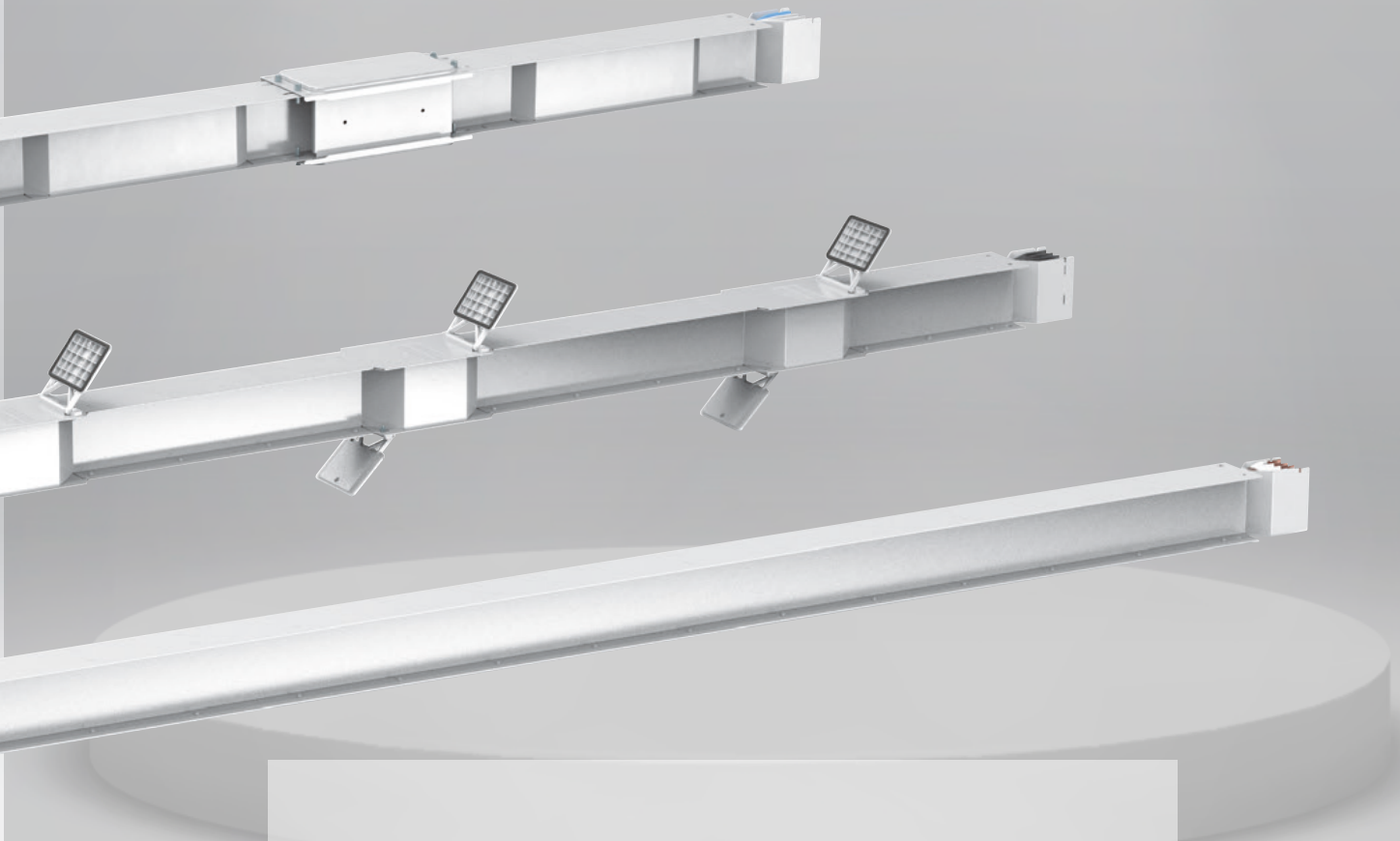




TECHNICAL GUIDE



XCP-S AND XCP-HP BUSBAR SYSTEMS

LEGRAND SUPPORTS YOU ON ALL YOUR PROJECTS

Busbars are essential components in modern electrical distribution, providing efficient, compact, and high-performance power delivery.

Their ability to carry high currents while occupying minimal space, combined with a construction that helps reduce electromagnetic emissions (EMC) in the surrounding environment, makes them an increasingly preferred solution. They simplify installation, support modularity, and adapt to evolving electrical needs, making them ideal for sectors such as data centers, commercial buildings, industrial automation, transportation infrastructure, renewable energy facilities, and large manufacturing plants. Whether for ensuring continuity in mission-critical environments or supporting scalable growth, busbars remain central to delivering safe and reliable power distribution.

As a global specialist in electrical and digital building infrastructures, Legrand provides high-quality, reliable, and flexible busbar solutions designed to meet the demands of these diverse sectors. With a strong focus on performance, modularity, and ease of installation, Legrand's busbar systems are engineered to support your projects with confidence.

Whether you are involved in system design, equipment manufacturing, installation, or maintenance, this guide aims to support informed decision-making by consolidating practical knowledge, engineering principles, and industry best practices. It offers a comprehensive overview of busbar construction, materials, performance criteria, and installation practices, along with insights into how Legrand's expertise and product innovations contribute to robust, future-ready power distribution.

LEGAL INFORMATION

Presentation pictures do not always include Personal Protective Equipment (PPE), but this is a legal and regulatory obligation that must be scrupulously respected.

In accordance with its continuous improvement policy, Legrand reserves the right to change the specifications and illustrations without notice. All illustrations, descriptions and technical information included in this document are provided as indications and cannot be held against Legrand.

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SAFETY INSTRUCTIONS



Any failure to strictly apply the procedures and to respect these recommendations could lead to serious risk of accidents, endangering people and property (in particular, without limitation, risk of burns, electric shocks, etc.).



General information

- Use only the products and accessories recommended by the Legrand Group in the catalogue, instructions, technical data sheets and all other documents provided by Legrand (hereinafter referred to as "the Documentation") in compliance with the installation rules.



Improper installation or use may result in the risk of arcing in the enclosure, overheating or fire. The busbars must be used under normal conditions, they must not be subjected to Voltage / Current / Temperature values other than those specified in the Documentation.

- Legrand declines all responsibility for any modification or repair of the equipment making up the busbars that is not authorized by the Legrand Group, as well as any failure to comply with the rules and recommendations specified by Legrand in the Documentation. In addition, in the cases mentioned above, the warranty granted by Legrand will not be applicable.
- It is necessary to check that the characteristics of the products are appropriate for their environment and use during maintenance operations, and to refer to the Documentation.
- If you have any questions or require clarification, please contact Legrand Group.

Protection/security

- The installation, use and maintenance of the enclosures and their components must be carried out by qualified, trained and authorized personnel, in accordance with the regulations in force in each country.
- The qualified, trained and authorized personnel are in charge of correcting interpretation of the technical documentation, handling and assembling safely the components, verifying the clearances, torque values, and mechanical fixings, executing the tests and inspections before energizing the system, maintenance and troubleshooting in accordance with the product's technical manual.
- People working on the installation must have the appropriate electrical authorizations for the work to be carried out.



- Wear the PPE (Personal Protective Equipment) necessary to work on live products.
- Respect the safety rules related to electrical work.
- Improper electrical and mechanical use of equipment can be dangerous and may result in personal injury or damage to property.

Maintenance

- Depending on the maintenance operations to be carried out, partial or total power cuts of the enclosure concerned should be planned before any work.
- When performing operations that involve access to the inside of the enclosure, be aware of the risk of burns before touching any component
- Before turning the power back on, make sure that there are no foreign bodies and that all physical protections have been put back in place (e.g.: screens, covers, faceplates).



Risk of electric shock, burns and explosion.

The rules and recommendations in this document are based on our knowledge of the typical conditions of use of our products in the fields of application usually encountered. However, it is always the customer's responsibility to verify and validate that Legrand products are suitable for its installation and use.

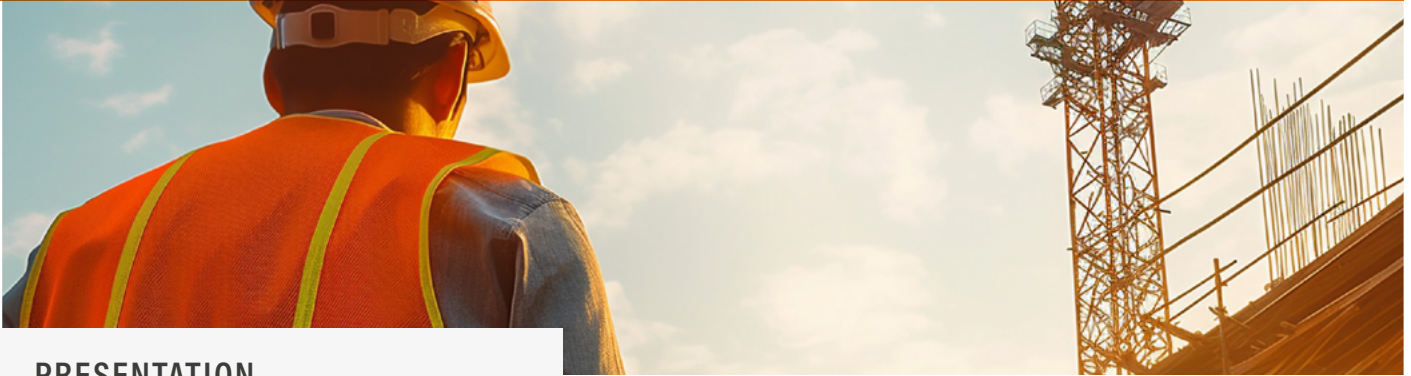
The customer must ensure proper installation, maintenance and operation of the equipment to avoid any risk of injury to personnel or damage to property in the event of product failure, especially for applications that require a very high level of safety (e.g., those in which the failure of a component may endanger human life or health).

The rules for storage, handling, installation and maintenance and the appropriate precautions and warnings must be strictly observed and applied.

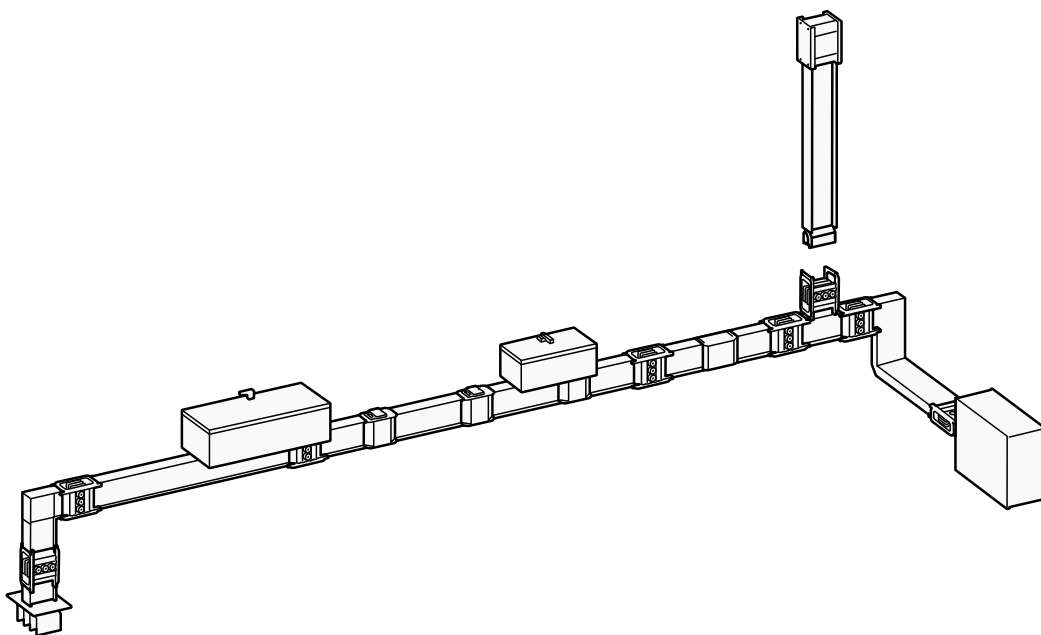


XCP-S AND XCP-HP BUSBAR SYSTEMS

GENERAL OVERVIEW



PRESENTATION



The busbar trunking system is used for the distribution of low voltage electrical energy, particularly suitable for industrial, commercial, and infrastructural environments.

The XCP busbar is a line dedicated to power transport and distribution for data center, medium to large industries and residential buildings. It is particularly appreciated in vertical riser systems in buildings designated for services, commercial, and data processing centers (banks, insurance companies, office buildings, skyscrapers, etc.).

CHARACTERISTICS

- IP 55 & IP 65
- 2 types of conductors : aluminum and copper
- Wide range of tap-off boxes (63 A to 1250 A) able to house protection device (fuses, MCCBs, MCBs, ...)
- Resistant to short-circuit stresses thanks to its ultra compact dimensions
- Electrical connection monobloc pre-installed on each element and mechanical flanges
- Quick to install, easy to manage, flexible to type
- Halogen-free materials



Long-term performance

 The XCP range of Zucchini busbar trunking systems is engineered to deliver a lifespan of **40 to 50 years**, provided that the maximum load does not exceed 70% of the rated current.

To ensure this long-term performance, the busbar system must be installed, used, and maintained in accordance with:


- The manufacturer's original instructions
- The European standard EN 61439-6
- Applicable national laws, standards, and regulations for electrical system design and maintenance

This durability is made possible by:

- The use of top-quality insulating materials
- The selection of high-grade conductors
- The integration of over 50 years of Legrand's experience in research, development, and product design

Conformity to standards and regulations

From a regulatory point of view, the busbar trunking system is assimilated to an electrical panel and must meet the requirements of the IEC EN 61439 standard, relating to low voltage switchgear and control gear assemblies. Among the requirements of the standard, the manufacturer is required to provide a series of technical documents and conformity tests.

 The standard does not impose any distinction on the entity that performs the tests: they can be carried out either by an internal laboratory of the manufacturer or by an independent third-party entity, if it is officially recognized as a certifying body. This allows for some flexibility while maintaining the reliability and traceability of the checks.

Part 6 of the IEC EN 61439 standard defines the busbar trunking system as: "An equipment enclosed in a housing, used to distribute and control electrical energy to all types of loads, consisting of a system of conductors (busbars) separated and supported by insulating material, housed in a duct, channel, or similar enclosure."

Ranges

The XCP busbar system is available in a wide range of sizes to meet various electrical distribution needs:

- From 630 A to 5000 A with aluminum alloy conductors, featuring a galvanic tin-plated surface treatment to ensure safe and long-lasting electrical contact.
- From 800 A to 6300 A with copper conductors specifically designed for electrical applications (Cu ETP - CW004A - A028), compliant with EN 13601 standards, a chemical purity of 99% and with an electrical conductivity greater than 98.3% IACS




The aluminum bars undergo a galvanic tin-plating process, depositing a protective tin layer before assembly. This treatment ensures excellent electrical contact, even when connected to copper plates or bars.

► Therefore, XCP aluminum busbars can be directly connected to copper conductors without any risk of electrical issues or galvanic corrosion between the two materials.

SPECIFICITIES OF XCP-S AND XCP-HP RANGES



 XCP-S and XCP-HP products are manufactured with **Halogen-free materials** and the sealants used are neutral-cure types, (Dow Corning sealants) which are widely adopted in the automotive industry, including environments with automated painting processes. These sealants are **silicone-free**, and compatible with paint processes don't interfere with surface treatments.

The rated current of the busbar, depending on the version, refers to the average ambient temperature:

- XCP-S (Standard performance) at 35°C (as required by the standard)
- XCP-HP (High Performance) at 50°C (55°C for copper busbar), offering the market appropriate oversized products for environments with high average ambient temperatures.



Ranges (continued)

SPECIFICITIES OF XCP-S AND XCP-HP RANGES

In accordance with IEC 61439-6, the rated current of the busbar is guaranteed in all installation positions : horizontal (edgewise - flatwise) and vertical. According to regulatory guidelines, the manufacturer must specify any derating factors in the test report; for the XCP duct, derating factors are not applied, as tests are conducted on a system of representative route elements for all permissible positions.

Ranges composition

In addition to straight elements for transport, both XCP-S and XCP-HP ranges include :



Straight element for distribution
▶ page 50



Expansion element ▶ page 74



Fire barrier element ▶ page 19



Phase transposition element ▶ page 79



"T" element ▶ page 58



Elbows ▶ page 53



Double elbows ▶ page 54



Feed units ▶ page 59



Connection interfaces ▶ page 62

Available in aluminum and copper conductors.

INSTALLATION ENVIRONMENT



INSTALLATION LOCATION

Pollution degree

The pollution degree is for evaluating clearances and creepage distances. The IEC EN 60664-1 standard establishes four degrees of pollution in the micro-environment where the equipment is installed:

POLLUTION DEGREE 1

No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.

POLLUTION DEGREE 2

Only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is to be expected.

POLLUTION DEGREE 3

Conductive pollution occurs, or dry, non-conductive pollution occurs which is expected to become conductive due to condensation.

POLLUTION DEGREE 4

Continuous conductivity occurs due to conductive dust, rain or other wet conditions.



The XCP system is certified for use in environments with **pollution degree 3**, making it suitable :

- ▶ for industrial applications
- ▶ or environments where condensation or the presence of conductive contaminants is expected.



Protection degree : IP 55 & IP 65 (on request)

The XCP busbar trunking system is certified for IP 55 protection degree. On request, it can also be supplied in IP 65 version.



In this configuration, it can only be used for power transport and not for derivation because the integrity of the IP65 enclosure would be compromised at the derivation points.

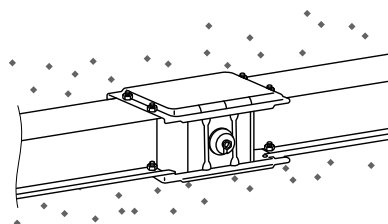
DIFFERENCE BETWEEN IP 55 AND IP 65

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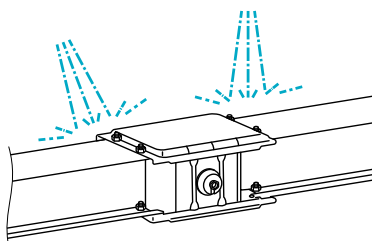
The IP (Ingress Protection) degree defines the level of protection offered by electrical enclosures against the penetration of solid objects and liquids. It is expressed with two digits:

- The first digit indicates protection against the ingress of solid objects (e.g., dust).
- The second digit indicates protection against the ingress of liquids (e.g., water).

IP 5 5

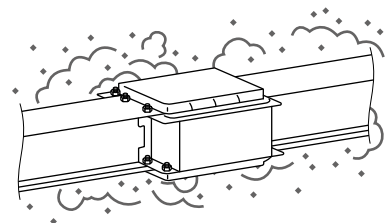


Protection against dust (not completely tight, but sufficient to prevent interference with operation).

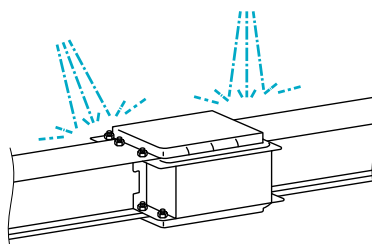


Protection against water jets.
Time duration test 3 min.
Limited ingress permitted.

IP 6 5



Dust tight.
No ingress of dust, 2 to 8 hours.



Protection against water jets.
Time duration test 3 min.
Limited ingress permitted.

INSTALLATION ENVIRONMENT

INSTALLATION LOCATION

Architectural constraints

For XCP ranges, the mounting height is not a critical factor, as the system is fully insulated. The height from the ground of the busbar trunking system can be based on accessibility, safety, and maintenance.

The presence of obstacles or architectural constraints should be taken into account during the design and planning phase.

Environmental parameters for installation

The correct range of the busbar system must take into account the environmental conditions expected at the installation site. Below are the main parameters to consider, with a distinction between indoor and outdoor installations:

	FOR INDOOR INSTALLATIONS	FOR OUTDOOR INSTALLATIONS
Ambient air temperature	From $-5\text{ }^{\circ}\text{C}$ to $+40\text{ }^{\circ}\text{C}$, with a 24-hour average = $35\text{ }^{\circ}\text{C}$	from $-25\text{ }^{\circ}\text{C}$ to $+40\text{ }^{\circ}\text{C}$, with a 24-hour average = $35\text{ }^{\circ}\text{C}$.
Relative humidity	Between 5% and 95%.	Between 15% and 100%
Temperature variation	The average rate of temperature variation, calculated over a 5-minute interval, should not exceed $0.5\text{ }^{\circ}\text{C}/\text{min}$	The average rate of temperature variation, calculated over a 5-minute interval, should not exceed $0.5\text{ }^{\circ}\text{C}/\text{min}$
Condensation	Moderate condensation may occur due to temperature variations	Condensation is expected and must be considered in the choice of enclosure and insulating materials
Wind-driven precipitation and dust	Not expected for indoor installations	Present in outdoor installations. The system must be protected.
Formation of ice	Not expected for indoor installations	Expected for outdoor installations. Appropriate protective measures must be adopted.



The XCP system is certified for indoor installations and meets the above environmental requirements for this type of application.



An exception applies to the XCP-HP busbar trunking system, which is certified to operate under nominal conditions at ambient temperatures up to $50\text{ }^{\circ}\text{C}$ for aluminium conductors and $55\text{ }^{\circ}\text{C}$ for copper conductors.



Special attention must be given to the environmental conditions that the busbar system may encounter before commissioning, particularly during transport, storage, and installation phases. The busbar must be transported, stored and installed in a dry environment, avoiding contact with rain, water, fire sprinkler, chemicals and urine.


If these conditions differ significantly from those defined in the standard reference (e.g., section 7.1 of IEC EN 61439), such as extreme temperatures or humidity levels, a specific agreement must be established between the assembly manufacturer and the user.



Environmental parameters for installation *(continued)*

This agreement should define:

- Acceptable temperature and humidity ranges during non-operational phases
- Packaging and protection measures to prevent mechanical or environmental damage
- Handling procedures to avoid deformation or contamination
- Storage duration limits and conditions (e.g., covered, ventilated, dry areas)

 Failure to comply with agreed transport and storage conditions may compromise the integrity of the insulation system, mechanical stability, or protection degree (IP) of the equipment.

PRESENCE OF WATER FROM A SOURCE OTHER THAN RAIN

Any presence of water from a source other than rain must be evaluated. Conditions may include :

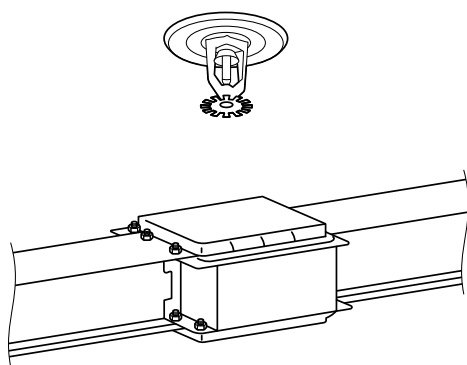
- No exposure
- Vertical dripping
- Water sprayed at an angle up to 60°
- Water splashed from any direction
- Water projected in jets from any direction
- Water projected in powerful jets from any direction

INSTALLATION SITE ALTITUDE

The equipment is designed to operate correctly up to 2000 meters altitude, corresponding to an atmospheric pressure not less than 80 kPa. The XCP system can also be installed above this altitude, thanks to its excellent dielectric properties.


 Consult with the technical site expert before proceeding with installation.

Indoor installation with sprinklers



+

XCP system offers good resistance to water sprays and can be considered suitable for environments equipped with sprinkler systems, provided it is installed according to the manufacturer's recommendations and completed with all required accessories to ensure full sprinkler-proof protection.

 The term "sprinkler-proof" refers to the ability of a system to:

- Withstand accidental or intentional activation of sprinklers, without water penetrating the enclosure.
- Maintain electrical insulation and functionality even in the presence of water sprays from above.

 If the XCP busbar trunking system needs to be installed near a sprinkler pipe, it can be ordered in a sprinkler-proof version.

INSTALLATION LOCATION

Indoor installation with sprinklers (*continued*)

LIST OF ACCESSORIES AND OPERATIONS REQUIRED FOR THE XCP LINE TO BE DECLARED SPRINKLER-PROOF

- Busbar element

JOINTS

In order to make a standard element IP 55 sprinkle proof, the kit of joint to be used is the one provided for IP65, but it must be assembled following the sprinkler-proof instructions.



For more information, please refer to the instruction sheet.

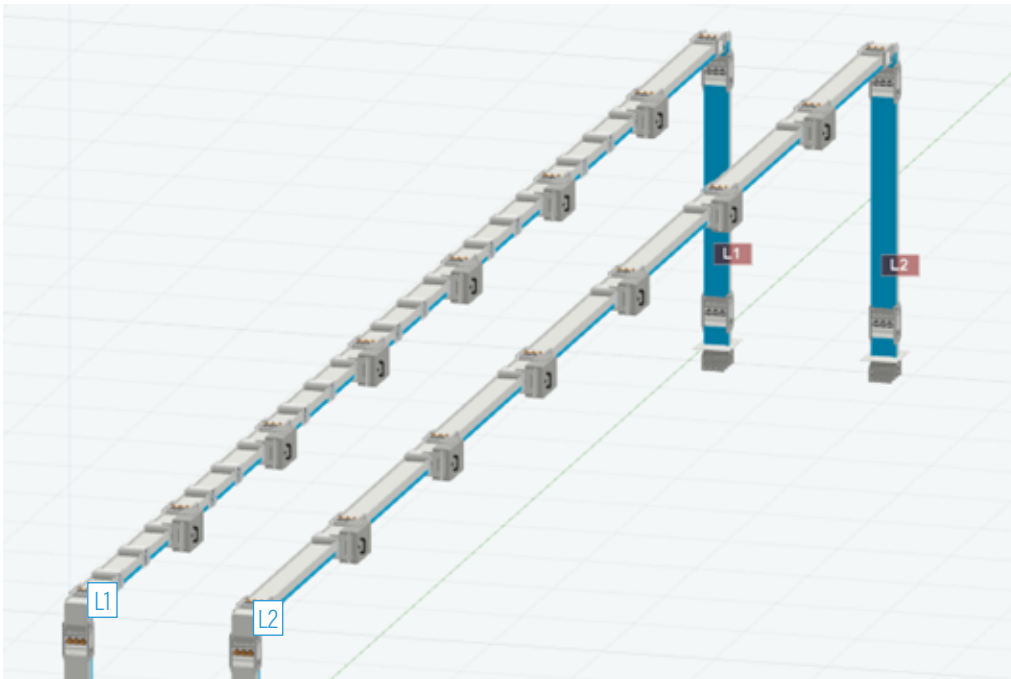
OUTLETS

If not used (no tap-off box installed), the derivation outlet must be protected using the appropriate accessory following the sprinkler-proof instructions.

- End cover unit

End feed units available are standard IP 55, and they are sprinkler-proof.

Example of installation :



The straight section between the two elbows is required to be sprinkler-proof in terms of protection rating.

Line L1 consists of standard 3+3 elements, while line L2 consists of elements with a derivation window, in which the Tap-off box is inserted.

Comparison of two XCP lines developed with the PSZ software.



Indoor installation with sprinklers (continued)

LIST OF ACCESSORIES AND OPERATIONS REQUIRED FOR THE XCP LINE TO BE DECLARED SPRINKLER-PROOF (CONTINUED)

Example of installation (continued)

PRODUCTS TO ORDER IF SPRINKLER PROOF BUSBARS ARE REQUESTED - OPTION 1							
ID	CAT.NOS	QUANTITY	DESCRIPTION	A	B	C	U
L1.01	63281007P	1	XCP-HP AI 2000 A board-trans feed RH std	300	0	0	200
L1.02	63280187P	1	XCP-HP AI 2000 A feeder element L=2001-2500	2150	0	0	0
L1.03	63280317P	1	XCP-HP AI 2000 A horizontal elbow LH std	300	300	0	0
L1.04	63280137P	1	XCP-HP AI 2000 A straight length L=3 m 3+3 outlets	3000	0	0	0
	50484021	1	XCA Tap-off box 63A 3x FUS NH00				
L1.05	63280137P	1	XCP-HP AI 2000 A straight length L=3 m 3+3 outlets	3000	0	0	0
	50484021	1	XCA Tap-off box 63A 3x FUS NH00				
L1.06	63280137P	1	XCP-HP AI 2000 A straight length L=3 m 3+3 outlets	3000	0	0	0
	50484021	1	XCA Tap-off box 63A 3x FUS NH00				
L1.07	63280137P	1	XCP-HP AI 2000 A straight length L=3 m 3+3 outlets	3000	0	0	0
	50484021	1	XCA Tap-off box 63A 3x FUS NH00				
L1.08	63280137P	1	XCP-HP AI 2000A straight length L=3 m 3+3 outl.	3000	0	0	0
	50484021	1	XCA Tap-off box 63A 3x FUS NH00				
L1.09	63280137P	1	XCP-HP AI 2000A straight length L=3 m 3+3 outl.	3000	0	0	0
	50484021	1	XCA Tap-off box 63A 3x FUS NH00				
L1.10	63280187P	1	XCP-HP AI 2000A feeder element L=2001-2500	2050	0	0	0
L1.11	63280317P	1	XCP-HP AI 2000A horizontal elbow LH std	300	300	0	0
L1.12	63280187P	1	XCP-HP AI 2000A feeder element L=2001-2500	2150	0	0	0
L1.13	63281017P	1	XCP-HP AI 2000A board-trans feed LH std	300	0	0	200
	65202004	4	XCA B210 hanger suspension				
	65202013	15	XCA single bracket for flatwise installation				
	IP65 joint	8	XCP IP65 COVER JOINT				
	67003601P	30	XCP KIT SHUTTER SPRINKLER PROOF				

PRODUCTS TO ORDER IF SPRINKLER PROOF BUSBARS ARE REQUESTED - OPTION 2							
ID	CAT.NOS	QUANTITY	DESCRIPTION	A	B	C	U
L2.01	63281007P	1	XCP-HP AI 2000A board-trans feed RH std	300	0	0	200
L2.02	63280187P	1	XCP-HP AI 2000A feeder element L=2001-2500	2150	0	0	0
L2.03	63280317P	1	XCP-HP AI 2000A horizontal elbow LH std	300	300	0	0
L2.04	63280237P	1	XCP-HP AI 2000A straight length L=3 m+outl. Spec	3000	0	0	0
			[d5=2350 d6=2350]				
	50484021	1	XCA Tap-off box 63A 3x FUS NH00				
L2.05	63280237P	1	XCP-HP AI 2000A straight length L=3 m+outl. Spec	3000	0	0	0
			[d5=2350 d6=2350]				
	50484021	1	XCA Tap-off box 63A 3x FUS NH00				
L2.06	63280237P	1	XCP-HP AI 2000A straight length L=3 m+outl. Spec	3000	0	0	0
			[d5=2350 d6=2350]				
	50484021	1	XCA Tap-off box 63A 3x FUS NH00				



INSTALLATION LOCATION

Indoor installation with sprinklers (*continued*)

LIST OF ACCESSORIES AND OPERATIONS REQUIRED FOR THE XCP LINE TO BE DECLARED SPRINKLER-PROOF (*CONTINUED*)

Example of installation (*continued*)

PRODUCTS TO ORDER IF SPRINKLER PROOF BUSBARS ARE REQUESTED - OPTION 2							
ID	CAT.NOS	QUANTITY	DESCRIPTION	A	B	C	U
L2.07	63280237P	1	XCP-HP AI 2000A straight length L=3 m+outl. Spec [d5=2350 d6=2350]	3000	0	0	0
	50484021	1	XCA Tap-off box 63A 3x FUS NH00				
L2.08	63280237P	1	XCP-HP AI 2000A straight length L=3 m+outl. Spec [d5=2350 d6=2350]	3000	0	0	0
	50484021	1	XCA Tap-off box 63A 3x FUS NH00				
L2.09	63280237P	1	XCP-HP AI 2000A straight length L=3 m+outl. Spec [d5=2350 d6=2350]	3000	0	0	0
	50484021	1	XCA Tap-off box 63A 3x FUS NH00				
L2.10	63280187P	1	XCP-HP AI 2000A feeder element L=2001-2500	2050	0	0	0
L2.11	63280317P	1	XCP-HP AI 2000A horizontal elbow LH std	300	300	0	0
L2.12	63280187P	1	XCP-HP AI 2000A feeder element L=2001-2500	2150	0	0	0
L2.13	63281017P	1	XCP-HP AI 2000A board-trans feed LH std	300	0	0	200
	65202004	4	XCA B210 hanger suspension				
	65202013	15	XCA single bracket for flatwise installation				
	IP65 joint	8	XCP IP65 COVER JOINT				
	67003601P	6	XCP KIT SHUTTER SPRINKLER PROOF				

To ensure that the line is guaranteed to be resistant to the sprinkler, the following codes must be ordered:

- XCP IP 65 cover joint
- XCP Kit shutter sprinkle proof (Cat.No 67003601P)

Scenario L2 involves using the busbar without outlets for transportation and only using the busbar with outlet where current branching is needed. This allows for a significant reduction in the use of «XCP SPRINKLER PROOF SHUTTER KIT» which have a significant impact on the final pricing.



Installation in explosive atmospheres (ATEX)

For some applications involving explosive atmospheres or functional safety, compliance with the requirements of other standards or legislation in addition to those specified in the IEC 61439 series might be required.

In the presence of potentially explosive atmospheres, the design and installation of busbar trunking systems must comply with the European ATEX directives (ATmosphères EXplosibles), specifically:

- Directive 2014/34/EU (ATEX 114): concerns equipment and protective systems intended for use in potentially explosive atmospheres.
- Directive 1999/92/EC (ATEX 153): concerns the safety and health protection of workers potentially at risk from explosive atmospheres.

REQUIREMENTS FOR BUSBAR TRUNKING SYSTEMS

The busbar trunking system :

- installed in classified zones must be ATEX certified and marked with the Ex symbol.
- must be selected according to the gas or dust group, temperature class, and type of protection (e.g., Ex e, Ex d, Ex t).
- must be installed by qualified personnel, in accordance with the manufacturer's instructions and applicable regulations.



The XCP system is not certified for installation in explosive atmospheres. If required, alternative solutions specifically designed and certified for ATEX environments must be considered.

Installation in humid and aggressive environments

In environments with high humidity or aggressive atmospheric conditions (e.g., industrial, coastal, or chemical areas), busbar trunking systems must comply with specific environmental performance requirements defined in IEC 61439-1.

CORROSIVE RESISTANCE

To ensure long-term durability, accessible metallic parts must resist corrosion. This is verified through standardized tests such as:

- Salt spray test (IEC 60068-2-11)
- SO₂ gas test (IEC 60068-2-42)



XCP demonstrates compliance with the corrosion resistance criteria under Severity A conditions, the highest level set by the standard.

Severity A test procedure includes:

- Six cycles of 24 hours each of damp heat cycling, according to IEC 60068-2-30:2005 (Test Db), at 40 ± 2 °C. Variant 1 or 2 is selected as recommended by Annex A of the standard.
- Followed by two cycles of 24 hours each of salt mist exposure, according to IEC 60068-2-11:1981 (Test Ka), at 35 ± 2 °C.

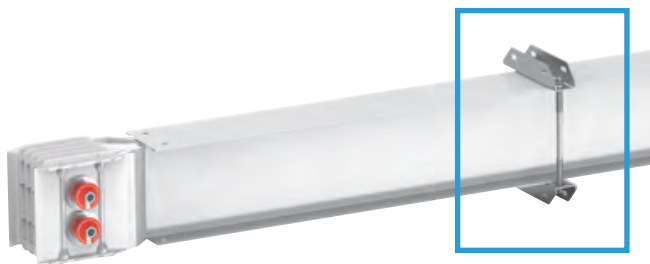


These tests simulate the combined effects of humidity and salt-laden air, ensuring the system's resistance to corrosion in the harshest environments.




