



Heat Insulation of Refrigerated Premises and Buildings – Technical Clauses

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CHAPTER 1 – PURPOSE

The purpose of these Technical Clauses is to define the heat insulation works of refrigerated premises and buildings; they give instructions concerning the materials and products necessary as well as the corresponding rules for installation and incorporation.

This document does not contain the texts of the regulations with which the works must comply.

Comment

In the field of safety, the main regulations concern:

- *Cold storage warehouse safety;*
- *Work safety;*
- *Electrical safety;*
- *Safety of establishments receiving the public; as the case may be.*
- *Fire safety*

In the field of environmental protection, cold storage warehouses shall comply with the regulations if this installations are classified owing to eventual risk

Premises and buildings containing food products shall comply with the corresponding regulations.

CHAPTER 2 – FIELD OF APPLICATION

This document applies to refrigerated premises and buildings intended for working with or storage of products of all kinds, requiring a specified temperature range* (packaging, refrigeration, freezing,...).

Comment

The most usual temperatures are from -40°C to +10°C

The works concerned are those of heat insulation of the envelope (floor, walls, ceiling) and the installation of insulating doors. They may also include weather protection, that is ensuring enclosure and top cover.

This document does not apply to special buildings such as enclosures for climatic tests, freezing tunnels, refrigerated premises on ships. Freezing tunnels are covered in a special document.

*Temperature references are Celsius temperature

CHAPTER 3 – MATERIALS AND PRODUCTS

The materials shall not release odour by their nature or because of the treatments to which they are subjected (fungicide treatment of wood, for example).

3.1 Materials for heat insulation of walls

3.11 Vapour barrier

Whatever its nature, the permeability of the vapour barrier in the undifferentiated part shall be less than $0,00752\text{mg/m}^2\cdot\text{h}\cdot\text{Pa}$ (89m) for premises where the temperature is equal or inferior to 0°C .

For premises with temperatures superior to 0°C there shall be no risk of condensation in the thickness of the insulation. A vapour barrier with permeability less than $0,01504\text{mg/m}^2\cdot\text{h}\cdot\text{Pa}$ (45m) satisfies this requirement.

Comment

For the thermal insulating materials refer to C.E certification

1° The value of that stress is part of the project date; see Appendix to Special Clauses

2° According to their origin, the heat insulations are as follows:

- *Organic origin:*
 - *Polystyrene,*
 - *Polyurethane,*
 - *Polyisocyanurate*
 - *Phenol-formaldehyde foams,*
 - *PVC foams;*

- *Plant origin : expanded cork;*

- *Mineral origin*
 - *Mineral wool, rigid or semirigid, surfaced or not,*
 - *Cellular glass, blocks or panels.*
 - *Expanded perlit*

3.13 Coverings and finish

The finished products shall be suitable to be ambient humidity and aggressivity.

Comment

There are several types :

- *Cement or plastic coatings (resin),*
- *Metal or plastic siding,*
- *Tile,*
- *Paint*
- *Wear bed.*

For coverings of galvanised sheet steel, see table and following article 3.14

In premises subject to health regulations, the finished coverings shall comply with those regulations.

Comment

For refrigerated premises and buildings in the food industry, see in particular existing documents concerning materials in contact with foods and concerning cleaning products for these materials.

Furthermore, for that purpose, it is recommended that smooth or slightly undulating (ondulations less than or equal to 2mm) surfaces to be chosen and that systems limiting the length of joints and their possibility of retaining dirt to be preferred.

Low temperature sensitive coverings are prohibited for premises at equal or inferior to 0°C temperatures in general, in zones where surface temperature of the walls vertical or horizontal can be equal or inferior to 0°C

Comment

This is the case, for example, of zones directly exposed to cold air flows coming from the refrigerating equipment.

For example, "earthenware" type tiles are sensitive to freezing.

The paints and substrates (coating or plaster) as well as the resins should have a maximum permeability to water vapour which is at least equal to that of the vapour barrier.

3.14 Prefabricated panels

The panel forms a complex consisting of an insulating core whose two faces receive a covering.

The covering is plane or ribbed.

The finished products on the inside shall comply with the instructions in the preceding article.

Comment

For galvanised sheet steel coverings, see the table below also.

Coverings of panels intended to constitute the floor of refrigerated premises or buildings shall be capable of withstanding the anticipated static and live loads (in particular, resistance to puncturing under concentrated loads).

Panel fasteners shall withstand, without irreversible deformation, the effect of loads exerted (dead weight, loads due to pressure variations...) See chapter 7

Outside coverings subjected to the sun's rays shall be of light colour shades (absorption coefficient less than 0.6).

Outside coverings and panels which are to provide enclosure and top covering shall be suitable to the environment.

Comment

Guidance can be found in the documents concerning metal roofing:

The above table is a guide for choosing coverings based on the various types of atmospheres (the outside atmospheres are defined in Appendix 3).

With reference to ISO standard P 7892:

"Determination of impact resistance", prefabricated panels for vertical walls shall withstand impacts in the following way:

- Performance conservation impacts : under the effect of an impact from a small hard body, energy 5 J (steel ball of 0.5kg with a falling height of 1 m), the indentation shall have a depth less than 2 mm and a diameter less than 15 mm without constituting and incipient detachment of the finished covering;
- Safety impacts : under the effect of an impact from a large soft body, energy 900 J (bag of 50 kg with a falling height of 1.8 m), the panel shall neither be crossed through nor pushed aside, its residual deformation shall be less than 1/200 of the span and no debris or dangerous element shall fall.

For the test, the panel shall rest on bearings and the span and fasteners shall be those of the project.

Comment

1° The DPMs may provide that the impact tests take place on the structure built on the site.

In this case, the tests shall be performed according to the instructions contained in the DPMs.

2° According to the spirit of the standards concerning impacts, these tests are not intended to check the mechanical strength of "cantilevered" panels (example: façade panel protruding vertically beyond horizontal support, (like a façade panel projecting above the roof to form a parapet). These special cases shall be provided for in the DPMs.

The insulation supplier shall be able to corroborate the following characteristics of panels.

- Thermal characteristics in the form of working performance;
- Mechanical characteristics under bending, in particular the load causing a deformation of 1/200 of the span with the bearing system provided;
- Deformation characteristics under load for panels intended for flooring;
- Characteristics of fastening devices (inserts, hangers ...) such as permissible force, corrosion resistance.

Comment

The devices concerned are used :

- *For assembling panels to each other;*
- *For fastening or hanging onto a frame;*
- *For fastening door frames and certain light weight accessories such as light fixtures.*

Guide for choosing finish coverings for precovered galvanised sheet steel sections or accessories									
Product	Finish covering on an exposed face (nature & thickness)	Outside atmosphere					Inside ambience		
		Non polluted rural	Industrial or Urban		Marine	Mixed or special	Healthy and dry	Damp	Aggressive
			Normal	Severe					
Galvanised sheet steel Z 225		Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	○	Not suitable	Not suitable
Prelacquered	Polyester or silicone treated polyester 10-15mm	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	○	Not suitable	Not suitable
Galvanised	Polyester or silicone treated polyester 25mm	●	○	Not suitable	Not suitable	Not suitable	●	○	Not suitable
	Polyurethane 25mm	●	○	○	○	○	●	○	○
Sheet steel Z 225	PVDF 20 to 25mm	●	●	○	○	○	●	○	○
	PVC 100 to 200 mm	●	●	○	●	○	●	●	○
	PVDF 35 to 60mm	●	●	○	●	○	●	●	○
Plastic covered galvanised sheet steel	PVC film 70 to 200mm	●	●	○	●	○	●	●	○
	PVF film 35 to 40mm	●	●	○	●	○	●	●	○
Stainless steel		○	○	○	○	○	○	○	○
Polyester	Gelcoat 400 to 500 g/m ²	○	○	○	○	○	○	○	○

● Suitable covering

○ Covering whose definitive choice as well as special characteristics shall be decided upon after querying the manufacturer and procuring his agreement.

Outside atmosphere means the environment outside the refrigerated premises.

Inside ambience means the environment inside the refrigerated premises.

The materials intended to provide the continuity of the heat insulation and the vapour barrier at assemblies between panels (as well as their solvent as the case may be) shall :

- Be compatible with the materials of the panels (core, covering);
- Have enough cohesion and elasticity to withstand stresses of thermal origin
- Comply with the intended use of the premises (inside environment, health regulations...).

The same will be true for any joint strips.

The panels intended to provide the enclosure or top cover⁽¹⁾ shall be subjected to an assessment procedure, with favourable conclusion for this application. In particular, top cover or roofing panels must contain fastening devices which are leak proof and heat insulated. The insulation specialist, among other checks, shall verify that the planned slope is appropriate according to that assessment.

Comment

In particular, a Technical agreement procedure exists. (EOTA)

3.2 Doors

3.21 General

The doors shall meet the same requirements at all contiguous walls. They shall meet the requirements according to the regulations which may concern them according to each case (for example, panic bolts). Each inside door shall include, at its manufacture, a device enabling it to be opened by hand by a person located on one side or on the other side.

Comment

The life of the covering depends on the application of the servicing instructions (cleaning and repair) described on annex 3.

The table here under gives and examples of premises classified according to inside ambience, that means the environment inside the refrigerated premise.

