



Transformer substations



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Inael Electrical Systems designs, produces and integrates transformer substations since 1998, in the plant located in Noblejas, Toledo. Inael's prefabricated buildings are approved by the main electricity companies in the world and are characterized by their great adaptability to the needs of each client.



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Generalities

The prefabricated transformer substations are defined, in the Norma UNE-EN 62271-202, as serie equipments that have been submitted to type test. These transformer substations are formed with the following elements:

- _ Prefabricated Building.
- _ Transformer or Transformers.
- _ Swicthgear of MediumVoltage .
- _ Panels Low Voltage.
- _ Connections and auxiliary equipment.
- Elements of safety.

Its object is to provide energy in Low Tension, from a system of High Tension.

These Transformer Substations, can be located in industrial areas, in restricted areas or in accessible places to the public for that, under the specified conditions of service, guarantee the safety of people, and don't produce environmental impact.



Utilization

The prefabricated buildings for transformer substations are for the outdoor installation or underground. All buildings have ready incoming and outgoing isolated of low and medium voltage cables. In the case of ground level buildings or compacts are practicable holes at the bottom of the front, with inclination to facilitate bending of the cables. In the underground buildings the input and output cable is located on a side wall, which is equipped with appropriate sealing parts adaptable to any diameter cable.

The available space, inside the prefabricated buildings, allows the realization of the diagrams normalized in the systems of electric energy distribution, with possibilities of alimentation of 1 or 2 transformers. The diagrams used more frequently are shown in page XX

The substations type EPH-1T and EPHS are manoeuvred from the inside of the prefabricated building. The substations EPH-BP, EPH-CS and EPH-COMP are manoeuvred from the outdoor of the prefabricated building.

The inside concrete metallic reinforcement, apart from giving the necessary mechanical strength, are welded together to make an equipotential mesh.

The installation place of the transformer substation, it should be conditioned according to the instructions given on page XX.

Technical standars and regulation

The transformer substations centres as well as their components are in conformity with the following norms:

- **IEC 62271-202.** High-voltage switchgear and controlgear. Part 202: high voltage / low voltaje Prefabricated substation.
- **IEC 62271-200.** High-voltage switchgear and controlgear-Part 200: A.C. Metalen closed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV.
- **IEC 60076.** Power transformers.
- **IEC60726-11.** Power transformers. Part 11: dry transformers.
- **IEC60529.** Degrees of protection provided by enclosures (IP Code).



Supply Characteristic

Our supply can include any variation that customers may require, from just the shipment of the building till a turnkey project, completely assembly. This system facilitates the installation that can be reduced to:

- The realization of the necessary excavation.
- To put the transformer substations in the excavation.
- Connection of the cables that will enter or leave from the transformer substations

Components

Prefabricated building “Monobloc”

The prefabricated buildings that act like housing of our transformer substations are of the type monobloc, and are essentially comprised of two parts:

- Base, on which is located the doors, the ventilation grilles, the supports for the different equipments, the pit of recupe- ration of oils, the holes for entrance / exit of cables, etc.
- Roof, is placed directly on the base and for its design, it is coupled appropriately forming a watertight assembly, in which is avoided any risk of filtrations.

The Prefabricated buildings are built in reinforce concrete and they are in conformity with the current EHE technical standards.

The metallic reinforced of the concrete, welded to each other, go together to the earth conductor to assure the electric continuity. Between the metallic reinforced of the base and of the roof, it is realized two connections, in opposite sides, using conductor of copper of 35 section mm2. The doors and the ventilation grilles have a minimum elec- tric resistance of 10 k Ω , in relation to the earth of the housing IEC 62271-200. Upon request doors and grids can be supply with grounding connections.



The protection grade against the penetrations of foreign bodies and water, of the outside part, is IP230 according to IEC 60529, the degree of protection against mechanical impacts is Ik10 according UNE EN 50102.

- Underground interiormanoeuvre.
- Ground level interior manoeuvre
- Ground level exterior manoeuvre.

Three types of buildings are manufactured for transformation substation:

Buildings indoor operation

These prefabricated buildings have an access door to the area of the equipment operation and another for each of the transformers that can be placed. In case is possible to extract the transformer from these doors. All the doors are located in the front part of the substation and it opens to outside. If it is required for the conditions of the installation, it can be added another access door to the area of the operation, to separate the area of the company and the are of the subscriber.

