



Exploration & Production

GENERAL SPECIFICATION

HVAC

GS HVA 100

Basis of design

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1. Scope

The present specification defines the reference documents and the data which shall be used as basis of design for HVAC systems.

The data listed in section 3 "Fixed data" are applicable to all projects.

The data listed in section 4 "Project data to be completed by Engineering" are specific to each project and shall be indicated and or calculated by Engineering.

The words and expressions in capital characters are defined inside the general specification **GS HVA 801**.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Equipment and installations must be in accordance with (in order of precedence):

1. The country local regulations where equipment and/or installations shall be operated
2. Total General Specifications as listed in **GS HVA 000**
3. The International Standards
4. The French Regulation (when Country local regulation does not exist).

International System of Units (SI).

Notes:

- In case of discrepancy between documents the more stringent requirements shall apply.
- The HVAC VENDOR or CONTRACTOR may propose proven improvements to the reference documents but shall obtain written approval of the COMPANY prior to implementation.
- A International Standard is a good "engineering practice" which shall be recognised and taken into consideration by VENDOR, SUPPLIER, MANUFACTURER and/or CONTRACTOR. If required, the translation of the standards must be included into HVAC scope.
- The latest revision of Standards, codes, regulations and the published errata if any must be used and applied by VENDOR, SUPPLIER, MANUFACTURER and CONTRACTOR.

Standards

Reference	Title
NF C26-220	Méthodes d'essai des matières isolantes - Méthode pour déterminer les indices de résistance et de tenue au cheminement des matériaux isolants solides dans des conditions humides (complétée par le rectificatif 1, septembre 1980)
UTE C63-100	Appareils mécaniques de connexion - Guide pratique pour l'exécution des appareils et de leurs enveloppes en vue de leur fonctionnement dans un environnement déterminé - Essais correspondants

Professional Documents

Reference	Title
ADC	Air Diffusion Institute (All documents in accordance with equipment or part of HVAC installation designed)
AFI	American Filtering Institute (All documents in accordance with equipment or part of HVAC installation designed)
AGA	American Gas Association (All documents in accordance with equipment or part of HVAC installation designed)
AICVF Codes	Association des Ingénieurs de Chauffage, Ventilation Français (All codes in accordance with equipment or part of HVAC installation designed)
AMCA	Air Moving and Conditioning Institute (All documents in accordance with equipment or part of HVAC installation designed)
ARI	Air Conditioning and Refrigeration Institute (All documents in accordance with equipment or part of HVAC installation designed)
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers (All documents in accordance with equipment or part of HVAC installation designed)
SMACNA	Sheet Metal and Air Conditioning CONTRACTORS' National Association. (All documents in accordance with equipment or part of HVAC installation designed)

Regulations

Reference	Title
Not applicable	

Codes

Statutory by law or recognised professional body approved by COMPANY.

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS HVA 000	List of HVAC specifications
GS HVA 801	Terminology, definitions, abbreviations

3. Fixed data

3.1 Temperature of a metal surface exposed to direct sunlight

A metal surface exposed to direct sunlight shall be considered at 80°Celsius. This value must be used for thermal insulation calculation for all applications.

3.2 Indoor conditions (Temperature/Humidity)

3.2.1 Indoor conditions during Winter

The following temperatures shall be considered:

- The “Winter temperature design point” is the temperature value to take into account for calculations
- The “Winter temperature tolerance” is the acceptable difference between the selected setting and the actual room temperature
- The “Setting range” is the range of temperature given to the user for selection of one room temperature.

Room	Winter temperature Design Point (°Celsius)	Winter temperature tolerance (°Celsius)	Setting range (°Celsius)
Ablution room	24	± 1	22 to 24
Air lock	16	± 1	14 to 16
Bakery	22	± 1	20 to 22
Battery room	16	± 1	14 to 16

Room	Winter temperature Design Point (°Celsius)	Winter temperature tolerance (°Celsius)	Setting range (°Celsius)
Bed room	20	± 1	18 to 20
Changing room	26	± 1	24 to 26
Coffee or tea room	22	± 1	19 to 22
Control room	22	± 1	19 to 22
Corridors	20	± 1	18 to 20
Dining room	22	± 1	20 to 22
Dish wash	22	±1	20 to 22
Dryer room	18	±1	16 to 18
Electrical room	22	± 0.5	21 to 22
Generator room	40	NA	NC
Grocery	16	± 1.5	13 to 16
HVAC room	16	± 1.5	13 to 16
Instrument room	22	± 0.5	21 to 22
Kitchen	24	± 2	20 to 24
Laboratory	20	± 1	18 to 20
Laundry	18	± 1.5	15 to 18
Library	22	± 1.5	19 to 22
Lockers room	16	NA	16
Meeting room, conference room	20	± 1	18 to 20
Mortuary	10	± 1	8 to 10
Office	20	± 0.5	19 to 20
Photocopy room	20	NA	20
Prayer room	20	± 1	18 to 20
Recreation room	22	± 1	20 to 22
Showers ¹	24	± 1	22 to 24
Sick bay, first aid, infirmary	24	± 0.5	23 to 24
Sport room	18	± 1	16 to 18