Installation in humid and aggressive environments (*continued*)

CORROSIVE RESISTANCE (CONTINUED)



For installations in highly aggressive atmospheres, it is strongly recommended to **order stainless steel fixing brackets**. The standard brackets are made of galvanized steel, which may deteriorate over time when exposed to aggressive agents.


On surface protection and fixing accessories, the standard **RAL 7035 painted finish** applied to the XCP busbar trunking system already provides **excellent resistance** to corrosion and is sufficient to pass the environmental tests described above.

 If higher performance is required—particularly in highly aggressive atmospheres—it is possible to evaluate, in consultation with the technical site expert, the replacement of the standard painted steel with more noble materials, such as Magnelis, which offers superior corrosion resistance.

If it is required that the busbar ducts be painted with specific colors or coatings, this request must be explicitly communicated and evaluated by Legrand during the project quotation phase.

In such cases, the painting process is carried out at our production facilities, following qualified and codified procedures that ensure:

- Mechanical integrity
- Thermal and electrical performance
- Compliance with applicable standards

 Please note that any post-installation painting of our busbar systems is not covered by the product standard and is not considered during the design and engineering of the product itself.

If the customer chooses to perform post-installation painting independently, it is important to understand that this may alter the system's performance. As a result, **Legrand may no longer recognize the product warranty**.



Installation in humid and aggressive environments (*continued*)

THERMAL STABILITY

The thermal stability test verifies that insulating and structural materials maintain their mechanical and dimensional integrity when exposed to elevated temperatures.

The test involves **exposure to 70 ± 2 °C for 168 hours**, followed by inspection for deformation, cracking, or loss of function.



XCP demonstrates excellent resistance to prolonged thermal stress without any degradation of performance or structure.

RESISTANCE OF INSULATING MATERIALS TO ABNORMAL HEAT AND FIRE DUE TO INTERNAL EFFECTS

This test simulates internal faults (e.g., overheating or short circuits) using the glow-wire test (IEC 60695-2-10), which applies a heated wire to the material to assess its fire resistance.

Test temperatures vary depending on the function of the part:

960 °C

For parts necessary to retain **current-carrying components** in position.

850 °C

For enclosures intended to be installed in **hollow walls**.

650 °C

For all other parts, including those retaining the **protective conductor** or intended to be embedded in or mounted on **combustion-resistant walls**.



XCP demonstrates full compliance with glow-wire tests, confirming the high fire resistance of its insulating materials and their ability to prevent fire propagation in case of internal faults.



INSTALLATION LOCATION

Installation of busbar trunking systems in marine environments

Marine environments present unique challenges for electrical installations due to:

- High levels of humidity and salinity, which contribute to corrosion and material degradation.
- Continuous mechanical vibrations, caused by engine operation, wave motion, and structural dynamics of the vessel.

These factors require that all components used in marine applications to be specifically designed and tested to withstand such conditions.

VIBRATION RESISTANCE AND CERTIFICATION



The XCP busbar trunking system has been tested and verified for use in marine environments.

When installed according to the manufacturer's marine installation guidelines, the system is certified to withstand vibration tests, including those performed on a vibration table. This ensures that the system maintains its mechanical integrity and electrical performance even under prolonged exposure to vibration, as typically encountered on ships, offshore platforms, and other marine structures.



To ensure proper performance in marine environments:

Use only components and accessories rated for marine use.

Follow the specific installation instructions for vibration-resistant mounting.

Ensure that all metallic parts are protected against corrosion (e.g., through coatings or materials selection).

Verify compatibility with the vessel's structural and environmental conditions.

Insulation class of materials (Class B and F)

The insulation class defines the maximum operating temperature of insulating materials:

- Class B: up to 130 °C
- Class F: up to 155 °C

In its standard configuration, the XCP system uses Class B insulating material for electrical insulation of the bars.



Class F insulated bars can be ordered upon request.



The remaining plastic components of the trunking system are already Class F rated, therefore it is possible to achieve a fully Class F compliant system when needed.



Fire resistance and flame propagation

In case of fire, busbar trunking systems must limit flame spread and ensure continuity of service, especially in critical environments such as public buildings, tunnels, and industrial facilities.

FLAME PROPAGATION

This test is suitable for all types and sizes of BTUs and is designed to assess the flame propagation resistance of busbar trunking systems (BTS) under typical installation and grouping conditions. The test is performed according to IEC 60332-3-10, with a flame exposure time of 40 minutes. The material passes if the flame self-extinguishes and does not propagate beyond a defined height.



XCP system uses self-extinguishing materials compliant with IEC 60332-1, ensuring limited flame spread.

FLAME PROPAGATION ON WALLS ON FLOORS

The objective of the flame propagation test is to evaluate the behavior of the busbar installed in a building and subjected to specific temperature and pressure conditions. This testing method allows for quantifying the capability of an element to withstand exposure to high temperatures by setting criteria that assess functions such as load-bearing capacity, fire containment (integrity), and heat transmission (insulation).

During the test, the furnace follows a standardized heating curve, and during the test, the average furnace temperature is monitored. Additionally, the pressure distribution within the furnace along its height is primarily influenced by the upward movement of gases and is therefore monitored throughout the entire test.

This test simulates a real installation scenario and the technical standard, (IEC 61439-6) in paragraph 10.102, speak about the resistance to fire penetration in the building.

The standard explains that the test shall be performed according to ISO 834-1, for fire resistance times of 60 min, 90 min, 120 min, 180 min or 240 min and on a representative straight length BTU sample. The tests were conducted according to the EN 1363 "Fire Resistance Test" standard, which is technically based on an ISO 834-1 "Fire Resistance Tests".


The test can be terminated for the following reasons:

- safety of personnel or imminent damage to equipment;
- fulfillment of the adopted criteria;
- request by the client.

The result of the test is determined by integrity and insulation.

Integrity is measured by the number of minutes the product maintains its separation functions without causing ignition on the cotton pad, without developing cracks large enough to allow the penetration of the control gauge, and without producing sustained flames. Insulation is measured by the number of minutes the test specimen maintains a temperature below 180°C on its unexposed surface or does not exhibit a temperature increase exceeding 140°C above the initial average temperature.

According to the standard 1366-3 (Fire resistance tests for service installations), which is applied in conjunction with UNI EN 1363-1, for each shape of busbar and each conductor material **the maximum number of conductors and the maximum cross section area of the conductors shall be tested**. Busbar with two or more conductors for each phase shall be treated as a separate shape. If both orientations of the conductors (vertical and horizontal) are to be covered, both orientations shall be tested.

 Results from the maximum sized busbar are also valid for smaller busbar (smaller cross section area of the conductors / less number of conductors) of the same type.



INSTALLATION ENVIRONMENT

INSTALLATION LOCATION

Fire resistance and flame propagation (*continued*)

FLAME PROPAGATION ON WALLS ON FLOORS (*CONTINUED*)



Thanks to its [integrated fire-stop barrier](#), the XCP system has been tested according to EN 1366-3 and achieves a minimum fire resistance rating of EI 120 (i.e., 120 minutes of integrity and insulation).

► This makes it [suitable for installations requiring fire compartmentation and service continuity during fire events](#).

TEST RESULTS OBTAINED BY XCP-HP

PRODUCT	RATING	MATERIAL	N°CONDUCTORS	ORIENTATION	EI	E
XCP-HP	2000	Al	5	Edgewise	240	240
	2000	Al	5	Flatwise	120	240
	2000	Al	5	Floor	180	180
	4000	Al	5	Edgewise	120	240
	4000	Al	5	Flatwise	120	240
	4000	Al	5	Floor	120	180
	5000	Al	5	Edgewise	120	240
	5000	Al	5	Flatwise	120	240
	5000	Al	5	Floor	120	180
	2500	Cu	5	Edgewise	120	240
	2500	Cu	5	Flatwise	120	240
	2500	Cu	5	Floor	120	180
	5000	Cu	5	Edgewise	120	240
	5000	Cu	5	Flatwise	120	240
	5000	Cu	5	Floor	120	180
	6300	Cu	5	Edgewise	120	240
	6300	Cu	5	Flatwise	120	240
	6300	Cu	5	Floor	120	180



FLAME PROPAGATION ON WALLS ON FLOORS (CONTINUED)

TEST RESULTS OBTAINED BY XCP-S

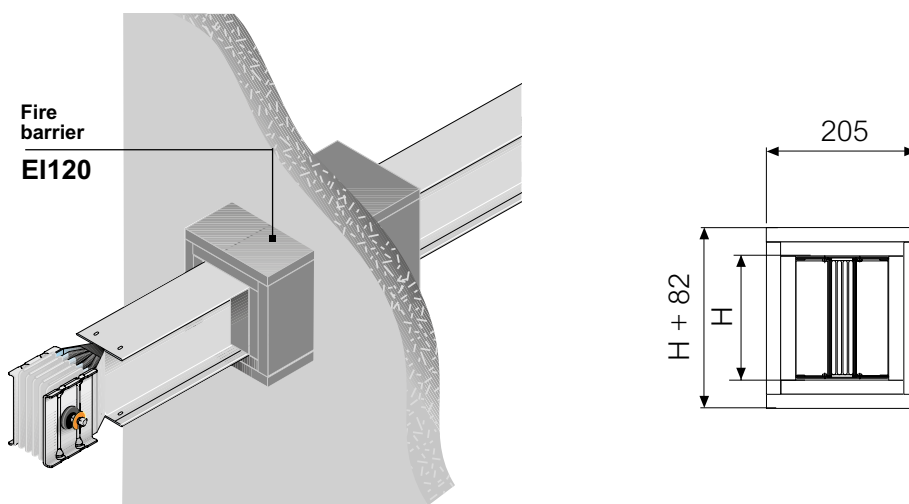
PRODUCT	RATING	MATERIAL	N°CONDUCTORS	ORIENTATION	EI	E
XCP-S	2000	Al	5	Edgewise	240	240
	2000	Al	5	Flatwise	120	240
	2000	Al	5	Floor	180	180
	4000	Al	5	Edgewise	120	240
	4000	Al	5	Flatwise	120	240
	4000	Al	5	Floor	120	180
	5000	Al	5	Edgewise	120	240
	5000	Al	5	Flatwise	120	240
	5000	Al	5	Floor	120	180
	2000	Cu	5	Edgewise	120	240
	2000	Cu	5	Flatwise	120	240
	2000	Cu	5	Floor	120	180
	5000	Cu	5	Edgewise	120	240
	5000	Cu	5	Flatwise	120	240
	5000	Cu	5	Floor	120	180
	6300	Cu	5	Edgewise	120	240
	6300	Cu	5	Flatwise	120	240
	6300	Cu	5	Floor	120	180

INSTALLATION PARAMETERS OF THE FIRE BARRIER

When a busbar trunking system passes through walls or ceilings with a declared fire resistance rating (REI), the busbar must ensure the same level of fire resistance at the penetration as the barrier itself. If the wall or floor does not have an REI fire-resistance rating, installing a fire-stop barrier at the penetration is not required and provides no functional benefit.



**It is not allowed to install a fire barrier that transitions from indoor to outdoor.
The use of outdoor fire barriers is prohibited, even if the fire barrier is protected by a roof.**



INSTALLATION LOCATION

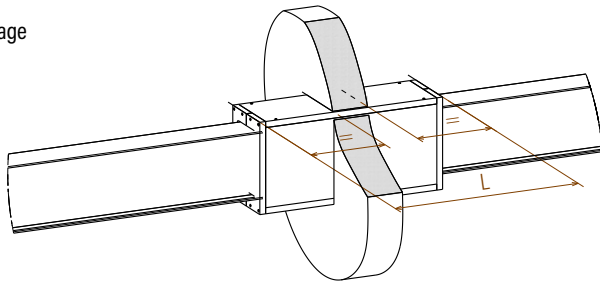
Fire resistance and flame propagation (*continued*)

INSTALLATION PARAMETERS OF THE FIRE BARRIER (*CONTINUED*)



To achieve this performance, make sure to install the 630 mm length fire barrier for aluminum (Al), and 1000 mm length for copper (Cu). Please note that it must be centered within the wall or slab.

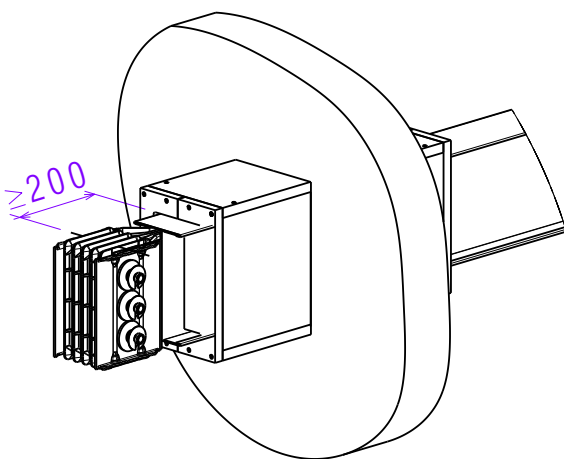
Wall passage



For busbars with :
aluminium conductor, L = 630 mm
copper conductors, L = 1000 mm

Once the busbar with the internal partition is inserted into the opening, the remaining empty space must be sealed with suitable material to ensure the correct EI fire resistance.

Minimum dimensions to be maintained to avoid issues during joint installation:



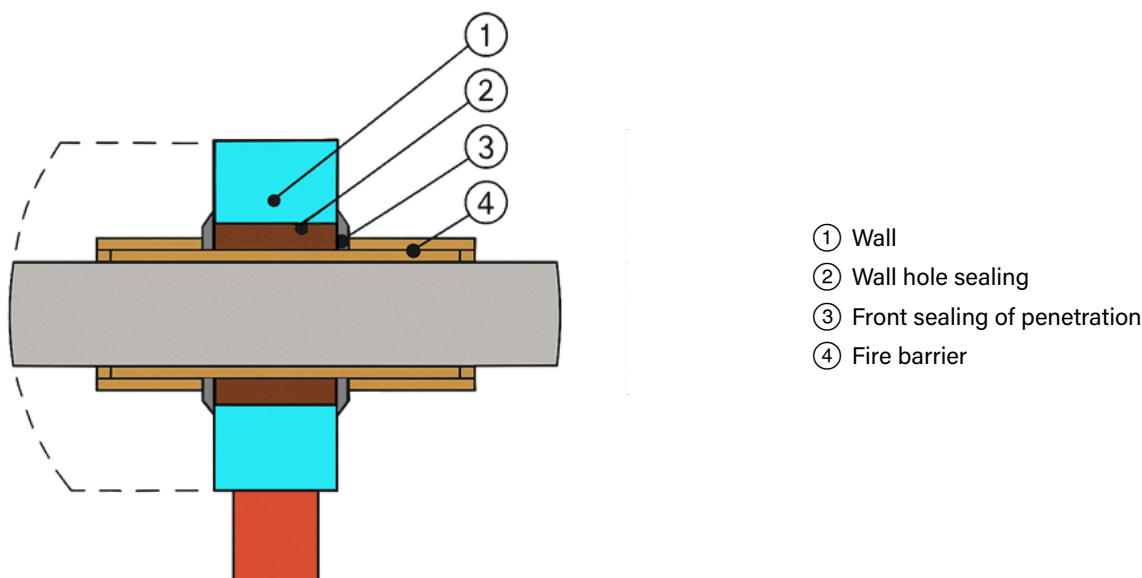
i Some elements contain air inside because the conductor does not completely fill the enclosure. To ensure proper sealing, these elements are assembled in the factory with an internal fire-barrier. These components are marked with a yellow label indicating that they are equipped with a fire barrier.



Fire resistance and flame propagation (*continued*)

INSTALLATION PARAMETERS OF THE FIRE BARRIER (*CONTINUED*)

Example of materials used to complete the installation:



FIRE RESISTANCE AND CIRCUIT INTEGRITY - IEC 60331

The **IEC 60331-1 standard** defines the test method for evaluating the circuit integrity of electric cables under fire conditions. It applies to cables with rated voltage up to and including 0.6/1.0 kV and with an overall diameter exceeding 20 mm. The goal is to verify that the cable **maintains electrical continuity under extreme fire conditions**.

TEST CONDITIONS

- Flame temperature: ≥ 830 °C
- Mechanical shock applied during fire
- Test duration: 120 minutes

APPLICATION TO BUSBAR TRUNKING SYSTEMS - DEVIATION FROM THE STANDARD

The **IEC 60331-1 standard is not applicable to busbar trunking systems**, as it is specifically designed for electric cables. However, due to frequent requests from the market for fire resistance performance, **Legrand has voluntarily tested its XCP busbar system under similar conditions**, applying a deviation from the standard

- Tested sample: Busbar trunking system (instead of cable)
- Flame temperature: ≥ 830 °C
- Test duration: 180 minutes (instead of 120 minutes)

This test was carried out to simulate extreme fire conditions and assess the structural and functional integrity of the XCP system.

Fire resistance and flame propagation (*continued*)

FIRE RESISTANCE AND CIRCUIT INTEGRITY - IEC 60331 (CONTINUED)

XCP system fire resistance option

STANDARD VERSION

- ▶ The standard XCP product resists fire for **30 minutes**.

SPECIAL VERSION (ON REQUEST)

- ▶ For projects requiring higher fire resistance, the XCP system can be supplied with **MICA insulation** applied along the lateral casing. This configuration allows the system to withstand fire for up to **180 minutes**.



The test was performed on a sample considered by experts to be representative of the entire XCP range. While no official busbar product standard currently governs this specific type of test, the results provide valuable insights and a strong indications of performance of the range, even if they cannot yet be formally generalized to all configuration.

Thermal expansion in busbar trunking systems

Electrical lines are subject to thermal expansion due to:

- Heat generated by current flow (Joule effect)
- Ambient temperature variations

This phenomenon is governed by the law of linear expansion:

$$\Delta L = \alpha \cdot L_0 \cdot \Delta T$$

Where:

ΔL = change in length

α = thermal expansion coefficient of the material

L_0 = initial length

ΔT = temperature variation

Understanding this principle is essential for predicting how much a busbar system may expand or contract under operating conditions.



Thermal expansion in busbar trunking systems (continued)

INTERACTION WITH BUILDING STRUCTURES

When busbar systems are mounted on or pass through structural elements, it is **crucial to consider**:

- The thermal behavior of the building itself, which may expand or contract differently from the busbar system.
- Transitions between different structural materials or zones, such as concrete to steel, indoor to outdoor, or between separate buildings.
- The presence of expansion joints in long structures (e.g., tunnels, bridges, industrial halls), which are designed to absorb movement.

 If not properly accounted for, these factors can introduce **mechanical stress**, leading to deformation, misalignment, or damage to the busbar and its components.

To mitigate these risks, it is necessary to:


- Install an appropriate number of expansion elements.
- Position them strategically along the busbar route.
- Coordinate with the structural design team during the planning phase.

SOLUTIONS FOR MANAGING THERMAL EXPANSION

• Single-axis expansion

When movement is expected along a single axis—for example, due to differential expansion between the building and the busbar system—the use of a dedicated expansion unit is recommended.

The XCP expansion element is designed to accommodate horizontal movement along the busbar axis, allowing the system to absorb thermal expansion without transferring stress to the structure or joints.

 For technical specification, refer to the:


- ▶ “Expansion units” chapter, page 74
- ▶ Installation guidelines of this guide

• Multi-axis movement

In more complex cases—such as transitions between independent structures or across expansion joints—movement may occur along two or three axes. In these scenarios:

- The busbar run should be interrupted at the transition point.
- A flexible connection should be installed between the two busbar sections.

This flexible link allows for movement in multiple directions and prevents mechanical stress from affecting the system, ensuring long-term reliability.

 During the design phase, it is essential to evaluate all potential sources of thermal movement and consider the thermal behavior of the building structure.

For linear movement, XCP expansion units should be used. For multi-directional movement, splitting the system and incorporating flexible connections is required.

Collaboration with structural engineers is crucial to identify expansion joints and movement zones, and the manufacturer’s installation guidelines must be followed precisely.



INSTALLATION ENVIRONMENT

INSTALLATION LOCATION

Mechanical impact resistance

Busbar trunking systems must be able to withstand mechanical impacts that may occur during transport, installation, or operation. According to IEC 61439-1, Clause 10.2.6, the system must comply with the IK rating defined in IEC 62262.



The XCP system has been tested and complies with IK10 (20 joules), depending on the configuration and enclosure type.

Ability to withstand mechanical loads

According to IEC 61439-1, Clause 10.2.4, the system must resist mechanical loads such as:

- The weight of the conductors and enclosure
- Forces due to thermal expansion
- External loads from mounting or accessories



The XCP system has been certified for mechanical robustness under simulated installation conditions, including both vertical and horizontal mounting. It complies with the standard's requirements and has been tested for heavy-duty installations, withstanding loads greater than 90 kg.

Installation of busbar trunking systems in seismic zones

Seismic activity affects many regions around the world, particularly those located near major tectonic fault lines. Electrical systems installed in these areas must be designed to withstand dynamic stresses caused by earthquakes, ensuring both operational continuity and mechanical safety.

CERTIFIED SEISMIC PERFORMANCE

The **IEC 61439-6 standard**, which governs busbar trunking systems, does not include specific requirements for seismic resistance. However, in projects where seismic qualification is required (e.g., according to **IEEE 693-2018**), it is essential that components are tested and certified to withstand seismic events.



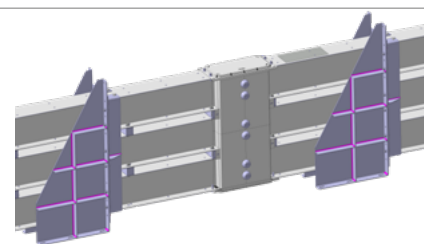
Installation of busbar trunking systems in seismic zones (continued)

CERTIFIED SEISMIC PERFORMANCE



Busbar trunking systems can be installed in seismic zones using certified support brackets and following proper installation guidelines.

- ▶ Certified support brackets
Cat.No 6521391 to 6521395 for XCP-S and Cat.No 65213792 to 65213797 for XCP-HP.



The busbar system and its brackets have been tested and certified to meet the following performance levels:

High performance level (IEEE 693-2018)

- Frequency range: 1.96 Hz to 50 Hz
- Damping: 5%
- Zero Period Acceleration (ZPA):
 - 1g on X and Y axes
 - 0.8g on Z axis
 - Duration: 40 seconds

Extra Performance Level

- Frequency range: 2.94 Hz to 50 Hz
- Damping: 5%
- Zero Period Acceleration (ZPA):
 - 1.5g on X and Y axes
 - 1.2g on Z axis
 - Duration: 40 seconds

These tests were conducted in accordance with **IEEE 693-2018**, an internationally recognized standard for seismic qualification of electrical equipment.



The seismic resistance of the entire system also **depends on how the support brackets are anchored** to the building structure. This anchoring is **the responsibility of the structural designer or installer**, depending on the type of structure and the anchoring systems used.

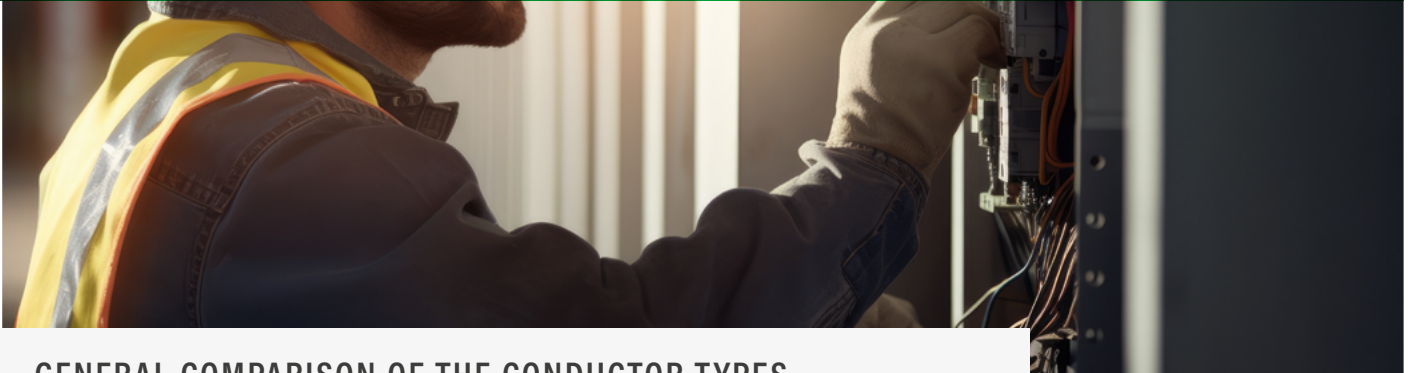
The manufacturer has certified the busbar trunking system and its support brackets, but cannot guarantee the seismic performance of the complete installation without proper integration with the supporting structure.

It is recommended to verify any local or project-specific seismic requirements, use only certified busbar systems and brackets designed for seismic applications, and coordinate with the structural engineer to ensure proper anchoring.



XCP-S AND XCP-HP BUSBAR SYSTEMS

ELECTRICAL ENVIRONMENT



GENERAL COMPARISON OF THE CONDUCTOR TYPES

Aluminium and copper are the two most commonly used metals for electrical conductors. Each material offers distinct advantages, and the choice between them depends on technical, economic, and application-specific factors.

Conductivity

Electrical conductivity is a fundamental factor in the selection of materials for power and signal transmission systems, as it directly affects efficiency and design constraints. When comparing conductive materials, it is essential to note that :

ALUMINIUM

Aluminium offers **higher conductivity per unit weight**, which means it can deliver efficient electrical performance while significantly reducing overall mass, making it **ideal for lightweight designs**. Aluminium is widely used in applications such as overhead power lines, where minimizing structural load and installation costs is critical.



COPPER

Copper has **higher electrical conductivity per unit volume**, which means it can carry more electric current through a smaller cross-sectional area, making it **ideal for compact wiring and components**. Systems using copper can achieve high efficiency without requiring large conductors, reducing space constraints in electrical designs.



Weight

The weight of a busbar is an important factor as it influences structural support requirements and installation complexity.

Aluminium is significantly lighter than copper—approximately one-third the density. This results in easier handling, reduced structural load, and lower transportation costs.

Corrosion resistance

ALUMINIUM

Aluminium naturally forms a thin oxide layer that protects it from further corrosion. However, this oxide layer can increase contact resistance at joints and connections. To prevent this, aluminium busbars are typically **tin-plated at the contact points** to ensure stable and low-resistance electrical connections.

COPPER

Copper offers **excellent intrinsic corrosion resistance**. The natural oxides that may develop on copper surfaces are generally conductive and therefore do not pose issues for current flow, ensures consistently low contact resistance, and maintains **reliable electrical performance over time**.

Mechanical properties

ALUMINIUM

Aluminium alloys offer a wide range of mechanical strengths and are suitable for **both rigid and flexible applications**.

COPPER

Copper is more ductile and has **higher tensile strength**, which can be beneficial in certain mechanical or thermal environments.

Workability and installation

ALUMINIUM

For the same current-carrying capacity, aluminium is significantly **lighter than copper**, although it requires larger cross-sections. When space is not a limiting factor, the reduced weight of aluminium busbars **simplifies the design of the support system** and makes **handling and installation easier**, especially on long runs or overhead installations.

COPPER

Copper is heavier, but it provides, for the same current-carrying capacity, **smaller cross-sections compared to aluminium**. This makes it particularly suitable for installations where space is limited or where **minimizing the overall footprint** of the system is essential.

Cost and sustainability

Aluminium is generally **more cost-effective** than copper. It is also **highly recyclable**, with low energy requirements for reprocessing. Aluminium busbars are a lightweight, cost-efficient, and corrosion-resistant alternative to copper. When properly treated, especially at contact points, they offer reliable performance in a wide range of electrical distribution systems. The choice between aluminium and copper should be based on a balanced evaluation of **performance, cost, weight, and installation requirements**.

ELECTRICAL CHARACTERISTICS FOR BOTH CONDUCTOR TYPES

Rated voltage (U_i and U_e)

RATED INSULATION VOLTAGE (U_i)

The rated insulation voltage (U_i) is the maximum voltage that the insulation system of a component or system can withstand without breaking down. It defines the electrical strength of the insulation and is used to determine the dielectric test levels during type testing. It is a design parameter, not necessarily the voltage at which the system operates.

For XCP systems, this value is **1000 V**.

 Ensuring the correct insulation voltage protects against electrical breakdowns and arc faults.

INSULATION VOLTAGE IN DC DISTRIBUTION SYSTEMS

In direct current (DC) applications, the insulation requirements are more demanding due to the absence of natural zero-crossings in the current. Therefore the rated insulation voltage increases from 1000 V to 1500 V.


This ensures safe operation and compliance with standards for DC distribution systems.

 In DC systems, using components rated for 1500 V insulation is essential for safety and compliance.

RATED OPERATING VOLTAGE (U_e)

The rated operating voltage (U_e) is the maximum voltage at which the system or component is intended to operate safely and continuously under normal conditions. It defines the functional limit of the system.

For XCP system, the rated operational voltage coincides with the insulation voltage: **1000 V**.

 Matching the operational voltage to the system design ensures safe and reliable performance.

ROUTINE AND CERTIFICATION TESTING

Each XCP product undergoes 100% routine testing in accordance with the product standard.

Specifically, every unit is tested at 3500 V for 1,5 second at the operating frequency (50Hz) . This ensures the integrity of the insulation and verifies the dielectric strength of each individual piece before delivery.

Certification testing

During type certification, the product is tested according to the standard requirements at 2500 V for 1 minute, as specified by the product standard.

This test confirms compliance with long-duration dielectric withstand requirements.

Impulse voltage test

In addition to dielectric tests, an impulse voltage test is performed during type certification.

The standard impulse voltage for the product category is 12 kV.

 At sea level, the test voltage is increased to 14.8 kV to account for atmospheric conditions and ensure robustness under real-world installation scenarios.



Direct current (DC) distribution systems

Direct current (DC) is increasingly used in modern electrical systems due to the rise of:

- Photovoltaic (PV) systems
- Data centers and telecom applications
- Battery energy storage systems (BESS)
- Electric vehicle (EV) charging infrastructure
- DC microgrids and industrial automation

Unlike alternating current (AC), DC flows in a constant direction and does not alternate polarity. This allows for more efficient energy transfer in certain applications, especially over short distances or in systems with frequent energy conversion.

TECHNICAL CONSIDERATIONS FOR BUSBAR SYSTEMS IN DC APPLICATIONS



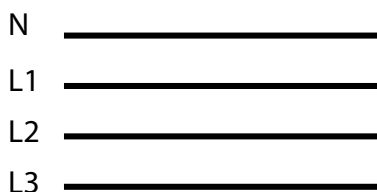
Busbar trunking systems can be used for both AC and DC.



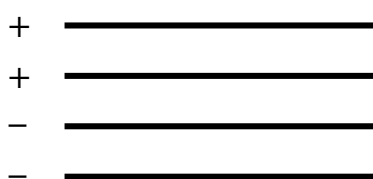
When used in DC applications, specific conditions must be met for safe and efficient operations.

Specific conditions in DC applications :

- Equal cross-section for all conductors
The cross-section of the bars must be the same for all poles (e.g., L1-L2-L3-N) to allow proper parallel coupling of conductors for each DC pole.
- Same enclosure for both poles
Both the positive and negative poles must be enclosed within the same metallic casing to ensure electromagnetic compatibility and safety.
- Voltage Compatibility
The working voltage in DC is up to 1500V



Three-phase system with alternating current



System with direct current

- The XCP Busbar range has to withstand dielectric test verification at 5000V_{DC} for 5 s



ELECTRICAL CHARACTERISTICS FOR BOTH CONDUCTOR TYPES

Direct current (DC) distribution systems (*continued*)

CURRENT CARRYING CAPACITY IN DC

When configured correctly, a busbar system can carry more current in DC than in AC. This is due to:

- the use of two conductors in parallel for each DC pole (positive and negative)
- the fact that in AC systems, typically only three out of four conductors are active (L1, L2, L3), while the neutral carries no current in a balanced system

By equating the power dissipated by the Joule effect in both cases, it is found that a busbar rated for AC can carry approximately 1.7 times more current in DC.

Example:

A busbar with a nominal current of 100 A in AC can carry up to 170 A in DC, under the specified conditions.

RESISTANCE AND VOLTAGE DROP IN DC

The DC resistance of the busbar, when properly balanced and installed, is approximately half the AC resistance: $R_{DC} = \frac{1}{2} \times R_{AC}$
The voltage drop at the end of the line can be calculated using: $\Delta V_{DC} = 2 \times I \times R_{DC} \times L/1000$

Where :

I= current

R_{DC} = resistance

L= length

INSTALLATION GUIDELINES AND SEQUENCES

When designing a DC busbar system:

- ensure symmetrical conductor layout for current balancing;
- use dedicated DC-rated components (e.g., circuit breakers, disconnectors);
- follow manufacturer guidelines for conductor pairing and enclosure grounding;
- consider thermal effects and voltage drop over long distances;
- refer to the DC-specific installation sequences provided in the technical documentation.

Frequency considerations: 50 Hz or 60 Hz

The difference between 50 Hz and 60 Hz originates from historical choices in power grid development. Today:

- 50 Hz is standard in Europe, Asia, and most of the world.
- 60 Hz is used in North America and parts of South America and Asia.

PRODUCT	50 HZ	60 HZ
Skin effect	Lower	Slightly higher
Inductive reactance	Lower	Higher
Magnetic losses	Lower	Higher
Equipment size (motors)	Slightly larger	Slightly smaller
Heat dissipation	Lower	Higher



Frequency considerations: 50 Hz or 60 Hz (continued)


At 60 Hz, components may experience higher eddy current and hysteresis losses, leading to increased heating.

- The skin effect is more pronounced at 60 Hz, which can affect current distribution in conductors.
- 60 Hz is used in North America and parts of South America and Asia.

XCP System Certification

The XCP busbar trunking system has been certified for operation at both 50 Hz and 60 Hz. This ensures:

- Full compliance with international standards.
- Reliable performance regardless of the installation region.
- Consistency of technical data, although some values (e.g., temperature rise, losses) may vary slightly between the two frequencies.

 When designing or specifying a system, it's important to verify the frequency of the local grid.

Even if the system is certified for both, technical data sheets may show different values for 50 Hz and 60 Hz operation. Always refer to the correct frequency-specific data when dimensioning or verifying performance.

Busbar Sizing – Design Guidelines

To correctly size the busbar system, one of the key steps is to verify the nominal current of the installation.

The busbar line may carry power either:

- from the transformer to the switchboard,
- or directly from the switchboard.

CONNECTION TO A TRANSFORMER

In this case, refer to the nameplate data of the transformer. Based on the nominal power and voltage (low-voltage side), you can calculate the nominal current delivered by the transformer using the following formula:

$$I = P / (\sqrt{3} \times V)$$

Where:

I = nominal power (VA or kVA)

V = line-to-line voltage (V)

Example:

Transformer rated at 1600 kVA, 400 V (low-voltage side):

$$I = 1\,600\,000 / \sqrt{3} \times 400 \approx 2309 \text{ A}$$

The rated current of the busbar must be higher than the rated current of the transformer.

CONNECTION TO A SWITCHBOARD

If the busbar is derived from a switchboard, check:

- The nameplate data of the protective circuit breaker, or
- The breaker settings (e.g., rated current or trip setting).

Example:

If the breaker is set to 2500 A, then the busbar must be sized so that its continuous current rating (I_n) remains greater than 2500 A. Moreover, the busbar must be dimensioned to withstand the thermal and electrical stresses associated with the non-tripping conditions of the breaker, ensuring safe operation even during prolonged overload conditions.



ELECTRICAL CHARACTERISTICS FOR BOTH CONDUCTOR TYPES

Short-circuit value

Another key step in selecting the correct busbar nominal current is to ensure that the chosen busbar trunking system can withstand the maximum short-circuit current of the system.