CLASSIFICATION OF THE PREMISES ACCORDING TO INSIDE AMBIENCE

CONSTRAINT	POSITIVE TEMPERATURE PREMISE						NEGATIVE TEMPERATURE PREMISE
	Fruit and Vegetables	Meat	Milk	Fish	Deep frozen food Canned food	Bread making	
WEAKLY CORROSIVE ENVIRONMENT	<ul style="list-style-type: none"> • Stocking (controlled ambience) • Predirilling premises for fruits and vegetables • Classified and packaging in fruit store room 	<ul style="list-style-type: none"> • Cold rooms for conservation mean • Slaughterhouse (1) • Chillrooms meat 	<ul style="list-style-type: none"> • Cold rooms for conservation <ul style="list-style-type: none"> - Butter - Fresh products 		<ul style="list-style-type: none"> • Preparing work shop for prepared food (1) 		<ul style="list-style-type: none"> • All other premises
AVERAGE CORROSIVE ENVIRONMENT	<ul style="list-style-type: none"> • Fourth range products work-shop 	<ul style="list-style-type: none"> • Cattle and poultry Slaughterhouse (1) • Delicatessen work shop • Sausage drying room (1) 	<ul style="list-style-type: none"> • Ice cream manufacturing premise • Butter preparing work shop 		<ul style="list-style-type: none"> • Preparing work shop for perarated food (1) • Preparing work shop for fruits and vegetables 		Storage facilities and plans for the preparation of un-packaged fish (e.g. tunny)
HIGHLY CORROSIVE ENVIRONMENT		<ul style="list-style-type: none"> • Sausage drying room (1) • Curing premise • Cooking premise • Tripe premise • Ham salting and picking premise • Shower premise 	<ul style="list-style-type: none"> • Dairy preparing work shop • Cheese dairy preparing work shop • Cheese dairy drying room 	Preparing work shop	Cooking work shop	Bread making	

(1) As the case may be

A waiver to this obligation is possible by joining an emergency door to the main door. The latter shall always be either a common door or a swinging door (see door and door component definitions in appendix 5).

Any outside door equipped with a system of single side locking, shall be able to be unlocked by hand from the inside.

Automatic doors shall :

- Comply with standards with regard to electrical parts;
- Contain a safety which stops and reverses the movement of the door when the leaf encounters an obstacle or a pedestrian (safety on rim in the case of sliding, overhead and up-an-over doors).
- To be suited to operating temperature conditions.

3.22 Dimensional tolerances

- On the inside clearance, vertical and horizontal, +5mm
- On the thickness of the leaf :
+3% with relation to nominal thickness.

Comment

The preferred dimensions, expressed in mm, for the vertical and horizontal inside clearances are given in the following table depending on the type of door. The dimensions given for a door begin with its horizontal inside clearance (see Appendix 5 § 25).

Preferred dimensions of doors			
Dimensions (mm)		Type of door	
Vertical inside clearance	Horizontal inside clearance	Common	Sliding
2000	800	Yes	
	1000	Yes	
2200	1200	Yes	Yes
	1500	Yes	Yes
2500	1600		Yes
	1800		Yes
	2200		
2800	1800		Yes
			Yes
3000	2000		Yes
	2200		Yes
	2600		
3500	2200		Yes
	2600		Yes

The preferred overall thickness of the leaves are as follows : 80mm, 120mm and 160mm. A thickness of 60mm is permitted for floors with inside horizontal clearance up to 2200mm.

3.23 Flatness, straightness

3.231 Leaf

- Curve and warp equal to or less than 1 mm/m :
The check is made using a straightedge of appropriate length given the dimensions of the leaf, and pressed in any direction against the leaf. The deflection at any point, divided by the length of the straight edge shall be equal to or less than 1 mm/m.
- In the case of smooth covering, exceptional flatness fault equal to or less than 1mm.
- Squaring fault less than 0.5mm :
The check is made using a square whose arms are 500mm long, placing it successively at the four angles of the leaf. The deflection at any point of the arms shall be less than the indicated value.

3.232 Case and case frame when there is one

The greatest deflection measured on a jamb post or a head-rail of cases and countercases, with relation to the length of the element, shall not exceed 1mm/m

3.233 Tubular packing (joint liner)

The dimensional tolerance on the nominal thickness is + 1mm.

3.24 Heat resistance

For insulating doors (see Appendix 5 “terminology”), the heat resistance of each leaf in the undifferentiated part shall be at least 70% of the heat resistance of the undifferentiated part of the walls.

For doors between two rooms with similar temperatures (temperature difference equal to or less than 10°C), 50% is admissible.

3.25 Leaf’s resistance to the effects of temperature differences between the two faces

The leaf shall be designed and chosen so that, under the extreme conditions expected, easy manipulation and leaktightness of the closing are provided.

Comment

For doors opening to the outside, these requirements are more easily obtained with light colour shades.

3.26 Hardware and accessories

The characteristics of the constituent materials shall be suitable for the ambiances of the premises and the use conditions, particularly with regard to corrosion resistance.

Comment

These ambiances and these use conditions appear in the contract documents; see the appendix and special clauses.

The design of systems for moving and closing shall take into account the type of door, in particular its dimensions and its weight, as well as servicing and cleaning.

Automatic doors shall be able to operate manually in case of failure of the specific mechanical system.

3.261 Special provisions for common doors

Comment

The usual types of closure are as follows:

- *Cremone bolt closure (manual closure);*
- *Closure with several catch points: automatic closure, the door is opened by pushing the leaf, by means of a release handle (on the inside and on the outside);*
- *Automatic closure at one catch point, definitive catch type (the door cannot open by pushing on the leaf).*

Common doors whose vertical clearance is higher than 2.30m shall have at least two catch points.

Hinges of doors equipped with draft strips or flaps shall be rising butt type.

3.262 Special provisions for sliding doors

The leaf support system shall be such that the leaf cannot fall after an accidental lifting (misuse of a fork lift truck, for example).

Insulating sliding doors shall be automatic closure type (see Appendix 5 "Terminology" art.10 and 12).

Comment

With a view to energy saving, automatic sliding doors can be fitted with

- *An opening restriction device*
- *A time delay automatic return device*

3.263 Special provisions for overhead doors

These doors shall include, at manufacture, a mechanical safety which stops the closure movement in case the control mechanism breaks.

3.264 Special provisions for swinging doors

For two leaf swinging doors, the overall width of the moving load which goes through them shall be less than two thirds of the door inside clearance.

Single leaf swinging doors are reserved for pedestrian only.

For top hung flexible slat doors, the overall width of the mobile load which crosses through them shall leave a free height of 0.40m under the slat fastening points.

3.27 Case (and any counter case)

The case (and any counter case) shall be suitable for the type of door and for the nature of the continuous wall. In particular, its strength and deformation characteristics shall be suitable to the stresses transmitted by the leaf.

Comment

These stresses are static and dynamic. They can depend on the weight of the leaf, its movement (rotation, translation), the frequency of the movements, the opening and closing

For premises with temperatures equal or inferior to 0°C, a cold bridge break shall exist between case and counter case.

3.28 Joints

3.281 Joint liner

The nature of the joint liner shall be suitable to the ambiances of the premises and to the conditions of use, and particularly with regard to the cleaning methods planned.

The joint liner's elasticity under transversal compression shall be suitable to the type of door upon which it is installed.

This quality shall be conserved within the temperature range planned, particularly at temperatures equal or inferior to 0°C.

3.282 Defrosting system

In the case of premises at temperatures equal or inferior to 0°C, the doors shall contain a joint defrosting system.

When this system is electrical, it shall comply with standard NF C 15-100 and the junction box shall indelibly indicate the power and the power supply voltage.

In every case, the correct operation of the heating system shall be able to be seen on an indicator (indicator lamp, for example).

3.29 Thresholds

For rooms at temperature equal or inferior to 0°C, the threshold shall be equipped with a heating system.

Threshold flush with floor

Its nature, its dimensions and its fastening system shall be suitable for the rolling of materials handling vehicles, for the nature of the substrate and for the dimensional variations of the floors.

When it is metallic, it shall be protected against corrosion.

3.3 Glazed sashes

Glazed sashes shall comply with the same requirements as the walls in which they are placed, in particular the requirements of the health regulations.

3.31 Frame

The frames shall be:

- Either of plastic such as cold resistant PVC or polyester;
- Or of metal with break in cold bridge

The glazing fillets shall slope to prevent washing water from stagnating.

3.32 Glazing

The glazing shall be suitable to the temperature difference between the two rooms, i.e. single, double or triple glazing, heated glazing...

Comment

The heat resistance of glazed sashes is one of the data of the project; see the Appendix of the Special Clauses.

3.4 Valves

Devices for balancing inside and outside pressures designed and installed by refrigeration specialist. Shall take into account of hyperbaric pressures or subatmospheric pressures generated by refrigeration equipment.

The minimal trip threshold, that is the value of the pressure beyond which they come into operation shall be 100 Pa (10mm water gange).

CHAPTER 4 – REQUIRED CONDITIONS BEFORE INSTALLATION

Heat insulation work cannot take place until the following conditions are met:

4.1 Freezing the foundation floor

The system to prevent freezing the floor (case of premises at negative temperature equal or inferior to 0°C shall have been designed and installed.

Furthermore, a floor temperature probe shall be installed with sound or visible check system.

Comment

In premises at temperatures equal or inferior to 0°C, foundation floor freezing source of lifting is prevented by bringing in heat to compensate the heat losses at the undersurface of the insulation by:

- *Natural or artificial ventilation,*
- *Electrical, hydraulic or aeraulic heating*

For operating safety reasons, it is recommended that the electrical or hydraulic networks be doubled. Each of these systems requires continuous monitoring and regular servicing.

4.2 State of the substrate flooring

The floor shall be dry (in the case of concrete or mortar slab and bed, it shall be at least 28 days old) free of sharp edges, flat and dustfree.

4.3 Vertical walls to be insulated for an existing building

They shall contain neither holes nor sharp edges.

Walls made of low temperature sensitive or waterproof materials are not permitted for premises at negative temperatures.

4.4 Roof and framing of existing buildings

The existing framing (trusses,...), the framing especially added for insulation works (for example, creation of a refrigerated room), and the horizontal walls are acceptance inspected by the insulation specialists for to flatness and appearance. These elements shall be considered to have the long lasting mechanical strength necessary, in particular under the effect of the loads added by the insulation and by the operation of the refrigerated room (temperature, pressure,...).

