

MANUFACTURED IN:



TECHNICAL MANUAL

ISOFRIGO and ISOFROZEN Range

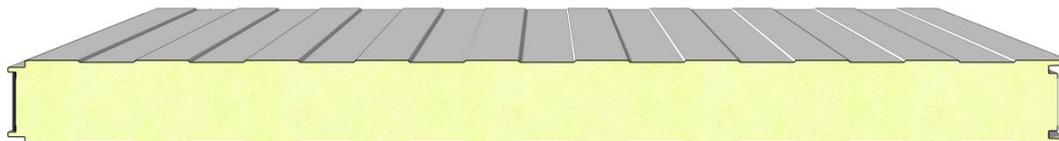


ISOPAN
INSULATING DESIGN

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ISOFRIGO Range



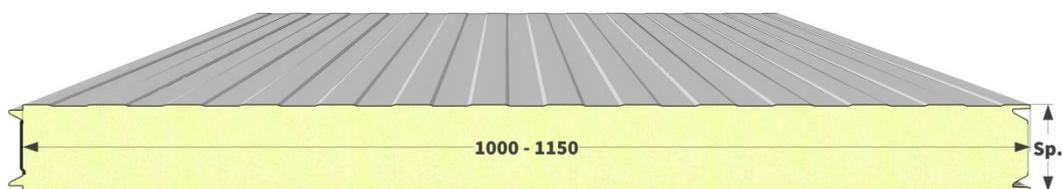
Double skin metal faced wall sandwich panels with polyurethane foam insulating core, used for the construction of wall cladding, internal division walls and false ceilings of prefabricated industrial and civil buildings. The ISOFROZEN Range panels differ from other polyurethane insulated panels due to the different jointing systems and high thickness, which ensure excellent thermal resistance performance and make the panel particularly suitable for controlled temperature rooms, even negative.

TYPES OF JOINTS

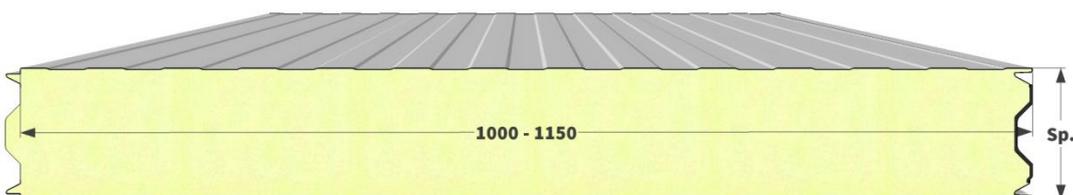
Labyrinth joint (tongue-and-groove):

Depending on the thickness chosen and the reference production site, three different options of labyrinth joint are available:

- **ISOFROZEN**



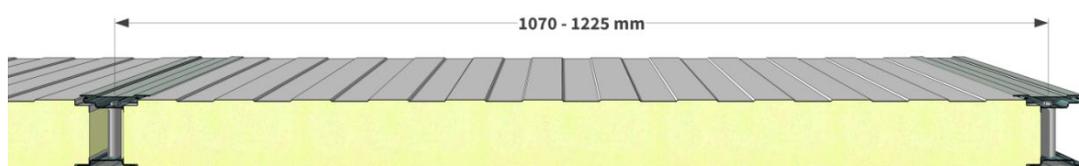
- **ISOFROZEN HT**



They feature three configurations, depending on the performance needed: **standard, with intumescent seal or thixotropic sealant** (see features in Annex B).

Injected joint

ISOFRIGO GI is manufactured only in the facility in Patrica (FR), Italy



It involves injecting polyurethane foam on site; this solution ensures top airtightness because it provides consistency to the insulating mass and allows heat bridges caused by the joints to be eliminated thanks to the lack of gaps and use of PVC gaskets under the tightening profile.

Moreover, the mechanical properties of this configuration also ensure higher performance since the system elements offer better resistance to accidental loads, specifically of axial type, and better bending stiffness.

GEOMETRIC FEATURES

	ISOFROZEN	ISOFROZEN HT	ISOFRIGO GI
Length	Up to maximum transportable		
Useful Pitch (mm)	1000-1150	1000-1150	1070-1225
Insulating Thickness (mm)	80*, 100, 120	120**, 150, 170*** 180**, 200, 240	120, 150, 180, 200
External face	micro-ridged lightly profiled metal sheet		
Internal face			

*thicknesses available subject to approval by the Technical Department

** thicknesses only produced in the plant of ISOPAN IBERICA (ESP) , ISOPAN DEUTSCHLAND (DE)

*** thicknesses only produced in the plant of ISOPAN EST (RO)

METAL FACINGS

- Hot dip galvanised steel by SENDZIMIR continuous process (UNI EN 10346) and pre-painted by means of a coil coating continuous process with different painting cycles based on end use (see: "Guide to Choosing Pre-painted").
- 3000 or 5000 series aluminium alloys and pre-painted on continuous lines with different painting cycles based on end use (see: "Guide to Choosing Pre-painted").
- Stainless steel AISI 304, 2B finish, according to EN 10088-1.
- In case of aluminium facings, these must be preferably applied on both sides: in fact, if different materials are used on the two sides, the panel may distort and bend due to the different thermal expansion coefficients of the sheets.
- For stainless steel facings, one should take into account the possible appearance of flaws that are highlighted by such reflecting surfaces.

PROTECTION OF THE PRE-PAINTED FACINGS

All pre-painted metal facings are supplied with an adhesive polyethylene protective film that prevents damage to the paint layer. If the material is specifically requested without protective film, Isopan assumes no liability in case of damages to the paint. The protective film that covers the pre-painted panels must be completely removed during assembly and, in any case, within sixty days after the material preparation.

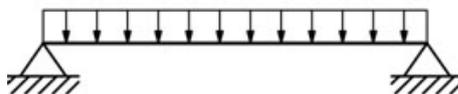
It is also recommended not to expose the panels covered by a protective film to direct sunlight.

INSULATION

Made with rigid polyurethane foam, having the following physical and mechanical features:

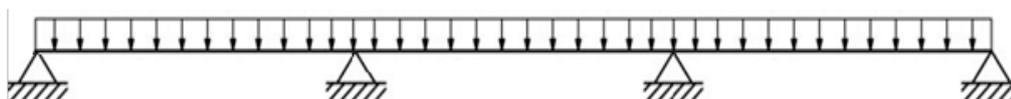
- Compressive strength ≥ 0.11 MPa (at 10% of deformation)
- Tensile strength ≥ 0.1 MPa
- Shear strength ≥ 0.1 MPa
- Thermal conductivity coefficient $\lambda = 0.022$ W/mK
- The 95% closed cells guarantee an anhygroscopic structure

- panel on two supports:



STEEL SHEETS 0.5/0.5 mm - Simple support 120 mm							
UNIFORMLY DISTRIBUTED LOAD [Kg/m ²]	NOMINAL PANEL THICKNESS mm						
	80	100	120	150	170	180	≥ 200
	MAX SPAN cm						
50	530	630	700	850	870	890	920
60	490	580	660	750	770	780	900
80	430	500	580	680	710	720	840
100	380	450	510	610	670	700	760
120	340	410	470	560	610	640	690
140	290	340	430	510	560	590	640
160	270	320	400	480	520	550	600
180	270	320	370	440	480	510	560
200	250	300	350	420	450	480	520

- panel on multiple supports:



STEEL SHEETS 0.5/0.5 mm - Multi-Support 120 mm							
UNIFORMLY DISTRIBUTED LOAD [Kg/m ²]	NOMINAL PANEL THICKNESS mm						
	80	100	120	150	170	180	≥ 200
	MAX SPAN cm						
50	630	740	840	900	920	930	960
60	570	650	770	870	885	900	920
80	480	580	670	790	820	830	850
100	420	510	640	680	695	710	730
120	380	460	590	590	610	620	630
140	340	410	530	530	540	550	560
160	310	380	470	480	480	490	500
180	290	350	430	435	435	440	445
200	270	320	400	400	400	405	410

JOINT

The shape of the labyrinth joint, together with the various sealing systems, is expressly designed to ensure product functionality.

Isopan has designed four types of joints (see Annex B) to meet the different needs that arise in industrial applications, even at negative temperatures.

REACTION TO FIRE (EN 13501-1)

The reaction to fire indicates the degree to which a material participates in the fire it is subjected to.

The standard of reference for the reaction to fire classification of building materials is **EN 13501-1** (Fire classification of construction products and building elements). This standard specifies:

Euroclasses: the standard distinguishes seven classes, with increasing contribution to fire, from A1 (non-combustible product) to F (product not tested/not classified).

Smoke: opacity growth speed of the smoke

- **s1** no smoke emission
- **s2** low smoke emission
- **s3** strong smoke emission

Burning droplets: fall of burning particles

- **d0** no burning particles
- **d1** few burning particles
- **d2** many burning droplets

The fire classification of the panel depends on the type of polyurethane foam used and the thickness of the insulation; for further information, please refer to the Isopan catalogue, the website www.isopan.com or contact the Technical Department.

RESTRICTIONS OF USE

- A thermohygroscopic check should be performed during the design stage. In certain conditions (e.g. high indoor humidity level) condensation can appear on the internal face of the panel with consequent dripping inside the building. If these conditions persist long enough, they can accelerate the natural degradation of the organic facing and the support itself.
- If an aluminium sheet is used as external face, it is necessary to consider the possible distortions of the panel (bending) due to the different thermal expansion coefficients.
- **Due to solar radiation, the external face of the panel can reach relatively high temperatures. In some cases, it can reach a temperature of 80÷90°C.** A high temperature gradient should cause the panel deflection the panel and wrinkle the metal sheet. Isopan recommends a minimum thickness of 0.6 mm for the external side support. The occurrence of the problem may be limited with an accurate design, taking into account environmental conditions, length, colour of the panels and sheet thickness. **(See the "Thermal expansion" section).**

GENERAL DESIGN INSTRUCTIONS

The wall panels generally require, during the design phase, a structure able to absorb the external loading stress that will not submit the panels to excessive and permanent distortions to the detriment of their basic characteristics. When choosing the panel types during the design phase, you should consider some parameters related to environmental actions like:

- **Wind action:** depends on the climatic zone of the building installation; the values vary depending on the wind speed, with consequent greater or lesser load pressure on the exposed surfaces (affects the type and number of panel fastening systems).
- **Thermal stress:** largely depends on the colour of the external surface of the panel and the building exposure, and can induce significant system deformations.
- **Atmospheric corrosion:** depends on the environment where the panels are installed (marine, industrial, urban, rural); mainly affects the degree of corrosivity on the panel surfaces. In this regard, suitable metallic or organic facings should be chosen (refer to the available documentation or contact the Isopan Technical Department).

In order to make up for possible lack of material due to damages during handling and assembly, Isopan recommends procuring spare panels (quantity equal to approximately 5% of the total).

TOLERANCES (ANNEX D EN 14509)

- Facing thickness: according to the reference standards for the products used
- Panel thickness: if ≤ 100 mm ± 2 mm; if > 100 mm $\pm 2\%$
- Length: if ≤ 3000 mm ± 5 mm; if > 3000 mm ± 10 mm

THERMAL EXPANSIONS

All the materials used for the construction of walls and roofs, especially metals, are subject to **thermal expansion and contraction** phenomena, resulting from the effect of temperature changes. The stresses due to thermal expansions of the metal sheet act on the siding and can cause functional and structural product anomalies, particularly in case of:

- Significant panel length ($L > 5000$ mm);
- Solar radiation;
- Medium and dark colours;
- High panel thickness;
- Inadequate thickness of the metal support.

Material	Thermal expansion coefficient ($^{\circ}\text{C}^{-1}$)
Aluminium	23.6×10^{-6}
Steel	12.0×10^{-6}
Stainless steel AISI 304	17.0×10^{-6}

-Values of linear thermal expansion coefficients-

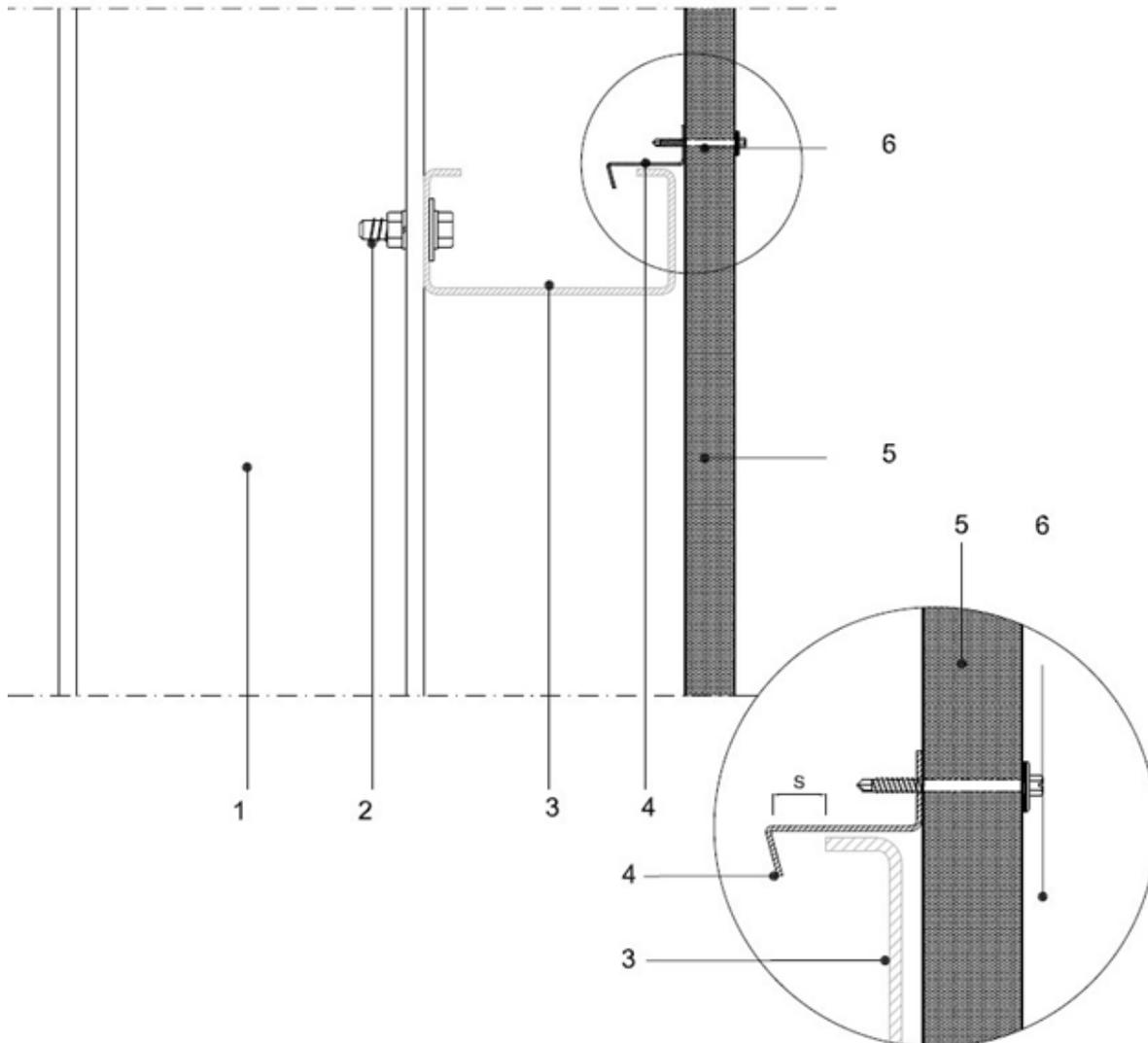
Type of facing		Surface temperature ($^{\circ}\text{C}$)	
		Min.	Max.
Insulated	Light	-20	+60
	Dark	-20	+80

Where "insulated" means that an insulating core is inserted between the external sheet and the structure; "light or dark" means the surface colour of the sheet.