TYPES OF SHORT-CIRCUIT FAULTS AND THEIR IMPACT ON BUSBAR DESIGN

In low-voltage systems with a neutral conductor, three main types of short-circuit faults can occur:

1. Phase-to-phase fault
2. Phase-to-neutral fault
3. Three-phase balanced fault (most severe in terms of current magnitude)

Additionally, single-phase faults to earth (phase-to-ground) are common and must be considered, especially in systems with TT or TN grounding schemes.

THEORETICAL CONSIDERATIONS

The estimated short-circuit current at a given point in the system is the current that would flow if a negligible impedance fault occurred between conductors or between a conductor and ground.

This value represents a worst-case scenario, assuming:

- Zero fault impedance
- Sufficient time for the current to reach its peak value before protection trips

In reality, actual fault currents are lower, due to:

- Impedance of the conductors
- Contact resistance at the fault point
- Fast tripping of protection devices

Factors influencing short-circuit current magnitude

- Transformer power: Higher power → Higher fault current
- Length and impedance of the upstream line: Longer line → Lower fault current
- Type of fault:
 - Three-phase faults generate the highest symmetrical current
 - Phase-to-neutral and phase-to-ground faults typically result in lower current, but can still be critical for protection and thermal stress

Formula for symmetrical short-circuit current

For a simplified estimation : $I_{cc} = E / Z_E + Z_L$

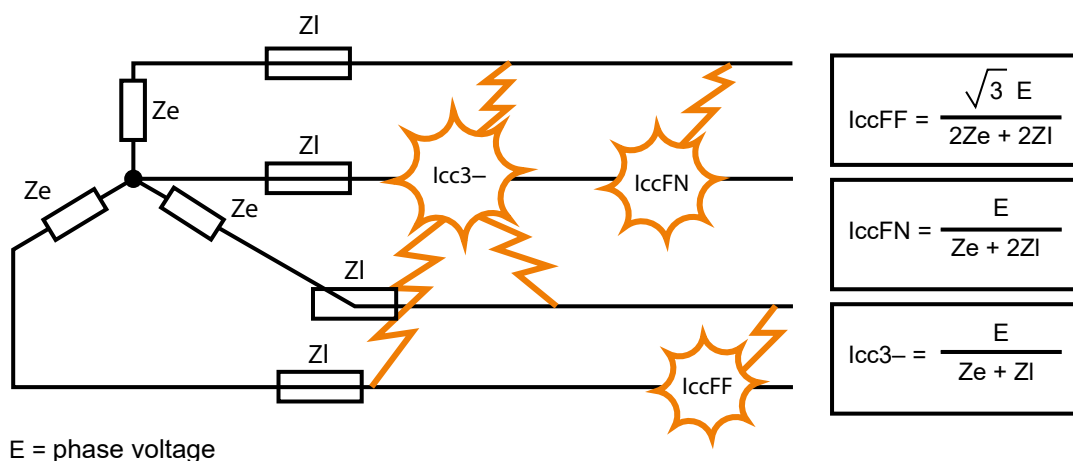
Where :

- I_{cc} = short-circuit current
- E = system voltage
- Z_E = internal impedance of the source (e.g: transformer)
- Z_L = impedance of the line up to the fault point



Short-circuit value (continued)

TYPES OF SHORT-CIRCUIT FAULTS AND THEIR IMPACT ON BUSBAR DESIGN (CONTINUED)



Design implications for busbar trunking systems

Even if the three-phase fault is the most demanding in terms of current, phase-to-neutral and phase-to-ground faults must also be considered because:

- They may not trip protections immediately, leading to longer fault duration
- They can cause localized overheating and damage to insulation
- In some systems, earth faults are cleared only after a delay (e.g., in IT systems)

Therefore, the busbar must be:

- Mechanically resistant to the peak current of any fault type
- Thermally resistant to the I^2t energy released during the fault
- Properly coordinated with the protection system to limit damage



Always verify:

- I_{cw} (short-time withstand current) for 1s or 3s, depending on breaker delay
- I_{pk} (peak withstand current) for mechanical stress
- I^2t for thermal energy absorption

CONNECTION TO A TRANSFORMER

Each component must be correctly dimensioned to withstand:

- Peak current during a fault (mechanical stress)
- Short-time withstand current (thermal stress)
- Energy released during the fault (I^2t)



ELECTRICAL CHARACTERISTICS FOR BOTH CONDUCTOR TYPES

Short-circuit value (continued)

CONNECTION TO A TRANSFORMER (CONTINUED)



Key parameters for busbar selection:

Peak short-circuit current (I_{pk})

- ▶ The mechanical withstand rating of the busbar must be higher than the peak short-circuit current.

Short-time withstand current (I_{cw})

- ▶ The thermal withstand rating of the busbar (typically for 1s or 3s) must be greater than or equal to the calculated short-circuit current over that duration.

Energy released during the fault (I^2t)

- ▶ The busbar must be able to dissipate the energy generated during the fault without damage.

Example of calculation

Given :

- Transformer power: $P = 1000$ kVA
- Short-circuit voltage: $U_k = 6\%$
- Nominal voltage: $U_n = 400$ V
- Energy released during the fault (I^2t)

STEP 1 Calculate the short-circuit current at transformer terminals

$$I_k = I_n / U_k\% = 1443 / 0.06 \approx 24.050$$

STEP 2 Estimate the peak current


This is the initial symmetrical short-circuit current. The peak current (used for mechanical stress verification) is typically:

$$I_{peak} = k \times I_k \text{ (with } k \approx 2.2) \rightarrow I_{peak} \approx 52.910 \text{ A}$$

Where k is a factor (usually between 1.8 and 2.5 depending on system characteristics).

STEP 3 Calculate the I^2t value (for 1s)

$$I^2t = I_k^2 \times t = (24.050)^2 \times 1.578 \times 10^6 \text{ A}^2\text{s}$$

 In systems with multiple transformers in parallel, ring networks, or meshed configurations, the short-circuit current increases significantly. For example, with two transformers in parallel, the short-circuit current may double.



Short-circuit value (continued)

CONNECTION TO A SWITCHBOARD

If the busbar trunking system is connected downstream of a switchboard, **the short-circuit withstand capability must be verified based on the upstream protection device.**

In this case, the key reference is the circuit breaker installed upstream of the busbar.



Key parameters to check:

Short-circuit breaking capacity of the breaker (I_{cu} / I_{cs})

- ▶ This value indicates the maximum fault current the breaker can interrupt.
- ▶ The busbar's short-circuit withstand rating must be equal to or greater than this value

Short-time withstand current (I_{cw})

- ▶ If the breaker has a delayed trip setting (e.g., for selectivity), the busbar must withstand the fault current for the set delay time (e.g., 1s or 3s).
- ▶ This is critical for thermal stress and energy dissipation (I^2t).

Example of calculation

Assuming :

- Upstream breaker: $I_n = 2500$ A
- Breaker short-circuit capacity: $I_{cu} = 50$ kA
- Breaker time delay: 1 second
-

Busbar selection must ensure:

- Rated current > 2500 Am
- Peak withstand current ≥ 50 kA $\times k$ (e.g., $k = 2.2 \rightarrow I_p \approx 110$ kA)
- Short-time withstand current ≥ 50 kA for 1s
- I^2t withstand $\geq (50,000)^2 \times 1 = 2.5 \times 10^9$ A²s

Always check the trip curve and selectivity settings of the breaker. A longer delay increases the thermal stress on the busbar.

BUSBAR SYSTEM - CERTIFICATION AND FAULT BEHAVIOR

The XCP busbar trunking system has been fully tested during the certification phase, and all values declared in the catalog are based on actual test results.

In the catalog:

- For phase-to-neutral configurations, where the neutral conductor has the same cross-section as the phase, the short-circuit withstand value is equivalent to that of a three-phase fault.
- In cases where the protective earth (PE) is implemented using the busbar housing (enclosure), the short-circuit withstand value is reduced to 60% of the nominal current, since the fault involves phase-to-earth voltage, which is lower than the line-to-line voltage.



This distinction is important when evaluating the system's behavior under single-phase fault conditions, such as phase-to-neutral or phase-to-earth faults.



ELECTRICAL CHARACTERISTICS FOR BOTH CONDUCTOR TYPES

Ambient temperature – Impact on busbar sizing

The ambient temperature at the installation site is an important factor in **determining the correct busbar size**. Depending on the environmental conditions, the rated current of the busbar may need to be derated. It is important to note that **ambient temperature refers to the actual temperature in the immediate vicinity of the busbar**, regardless of where it is installed (e.g., inside technical rooms, electrical shafts, rooftops).

TEMPERATURE DERATING

The ambient temperature affects the thermal behavior of the busbar trunking system. During the design phase, the rated current at the reference temperature must be **multiplied by a correction factor (Kt)** based on the actual operating temperature.

FORMULA

$$I_z = I_{z0} \times K_t$$

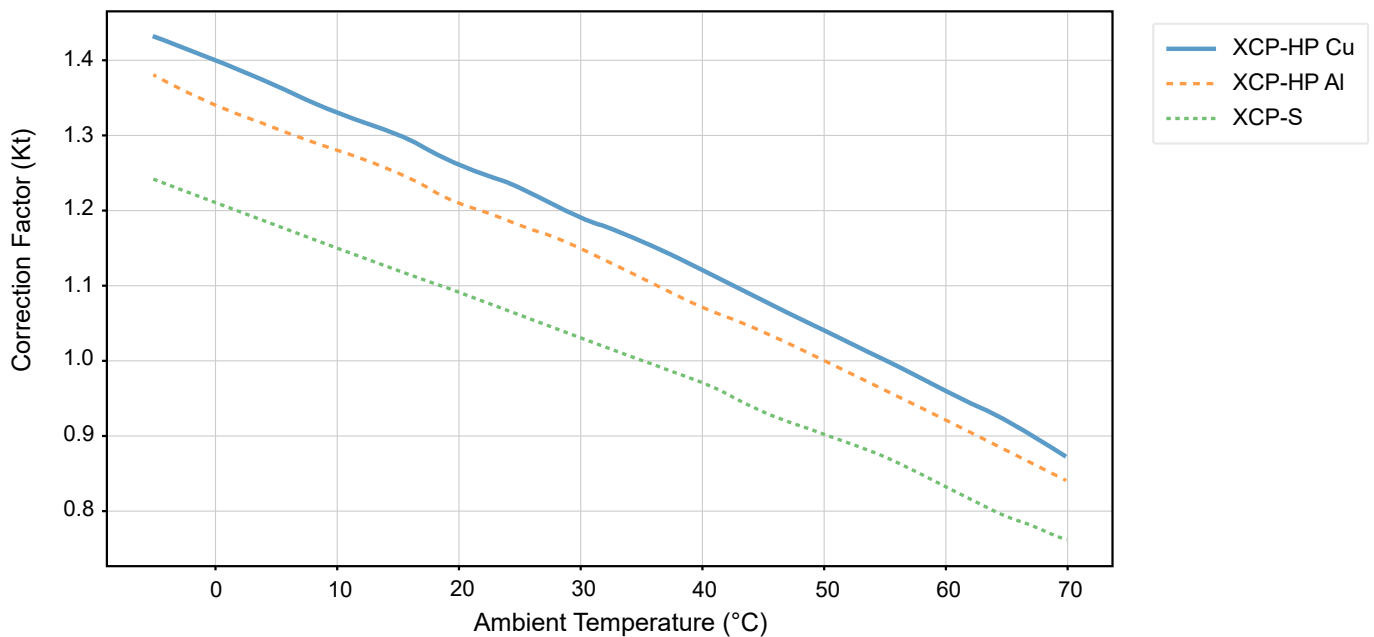
Where:

- I_z = corrected rated current
- I_{z0} = rated current at reference temperature
- K_t = temperature correction factor

Reference temperatures by product line:


PRODUCT LINE	REFERENCE AMBIENT TEMPERATURE
XCP-S	35°C
XCP-HP Cu	55°C
XCP-HP Al	50°C

Temperature Derating Correction Factors for XCP Busbar Systems



Ambient temperature – Impact on busbar sizing (*continued*)

TEMPERATURE DERATING (*CONTINUED*)

 If the actual ambient temperature exceeds the reference value, the busbar must be derated according to the correction tables provided in the technical documentation

Overtating in lower temperatures

Conversely, if the ambient **temperature is lower** than the reference temperature, the correction factors can be used to determine the **maximum allowable current** without exceeding the thermal limits defined by the product standard.

This is particularly useful for:

- Setting protection delays on upstream circuit breakers
- Optimizing system performance in controlled environments



The overall system is designed to operate at a specific current rating. Selecting a smaller busbar size and relying on favorable temperature conditions to reach higher currents is not recommended.

This approach may lead to:

- Mismatch in power handling capabilities
- Thermal imbalance
- Unreliable operation, especially under fault or overload conditions

Always size the busbar system **according to the nominal current requirements**, and use temperature correction only for fine-tuning or protection coordination, not for compensating undersized components.

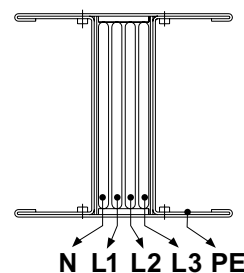
Always consult the **official derating tables** to ensure compliance with thermal limits and avoid overheating or premature aging of the system.

Busbar configuration based on earthing system (TT, TN, IT)

Depending on the earthing system used (TT, TN, IT), the busbar trunking system may require different construction configurations to meet electrical and safety requirements. Typical configurations :

4 CONDUCTORS SYSTEM

- L1, L2, L3, N
- PE provided by the housing (enclosure)
- Suitable for TN systems where the enclosure ensures protective grounding.

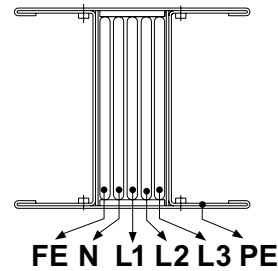


ELECTRICAL CHARACTERISTICS FOR BOTH CONDUCTOR TYPES

Busbar Configuration Based on Earthing System (TT, TN, IT) (continued)

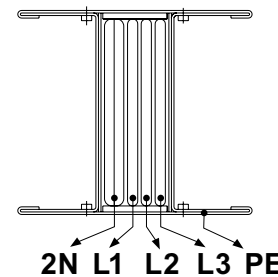
5 CONDUCTORS SYSTEM WITH FUNCTIONAL EARTH

- L1, L2, L3, N, FE
- One conductor used as functional earth (FE)
- PE still provided by the housing
- Common in IT systems or specific industrial applications.



5 CONDUCTORS SYSTEM WITH DOUBLE NEUTRAL (2N)

- L1, L2, L3, N, N
- Neutral section sized at 200% of the phase conductor
- Used in systems with high harmonic content or unbalanced loads
- PE provided by the housing



PEN SYSTEM (TN-C)

- Combined neutral and protective earth (PEN)
- Implemented using a dedicated conductor in parallel with the enclosure
- Supplied using busbar code -RL, which includes a reinforced neutral conductor
- Ensures both current return path and protective grounding

PE OPTIONS (PROTECTIVE EARTH)

For both 4C and 5C configurations, the PE can be implemented in different ways:

- PE1: Standard PE via enclosure
- PE2: Reinforced PE with extra copper conductor
- PE3: Reinforced PE with extra aluminum conductor

These options allow flexibility depending on:

- Fault current levels
- Installation standards
- System grounding type



Busbar Configuration Based on Earthing System (TT, TN, IT) (continued)

Number of conductors according to neutral system

POWER GRID	TT	TNC	TNS	IT WITHOUT NEUTRAL	IT WITH NEUTRAL
3P+N+PE	4 conductors ⁽¹⁾	-	5 conductors ⁽²⁾		4 conductors ⁽²⁾
3P+PEN	-	4 conductors ⁽²⁾	-		-
3P+PE	-	-	-	3 conductors ⁽²⁾	-
3P+2N+PE	5 conductors ⁽¹⁾	-	5 conductors ⁽²⁾		-
3P+N+FE+PE	5 conductors ⁽¹⁾	-	5 conductors ⁽²⁾		-

⁽¹⁾ : The outer casing acts as an earth conductor (PE).

⁽²⁾ : The use of earth fault protection makes it possible to reduce the size of the system and eliminate the need for a PE conductor in TNC or TNS systems. This **reduces weight, costs, and environmental impact**. If ground fault protection is used upstream of the installation, it may be possible to eliminate a conductor as long as the protection is set correctly.

PE or PEN conductor should not be cut, please contact Legrand to define the accessories that will allow its continuity.

Always verify the compatibility of the chosen configuration with local regulations and the fault current requirements of the system.

Technical parameters for protection sizing

To correctly size protective devices in a busbar system, several key electrical parameters are provided in the technical documentation. These values are essential for verifying the system's safety and compliance with standards.

FAULT LOOP PARAMETERS

RESISTANCE (R) AND REACTANCE (X)

These parameters represent the opposition to current flow in the event of a fault. They are used to calculate the **impedance (Z)** of the fault loop, which is critical for determining the fault current and the disconnection time of protective devices

IMPEDANCE (Z)

It is the vector sum of resistance and reactance. It defines the total opposition to fault current and is used in coordination studies and fault analysis.

ZERO-SEQUENCE SHORT-CIRCUIT CURRENTS

These values refer to phase-to-neutral (Ph-N) and phase-to-protective earth (Ph-PE) short-circuit conditions. They are used to:

- Verify the selectivity and sensitivity of residual current devices (RCDs)
- Ensure correct operation of protective relays
- Evaluate neutral conductor sizing, especially in systems with harmonic distortion

These parameters are typically calculated under worst-case conditions and are essential for ensuring that the system can safely interrupt fault currents and protect both equipment and personnel.



Electromagnetic compatibility (EMC)

Electromagnetic fields (EMFs) are generated whenever electric current flows through a conductor. These fields consist of two components:

- Electric field: created by voltage.
- Magnetic field: created by current flow.

When conductors carry alternating current (AC), they produce dynamic electromagnetic fields that can interfere with nearby electronic devices. This phenomenon is known as **Electromagnetic Interference (EMI)**.

EMI can be:

- Man-made: from electronic circuits, switching devices, motors, etc.
- Natural: from lightning, cosmic radiation, or atmospheric disturbances.

PROBLEMS CAUSED BY EMI

Electromagnetic interference can:

- Degrade the performance of sensitive equipment.
- Cause data loss or communication errors.
- Lead to non-compliance with safety and EMC regulations.
- Create electromagnetic pollution in industrial and residential environments.

The EN 61439-6 standard governs busbar trunking systems (BTS) and includes specific guidelines for measuring and limiting electromagnetic emissions.

Key points:

- Magnetic field measurements must be taken using calibrated instruments along defined axes.
- The standard defines exposure limits:
 - Electric field: 5 kV/m
 - Magnetic induction: 100 μ T
 - Attention threshold: 10 μ T
 - Quality target: 3 μ T



These limits are designed to protect people and equipment from excessive electromagnetic exposure, especially at industrial frequency (50 Hz).

BENEFITS OF USING BUSBARS INSTEAD OF CABLES

Busbar trunking systems offer significant EMC advantages over traditional cable systems:

- **Compact conductor arrangement:** Phases are placed very close together, minimizing the loop area and reducing magnetic field generation.
- **Balanced currents:** Three-phase currents are naturally offset by 120°, which causes the magnetic fields to cancel each other out.
- **Metallic casing:** Acts as a shield, reducing both electric and magnetic field emissions.

Even in cases of imperfect current balance, the metal enclosure of the busbar system helps contain the electromagnetic field, preventing it from spreading into the surrounding environment.



Electromagnetic compatibility (EMC) (continued)

BENEFITS OF USING STEEL ENCLOSURE INSTEAD ALUMINIUM

The material of the busbar casing significantly affects EMC performance:

- Steel enclosures **reduce magnetic emissions by up to 66%** compared to aluminum.
- Steel has **higher magnetic permeability**, making it more effective at shielding.
- Aluminum, while lighter and corrosion-resistant, offers less protection against magnetic fields.

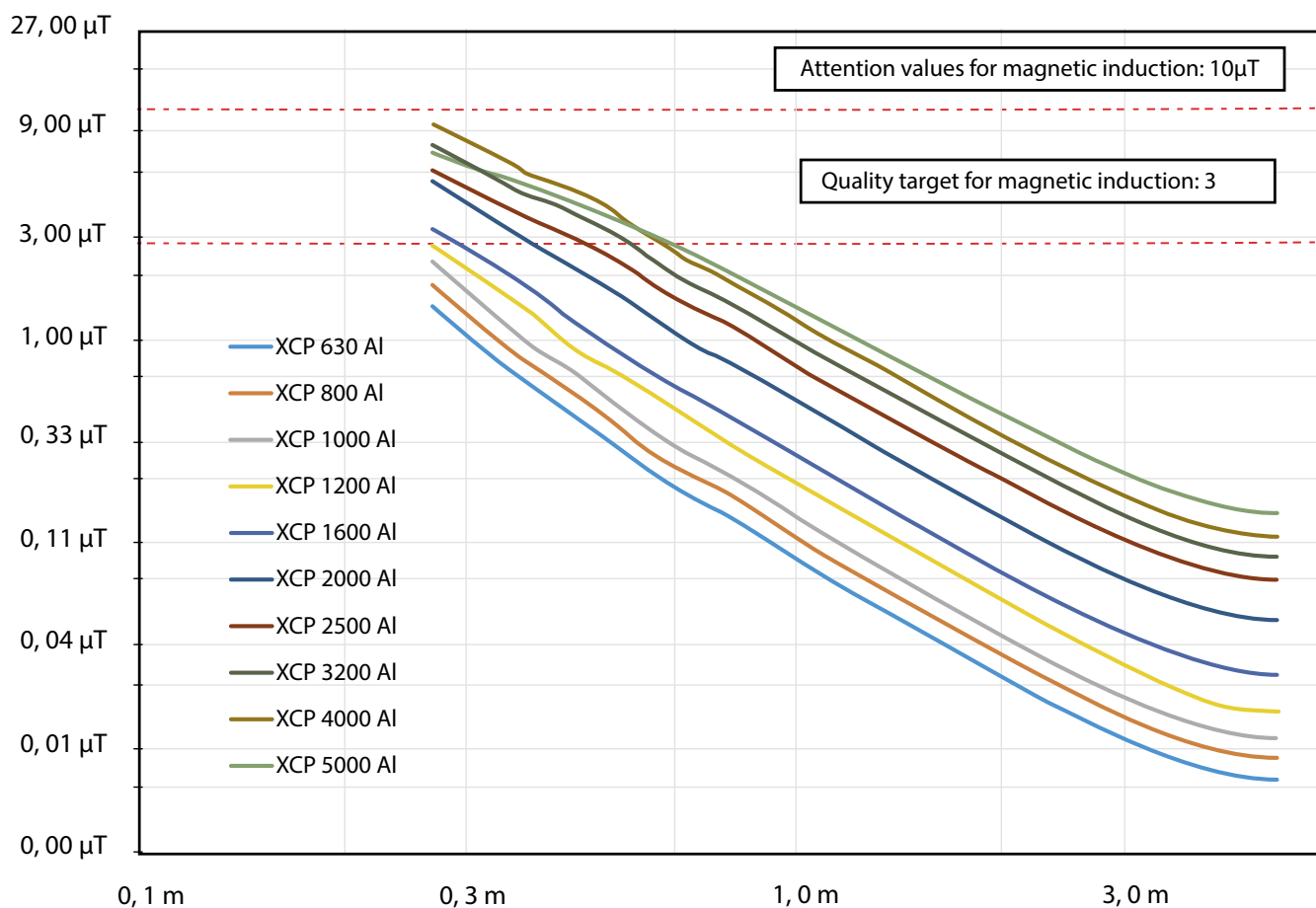
Measurements show that at the same current and distance, steel-cased busbars consistently emit lower magnetic field levels than aluminium-cased ones.



To ensure EMC compliance and minimize interference:

- ▶ **Use busbar trunking systems** instead of cables, especially in sensitive environments.
- ▶ Choose **steel enclosures** for better magnetic shielding.
- ▶ Keep busbars away from **sensitive zones** (e.g., control rooms, medical equipment).
- ▶ **Limit current levels** near sensitive areas.
- ▶ Follow **EN 61439-6** measurement protocols during design and testing.

Electromagnetic induction (μT) as a function of the current (A) and distance (m) from the busbar



ELECTRICAL CHARACTERISTICS FOR BOTH CONDUCTOR TYPES

Voltage drop

Voltage drop refers to the reduction in voltage as electric current flows through a conductor (like a cable or transmission line). It occurs due to the resistance (R) and reactance (X) of the line.

FORMULA $\Delta V = I \times (R \cos \phi + X \sin \phi)$

Where:

- I = current
- R = resistance
- X = reactance
- ϕ = phase angle between voltage and current

Importance of voltage drop

- Efficiency loss: excessive voltage drop means energy is lost as heat.
- Equipment malfunction: devices may not operate correctly if voltage is too low.
- Regulatory limits: electrical standards often set maximum allowable voltage drops (e.g., 4–5%).

POWER FACTOR (PF)

The power factor is the ratio of real power (used to do work) to apparent power (total power in the system):

FORMULA Power factor = $\cos \phi$

Ideal PF = 1 (purely resistive load)

Low PF (e.g., 0.6–0.8) indicates a reactive load (inductive or capacitive)

In Electrical Installations:

- A power factor **close to 1** is desirable.
- In industrial systems, PF is often maintained **above 0.9** to reduce losses and avoid penalties from utility companies.

Power factor correction

Power factor correction involves adding capacitors (or sometimes inductors) to the system to neutralize the reactive power and bring the power factor closer to 1.



Power factor correction reduces current in the system, minimizes voltage drop, improves energy efficiency, and avoids utility penalties.

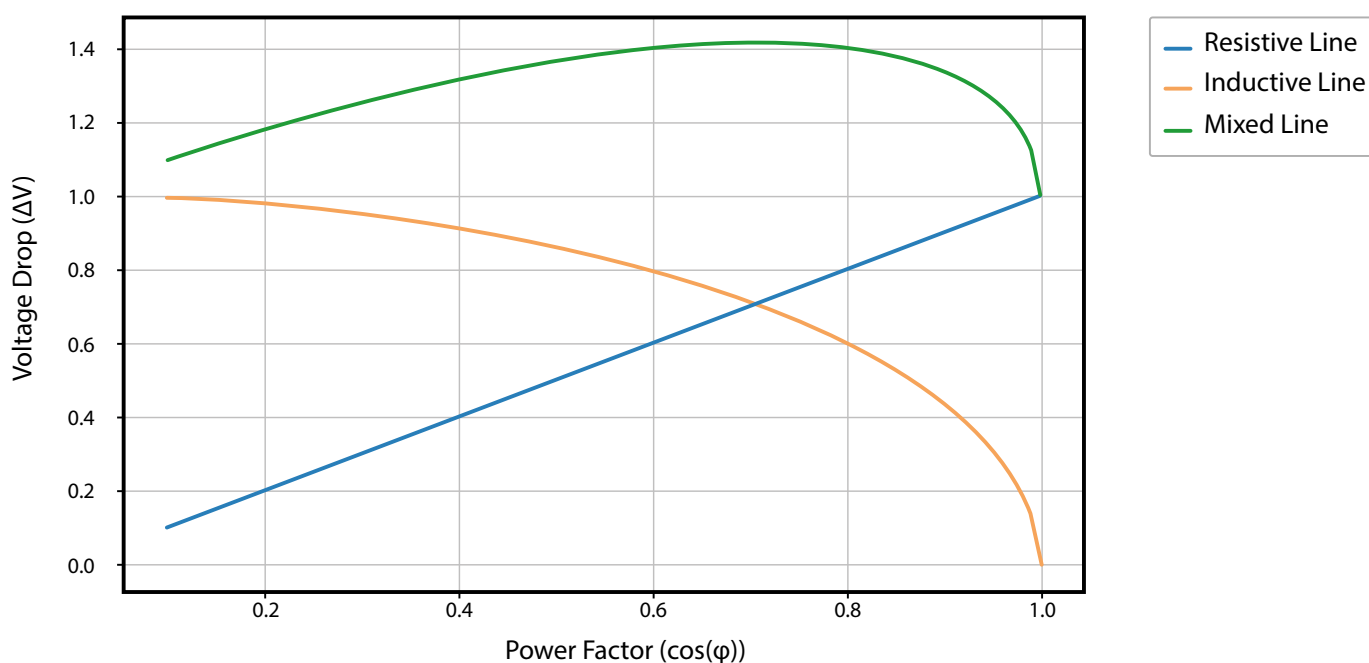


Voltage drop (continued)

When the power factor increases, (i.e., the load becomes more resistive), $\phi \cos \phi$ increases and $\phi \sin \phi$ decreases.

- In a **resistive line**: this leads to a higher voltage drop.
- In a **reactive (inductive) line**: the drop decreases.
- In a **mixed line**: the behavior is more complex and can show a minimum point.

Voltage Drop vs Power Factor for Different Types of Lines



Voltage drop does not always increase with power factor. In highly reactive lines, increasing the power factor can actually reduce the voltage drop. The behavior depends on the relative values of R and X in the line.



ELECTRICAL CHARACTERISTICS FOR BOTH CONDUCTOR TYPES


Voltage drop (*continued*)

To support the design phase, the technical documentation of the busbar trunking system provides the necessary values to calculate the **maximum voltage drop**, assuming that the operating current is equal to the rated current of the system.


To simplify the calculation, a **coefficient k** is provided, which varies depending on the **power factor (cosφ)**, ranging from **0.7 to 1**.

This coefficient allows for an approximate estimation of the voltage drop based on:

- Operating current I_b
- Length of the run L
- Rated system voltage U_n

 The k value is approximate, as it is based on the thermal equilibrium resistance of the busbar, meaning it assumes the system is carrying 100% of its rated current.

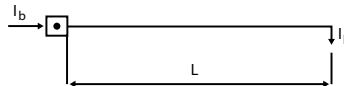
FORMULA $\Delta V\% = 2b \times [(k \times I_b \times L) / U_n] \times 100$

 If a more accurate verification is needed for currents lower than the rated value, it is possible to request a specific value from Legrand, calculated according to the actual operating conditions.

Additionally, to account for the load distribution along the busbar, a coefficient b is introduced. This coefficient varies depending on the type of load (concentrated, distributed...)

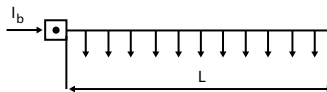
$b=1$

Supplies at one end and load at the end of the line



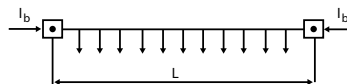
$b=1/2$

Supplies at one end and with load evenly distributed



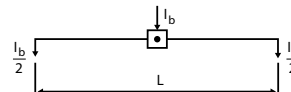
$b=1/4$

Supplies at both ends and with load evenly distributed



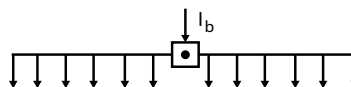
$b=1/4$

Central supply with loads at both ends



$b=1/8$

Central supply with loads distributed evenly



The b coefficient must be included in the voltage drop formula to obtain a more realistic estimation based on the load layout and positioning.




Joule losses

Joule losses, also known as **resistive losses**, are the energy dissipated as heat when electric current flows through a conductor. These losses are proportional to the square of the current and the resistance of the conductor, and they represent real energy consumption that is ultimately paid for in the electricity bill if not properly managed.

In the product catalog, an indicative value of Joule losses per meter (W/m) is provided. This value:

- refers to **straight busbar elements**
- is based on the assumption that the busbar is carrying **100% of its rated current**
- may slightly **vary** from one component to another due to differences in geometry and material

 This value is approximate, as it is calculated using the thermal equilibrium resistance, which assumes continuous operation at full rated current.

If the actual operating current is lower than the rated current, it is possible to calculate an estimated loss value. However, this will still be an approximation, as it relies on the same thermal equilibrium resistance.

Three-phase regime losses are:

$$P_j = (3 \times R_t \times I_b^2 \times L) / 1000$$

In one-phase regime:


$$P_j = (2 \times R_t \times I_b^2 \times L) / 1000$$

Where:

I_b = Utilization current (A)

R_t = Phase resistance for unit of length of the busbar trunking system, measured at thermal regime (mΩ/m)

L = Busbar length

 For more precise evaluations under specific operating conditions, it is possible to request detailed data from Legrand.

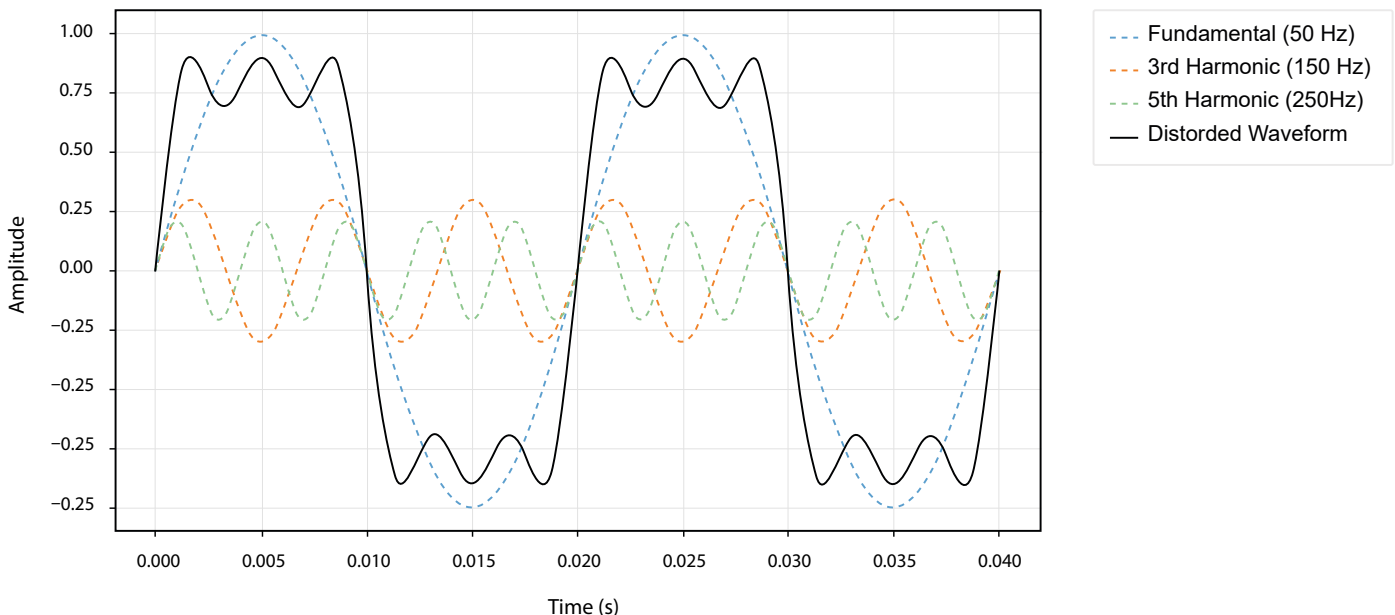
ELECTRICAL CHARACTERISTICS FOR BOTH CONDUCTOR TYPES

Harmonic Distortion (THD)

In an ideal electrical distribution system, **voltages and currents should have a perfectly sinusoidal waveform**. However, in real-life applications, many devices—such as inverters, dimmers, and switching power supplies—introduce **non-linear loads** that distort the current waveform.

These distortions generate **harmonic components**, which are sinusoidal waveforms with frequencies that are integer multiples of the fundamental frequency (e.g., 50 Hz, 100 Hz, 150 Hz, etc.). The presence of these harmonics is quantified by the **Total Harmonic Distortion (THD)**.