In the case of inside metal framing, the grade or class of the metal shall be considered to be suitable to the working temperatures. In the case of premises with temperatures, equal or inferior to 0°C the insulation specialist shall make sure that the seatings of these inside framing members have a cold bridge break near the foundations, that is, insulating blocks at the same level as the heat insulation coming for the floor, heating system,...

Unless otherwise indicated in the DPMs, the direct supports of the insulation in the ceiling shall be considered to have a deflection, limited to 1/200 of the span, when in service.

If the space above a horizontal wall is to be ventilated, the inspection shall also include this point.

4.5 Framing supporting prefabricated insulating panels for refrigerated buildings

This framing is assumed to comprise all the metal support and anchor pieces necessary for the placing of panels and adapted both the additional climatic loads and to the exceptional extra loads stipulated in the DPMs in such a way that the deflection between two fixing points does not exceed 1/200 of the span as a function of the thickness of the panels.

In the case of inside metal framing, the grade or class of the metal shall be considered to be suitable to the working temperatures. In the case of premises with temperatures equal or inferior to 0°C, the insulation specialist shall make sure that the seatings of these internal framing members contain a cold bridge break near the foundations, that is, insulating blocks at the same level as the heat insulation to come for the floor, heating system,...

The insulation specialist shall check the flatness and the positioning of the elements which are intended to receive the panels, and in particular that their laying plane contains no protrusions other than braces, bolts, joint strips or reinforcements.

In the case of panels which are used for roofing, it shall also be verified that the surface receiving these panels has the specified slope.

4.6 Walls near doors to be installed

The position and level marking shall be traced on the site, including and handling system crossing through the door.

The space shall be disengaged for the door including its closed position and the plane it crosses when opening (levels and slopes of inside and outside finished floors, rails, pipes, posts), as well as the other special elements governing the installation and operation.

In case of a door opening in a masonry wall, the insulation specialist shall also check the following points:

- The plumb, in the two perpendicular vertical planes, of the piers;
- The three sides of the door opening shall form a plane;
- Overall dimensions, in particular the height under the head-rail;
- Service holes for embedments and sinkings for thresholds.

CHAPTER 5 – INSTALLATION

5.1 Floors

5.11 So called traditional technique

5.111 Vapour Barrier

The minimal overlap of the polyethylene sheet when dry is 0.15m; asphalt impregnated felts or beds are bonded or torched with minimal overlap of 0.10m.

Petroleum tar shall be applied in one or two layers.

Whatever the type of vapour barrier used, it shall be continuous with the vapour barrier of the vertical walls. A simple overlap when dry is not sufficient.

Comment

If a felt aluminium complex were used all direct accidental contact between the concrete and the aluminium foil must be avoided.

5.112 Heat Insulation

The rigid insulating material is chosen based upon its mechanical resistance to the loads planned (see art 3.12).

The fastening of the panels, mechanically or by bonding, is not necessary. When the floor insulation is laid in several layers each layer is positioned with intersecting joints.

The continuity of the heat insulation shall be provided with the vertical walls.

This can be done:

- Either by cross joints: alternating horizontal and vertical layers (see figure below);
- Or by packing the joint with an expanded heat insulation on the site and worked flush;
- Or by any other methods with equivalent efficiency.

A film to protect against the batching water of the slabbing is applied to the top layer. The maximum permeability of the film should be at least equal to that of the vapour barrier.

5.113 Slabbing

The precautions to be taken at the junction of this slabbing with the outside non refrigerated floor are describes in Article 5.64 concerning door thresholds.

In the case of a sloping floor, the flush thresholds are the high points.

Comment

Floors designed to be washed generously with water shall include a leak tight covering to protect the insulation from contact with water.

For premises with temperatures superior to 0°C, this can be located under the slabbing.
Premises, whose temperature is permanently equal or inferior to 0°C, shall not be washed generously with water.

The panels are laid on the substrate floor by the intermediary:

- Either of a bed of sand for premises with temperatures superior to 0°C.
- Or of a framing (rafters for example). In this latter case, the intermediate space under the panels shall be ventilated and the panels shall be resistant to puncturing by the framing elements and to bending between these supports.

In every case, the heat insulation and the vapour barrier shall be continuous:

- Between the panels themselves;
- Between the panels and the vertical walls.

5.2 Vertical walls

5.21 Case of doubling existing walls

5.211 Vapour barrier

The vapour barrier shall be connected to the floor vapour barrier.

1. Bitumen emulsion and solvented mastics

These are applied in several layers with reinforcement glass fabric or fibreglass at the angles.

2. Polyethylene film

The minimal overlap when dry for the sheets is 0.15M.

3. Asphalt felt, with or without aluminium surfacing

The minimal overlap of the strips is 0.10m with the aluminium surfacing placed at the outside.

4. Aluminium or aluminium plastic complex

The most watertight side of the complex is placed uppermost.

5.212 Heat insulation

The heat insulation shall consist of rigid panels.

The panels of the first layer are fastened to the walls by bonding and fasteners;

- By bonding: with pitch, by solution or emulsion of bitumen or by special adhesive, compatible with the working temperatures;
- By mechanical fasteners at a rate of 4 fasteners per m², a minimum of 4 fasteners per panel. All measures shall be taken to make the vapour barrier continuous.

The insulation panels of the following layers, positioned with crossing joints, shall be bonded and mechanically fastened by fasteners crossing through the first layer for the panel of the second and by fasteners fastened to the second for the third, same fixing density as the first layer.

5.213 Covering

The insulation of the vertical walls shall be covered. The covering at the lower part shall protect the insulation from impacts and from rising the infiltrating water.

For premises subjected to health regulations, it should be remembered that this covering must comply with this regulation.

1. Cement coating

The binders used are:

- The Portland cements (ordinary and pointing) pure or with lime, mixed at a minimum of 400kg/m³;
- Special binders for coatings.

The coating is laid in at least two coats.

The reinforcement is:

- Either metal mesh (grid approximately 30 mm) fastened to the insulation before the first coat;
- Or a glass fabric, pressed against the first coat when it is still fresh.

The grooves and edges are installed at the same time as the coating.

For cement coatings, contraction joints through the thickness of the second layer are made at regular intervals (surface less than 25m², largest dimension less than 6m). in the case of premises for food products, these joints shall be well packed before the first refrigeration of the premises with the aid of mastic.

The angle protectors and edge sections shall be protected against corrosion.

In case of finish by tiling, the ceramic tiles shall be laid by bonding or in a cement bath, on a coating which is mesh reinforced, rough worked and straightened.

2. Metal or plastic siding

The ribs shall be laid vertically. Air circulation shall be provided between the insulation and the siding.

3. Angle protection

Whatever the covering, protruding angles shall be protected against impacts (sections for example), depending on the handling vehicles planned.

5.22 Vertical walls of prefabricated panels, either participating or not participating in the enclosures

Comment

The case of prefabricated panels not participating in the enclosures is the case for example, of a refrigerated room to be built in an existing building.

It should be remembered that prefabricated panels providing enclosures shall be covered by an assessment procedure, concluding that they are suitable for that application.

5.221 Preparation

The guides which are to receive the panels shall be fastened.

All arrangements shall be taken at the bottom part to avoid water infiltration and rising in the insulation material.

5.222 Positioning

The plumb and the upper level of the panels shall be checked as they are laid.
“The number of fixtures per panel must be such that if one of them breaks the others are capable of withstanding the scheduled load conditions without resulting in destruction. The nature of these fixtures, or their surface treatment, must be chosen in such a way as to resist the atmospheric corrosion to which they are exposed. The fixing systems must in no case constitute damaging heat bridges or discontinuities of the vapour barrier”.

If this is to be provided, the mechanical protection of the lower part shall be installed, leaving the possibility of installing panels, and connecting the insulation and vapour barrier with those on the floor.

5.223 Panel continuity

The continuity of the heat insulation and of the vapour barrier shall be ensured for all the assembly system and joints, with or without joint strips.

5.3 Horizontal walls

5.31 Case of existing buildings (so called traditional technique)

Two cases are possible (see below).

In these two cases, the continuity of the heat insulation and of the vapour barrier shall be ensured at the junction between vertical and horizontal walls, taking contraction into account.

If mastic is used, it shall keep its plasticity at the working temperature.

Contraction of the vapour barrier at the junction can be provided for with a bellows expansion joint.

5.311 Direct laying under an existing wall or masonry

Vapour barrier

The vapour barrier shall be of emulsion or bitumen solution.

In case the vapour barrier is laid before the fasteners, a vapour barrier connection shall be made afterward next to the fasteners.

Insulation

The insulation panels are bonded and pointed, layer by layer, with crossing joints, either by iron rods, or by insulation braces, or by threaded rods, associated with insulation collars.

Covering

The covering can be done in the same way as for the covering for vertical walls (See Art. 5.213), as long as the fastening method is compatible with the dead weight and with any loads.

5.3.1.2 Laying on ceiling separated from the high floor or from the existing roof

This arrangement requires ventilation of the separating space.

1. Insulation under joists

Joists

The joist may be wood or steel.

The section of the pieces is chosen so that the deflection would be limited to 1/200 of the span under the effect of the various loads: weight of the materials, pressure difference,...

Vapour barrier

The vapour barrier is positioned under the joist being careful of the seal and continuity.

Insulation

Insulating panels are fastened under the joist in the same way as under masonry.

Covering

Instructions identical to laying under the masonry.

2. Suspended ceilings

This case is limited to premises at temperatures superior to 0°C.

The installation may be by building framing of sections with cold bridge break, suspended directly to the wall or to the existing roof, and receiving the heat insulation in rigid panels.

The suspension system must be suitable for the weight of the panels as well as for the loads resulting from pressure differences between the room and the separating space.

It is necessary to take measures against upward building of the panels.