The ventilation grilles are metallic, and are only installed in the area of the transfor- mer or transformers and under the ventilation grilles is located a metallic net whose light is smaller than 6mm. The building can be supply with or without transformer equipments, but in both cases it should provide as minimum:

- Handrail or defense of the transformer.
- Specific floor prepare to set the transformer with floor fastening.
- Oil collecting pit.
- Platen for the mechanical blockage between the base and the roof.
- Two braids for electric connection between the base and the roof.
- Reinforce concrete in Medium and Low voltage room.

Underground Building

These concrete buildings have in the roof an entrance for personnel, that allow the incoming into the building through a metallic stair. The earthing is done through 2 security screws with square head that move with a standard key. When opening the door, a perimeter fence protects people of falls or accidents.

The ventilation of these building is done with grids in the ground level horizontal ventilation or grids placed in metallic chimneys of galvanized steel (vertical ventilation).

Doors and grids frames are raised 70 mm to allow the installation of the pavement that corresponds to the installation área.

For the incoming and output of the transformers and equipment , building is provided with concrete covers removed from inside of the building.

Even if the building is supplied without transformer, is equipped with the following:

- These concrete buildings have in the roof an entrance for personnel, that allow the incoming into the building through a metallic stair. The earthing is done through 2 security screws with square head that move with a standard key. When opening the door, a perimeter fence protects people of falls or accidents. The ventilation of these building is done with grids in the ground level horizontal ventilation or grids placed in metallic chimneys of galvanized steel (vertical ventilation).
- Doors and grids frames are raised 70 mm to allow the installation of the pavement that corresponds to the installation área.
- For the incoming and output of the transformers and equipment , building is provided with concrete covers removed from inside of the building.
- Even if the building is supplied without transformer, is equipped with the following:

Buildings with outdoor operation: compact type

These buildings have a door with two sheets located in the front part; one allows the Access to the operation área and protection corresponding to the cells of médium voltage and another facilitates the entrance to the low voltage panel. In these buildings the whole assembly of operation is placed on a platform that is introduce inside this building, through the roof, for that it is necessary to move away the piece that conforms the same. The ventilation grilles are metallic.

These buildings always include the earth of ironworks, however, the earth of neutral and the illumination as well go incorporated to the compact tr ansformer substations on platform that can lodge in.

In this type of building is included:

- Oil collecting pit
- Steel inserts between door and walls.
- Braided strap for electrical connexion between base and ceiling.



Indoor equipment of Transformer Center

In the prefabricated buildings it can be installed, installed optionally with the following equipmets: 1 or 2 transformers up to 1.600 kVA. From 1000 kVA, the transformers must be equipped with forced ventilation. The primary and secondary tensions will be in conformity with the customer’ s specifications being, its maximum value of 36 kV. It will also correspond to the required values, Vector group, the losses, the acoustic power etc...

Full gas insulated MV switchgear and hybrid.

Connections between switchgear and transformer are done with proper insulation and sections for wiring.

Low Voltage board with up to 8 outlets with or without. Interconnections by means of LV cable.

Hardware earthing service earth comprisedof the 2 earthing nets are connected with a box to realize the measurements with the earthings.

Lighting indoor installation with light point of 100 watts in every room, emergency light in switchgear is and low voltage panel with light point of 16 amps and a protection panel with magnetothermal and differential protection.

Security equipment composed with a safety signaling kit, gloves, isolated bench and fire extinguisher.