-Temperature range-

For high surface temperatures, the linear extension of the metal face must be absorbed by the system; cyclic temperature changes related to the day-night or freeze-thaw fluctuations create uncontrollable cyclic stresses that fatigue the support elements. These stresses may cause flaws and undulations in wall panels and, in more severe cases, even wrinkling phenomena. These issues may be overcome by complying with the requirements:

- Calculate in advance the deformation induced on the panel by the thermal expansion
- Do not use dark colours on long panels
- Use suitable thickness of the metallic supports (minimum 0.6 mm to be assessed based on specific design issues)
- Segment the panels
- Use a panel fastening system able to offset the shift caused by the excessive thermal expansions; this solution is particularly important when using panels with aluminium support (see for example figure below).



No.	Description
1	Steel load-bearing structure
2	Bolt
3	Steel "C" profile for intermediate support
4	Block profile
5	ISOPAN Wall panel
6	Fixing screw
S	Compensation clearance for thermal expansion



Therefore, the assembly phase is critical for the following reasons:

- **the very nature of the mechanical joint:** the profiles of the tongue-and-groove joints are accurate and, therefore, due to the effect of linear elongation and bowing caused by solar irradiation, the assembly phase can be difficult or compromised;
- **the bending stiffness of the panel:** panels with high thicknesses have a higher stiffness than those with average-low thicknesses; any abnormalities during assembly due to thermal effects cannot be resolved with "adjustments" during installation, causing jointing difficulties.

Sandwich panels with dark external faces that reach external surface temperatures of around +80°C (as described in UNI EN 14509) are submitted to a deflection perpendicular to the longitudinal axis of the panel. This deflection, which depends on the temperature difference between the external and internal metal sheet, is particularly noticeable for long simple span panels.

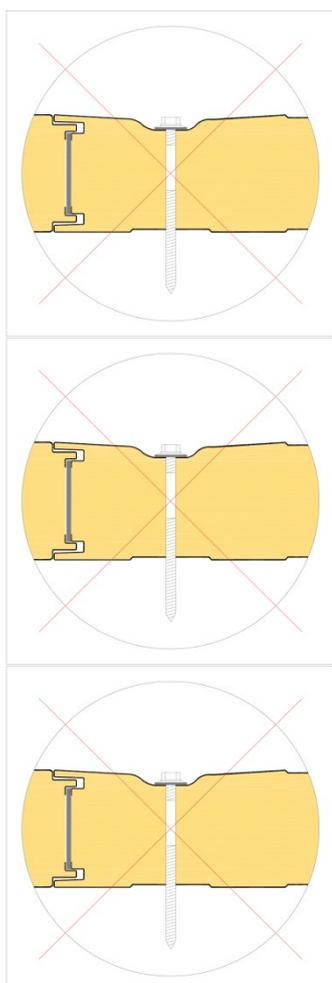
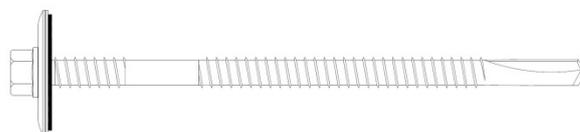
FASTENING INSTRUCTIONS

The purpose of the fastening elements is to efficiently anchor the panel to the load-bearing structure; the type of fastening unit depends on the type of support. The number and position of the fastening elements must guarantee resistance to the stresses induced by dynamic load, which can also exist in depression.

Appropriately coated carbon steels or austenitic type stainless steels must be chosen as suitable materials to fasten panels. You should pay particular attention to the compatibility of the steel and aluminium materials in order to prevent the formation of galvanic currents.

Fastening methods

Fastening varies depending on the project to be implemented and site application system of the panels. Isopan recommends using double-threaded screws with washer and sealing gasket with 19 mm minimum diameter.



A

Incorrect tightening due to a high torque applied to the screw with marked deformations of the sheet metal. **In this situation the optimal closing of the interlocking is no longer guaranteed, therefore, the aesthetic functionality of the product remains compromised.**

B

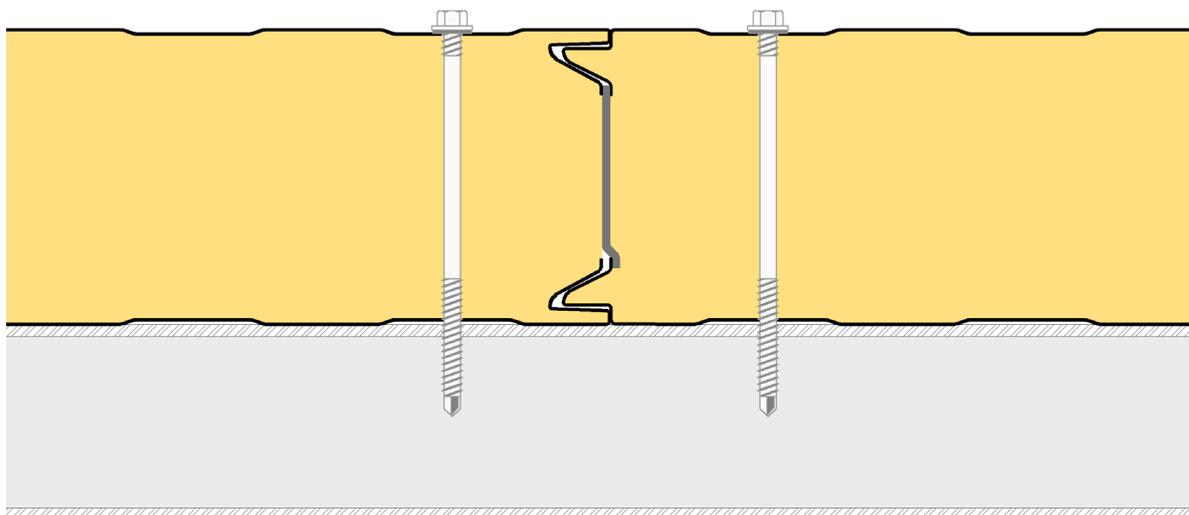
Incorrect tightening due to the torque applied to the screw being insufficient to ensure correct fastening of the panel to the structure.

C

Correct tightening obtained by applying sufficient torque to the screw to ensure fastening of the panel to the structure.

Screw length

The correct length of the screw depends on the panel thickness and on the type of support (steel, wood).



Fixing Support	Screw Length (mm)
Steel	Panel thickness + 30 mm
Wood	Panel thickness + 40 mm

ASSEMBLY INSTRUCTIONS

The correct sequence of assembly operations is the following:

Preliminary operations

- Verify that the supports are properly aligned.
- Pay particular attention to the contact points between the supports and the panel support plates to avoid phenomena linked to electrochemical corrosion if non-compatible metals are coupled. For this purpose, elastomer or expanded resin strips may be applied as separators.
- Ensure that the site area has appropriate storage and handling capacity in order to prevent material damage.
- Use suitable tools (toothed circular saw, jigsaw, shears, nibbler) for on-site cutting operations. The use of equipment that produces metallic sparks (e.g. abrasive discs, disc cutter) is absolutely not recommended.
- Use suitable handling systems, particularly for long or heavy panels, in order to prevent safety risks on site and damages to the product.

Using acetic silicones is prohibited as they tend to attack the pre-painted galvanised sheet and form incipient oxidation. It is best to use single component sealant silicones with neutral curing that tend to harden due to the air humidity and, being free of solvents, do not attack the paint.

Assembly

- Apply the basic flashing (when provided) to the foot of the wall, as well as the flashing that must be installed before the wall, such as drip edges, roof fittings, etc.
- Remove the protective film from the panels, if any.
- Apply the panels starting from the bottom of the wall, or the side end in case of vertical assembly, taking care to perform correct joints and to ensure they are plumb.*
- Systematically fasten the elements after ensuring they match correctly. The fixing screw must be inserted orthogonally to the panel.
- If the wall height involves the need to assemble panels vertically, the junction is made at the frame and requires appropriate use of shaped fitting flashing (ridge caps, drip edges, etc.).
- Use "U" ridge caps and drip edges for doors and window frames.
- Apply the finishing elements (angle bars, perimeter edgings, fittings).
- Check and clean the walls, with particular attention to metal scraps, fastenings and fittings with door and window frames.

***Note: it is mandatory to adhere to the correct installation direction of the panels during assembly**

PACKAGE COMPOSITION

The panels are normally supplied packaged and wrapped with extensible polyethylene film; the standard composition of the package is as shown below:

Panel thickness (mm)	80	100	120	150	180	200
No. of panels per package	9	7	6	5	4	4

Package compositions and types of packaging other than standard must be explicitly requested when ordering.

TRANSPORT AND STORAGE

Lorry loading

- The packages of panels are loaded on lorries, usually two in width and three in height. The packages include polystyrene spacers at the base, which are thick enough to allow for the lift straps.
- The goods are arranged on the vehicles so as to ensure safe transportation, in accordance with the requirements of the carrier, who is solely responsible for load integrity. Due to the weight bearing on the bottom package, the pressure exerted in tying points and the belts, some slight product deformation is to be considered admissible.
- Isopan assumes no liability for loading lorries that are already partially occupied with other materials, or that do not have a suitable loading floor.

The customer who will pick up the material must instruct drivers for the purpose.

Lorry unloading with crane

- Use any type of crane equipped with lifting beam and equipped straps. Isopan can advise customers on the choice of lifting beams and straps. By using correct lifting systems, the panels will not be damaged.
- Never use chains or metal cables for lifting under any circumstances. As a general rule, sling the packages leaving about 1/4 of their length protruding from each end.

Lorry unloading with forklifts

- If the lorries are unloaded using a forklift, the length of the packages and their possible bending should be taken into account in order to prevent damages to the bottom of the package.
- The forks must be wide and long enough in order not to damage the product. When possible, protective material against surface abrasion and scratches should be applied between the fork and the package.

Indoor storage (Annex A)

- The materials must be stored in ventilated indoor facilities that are free of dust and humidity and not subject to temperature changes.
- Moisture that can penetrate (rain) or form (condensation) between two panels can damage the facings since it is particularly aggressive on metals and facings, with subsequent oxidation.
- Pre-painted facings may be more exposed to the negative consequences of combined heat/humidity conditions.

Outdoor storage (Annex A)

- If the packages and accessories are stored outdoors, the surface must absolutely be inclined longitudinally to prevent the accumulation of moisture and allow water run-off and natural air circulation.
- If storage is not shortly followed by pick-up for installation, it is advisable to cover the packages with a protective tarp, assuring impermeability as well as adequate ventilation to prevent condensate from accumulating and puddles of water from forming.

Storage terms (Annex A)

- Based on experience, in order to maintain original product performance, continuous indoor storage in closed and ventilated facilities should not exceed six months, while outdoor storage should never exceed sixty days from the date of production. These terms refer to the properly stored product, as instructed in the "storage" chapter in Annex A. However, the materials must always be protected against direct sunlight, as it may cause alterations.
- In case of transport in containers, the products must be removed from the containers as soon as possible and, however, no later than 15 days from the loading date, to prevent deterioration of the metal facings and organic coatings (e.g. blistering). Moisture inside the container must absolutely be avoided. Upon customer request, Isopan can provide special packages that are more suitable for transport in containers.

PACKAGING

Isopan suggests carefully choosing the type of packaging depending on destination, type of transport, conditions and length of storage.

To choose the correct type of packaging, please refer to the document "**Packaging and Services**" on www.isopan.com.

DURABILITY

Product durability depends on the intrinsic features of the panel used in relation with its final use. The panel, including the features of the metal sheets, must be chosen after a proper design of the wall.

In this regard we recommend, if necessary, using the Isopan documentation, also available on the web (www.isopan.com), and/or the reference standards.

MAINTENANCE

All types of facings, including those made with metal sandwich panels, require maintenance.

The type and frequency of maintenance activities depend on the product used for the outer facing (steel, aluminium); in any case, we recommend periodically inspecting the building (at least once a year), in order to assess its conditions.

In order to maintain the aesthetic and physical properties of the elements and to extend the efficiency of the protective facing, it is also recommended to regularly clean the wall, paying special attention to the areas that could facilitate rain water stagnation, where substances that are harmful to the durability of the metal sheet may be concentrated.

If you notice any problems following an on-site inspection, you must react immediately in order to restore the initial general conditions (e.g. restoring the paint where there are local abrasions or scratches).

At the customer's request, Isopan can provide useful information to solve some problems related to this topic.

SAFETY AND DISPOSAL

Pursuant to Directive 68/548/EEC the sandwich panel does not require labelling. To meet customers' requirements, Isopan has drawn-up a "Technical details for safety" document, to be referenced for any kind of information related to safety.

Caution: all information contained in the product data sheets must be validated by a qualified technician according to the laws in force in the country of installation of the panels.

Technical specifications and features are not binding. Isopan reserves the right to make changes without prior notice; the latest documentation is available on our website www.isopan.com. For whatever is not explicitly specified herein, please refer to the "General conditions of sale of the corrugated metal sheets, insulated metal panels and accessories". All the products that fall under the EN 14509 standard field of application are CE marked.

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Annex A

LORRY UNLOADING WITH CRANE

For lifting, the packages must always be sling in at least two points. The distance between them must be no less than half the length of the packages.

Lifting should be possibly carried out using synthetic fibre straps (Nylon) no thinner than 10 cm, so that the load is distributed on the strap and does not cause distortion.

(see Figure 1)

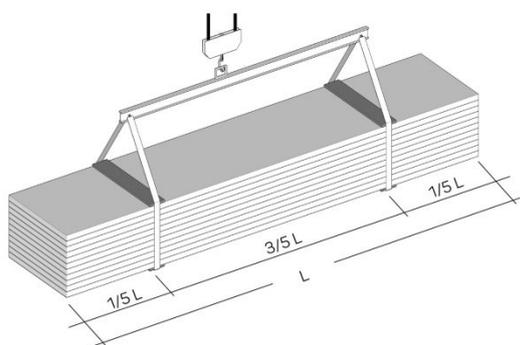


Figure 1

Suitable spacers must be placed under and above the package, made of sturdy solid wood or plastic elements to avoid direct contact of the strap with the package.

These spacers must be at least 4 cm longer than the width of the package and be at least as wide as the strap.

Make sure that the straps and supports cannot move during lifting and that manoeuvres are performed cautiously.

LORRY UNLOADING WITH FORKLIFTS

If the lorries are unloaded with a forklift, take into account the length of the packages and their possible bending in order to avoid damaging the bottom of the package and/or to the extreme failure limit of the panels.

We recommend using forklifts that are suitable for handling panels and similar products.

STORAGE

The packages must always be kept off the ground both in the warehouse and, more so, at the construction site. They must have plastic foam supports with flat surfaces longer than the width of the panels and at a distance adequate to the features of the product.

The packages should preferably be stored in dry facilities to prevent stagnation of condensation water on inner, less ventilated, elements, which is particularly aggressive on metals, resulting in the formation of oxidation.

The panels must be stored in dry ventilated facilities; should this not be possible, open the packages and ventilate the panels (spacing them from one other). If the panels remain packaged outdoors, the galvanised facing may oxidise (white rust) even after a few days, due to electrolytic corrosion.