¹ Room given access to showers shall be maintained at 24°C

Room	Winter temperature Design Point (°Celsius)	Winter temperature tolerance (°Celsius)	Setting range (°Celsius)
Storage (non perishable foodstuffs)	14	NA	14
Storage	16	NA	16
Telecom room	22	± 1	20 to 22
Transformer room	7	± 2	5 to 7
Toilets	19	NA	19
TV room	22	± 1	20 to 22
Vegetables preparation	16	± 1	14 to 16
Waste room	8	NA	8
Workshop	16	± 1.5	13 to 16

Note: NA = Not Applicable, NC = Not Controlled

A relative humidity at least equal to 30% shall be maintained in all areas and the necessary equipment must be designed and supplied by the HVAC CONTRACTOR.

3.2.2 Indoor conditions during Summer

The conditions listed hereafter should be adequate for all equipment (HVAC equipment or all other equipment located in the rooms) even if sensitive to temperature or relative humidity. The HVAC CONTRACTOR shall check the recommendations from the various equipment MANUFACTURERS and use the more stringent requirements for design.

The following conditions shall be considered:

- The “Summer temperature design point” is the temperature to take into account for calculations.
- The “Relative humidity” is the humidity which shall be achieved at any temperature within the setting range.
- The “Summer temperature tolerance” is the acceptable difference between the selected setting and the actual room temperature.
- The “Setting range” is the range of temperature given to the user for selection of one room temperature. The higher value indicated must be only taken into account to define (or to check, when heater is installed for winter) the capacity of terminal heating coils. But air flow rates and cooling capacities must be defined in accordance with “Summer temperature design point”.

Room	Summer temperature Design Point (°Celsius)	Relative humidity (%)	Summer temperature tolerance (°Celsius)	Setting range (°Celsius)
Ablution room	24	50 to 65	± 1	24 to 26
Air lock	24	NC	± 1	24 to 26
Bakery	24	NC	± 1	24 to 26
Battery room	20	40 to 55	± 1	20 to 22
Bed room	24	50 to 65	± 1	24 to 26
Changing room	24	50 to 65	± 1	24 to 26
Coffee or tea room	24	50 to 65	± 1	24 to 26
Control room	22	40 to 50	± 1	22 to 24
Corridors	24	NC	± 1	24 to 26
Dining room	24	50 to 65	± 1	24 to 26
Dish wash	24	NC	±1	24 to 26
Dryer room	24	NC	±1.5	24 to 27
Electrical room	22	40 to 50	± 1	22 to 24
Generator room	40	NC	NA	NC
Grocery	18	50 to 65	± 1.5	18 to 21
HVAC room	24	40 to 50	± 1.5	24 to 27
Instrument room	22	40 to 50	± 1	22 to 24
Kitchen	24	50 to 65	± 1	24 to 26
Laboratory	20	55 to 65	± 1	20 to 22
Laundry	24	NC	± 1.5	24 to 27
Library	22	40 to 55	± 1	22 to 24
Lockers room	24	50 to 65	± 1.5	24 to 27
Meeting room, conference room	20	50 to 65	± 1.5	20 to 23
Mortuary	8	50 to 65	± 1	8 to 10
Office	See hereafter	50 to 65	± 0,.	Design point +0; +1
Photocopy room	24	50 to 65	± 1	24 to 26

Room	Summer temperature Design Point (°Celsius)	Relative humidity (%)	Summer temperature tolerance (°Celsius)	Setting range (°Celsius)
Prayer room	20	50 to 65	± 2	20 to 24
Sport room ²	22	40 to 65	± 1	22 to 24
Recreation room	20	50 to 65	± 1	20 to 22
Showers ³	22	NC	± 1	22 to 24
Sick bay, first aid, infirmary	22	50 to 65	± 0.5	22 to 23
Storage (non perishable foods)	14	50 to 65	NA	14
Storage	26	60 to 70	± 3	26 to 32
Telecom room	22	50 to 65	± 1	22 to 24
Toilets	24	NC	± 1.5	24 to 27
Transformer room	32	Max. 85	± 2	32 to 36
TV room	22	50 to 65	± 1	22 to 24
Vegetables preparation	14	NC	NA	14 to 16
Waste room	8	NC	± 1	8
Workshop	24	50 to 65	± 1.5	27 to 27

Note: NA = Not Applicable, NC = Not Controlled

For office and equivalent room, care shall be taken by CONTRACTOR to provide equipment ensuring an evolution of temperature according to the following formula:

$$T_{int} = \frac{Text - 4}{2} + 10$$

with: T_{int} = setting point temperature in ° Celsius

$Text$ = outside air temperature in ° Celsius

Result of this calculation shall be limited to a minimum of 21°C and a maximum of 24°C.