The spacing of the section shall be suitable to the dimensions of the panels and to their mechanical strength. The fastening of the panels to the sections shall ensure resistance to the loads (see above) and shall also provide for continuity of the insulation and of the vapour barrier (mastic joint).

5.32 Horizontal walls or prefabricated panels which provide neither enclosure nor top cover ⁽¹⁾

This type of insulation requires ventilating the space above the panels.

The panels can:

- Either rest on the vertical walls of the refrigerated room when the panels are self-supporting;
- Or rest on a support built inside the room;
- Or be suspended from a framing outside the room.

In the three cases the panels and their fastenings shall withstand the loads (dead weight, pressure difference) with a deflection limited to 1/200 of the span. Furthermore, the continuity of the heat insulation and of the vapour barrier shall be provided at the assemblies between panels and at the junction with the vertical walls.

5.321 Panel Laying

The panel shall be laid on the support in the same way as vertical panels.

The panel cannot be used;

- For temporary or permanent storage
- For traffic

⁽¹⁾ In direct contact with the external ambience

5.322 Suspended panels

The number of fasteners per panel shall be such that, if one of them breaks, the others will support the ceiling without ruining the whole under the expected load conditions.

The nature or the surface treatment of these fasteners shall be chosen to withstand the corrosion from the atmosphere to which they will be subjected.

The suspension and possible fastening systems shall never constitute cold bridges or adversely affect the continuity of the vapour barrier.

5.33 Horizontal walls of prefabricated panels providing enclosures, sheltered by an “umbrella” top cover

It should be remembered that prefabricated panels providing enclosures shall be covered by an assessment procedure concluding that they are suitable for such application.

Comment

Particularly, a Technical agreement procedure exists. (EOTA)

The installation is the same as in the preceding Article (5.32), the difference is that the loads shall include any wind effects which act directly on the panels.

5.34 Horizontal walls of prefabricated panels providing enclosure and top covering ⁽¹⁾

It should be remembered that prefabricated panels providing enclosure and top covering shall be covered by an assessment procedure concluding that they are suitable for the application.

Comment

Particularly, a Technical agreement procedure exists. (EOTA)

Unless other instructions are given in the assessment procedure, the following provisions shall be respected:

5.341 Minimal slope of the substrate

a) Sloping part shorter than the panel

- For a main rib height equal to or greater than 35mm : minimal slope : 5%.
- For a main rib height from 25 to 35mm;
 - Minimal slope : 7% in protected location
 - Minimal slope : 15% near the sea, in very windy area, in altitude higher than 500m.
- For a main rib height less than 25mm, there is no general rule.

b) Sloping part longer than the panel

- For a main rib height equal to or greater than 35mm, in protected location of zones I and II : minimal slope : 7%
- Other case : minimal slope : 10%, near the sea, in very windy area, in altitude higher than 500m.

⁽¹⁾ In direct contact with the external ambience

- For a main rib height from 25 and 35mm, in protected location minimal slope: 10%
Minimal slope: 15% near the sea, in very windy area, in altitude higher than 500m.
- For a main rib height less than 25mm, there is no general rule.

Minimal slope in %

Sloping part shorter than the panel			Sloping part longer than the panel	
Area	Protected location	Near the sea (1) Very windy area (2) Altitude > 500m	Protected location	Near the sea (1) Very windy area (2) Altitude > 500m
Main rib				
>35mm	5	5	7	10
>25mm <35mm	7	15	10	15
<25mm	No general rule			

(1) Near the sea approximately 20km wide

(2) Normal basic dynamic pressure level > 70 daN/m²

5.342 Overlaps

The overlaps are made with continuity of the heat insulation and of the vapour barrier.

1. Longitudinal overlap

- By superposing ribs in the direction opposite the direction of the prevailing winds while ensuring the continuity of the insulation and the vapour barrier;
- By bridging, the elements are placed edge to edge, a complementary element is positioned to overlap the two adjoining ribs.

Bridging is not permissible for metal sheets without raised parts.

The bridging element shall ensure the continuities necessary at each longitudinal-transversal junction.

2. Transversal overlap

The transversal overlap is always done next to a bearing point with minimal overlap of 250mm. the two covering in the overlap shall be fastened to each other by a system enabling the panels to expand.

5.343 Deformations

The maximal deflection shall not exceed 1/200 of the span.

5.44 Fastening

The fastening system shall be such that the breaking of an individual fastener shall not cause the ruin of the whole, in particular, under wind effect.

This system shall not constitute cold bridges or cause discontinuities in the vapour barrier. The corrosion resistance of the fasteners shall be suitable for the atmosphere to which they are subjected.

5.345 Individual points: ridges, gutters, edges

1. Common instructions

Connections of panels to each other (ridge, gutter, edges) or to other walls shall be done while ensuring:

- Rain proofing,
- Continuity of the heat insulation,
- Continuity of the vapour barrier.

The rain proofing can be obtained with traditional roofing techniques using linear metallic accessories such as ridge cape, edge strips, rim sections.

The overlap of the linear accessories on the panels, in every case, shall be equal to or greater than 120mm and they shall be fastened to the outside covering in a waterproofing way (sealing rivets for example).

2. Gutter

When a gutter or a channel is not planned, structural measures should be taken to prevent rain water from streaming on the vertical wall and any risk of infiltration at the foot of the building.

Connection of a gutter on a wall (encased channel) is prohibited.

3. Ridge and edge

The connection of a ridge or an edge to a wall generally requires a flashing strip fastened to the wall so as to prevent streaming water (flashing or masonry, edge strip, with mastic,...).

When the wall itself is a ribbed panel, one solution is to replace the flashing strip with back siding separated from the wall by a ventilated air space and protected at the top from rain water.

<p style="text-align: center;"><i>Comment</i></p>

<p><i>This solution is particularly suitable for low height of back siding.</i></p>

In case of connection to a wall of prefabricated insulating panels with metal covering, the continuity of the heat insulation may make it necessary to eliminate covering in the connection zone. The mechanical strength of the panels, weakened in this way, shall be re-established if need be (for example, by adding rails).

5.346 Penetrations

Penetrations are prohibited in prefabricated panels which provide the top cover of buildings which operate at negative temperatures.

Penetrations in the roofing of buildings operating at positive temperatures shall ensure rain water seal and the continuity of the insulation and of the vapour barrier.

To avoid condensation, the penetrations are to be insulated over a determined length and thickness depending on the working temperatures.

The other instructions are given in Article 5.5.

5.4 Case of roofs of ribbed sheet steel panels, supporting a heat insulation and a sealing covering

This roof system is only permissible for refrigerated premises with temperatures superior to 0°C. The vertical walls are built as described above (Article 5.2).

The roof is built in compliance with standard.

The continuity of the heat insulation and the airtightness shall be provided, in particular, at the connection between the vertical walls and the roofing. The sealing covering of the roof shall in this case act as a vapour barrier.

5.5 Penetrations in vertical or horizontal walls

Comment

As a general rule, penetrations are to be avoided. As already mentioned, they are prohibited in prefabricated panels which provide top cover for buildings at temperatures equal or inferior to 0°C.

Crossing through walls shall:

- Provide at least the same fire resistance as the adjacent walls;
- Provide rainproofing for exposed walls;
- Provide vapour barrier continuity;
- Limit any break in the heat insulation.

5.51 Penetration of metal framing

Crossing through framing for premises at negative temperatures shall ensure that any cold bridge is broken (for example, picking up at the stresses with hard wood pieces).

Comment

This requirement may be imposed also for partitions separating premises at temperatures superior to 0°C which are very different.

5.52 Pipes

In every case, pipes shall be heat insulated where they cross through walls, in continuity with the heat insulation of the wall.

In case of non-insulated piping undifferentiated party, the heat insulation of the cross-through shall be extended 0.50m beyond each facing. The rim of the insulation shall be protected at the end.

5.53 Electric cables

The crossing shall be in a sleeve protruding at least 0.30m beyond each facing.

The space between cables and sleeve shall be filled with a heat insulation and sealed at the end.

5.54 Hangers

Comment

In general, hangers are necessary to install the weight of suspended equipment to a framing.

They shall be designed to perform the functions listed above (beginning of Article 5.5).

5.6 Doors

Comment

It should be remembered that the safety regulations can be restrictive on this point. For the simulations circulation of self-propelled trucks and pedestrians, see in particular the concerned national rules.

5.61 Storage in the work site

The equipment shall be stored where it is sheltered from water and from the sun's rays (under opaque tarpaulins).

The leaves shall be separated by blocks to protect the joints.

5.62 Door opening

5.621 Door opening in the masonry wall

The door opening shall be built before the insulation specialist's work and checked by him. See Article 4.6.

5.622 Door opening in the wall of prefabricated panels

The door opening is reserved or cut out upon request depending upon the type and dimensions of the door.

5.63 Case and countercase

The specification of the deflection, equal to or less than 1mm/m, mentioned in Article 3.232 shall be respected on the structure in place, with the refrigerated room operating.

5.631 Case of masonry wall

The fastening of the case and of any system supporting the wall (rail, floor guiding,...) shall be done by embedment of mechanical fastening.

5.632 Case of walls of prefabricated panels

The fastening of the case, of the countercase and of the whole system supporting the door (rail, floor guiding,...) shall be by mechanical assembly.

5.64 Flush Threshold

It should be remembered that this threshold shall not be a low point.

In case of a metal threshold, it shall be adjusted in position then embedded in a concrete slab.

Comment

The position of the threshold depends on the type of door: the threshold is either included in the sill plane (support sill), or offset from it. The level adjustment is very important.

The threshold support concrete slab shall be either built into the cold room slabbing, or be independent.

Comment

The Independent slab can contain a heating system by embedded electric wires.

The joint between the threshold support concrete slab and the outside slab (at ambient temperature) shall offset from the threshold by a distance of approximately 0.50 m. The edge shall be treated based on the planned circulation (L-pieces for example).