The panels must be stored to facilitate water run-off, especially when it is necessary to temporarily store them outside (see Figure 2).

If storage is not shortly followed by pick-up for installation, it is advisable to cover the packages with protective tarps.

To maintain original product performance, continuous indoor storage in ventilated facilities should not exceed six months, while outdoor storage should never exceed 60 days.

Packages stored at a height must always be properly bound to the structure.

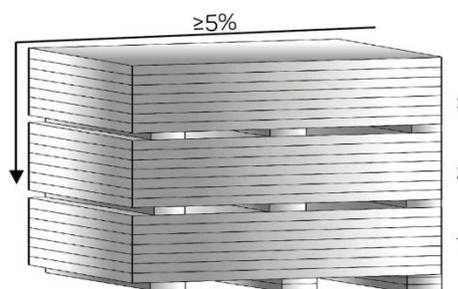


Figure 2

PRE-PAINTED FACES



In case of prolonged storage, the pre-painted products must be stored indoors or under a canopy. There is the risk that stagnant humidity may attack the paint layer, causing it to detach from the galvanised support. It is not recommend to wait for more than two weeks from when the products were stored at the site.

In case of container transport, the products must be removed from the container within 15 days from the loading date in order to prevent the metal supports from deteriorating.

PANEL HANDLING

The panels must be handled using adequate means of protection (accident-prevention shoes, gloves, overalls, etc.) in compliance with current regulations.

The individual element must always be manually handled by lifting the element without dragging it on the ground and turning it sideways beside the package; it must be transported by at least two people according to the length, keeping the element on its side. (see Figure 3)

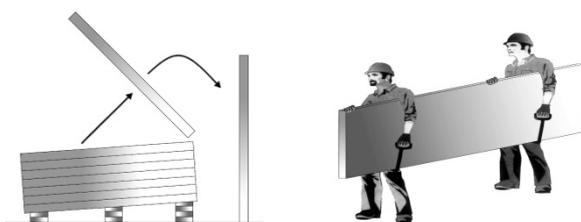


Figure 3
 Pick-up equipment as well as gloves must be clean and not damage the elements.

INSTALLATION

The panel installation personnel must be qualified and know the correct technique to perform the work in a workmanlike manner. If required, the seller can provide appropriate guidance and instructions.

The installation personnel must be equipped with footwear with soles that do not damage the external surface of the panel.

On-site cutting operations must be done with suitable tools (jigsaw, shears, nibbler, etc.).

We do not recommend using tools with abrasive discs.

To fasten the panels, it is advisable to use devices that can be provided by the seller.

Tighten the screws using a screwdriver with torque limitation.

For roofs with pitch elements without intermediate joints (overlaps), the slope should usually be no less than 7%. For smaller slopes, adopt the requirements of the seller.

In case of head overlaps, the slope should take into account the type of joint and material used, as well as the specific environmental conditions.

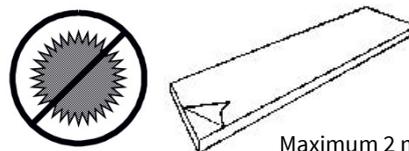
During panel assembly and, in particular, in roofs, it is necessary to immediately remove all residual materials paying special attention to metal ones that may cause early deterioration of the metal faces by oxidising.

PROTECTIVE FILM

The pre-painted metal facings are supplied upon request with adhesive polyethylene protective film that prevents damage to the paint layer.

The protective film covering the pre-painted panels must be completely removed during assembly or, in any case, within 60 days from material preparation.

It is also recommended not to expose the panels covered by a protective film to direct sunlight.



For the panels expressly requested without protective film, special care is required during handling on site and installation.

MAINTENANCE

The main routine maintenance operation is cleaning the panels. The panel surfaces that, following visual inspection, are found to be dirty or oxidised can be washed with soap and water using a soft brush. The cleaning water pressure can be applied up to 50 bar, but the jet must not be too close or perpendicular to the surfaces. Near the joints the water must be sprayed at a sufficient angle not to undermine their tightness.

YEARLY CHECKS OF THE ISOPAN PANELS	
WHAT TO INSPECT	CORRECTIVE ACTIONS
Conditions of the pre-painted surfaces (cracks and colour unevenness)	Assess the condition of the surfaces Repaint where possible
Scratches and dents	Repaint and repair dents
Fastening screws	Remove a screw and check if oxidised Tighten the screws where necessary
Angle parts of cut	Check the state of oxidation Clean and repaint

These provisions are taken from the General Conditions of Sale.

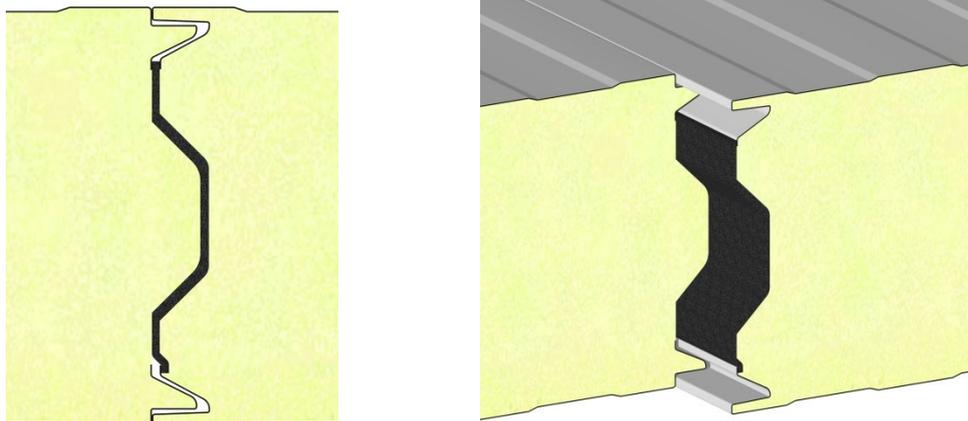
Annex B - Type of joint

In the cold room, a stable and pre-set temperature is maintained. The temperature depends on the intended function for the cold room. An important feature for a cold room is maintaining the temperature constant: when the cold room starts operating, the temperature difference established between the inside and outside generates a proportional pressure difference. The natural tendency to re-balance the pressure gradient would trigger spontaneous air seepage from outside to the inside of the cold room (in case of rooms with lower temperature than outside, in the opposite direction otherwise). Besides the obvious considerations on the unfavourable thermal flow related to ΔT and tending to reduce cold room efficiency, this phenomenon – in case of excessive casing permeability to humid air – would lead to outside water vapour and air reaching cold areas of the store room. Hence, thermohygrometric conditions would occur such to cause water vapour condensation or even its subsequent solidification and ice build-up. Generally, compensation valves are installed on the cold room ceiling to maintain the balance between internal and external pressures.

With regard to air tightness, Isopan has designed four jointing systems:

1 - DRY JOINT

Suitable for rooms with positive temperatures and not below 4°C. In case of rooms with temperatures below 4°C it is appropriate to carry out a thermohygrometric analysis of joint permeability, which might affect the efficiency of the cold room and cause issues of condensation and/or ice formation. The joint geometry is tongue-and-groove interlock and the panel is fitted with standard PVC gasket inserted during production, hence no additional on-site work steps are required.



Average Joint Thermal Transmittance [Thickness 200 mm]: $U_f = 0.156 \text{ W/m}^2\text{K}$

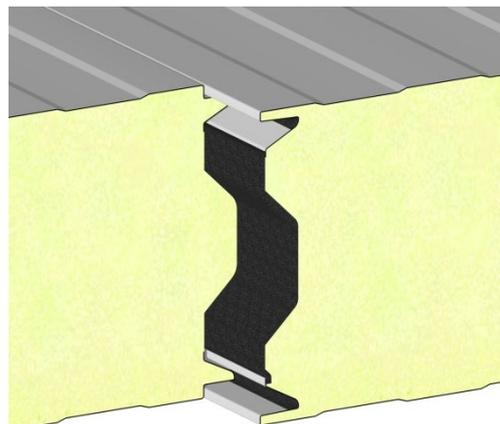
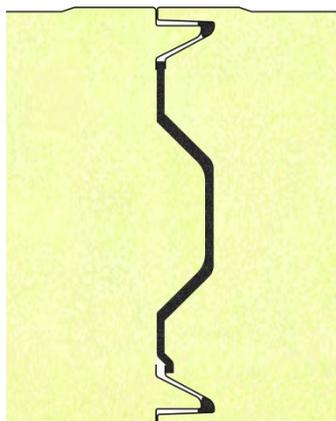
In the standard configuration (dry joint) the **air permeability** was measured with a 50 Pa pressure difference between the inside and outside of the structure and determined in terms of $\text{m}^3/\text{m}^2\text{h}$, as indicated by the Standard EN 14509:2013. The test method used is compliant with the provisions of EN 12114:2001 (*Thermal performance of buildings. Air permeability of building elements and components. Laboratory test method*), obtaining the following results:

Positive pressure Pa	AIR PERMEABILITY	
	$\text{m}^3 / \text{m}^2\text{h}$ pitch 1000	$\text{m}^3 / \text{m}^2\text{h}$ pitch 1150
50	0,01	0,01
67	0,05	0,04
91	0,09	0,08
122	0,12	0,10
165	0,18	0,16
223	0,24	0,21
301	0,38	0,33
407	0,52	0,45
549	0,64	0,56
741	0,85	0,74
1000	1,07	0,93

Negative pressure Pa	AIR PERMEABILITY	
	$\text{m}^3 / \text{m}^2\text{h}$ pitch 1000	$\text{m}^3 / \text{m}^2\text{h}$ pitch 1150
50	0,01	0,01
67	0,03	0,03
91	0,08	0,07
122	0,10	0,09
165	0,16	0,14
223	0,20	0,17
301	0,30	0,26
407	0,46	0,40
549	0,62	0,54
741	0,79	0,69
1000	1,01	0,88

2 - JOINT WITH BITUMINOUS TAPE

Suitable for rooms with temperatures not below -1°C. In case of cold rooms with temperatures below -1°C it is appropriate to carry out a thermohygroscopic analysis of joint permeability, which might affect the efficiency of the cold room and cause issues of condensation and/or ice formation. The joint consists of the standard panel configuration added during assembly with two bituminous strips in the two female recesses along the entire length, which assure good seal to air flow between inside and outside, and vice-versa.



Average Joint Thermal Transmittance [Thickness 200 mm]: $U_f = 0.145 \text{ W/m}^2\text{K}$

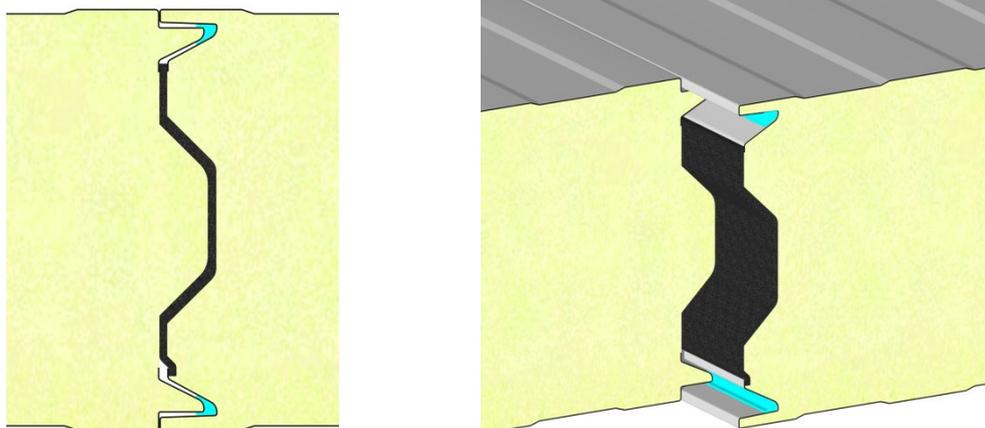
In the configuration with bituminous tape **air permeability** was measured with up to 1,000 Pa of pressure difference between inside and outside of the structure and determined in terms of $\text{m}^3/\text{m}^2\text{h}$, as indicated by Standard EN 14509:2013. The test method used is compliant with the provisions of EN 12114:2001 (*Thermal performance of buildings. Air permeability of building elements and components. Laboratory test method*), obtaining the following results:

Positive pressure Pa	AIR PERMEABILITY	
	$\text{m}^3 / \text{m}^2\text{h}$ pitch 1000	$\text{m}^3 / \text{m}^2\text{h}$ pitch 1150
50	0,01	0,01
67	0,02	0,02
91	0,06	0,05
122	0,09	0,08
165	0,15	0,13
223	0,21	0,18
301	0,35	0,30
407	0,48	0,42
549	0,61	0,53
741	0,75	0,65
1000	0,89	0,77

Negative pressure Pa	AIR PERMEABILITY	
	$\text{m}^3 / \text{m}^2\text{h}$ pitch 1000	$\text{m}^3 / \text{m}^2\text{h}$ pitch 1150
50	0,00	0,00
67	0,02	0,02
91	0,06	0,05
122	0,09	0,08
165	0,15	0,13
223	0,22	0,19
301	0,35	0,30
407	0,48	0,42
549	0,60	0,52
741	0,72	0,63
1000	0,85	0,74

3 - JOINT WITH THIXOTROPIC SEALANT

Indicated for negative temperature premises; the thixotropic behaviour of the sealant provides excellent air tightness thanks to the lack of cracks. The sealant is added inside the groove of the female side, along the entire length of the panel, by using a gun.