3.3 Air velocity

In occupied rooms, the air distribution shall be such that air velocity at 0.9 m from floor shall never exceed 0.15 m/s.

² For squash room, design point: 17°C / 40 to 65%

³ Room given access to showers shall be maintained at 22°C

3.4 Fresh Air flow rates

The Fresh Air flow rates must be in accordance with the following values:

Room	Fresh air flow rate
Electrical/Instrumentation room	Minimum 1 room volume/hour
Unoccupied room	0.5 room volume/hour
Occupied room	18 m ³ /h/person
Conference room	18 m ³ /h/m ² of floor
Dining room	22 m ³ /h/person
Kitchen 1 to 150 meals	25 m ³ /h/meal
Kitchen 151 to 500 meals	20 m ³ /h/meal
Meeting room	6 m ³ /h/m ² of floor
Mortuary	2 room volumes/hour
Recreation room, TV room, tea room	30 m ³ /h/person
Showers	0.5 room volume/hour
Sport room	25 m ³ /h/person
Storage	0.5 room volume/hour
Toilets	0.5 room volume/hour

3.5 Exhaust Air flow rates

The Exhaust Air flow rates must be in accordance with the following values:

Room	Exhaust air flow rate
Changing room	2 room volumes/hour
Kitchen	Depending on hood characteristics
Mortuary	2 room volumes/hour
Sport room	Blown air flow rate ⁴
Showers	45 m ³ /h/cabin when isolated 30 + (5xN) m ³ /h/cabin when grouped (N= Number of showers)
Toilets	35 m ³ /h/cabin when isolated 30 + (5xN) m ³ /h/cabin when grouped (N= Number of toilets)

⁴ Blown air flow rate must be converted to indoor conditions of room (temperature and relative humidity inside room). It means that mass of blown air flow and mass of exhaust air must be equal.

3.6 Air change volume

The minimum air change volume defined hereafter are independent of any pressurisation or fresh air volume requirement.

3.6.1 Battery room with open batteries

The minimum air flow rate Q (m³/h) is defined by:

$$Q = 0.05 \times I \times N$$

Where:

- I is the maximum charging current (expressed in Ampere)
- N is the quantity of elements

The value of the maximum charging current depends on the battery charger's protection and shall be stated by the charger MANUFACTURER.

- For a certified charger with a charging current protection, the value of " I " may be assumed to be $0.2 \times C$ (C corresponds to capacity in Ah) for a rough estimation of ventilation. This value must be checked as soon as the actual specific data is available
- For a charger fitted only with AC supply maximum current protection, the value of " I " cannot and shall not be estimated without data from the charger MANUFACTURER.

3.6.2 Battery room with recombination batteries

The minimum air flow rate Q (m³/h) is defined by:

$$Q = 0.0025 \times I \times N$$

Where:

- I is the maximum charging current (expressed in Ampere)
- N is the quantity of elements

The value of the maximum charging current depends on the battery charger's protection and shall be stated by the charger MANUFACTURER.

The value of " I " may be assumed to be $0.2 \times C$ (C corresponds to capacity in Ah) for a rough estimation of ventilation. This value must be checked as soon as the actual specific data is available.

3.6.3 Other rooms

Room	Minimum air change volumes, in volume of room / hour
Ablution room	4
Air lock	40 to 60 - see note (1)
Bakery	20
Bed room	3
Coffee or tea room	3
Control room	2

Room	Minimum air change volumes, in volume of room / hour
Corridors	1.5
Dining room	2
Dryer room	10
Electrical room	1.5
Grocery	2
HVAC room	1.5
Instrument room	1.5
Kitchen	30
Laboratory room	See note (2)
Laundry	10
Library	3
Lockers room	5
Meeting room, conference room	4 - see note (3)
Mortuary	2 - see note (4)
Office	3 - see note (3)
Photocopy room	2
Prayer room	4
Recreation room	4
Showers ⁵ , baths	1.5
Sick bay, first aid, infirmary	4
Sport room	4
Store	1.5
Telecom room	3
Toilets	1.5
TV room	4
Vegetables preparation	1.5
Waste room	No mechanical air change
Workshop	1.5