Illustration of Harmonic Distorsion in Current Waveform



The dashed blue line represents the fundamental 50 Hz sine wave.
The dotted lines show the 3rd harmonic (150 Hz) and 5th harmonic (250 Hz) components.
The black line is the resulting distorted waveform, which is the sum of the fundamental and harmonic components.

Harmonic distortion can lead to several issues in electrical systems:

- Worsening of the power factor
- Overheating of the neutral conductor
- Increased Joule losses in transformers, motors, and conductors
- Malfunction or instability of protection devices (e.g., thermal-magnetic and residual current circuit breakers)
- Unbalanced loads, especially in systems where single-phase loads are distributed from a three-phase backbone

 These effects are no longer limited to industrial environments, they are increasingly common in commercial and service-sector installations.



Harmonic Distortion (THD) (continued)



To ensure safe and efficient operation, busbar trunking systems must be **derated** when operating in environments with **significant harmonic distortion**. The derating is based on the percentage of THD present in the system.

► The higher the THD, the greater the thermal stress on the conductors, especially the neutral, which may carry more current than the phases in the presence of triplen harmonics (3rd, 9th, etc.).

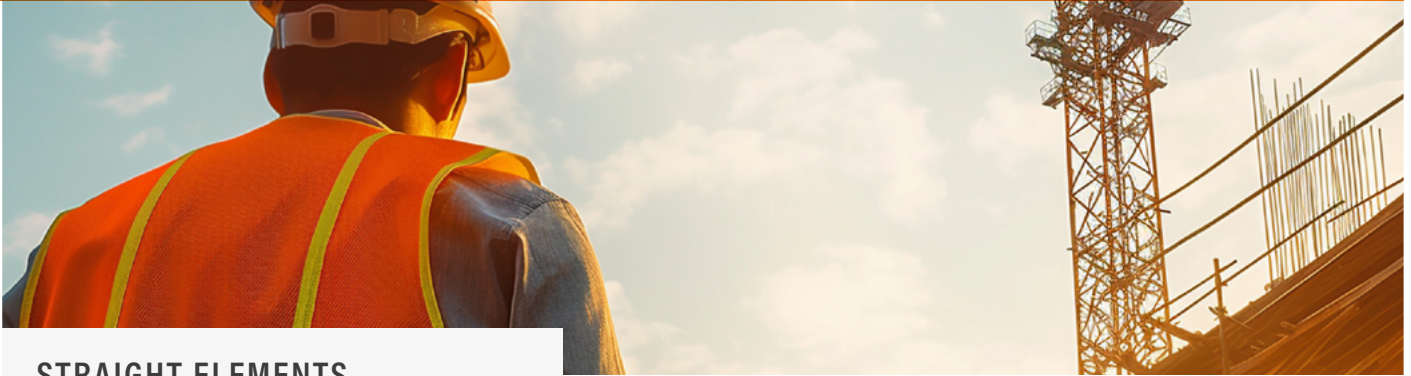
Manufacturers typically provide derating tables or correction factors based on THD levels. These should be consulted during the design phase to ensure the selected busbar system can handle the harmonic load safely.

RATED CURRENT	630	800	1000	1250	1600	2000	2500	3200	4000	5000	6300
XCP busbar to be used											
THD ≤ 15%	630	800	1000	1250	1600	2000	2500	3200	4000	5000	6300
15% < THD ≤ 33%	800	1000	1250	1600	2000	2500	3200	4000	5000	6300	-
THD > 33%	1000	1250	1600	2000	2500	3200	4000	5000	6300	-	-



XCP-S AND XCP-HP BUSBAR SYSTEMS

PRODUCT COMPONENTS



STRAIGHT ELEMENTS

The straight elements of the XCP series consist of the following components:

- **Casing:**

The casing is constructed from four "C shaped" ribbed and flanged profiles, riveted and assembled with steel rivets (thickness 1.5 mm, dimensions 120 or 125mm x 130 up to 800mm), made of hot-dip galvanized steel and pre-painted.

- **External coating :**

The line is externally coated with paint that enhances resistance to chemical agents, improves corrosion resistance of the galvanized sheet, and facilitates thermal dissipation. The standard color is RAL 7035 (light grey).

- **Conductors :**

Conductors are made of aluminum alloy covered with five galvanic processes, including layers of copper and final tin plating. Alternatively, XCP lines are available with electrolytic copper conductors with electrical conductivity > 98%, according to UNI EN 13601.

Conductors are isolated from each other with a double layer of polyester PET film (2x0.19mm=0.38mm), Class B (130°C). The conductors are packed against each other (like a sandwich) in order to minimize the distance between phases, thereby reducing mutual reactance and consequently the impedance of the busbar.



On request, Class F 155 °C DMD insulating material is available (2x0.23mm=0.46mm).

This material is V1 self-extinguishing, non-hygroscopic, with high dielectric strength, and complies with the glowing wire test according to EN 60695-2-1 (IEC 50.11).

The **monoblock** is a core component of the XCP busbar system, designed to ensure **fast, secure, and long-lasting electrical connections** between active conductors and the protective earth (PE). It plays a crucial role in both the mechanical integrity and electrical performance of the system.

At the heart of the monoblock is a series of conductive plates:

- For copper busbars (Cu), the plates are made of high-conductivity copper.
- For aluminum busbars (Al), the plates are made of tinned aluminum.

These plates are arranged to form the electrical path between phases and are separated by thermosetting plastic insulators, rated in temperature class "F", which ensures that the system maintains its electrical insulation and mechanical strength over time—even under demanding thermal conditions.



The monoblock uses a bolt-based connection system, with the number of bolts depending on the height of the busbar:


- Configurations may include 1 bolt, 3 bolts, or combinations such as 1+1 up to 3+3+3.
- Each bolt is fitted with a double-headed nut featuring a predefined break point.

During installation:

- The outer head is tightened using a hex key (size 19).
- Once the correct torque is reached, the collar between the two heads breaks.


 This mechanism ensures that the connection is made at the nominal torque, guaranteeing optimal electrical continuity and long-term reliability.

The PE conductor, typically the enclosure, is also connected via the monoblock, ensuring a complete and secure grounding path. To maintain consistent contact pressure, even during thermal expansion and contraction, the monoblock includes Belleville (cup) springs for each bolt.

 These springs distribute pressure evenly across the contact surfaces and compensate for thermal excursions, preserving the integrity of the connection.

Pre-assembly and quality assurance

To streamline installation and ensure consistency, all straight elements, path elements, and components of the XCP line are delivered with a pre-assembled monoblock.

 Each unit undergoes a factory insulation test at 3.5 kV, both between phases and to ground, verifying compliance with product standards. Legrand certifies that 100% of monoblocks are produced, inspected, and verified according to a dedicated quality plan. Quality labels are applied by sampling during final qualification checks.

The mechanical junction is completed by applying IP flanges equipped with anti-aging gaskets that guarantee IP55 protection, with the possibility of having IP65.

 The IP65 line is used only for transport elements.

The “monoblock” that makes the junction between the elements can, if necessary, be used to draw power by applying a “bolt-on” TOB; therefore, each junction of the XCP line is already prepared for a fixed position derivation. The junction monoblock is also equipped with a device (consent tooth) that facilitates correct assembly respecting the phase-neutral sequence, avoiding errors during installation.

All components and accessories of the XCP line are sold already in IP55 version, the same basic protection degree of the line.

The entire busbar is halogen-free and has the characteristic of NON flame propagation; in this regard, our product standard 61439-6 requires this verification by referring to the specific standard IEC 60332-3.

During assembly and operation, the conductive bars within the Monoblock junction system may not always be perfectly aligned. This is a normal condition and does not compromise the functionality or safety of the connection. A maximum misalignment of up to 5 mm between the bars is permitted.

This tolerance ensures that the system remains mechanically stable and electrically reliable, even in cases where slight deviations occur due to manufacturing or installation constraints.

STRAIGHT ELEMENTS

There are two types of straight elements:

- Transport elements
- Distribution elements

Transport elements

These do not feature tap-off windows and are used solely for power distribution. They can be ordered in lengths starting from 500 mm up to the standard 3000 mm, depending on the specific requirements of the installation.



Distribution elements

These include tap-off windows on both sides for current derivation. The standard 3000 mm element features three tap-off windows on each side.

Shorter lengths are also available; however, the number of tap-off windows decreases accordingly. This is due to the minimum spacing required between windows to ensure sufficient room for installing tap-off boxes. The outlets are closed by a shutter that guarantees IP55 protection; with the shutter open, the outlet has IP2X protection (finger proof).



For all available versions and configurations, please refer to the product catalog or the design software.



DIRECTIONAL CHANGES

To accommodate changes in direction, various elbow elements are available to meet different installation needs.

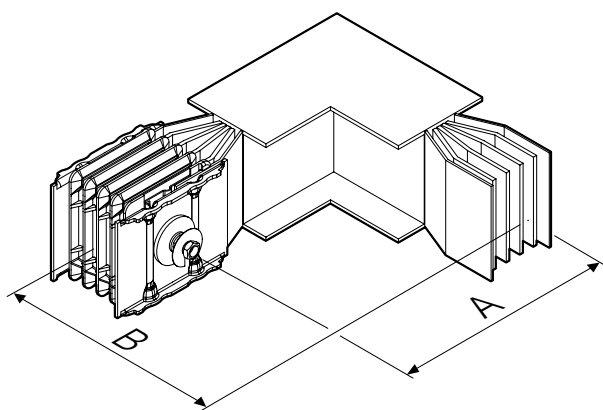
Horizontal elbow

To determine the correct type of horizontal elbow, consider positioning the element "on edge", meaning the conductors are perpendicular to the ground.

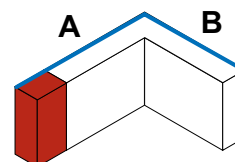
In this configuration, horizontal angles allow for a change in direction parallel to the ground.

The two legs of an elbow element, referred to as Leg A and Leg B, are supplied with standard lengths.

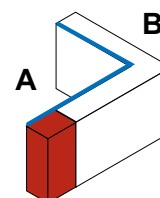
However, to meet specific design requirements, these lengths can be adjusted—either increased or decreased—within defined minimum and maximum limits.



- When the neutral bar is on the outside of the angle, it is classified as a right horizontal angle (Type 1).



- When the neutral bar is on the inside of the angle, it is classified as a left horizontal angle (Type 2).



For detailed configurations and dimensions, please refer to the product catalog or the design software.

Vertical elbow

To correctly identify the type of vertical elbow required, the element should always be positioned "on edge", with the conductors perpendicular to the ground.

In this orientation:

- The side with the monoblock should face the observer.
- The side without the monoblock should point upward.

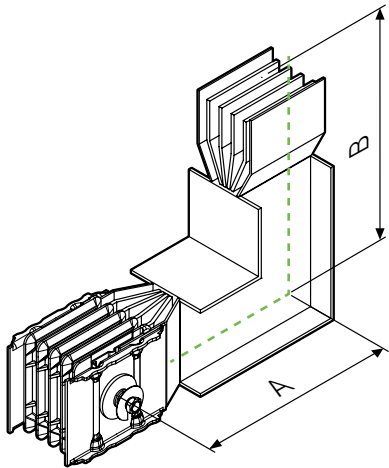
This configuration allows vertical elbows to change the routing upward or downward.

DIRECTIONAL CHANGES

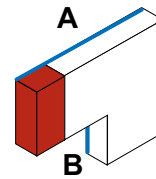
Vertical elbows (continued)

The two legs of an elbow element, referred to as Leg A and Leg B, are supplied with standard lengths. However, to meet specific design requirements, these lengths can be adjusted—either increased or decreased—within defined minimum and maximum limits. For all non-standard vertical elbows, **only one of the two legs (A or B) can exceed 600 mm in length.**

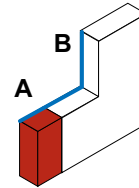
For example, if a vertical elbow is ordered with Leg A = 1000 mm, then Leg B must be ≤ 600 mm.



- If the neutral bar is on the left side, the elbow is classified as a Left Vertical Elbow (Type 1).



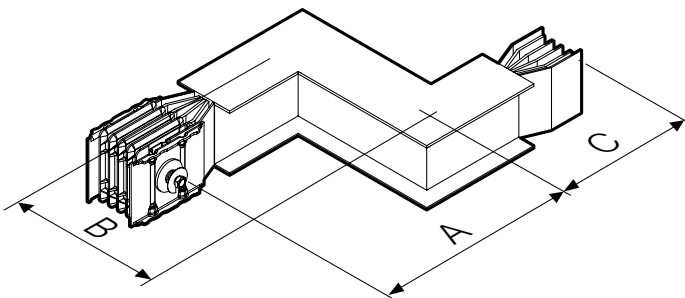
- If the neutral bar is on the right side, the elbow is classified as a Right Vertical Elbow (Type 2).



For detailed configurations and dimensions, please refer to the product catalog or the design software.

Double horizontal elbows

A double horizontal angle is the combination of two horizontal elbows.



For safety during production and to facilitate installation, when one of the dimensions approaches the maximum manufacturable size (e.g., A = 1100 mm), the other two dimensions should be kept close to standard values (e.g., B = 300 mm, C = 310 mm).



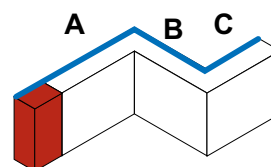
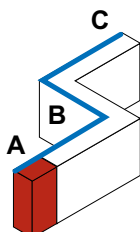
For detailed configurations and dimensions, please refer to the product catalog or the design software.



Double horizontal elbows (continued)

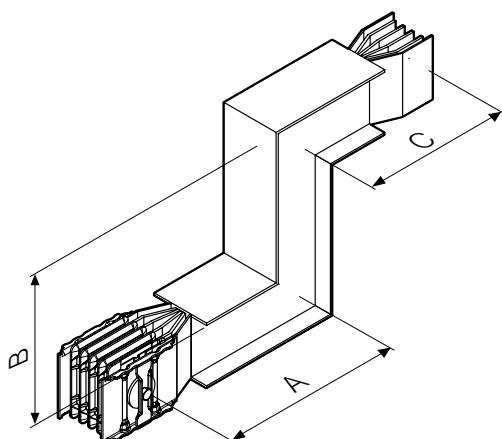
To determine its type, observe the configuration starting from the monoblock:

- If the first elbow encountered is left-oriented, the configuration is a Left + Right Double Horizontal Angle (Type 2)
- If the first elbow encountered is right-oriented, the configuration is a Right + Left Double Horizontal Angle (Type 1)



This classification helps ensure correct installation and alignment of the busbar system, especially in complex layouts.

Double vertical elbows



A double vertical angle is the combination of two vertical elbows.

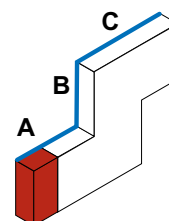
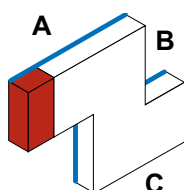
- i** For safety during production and to facilitate installation, when one of the dimensions approaches the maximum manufacturable size (e.g., $A = 1100$ mm), the other two dimensions should be kept close to standard values (e.g., $B = 300$ mm, $C = 310$ mm).



For detailed configurations and dimensions, please refer to the product catalog or the design software.

To determine its type, observe the configuration starting from the monoblock:

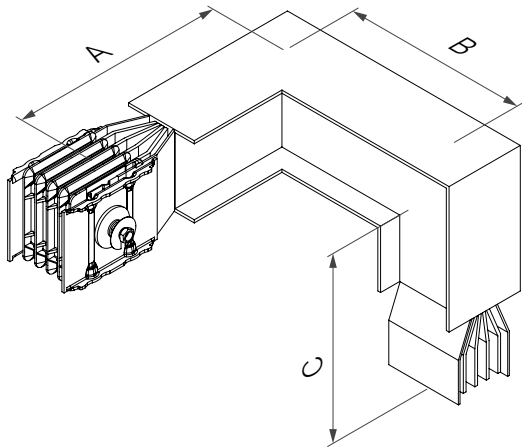
- If the first elbow encountered is left-oriented, the configuration is a Left + Right Double Vertical Angle (Type 1)
- If the first elbow encountered is right-oriented, the configuration is a Right + Left Double Vertical Angle (Type 2)



This classification ensures correct orientation and alignment of the vertical path in the busbar system.

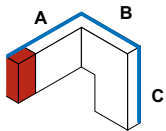
DIRECTIONAL CHANGES

Double horizontal + vertical elbows

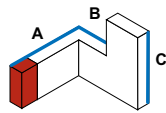


A horizontal + vertical double angle is the combination of one horizontal elbow and one vertical elbow, arranged in sequence starting from the monoblock side.

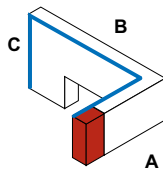
Depending on the orientation of the elbows, there are four possible types:



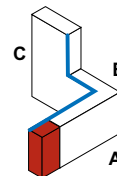
TYPE 1
Horizontal
Right + Vertical
Right



TYPE 2
Horizontal
Right + Vertical
Left



TYPE 3
Horizontal Left
+ Vertical Right



TYPE 4
Horizontal Left
+ Vertical Left

This classification helps ensure correct routing and alignment of the busbar system in complex three-dimensional layouts.

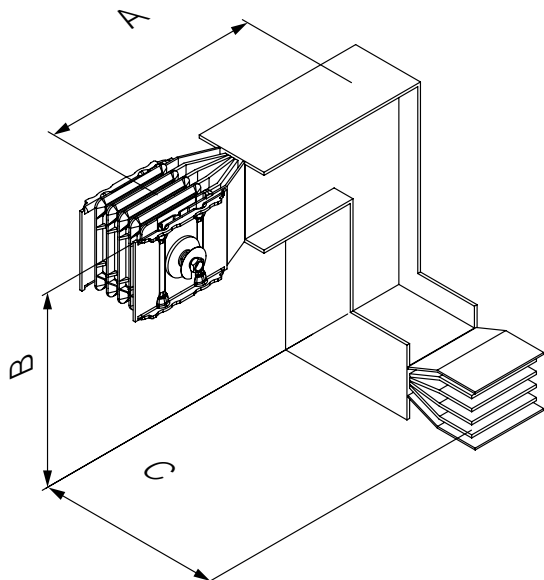
i For safety during production and to simplify installation, when one of the dimensions approaches the maximum manufacturable limit (e.g., $A = 1100$ mm), the other two dimensions should be kept close to standard values (e.g., $B = 300$ mm, $C = 310$ mm).



For further details and visual references, please refer to the product catalog or the design software.

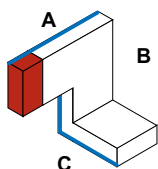


Double vertical + horizontal elbows

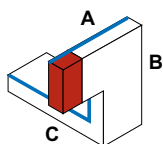


A vertical + horizontal double angle is the combination of one vertical elbow and one horizontal elbow, arranged in sequence starting from the monoblock side.

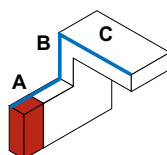
Depending on the orientation of the elbows, there are four possible types:



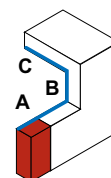
TYPE 1
Vertical Right
+ Horizontal
Right



TYPE 2
Vertical Right +
Horizontal Left



TYPE 3
Vertical Left
+ Horizontal
Right



TYPE 4
Vertical Left +
Horizontal Left

This classification helps ensure correct routing and alignment of the busbar system in complex three-dimensional layouts.

For safety during production and to simplify installation, when one of the dimensions approaches the maximum manufacturable limit (e.g., A = 1100 mm), the other two dimensions should be kept close to standard values (e.g., B = 300 mm, C = 310 mm).



For further details and visual references, please refer to the product catalog or the design software.

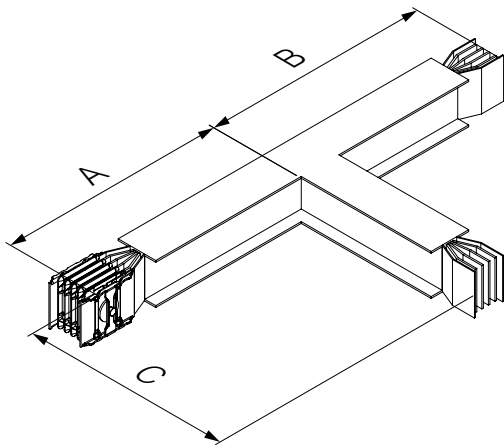


DIRECTIONAL CHANGES

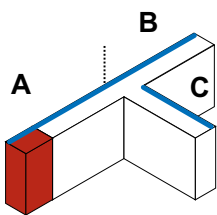
T-elements

T-elements are used to split the main line into two branches, combining the effect of two diverging elbows. There are four different types of T-elements available, depending on the orientation and configuration of the branches. These elements are essential for creating branching points in busbar trunking systems, especially in complex layouts where multiple distribution paths are required.

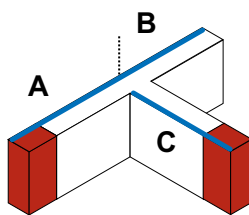
HORIZONTAL T-ELEMENTS



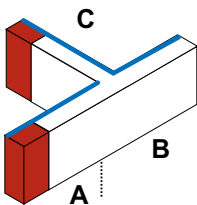
TYPE 1



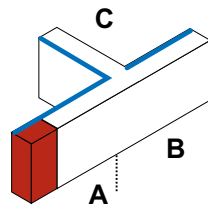
TYPE 2



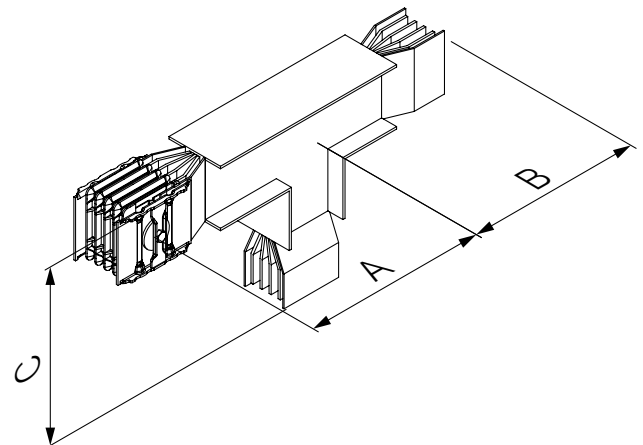
TYPE 3



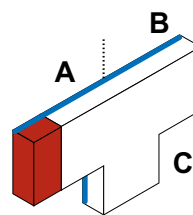
TYPE 4



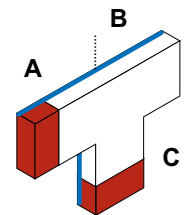
VERTICAL T-ELEMENTS



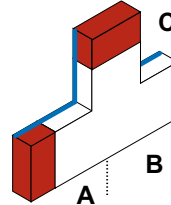
TYPE 1



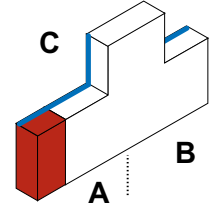
TYPE 2



TYPE 3



TYPE 4



For all non-standard T-elements, only one of the three sides can exceed 600 mm in length. For example: If the A dimension is 650 mm, then dimensions B and C must each be ≤ 600 mm.



For further details and visual references, please refer to the product catalog or the design software.




FEED UNITS

Feed units allow the XCP to be electrically powered through a cable line or directly connected to a distribution electrical panel; the assembly on the line is carried out through a quick connection to the monoblock, as with the straight elements.



The power supplies are equipped with stubs for connecting cables fitted with lugs compatible with a 15x20 mm slotted hole.

 The cable entry point is generally located at the rear of the power supply where there is a removable flange, but it is also possible to enter with the cables **from the side** flanges.

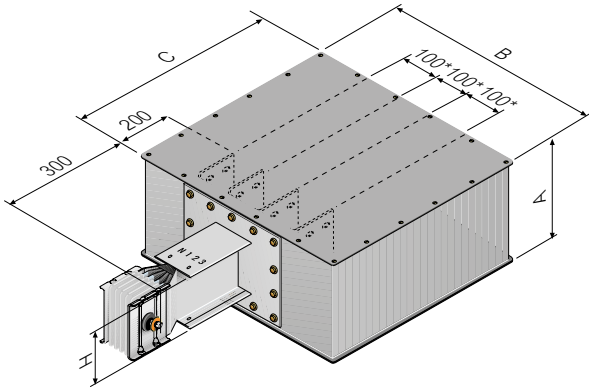
The XCP line has power supplies with in-line and offset positioning for the construction of risers. Intermediate power supplies and power boxes with switch-disconnectors are also available; the latter allow the entire line to be isolated for any maintenance or layout modification.



FEED UNITS

End feed units

End feed units are used at the ends of busbar lines when power is supplied via cables.



* 120 mm for 6300 A (Cu) and 5000 A (Al)

i Dimension H changes with the rating. For more information, please refer to the rating technical sheet.

End feed units are available in two configurations:

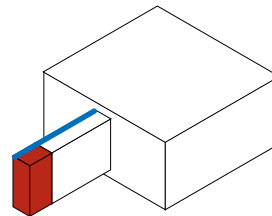
- Left-side version: with monoblock installed (Type 1)
- Right-side version: without monoblock (Type 2)

i Custom configurations are available upon request.

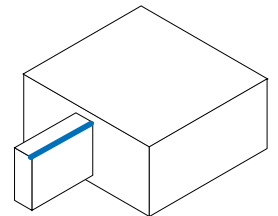
XCP-HP				
RATING (A)		DIMENSIONS (MM)		
Conductor type		A	B	C
Aluminum	Copper			
630 - 1250	800 - 1250	320	615	610
1600 - 2000	1600 - 2500	320	615	810
2500 - 4000	3200 - 5000	600	615	810
5000	6300	900	615	810

XCP-S				
RATING (A)		DIMENSIONS (MM)		
Conductor type		A	B	C
Aluminum	Copper			
630 - 1000	800 - 1250	320	615	610
1250 - 2000	1600 - 2000	320	615	810
2500 - 4000	2500 - 5000	600	615	810
5000	6300	815	615	810

TYPE 1



TYPE 2



CONSTRUCTION DETAILS

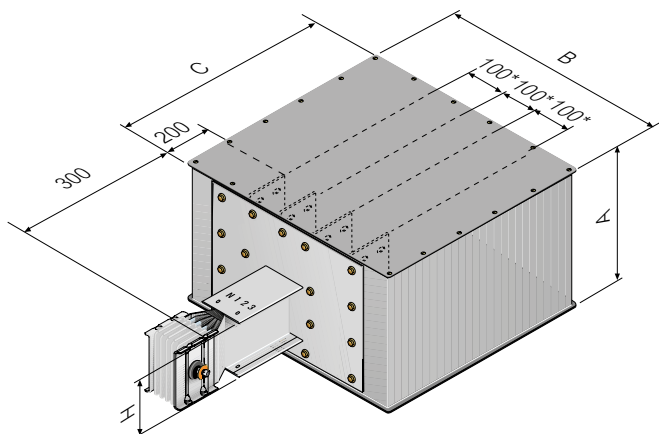
- For **single-bar busways**, the end feed unit is supplied with one blind rear closing plate made of aluminum.
 - For **double-bar busways**, the unit includes two closing plates and one additional metal flange per side.
 - For **triple-bar busways**, the unit includes three closing plates and three additional aluminum flanges per side.
- Cable connection is made directly to the bars using bolts.



Rising mains feed units

The rising mains feed units are used at the departure of the riser mains lines, when the busbar must be placed close to the wall and powered using cables.

They allow the busbar to be installed **40 mm away from the wall**.



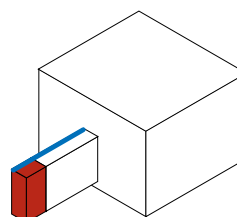
Dimension H changes with the rating. For more information, please refer to the rating technical sheet.

Rising mains feed units are available in two configurations:

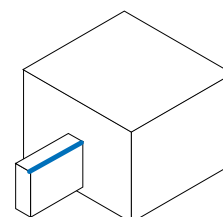
- Left-side version: supplied with pre-fitted monobloc (Type 1)
- Right-side version: without monobloc (Type 2)

Custom configurations are available upon request.

TYPE 1



TYPE 2



CONSTRUCTION DETAILS

- For **single-bar busways**, the end feed unit is supplied with one blind rear closing plate made of aluminum.
- For **double-bar busways**, the unit includes two closing plates and one additional metal flange per side.
- For **triple-bar busways**, the unit includes three closing plates and three additional aluminum flanges per side.

Cable connection is made directly to the bars using bolts.



To feed the power supply cable through the back power supply flanges, it will be necessary to drill a hole in case of single bar, and two holes in case of double bar.

XCP-HP				
RATING (A)		DIMENSIONS (MM)		
Conductor type		A	B	C
Aluminum	Copper			
630 - 1250	800 - 1250	320	615	610
1600 - 2000	1600 - 2500	320	615	810
2500 - 4000	3200 - 5000	600	615	810
5000	6300	900	615	810

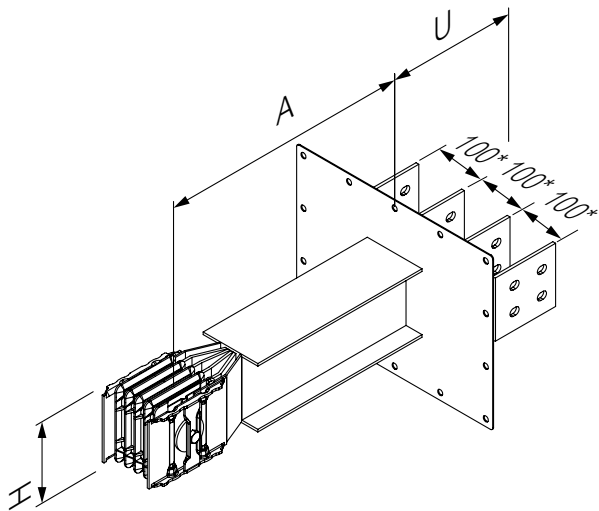
XCP-S				
RATING (A)		DIMENSIONS (MM)		
Conductor type		A	B	C
Aluminum	Copper			
630 - 1000	800 - 1250	320	615	610
1250 - 2000	1600 - 2000	320	615	810
2500 - 4000	2500 - 5000	600	615	810
5000	6300	815	615	810



FEED UNITS

Standard connection interface

Standard bar outlet units are used at the ends of busbar lines to connect the busbar system to switchboards or transformers.



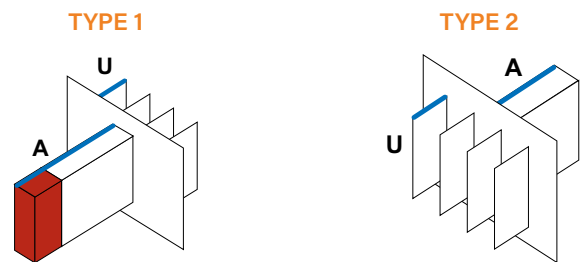
*120 mm for 6300 A (Cu) and 5000 A (Al)

RATING (A)		DIMENSIONS (MM)	
Conductor type		A (MIN - MAX)	U (MIN - MAX)
Aluminum	Copper		
630 - 6300		300 - 1299	150 - 400

i Dimension H changes with the rating.
For more information, please refer to the rating technical sheet.

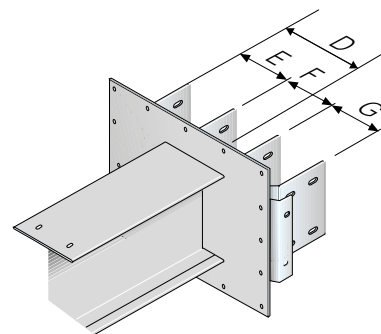
They are available in two configurations:

- Left-side version: with pre-mounted monobloc (Type 1)
- Right-side version: without monobloc (Type 2)



i Custom configurations are available upon request including:

- different lengths
- bar spacing
- drilling patterns



If the installation requires the use of power centre Legrand XL³ 4000, standard connection interfaces may be supplied already fitted on the cabinet itself.



Special configurations

Some of the previously described configurations can be combined in various ways to meet installation requirements, especially when **space constraints or dimensional limitations** are present in the installation area.

These combinations are designed to offer **flexibility and adaptability**.

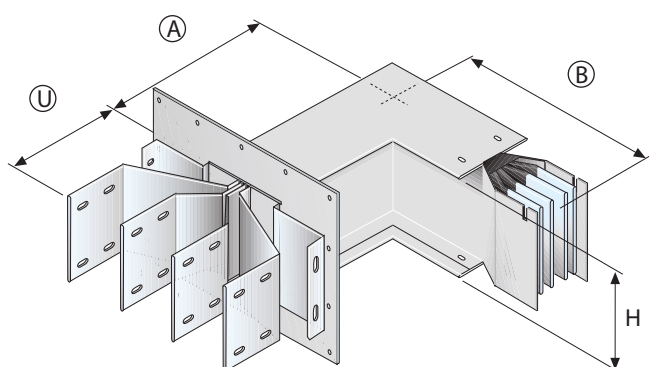
The technical characteristics remain the same as previously described, but special attention must be paid to the minimum and maximum dimensions that can be manufactured.

To verify whether the required dimensions can be produced, please refer to the design software

Below you will find the available configuration options.

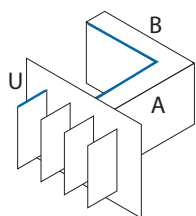
STANDARD CONNECTION INTERFACE + HORIZONTAL ELBOW

This element is the union of a standard connection interface with a horizontal elbow.

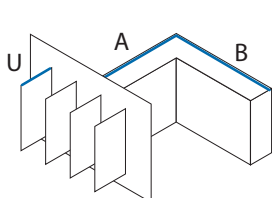


Dimension H changes with the rating. For more information, please refer to the rating technical sheet.

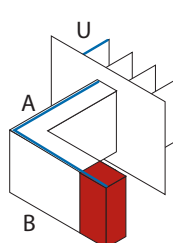
TYPE 1



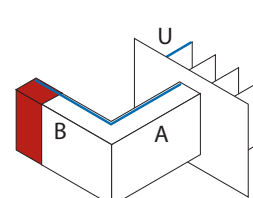
TYPE 2



TYPE 3



TYPE 4

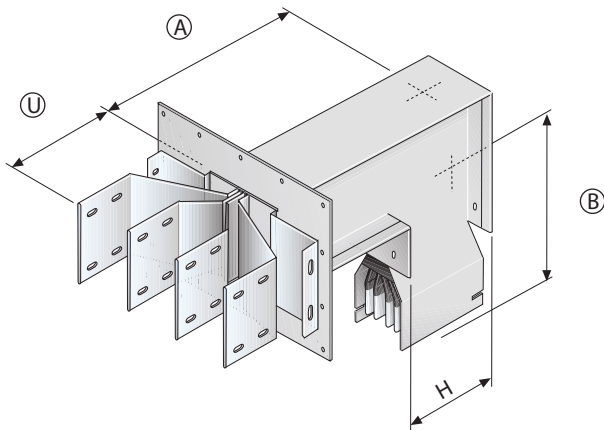


FEED UNITS

Special configurations (continued)

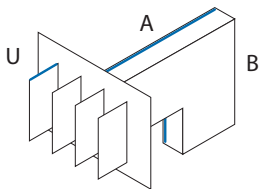
STANDARD CONNECTION INTERFACE + VERTICAL ELBOW

This element is the union of a standard connection interface with a vertical elbow.

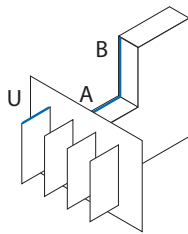


i Dimension H changes with the rating.
For more information, please refer to the rating technical sheet.