Average Joint Thermal Transmittance [Thickness 200 mm]: $U_f = 0.140 \text{ W/m}^2\text{K}$

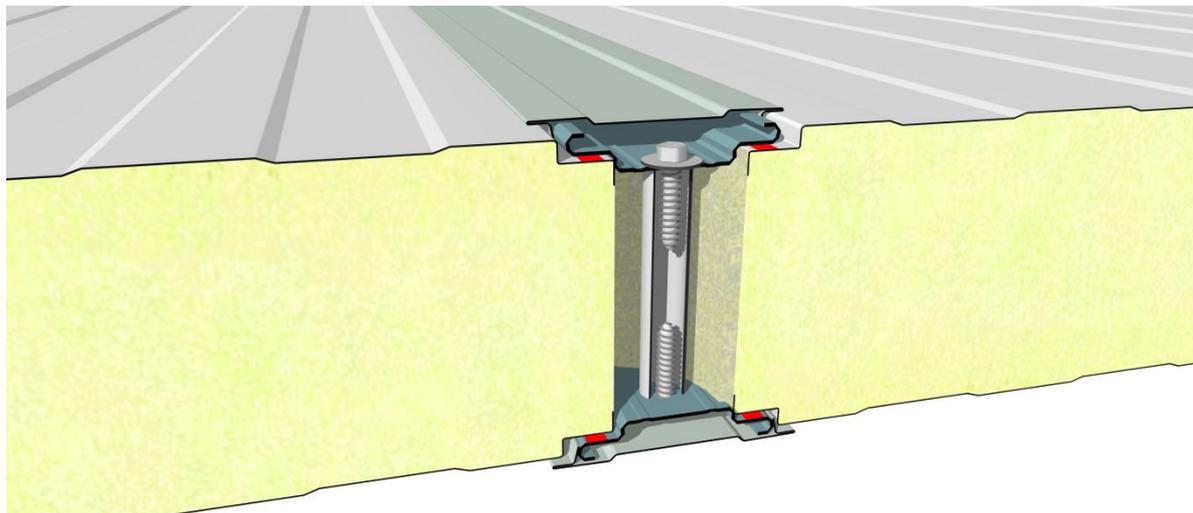
In the configuration with thixotropic sealant **air permeability** was measured, with a 50 Pa pressure difference between the inside and outside of the structure and determined in terms of $\text{m}^3/\text{m}^2\text{h}$, as indicated by the Standard EN 14509:2013. The test method used is compliant with the provisions of EN 12114:2001 (*Thermal performance of buildings. Air permeability of building elements and components. Laboratory test method*), obtaining the following results:

Positive pressure Pa	AIR PERMEABILITY	
	$\text{m}^3 / \text{m}^2\text{h}$ pitch 1000	$\text{m}^3 / \text{m}^2\text{h}$ pitch 1150
50	0,00	0,00
67	0,00	0,00
91	0,00	0,00
122	0,01	0,01
165	0,02	0,02
223	0,05	0,04
301	0,06	0,05
407	0,14	0,12
549	0,21	0,18
741	0,29	0,25
1000	0,37	0,32

Negative pressure Pa	AIR PERMEABILITY	
	$\text{m}^3 / \text{m}^2\text{h}$ pitch 1000	$\text{m}^3 / \text{m}^2\text{h}$ pitch 1150
50	0,00	0,00
67	0,00	0,00
91	0,00	0,00
122	0,00	0,00
165	0,01	0,01
223	0,02	0,02
301	0,05	0,04
407	0,06	0,05
549	0,10	0,09
741	0,17	0,15
1000	0,29	0,25

4 - INJECTED JOINT

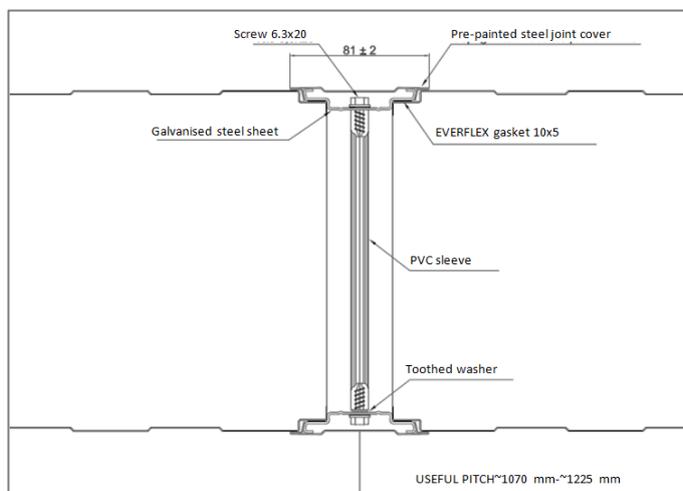
Particularly suitable for rooms with very significant negative temperatures, which call for stringent requirements in terms of minimising heat bridges and air permeability. The absence of cracks and the use of PVC gaskets below the plates ensure excellent airtightness and minimisation of heat bridges.



Average Joint Thermal Transmittance
[Thickness 200 mm]: $U_f = 0.119 \text{ W/m}^2\text{K}$

The interlock configuration for this type of joint is male – male. The components are:

- Galvanised steel sheet;
- Galvanised screws 6.3x20 mm;
- PVC sleeve;
- Toothed washer;
- PVC washer;
- PUR gasket;
- Pre-painted steel joint cover.



The length of the PVC sleeve depends on the thickness of the panel. Below is a summary diagram of the various lengths:

Panel thickness (mm)	PVC Sleeve length (mm)
80	53
100	73
120	93
150	123
200	173

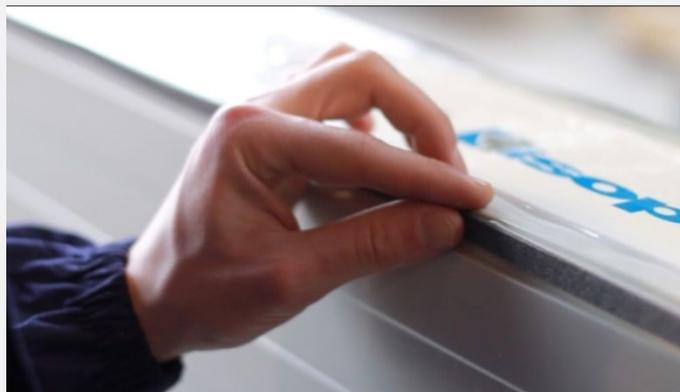
For the assembly instructions, refer to **Annex C**

Annex C

INJECTED JOINT - SITE INSTALLATION INSTRUCTIONS

Step 1

Firstly apply the specific PUR gasket to the male joint edges, on both sides. This gasket improves airtightness, preventing the polyurethane foam injected on site from escaping from the edges. It must be applied on both sides of the joint.



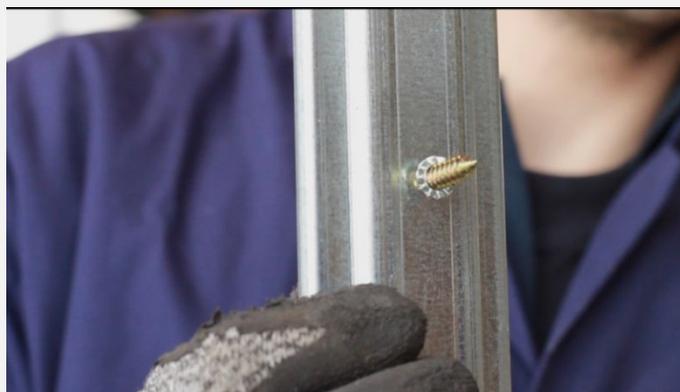
Step 2

To prevent panel shifting movements during foaming, due to the pressure exerted by the foam on the walls during curing, it is necessary to fasten the first panel to the base and roof. It is just as important to avoid through fastenings that completely cross the panel to avoid heat bridges due to the fastening units.



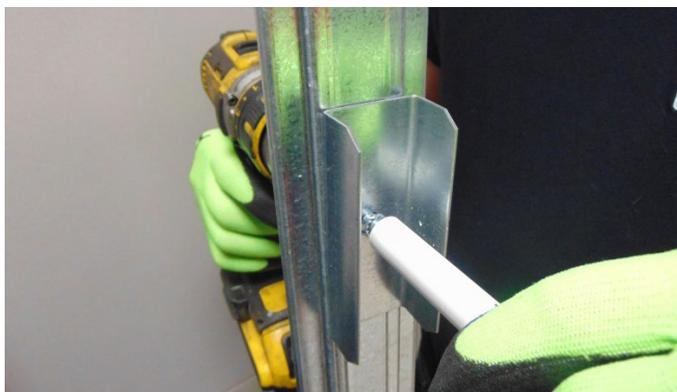
Step 3

Where it is not planned to use the spacer (the U profile) the screw has to be inserted into the hole located on the omega profile. A toothed washer is inserted on the inside of the sheet to prevent the sleeve from slipping during tightening.



Step 4

Where it is planned to use the spacer (the U profile) the screw has to be inserted into the hole located on the omega profile; on the inner side of the profile, first of all the spacer has to be inserted and then the toothed washer (like in the 3rd FASE) which prevents the slippage of the sleeve during the tightening phase.



Step 5

Secure the screw to the PVC sleeve by applying the correct fastening torque, repeat the operation for all holes on the steel sheet.

Note: Where the spacer is placed, fix the screw to the shorter sleeve, instead of the standard one.



Step 6

Use galvanised steel screws also to secure the steel sheet to the sleeves on the opposite side. Apply a PVC washer between screw and sheet to improve airtightness. Where it is planned to use the spacer (the U profile), insert the spacer before inserting the omega profile e proceed to tightening the galvanized screws with PVC washers.



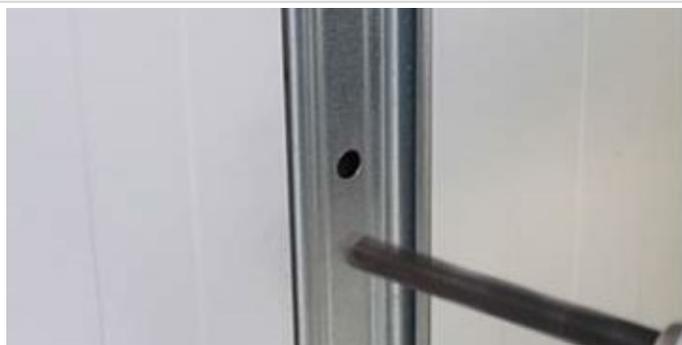
Step 7

Insert the assembled sheets in the male panel interlock. Ensure the clearance between the sheets is sufficient not to damage the sealing gaskets applied previously on the joint edges.



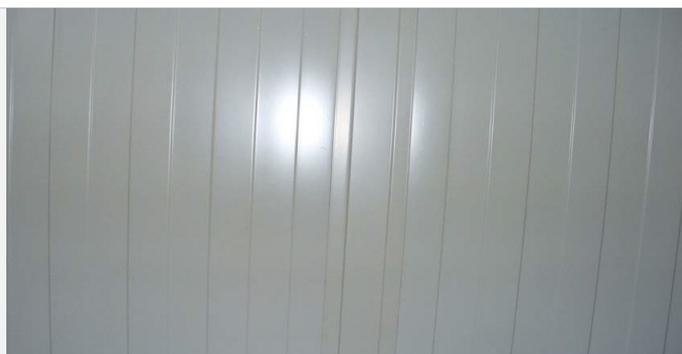
Step 8

Move the panel next to the sheet interlock and foam through the holes of the galvanised sheet.



Step 9

Install the painted casing.



Annex D

VACUUM LIFTER

If the panels are handled with vacuum lifters, the operations must be performed avoiding stresses on the panel metal sheet. The action which performs the suction pad on the metal sheet during lifting must be redistributed properly taking into account the length and the weight of the panel itself.

To prevent excessive actions of the suction pads that could cause the detachment of the metal sheet from the insulating layer, Isopan recommends to observe the following restrictions:

Polyurethane Panels:

Minimal surfaces for all the suction pads - Panels with Steel supports 0,4 / 0,4												
Panel length [mm]	Panel thickness [mm]											
	25	30	35	40	50	60	80	100	120	150	180	200
2000	340 cm ²	350 cm ²	350 cm ²	360 cm ²	380 cm ²	390 cm ²	430 cm ²	460 cm ²	490 cm ²	540 cm ²	590 cm ²	620 cm ²
3500	590 cm ²	600 cm ²	620 cm ²	630 cm ²	660 cm ²	690 cm ²	740 cm ²	800 cm ²	850 cm ²	940 cm ²	1.020 cm ²	1.080 cm ²
5000	840 cm ²	860 cm ²	880 cm ²	900 cm ²	940 cm ²	980 cm ²	1.060 cm ²	1.140 cm ²	1.220 cm ²	1.340 cm ²	1.460 cm ²	1.540 cm ²
6500	1.090 cm ²	1.120 cm ²	1.140 cm ²	1.170 cm ²	1.220 cm ²	1.270 cm ²	1.380 cm ²	1.480 cm ²	1.580 cm ²	1.740 cm ²	1.900 cm ²	2.000 cm ²
8000	1.340 cm ²	1.370 cm ²	1.400 cm ²	1.440 cm ²	1.500 cm ²	1.560 cm ²	1.690 cm ²	1.820 cm ²	1.950 cm ²	2.140 cm ²	2.330 cm ²	2.460 cm ²
10000	1.670 cm ²	1.710 cm ²	1.750 cm ²	1.790 cm ²	1.870 cm ²	1.950 cm ²	2.110 cm ²	2.270 cm ²	2.430 cm ²	2.670 cm ²	2.910 cm ²	3.070 cm ²
13000	2.170 cm ²	2.230 cm ²	2.280 cm ²	2.330 cm ²	2.430 cm ²	2.540 cm ²	2.750 cm ²	2.950 cm ²	3.160 cm ²	3.470 cm ²	3.790 cm ²	3.990 cm ²

Minimal surfaces for all the suction pads - Panels with Steel supports 0,6 / 0,6												
Panel length [mm]	Panel thickness [mm]											
	25	30	35	40	50	60	80	100	120	150	180	200
2000	490 cm ²	490 cm ²	500 cm ²	510 cm ²	530 cm ²	540 cm ²	570 cm ²	610 cm ²	640 cm ²	690 cm ²	730 cm ²	770 cm ²
3500	850 cm ²	860 cm ²	870 cm ²	890 cm ²	920 cm ²	940 cm ²	1.000 cm ²	1.060 cm ²	1.110 cm ²	1.200 cm ²	1.280 cm ²	1.340 cm ²
5000	1.210 cm ²	1.230 cm ²	1.250 cm ²	1.270 cm ²	1.310 cm ²	1.350 cm ²	1.430 cm ²	1.510 cm ²	1.590 cm ²	1.710 cm ²	1.830 cm ²	1.910 cm ²
6500	1.570 cm ²	1.590 cm ²	1.620 cm ²	1.640 cm ²	1.700 cm ²	1.750 cm ²	1.850 cm ²	1.960 cm ²	2.060 cm ²	2.220 cm ²	2.370 cm ²	2.480 cm ²
8000	1.930 cm ²	1.960 cm ²	1.990 cm ²	2.020 cm ²	2.090 cm ²	2.150 cm ²	2.280 cm ²	2.410 cm ²	2.530 cm ²	2.730 cm ²	2.920 cm ²	3.050 cm ²
10000	2.410 cm ²	2.450 cm ²	2.490 cm ²	2.530 cm ²	2.610 cm ²	2.690 cm ²	2.850 cm ²	3.010 cm ²	3.170 cm ²	3.410 cm ²	3.650 cm ²	3.810 cm ²
13000	3.130 cm ²	3.180 cm ²	3.230 cm ²	3.280 cm ²	3.390 cm ²	3.490 cm ²	3.700 cm ²	3.910 cm ²	4.120 cm ²	4.430 cm ²	4.740 cm ²	4.950 cm ²

Minimal surfaces for all the suction pads - Panels with Steel supports 0,8 / 0,8												
Panel length [mm]	Panel thickness [mm]											
	25	30	35	40	50	60	80	100	120	150	180	200
2000	630 cm ²	640 cm ²	650 cm ²	660 cm ²	670 cm ²	690 cm ²	720 cm ²	750 cm ²	780 cm ²	830 cm ²	880 cm ²	910 cm ²
3500	1.100 cm ²	1.120 cm ²	1.130 cm ²	1.140 cm ²	1.170 cm ²	1.200 cm ²	1.260 cm ²	1.310 cm ²	1.370 cm ²	1.450 cm ²	1.540 cm ²	1.590 cm ²
5000	1.570 cm ²	1.590 cm ²	1.610 cm ²	1.630 cm ²	1.670 cm ²	1.710 cm ²	1.790 cm ²	1.870 cm ²	1.950 cm ²	2.070 cm ²	2.190 cm ²	2.270 cm ²
6500	2.040 cm ²	2.070 cm ²	2.100 cm ²	2.120 cm ²	2.170 cm ²	2.230 cm ²	2.330 cm ²	2.430 cm ²	2.540 cm ²	2.690 cm ²	2.850 cm ²	2.950 cm ²
8000	2.510 cm ²	2.550 cm ²	2.580 cm ²	2.610 cm ²	2.670 cm ²	2.740 cm ²	2.870 cm ²	2.990 cm ²	3.120 cm ²	3.310 cm ²	3.510 cm ²	3.630 cm ²
10000	3.140 cm ²	3.180 cm ²	3.220 cm ²	3.260 cm ²	3.340 cm ²	3.420 cm ²	3.580 cm ²	3.740 cm ²	3.900 cm ²	4.140 cm ²	4.380 cm ²	4.540 cm ²
13000	4.080 cm ²	4.130 cm ²	4.190 cm ²	4.240 cm ²	4.340 cm ²	4.450 cm ²	4.650 cm ²	4.860 cm ²	5.070 cm ²	5.380 cm ²	5.690 cm ²	5.900 cm ²