⁵ Room given access to showers baths shall be maintained at 24°C

Notes:

- (1) Depending on leakage air flow rate, particularly on doors. For air locks, air change volumes are not considered as a parameter. The blown air flow rate must be designed taking into account the differential pressures for all doors, walls, partitions, to maintain the required overpressure inside air locks.
- (2) A dilution approach must be in accordance with the following items:
 - Chemicals pollutants
 - Mixing of pollutants
 - Masses of pollutants
 - Limit exposure values, mean exposure values, Inferior exposure limit.
- (3) In case of variable flow, the air change volume must be increased to 5.
- (4) Air change volume is defined in using cooling drawers.

3.7 Overpressure inside rooms

Unless otherwise specified, the reference pressure shall be the ambient pressure outside of the building with no wind.

The leakage air flow rates (through walls, roofs, floors, windows) must be calculated by CONTRACTOR, from architectural data. Some values can be indicated by MANUFACTURERS.

Maximum leakage air flow rates shall be 35 m³/h/linear meter of joint, for a door, under a differential pressure of 30Pa (guaranteed by MANUFACTURERS and by Engineering of CONTRACTOR).

For walls and partition, infiltration of 10⁻⁵ m³/m² of wall.

Pressurisation values to be obtained inside rooms are indicated hereafter:

Room	Differential pressure between room and outside, in Pascal
Ablution room	30
Air lock	30
Bakery	30
Battery room	30
Bed room	50
Coffee or tea room	50
Control room	50
Corridors	50
Dining room	50
Dryer room	30
Electrical room	50
Grocery	30

Room	Differential pressure between room and outside, in Pascal
HVAC room	50
Instrument room	50
Kitchen	30
Laboratory room	50
Laundry	30
Library room ⁶	30
Lockers room	30
Meeting room, conference room	30
Mortuary	30
Office	50
Photocopy room	30
Prayer room	30
Recreation room	30
Showers baths	30
Sick bay, first aid, infirmary	30
Sport room	30
Store	30
Telecom room	50
Toilets	30
TV room	30
Vegetables preparation	30
Waste room	30
Workshop	50

Leakage air flow rates taken into account for HVAC equipment design shall be justified by calculation note and/or MANUFACTURER's certificates.

3.8 Tropicalisation

Electrical equipment shall withstand their environment i.e.:

- Their position in the installation
- Psychrometric conditions surrounding the electrical equipment.

⁶ Not applicable for building type "Laboratory"

Depending on environment, treatments shall have to satisfy the following requirements:

- UTE C 63-100 for the following limit conditions (couple “temperature/relative humidity”):

Temperature (°C)	20	30	40
Relative humidity (%)	80	60	45

- Standard NF C 26-220, beyond operating conditions here above.

3.9 U-values

The U-values must be calculated by CONTRACTOR, from architectural data. The convection and radiation factors must be calculated taking into account the actual values of wind and colours.

If the calculated U-values are higher than the reference U-values, the calculated U-values must be taken into account; otherwise the reference U-values shall be used.

	Reference U-value in W/m ² /°C
External walls	0.6
Roof	0.6
Floor	0.6
Doors	3.5
Windows	2.7
Partitions/internal walls	2.2

3.10 Rooms classification and activity

Room	Number of persons inside rooms	Activity type
Ablution room	1 person/3 m ² of floor	Light work
Air lock	0	
Bakery	2	Light work
Battery room	2	Heavy work
Bed room	Number of bed	
Coffee or tea room	1 person/m ² of floor	Sedentary work
Conference room	1 person/m ² of floor	Seated
Control room	4	Sedentary work
Corridors	0	
Dining room	Number of seats	Seated
Dryer room	1	Heavy work



Room	Number of persons inside rooms	Activity type
Electrical room	2	Light work
Grocery	0	
HVAC room	2	Heavy work
Instrument room	2	Light work
Kitchen	3	Light work
Laboratory room	2	Sedentary work
Laundry	1	Heavy work
Library	2	Sedentary work
Lockers room	0	
Meeting room	1 person/3 m ² of floor	Seated
Mortuary	2	Sedentary work
Office	1 person/7 m ² of floor	Office work
Photocopy room	1	Light work
Prayer room	1 person/0.8 m ² of floor	Seated
Recreation room	1 person/m ² of floor	Seated
Showers	1 per shower	Light work
Sick bay	2	Seated
Sport room	1 person/3 m ² of floor	Heavy work
Store	0	
Telecom room	1	Seated
Toilets	0	
TV room	1 person/m ² of floor	Seated
Vegetables preparation	1	Heavy work
Waste room	0	
Workshop	2	Heavy work