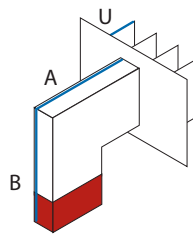
TYPE 1



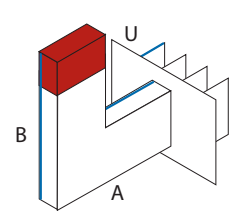
TYPE 2



TYPE 3

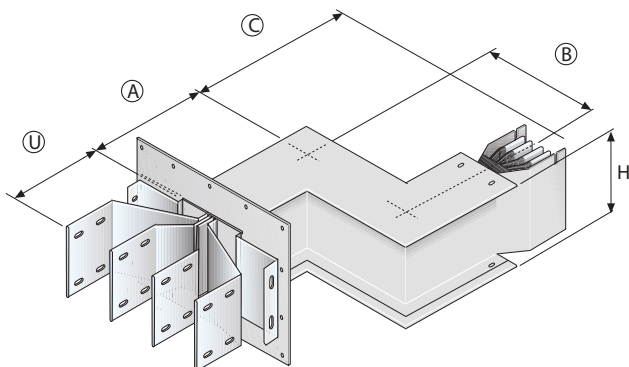


TYPE 4



STANDARD CONNECTION INTERFACE + DOUBLE HORIZONTAL ELBOW

This element is the union of a connection interface with two horizontal elbows.

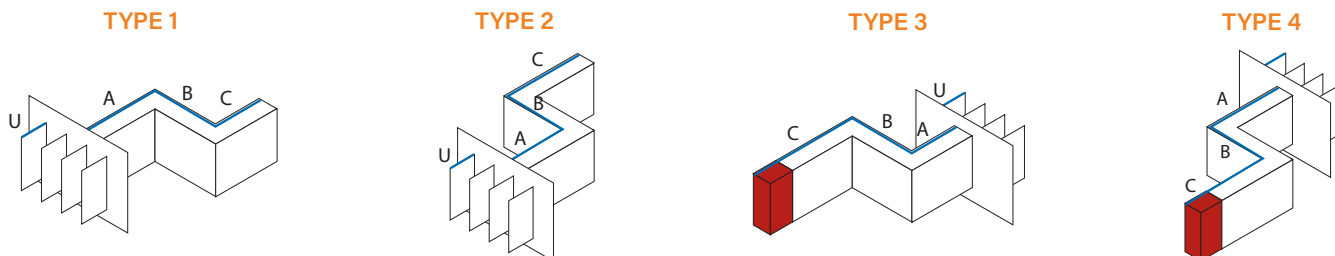


i Dimension H changes with the rating.
For more information, please refer to the rating technical sheet.



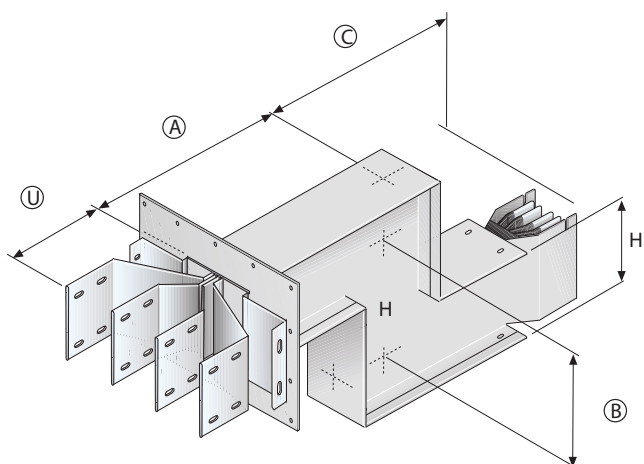
Special configurations (continued)

STANDARD CONNECTION INTERFACE + DOUBLE HORIZONTAL ELBOW (CONTINUED)

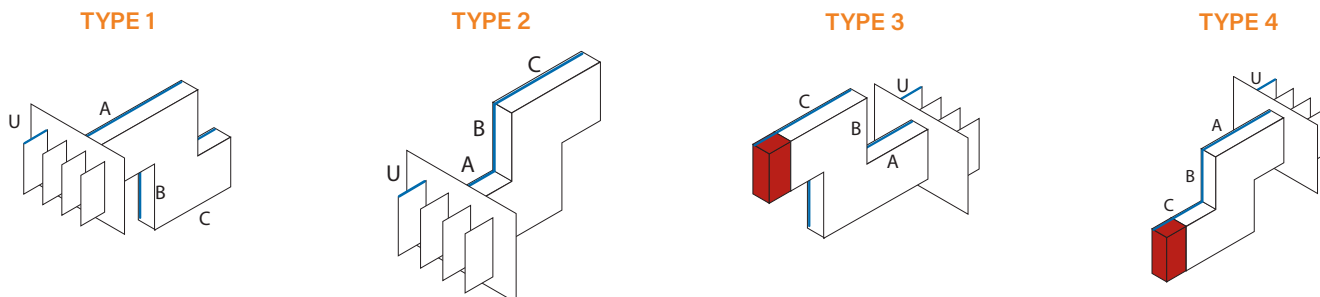


STANDARD CONNECTION INTERFACE + DOUBLE VERTICAL ELBOW

This element is the union of a connection interface with two vertical elbows.



i Dimension H changes with the rating. For more information, please refer to the rating technical sheet.

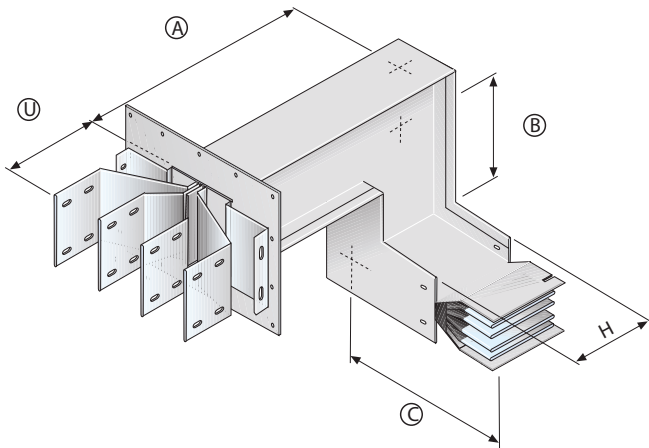



FEED UNITS

Special configurations (continued)

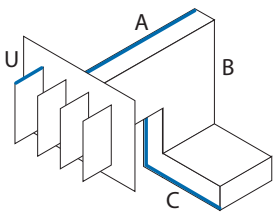
STANDARD CONNECTION INTERFACE + VERTICAL ELBOW + HORIZONTAL ELBOW

This element is the union of a connection interface with a double vertical + horizontal elbow.

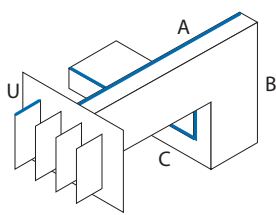


 Dimension H changes with the rating.
For more information, please refer to the rating technical sheet.

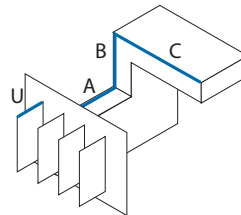
TYPE 1



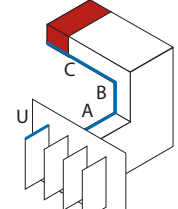
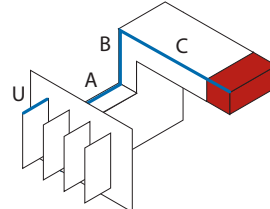
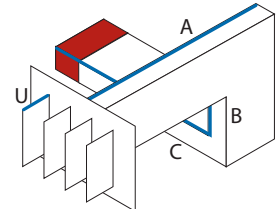
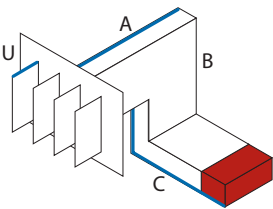
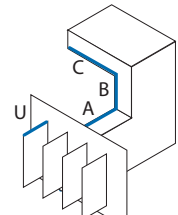
TYPE 2



TYPE 3



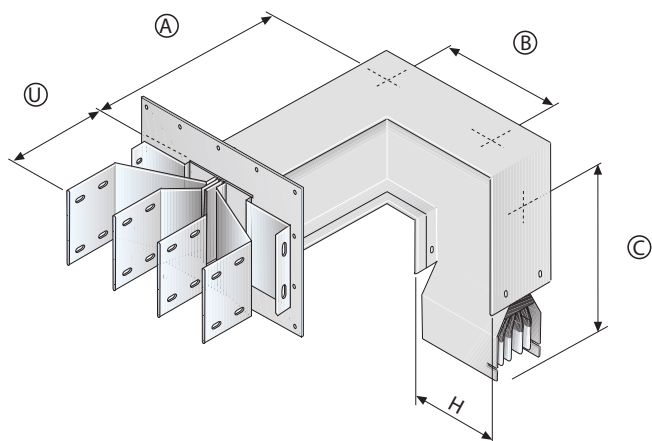
TYPE 4



Special configurations (continued)

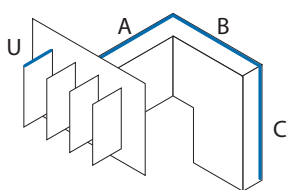
STANDARD CONNECTION INTERFACE + HORIZONTAL ELBOW + VERTICAL ELBOW

This element is the union of a connection interface with a double horizontal + vertical elbow.

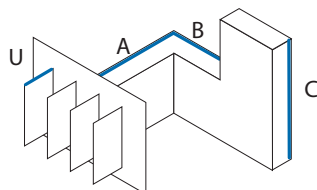


Dimension H changes with the rating. For more information, please refer to the rating technical sheet.

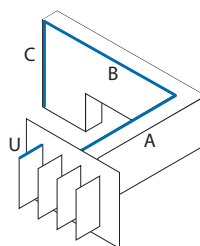
TYPE 1



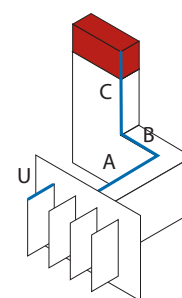
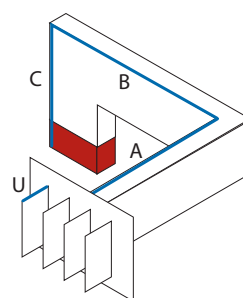
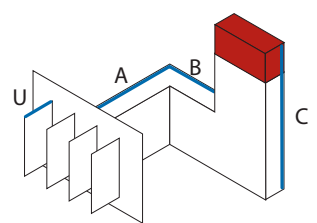
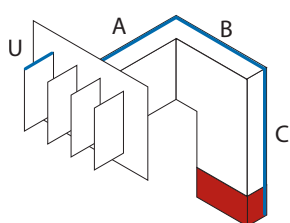
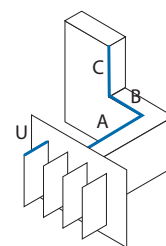
TYPE 2



TYPE 3



TYPE 4



Drilling details

Updated drilling details are available in STEP format on the official website legrand.com or directly within the design software.



Dimensional accuracy is essential to ensure that the busbar accessory fits properly and there is sufficient space for connection to the switchboard.

Before proceeding with installation, always verify the overall dimensions and clearances using the design software to confirm compatibility with the available space.

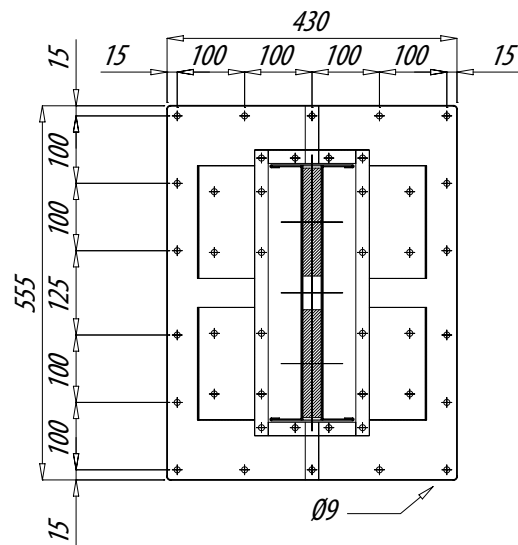
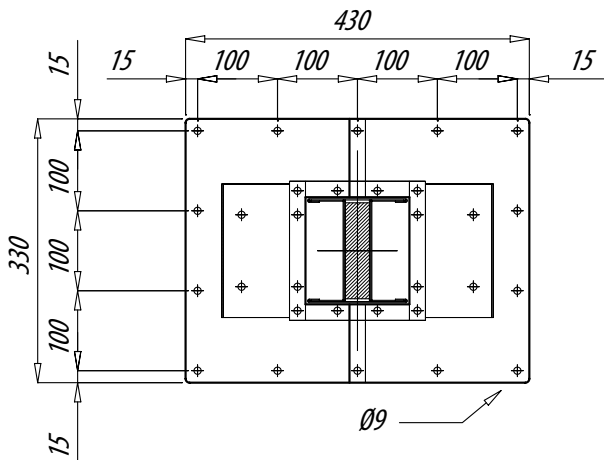


FEED UNITS

Drilling details (continued)

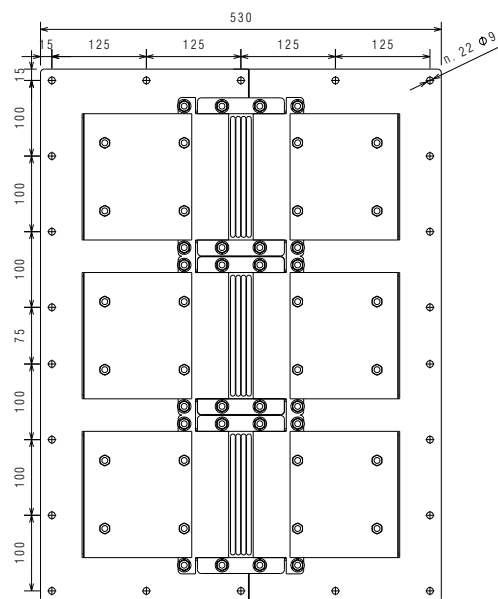
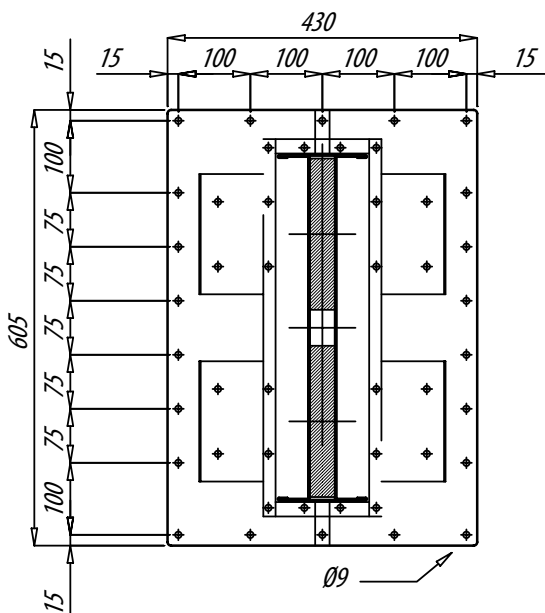
XCP-S Aluminium: 630 A - 2000 A | **Copper:** 800 A - 2000 A
XCP-HP Aluminium: 630 A - 2000 A | **Copper:** 800 A - 2500 A

XCP-S Aluminium: 2500 A - 3200 A | **Copper:** 2500 A - 4000 A
XCP-HP Aluminium: 2500 A - 3200 A | **Copper:** 2500 A - 4000 A



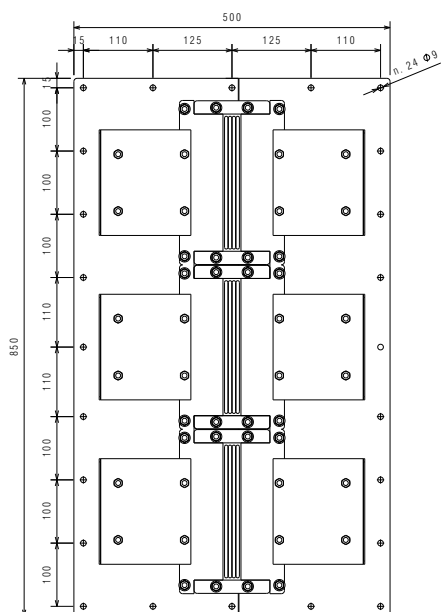
XCP-S Aluminium: 4000 A | **Copper:** 5000 A
XCP-HP Aluminium: 4000 A | **Copper:** 5000 A

XCP-S Aluminium: 5000 A | **Copper:** 6300 A

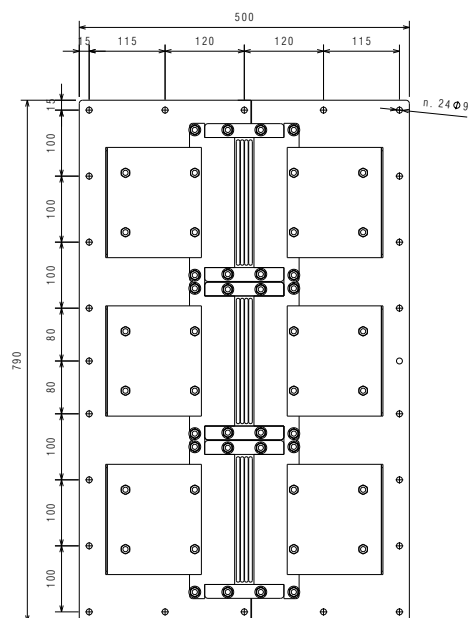


Drilling details (continued)

XCP-HP Aluminium: 5000 A



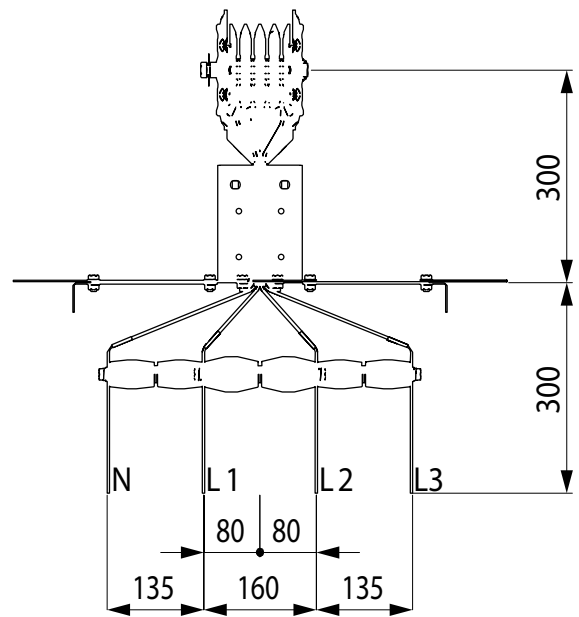
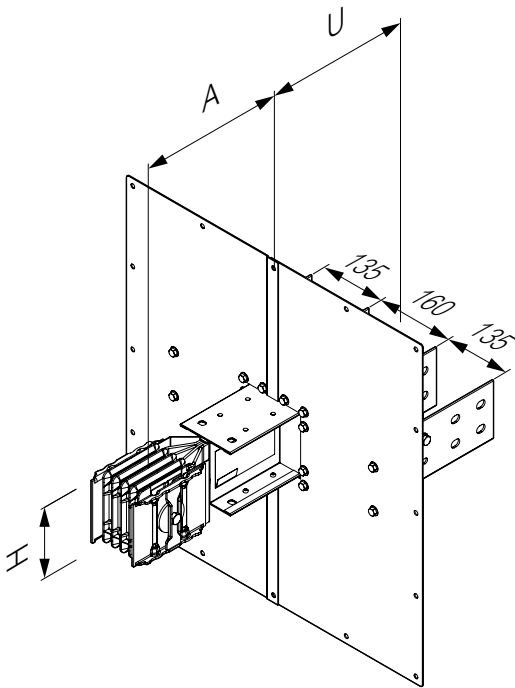
XCP-HP Copper: 6300 A



CAST RESIN TRANSFORMER (CTR) ELEMENT

Busbar connection element CRT (Cast Resin Transformer)

This connection element is designed to facilitate the interface between the busbar system and a cast resin transformer (CRT).



DIMENSIONS (MM)	U (MIN - MAX)	A (MIN - MAX)
Single bar	300 - 400	200 - 1299
Double bar	300 - 400	200 - 1299
Triple bar	300 - 400	250 - 1299

 Dimension H changes with the rating. For more information, please refer to the catalog.

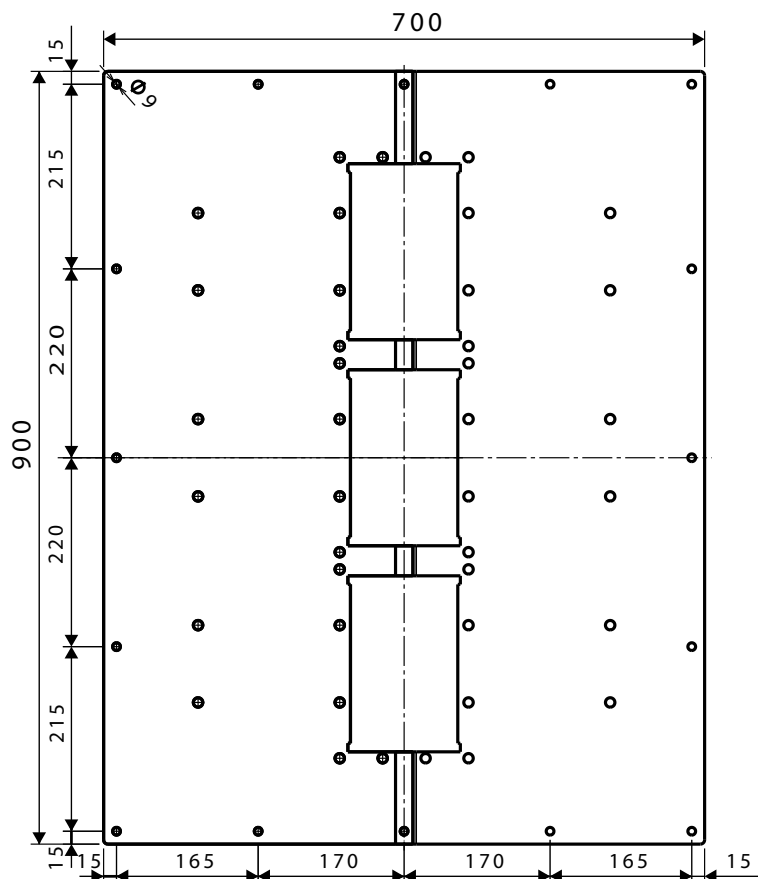
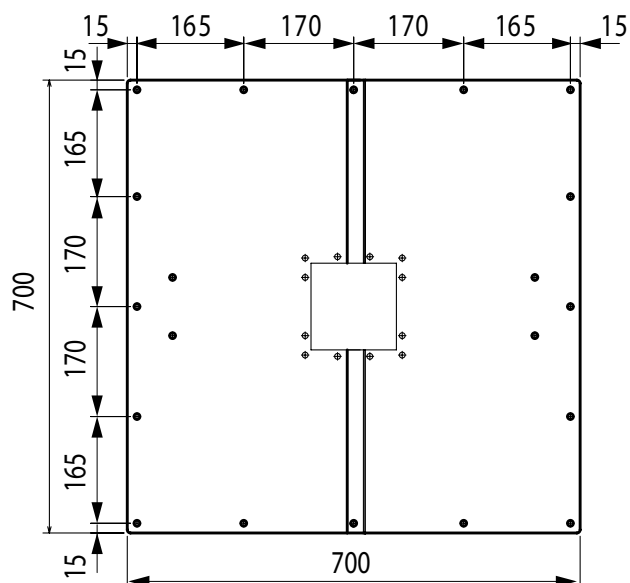


Drilling details

CRT flanges are available in two versions:

700 x 700mm version (single and double bar pack) :

900 x 700mm version :



Thanks to the offset positioning of the connection strips, it simplifies alignment and connection to the transformer terminals. Additionally, it provides **enhanced insulation safety** in environments subject to strong vibrations, thanks to the insulating supports placed between the connection bars.

- This solution ensures both mechanical stability and electrical reliability, making it ideal for transformer connections in demanding installation conditions.



CAST RESIN TRANSFORMER (CTR) ELEMENT

Cast resin transformer (CRT) connection

CONNECTIONS TO TRANSFORMER TERMINALS - HEAVY DUTY SYSTEMS



It is mandatory to use silver-plated copper surfaces in contact with the transformer terminals.

- In case of direct connection with braid, the braid terminals must be silver-plated.
- In case of connection via expansion/adaptation bars, the bars must be silver-plated, while the braids may have bare copper terminals.

CONNECTIONS TO TRANSFORMER TERMINALS - NON-HEAVY DUTY SYSTEMS



It is mandatory to use silver-plated copper surfaces in contact with the transformer terminals.

- In case of direct connection with braid, the braid terminals must be silver-plated.
- In case of connection via expansion/adaptation bars, the bars must be silver-plated, while the braids may have bare copper terminals.

BRAID CROSS-SECTIONS

For heavy duty systems, braid cross-sections **must** comply with the values shown in the table below.

HEAVY DUTY LIKE DATA CENTER				
FLEXIBLE WITH SILVER-PLATED OR BARE COPPER TERMINALS				
KVA	RANGE (A)	SECTION (MM ²)	QUANTITY	TOTAL SECTION (MM ²)
400	630	400	1	400
500	800	500	1	500
630	1000	600	1	600
800	1250	800	1	800
1000	1600	1000	1	1000
1250	2000	1200	1	1200
1600	2500	800	2	1600
2000	3200	1000	2	2000
2500	4000	1200	2	2400
3150	5000	1200	3	3600
4000	6300	1200	4	4800



Cast resin transformer (CRT) connection (continued)

BRAID CROSS-SECTIONS

For non-heavy duty systems, braid cross-sections **must** comply with the values shown in the table below.

IEC 61439-6 STANDARD AND NO DATA CENTER

FLEXIBLE WITH SILVER-PLATED OR BARE COPPER TERMINALS

RANGE (A)	SECTION (MM ²)	QUANTITY	TOTAL SECTION (MM ²)
630	300	1	300
800	400	1	400
1000	500	1	500
1250	600	1	600
1600	800	1	800
2000	1000	1	1000
2500	600	2	1200
3200	800	2	1600
4000	1000	2	2000
5000	1000	3	3000
6300	1200	3	3600

USE OF BOXES AND PROTECTIVE ENCLOSURES

If required, use:

- Transformer-specific boxes
- Protective enclosures for connections between transformer and ATR



Enclosures must always be ventilated unless otherwise specified.

The connections made with flexible copper braid and tinned terminals, provided by Legrand as a standard electrical connection between the transformer and the bar duct, are designed and compatible for direct contact on the aluminium terminals of the transformer (provided that the joints are made according to the correct relevant procedures by qualified installers).



EXPANSION ELEMENTS

Expansion elements are 1.5 meters long straight sections that allow up to ± 25 mm (total 50 mm) axial movement. Their correct use ensures the mechanical continuity and reliability of the system.

Installation criteria

The expansion element must be secured in position but free to move to allow for proper thermal expansion.

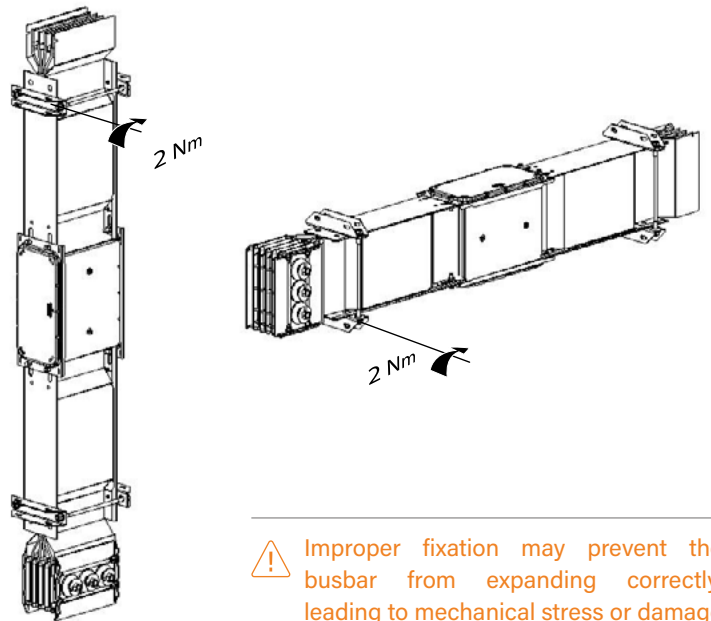
Therefore, it must be installed according to the following guidelines:

- Ensure that no rigid brackets are placed along the expansion zone.

For vertical installation (riser columns)

According to the installation manual, for vertical sections:

- Standard brackets must be tightened to 15 Nm during initial installation.
- The busbar must be fixed both above and below the expansion element.
- Once the busbar is secured and the joint connections are tightened, the torque on the standard brackets must be reduced to 2 Nm to allow for proper expansion movement.



! Improper fixation may prevent the busbar from expanding correctly, leading to mechanical stress or damage over time.

Structural joints or decoupling points

An expansion element must be installed wherever the line crosses a structural expansion joint or a mechanical joint in the building.

- !** If a decoupling element is required (allowing movement along two or three axes), an expansion element **must not** be used. Instead, the line must be fully decoupled at that point.



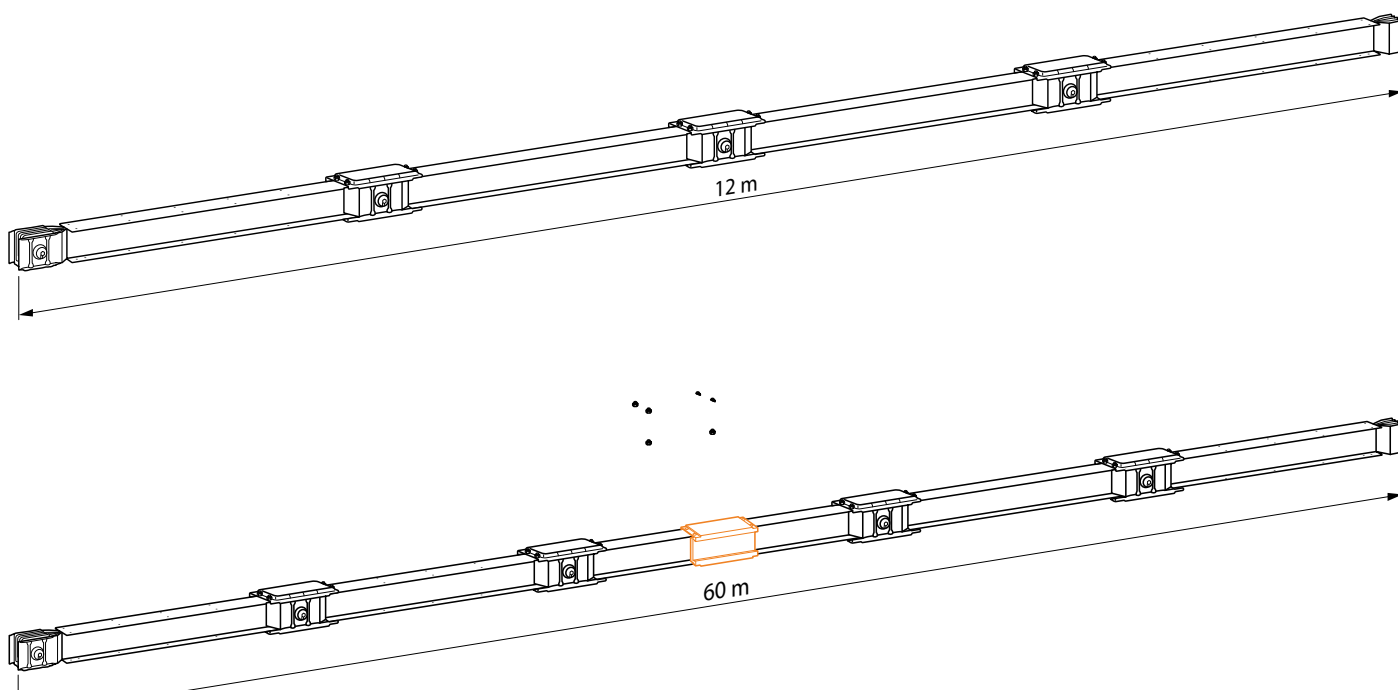
Straight sections (horizontal installation)

For straight-line runs, use the following formula:

$$DIL = (L/K) (I/I_n) - 1$$

Where:

- n = number of expansion elements to install
- Ltotal = total length of the line
- I = operation current
- In = nominal current
- K = 35m = maximum distance between expansion elements
- DIL : expansion element



Example :

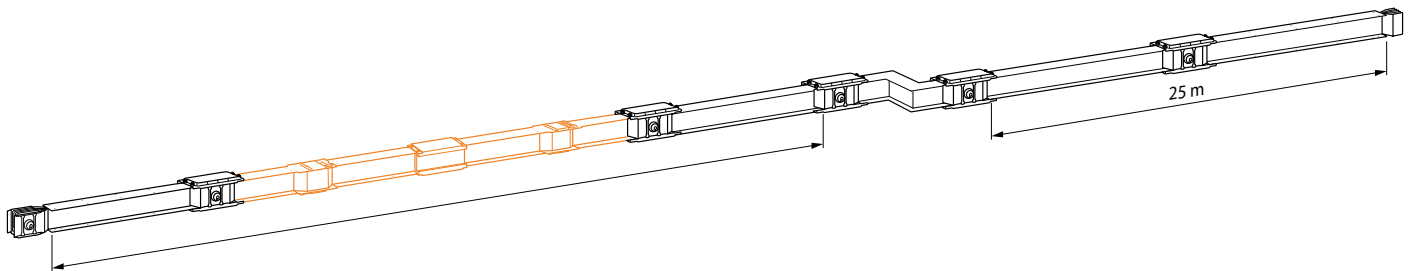
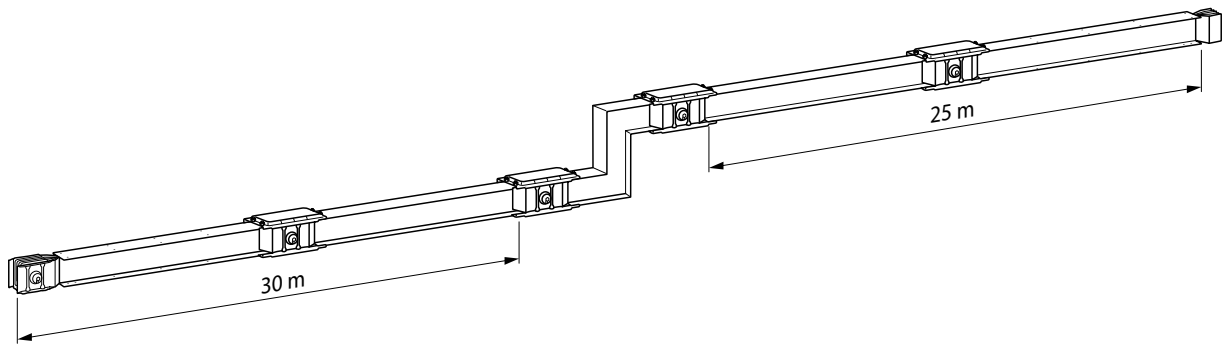
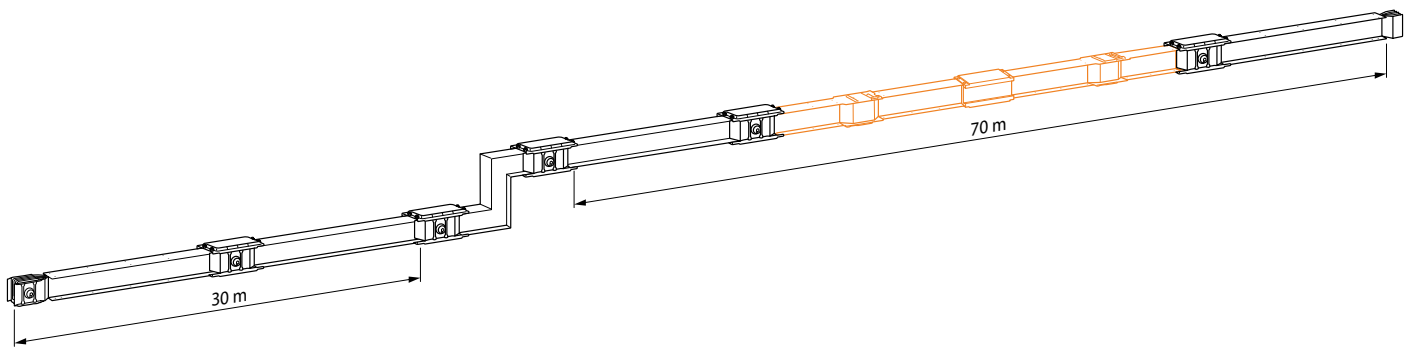
L	60	90	44	192	200	170	340
K	35	35	35	35	35	35	35
N° DIL	1	2	1	5	5	4	9

EXPANSION ELEMENTS

Lines with elbow

In the presence of elbows:

- Consider the length between one bend and the next, or between the start of the line and the first elbow.
- Apply the same formula using $K=35\text{m}$.