The threshold support concrete slab shall not settle below the outside slab.

The concentration under the metal part shall not modify the position of the metal part and shall ensure continuous embedment and compaction.

When the threshold support slab is integrated with the slabbing of the cold room, it shall be built to support the stresses and shift resulting from cooling of the room. In case of a door opening in prefabricated panels, these shifts shall not cause deformations harmful to the stability of the panels or to the operation of the door. One solution is to interpose a compressible product in zones which are to be subjected to compression.

5.65 Leaves

The leaves are installed and adjusted in position.

The specifications on flatness and strength, mentioned in articles 3.231, shall be respected on leaves in places, with the cold room in operation.

5.66 Protection devices

Any devices which may be necessary for protecting doors shall be positioned on each side of the door opening. This is also true for the protection of sensitive elements (mechanisms, housing, ...).

Their dimensions and their fastening shall be suitable to the stresses expected (vehicle traffic).

5.7 installing balancing devices (valves)

Comment

The present design of balancing devices precludes them from opposing the effect of rapid temperature variations inside the premises, particularly when the cold is being introduced (see chapter 7).

5.71 Location

These devices shall be installed in accessible zones (for servicing).

Comment

This point of view can limit the installation in ceilings. In general, the zone half way up the walls is favourable.

On the inside, they should emerge in calm zones (to avoid draft due to convection or to evaporators) and outside the reach of stored materials or products. On the outside, the devices should emerge in the open air or in a room whose volume is large enough to enable the necessary air movements.

5.72 Number

For ever volume in the inside of which the temperature can be considered as uniform, the number of devices is determined to limit the pressure differences between the inside and the outside.

CHAPTER 6 – INSPECTION AND TESTING

6.1 Door Operation

For each door, the following inspection and testing are to be performed:

- Checking correct operation;
- checking the opening system from the safety point of view;
- visual check on seal; non passage of light at joints.

The joint heating system shall be tested after the premises are brought to temperatures equal or inferior to 0°C.

6.2 Balancing devices

The following points shall be checked:

- for the direct air intake valves (mechanical or electrical systems):
 - the preparation of the dampers,
 - the supply and operation of the electrical heating resistors and the indicator lamps;
- for hydraulic valves: nature and levels of the fluid.

6.3 Gastightness of so called “controlled atmosphere” premises

Except for floors own seal, the seal quality is checked in the following way:

- taking the cold production out of service;
- placing the room under hyperbaric pressure at a value from higher than 160 and equal or less than 200 Pa (16 to 20 mm water gauge maximum);
- measuring the time it takes between the end of bringing to hyperbaric pressure and the detection of a hyperbaric pressure equal to half the initial hyperbaric pressure.

This duration should be at least 30 minutes.

Comment

To avoid unwanted pressure variations, it is recommended to perform these tests:

- *Either early in the morning,*
- *or late in the evening.*

Furthermore, using a pressure gauge, stability of the pressure of the room should be checked before bringing to hyperbaric pressure and make sure that the temperature in the premises remains constant.

CHAPTER 7 – CONDITIONS FOR PLACING INTO SERVICE



7.1 Conditions for placing into service

7.11 Prior conditions

The drying times for the materials shall be respected.

Comment

For concrete and mortars, the times enable the removal of excess water which might freeze and also the obtainment of mechanical resistance to various stresses.

The pressure balancing devices as well as the door joint heating system and their indicators shall be installed under operating condition.

7.12 introducing the cold

The speed of bringing the temperature down in the room shall be gradual; from ambient temperature to 0°C, it shall not exceed 15°K in 24 hours.

When introducing the cold and until the operating temperature is approaching, one door shall be constantly left ajar.

Comment

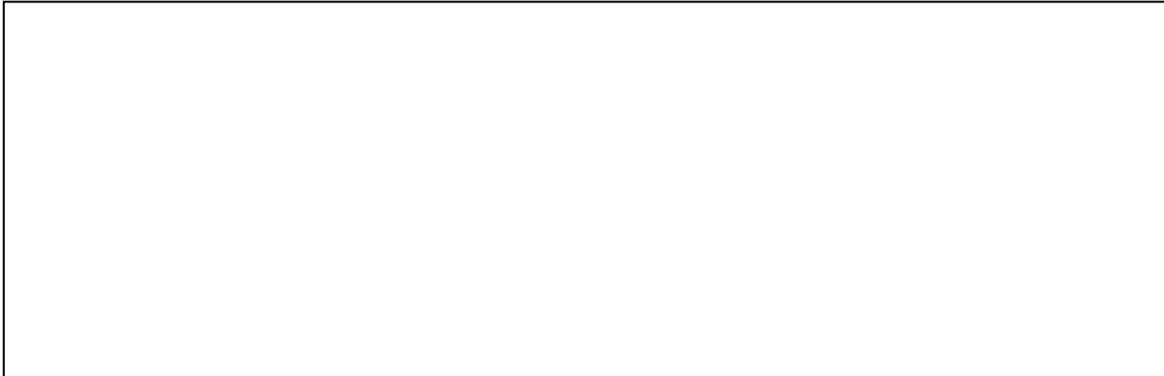
The pressure balancing systems are not designed to balance pressures during the placing into service. This function can only be provided by a partial opening of the door. The risk here is the collapse of the room's envelope.

When the operating temperature planned is equal or inferior to 0°C, the temperature shall be levelled off when the room approaches 0°C. The duration of this levelling depends on the rate of humidity of the materials. It is from two to eight days.

Beginning at 0°C, the temperature reduction speed shall not exceed 5°K in 24 hours.

The door shall be closed when the temperature approaches its operating level (a few degrees Celsius digress above).

7.2 Conditions for restarting the refrigeration equipment



7.21 Case of restarting at the end of evaporator defrosting

The fan(s) shall not be started up before the circulation of the refrigerant in the evaporator. "where there are several fans, it is recommended that they be brought into service progressively".

The heating will have started before starting up the fans.

Comment

When the fans are working on the evaporator which is still hot, a mass of hot air is propagated which can cause an almost instantaneous pressure rise with attendant risk to the stability of the walls.

Furthermore, the defrosting water, still liquid, can be sprayed in the form of droplets which can be deposited on the wall and cause the surface to deteriorate following freezing-thawing cycles.

7.22 Case of restarting after filling the room

When the products brought in represent a major proportion of the total volume and are at relatively high temperature, and when inside air of the room is heated by the opening of the doors, the refrigerating equipment shall be operated at limited power and, possible, partial opening of the doors.

Comment

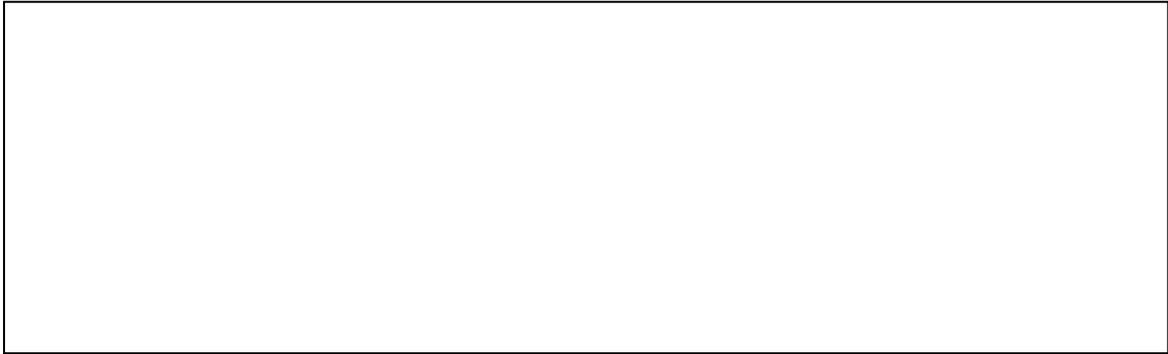
In this case, the risk is almost instantaneous pressure drop, sometimes aggravated by a partial drop in the pressure of the water vapour, involving the same risks on the stability of the walls.

7.3 Precautions when stopping the operation of the refrigerating equipment

For premises at temperatures superior to 0°C there are no special precautions.

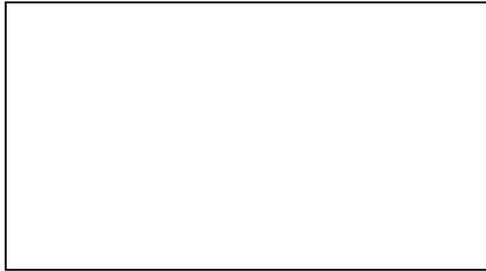
For premises the temperatures equal or inferior to 0°C, the following precautions are recommended:

- the correct operation of the balancing devices shall be checked;
- the doors shall be closed at temperatures equal or inferior to 0°C;
- the refrigeration equipment shall be stopped;
- the doors can be opened slightly when the temperature of the room is superior to 0°C.



Thermal insulation of refrigerated premises and buildings

Appendices



1 Critical compressive strength

This is determined by the method and preparation defined in International Standard ISO 844. But the thickness of the test pieces is 80mm, the movement speed is 5mm/min and the calculation is conducted as indicated below.

Its value is determined based upon the stress-deformation diagram as given on the figure below.

It is expressed in daN/cm² (1 daN/cm² = 1 bar = 0.1 MPa).

1 Critical Strength

2 stress (daN/cm²)

3 diagram of the first type

4 stress (daN/cm²)

5 diagram of the second type

6 deformation (%)

2 Working strength, working deformation

The working strength R_{cs} is to be specified for each product as a function of the evolution in time of the insulation's characteristics (creep, fatigue, ...)

In the absence of corroboration relative to this phenomena, the working strength is conventionally taken at 60% of the critical strength, except in the case where corresponding deformation, read on the diagram, is greater than 2%.