Sensible and latent heat gains must be taken into account in accordance with the following values, for cooling loads calculation:

	28°C		27°C		26°C		24°C		21°C	
Activity type	Sens.	Lat.	Sens.	Lat.	Sens.	Lat.	Sens.	Lat.	Sens.	Lat.
Seated	51	51	57	45	61	41	67	35	75	27
Office work	52	79	58	73	63	69	71	60	82	49
Sedentary work	56	106	64	97	71	90	82	79	94	67
Light work	56	164	64	155	72	147	86	133	107	113
Heavy work	131	292	138	288	142	282	153	270	176	247

(Values in Watts)

Heating loads calculation (winter period) shall not take into account the heat gains from equipment.

3.11 Hazardous Area classification

The HVAC equipment must be certified for the hazardous area where they are located in accordance with Project classification.

Furthermore, they must comply with the specific requirements of the room or package where they are installed or connected with battery room, gas storage, fume cupboard...

Every HVAC equipment for hazardous area must fulfil the ATEX directives.

3.12 Sound pressure levels

Maximum sound pressure levels, measured at any point of an occupied room, and due to HVAC equipment, must be as follow:

Room	Maximum sound pressure levels in dB(A)
Ablution room	55
Air lock	55
Bakery	55
Battery room	65
Bed room	40
Coffee or tea room	50
Control room	50
Corridors	55
Dining room	50
Dryer room	55

Room	Maximum sound pressure levels in dB(A)
Electrical room	55
Grocery	60
HVAC room	85
Instrument room	55
Kitchen	55
Laboratory	50
Laundry	55
Lockers room	60
Meeting room	45
Mortuary	45
Office	45
Photocopy room	50
Prayer room	45
Recreation room	40
Showers baths	50
Sick bay, first aid, infirmary	40
Sport room	50
Storage	65
Telecom room	40
Toilets	55
TV room	40
Vegetables preparation	55
Waste room	60
Workshop	55

HVAC equipment located outside of building:

The maximum sound pressure levels of HVAC equipment installed outside of building, must be 85 dB(A) at 1 meter from noise emitting equipment. In any case, the sound pressure level of HVAC equipment measured at 0.5 m from a wall, shall be inferior to 65 dB(A).

3.13 Heat gains from Lighting

The following values must be taken into account for cooling loads calculations (assuming fluorescent type of lighting):

Room	Ratio (W/m ²)
Corridor	12
Control room, meeting room	18
Bedroom and other occupied rooms, dining room, electrical room, kitchen, bakery, showers baths, toilets	15
Store, waste, mortuary, prier room	12
Stairs	18
Other	15
Conference room	20

Heating loads calculation (winter period) shall not take into account the heat gains from lighting.

3.14 Over-design

3.14.1 Over-design parameters for calculation notes

3.14.1.1 Heat gains calculation

Over-design coefficient shall be as follows: **10%**

3.14.1.2 Cooling gains calculation

Over-design coefficient shall be as follows: **10%**

Note: The above over-design coefficient shall be applied to all loads (i.e. sun loads, people loads, light loads, equipment loads, etc.).

3.14.1.3 Fresh air flow rate

Over-design coefficient shall be as follows:

- **15%** when air cooling or air dehumidification is ensured by chilled water unit(s)
- **10%** when air cooling or air dehumidification is ensured by direct expansion unit(s).

3.14.2 Over-design parameters for selection of equipment

3.14.2.1 Cooling and heating coils

Over-design coefficient to apply to the surface area (and not to the coil capacity) shall be as follows:

- **10%** when air cooling or air dehumidification is ensured by chilled water unit(s)
- **0%** when air cooling or air dehumidification is ensured by direct expansion unit(s).

The coil capacity results from “over-design parameters for calculations notes” indicated above.

3.14.2.2 Chilled water unit/Direct expansion unit

Over-design coefficient shall be as follows:

- **10%** on the cooling capacity resulting from the over-design required in paragraphs "Cooling gains calculation"/"Fresh air flow rate"/"Cooling and heating coils" when the chilled production is provided by chilled water unit(s)
- **0%** when the chilled production is provided by direct expansion unit(s).

3.14.2.3 Fan and motor (supply and/or exhaust fans)

Over-design coefficient shall be as follows: **10%**

3.14.2.4 Ducting

Sizing of ducting shall be defined taking into account 105% of over-designed air flow rate, without changing the maximum air velocity indicated in COMPANY's document.