Presence of T elements

T elements (both horizontal and vertical) are considered fixed points that do not allow for expansion.

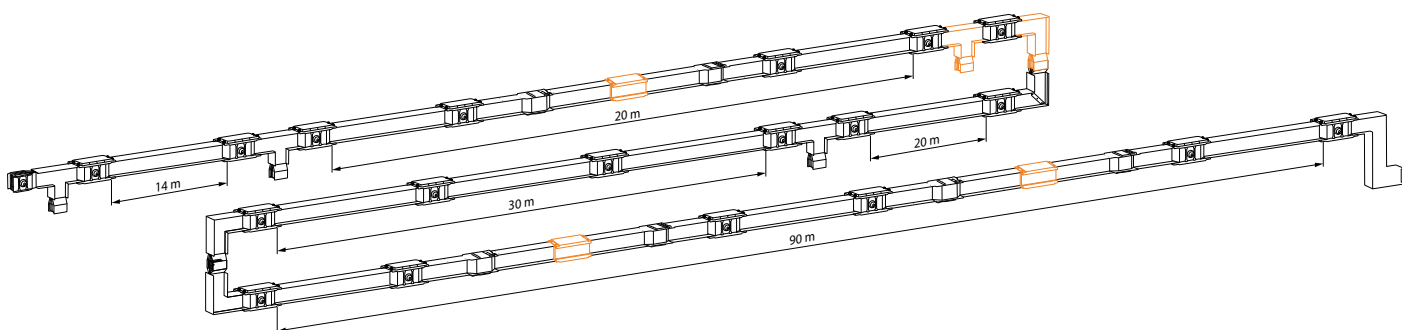
Between two T elements, stricter rules apply:

- $L \leq 15\text{m}$: no expansion element necessary
- If $15 < L < 35\text{m}$: use one expansion element
- $L \geq 35\text{m}$: use the formula

$$DIL = (L/K)(I/IN)$$

with $K=35\text{m}$

If a T element is located near an elbow or any element that changes the route, apply the standard rule with $K=35\text{m}$.



Vertically installed – Riser columns

For busbar sections installed vertically (riser columns), the same expansion calculation formula used for horizontal sections applies, with a standard value of $K = 35\text{m}$.

If T elements are present along the vertical section, the same rules described for horizontal busbar apply:

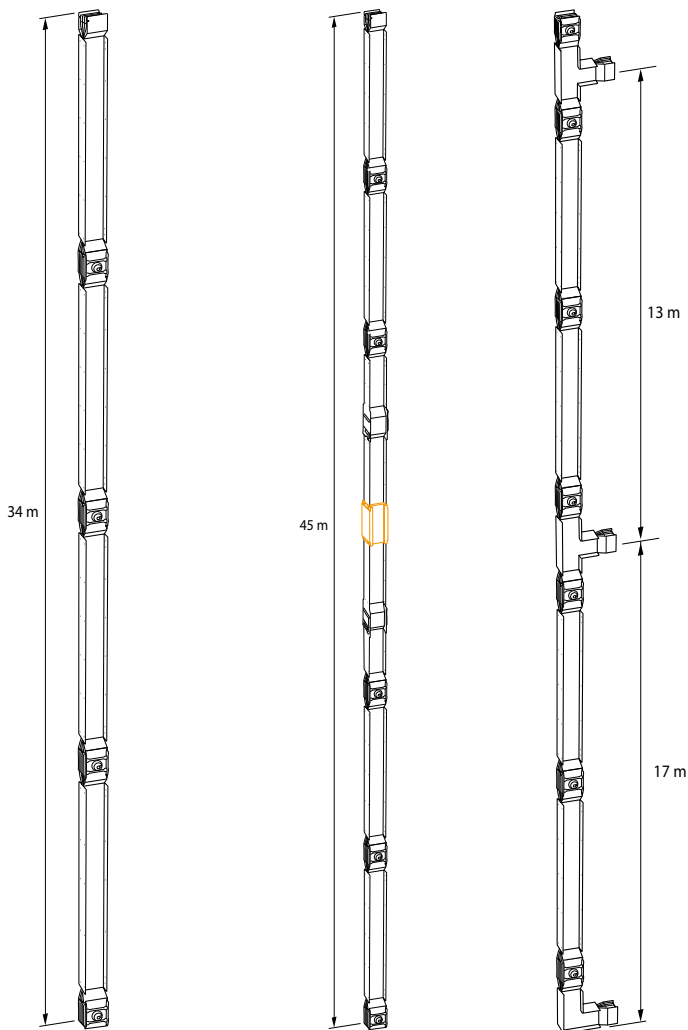
- $L \leq 15\text{m}$: no expansion element necessary
- If $15 < L < 35\text{m}$: use one expansion element
- $L \geq 35\text{m}$: use the formula

$$DIL = (L/K)(I/IN)$$

with $K=35\text{m}$

Vertically installed – Riser columns (continued)

MOUNTING FOR RISER COLUMNS



⚠ It is mandatory to use the mounting system recommended by Legrand, employing spring brackets (for riser columns > 4m).

The busbar **must not** be rigidly fixed to the wall, allowing for free thermal expansion.

No riser column brackets should be installed on the expansion element —**only centering brackets** must be used to ensure proper busbar movement.

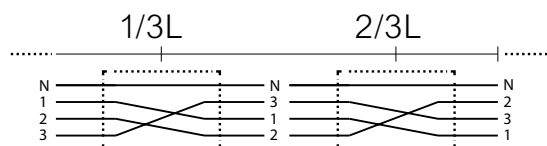
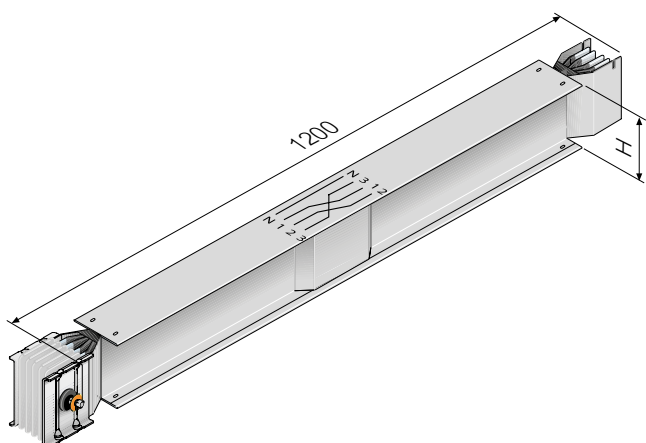
Conclusion

The correct installation of XCP expansion elements is essential to ensure the durability, safety, and reliability of electrical lines, especially in environments subject to significant thermal variations or rigid structural constraints.



TRANSPOSITION ELEMENTS

A phase transposition element is a component installed along an electrical line (typically in busbar trunking systems or cable trays) that allows the physical position of the phases (e.g., L1, L2, L3) to be swapped along the route.



Electric diagram: Two elements offer all the possible reciprocal positions among the phases along the line.

LENGTH OF ELEMENT

Aluminium/Copper conductors

Rating (A)	Length (L)
630 - 6300	1200 mm

WHAT IS PHASE TRANSPOSITION?

Phase transposition is the practice of **swapping the physical positions of the phases** (L1, L2, L3) along a three-phase line. Each phase occupies every possible position (outer, center, opposite) for an equal portion of the route.

This helps to:

- **Equalize phase heating:**
on long runs, the outer phases (L1 and L3) tend to dissipate more heat than the center phase (L2), creating thermal imbalance;
- **Balance electrical losses:**
transposing the phases helps distribute Joule losses and skin effect more evenly;
- **Reduce electromagnetic stress:**
transposition helps compensate for electrodynamic forces between conductors, improving mechanical stability;
- **Optimize system lifespan:**
by reducing hotspots and imbalances, it enhances reliability and extends the service life of the installation.

INSTALLATION FREQUENCY

For long electrical lines (typically over 100 meters), phase transposition may be beneficial to balance electrical characteristics:

2 transposition elements:

- One placed at 1/3 of the route
- One at 2/3 of the route

This ensures that all possible combinations of phase positions are present along the path, helping to minimize voltage drop and load imbalance.

3 transposition elements:

- Recommended when the same phase sequence is required at both the beginning and end of the line.
- The elements are distributed to restore the original sequence after balancing.



Installing a phase transposition element **improves thermal efficiency of the system, reduces the risk of localized overheating, simplifies predictive maintenance**, thanks to a more uniform phase behavior.

It is recommended for long runs (e.g., over 100 meters) or in systems with high and continuous loads.



PHASE INVERSION AND NEUTRAL ROTATION ELEMENTS



These elements are intended **only for energy transport, not for derivations.**

Do not use phase inversion or neutral jump elements in lines that include:

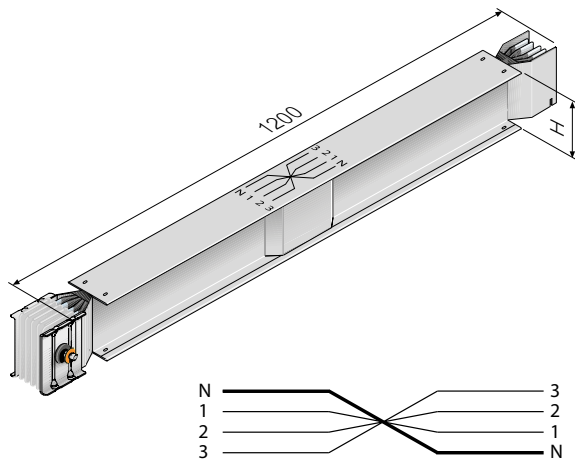
- Tap-off units
- Derivation boxes
- Straight sections with branch connections

Using these elements in such configurations can **lead to serious issues, such as:**

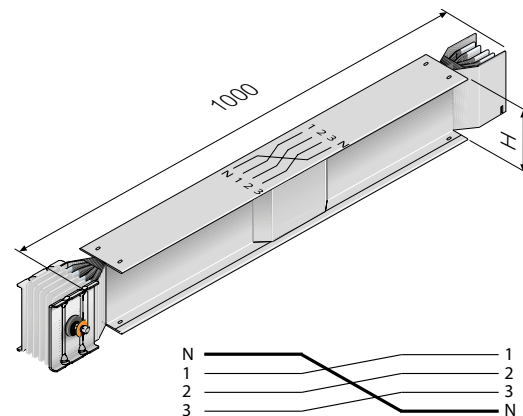
- Incorrect phase sequence at the load
- Misalignment of the neutral conductor
- Potential damage to connected equipment

Always ensure that the phase sequence and neutral position are **clearly known and match the system diagrams** before installation.

PHASE INVERSION ELEMENT



NEUTRAL JUMP ELEMENT



The phase inversion element is designed to completely reverse the positions of the phases and the neutral.

It is typically used in:

- connections between transformers and switchboards
- connections between switchboards, when the starting phase sequence differs from the arrival sequence.

This element ensures that **the correct phase order is restored or matched between two points** in the system.

The neutral jump element is a straight section used to adapt the phase sequence of the busbar system to the required sequence at the installation endpoints, when they differ.

It is typically used in:

- connections between switchboard, where only the neutral position is identified, and the phase sequence must be adjusted accordingly.

Dimension H changes with the rating. For more information, please refer to the catalog.



JUNCTION RCP (IP68) – XCP (IP55)

The RCP busbar system is compatible with XCP busbar system.

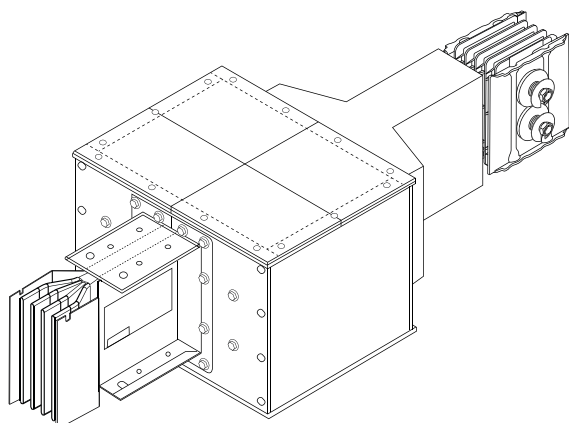
An IP 68 product is dust-tight and protected against the effects of continuous immersion in water.

When an RCP element is connected with an XCP element, the Ingress Protection (IP) becomes IP 55 at the junction point.

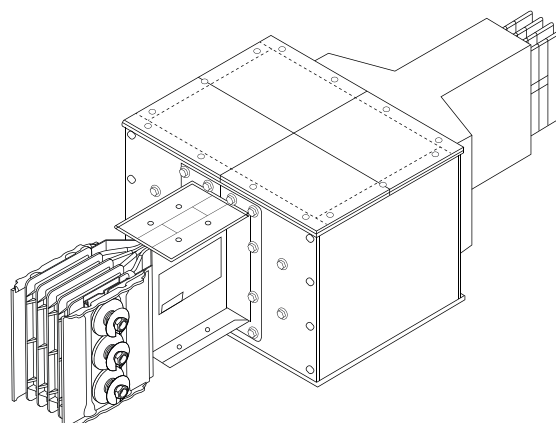
The connection is made with the appropriate RCP - XCP junction (as in the picture). To proceed with the connection, simply insert the RCP - XCP junction within the line in the desired section as if it is any element.

There are 4 types of RCP - XCP junction:

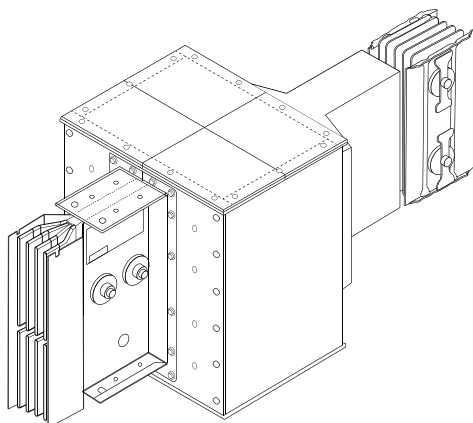
RIGHT JUNCTION WITH SINGLE BAR



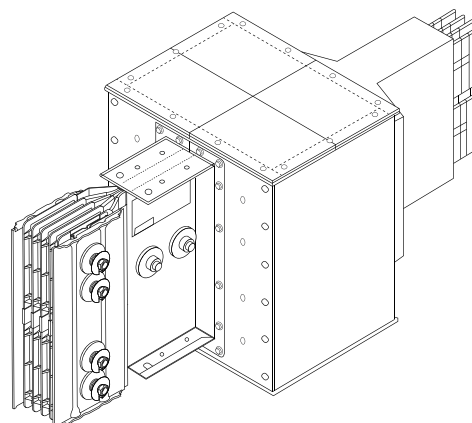
LEFT JUNCTION WITH SINGLE BAR



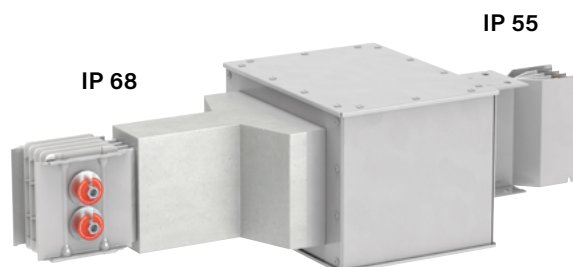
RIGHT JUNCTION WITH DOUBLE BAR



LEFT JUNCTION WITH DOUBLE BAR



When transitioning from an IP55 solution to an IP68 one, entry into the IP68 environment is only allowed after completing the first IP68-rated junction.



TAP-OFF BOXES (TOB)

The XCP busbar system may include removable components, such as tap-off units, designed to allow flexible connection and disconnection of loads along the distribution line.

Tap-off boxes allow power to be drawn from the busbar trunking system. There are two main types of connection to the busbar:

- Plug-in tap-off boxes
- Bolt-on tap-off boxes

GENERAL RULES FOR ALL TAP-OFF BOXES

For all tap-off boxes, the following rules apply:

Standard codes


If a standard code is ordered, the lead time is short, as the boxes are already available in stock and the cost can be known immediately.

Custom boxes

In many cases, custom boxes are required based on specific customer needs.


To request a custom box, please contact Legrand, providing as many details as possible, such as:

- Current rating
- Type of line where the box will be installed
- Protection device or internal equipment required

 The more detailed the request, the faster and more efficient the evaluation process will be. Legrand's technical team will assess the feasibility of the requested solution. If approved, a dedicated reference and project cost will be provided to the sales department.

Safety Precautions:

- Always refer to the instruction manuals before performing any removal or installation operation.
- Ensure that the load is disconnected before handling any removable part.
- Unless explicitly stated otherwise, assume that no voltage is present before proceeding.
- Use appropriate personal protective equipment (PPE) and follow all lockout/tagout procedures where applicable.

 **These operations must be carried out by skilled personnel trained in the safe handling of electrical distribution systems. Improper removal or reconnection of tap-off units can lead to electrical hazards, equipment damage, or personal injury.**

Installation reminder

Before installing any tap-off box, it is essential to check the instruction sheet to avoid potential damage.

Design Considerations

During the design phase, it is important to verify that the dimensions of the tap-off boxes do not interfere with each other when multiple boxes are installed on the same busbar.

Maintaining minimum spacing is essential to ensure proper installation and safe opening of each tap-off box.

 All dimensional details and clearances are provided in the installation manual, which must be consulted during planning and installation.



Plug in tap-off boxes

Thanks to its design, which ensures the operator's safety at all times, the plug-in tap-off box can be installed on an energized busbar. Before performing this operation, please consult the operating manual.

They are available in:

- **Metal**, with ratings up to 630 A
- **Fiberglass**, with ratings up to 250 A

Always refer to the installation instructions before proceeding.

Bolt-on tap-off boxes

Bolt-on tap-off boxes are installed on the busbar joint using a dedicated monoblock. They are rated **up to 1250 A**. They are ideal for **environments with harmonics and vibrations**, to guarantee a secure electrical contact.



Installation must be performed with the line de-energized.

FIBERGLASS TAP-OFF BOXES

SIZE 1 - UP TO 32 A

- Compact box, available only with fuses
- Extended version with DIN rail:
Empty with blank cover (free wiring)
Pre-configured with 4 or 8 DIN modules, front flap, and installed DIN rail

SIZE 2 - UP TO 160 A

Available:

- With fuse base:
Up to 63 A: 3xCH22
Up to 160 A: 3xNH00
- Pre-configured for DPX³ MCCBs (not included)
- Empty or with DIN rail:
12 DIN modules
12 DIN modules + 2 P17 sockets

SIZE 3 - UP TO 250 A

Available as:

- With NH2 fuse base
- Pre-configured for DPX³ MCCBs
- Empty or with DIN rail:
12 + 12 DIN modules
12 + 12 DIN modules + 3 P17 sockets

METAL TAP-OFF BOXES



Metal TOBs can be installed and removed even when the busbar is energized. Compatible with busbars of any rating.

SIZE 1 - 63 A TO 160 A

Pre-configured for DPX³ MCCBs

- Available in two versions:
Hinged cover
Fully removable cover
- Pre-configured means:
Equipped with remote handle on the cover
Internal rotary mechanism
- No internal disconnection device; disconnection is ensured by the remote handle. When the cover is opened, the breaker is in OFF position.



The upstream contact area is protected and ensures IP20 protection (protected against solid foreign object of 12.5 Ø mm and greater).



TAP-OFF BOXES (TOBs)

Bolt-on tap-off boxes (continued)

METAL TAP-OFF BOXES


SIZE 1 – 63 A TO 160 A (CONTINUED)

Boxes with disconnect switch (AC23)

- Equipped with AC23 disconnect switch and fuse base (**fuses not included**)

 Refer to Legrand catalog for fuse selection.

- Operated via rotary handle on the cover
- No internal disconnection device

 AC21A cover – the box cannot be opened, closed, installed, or removed if the switch is in the "ON" position

Boxes with disconnect switch (AC23) (continued)

- **Only available in 63 A version**

Empty boxes

Empty boxes allow the installer to choose the protection device. They are always equipped with disconnection device on the cover.– IP20 protection when opened.

SIZE 2 – UP TO 250 A


- Pre-configured for DPX³ MCCBs
- Available in two versions:
 - Hinged cover
 - Fully removable cover
- Pre-configured means:
 - Equipped with remote handle on the cover
 - Internal rotary mechanism
- No internal disconnection device; disconnection ensured by the handle. When the cover is opened, the breaker is in OFF position.



The upstream contact area is protected and ensures IP20 protection.

Boxes with disconnect switch (AC23)

- Equipped with AC23 disconnect switch and fuse base
- Operated via rotary handle on the cover

 AC21A cover – the box cannot be opened, closed, installed, or removed if the switch is in the "ON" position

- **Only available in 125 A, 160 A versions**

Fuse boxes

To be equipped with NH00 fuses, **not included**. Equipped with disconnection device on the cover – IP20 protection when opened.

Empty boxes

Empty boxes allow the installer to choose the protection device. They are always equipped with disconnection device on the cover – IP20 protection when opened.

SIZE 3 – 400 A AND 630 A

- Pre-configured for DPX³ MCCBs
- Available in two versions:
 - Hinged cover
 - Fully removable cover
- Pre-configured means:
 - Equipped with remote handle on the cover
 - Internal rotary mechanism
- No internal disconnection device; disconnection ensured by the handle. When the cover is opened, the breaker is in OFF position.



The upstream contact area is protected and ensures IP20 protection.



Bolt-on tap-off boxes (continued)

METAL TAP-OFF BOXES

SIZE 3 - 400 A AND 630 A (CONTINUED)

Fuse boxes:

Available in:


- 400 A: to be equipped with NH2 fuses
- 630 A: to be equipped with NH3 fuses

Fuses **not included**.

Equipped with disconnection device on the cover – IP20 protection when opened.

Boxes with Disconnect Switch (AC23)

- Equipped with AC23 disconnect switch and fuse base (fuses not included)

 AC21A cover – the box cannot be opened, closed, installed, or removed if the switch is in the "ON" position

- Operated via rotary handle on the cover.
- **Only available in 250 A, 400 A, and 630 A**

versions

Empty boxes

Empty boxes allow the installer to choose the protection device. They are always equipped with disconnection device on the cover – IP20 protection when opened.



XCP-S AND XCP-HP BUSBAR SYSTEMS SUPPORT SYSTEM



HORIZONTAL ORIENTATION

+ Thanks to its ultra-compact design and excellent thermal dissipation, the XCP busbar does not require derating based on installation position.

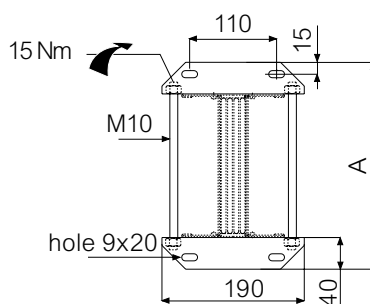
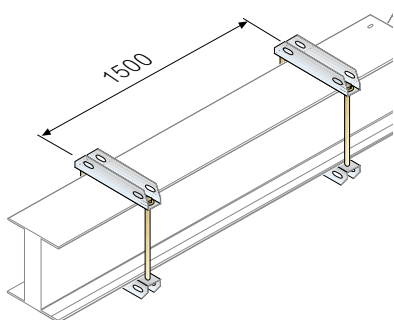
The XCP busbar system is composed of a wide range of elements designed to adapt to the specific layout and structural requirements of modern buildings. Depending on the project, installation can be carried out in different orientations, each of which requires specific material configurations—for example, different types of brackets.




During the design phase, it is essential to verify that the chosen orientation allows the installation of all necessary components. This includes ensuring sufficient space for tap-off boxes where required, as well as evaluating the compatibility of each accessory with the selected configuration. Proper assessment at this stage ensures a smooth installation process and optimal system performance.

Flatwise orientation

In technical terms, the flatwise orientation refers to a configuration in which the busbar conductors inside the trunking system are arranged parallel to the surface on which the system is installed.

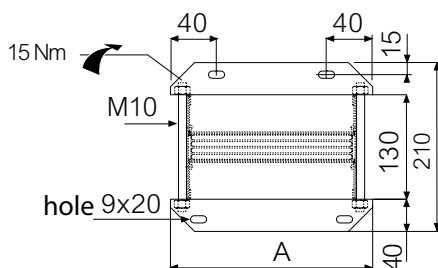
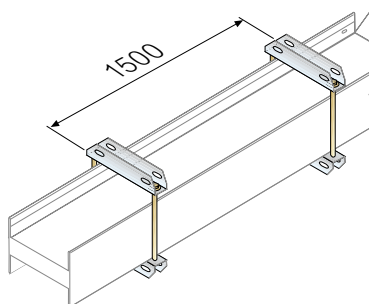


 This layout is typically recommended when the busbar is routed through confined spaces, such as raised floors or other installations with limited height availability.



Edgewise orientation

In technical terms, the edgewise orientation refers to a configuration in which the conductors inside the busbar trunking system are positioned perpendicular to the floor.



This layout is typically selected when tap-off boxes (TOBs) must be installed along the line, as it provides the most suitable geometry for mounting and accessing the derivation units.

Bracket types

The type of brackets required for support are standard collar brackets. They are equipped with holes for attachment to shelves/ supports (not supplied).



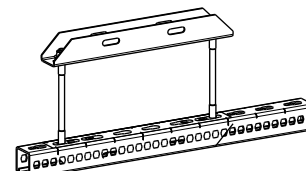
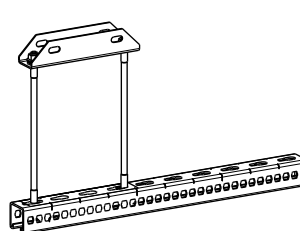
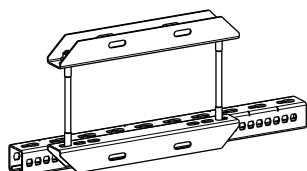
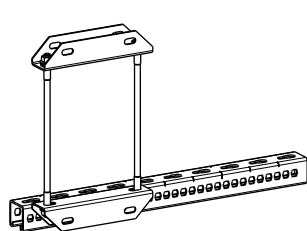
The standard collar can be used as a half-collar, fixing directly the rods to a support to save space.



The installer must provide appropriately sized shelves to support the busbar weight.

The use of ceiling rods not recommended, as they do not guarantee dynamic resistance in case of a short circuit.

Examples of installation :



- Using the standard collar bracket

- Using the half-collar bracket

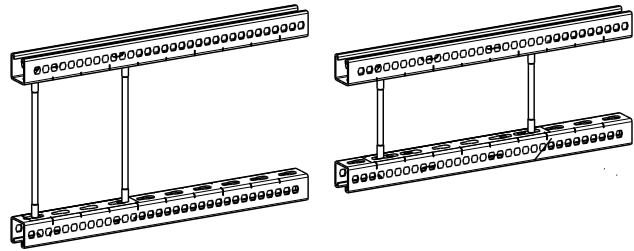


HORIZONTAL ORIENTATION

Bracket types

Examples of installation :

- Using only the rods of the collar bracket



General rules for brackets installation

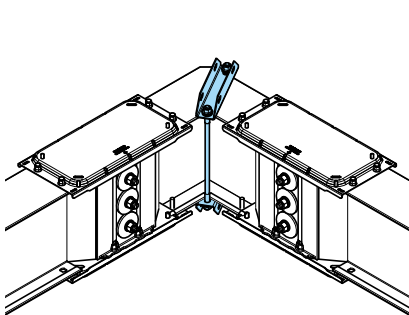


- Each element must be supported **by brackets, not by the junction**.
- Straight elements must be supported by **at least two brackets** to ensure alignment and prevent falls during installation.
- For 3-meter elements, a maximum spacing of 2 meters between brackets is recommended, preferably 1.5 meters.
- For elements shorter than 3 meters, if a 1.5-meter spacing cannot be maintained, reduce the spacing while still using two brackets.
- Avoid placing brackets **less than 150 mm** from the junction to prevent interference with the junction cap.

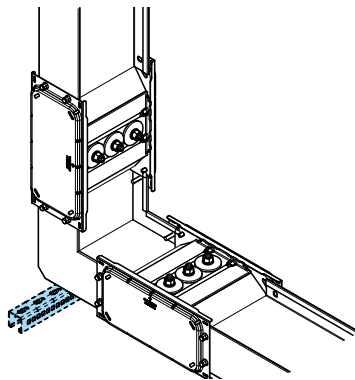
Special elements

- For small figures (e.g., elbows), **at least one bracket must be installed**, even without a collar if space is limited.
- If a figure cannot be directly supported, ensure adjacent figures are properly fixed near the junction.
- Do not install brackets or collars on junction flanges, as this **may compromise electrical insulation**.

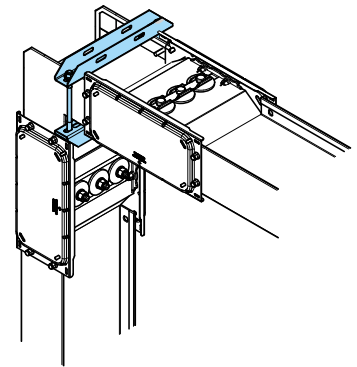
Examples of brackets to use :



- Where space is available



- Where the collar cannot be installed



- If there is no space to support the figure, ensure that the figures before and after are properly fixed as close as possible to the junction

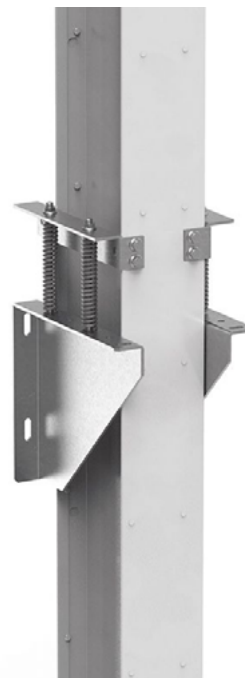


VERTICAL ORIENTATION

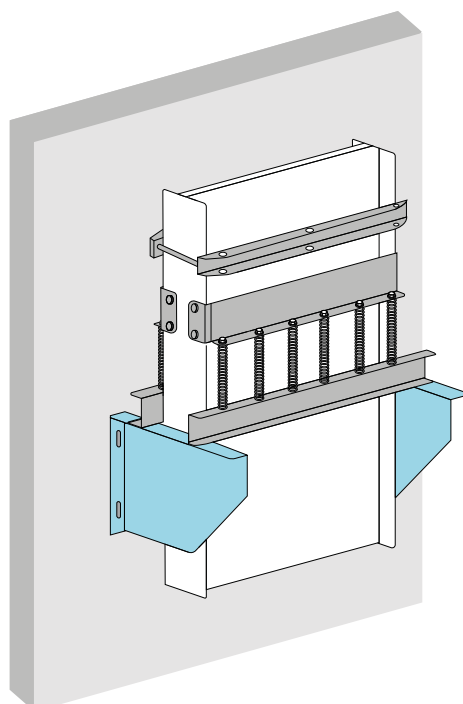
In many applications where busbar trunking systems are used, the distribution of high power over long distances often requires vertical installation.

This configuration is common in tall buildings—such as high-rise structures—where the busbar must deliver power across multiple floors, as well as in cases where the line must run from a technical room to an upper or lower level.

Because vertical installation is frequently required, it is essential to follow all specific rules and guidelines associated with this configuration. Proper support spacing, mechanical fixing, and alignment must be respected to ensure the stability of the system, avoid excessive mechanical stress on joints, and guarantee safe and reliable operation throughout the entire installation height.



Flatwise installation



In case of limited space or specific needs, this type of bracket (in blue) can be used.



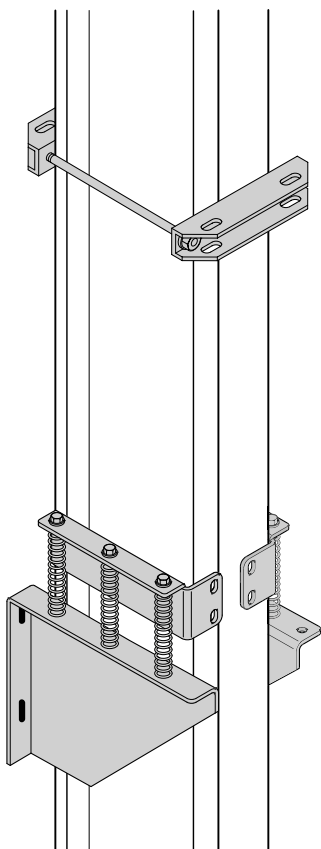
Install in this configuration only lines dedicated to transport, not distribution



SUPPORT SYSTEM

VERTICAL ORIENTATION

Edgewise installation

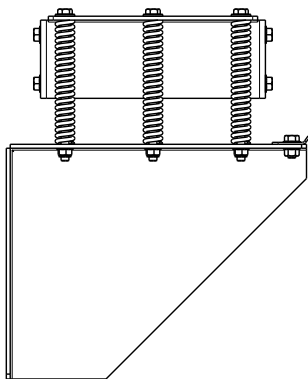


This configuration allows the installation of tap-off boxes.



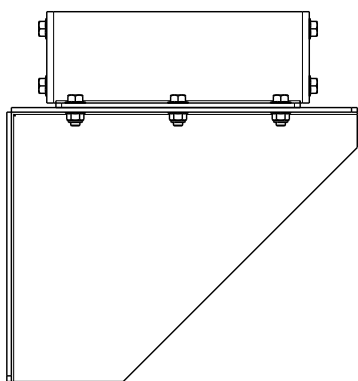
Bracket types

Different types of brackets are available, and the choice depends on how the designer intends to install and support the busbar system. Each bracket configuration is suitable for specific installation conditions



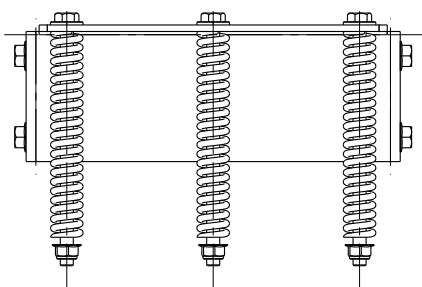
TYPE A - COMPLETE BRACKET

The Type A is the full support bracket and is used for vertical installations with lengths **greater than 4 meters**. It includes the complete set of components required to sustain the mechanical load and ensure proper alignment over extended vertical runs.



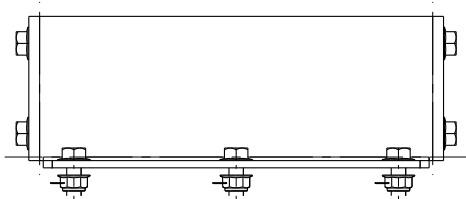
TYPE B - VERTICAL BRACKET WITHOUT SPRINGS

Unlike Type A, Type B does not include springs. It is used for vertical installations with lengths **below 4 meters**, where the mechanical loads are lower and the full spring-based compensation is not required.