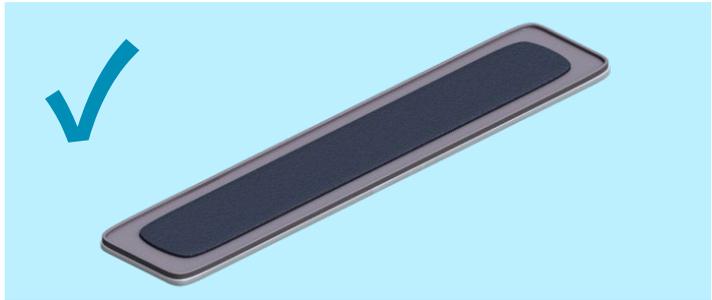
Mineral wool Panels:

Minimal surfaces for all the suction pads - Panels with Steel supports 0,5 / 0,5							
Panel length [mm]	Panel thickness [mm]						
	50	60	80	100	120	150	200
2000	470 cm ²	490 cm ²	510 cm ²	530 cm ²	570 cm ²	610 cm ²	690 cm ²
3500	820 cm ²	860 cm ²	890 cm ²	930 cm ²	1.000 cm ²	1.070 cm ²	1.210 cm ²
5000	1.170 cm ²	1.220 cm ²	1.270 cm ²	1.320 cm ²	1.420 cm ²	1.520 cm ²	1.720 cm ²
6500	1.520 cm ²	1.590 cm ²	1.650 cm ²	1.720 cm ²	1.850 cm ²	1.980 cm ²	2.240 cm ²
8000	1.870 cm ²	1.950 cm ²	2.030 cm ²	2.110 cm ²	2.270 cm ²	2.430 cm ²	2.750 cm ²
10000	2.340 cm ²	2.440 cm ²	2.540 cm ²	2.640 cm ²	2.840 cm ²	3.040 cm ²	3.440 cm ²
13000	3.040 cm ²	3.170 cm ²	3.300 cm ²	3.430 cm ²	3.690 cm ²	3.950 cm ²	4.470 cm ²

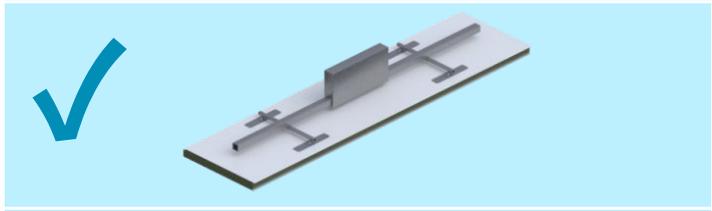
Minimal surfaces for all the suction pads - Panels with Steel supports 0,8 / 0,8							
Panel length [mm]	Panel thickness [mm]						
	50	60	80	100	120	150	200
2000	690 cm ²	710 cm ²	730 cm ²	750 cm ²	790 cm ²	830 cm ²	910 cm ²
3500	1.210 cm ²	1.240 cm ²	1.280 cm ²	1.310 cm ²	1.380 cm ²	1.450 cm ²	1.590 cm ²
5000	1.720 cm ²	1.770 cm ²	1.820 cm ²	1.870 cm ²	1.970 cm ²	2.070 cm ²	2.270 cm ²
6500	2.240 cm ²	2.300 cm ²	2.370 cm ²	2.430 cm ²	2.560 cm ²	2.690 cm ²	2.950 cm ²
8000	2.750 cm ²	2.830 cm ²	2.910 cm ²	2.990 cm ²	3.150 cm ²	3.310 cm ²	3.630 cm ²
10000	3.440 cm ²	3.540 cm ²	3.640 cm ²	3.740 cm ²	3.940 cm ²	4.140 cm ²	4.540 cm ²
13000	4.470 cm ²	4.600 cm ²	4.730 cm ²	4.860 cm ²	5.120 cm ²	5.380 cm ²	5.900 cm ²

N.B. : Thicknesses that are not listed in the tables can be interpolated linearly.

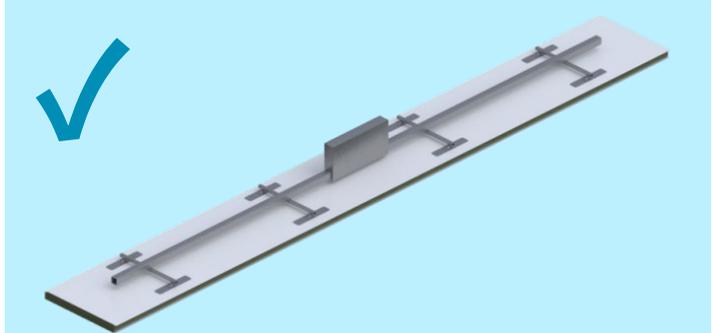
TO ENSURE THE FLATNESS OF THE METAL SHEET DURING THE AIR INTAKE YOU MUST PUT IN THE SUCTION PADS AN APPROPRIATE BUFFER STIFFENING



AT LEAST 4 SUCTION PADS EQUALLY DISTRIBUTED FOR PANEL LENGTHS LOWER THAN 6 METERS

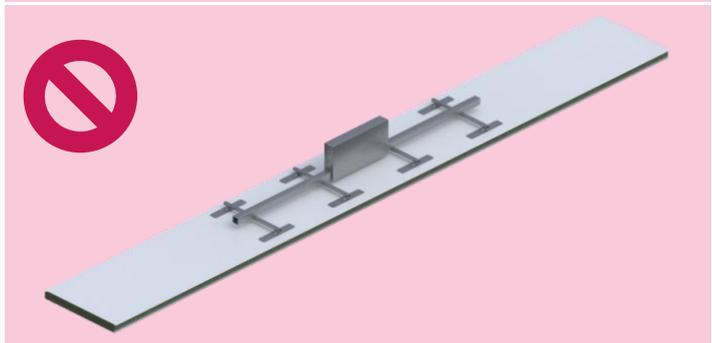
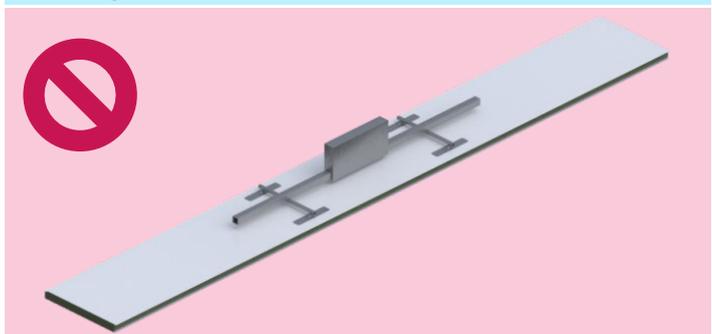