3.14.2.5 Exchangers (coils and shell and tubes exchangers)

Over-design coefficient to apply to the surface area shall be as follows: **10%**

Note: See also paragraph "Cooling and heating coils".

3.15 Equipment minimum performances

Equipment shall be designed for continuous operation at maximum capacity and for the specified range, when indicated.

During FAT and/or commissioning, the performances of equipment shall be checked. Results of checking, including the tolerances on measurement, must be in accordance with requested Design Values with "no negative tolerance".

(See also **GS HVA 801**, section "Definitions").

3.16 Specific algorithms

Calculation notes must be provided by CONTRACTOR with clear indication of each used algorithm.

The CONTRACTOR must use the calculation codes available in the country where equipment will be installed. In case where country codes are different from codes stated in "Reference documents" section, the most stringent code shall apply.

The following specific approaches must be used for calculation:

3.16.1 Psychrometrics calculation

P_0 : Atmospheric reference pressure at sea level (101 325 Pa)

T_0 : Melting ice temperature (273.15K)

ρ_0 : Mass of 1 m³ of dry air at P_0, T_0 (1.293 kg/m³)

R : Gas constant (8.3143 J/mole.K)

M_V : Molar mass of water vapour (18.01534 10⁻³ kg)

M_a : Molar mass of dry air (28.9654 10⁻³ kg)

$$\delta : \frac{M_v}{M_a} = 0.62198$$

L_0 : Latent heat of water vaporisation at 0°C (2500.4 kJ / kg)

3.16.1.1 Specific humidity

$$r = \delta \times \frac{P_v}{P_0 - P_v}$$

with:

r (g/kg dry air): specific humidity

p_v (Pa): partial pressure of water vapour

3.16.1.2 Saturation vapour pressure: P_s

$$\ln P_s = \frac{A \cdot t}{B + t} + C$$

With:

t (°C): air temperature

P_s (Pa): saturation vapour pressure

$\ln$: Neperian logarithm

The values A, B and C reported in this calculation note are taken from "Vapour-pressure equation for water in the range 0 to 100°C", A. Wexler and L. Greespan, publication of Research of the National Bureau of Standards, Vol. 75A - N° 3, May - June 1971.

A: 17.438 B: 239.78 C: 6.4178

The vapour pressure difference given by the above relation and by reference charts is lower than 0.1% from 0 to +35°C.

3.16.1.3 Partial pressure of the water vapour: P_v

$$P_v = P_s \times RH$$

with:

RH (%): Relative humidity of air

3.16.1.4 Density of the moist air

$$\rho = \rho_0 \times \frac{T_0}{T} \times \frac{P}{P_0} \times \frac{\delta(1+r)}{\delta+r}$$

with:

ρ (kg/m³): density of the moist air

T (K): temperature of the moist air

P (Pa): pressure of the moisture air

3.16.1.5 Variation of air volume with temperature and/or pressure variation

$$V_2 = \frac{P_1}{P_2} \times \frac{T_2}{T_1} \times V_1$$

with:

V_1 (m³): volume at T_1 temperature

V_2 (m³): volume at T_2 temperature

T_1 (K): absolute temperature

T_2 (K): absolute temperature

P_1 (Pa): absolute pressure at T_1 temperature

P_2 (Pa): absolute pressure at T_2 temperature

3.16.2 Singular pressure loss

$$\Delta p = \zeta \times \frac{\rho}{2} \times v^2$$

with:

Δp (Pa): singular pressure loss

ζ : singular pressure loss coefficient (according Idel'Cik - Memento des pertes de charges -, and Porcher - Cours de climatisation)

ρ (kg/m³): air density

v (m/s): average air velocity

3.16.3 Equivalent diameter

$$d = \frac{2 \times a \times b}{a + b}$$

with:

d (mm): duct equivalent diameter

a (mm): duct width

b (mm): duct height

3.16.4 Static pressure gain

The velocity reduction inside a duct leads to a static pressure gain:

$$\Delta p_s = 4.5 \times 9.81 \times 10^{-2} (V_2^2 - V_1^2)$$

with:

Δp_s (Pa): static pressure

V_1 (m/s): downstream velocity

V_2 (m/s): upstream velocity

In practice, pressure gain will only be calculated in case of main velocity changes and only 75% of theoretic gain will be considered as effectively obtained.

