content to the specified temperature.
- 6.1.8 The procedure for calculation of the heating load has been described in the ASHRAE Handbook, Fundamental Volume, chapter 25.
- 6.2 COOLING LOAD
- 6.2.1 The following activities should be performed for cooling load calculation:
- Obtain characteristic of the building. Building materials, component size, external surface colors and shape are usually determined from building plans and specifications.
 - Determine- building location and orientation and external shading. Shading from adjacent buildings can be determined by a site plan or by visiting the proposed site. The possibility of abnormally high ground-reflected solar radiation should not be overlooked.
 - Obtain appropriate weather data and select outdoor design conditions.
 - Select indoor design conditions, such as indoor dry- bulb temperature, indoor wet-bulb temperature and ventilation rate.
 - Obtain a proposed schedule of lighting, occupant, internal equipment, appliances and processes that would contribute to the internal thermal load.
 - Select the time of day and month to do the cooling load calculation. For zone between north latitude of 20 and 40, the pick space cooling load usually occur in July or August.