General dimensions

Technical specifications												
Building rage		Types	Indoor (cm)			Outdoor (cm)			N° de traf. Max. power	Transformer width zone	Weight aprox. (kg)	
			Lenght	Width	Height	Lenght	Width	Height				
Building or power station	Indoor operation	EPH-1T-3390	339	220	240	359	240	310	1/1000	160	12.070	
		EPH-1T-3900	390			410					13.880	
		EPH-1T-4250	425			445					15.540	
		EPH-1T-4800	480			500					17.610	
		EPH-1T-5900	590			610					21.550	
		EPH-1T-5900-3P	590			610					19.530	
		EPH-2T-5900	590			610			2/1000		19.310	
		EPH-1T-6410	641			661			1/1000		23.450	
		EPH-2T-64010*	641			661			2/1000		21.220	
		EPH-2T-7300	730			750			1.2 or 3 /1800		24.680	
		EPH-XT-8410*	841			861					26.100	
		EPH-XT-8760*	876			896					26.930	
		EPH-XT-9110*	911			931					29.633	
		EPH-XT-9430*	943			963					30.670	
		EPH-XT-9810*	981			1001					31.377	
		EPH-XT-10160*	1016			1036					32.500	
		EPH-XT-10320*	1032			1052					33.010	
		EPH-XT-10670*	1067			1087					33.350	
		EPH-XT-11210*	1121			1141					35.860	
	Outdoor operation	EPH-BP	196	110	190	216	130	208	1/250	11	4.900	
		EPH-COMP	185	178	204	205	198	222	1/630	90	5.900	
		EPH-CS							-	-	6.100	
Underground vertical ventilation		EPHS-1T-4250-W	420	220	250	550	250	288	1/1000	136	23.500	
		EPHS-1T-6200-W	620			650			2/1000		32.550	
		EPHS-2T-6200-W							1/1000		25.500	
Underground horizontal ventilation		EPHS-1T-4250-W	420			630			330		2/1000	34.550
		EPHS-1T-6200-W	620			730						
		EPHS-2T-6200-W				810						

* Delivery only under order
X -> Buildings with 0, 1, 2 and 3 power transforemrs

Typical electrical

With indoor operation

Diagram		Building Dimensions doors and grids		
Denomination	Type		Rated voltage	
			24kV	36kV
2L1P	EPH-1T-3390	Transformer door	1250 x 2100	1250 x 2290
3L1PA	EPH-1T-4250	Personnel door	900 x 2100	1250 x 2290
2L2P	EPH-2T-5900	Front grids	1250 x 680	
3L2P	EPH-2T-5900			
1L1P+M	EPH-1T-4250			
1L+1PA+M+2P+2T	EPH-2T-6410			
2L+1PA+P+M	EPH-1T-4800			
3L+1PA+P+M	EPH-1T-5900	Lateral grids	1500 x 850	
4L+1PA+Pa+M	EPH-1T-5900			
3L+1PA+PA+M+2P	EPH-2T-7300			
3L+1PA	EPHS-1T-4200			
3L+2PA	EPHS-2T-6200			

* Delivery only under order for transformers
> 1000kVA

Configurations of substations with outdoor operation

Diagram	Building			
Denomination	Type	Denomination	Gu cnnq	K-U-Cnnq
Transformer + L.V. Panel	EPH-BP	Under Post	1 de 1000x970 1 de 1000x1290	970x970
2L1P + Transformer + L.V. Panel	EPH-COMP/UF EPH-COMP/IB	Compact	1188x1222 1256x1400	562x1222 544x1400
3L 4L 2L1P	EPH-CS	Sectioning, Operationor Distribution.	1800x14000	--

Digging dimensions

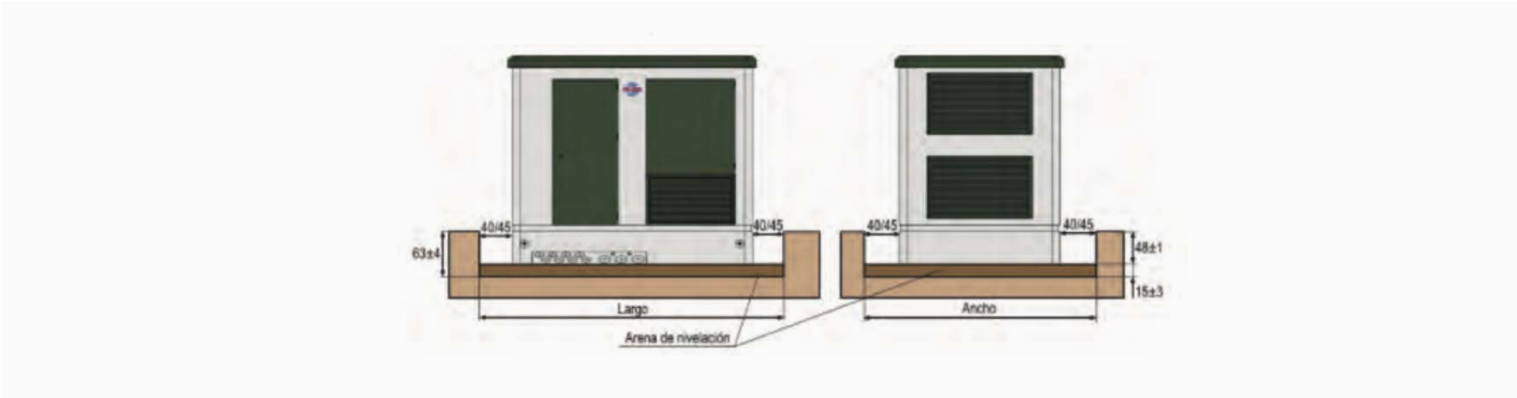
For the installation of the concrete buildings an excavation has to be done previously with the dimensions of the drawings. A reinforced concrete slab is recommended when ground resistance is under 1 kg/cm2 or areas with high probability of finding aquifers.