3.16.5 Air temperature increase between inlet and outlet of fan

Air temperature increase between inlet and outlet of the fan is defined by:

$$\Delta t = \frac{\Delta P_t}{102 \times \rho \times \eta_v \times c_p \times 9.81} \times x$$

with:

ρ (kg/m³): density of air at fan inlet

η_v : fan efficiency

c_p (kJ/kg.K): mass heat of air

x : factor of air compressibility

$$x = -0.35 \times \frac{\Delta P_t}{P_a} + 1$$

with:

ΔP_t (Pa): total static pressure of the fan

P_a (Pa): atmospheric pressure

3.16.6 Convection factors (used in U-values calculations)

For U-values calculation, the outside convection factor shall be calculated as following:

$$h_c = 6.2 + 4.2 \times w \text{ when } w < 5 \text{ m/s}$$

$$h_c = 7.15 \times w^{0.78} \text{ when } w \geq 5 \text{ m/s}$$

with:

h_c : outside convection factor

w: wind velocity in m/s

4. Project data to be completed by Engineering

Data to be completed are indicated with the symbol “Δ”.

4.1 Location

- Latitude: Δ
- Longitude: Δ

4.2 Building types

The building type and its localisation shall impact on the HVAC design (e.g. choice of materials, etc.).

The building type must be selected by Engineering, with COMPANY approval, in the following list:

Building or part of building classified as	Building type
Rural environment	RU
Industrial equipment	IN
General activity in industrial environment	INT
Marine environment	MA
General activity in marine environment	MAT

4.3 External conditions

- **Atmospheric pressure:** Δ hPa to Δ hPa
- **Air temperature:**
 - Temperature for cooling and heating load calculations:
 - . Δ ° Celsius (summer)
 - . Δ ° Celsius (winter)
 - Fresh air temperature design for heat gain calculations:
 - . Δ °Celsius

- Temperature profile to use for heat gain calculations:

Hour	Dry bulb (°C)	Wet bulb (°C)	Hour	Dry bulb (°C)	Wet bulb (°C)
0	Δ	Δ	12	Δ	Δ
1	Δ	Δ	13	Δ	Δ
2	Δ	Δ	14	Δ	Δ
3	Δ	Δ	15	Δ	Δ
4	Δ	Δ	16	Δ	Δ
5	Δ	Δ	17	Δ	Δ
6	Δ	Δ	18	Δ	Δ
7	Δ	Δ	19	Δ	Δ
8	Δ	Δ	20	Δ	Δ
9	Δ	Δ	21	Δ	Δ
10	Δ	Δ	22	Δ	Δ
11	Δ	Δ	23	Δ	Δ

- Daily range: Δ ° Celsius

- **Sea water temperature**

- Δ ° Celsius (summer)
- Δ ° Celsius (winter)

- **Maximum sun radiation (expressed in W/m²)**

Month	NE	E	SE	S	SO	W	NO	N	Horizontal
January	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
February	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
March	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
April	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
May	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
June	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
July	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
August	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
September	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
October	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
November	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
December	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ

- **Wind**

(Accuracy on wind velocities is $\pm 5\%$)

Wind		Return Periods			Direction
		100 years	10 years	1 year	
	V_{1mn} (m/s)	Δ	Δ	Δ	Δ
Maximum Wind at 10 m	V_{10mn} (m/s)	Δ	Δ	Δ	Δ
	V_{1h} (m/s)	Δ	Δ	Δ	Δ

100 Year Return Period 10 min sustained wind		Direction							
		N	NE	E	SE	S	SW	W	NW
	V_{1mn} (m/s)	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
Wind at +10 m	V_{10mn} (m/s)	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
	V_{1h} (m/s)	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ

10 Year Return Period 10 min sustained wind		Direction							
		N	NE	E	SE	S	SW	W	NW
	V_{1mn} (m/s)	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
Wind at +10 m	V_{10mn} (m/s)	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
	V_{1h} (m/s)	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ

1 Year Return Period 10 min sustained wind		Direction							
		N	NE	E	SE	S	SW	W	NW
	V_{1mn} (m/s)	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
Wind at +10 m	V_{10mn} (m/s)	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
	V_{1h} (m/s)	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ

4.4 Additional requirements for external conditions

In addition to the above data, the following hypotheses shall be taken into account for HVAC equipment design:

- Fresh air temperature for the air handling units: Δ ° Celsius
- Fresh air relative humidity for the air handling units: Δ %
- Atmospheric pressure: Δ hPa
- Fresh air temperature inlet on condensers (when air cooled condensers are used): Δ ° Celsius

- Air condensers calculation must take into account the wind effect when wind velocity is: Δ m/s

4.5 Calculated U-values

	Calculated U-value in $W/m^2/^\circ C$
External walls	Δ
Roof	Δ
Floor	Δ
Doors	Δ
Windows	Δ
Partitions/internal walls	Δ

Note: The calculated U-Values must not be inferior to the reference U-Values indicated in section "Data fixed by COMPANY".