The conventional working deformation d_s is the value of the deformation (read on the diagram), corresponding to the working strength.

To summarise, there are two cases:

First case: $R_{cs} = 0.6 R_{critical}$ and $d_s < 2\%$

Second case: $R_{cs} < 0.6 R_{critical}$ and $d_s = 2\%$

3 Expressing the results

The working strength and conventional working deformation values are given as specified below:

$$\text{Working strength } R_{cs} = \dots \text{ daN/cm}^2$$
$$\text{Conventional working deformation } d_s = \dots \%$$

The values of R_{cs} and d_s are not average values; they are limit values for fractile 0.05. This means that the statistical interpretation of the test results shall demonstrate that 95% of the corresponding production, for a deformation equal to the announced value d_s has a compressive strength at least equal to the declared value R_{cs} .

4 For requirements

The requirements of working strength or conventional deformation are given in the code documents relative to floors i.e. industrial floors, slabbing, cold room floors...

5 Special case of expanding plastic heat insulations for cold room floors

According to paragraph 3.12 of the Technical Clauses Of the present document, the settling under load of the insulation shall equal to or less than R_{cs} .

First example

The maximal load at the top surface of the insulation is uniformly distributed and equivalent to 0.24 bar (0.024 MRa, that is approximately 2.4 t/m²).

Expanded plastic insulations whose R_{cs} is equal to or greater than 0.24 daN/cm² are suitable.

Second example

The maximal load at the top surface of the insulation is exerted by a rack leg, that is 3 tons distributed over a 10cm square plate (see adjacent figures).

Under the Hypothesis of the distribution along lines at 45° in the concrete slab 20cm thick and not taking its weight into account, the load on the insulation is:

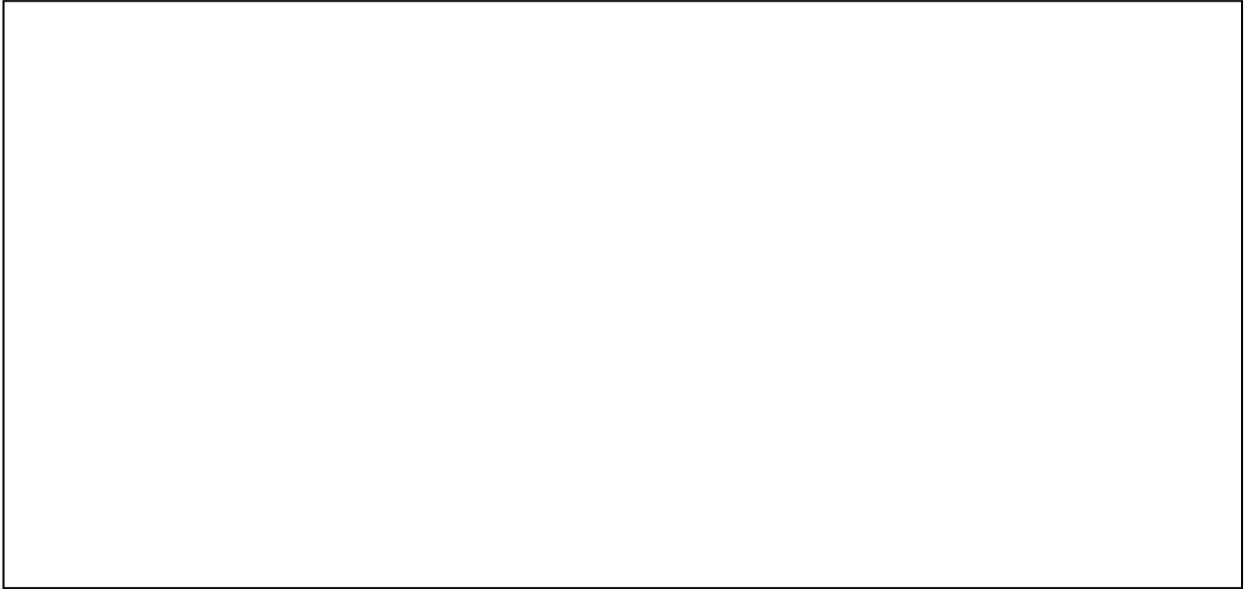
$$\frac{3000\text{kg}}{50 \times 50\text{cm}^2} = 1.2 \text{ daN/cm}^2 = 0.12 \text{ MPa}$$

The expanded plastic insulations whose R_{cs} is equal to or greater than 1.2 daN/cm² are suitable.

Minimal spacing: 0.5 m

Concrete slab

Insulation



Appendix 2

Definition of zones and situations (wind and rain together)

This appendix is relating to national climatic zones. The French references are indicated as example.

France is divided into 3 application zones (with regard to wind and rain together) (*)

ZONES

ZONE 1

All the interior of the country located at altitudes less than 200m

ZONE 2

Atlantic side, 20km wide, from Lorient to the Spanish border.

Transition of approximately 20km between zone 1 and zone 3 for the coasts of the English Channel, Brittany and the North Sea.

Altitudes from 200 to 500m

ZONE 3

Coasts of the North Sea, of the English Channel and of the Atlantic as far as Lorient, 20km wide. Rhone Valley, up to the point of three "departments" Isère, Drôme, Ardèche.

Provence, Languedoc, Roussillon, Corsica.

Altitudes higher than 500m.

The adjacent map illustrates this breakdown.

Note

In case of uncertainty as to whether a location belongs to a zone, the Document Specific to the Contract with specify this.

Situations

On these zones, we need to superpose the effect resulting from the local situation, that is, in each zone, a subdivision into 3 types of situations.

The situations correspond to local surfaces of very small area in comparison with the zones.

(*) This breakdown is given provisionally. Studies undertaken by the CSTB will soon establish more precise climatic maps.

Protected situation

Bottom of valley, surrounded by hills all the way around and protected in this way against wind from all directions.

Land bordered by hills on one part of its perimeter, corresponding to the direction of the most violent winds and protected from this wind direction.

Normal situation

Plain or plateau which can include minor altitude differences, extensive or not (dells, rolling country).

Exposed situation

Near the sea: the shore, about 5km wide, the cliff tops, highlands or narrow peninsulas, estuaries of bays enclosed or deeply the cut through the lands.

At the interior of the country: narrow valleys where the wind goes in freely, isolated and high mountains (for example, Mong Aigoual and Mont Ventoux) and certain hills.

Zone I

Zone II

Zone III

----- Lines at 20 and 40km from the sea

_____ Approximate lines of levels 200 and 500m

- Regional meteorological centres
- Main stations
- Information stations

Map of zones

This breakdown into three zones is not to be confused with the breakdown into Regions of Snow or Winds given in the NV Rules.

Appendix 3

Servicing instructions

1 For the walls in general

1.1 Cleaning

The cleaning products, particularly with relation to their nature and their mixing proportions, shall be suitable to the nature of the covering to be cleaned. The contractor shall give the owner, in writing, the nature of the coverings which he has installed.

Comment

It should be remembered, that in the food industries, certain products and methods are covered by national rules.

A cleaning product, proportioned in compliance with its application (see above) and at an inside temperatures less than 30°C, shall not stay in contact with the covering too long; in general, the maximal duration is 30 minutes. The rinsing with water shall take place with a nozzle pressure less than 50 bars and at a temperature less than 30°C in general, with peaks of 50°C to soften greases.

Comment

The efficiency of cleaning products diminishes considerably at temperature rises.
High pressure cleaning has destructive effects on the stability of coverings and joints.

Premises at negative temperatures shall not be washed with large quantities of water.

Comment

The risk of freezing linked to the presence of liquid water when introducing cold is particularly dangerous for floors.

1.2 Deterioration

Any deterioration of the surface state of the facing and of the floors or of the protection of the heat insulation or of the vapour barrier shall be immediately treated.

Repairs to the finish of prefabricated metal panels is possible with certain precautions:

- The room shall be at positive temperatures. The foods shall be removed except for small localised retouches;
- The existing finish products to be repaired shall be identified

- The surfaces shall be prepared (removal of damaged layers and various soiling). The preparation method shall be suitable to the size of the damaged zones and to the type of deterioration (spraying hot water under pressure, spraying sandy abrasives under low pressure, mechanical cleaning, chemical cleaning). The final surface shall be clean, dry and chemically inert;
- The products to be applied are retouch lacquers which shall be compatible with the original finish. According to the amount of damage, several layers may be necessary: pre-touch, primer, intermediate layer, finish. Two-component polyurethane paints are suitable whatever the substrate;
- Wait before reusing the room. The following durations are approximate:
 - Dust-dry at the end of 1 to 3 hours,
 - Complete drying in 24 hours,
 - Washing possible after 48 hours.

In the case of stainless steel contaminated by an aggressive body, it is necessary to neutralise the contaminated zones, using a passivating product.

1.3 Ceilings, attics and roof under structures

The attics shall be inspected periodically to check:

- The correct operation of the ventilation,
- The good condition of the room under structures.

Comment

Consideration under the roof and on the framing causes droplets to form which fall on the insulated ceiling of the cold room, penetrate the material and form ice beads therein.

During the inspections, it is necessary to be sure not to damage the vapour barrier of these ceilings, particularly in the case of traditional techniques.

Comment

Any accidental perforation of the vapour barrier will be penetrations and leaks.

The seal provided is a water vapour seal and not a water seal. If the ventilation is insufficient to prevent condensation, it is necessary to insulate the roof and/or install mechanical ventilation.

1.4 Roof

The normal servicing includes:

- Periodic removal of leaves, grass, moulds and other deposits of foreign objects;
- Maintaining the rainwater drains in good condition;

Comment

[FESI document 7](#)
A check on the gutters is particularly useful when the leaves are falling.

- Keeping the protective coverings continuous in case of accidental damage;
- Keeping particular works in good condition such as flashing, sip caps, ledges.