TYPE C - "C-SHAPED" BRACKET WITH SPRINGS

Type C consists of C-shaped fixing brackets combined with springs but does not include a cantilever bracket. This configuration is suitable **when anchoring can be performed using alternative support systems provided by the designer**. It allows secure locking of the busbar while relying on the building's existing structural elements for final support.



TYPE D - "C-SHAPED" BRACKET ONLY

Type D includes only the C-shaped locking bracket. All additional fixing and support elements must be supplied or defined by the designer. This option is used **when the project already includes dedicated structural supports or when a customized fixing solution is required**.

VERTICAL ORIENTATION

General rules for brackets installation



For lines < 2 meters

- Use standard collar brackets, as in horizontal configuration (page 86).

For lines between 2 and 4 meters

- If wall-mounted:
Use Type B brackets (vertical wall mount without springs).
- If floor-mounted:
Use Type D brackets (vertical without springs and without shelf).
- Position the bracket at the lowest point of the run.
- Add a standard horizontal bracket every 1.5 meters to ensure proper alignment.

For busbars > 4 meters

- If wall-mounted:
Use Type A brackets (complete).
- If floor-mounted:
Use Type C brackets (with springs, without shelf).
- Install a standard collar bracket every 1.5 meters for additional support.
- Type A or C brackets must be spaced according to the rules—see the chapter on vertical bracket spacing (page 92).

Note for vertically installed flat busbars:

- The same support rules apply.
- Only one type of vertical bracket is used, suitable for all configurations.
- A standard horizontal bracket must be installed every 1.5 meters.

Rules for bracket spacing and spring preload

To ensure proper vertical installation, follow these rules for spacing between vertical brackets.

SPACING CONSTRAINTS

Vertical brackets with springs are designed to be installed at specific distances, depending on the busbar rating (see table). This allows the springs to operate with an optimal 25 mm travel from the resting position. If preloading is desired, the (H) dimension becomes 100 mm.



Rules for bracket spacing and spring preload (continued)

SPACING CONSTRAINTS (CONTINUED)

MAXIMUM SPRING SUSPENSION DISTANCE (D max. - in meter)								
XCP-S					XCP-HP			
Aluminium			Copper		Aluminium		Copper	
In (A)	D max. (m)	Number of springs	D max. (m)	Number of springs	D max. (m)	Number of springs	D max. (m)	Number of springs
630	11	4	-	-	10	4	-	-
800	10	4	9	4	10	4	9	4
1000	10	4	8	4	9	4	7	4
1250	9	4	7	4	9	4	7	4
1600	10	6	6	4	10	6	6	4
2000	9	6	6	6	9	6	4	4
2500	12	8	9	8	11	8	5	6
3200	11	12	7	8	11	12	6	8
4000	10	12	7	12	10	12	6	12
5000	7	12	5	12	6	12	5	12
6300	-	-	4	12	-	-	4	12

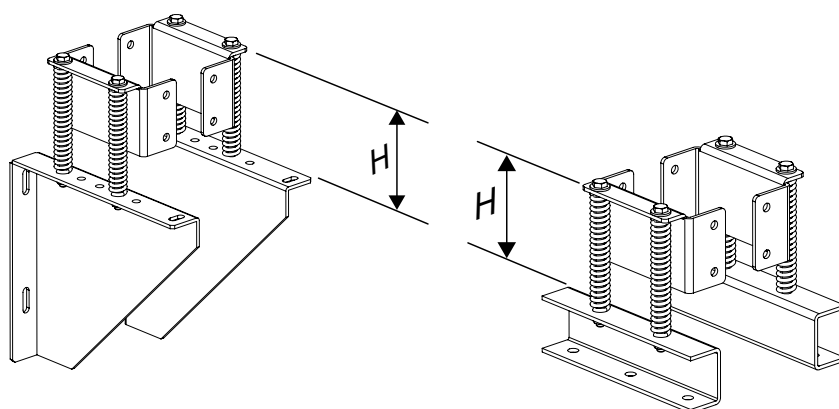
For 3 conductors version, multiply D max. per 1.1 for both product lines
For 5 conductors version, multiply D max. per 0.9 for both product lines.

IF SPACING CANNOT BE MAINTAINED

If spacing must be reduced, install brackets closer than the maximum distance in the table. Use the provided formula to calculate the correct (H) dimension for spring preload.

$$W = (\text{Conductor (Kg/m)} \times D(\text{m}) + \text{total weight of the device}) / \text{Number of springs}$$

$$H = 130 - (W/3)$$



AFTER INSTALLATION

Loosen the spring locking nut.

DESIGN PHASE SPACING GUIDELINES



The minimum distance from walls to avoid issues during edgewise installation is 300 mm.

VARIABLES TO CONSIDER FOR PROPER ASSEMBLY:

- Bolt position for monobloc tightening: minimum 100 mm.
- Size of the distribution box: at least 300 mm.
- Brackets and their assembly.
- Accessibility to screws for bracket installation and junction closure.
- Materials needed to compensate for wall imperfections.

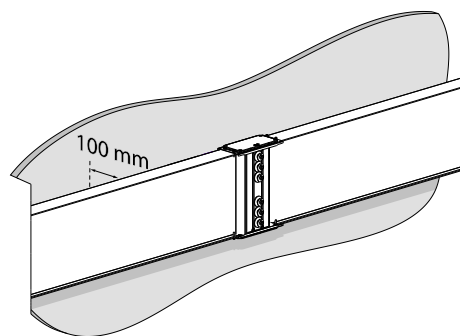
FOR RISING MAINS INSTALLATION:

- If fire barriers are not required, brackets can be fixed directly to the wall.
- If fire barriers are required, allow spacing between the bracket and the wall to maintain a 100 mm gap behind the busbar for fire barrier placement.

Minimum distance from the wall for the elements

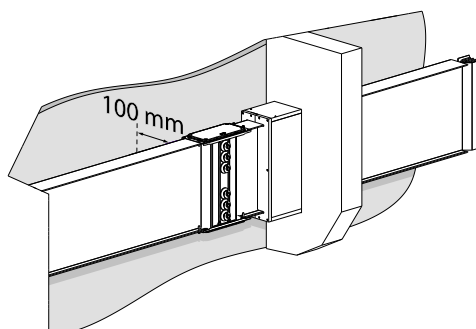
EDGEWISE INSTALLATION

XCP IP 55
Single bars
Bouble bars

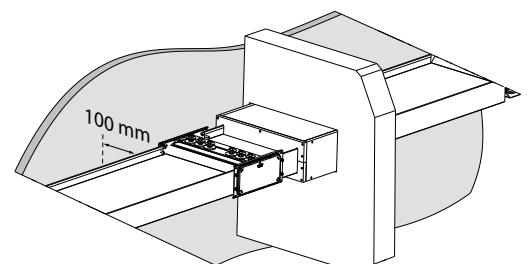
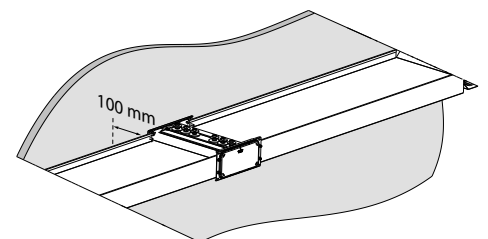


XCP IP 55
with external fire
barrier

Single bars
Double bars



FLATWISE INSTALLATION



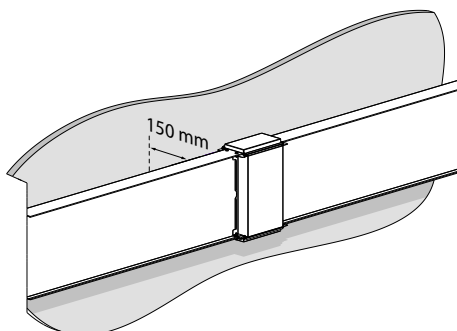
Minimum distance from the wall for the elements (continued)

EDGEWISE INSTALLATION

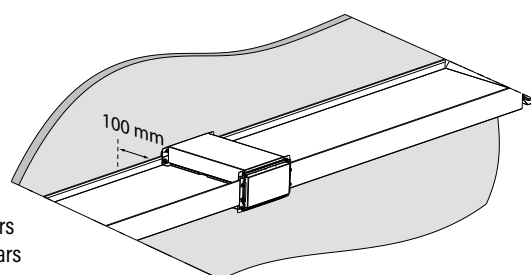
FLATWISE INSTALLATION

XCP IP 65
with or without
external fire barrier

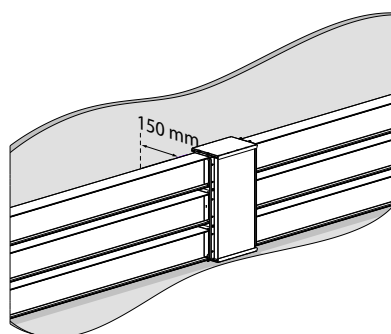
Single bars
Double bars



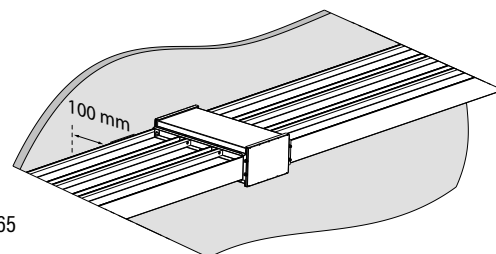
Single bars
Double bars



XCP IP 55
Triple bars

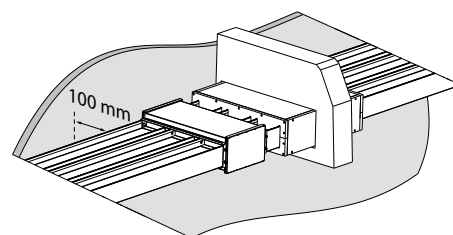
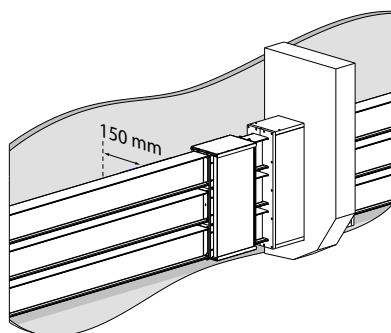


XCP IP 55 & 65
Triple bars



XCP IP 65
with external fire
barrier

Triple bars



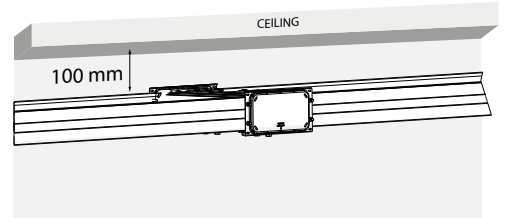
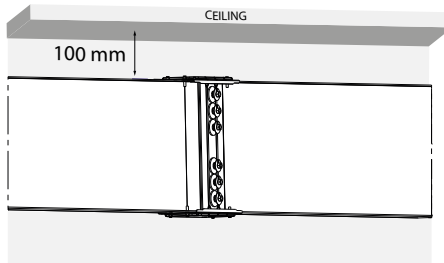
DESIGN PHASE SPACING GUIDELINES

Minimum distance from the ceiling for the elements

EDGEWISE INSTALLATION

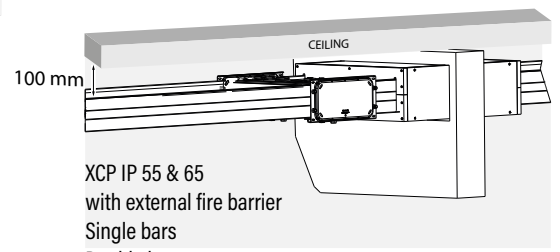
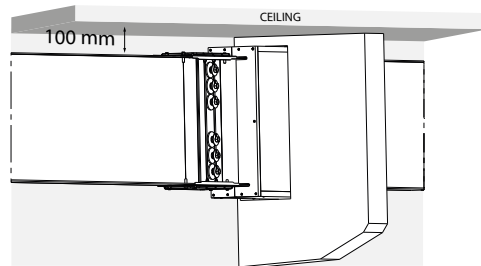
FLATWISE INSTALLATION

XCP IP 55
Single bars
Bouble bars



XCP IP 55
with external fire
barrier

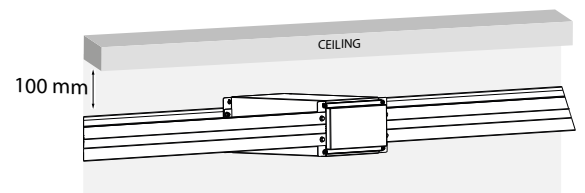
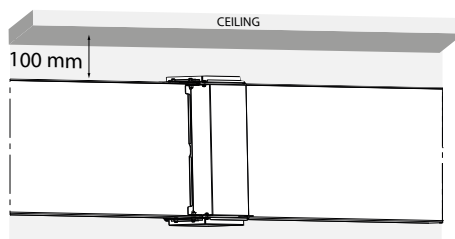
Single bars
Double bars



XCP IP 55 & 65
with external fire barrier
Single bars
Double bars

XCP IP 65
with or without
external fire barrier

Single bars
Double bars

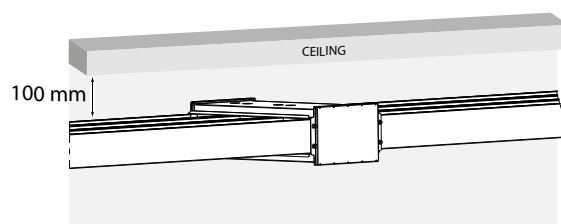
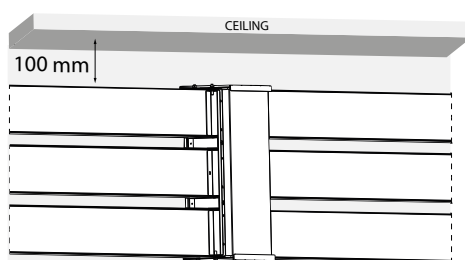


Minimum distance from the ceiling for the elements (continued)

EDGEWISE INSTALLATION

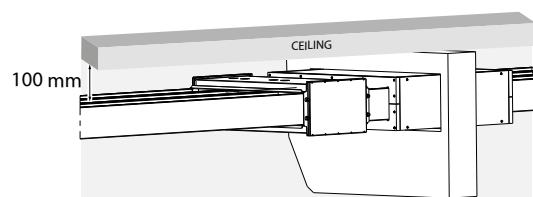
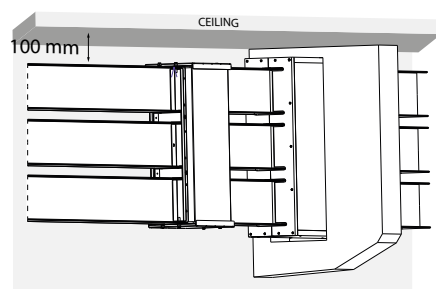
FLATWISE INSTALLATION

XCP IP 55 & 65
Triple bars

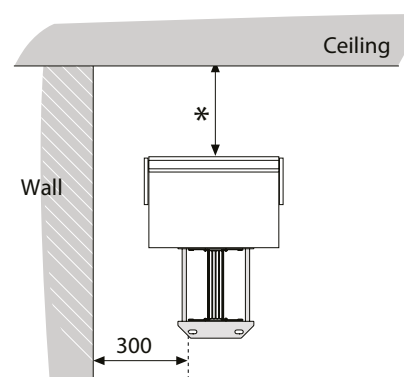
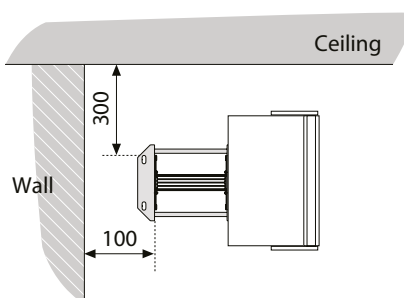
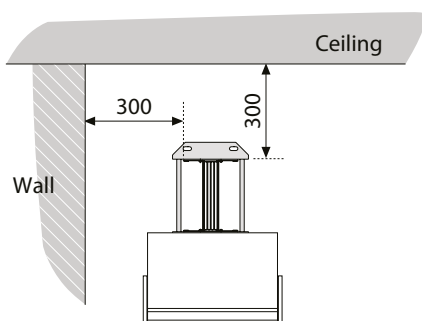


XCP IP 55 & 65
with external fire
barrier

Triple bars



When there are tap-off units along the busbars, the minimum distances depend on the dimensions of the tap-offs selected and its position on the busbar.



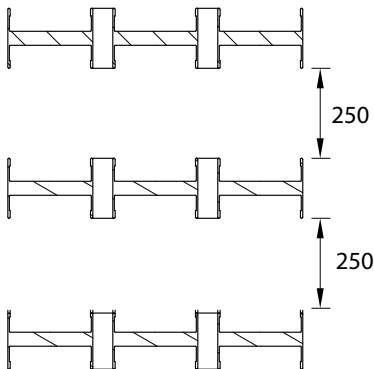
When there is a tap-off box installed above the busbar, check the overall dimension of the open cover of the tap-off unit used in the specific section.



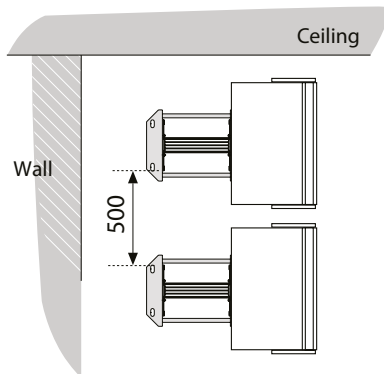
DESIGN PHASE SPACING GUIDELINES

Minimum distance from the ceiling for the elements (continued)

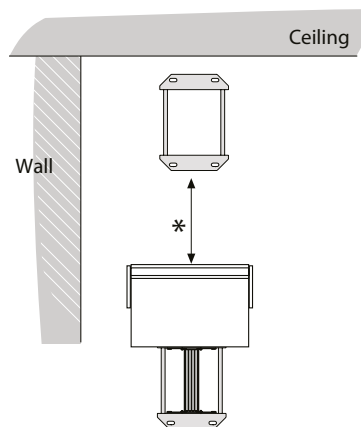
Flat Busbars Installed One Above the Other



Flat busbars installed one above the other must be spaced at least 250 mm apart. If the spacing is less than 250 mm, derating is required.



If there are tap-off-boxes installed, the distances are different.



When there is a tab-off box installed below an element or a ceiling the busbar, check the overall dimension of the open cover of the tap-off unit used in the specific section.

Seismic environment compliance

The XCP busbar system is certified for use in seismic environments according to IEEE Std 693-2018. The system successfully meets the following performance levels:

High Performance Level (to 50 Hz):

Achieved frequency: 1.96 Hz
 ZPA: 1 g on the X and Y axes and 0.8 g on the Z axis
 Duration: 40 seconds

Extra Performance Level (to 50 Hz):

Achieved frequency: 2.94 Hz
 ZPA: 1.5 g on the X and Y axes and 1.2 g on the Z axis
 Duration: 40 seconds



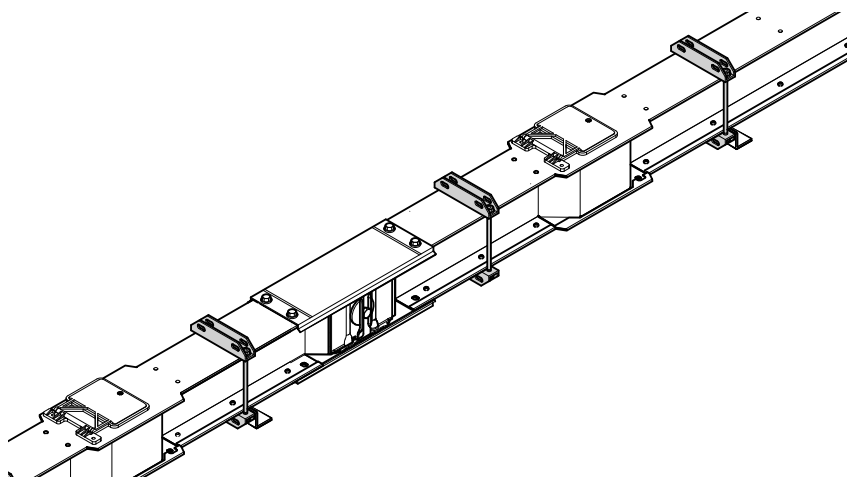
INSTALLATION CONFIGURATION IN SEISMIC CONDITIONS

The required bracket configuration depends on the installation orientation and the number of parallel busbar runs:

Horizontal Installation

- Single busbar run

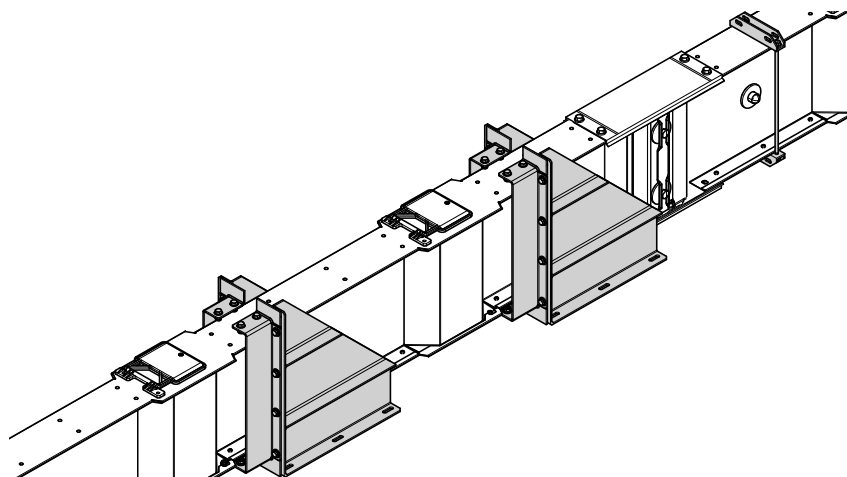
Standard brackets may be used.



- Double busbar run

The sequence must follow three seismic brackets + one standard bracket, repeating as needed.

For example, with two 3-meter busbar elements requiring two brackets each, the installation would use three seismic brackets and one standard bracket.

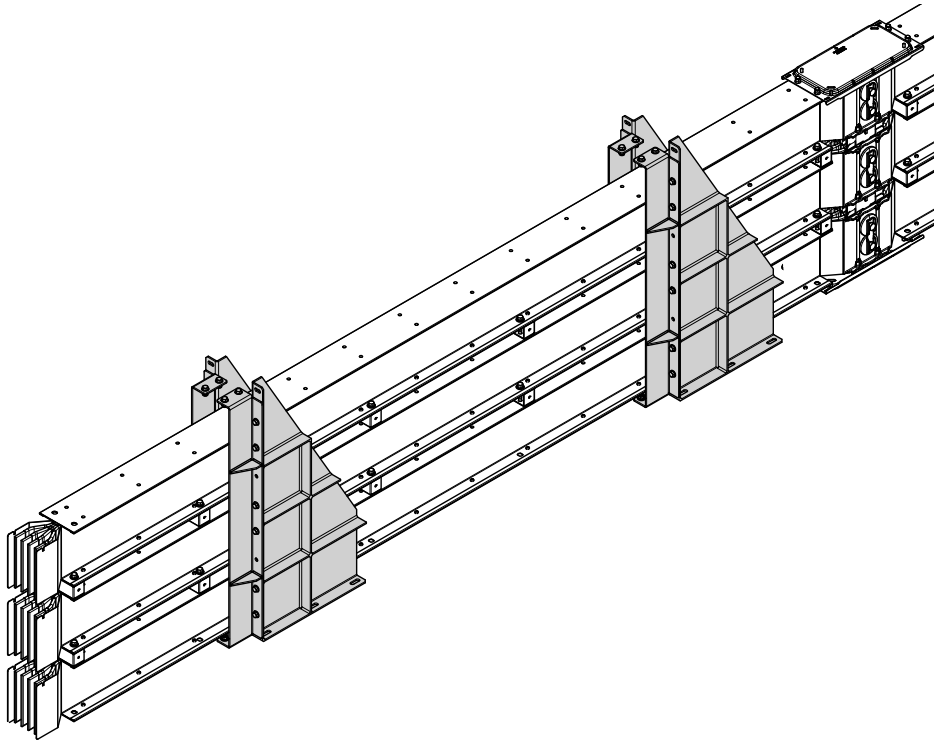


Seismic environment compliance (continued)

INSTALLATION CONFIGURATION IN SEISMIC CONDITIONS (CONTINUED)

Horizontal Installation

- Triple busbar run
Only seismic brackets are allowed.

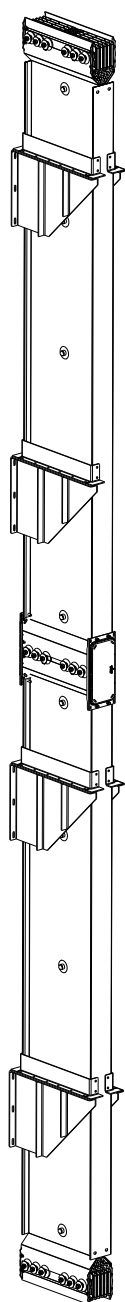


Seismic environment compliance (continued)

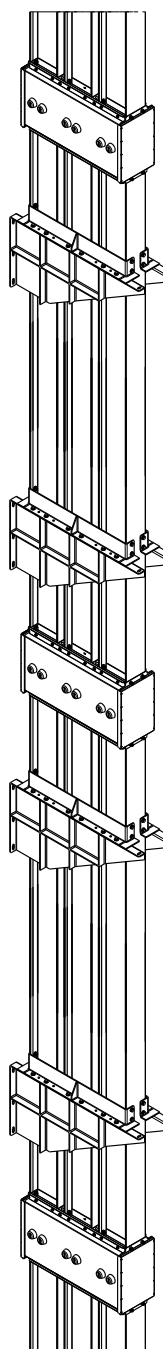
INSTALLATION CONFIGURATION IN SEISMIC CONDITIONS (CONTINUED)

Vertical installation

- Single/double busbar run:
Use Type B brackets.



- Triple busbar run:
Only seismic brackets are permitted.



DESIGN PHASE SPACING GUIDELINES

Marine environment installation

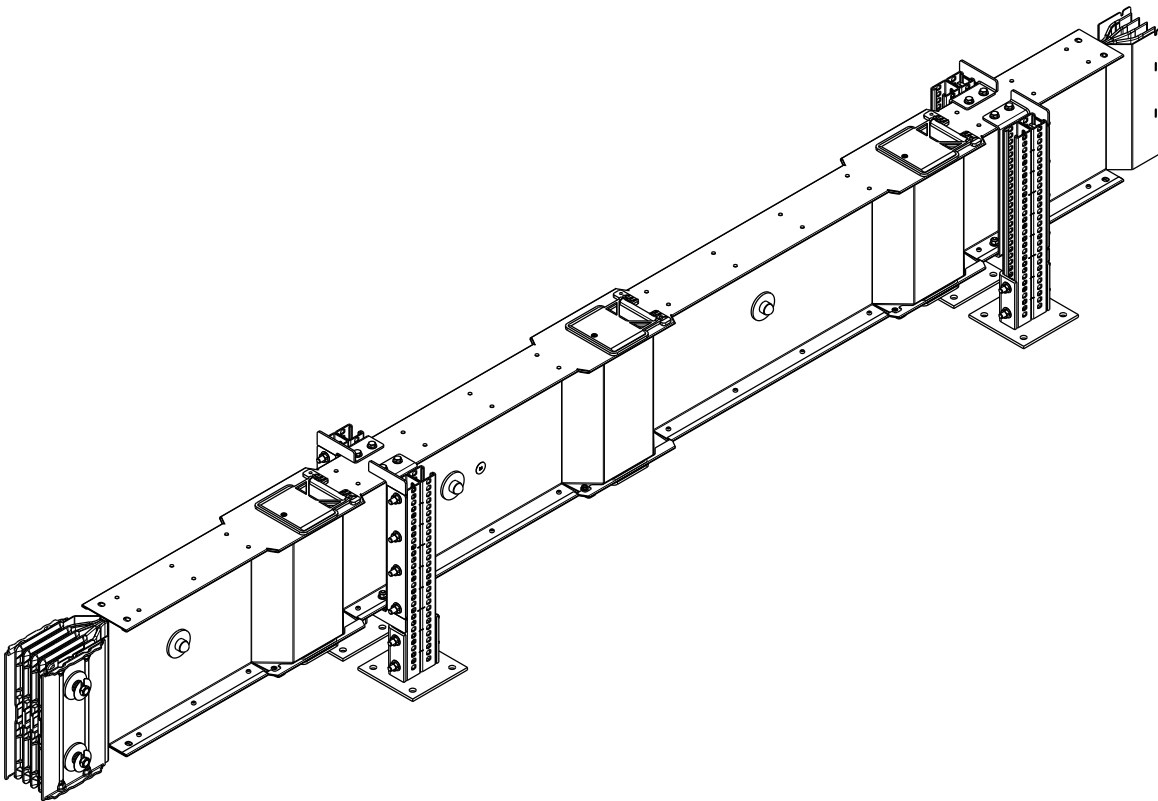
The XCP busbar system can be installed in marine environments. For this type of installation, marine-grade brackets must be used, following the same installation rules applied to standard brackets. This ensures proper mechanical support, stability, and compliance with the specific requirements of shipboard and offshore installations.



For naval installation, always use type E brackets.

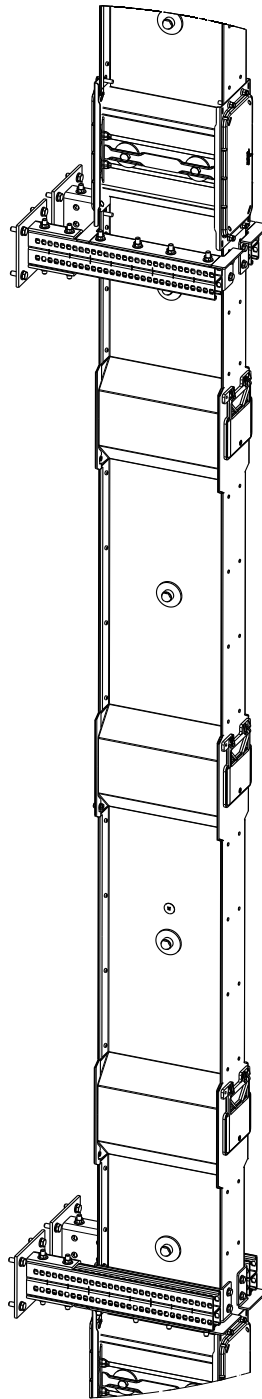
Horizontal Installation

- Single and double busbar run



Marine environment installation (continued)

Vertical Installation



XCP-S AND XCP-HP BUSBAR SYSTEMS SITE MEASUREMENTS



PRESENTATION

The survey of a busbar system is invariably based on the definition of the reciprocal position of the starting point and the end point, regardless of whether it is a complete transportation, connection, horizontal or vertical distribution line or a simple straight element for the completion of a line already partially supplied and installed.

In general, to achieve this result, a series of information needed that can be found on site and which includes:

1. Dimensions of the building works affected by the passage of the busbars, including any differences in height between the support surfaces of the equipment involved, pillars, pilasters, lowered beams, holes in the walls, floors and any architectural detail that may influence the routing of the busducts themselves;
2. Size and position of any systems already installed (pipes, cable trays, lighting, air conditioning, ventilation, etc. Etc.) That may influence the routing of the busbars;
3. Type, rating, configuration of the conductors, their material, degree of protection of the ducts to be supplied;
4. Size of any electrical switchboard on which the busbar lines incomes: overall width, depth, height; width of each column, thickness of the sides, back and front panels; presence of any ventilation towers; presence of a possible support base;
5. Position of incoming busbars on the top of the switchboards (dimensions of any holes already prefit and their position with respect to the relative columns or position of the axis of each busbar from the sides and from the front/back);
6. Sequence of phases inside the switchboards for each busbar line;
7. Position of the switchboards inside their respective rooms (distance of the sides from the side walls, of the front and back from the front and rear walls);
8. Dimensions of any transformers with or without box;
9. Sequence of the phases of the lv bars of the transformers;
10. Position of the transformers inside their cells or in the rooms that house them;
11. Possible sequence of phases of elements already installed;
12. Position of the monoblock of elements already installed;
13. On-site verification of the minimum space required for the installation of the lines, including elements such as any end feed units, adapters, expansion joints, line disconnectors, rate reducers, tap-off boxes, etc., Etc.



KEY POINTS TO DEVELOP THE DESIGN OF THE PROJECT

Building drawings

To develop the busbar lines it is **mandatory to have the architectural drawing of the building**. It is also necessary to have the dimension and position of the existing devices and the future devices to install.

Construction features

It is important to verify the **presence of the other item installed** such as cable trays, pipes, sprinklers, etc. because they could affect the routing of the busbar.

Transformer and switchboard

It is mandatory to have the **dimensions, the technical characteristics and placement** of the transformer and the switchboard in the technical room.



SITE MEASUREMENTS

KEY POINTS TO DEVELOP THE DESIGN OF THE PROJECT

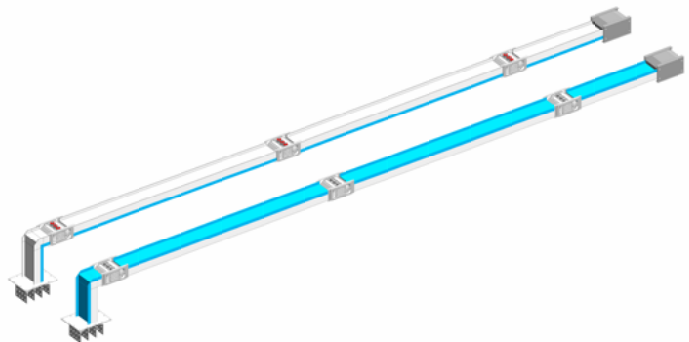
Sequences

SEQUENCES OF THE PHASES

The sequence of the phases on switchboard has to be clear because the position of the neutral and the phases affects the transformer connection and the installation of the tap-off boxes (if requested) along the busbar line.



For the neutral position, the busbar paths are designed considering the "N" position. Neutral side is defined at the design stage.



The neutral side is indicated with a blue wrap on the bar.



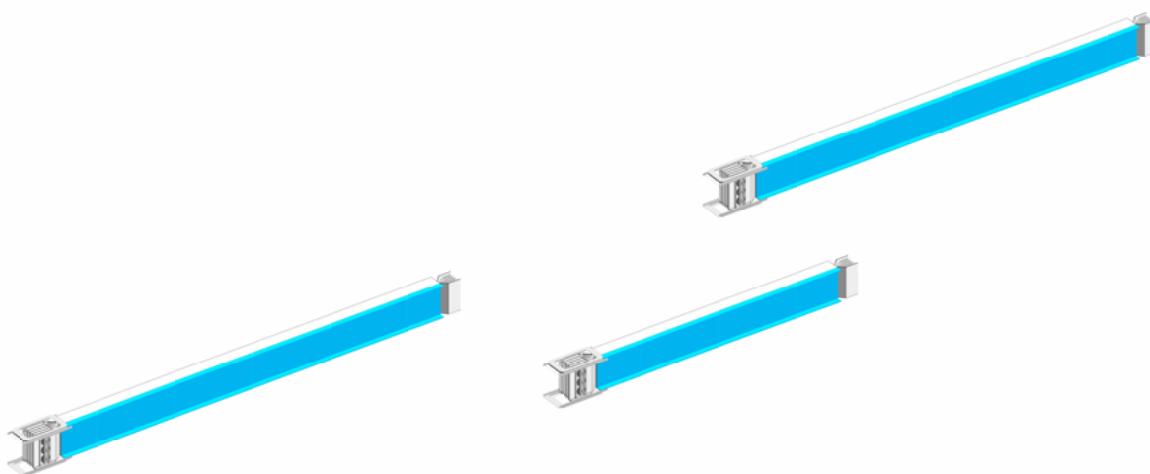
Sequences (continued)

SEQUENCES OF THE MONOBLOCKS ON JOINTS

All the elements are connected by interlocking the monoblock to the end of the busbars, therefore, **it is mandatory to know the correct side of the monoblock position.**



Connecting the lines on the PSZ software:



KEY POINTS TO DEVELOP THE DESIGN OF THE PROJECT

Distances from the structure

The minimum distance from the walls to avoid problems during edgewise installation of the busbar is 300 mm.