4.6 Utility data

4.6.1 Utility fluids (main characteristics)

	Operating conditions		Design conditions	
	P (barg)	T ($^\circ C$)	P (barg)	T ($^\circ C$)
Compressed air	Δ	Δ	Δ	Δ
Sea water	Δ	Δ	Δ	Δ
Fresh water	Δ	Δ	Δ	Δ

4.6.2 Compressed air

	Target values	Average
Filtration (μm)	Δ	Δ
Dew point	Δ	Δ
Temp. at delivery point ($^\circ C$)	Δ	Δ

4.6.3 Sea water analysis

Sea water analysis report (water to use for chilled water unit(s) condensation):

	Target values	Average
pH at $25^\circ C$	Δ	Δ
Chlorine Resistance (mg/l)	Δ	Δ
Salinity (g/l)	Δ	Δ

	Target values	Average
Calcium (mg/l)	Δ	Δ
Magnesium (mg/l)	Δ	Δ
Total Iron (mg/l)	Δ	Δ
Total dissolved Solid (mg/l)	Δ	Δ
Turbidity (NTU)	Δ	Δ
Total oil content (ppmV)	Δ	Δ
Total hardness	Δ	Δ

4.6.4 Fresh water analysis

Fresh water analysis report (water to use for chilled water unit(s) network):

	Target values	Average
pH at 25°C	Δ	Δ
Resistance Chlorine (mg/l)	Δ	Δ
Salinity	Δ	Δ
Calcium	Δ	Δ
Magnesium	Δ	Δ
Total Iron (mg/l)	Δ	Δ
Total dissolved solid (mg/l)	Δ	Δ
Turbidity (NTU)	Δ	Δ
Total oil content (ppmV)	Δ	Δ
Total hardness	Δ	Δ

4.6.5 Supply temperatures for heat exchangers

Type of exchanger	Parameter	Value
Heating coil	Water inlet temperature (°C)	Δ
Cooling coil	Water inlet temperature (°C)	Δ
Direct expansion coil	Minimum evaporating temperature (°C)	+1.5 (air flow rate with dirty filters)

4.6.6 Water characteristics for heat exchangers

	Target values	Average
PH at 25°C	Δ	Δ
Residual Chlorine (mg/l)	Δ	Δ
Salinity	Δ	Δ
Calcium	Δ	Δ
Magnesium	Δ	Δ
Total Iron (mg/l)	Δ	Δ
Total dissolved solid (mg/l)	Δ	Δ
Turbidity (NTU)	Δ	Δ
Total oil content (ppmV)	Δ	Δ
Total hardness	Δ	Δ

Percentage of glycol for hot water (% in mass) Δ

Viscosity of mixing for hot water (cSt) Δ

Percentage of glycol for cold water (% in mass) Δ

Viscosity of mixing for cold water (cSt) Δ

4.6.7 Normal Electrical power supply

The voltage systems available are the following:

	Nominal value	Variations
Main supply	Δ	Δ
Main switchboard short circuit current value	Δ	Δ
Ground system	Δ	Δ
Frequency (Hz)	Δ	Δ
Control voltage ⁷	Δ	Δ
Fire dampers motor supply	Δ	Δ

⁷: generated in main HVAC electrical cabinet by transformer

4.6.8 Emergency Electrical power supply

The voltage systems available are the following:

	Nominal value	Variations
Main supply	Δ	Δ
Main switchboard short circuit current value	Δ	Δ
Ground system	Δ	Δ
Frequency	Δ	Δ
Control voltage VAC ⁸	Δ	Δ
Fire dampers motor supply VDC	Δ	Δ

4.7 Heat gains from equipment

The following values must be taken into account for cooling loads calculations:

Equipment	Heat gains in Watts/room
Bakery	Δ
Battery room	Δ
Bed room	Δ
Coffee or tea room	Δ
Control room	Δ
Dining room	Δ
Documents room	Δ
Dryer room	Δ
Electrical technical room	Δ
Emergency electrical room	Δ
HVAC room	Δ
Instrument room	Δ
Kitchen	Δ
Laboratory room	Δ
Laundry	Δ
Maintenance offices	Δ
Mess room	Δ
Meeting room	Δ

⁸: generated in main HVAC electrical cabinet by transformer



Equipment	Heat gains in Watts/room
Office	Δ
Photocopy room	Δ
Prayer room	Δ
Printer room	Δ
Recreation room	Δ
Sick bay, first aid, infirmary	Δ
Telecom room	Δ
TV room	Δ
Vegetables preparation	Δ
Waste room	Δ
Workshop	Δ

Notes: For Computer minimum 300 W; for printer minimum 500 W. Heating loads calculation (winter period) shall not take into account the heat gains from equipment.