1.5 Heating floor and crawl space

(case of premises at negative temperatures)

According to the case, the checks shall concern:

- Natural air draft of the crawl spaces;
- Operation of the mechanical ventilation system;
- Operation of the electrical heating system;
- Operation of the circulation of the fluids.

In every case, the alarm trip in case of risk of freezing shall be checked.

1.6 Special balance (or pressure equalising) devices

(valves)

The servicing of direct intake valves (mechanical or hydraulic system) concerns the correct operation of the dampers.

Servicing hydraulic valves concerns the level of liquid and the non-obstruction of the overflows.

In every case, it also concerns:

- The operation of the heating system;
- The operation check device;
- The non-obstruction of the inputs and outputs of the valves.

2. For Floors

Damage to doors, protective devices, thresholds, joints, shall be immediately repaired. For damaged to finish, for Article 1.2 of this Appendix.

2.1 Cleaning door leaves

The recommendations of Article 1.1 are applicable.

The cleaning shall not cause the formation of ice around the door, in particular, at the threshold.

2.2 Hardware and locks

Visual inspection of their condition.

Checking the proper operation of locks and unlocking systems.

Lubrication of hinges, articulations and other movement devices.

2.3 Joints

Visual inspection of their condition. Smearing packing's with talc or powdered silicone.

Checking the heating operation indicator.

2.4 Clearances

Visual inspection of their condition.

2.5 Automatic doors

Their servicing is covered by a manual written by the manufacturer which shall be turned over to the owner.

3. Refrigeration and air conditioning installations

The servicing shall be performed according to the instructions from the refrigeration specialists. In all cases, the timing of the fans shall be checked.

Comment

Premature start-ups of fans can cause unexpected pressure rises or water spray at the end of defrosting with damage to facings.

Appendix 4
(non-contractual)

Classification of outside atmospheres

Comment

Each country may use its own terminology pending the publication of CEN standard which is currently being drafted.

1. Role of non-polluted atmosphere

Environment corresponding to the outside of buildings located in the country, in the absence of particular corrosion source as, for example, fall-out of smoke containing sulphurous fumes (heating with fuel oil).

2. Normal urban atmosphere

Environment corresponding to the outside of buildings for fairly large urban areas, containing one or several factories producing gases and smoke, creating a substantial increase in atmospheric corrosion without being the source of corrosion due to the high content of chemical components (see article 4).

3. Normal industrial atmosphere

Environment corresponding to the outside of buildings located in an industrial environment, containing one or several factories producing gases and smoke, creating a substantial increase in atmospheric corrosion without being the source of corrosion due to the high content of chemical components (see Article 4).

4. Severe industrial or urban atmosphere

Environment corresponding to the outside of buildings located in fairly large urban areas or in industrial areas. In comparison with the atmospheres described in Articles 2 and 3, the increase of the aggressivity is due to the high content of chemical compounds (refineries, incineration plants, distilleries, fertilizer plants, cement plants, paper plants, etc...), continuously or intermittently.

5. Marine atmosphere

Environment corresponding to buildings located less than 10km from the coast, excluding conditions of direct attack by seawater (sea front).

6. Mixed atmosphere

Environment corresponding to a combination of marine atmosphere and industrial or urban atmosphere.

7. Particular exposures

The severity of the exposures described above is increased by certain effects, such as:

- Abrasion,
- High temperatures,
- Substantial dust deposits,
- Sea spray on the seafront...

Appendix 5
(non-contractual)

**Terminology and basic data
concerning the doors of
refrigerated buildings**

Note:

This terminology is sometimes different from what is used in building in general.

1. DOORWAY

Rectangular opening, reserved or cut in a wall or a partition to enable it to be crossed through.

2. EQUIPMENT HATCH

Opening placed above a doorway, with smaller dimensions than the doorway, designed for passage of a materials handling system.

When a handling system is not running, a shutter closes the opening around the handling system.

3. THRESHOLD

Horizontal bottom part of a doorway.

The threshold is called “flush” when the floors of the inside and outside rooms are at the same level and in continuity from one to the other (without intermediate raised piece).

The threshold is called “step” when the floors are not at the same level. In general, the inside floor (cold side) is higher.

The threshold can be part of the case or counter case; in this case, the main element is called the sill (see further on).

4. CASE

Structure fastened to the wall along the edges of the doorway, on a single facing of a wall (see adjacent figure).

5. COUNTERCASE

Structure fastened to the wall along the edges of a doorway on the side opposite the case (see adjacent figure).

6. JAMB POST

Vertical part of a case or counter-case

7. HEAD-RAIL

Horizontal part of a case or counter- case

8. SILL

When there is one, it is the bottom horizontal part of a case or counter-case. It constitutes the threshold.

9. CASEWORK

This term is reserved for the situation where the case and counter-case are a single piece which connects the two facings of the wall.

10. DOOR

Movable structure, composed of one of several leaves, which can close the doorway.

In open position, the doorway is free, at least partially. In this position, the dimensions of the opening are called passage dimensions or free passage : clearance width and clearance width and clearance height. When the door elements protrude into the opening, the passage dimensions concerned are reduced by the dimensions of the protrusions.

The following are distinguished:

- *Manual doors* : The movement of closing or opening is caused by a force supplied by a person;
- *Automatic doors* : The movement is caused by a specific mechanical force (electricity, fluid,...). This force is actuated by a pushbutton, a pull, a photocell,...

11 AUTOMATIC RETURN DOOR

The normal position of the door is closed, the open position is not stable.

In certain cases of common doors, the return can take place up to an opening of 90°; beyond that that, the door remains open.

12. CLOSURE

A system which closes the door and keeps it in that position.

For insulating doors (see further on), this system implies a mechanism which makes it possible to obtain a seal between the leaf and the case.

The following are distinguished:

- *Manual closure* : Human action is sufficient to close the door,
- *Automatic closure* : An outside force (gravity, spring,...) is automatically brought into use at travel limit.

13. OVERLAP

Surface at the periphery of the leaf which overlaps the case in closed position.

In general, the overlap is given by its width.

14. RIM

Narrow face of a leaf.

15. VISION PANEL

Transparent part of a leaf.

16. JOINT

Space built or existing between two elements. Here, most often, it is the space between the leaf and the case.

17. JOINT LINER (or TUBULAR PACKING)

Formed or flexible material, placed in the joint and participating in the door seal.

The draft strip (or draft band) is a joint liner placed between the leaf and the threshold or around the handling system in the equipment hatch.

18. HARDWARE

Set of mechanical pieces to provide the movement between the leaf and the case, along with the closure and locking parts.

19. SINGLE SIDE LOCKING SYSTEM

System which prevents intrusion by opening the door.

20. INSULATING DOOR

Door with the three following characteristics:

- Thermal resistance of the leaf in the undifferentiated part equal to or greater than $1.6\text{m}^2\text{C/W}$;
- Thermal resistance of the leaf in the undifferentiated part equal to or greater than 70% of that of the continuous wall in the undifferentiated part;
- Presence of an airtight joint liner on the four sides of the leaf. This liner is compressed or pressed (bending of a lip) against the case and the threshold in closed position.

20.1 Common door

Each leaf turns around a vertical axis, consisting of hinges fastened to the case, remaining on a single side of the doorway.

The door possesses one or two leaves.

20.11 Flush door

In closed position, the thickness of the door is mainly found in the extension of the thickness of the wall (see figure below).

20.12 Semi-flush door

The door thickness is located partially in the wall thickness, partially over-fitted (see figure below).

20.13 Over-fitted door

The whole door is over-fitted on the wall (see figure below).

20.2 Sliding door

The main movement of each leaf is a horizontal translation.

The door has one or two leaves.

20.3 Overhead door

At opening, the whole horizontal line of this leaf moves upward, remaining parallel to itself. The side rims are guided (at least at certain points).

20.31 Vertical sliding door

The main movement of each leaf is a vertical translation.

The door can have one or two leaves

20.32 Vertical folding door

The leaf consists of two panels, hinged to each other on a mobile horizontal axis; the upper part of the leaf turns around a fixed horizontal axis.

21. SEMI-INSULATING DOOR

Door whose insulating and air sealing qualities are weaker than those for insulating doors:

- Thermal resistance of the leaf in the undifferentiated part equal to or greater than $1.3\text{m}^2\text{C/W}$;
- With or without peripheral joint liner.

21.2 Common door

See 20.1.

21.2 Sliding door

See 20.2.

21.3 Swinging door

Manual swivel door with automatic return, with one or two leaves, each of which can swing on both sides of the doorway.

21.4 Up-and-over door

Single leaf door composed of several panels, articulated two by two on a mobile horizontal axis. When they are within the doorway, the panel movement is a vertical translation. When they escape the doorway, their movement is in any direction (often horizontal), the articulation axes remaining horizontal.

22. NON INSULATING DOOR

Door whose thermal insulation and water seal qualities are weaker than those of semi-insulating doors:

- Thermal resistance of the leaf in the undifferentiated part less than $1.3\text{m}^2\text{C/W}$;
- No peripheral joint liner.

22.1 Swinging door

See 21.3.

The swinging door is rigid or flexible. When it is flexible, each leaf deforms itself at the opening under the thrust of a person or truck but comes back to its plane shape when the thrust stops.

22.2 Overhead door

See 20.3.

22.3 Top hung flexible slat door

Set of flexible vertical slats, placed side by side and with overlap and hung (fixed or mobile) at the top part of the doorway.

23. WICKET

Small door, especially adapted to a type of materials handling and normally too small for passage of a person.

24. EMERGENCY DOOR

Door designed for rapid evacuation of personnel.

25. DESIGNATING DOORS – CONVENTIONS

Declaring door dimensions begins with width, followed by height.

In every case, the opening direction is given for an observer who is looking at a closed door; this observer is located on the same side as the leaf (or its over fitting) with relation to the continuous wall.