AT LEAST 8 SUCTION PADS EQUALLY DISTRIBUTED FOR PANEL LENGTHS HIGHER THAN 6 METERS



NOT ENOUGH SUCTION PADS

SUCTION PADS NOT EQUALLY DISTRIBUTED

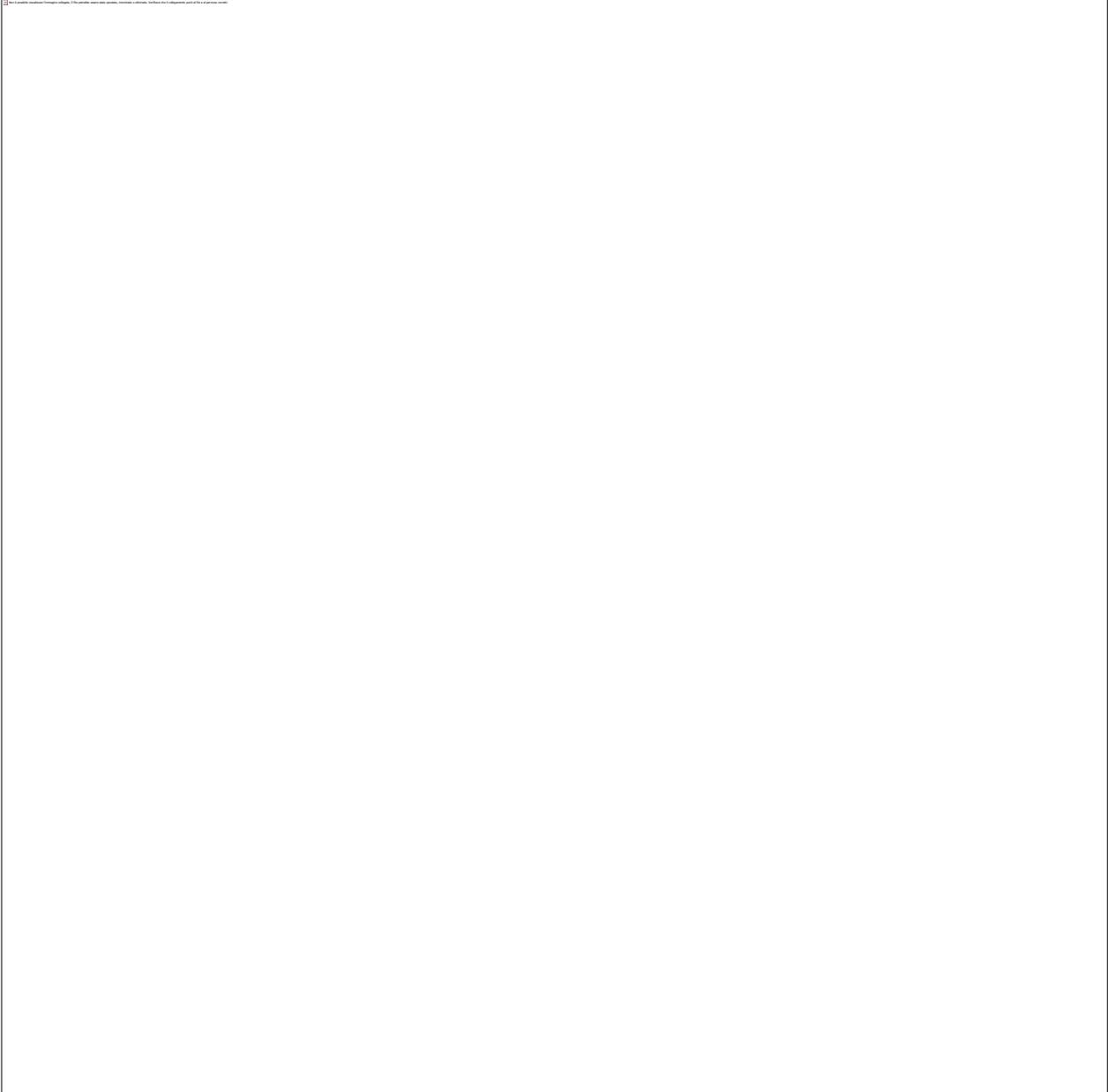


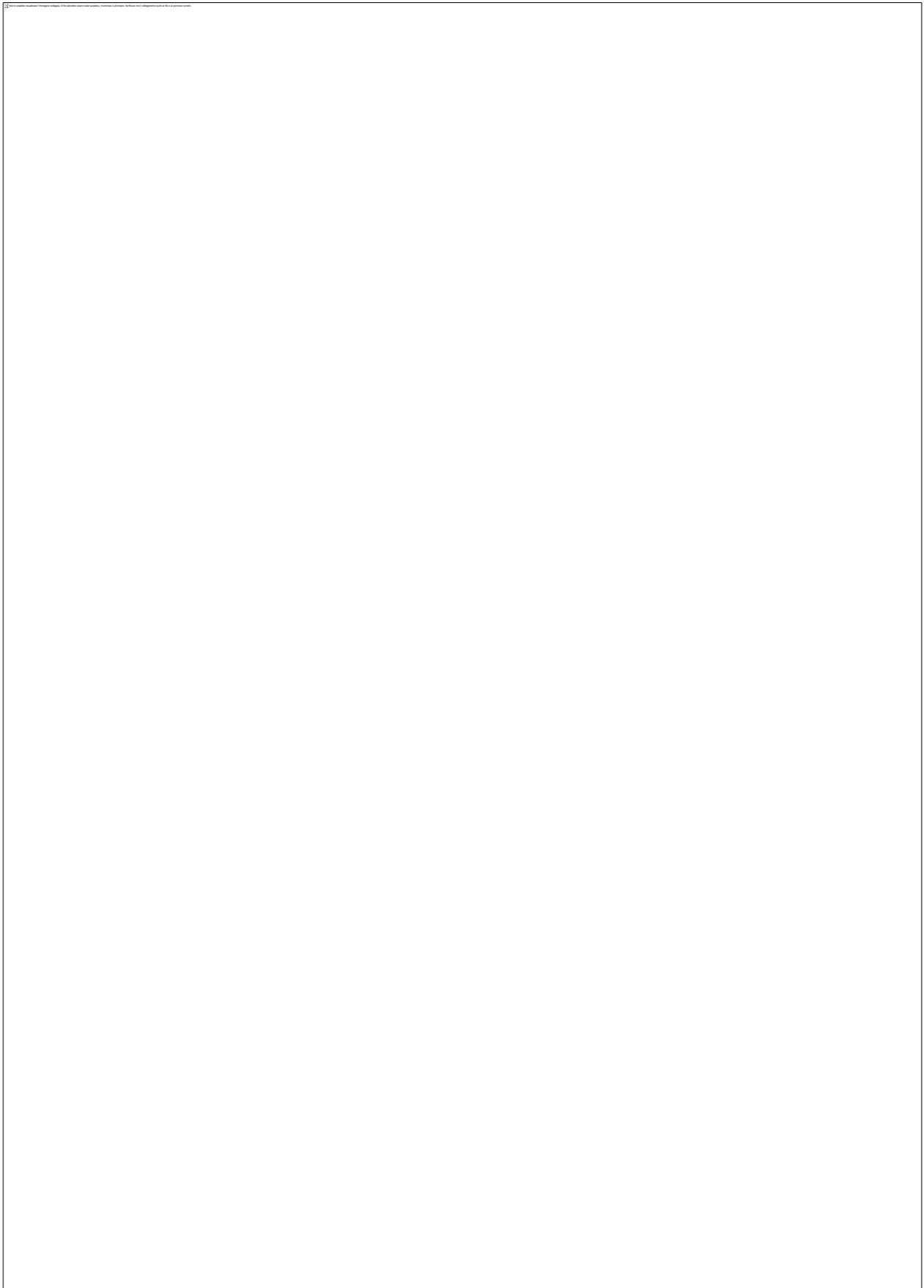
Annex E

BUILDING DETAILS

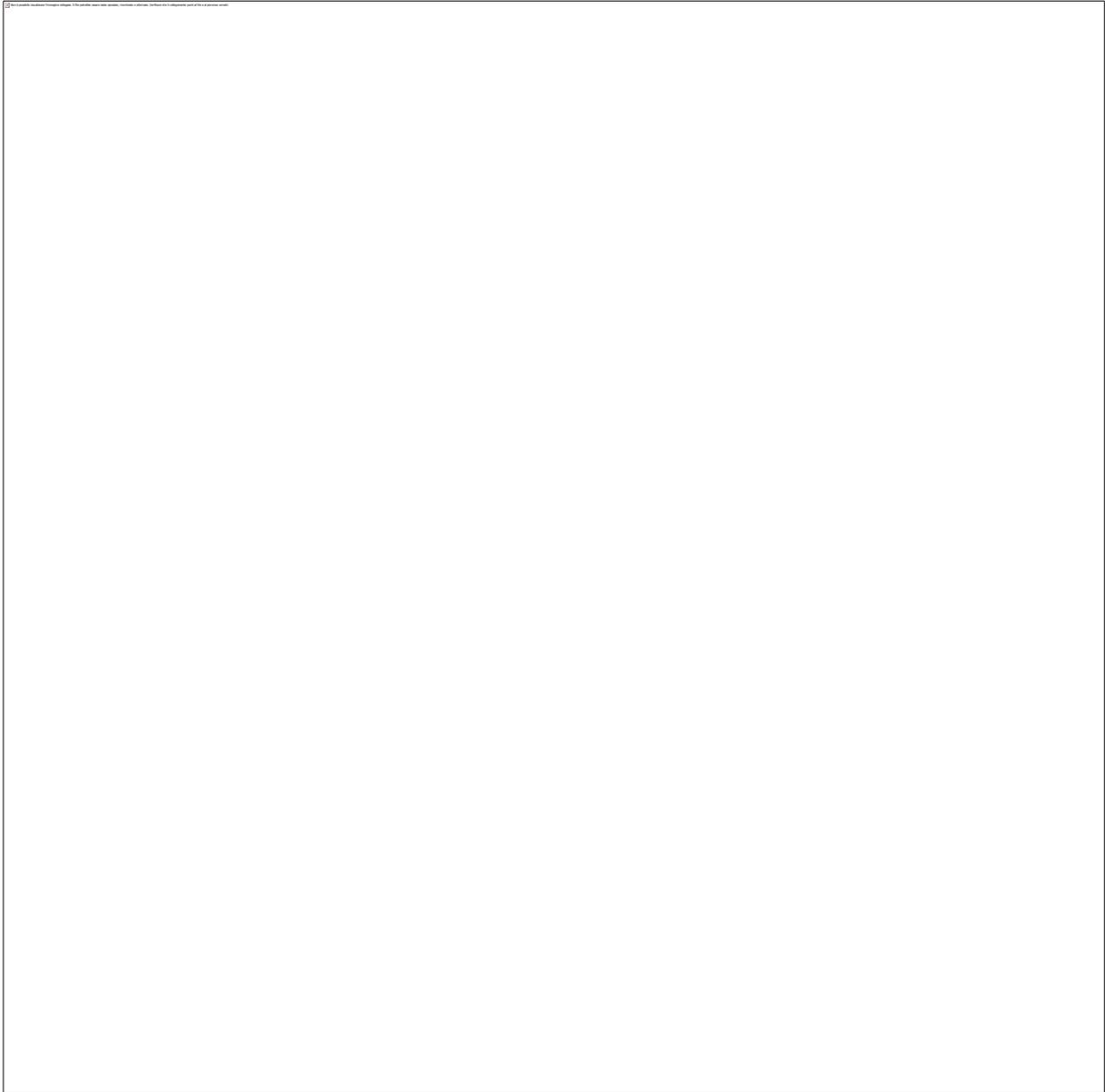
- CF24 – Wall/ceiling detail for cold rooms*
- CF25 – Wall/ceiling detail for cold rooms*
- CF26 – Wall/ceiling corner detail for cold rooms*
- CF27 – Wall/wall corner detail for cold rooms*
- CF28 – Wall and ceiling butt joint detail for cold rooms*
- CF29 – Wall/ceiling detail for cold rooms with thermal break*
- CF30 – Ceiling hangers detail for cold rooms*
- CF31 – Ceiling hangers detail for cold rooms*
- CF32 – Base joint detail for cold rooms*