Remember we will need an access to the site of a 31 tn truck and a crane to make the unloading.

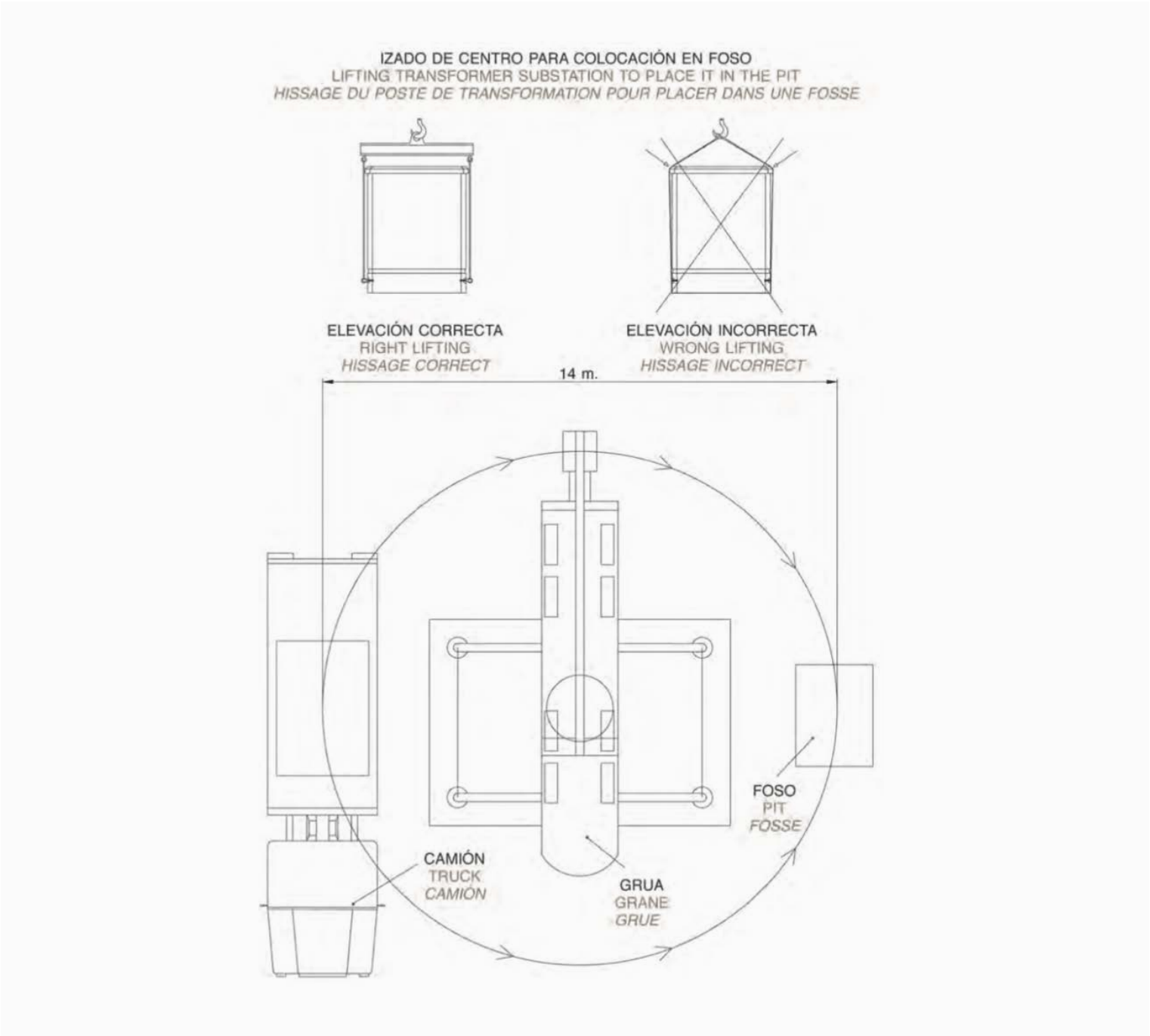
In those cases where there is no easy access, please consult with us.