Common door with one leaf

The door is called RH (right hinged) when the hinged are on the right of the leaf.

The door is called LH (left hinged) in the opposite case.

Sliding door with one leaf

The door is called RD (right sliding) when the movement of the leaf for the opening is toward the right.

The door is called LS (left sliding) in the opposite case.

Heat insulation of refrigerated premises and buildings

Special Clauses

Special Clauses

1. Purpose

The purpose of these Special Clauses is to specify the special administrative clauses applicable to works of heat insulation of refrigerated premises and buildings, covered by Technical Clauses of this document.

2. Scope of the works

2.1

Unless otherwise specified in the Documents Particuliers du Marché (DPM) (Documents Specific to the Contract), the works to be performed by the insulation specialist are as follows :

- The supply and installation of the heat insulation, vapour barrier, coverings and all the complementary material (joints, seals, adhesives, mastics, hangers,...) for the heat insulation of the existing walls or, according to the contract, for building walls, in order to constitute a refrigerated room or building;
- Supply and installation of glazed sashes;
- Supply and installation of insulating doors, including cases;
- Supply and installation of door protection devices;
- Cutting the prefabricated panels to size for the doorways;
- Joist work of ceilings in traditional techniques;
- Recovery of rainwater down to the floor in the case of roofing of prefabricated panels on inside framing;
- Performance of inspection and testing specified in the Technical Clauses.

The determination of the thicknesses and the choice of heat insulation depending upon the maximal heat losses indicated in paragraph 3.12 of the Technical Clauses and on the operating conditions given in advance (see the appendix), as well as the choice of coverings based on the ambiances and the use conditions, are the responsibility of the insulation specialist.

If the DPMs impose materials or thicknesses which are different, the insulation specialist shall give his opinion in writing to the owner or to his representative.

2.2

Unless otherwise indicated in the DPM's, these works therefore do not include the following :

- Flooring shellwork : the bearing struction on the one hand and the slab or floating concrete bed on insulation on the other hand, in particular under the door threshold;
- The service holes or grooves made in the masonry for installing the door cases;
- The building of the primary support frame for the insulation;
- Any framing necessary for installing the doors;

- The installation of ventilations around walls and ceilings;
- The installation of systems or devices to prevent freezing of the foundation floor (case of premises at negative temperatures);
- Various supplies (electric power, compressed air, heat bearing fluid) to operate automatic doors, heat joints, connect valves,...;
- Supply and installation of a mechanical protection inside and outside at the lower part of the panels constituting the vertical walls;
- Supply and installation of pressure balancing or equalising devices.

2.3

If the owner requests work not included in the first section above and which is not requested in the DPMs, the contractor is free to accept such work or not.

This is the case particularly for :

- Building doorways in walls other than the prefabricated panels;
- Waterproofing of floors to be washed generously with water;
- Airproofing of floors in the case of so called "controlled atmosphere" premises;
- Cutting out and sealing around penetrations of walls ceilings.

If the contractor accepts this work, this acceptance shall entail additional remuneration (rider).

3. Works co-ordination

The owner shall designate the main contractor and the technical inspector and shall indicate to the insulation specialist the work entrusted and the powers delegated, particularly with relation to co-ordination with other contractors, shellwork contractor, framer, refrigeration specialist....

3.1

Information to be given to the insulation specialist

The date on which this information is to be communicated shall be established by the owner after the contract is signed.

3.11 Concerning the fastening of the prefabricated panels :

- The position of the bearing lines or the fastening point;
- The rest surfaces (as the case may be);
- The maximal stresses and forces;
- The flatness tolerances which the framing is to respect at the bearing points.

3.12 Concerning the doors :

- The services holes or framing which may be necessary;
- The loads to be picked up and their movement line;
- The spaces to be left free for the door movements (including slopes and service holes in the floors) as well as the dimensions of any protection devices which may be necessary;
- The overall dimensions of the operating accessories;
- The characteristics of the supplies necessary, i.e. electric power, compressed air, heat bearing fluid and location of connections.

3.2

If the insulation specialist does not have certain of the data covered by the Appendix to these special Clauses, he shall immediately notify the owner and the main contractor to let him know what they are going to do about this within 8 days,

The execution schedule is extended as the case may be.

3.3

Acceptance by the insulation specialist

The insulation specialist shall not be given his work until he has accepted, in writing, the floors and walls to be insulated, the framing and supports of the walls or insulation panels, under the conditions of Article 4 of the Technical Clauses and depending upon the information supplied by the prime contractor about their nature.

If the conditions required are not satisfied, the insulation specialist shall so notify the owner and the prime contractor properly.

The owner's decision will be covered by a new job order; the date of the beginning of the contractual schedule shall not be earlier than the date upon which this new job order is received.

The acceptance of the substrate floor by the insulation specialist does not concern its strength with relation to the expected live loads.

The insulation specialist's acceptance of the framing does not concern its mechanical strength and durability

3.4

Unexpected work on the structures

During the job, if work not provided for in the insulation specialist's contract is planned on the walls and ceilings installed by them (for example hanging equipment, drilling for fastening system, cut-out for pipe passage), he shall be so informed so he can give his agreement.

4. Placing into services

Before the end of his works, the installation specialist shall submit to the owner and to the prime contractor a manual for placing into service and maintenance, specifying the measures to be taken to avoid damage to the works when they are operating.

Comment

The Technical Clauses specify the conditions for placing into services in Article 7 of the Servicing Manual in Appendix 3.

APPENDIX

MEMORANDUM FOR PERPARING DOCUMENT SPECIFIC TO CONTRACT

The purpose of this memorandum is to review the data of a plan for a refrigerated room or building the order to prepare documents specific to a contract.

Comment

This information is necessary to obtain the technical coherence of the installation and the correct estimation of the costs of the works. It shall therefore already be normally known at the moment when the tenders are invited. It results most often from collaboration between the prime contractor, the shell work and framing contractor, the insulation specialist and the refrigeration specialist.

Whenever possible, this information is presented in drawings.

1 Concerning the building and its outside environment

- The type of building

A distinction is made between refrigerated premises and refrigerated buildings. Refrigerated premises are those whose walls containing the heat insulation are not in contact with the outside.

These walls are:

- Liners inside existing walls which provide the enclosure and the top cover,
- Or walls, most often prefabricated, installed inside an existing building to create a refrigerated enclosure (room) or limited volume.

Refrigerated buildings are those whose walls, containing the heat insulation (prefabricated panels), perform the functions of enclosure and top cover. In the case of top cover, if the slope is imposed, it must be specified. In certain cases to be defined, the top cover is provided by a separate structure (umbrella).

- The local climatic conditions of the site (relative humidity, temperature, solar radiation, wind,...)

Unless otherwise indicated in the documents specific to the contract (DPMs)

- The outside temperatures are to be taken conventionally as equal to +30°C for the roofs, (1) +25 °C for the vertical walls and +15 °C for the floors,
- The snow and wind loads

(1) French basic values as example

Comment

It is important to know the solar radiation exposure for each façade orientation.

- The degree of aggressivity of the atmosphere (see the classification of Appendix 4 of the Technical Clauses)
- The measures taken to avoid freezing of the natural underlying soil.
- The nature of the impacts which the outside faces of the refrigerated premises or building must withstand.
- The dimensions, the type and the location (drawing of wall hole) of the doors to be installed:
 - Manual or automatic
 - Common, sliding,... (see appendix 5, "Terminology" of the Technical Clauses);
 - Whether or not there is to be an overhead materials handling system through the door;
 - Whether or not there is to be over head materials handling system through the door;
 - Whether the threshold is to be flush, step type,...;
 - For doors placed on the outside, the orientation, the colour and the architectural arrangements which may influence the degree of exposure of the door to solar radiation shall be specified;
 - In the case of doorways already built, the real dimensions shall be given with the relation to vertical and horizontal position markers.

Comment

The other characteristics of the doors, such as their fire resistance, their stability and the effect of temperature differences the heating of the joints, etc... are the responsibility of the insulation specialist.

- The thermal resistance of the glazed sashes.
- In the case of refrigerated premises : the nature of the existing floors and walls to be insulated as well as the framing designed to support the insulation. The existence or possibility of building a ventilated space under the existing roof shall also be indicated.

2. Concerning the operation of the installation

- The operating temperature(s) :
 - Positive temperature : equal to or greater than 0 °C
 - Negative temperature : less than 0 °C
 - The operating cycles and the operations rate (frequency and movements).
 - The maximal temperature of the outside faces of the refrigerated premises.
 - The maximal inside humidity.
 - The value and the location of loads on the floor or against the walls.

Comment

The loads can come from apparatus for storing products (on pallets, on rails, on racks), from tooling, from handling vehicles, from refrigeration equipment,...

For floors built by so called traditional techniques, the insulation specialist shall know the maximal compressive stress exerted at the heat insulation.

Comment

This value depends not only on the value of the loads but also on their nature (concentrated load or distributed load) and on the relative stiffness of the floor covering (concrete slab) in comparison with the insulation. The collaboration between the main contractor, the engineering firm, the shell work contractor and the insulation specialist is very necessary here, particularly in the case of heat insulation of expanded plastic.

For the walls, the insulation specialist shall know whether certain fastening systems are planned to be hooked onto vertical walls and to ceilings which he is to install, or to cross through them.

- The intended use of the premises, in particular the nature of the products treated or stored therein, specifying any aggressivity of the ambiances (salt) as well as the methods of washing and servicing (nature of the systems and of the products, periodicity) including the cleaning of the outside walls (docks,...).
- The nature of the impacts which the internal surface of the walls must withstand.

Comment

It should be remembered that the operation of the refrigeration equipment can, in certain cases, cause instantaneous temperature variations which are much higher than the above values. The balancing devices are insufficient to limit the destructive effects of hyperbaric pressures or sum-atmospheric pressures generated in these cases (see chapter 7 of the Technical Clauses).