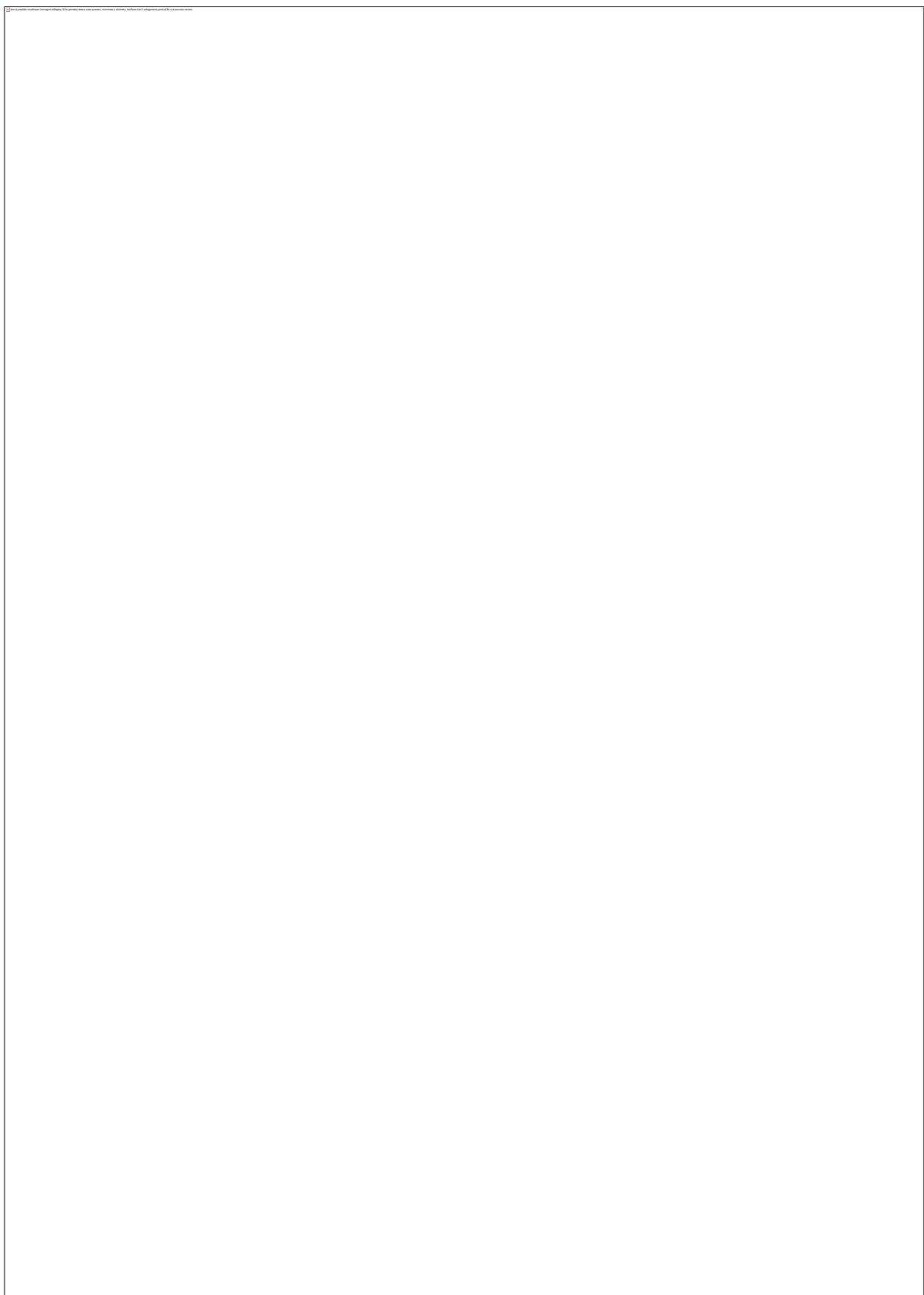
WALL/CEILING DETAIL FOR COLD ROOMS



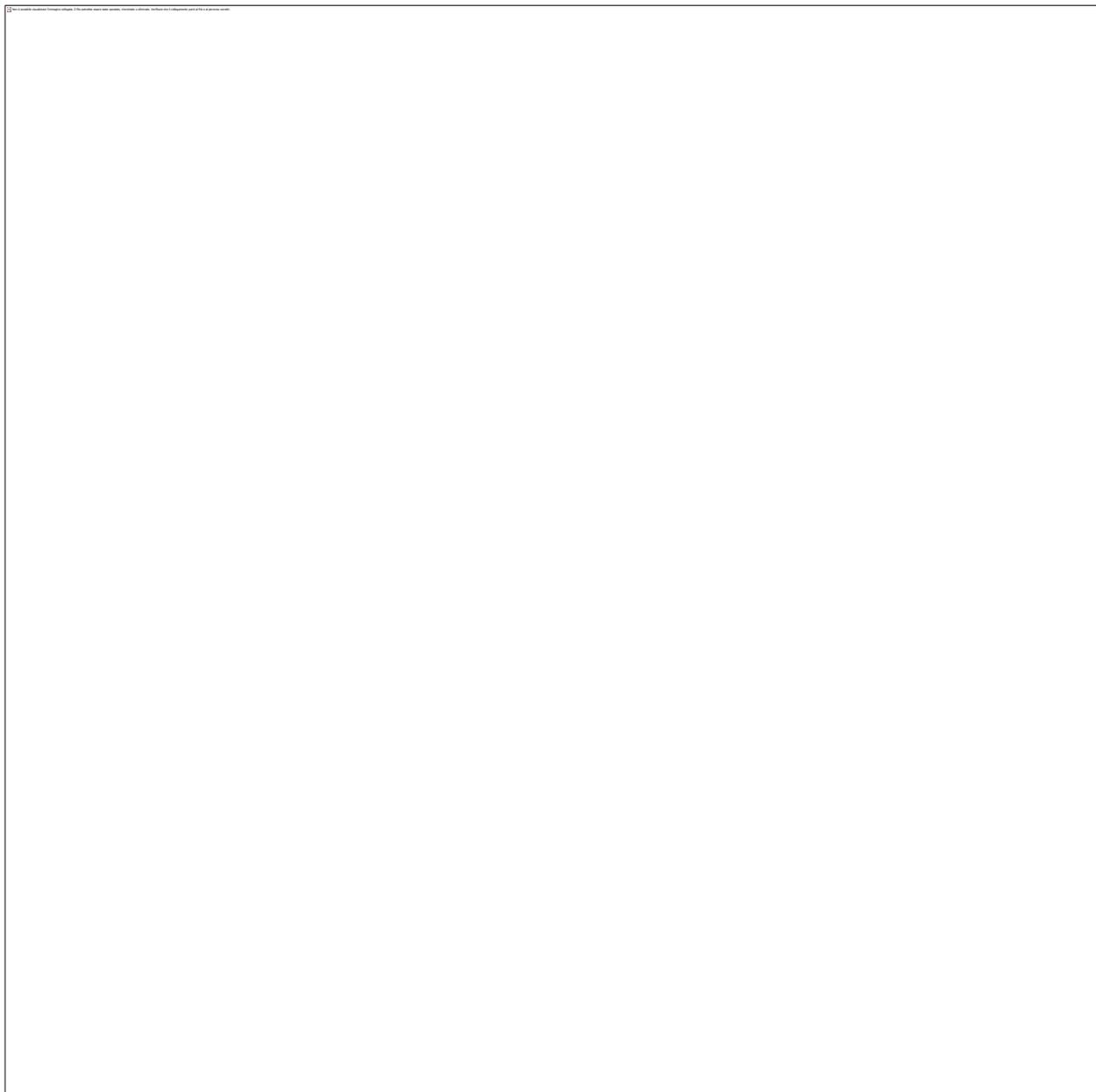


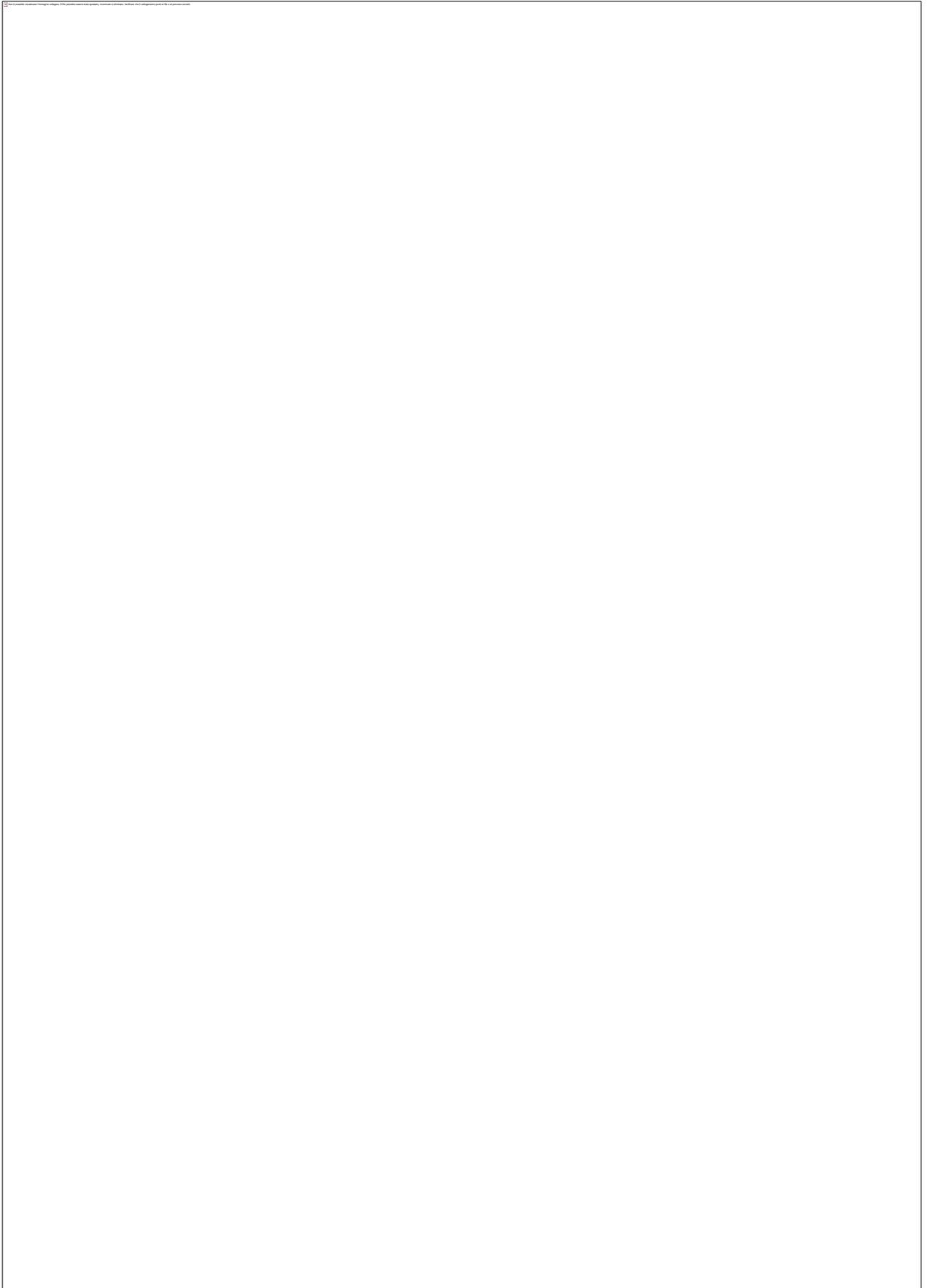
WALL/CEILING DETAIL FOR COLD ROOMS



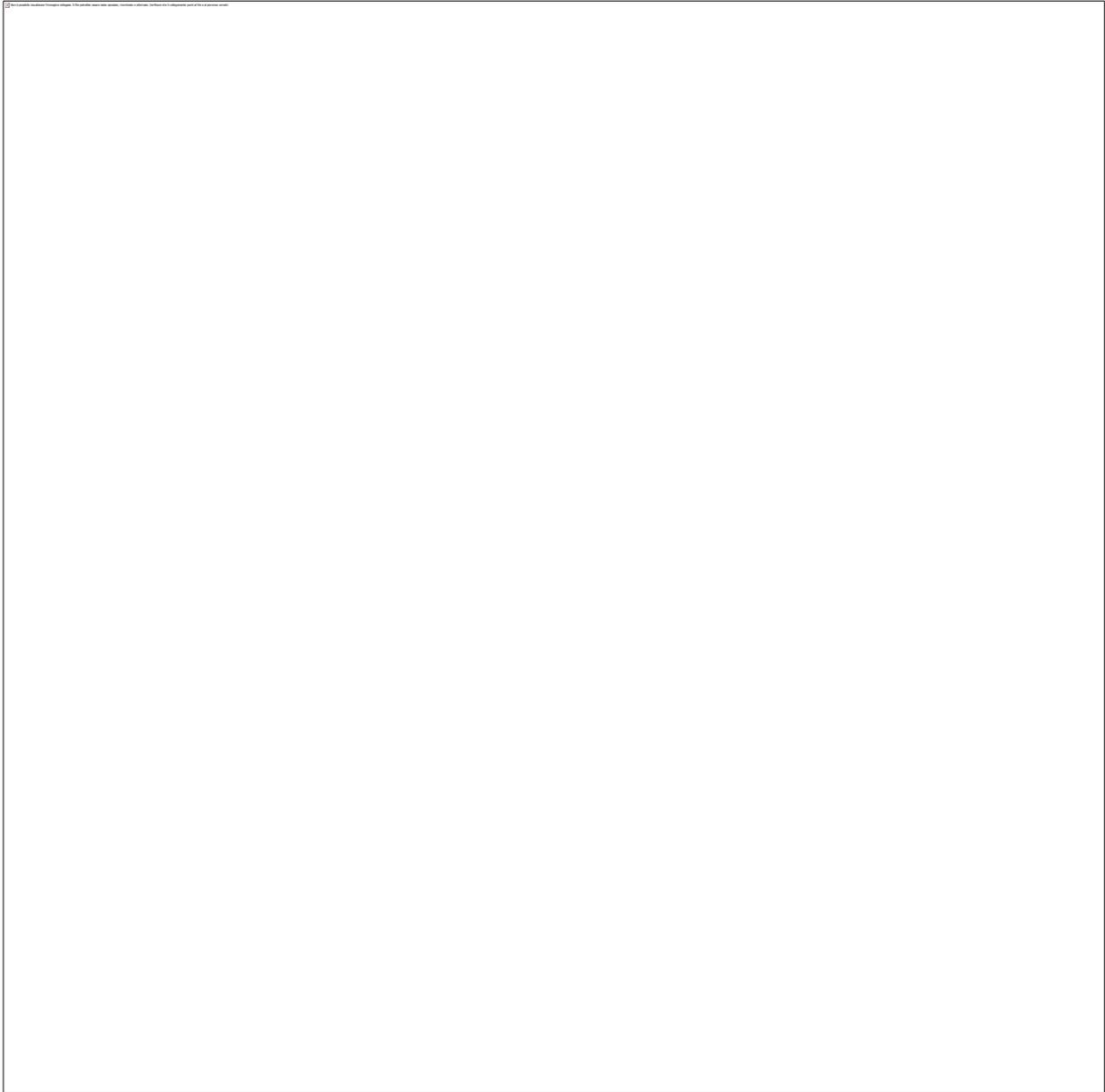


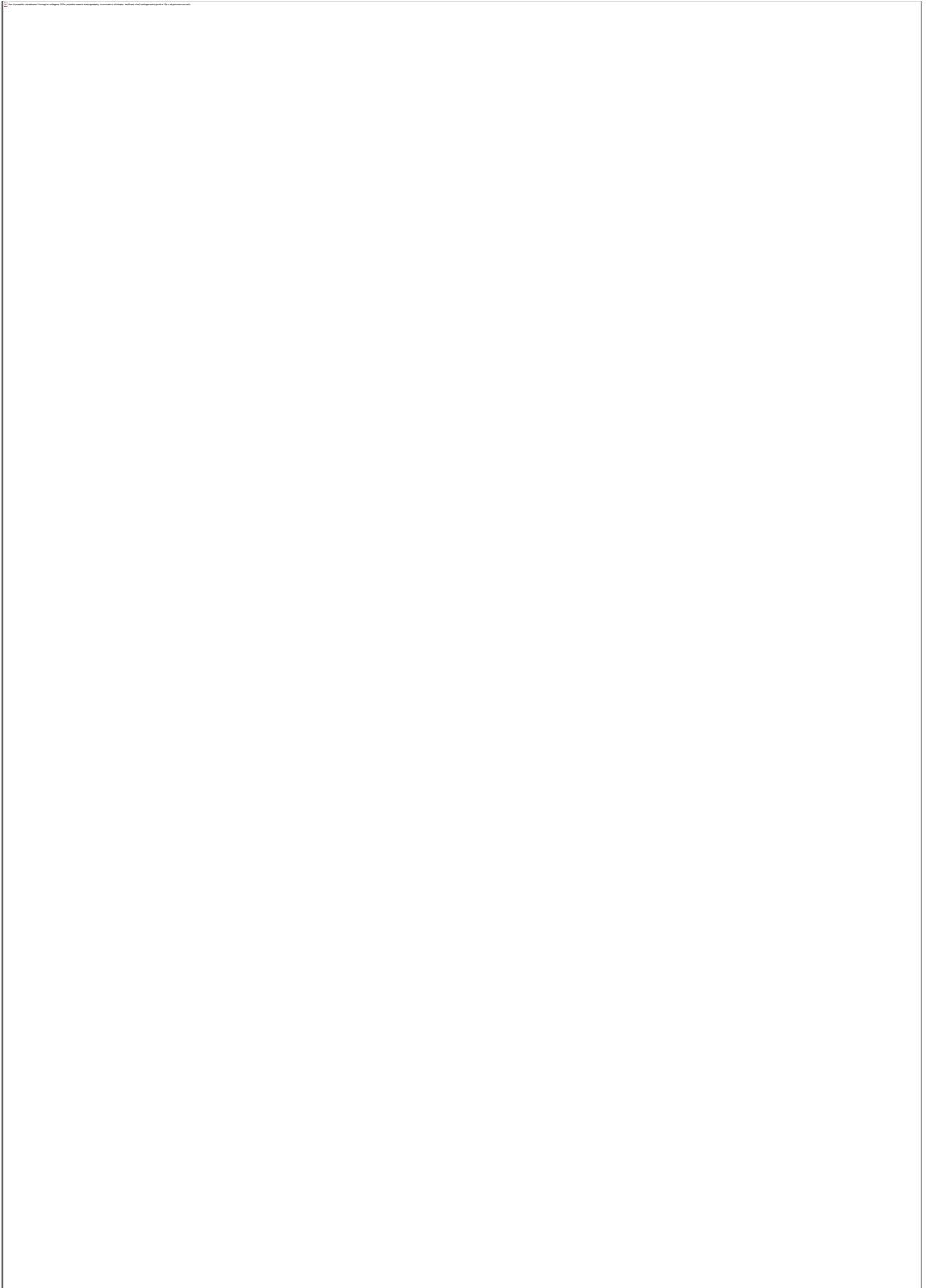
WALL/CEILING CORNER DETAIL FOR COLD ROOMS