The excavation must have a levelled washed sand bed with a minimum thickness of 150 mm. The assembly of the equipments in the building will be done in the factory.

Type	Ancho	Lenght	Height
EPH-1T-3390	325 ± 50	445 ± 50	62 ± 4
EPH-1T-3900		495 ± 50	
EPH-1T-4250		530 ± 50	
EPH-1T-4800		585 ± 50	
EPH-1T-5900		695 ± 50	
EPH-1T-5900-3P			
EPH-2T-5900			
EPH-1T-6410		740 ± 50	
EPH-2T-6410			
EPH-XT-7300		835 ± 50	
EPH-XT-8410		945 ± 50	
EPH-XT-8760		980 ± 50	
EPH-XT-9110		1015 ± 50	
EPH-XT-9430		1050 ± 50	
EPH-XT-9810		1085 ± 50	
EPH-XT-10160		1120 ± 50	
EPH-XT-10320		1137 ± 50	
EPH-XT-10670		1177 ± 50	
EPH-XT-11210		1226 ± 50	
EPH-BP	215 ± 50	300 ± 50	
EPH-COMP	285 ± 50	290 ± 50	
EPH-CS			
EPHS-1T-4200-W	440 ± 50	740 ± 50	270 ± 10
EPHS-1T-6200-W	440 ± 50	940 ± 50	
EPHS-2T-6200-W		820 ± 50	
EPHS-1T-4200-VH		1020 ± 50	
EPHS-1T-6200-VH	520 ± 50	1100 ± 50	
EPHS-1T-6200-VH			