The variables that must be taken into account for correct assembly are :

- position of the bolt for tightening the monobloc ; the minimum distance is 100 mm
- sizes of the distribution element (box) selected for the collection of power (at least 300 mm)
- any brackets and their assembly
- accessibility to the actual installation in order to compensate for wall imperfections

In case of rising mains installation, if the system does not require fire barriers, the bracket can be directly secured to the wall. Otherwise, allow for a spacing support between the bracket and the wall to ensure that the back of the busbar remains at a distance of 100 mm from the wall, therefore ensuring enough space for the positioning of the partitions.



For more details on the minimum distances from the wall and the ceiling, please refer to ► [page 92](#).

Tools

To proceed with measuring, make sure to be equipped with :

- a meter (3m - 5m - 8m)
- a smartphone (for pictures)
- goniometer
- a pencil
- a self-leveling laser
- a leveling laser
- a laser distance meter
- a pen and paper

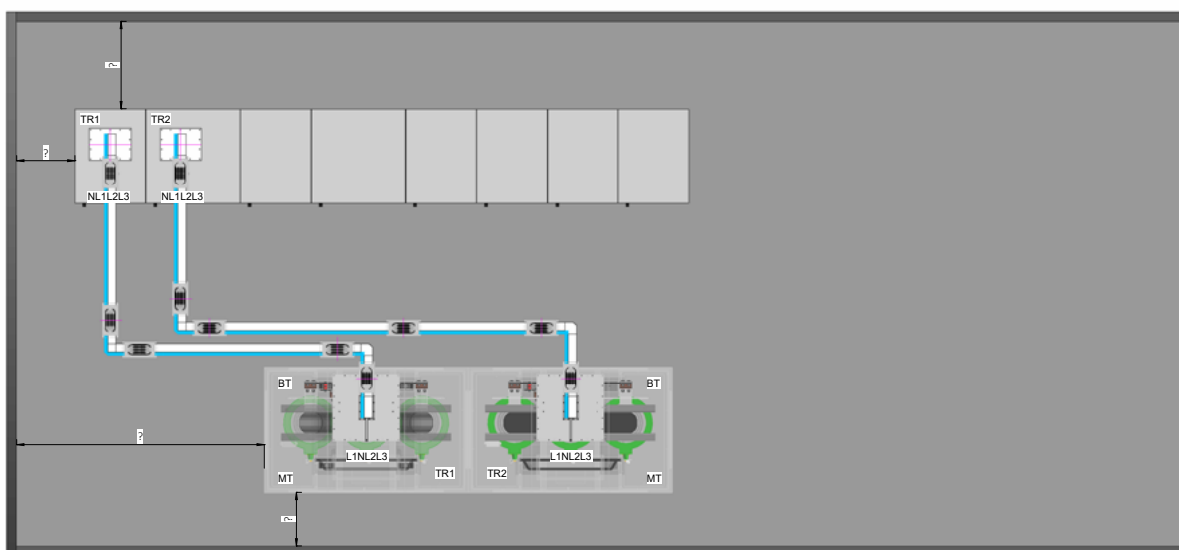


MEASUREMENT METHOD

Step 1 : start point

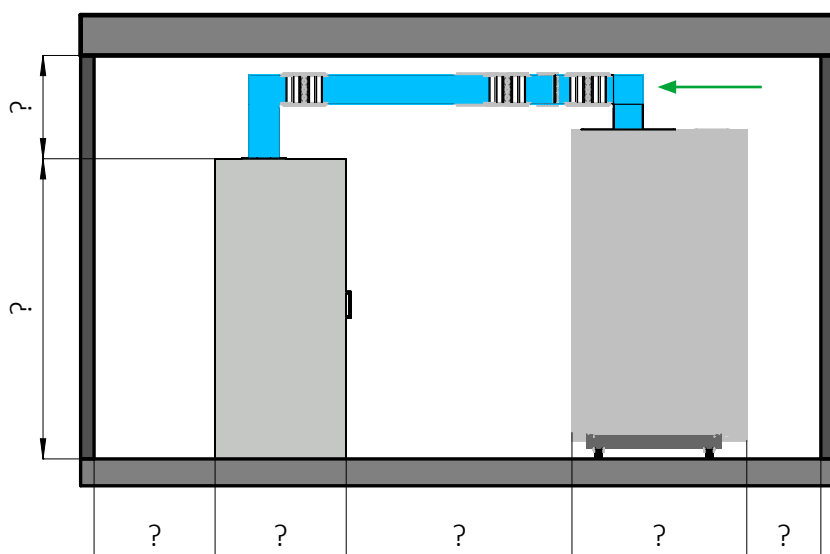
START THE MEASUREMENT FROM THE TRANSFORMER

1. Check the plan for the position of the transformer in the room
2. Measure the distances of the transformer from the wall



3. Check the sectional layout to get distances from ceiling/walls/floor
4. The space available for the connection of the busbars on the transformer is defined

To be verified and confirmed on site

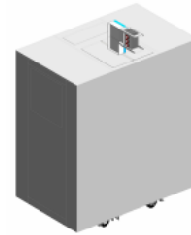


MEASUREMENT METHOD

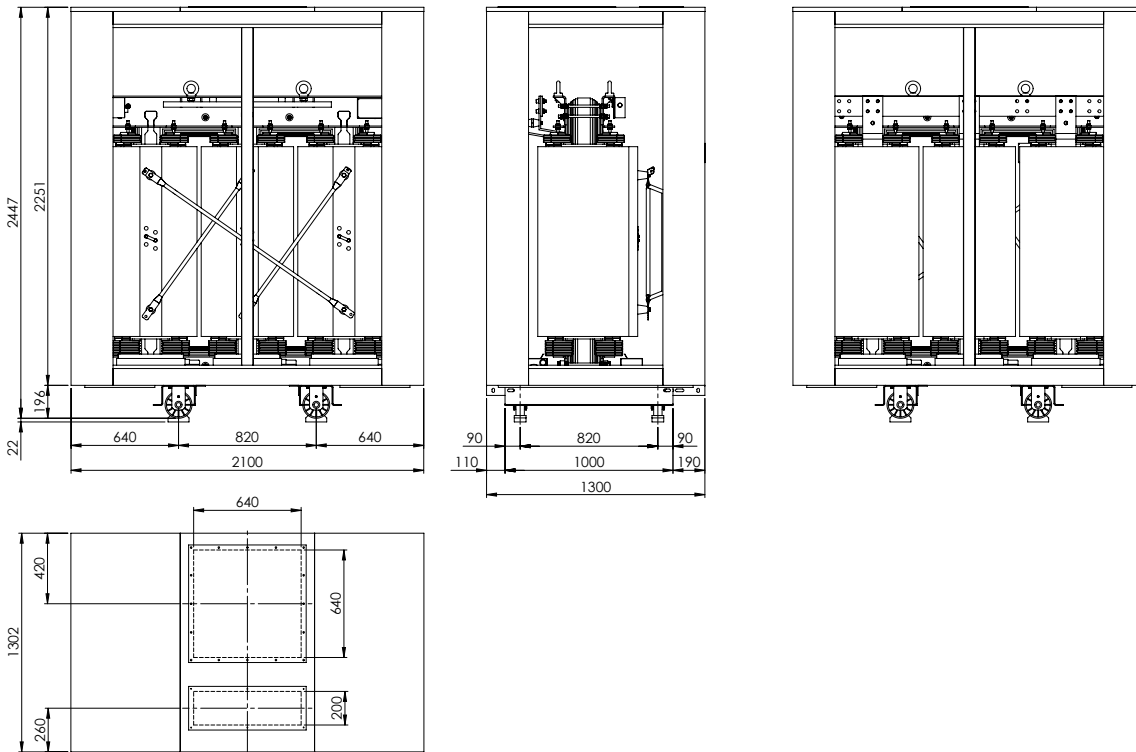
Step 1 : start point (continued)

IN CASE OF TRANSFORMER ENCLOSURE

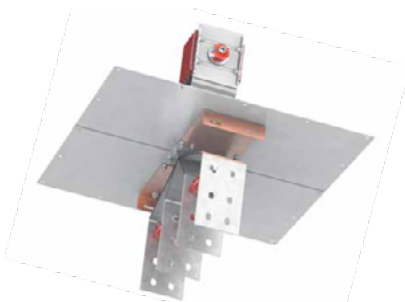
1. Take the enclosure dimensions on sectional drawings
2. Take the dimensions of the cover plate on top of the enclosure to verify the flange end connection



⚠ Make sure to add the height of the antivibration kit (e.g: 22 mm)



Product visual



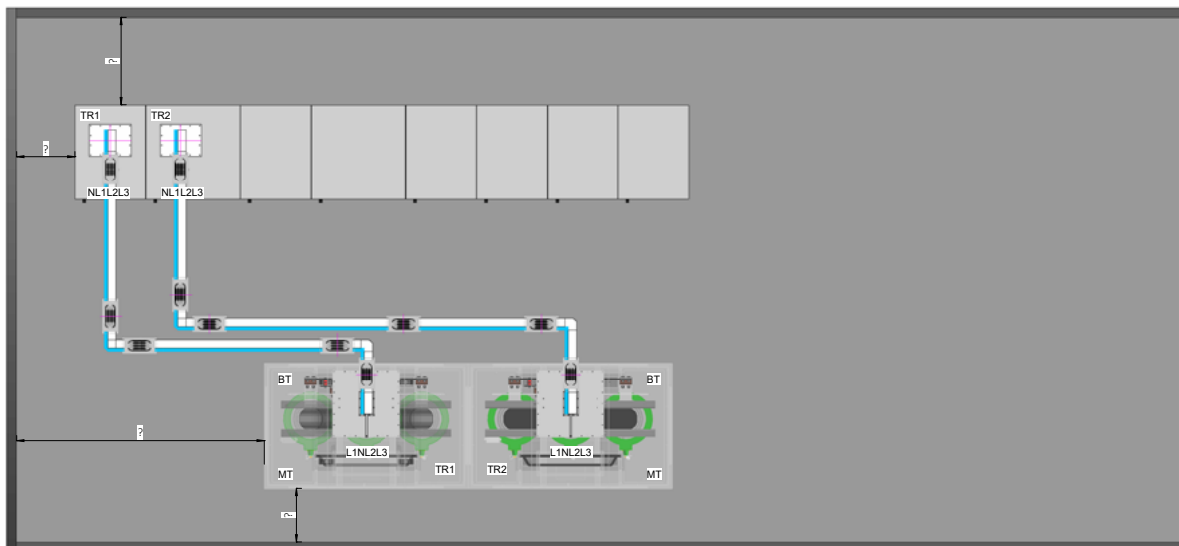
Examples of installation



Step 2 : End point

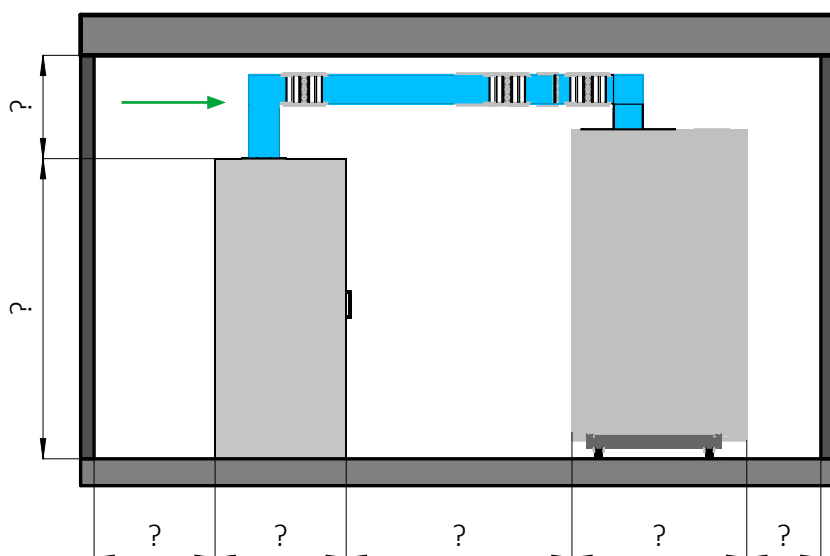
START THE MEASUREMENT FROM THE SWITCHBOARD

1. Check the plan for the position of the switchboard in the room
2. Measure the distance of the switchboard from the wall



3. Check the sectional layout to get distances from ceiling/walls/floor
4. The space available for the connection of the busbars on the switchboard is defined

To be verified and confirmed on site

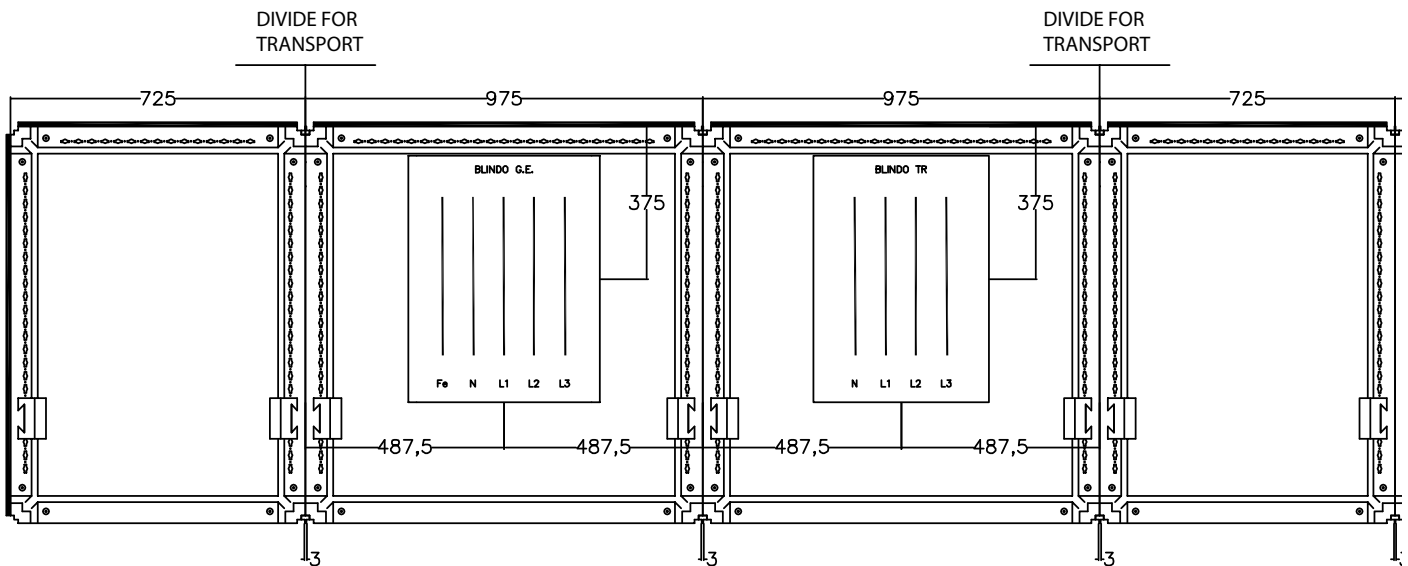


SITE MEASUREMENTS

MEASUREMENT METHOD

Step 2 : End point (continued)

5. Check the sectional drawing of the switchboard to get its dimensions
6. Check the sectional drawings of the switchboard to know the end device of connection (e.g: transformer 1 - transformer 2...)
7. Check the switchboard top drawing to get the space available for the busbar flange end connection.
8. Check the top drawing of the switchboard to know the sequence of the phases



Product visual



Examples of installation



Step 3 : Take measurements on site and make preliminary design

After having defined the start point (transformer) and the end points (panel, UPS, ...) of the line, make **preliminary measurements on site**.

The ideal condition is having a concrete building and its drawings (general plans, rooms layout, sectionals drawings...)



Keep in mind the distances to keep from wall/ceiling/floor.

► Refer to [page 94](#) for more information.

- 💡 Start the busbar design in PSZ software. (available only for technical team)
- In this first step, we suggest to define the elbows and the panel connections and keeping the straight elements pending. The pending elements should be defined during the next site visits

Step 4 : Define the pending elements

Split the project in small parts and identify the design pending parts.

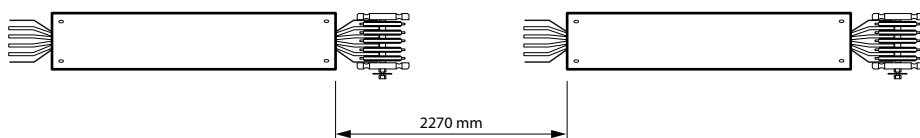
In order to complete the pending parts :

1. Make inspections on site to define the type and length of the pending busbar parts.
2. Finalize the design in PSZ and get the correct list of material (BOM).



The final design is only achievable when the pending elements have been correctly selected, their dimensions have been measured on site and added to the PSZ.

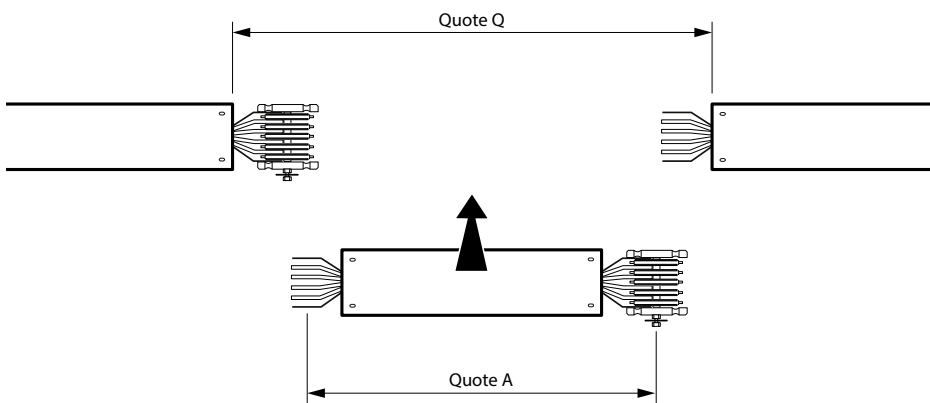
MEASUREMENTS OF PENDING STRAIGHT ELEMENTS



Step 1 : Measurements on site
2270 mm from the edge of the casing to another parallel edge.



Step 4 : Define the pending elements (continued)



Step 2 : Adapt values to PSZ

$2270 \text{ mm} - (135 * 2) = 2000 \text{ mm}$

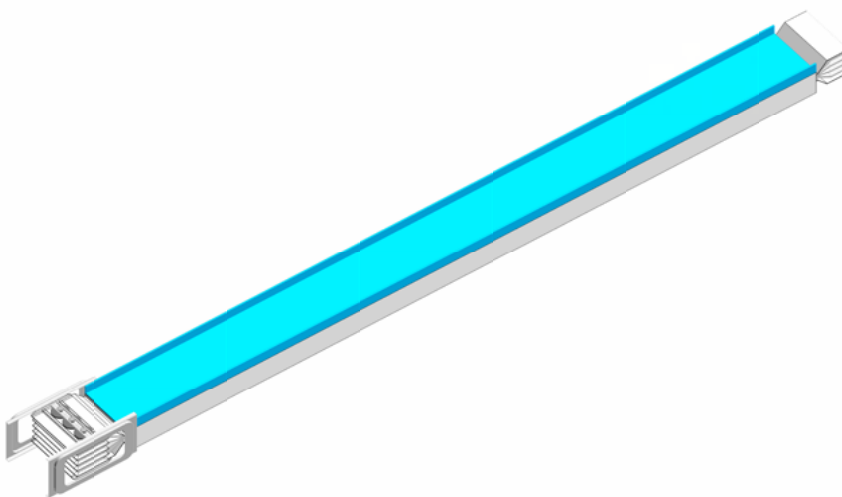
2000 mm is the QUOTE A.

This is the value to add in PSZ

QUOTE Q = 2270 mm

joint with monoblock = 135 mm

joint without monoblock = 135 mm



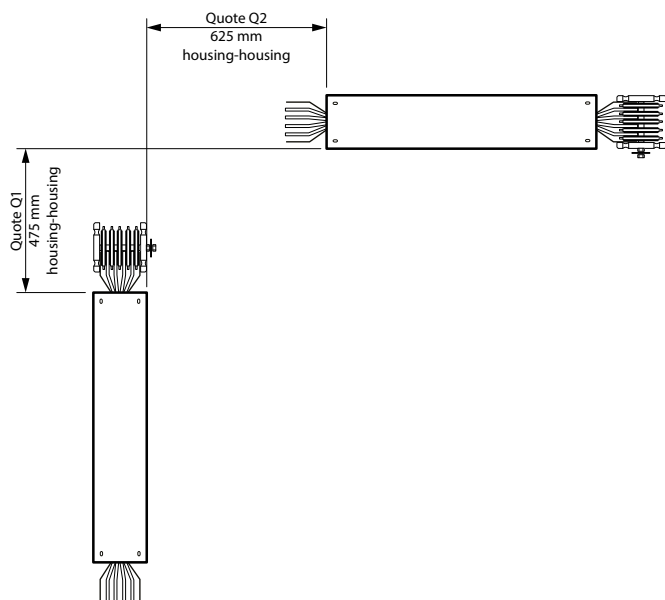
Step 3 : Add the measure to PSZ

2000 mm from central joints without monoblock to central joints with monoblock (screws)



Step 4 : Define the pending elements (continued)

MEASUREMENTS OF PENDING EDGEWISE ELBOW



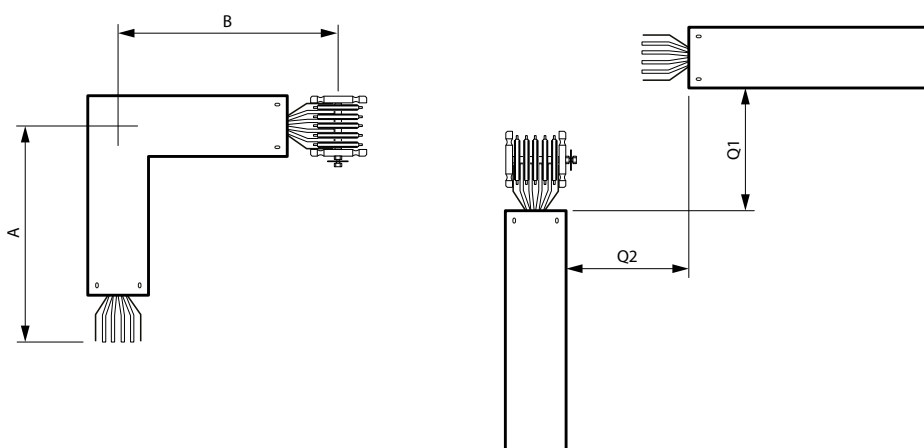
Step 1 : Measurements on site

Quote Q2

625 mm from the edge of the casing to another parallel edge.

Quote Q1

475 mm from the edge of the casing to another parallel edge.



Step 2 : Adapt values to PSZ

These are the values to add to PSZ :
 $475 - 75 \text{ mm}^* = 400 \text{ mm}$
 as the "A length"

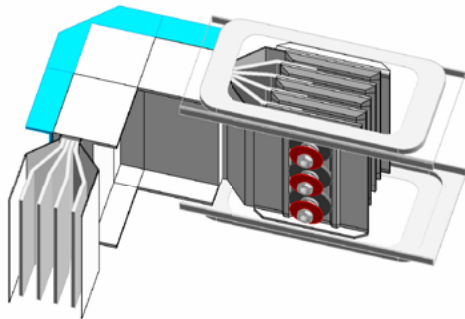
$625 - 75 \text{ mm}^* = 550 \text{ mm}$
 as the B length

*75 mm is the joint axis (in this case) this value varies depending on the range :
 For XCP-S : 75 mm
 For XCP-HP : 72.5 mm

MEASUREMENT METHOD

Step 4 : Define the pending elements (continued)

MEASUREMENTS OF PENDING EDGEWISE ELBOW (CONTINUED)



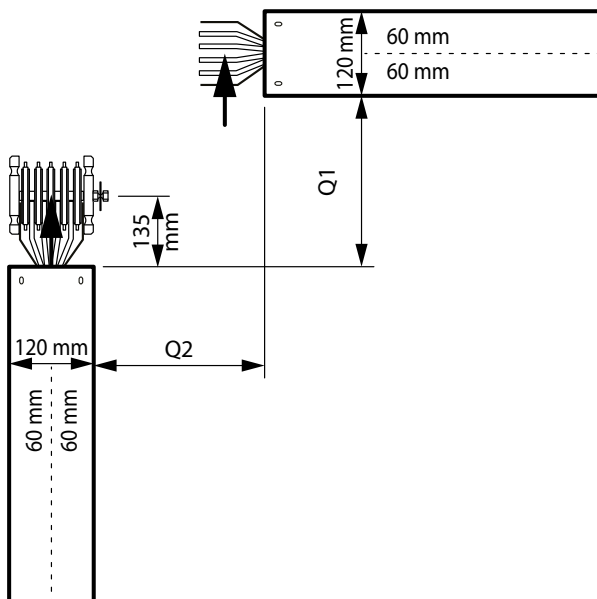
Step 3 : Add the measure to PSZ

400 mm and 500 mm are the distances from central joints to the center of the elbow.

The L size of the busbar does not change.

For XCP-S : L = 120 mm

For XCP-HP : L = 125 mm



Example with L = 120 mm

60 mm is the half of L

135 mm is the distance from the busbar casing to the screws

Q1 + 60mm = the center of the busbar

e.g. : 475 mm + 60 mm = 535 mm

Center of the busbar - 135 mm = the center of the axis

e.g. : 535 mm - 135 mm = 400 mm

the center of the axis (here 400 mm) is the dimension A to add in PSZ

i Quick calculation to get the same result:

135 - 60 = 75 mm

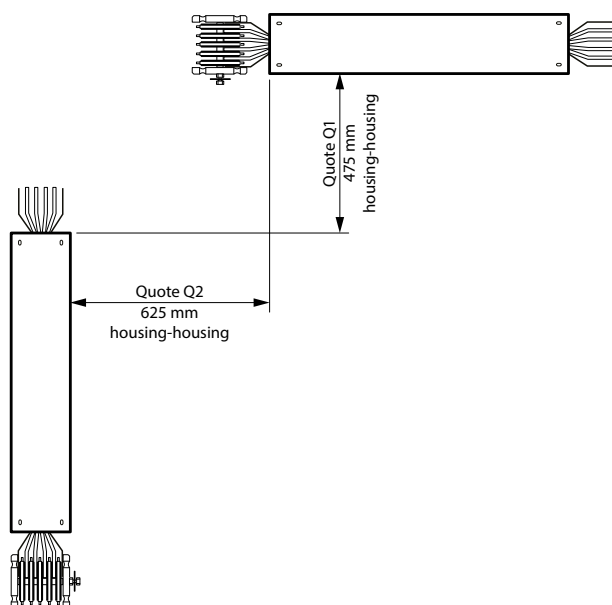
475 mm - 75 mm = 400 mm

Same procedure for Q2.



Step 4 : Define the pending elements (continued)

MEASUREMENTS OF PENDING FLATWISE ELBOW



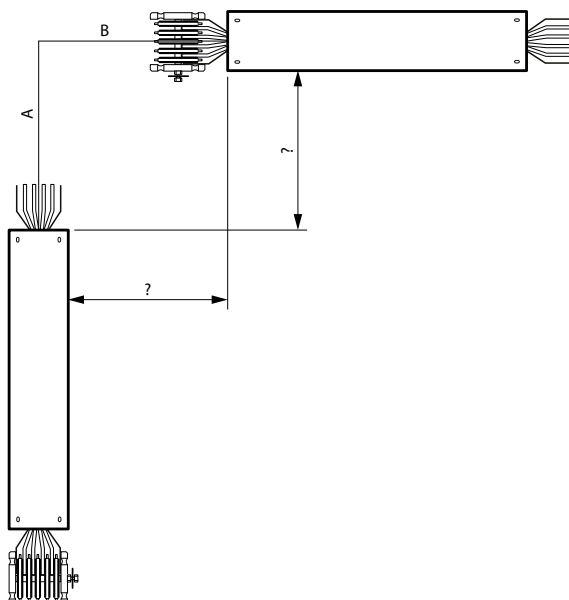
Step 1 : Measurements on site

Quote Q2

625 mm from the edge of the casing to another parallel edge.

Quote Q1

475 mm from the edge of the casing to another parallel edge.



Step 2 : Adapt values to PSZ

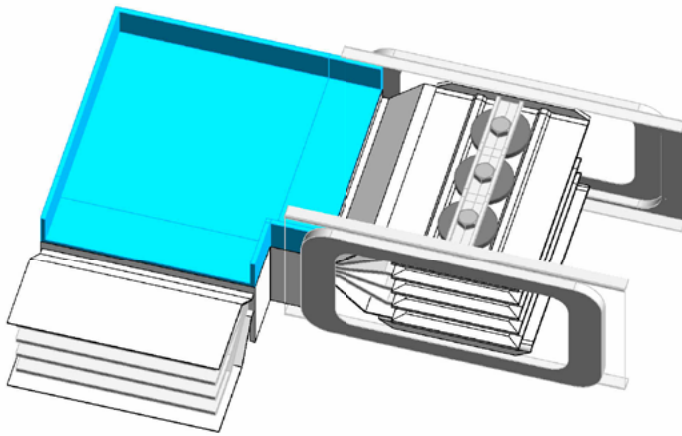
These are the values to add to PSZ :
 $475 - 25 \text{ mm}^* = 450 \text{ mm}$
 as the "A length"

$625 - 25 \text{ mm}^* = 600 \text{ mm}$
 as the B length

*25 mm is the central joint axis

Step 4 : Define the pending elements (continued)

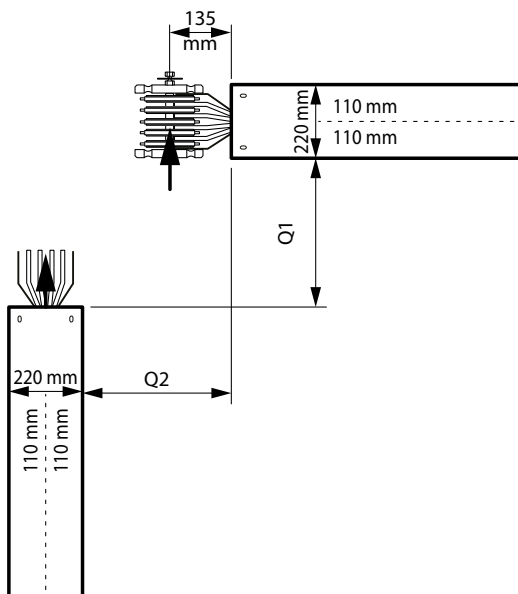
MEASUREMENTS OF PENDING FLATWISE ELBOW (CONTINUED)



Step 3 : Add the measure to PSZ

450 mm and 600 mm are the distances from central joints to the center of the elbow.

The H size of the busbar changes based on the rage and the rating



Example with H = 110 mm

110 mm is the half of H

135 mm is the distance from the busbar casing to the screws

Q1 + 110 mm = the center of the busbar

e.g. : 475 mm + 110 mm = 585 mm

Center of the busbar - 135 mm = the center of the axis

e.g. : 585 mm - 135 mm = 450 mm

the center of the axis (here 450 mm) is the dimension A to add in PSZ

Quick calculation to get the same result:

135 - 110 = 25 mm

475 mm - 75 mm = 400 mm

Same procedure for Q2.

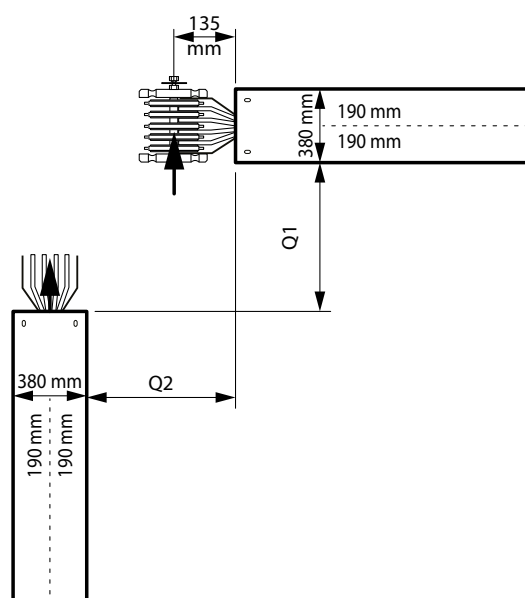


Step 4 : Define the pending elements (continued)

MEASUREMENTS OF PENDING FLATWISE ELBOW (CONTINUED)



Be careful when half of the H value is higher than 135 mm



Example with H = 380 mm

190 mm is the half of H

135 mm is the distance from the busbar casing to the screws

$Q1 + 190 \text{ mm} = \text{the center of the busbar}$

e.g. : $475 \text{ mm} + 190 \text{ mm} = 665 \text{ mm}$

$\text{Center of the busbar} - 135 \text{ mm} = \text{the center of the axis}$

e.g. : $665 \text{ mm} - 135 \text{ mm} = 530 \text{ mm}$

the center of the axis (here 530 mm) is the dimension A to add in PSZ

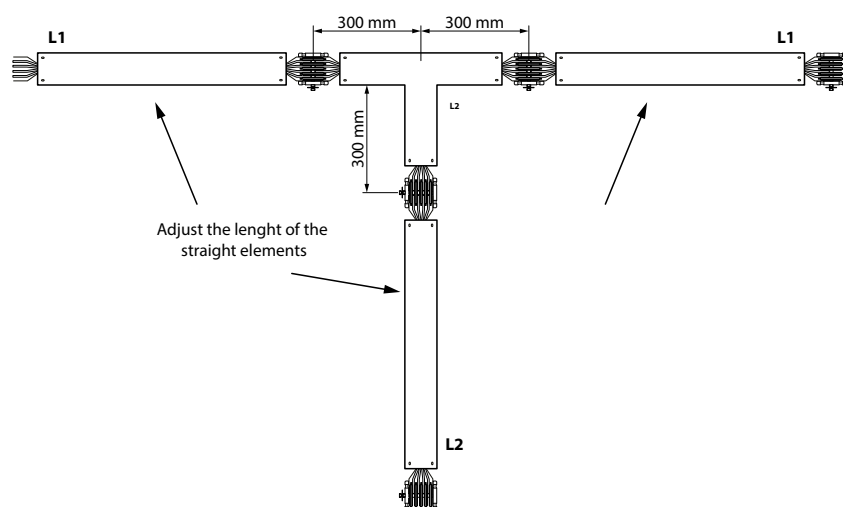
Quick calculation to get the same result:

$$135 - 190 = -55 \text{ mm}$$

$$475 \text{ mm} - (-55 \text{ mm}) = 475 \text{ mm} + 55 \text{ mm} = 530 \text{ mm}$$

Same procedure for Q2.

MEASUREMENTS OF PENDING T-ELEMENT



Using a standard T element:

1. Define the backbone line (e.g. L1)
2. Add the dimension of the T (e.g. $300 + 300$) to the backbone line
3. Add the dimension of T element to the branch (e.g.; L2)
4. Adjust the length of the straight (or elbows) elements of L1 and L2





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