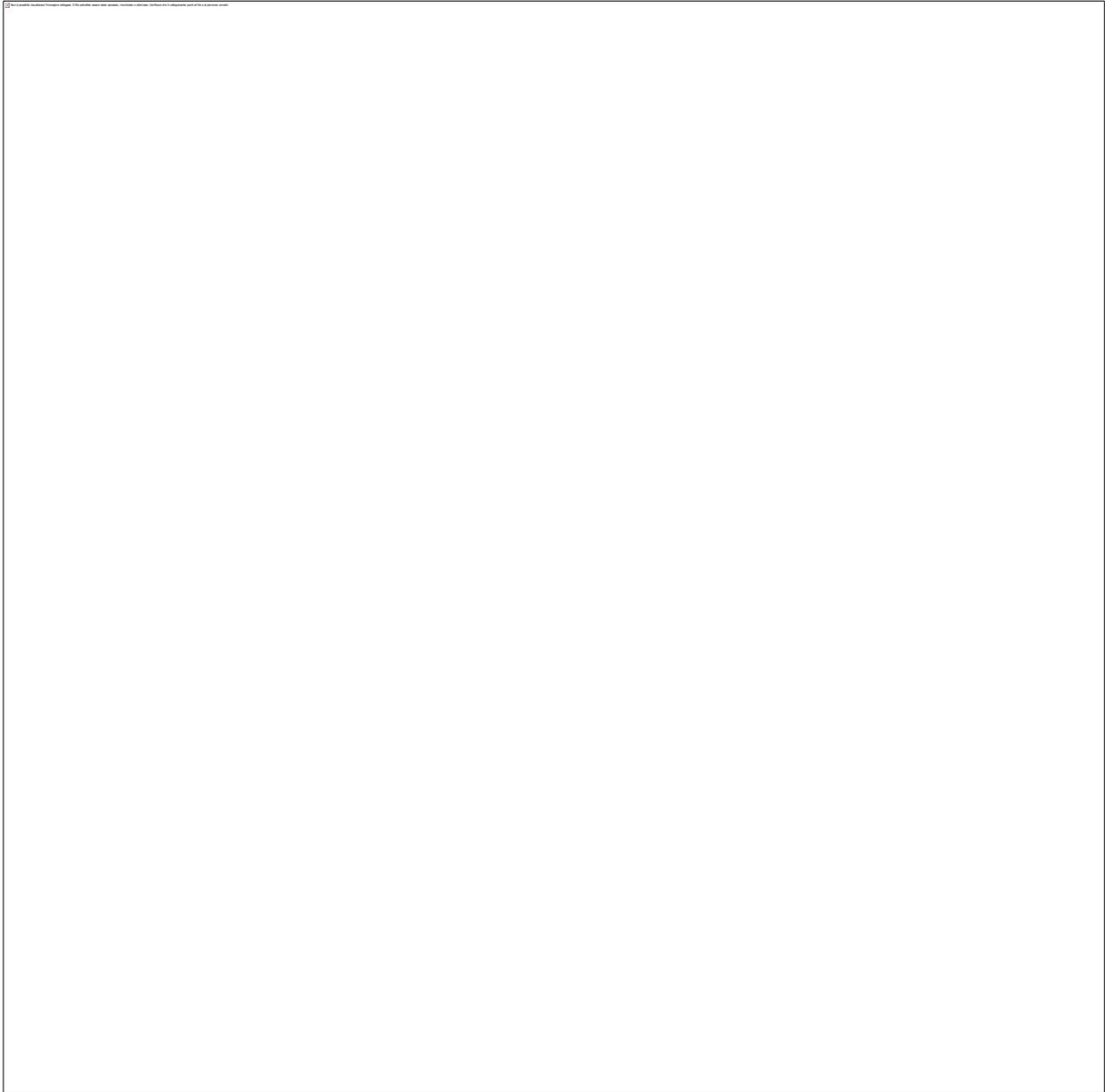


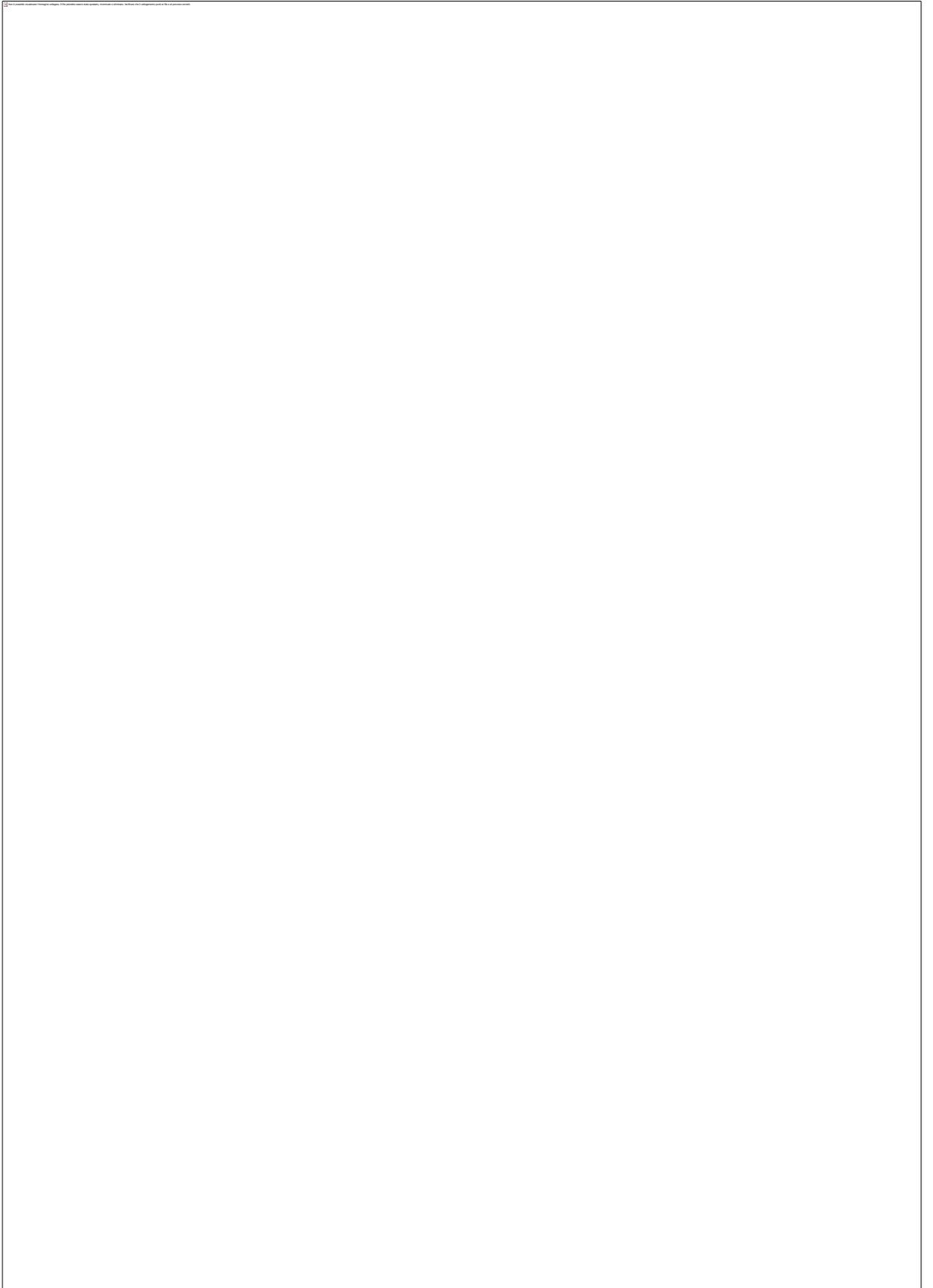
WALL/WALL CORNER DETAIL FOR COLD ROOMS





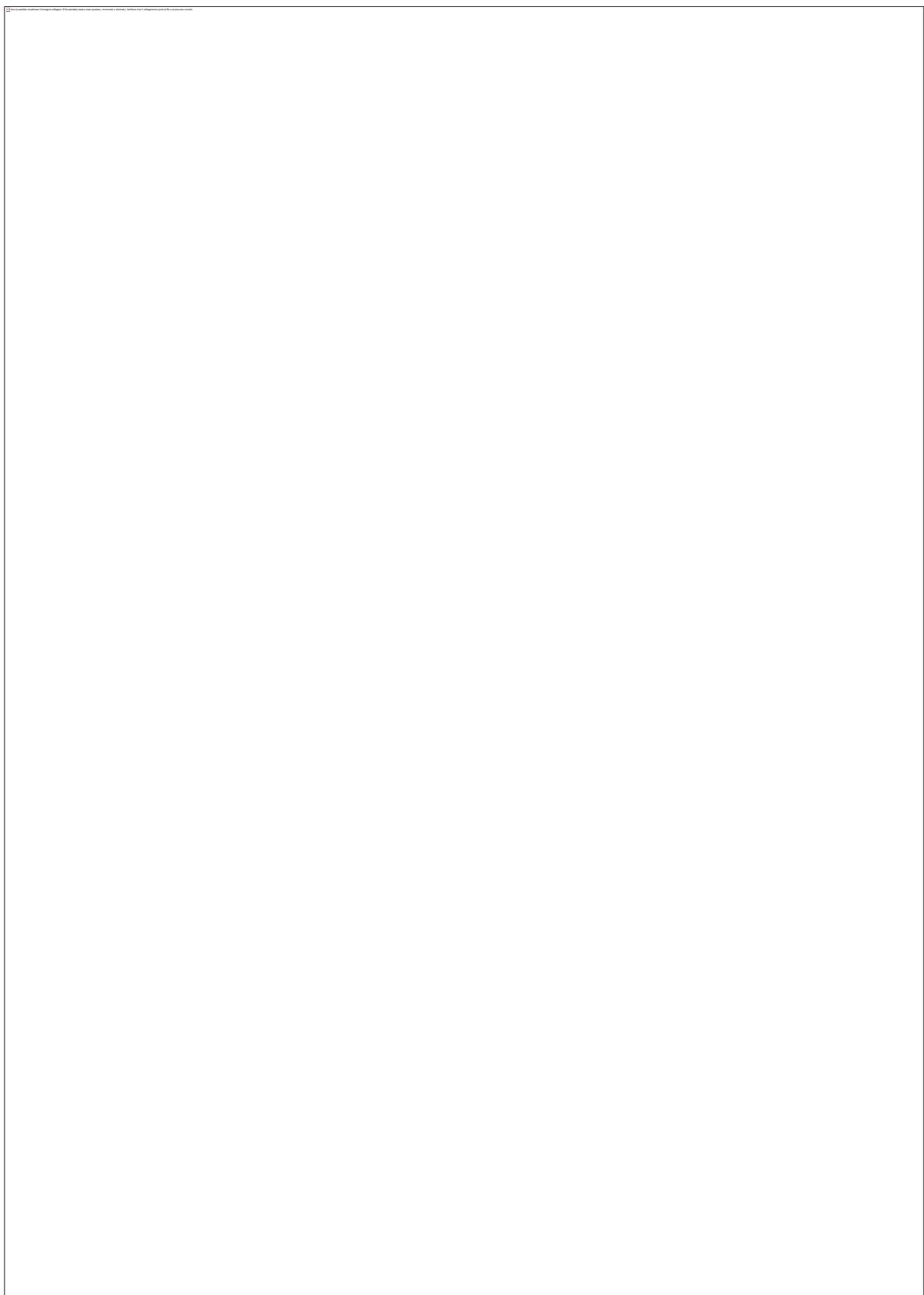
WALL AND CEILING BUTT JOINT DETAIL FOR COLD ROOMS



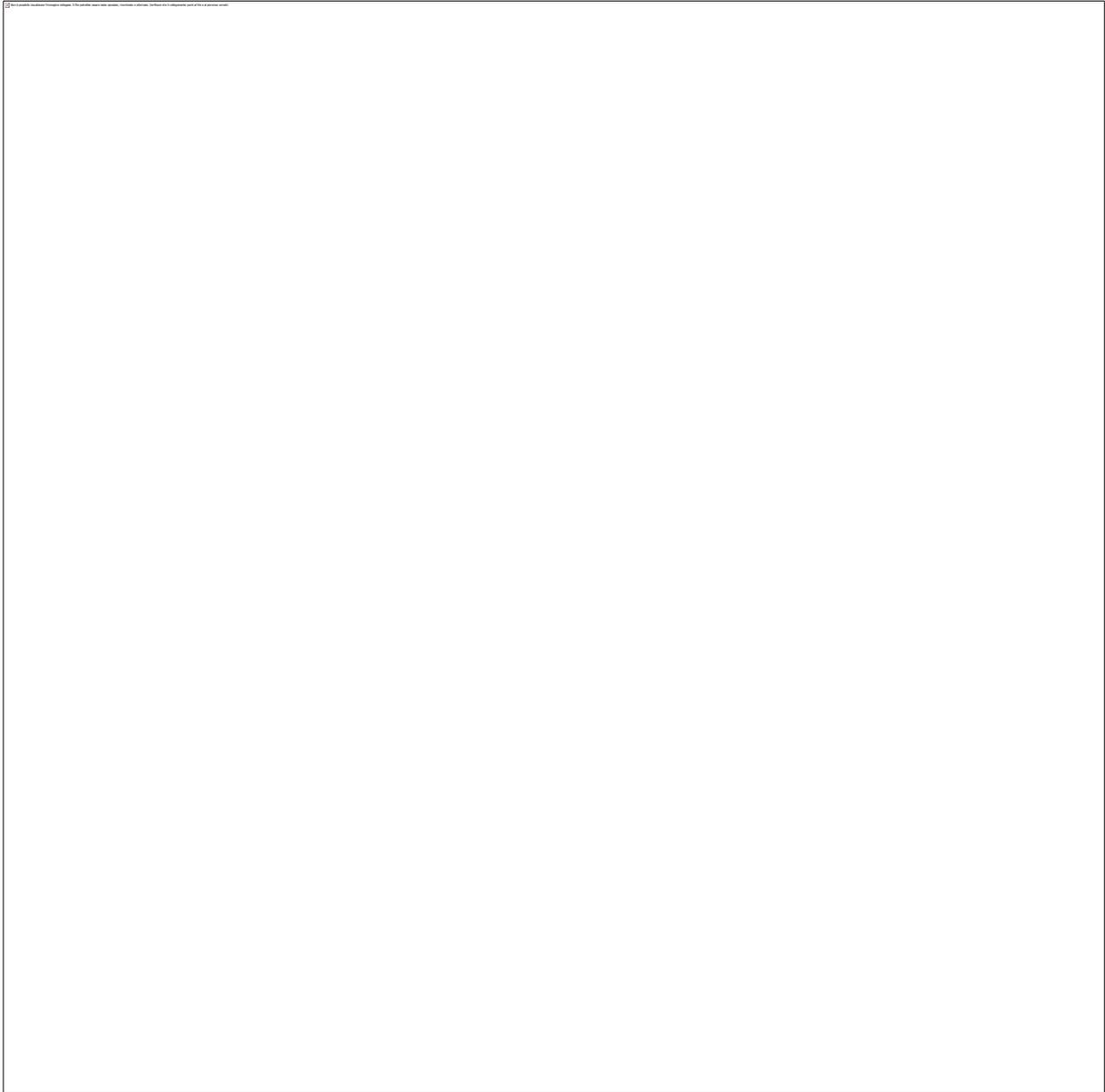


WALL/CEILING DETAIL FOR COLD ROOMS WITH THERMAL BREAK



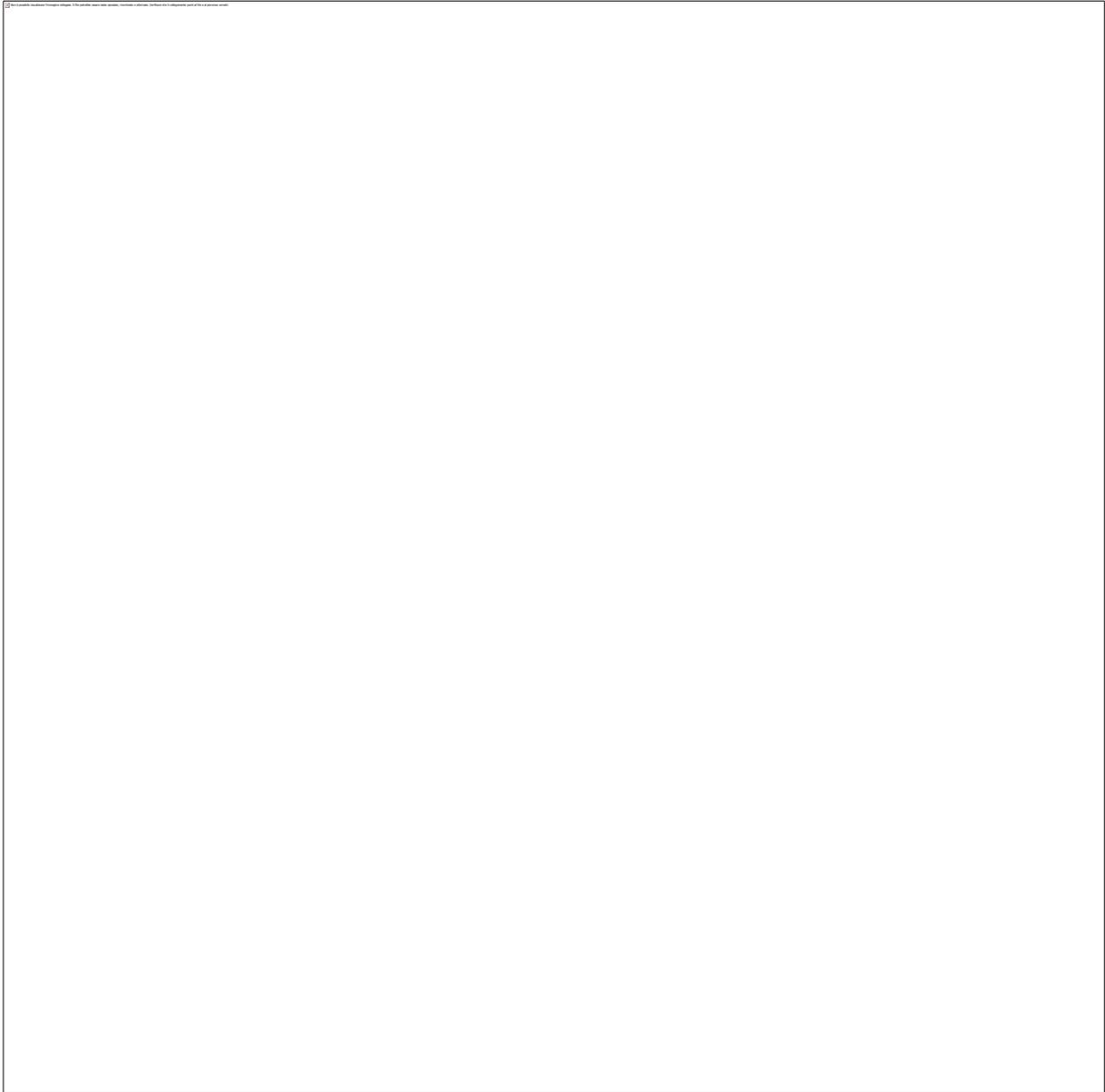


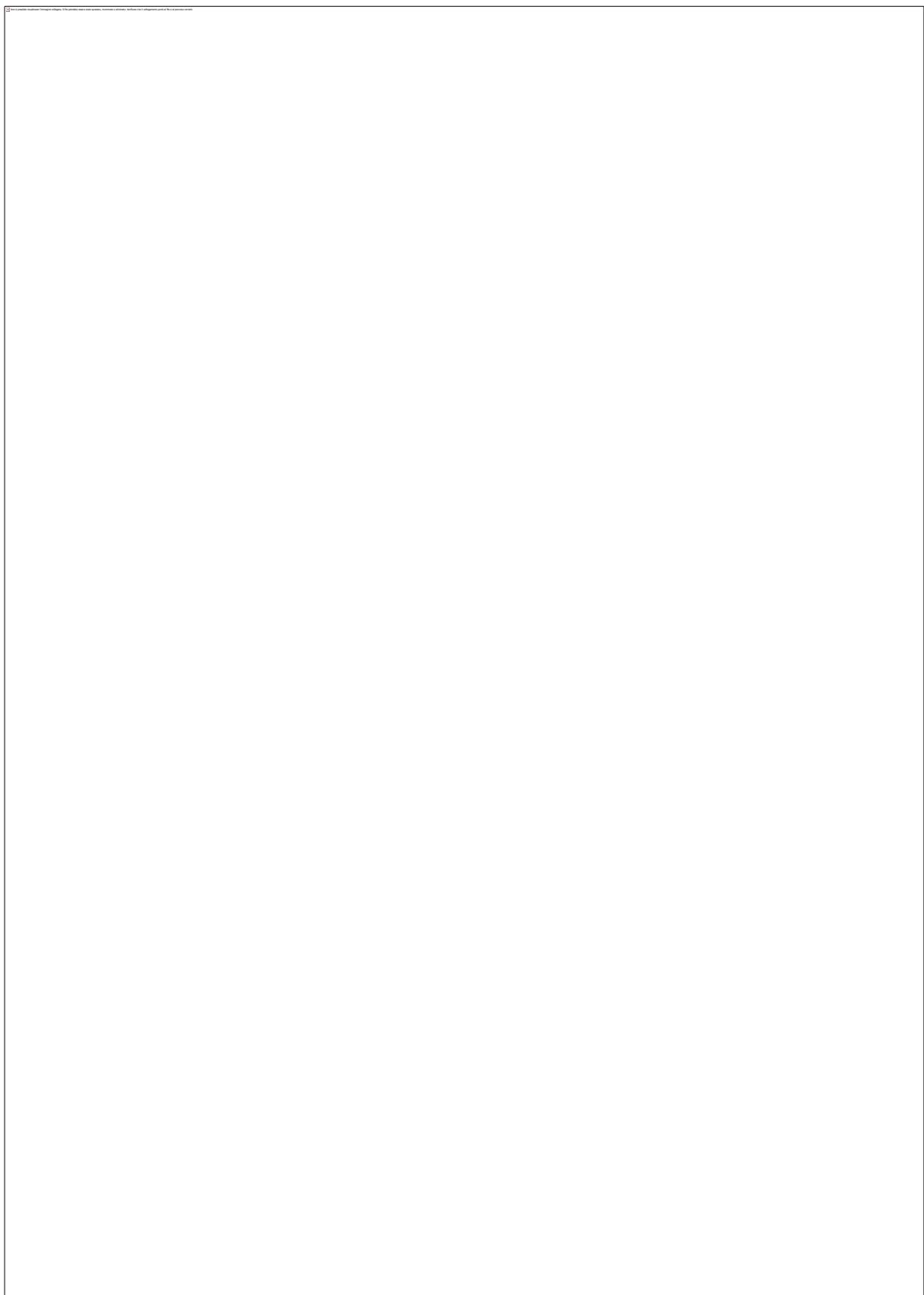
CEILING HANGERS DETAIL FOR COLD ROOMS





CEILING HANGERS DETAIL FOR COLD ROOMS





BASE JOINT DETAIL FOR COLD ROOMS