Lifting and unloading



GENERAL TERMS AND CONDITIONS OF SALE
ALL PRICES, CODES, AND REFERENCES INDICATED IN THIS PRICE LIST ARE SUBJECT TO CHANGE WITHOUT PRIOR NOTICE
GENERAL TERMS Any sale made by the Seller shall be expressly subject to the Buyer’s full acceptance of the terms and conditions specified below and the waiver of the Buyer’s general terms of purchase. This acceptance and waiver shall be deemed to have been made with every order placed by the Buyer.
PURPOSE AND SCOPE OF OFFERS The applicable prices are those listed in the Seller’s current price list on the date of the order. Prices and conditions for specific offers shall apply exclusively to the products quoted and shall remain valid for one month unless otherwise stipulated. Acceptance of an offer must be formalized through a purchase order to the Seller. The order shall be considered definitively accepted only after the Seller’s express and unconditional confirmation. Any modifications or variations in scope, deadlines, or other contractual terms proposed by either party must always be communicated in writing and accepted in the same manner.
PAYMENT TERMS Unless special agreements are made, all our sales are insured by an insurance company and must be paid within a maximum period of 60 days from the invoice date, in accordance with the provisions of Law 15/2010 of July 5, amending Law 3/2004 of December 29, which establishes measures to combat late payment in commercial transactions. Under no circumstances shall the maximum deadlines established in this law be exceeded. For orders below €300, payment must be made in advance. In the case of international sales, if payment is made by documentary credit, the Buyer must obtain the Seller’s acceptance of the letter of credit terms and the confirming bank before issuance. Due to the management costs borne by the Seller, a minimum invoice amount of €150 will apply to all sales.
TRANSPORTATION AND INSURANCE For shipments within the Iberian Peninsula, orders exceeding a net value of €2,000 will be shipped freight prepaid. For any other destination, goods will be delivered under EXW Toledo conditions. For prepaid shipments, no transport claims will be accepted after 48 hours from delivery. In cases of urgent shipments requested by the customer, goods will always be shipped freight collect. Goods always travel at the Buyer’s expense and risk, who, in case of damage or delay, must file the relevant claim with the transport companies or agents within 48 hours.
TOOLING AND PACKAGING Tooling manufactured for the production of special products shall be at the customer’s expense and shall be stored at INAEL, used exclusively for the orders for which they were manufactured. Such tooling may only be used for third parties with the express authorization of the customer and will become INAEL’s property five years after its last use. The delivery of tooling must be expressly agreed upon at the time of the order. All materials shipped from INAEL to customers are packaged in standard packaging suitable for road transport. Any specific packaging requested by the Buyer shall be at their expense.
MANUFACTURING In the event of force majeure of any kind, including but not limited to the unavailability of raw materials, manufacturing difficulties, strikes, communication disruptions, or catastrophes, INAEL shall be automatically released from any commitments made, reserving the right to cancel pending manufacturing orders without prior notice.
DELIVERY TIMES Delivery times are approximate unless the Seller expressly agrees to firm delivery deadlines. Delivery times shall commence from the latest of the following dates: - The date of INAEL’s unconditional acceptance of the order. - The date INAEL receives from the customer all the necessary information required to process the order. - The date INAEL receives the advance payment the customer has committed to under the terms of the sales contract. - In the case of payment by Letter of Credit, the date an acceptable documentary credit for INAEL is notified and, if required, confirmed by the same.
If these preconditions are not met within six months of the contract’s existence, the contract shall become null and void, and the Buyer shall waive any claims for damages.
If the Buyer requests a postponement of the delivery date, INAEL may invoice the products when they are made available on the agreed date, without prejudice to charging the Buyer for any incurred storage costs..

GENERAL TERMS AND CONDITIONS OF SALE
OWNERSHIP OF GOODS AND RETENTION OF TITLE INAEL shall retain ownership of the goods until full payment of the invoice sale price has been made, even if a bill of exchange has been issued. The customer is authorized to transform the goods, but this authorization shall automatically cease if the customer fails to strictly comply with the established conditions.
RETURN OF MATERIALS Returns will not be accepted without the express intervention and consent of INAEL, and under no circumstances for special materials. If a return is accepted, all transportation, inspection, repair, or reconditioning costs will be borne exclusively by the sender. No returns of any type of material will be accepted after one year from the delivery date.
TESTING Our products are always tested and verified before being shipped to our customers. If desired, routine tests can be carried out in the presence of customers at our factory, provided that prior notice is given when placing the order to schedule a date. If any other type of testing, third-party inspection, or additional actions are required, they must be quoted and approved by INAEL, with all costs borne by the customer.
WARRANTY We guarantee our manufactured products for one year from the factory dispatch date against any material defects or manufacturing faults. During this period, we commit to repairing or replacing any recognized defective parts at our expense and at our factory within the shortest possible time, without compensation to either party and without accepting liability for any direct or indirect damages that may arise.
To maintain the validity of our warranty, it is essential to follow the instructions in our assembly and maintenance manuals. Any repair or modification of our products without our intervention or consent will result in the immediate termination of the warranty.
Repair, replacement, or substitution of the product or any part thereof during the warranty period shall in no case extend the warranty period of the product.
ENVIRONMENTAL REGULATIONS The holder of the waste is responsible for its collection and disposal or ensuring its proper collection and disposal. For professional electrical and electronic equipment subject to European Directives 2002/96/EC of January 27, 2003, and 2006/66/EC of September 6, 2006, as well as the applicable regulations implementing them, the organizational and financial responsibility for the collection and processing of waste generated by these devices marketed after August 13, 2005, has been transferred to the direct purchaser, who accepts this responsibility. The direct purchaser agrees to assume responsibility for the collection, disposal, processing, and recycling of the waste generated. Failure to comply with these obligations may result in the imposition of criminal penalties by each member state of the European Union. INAEL hereby guarantees that the substances, whether alone or contained in products incorporated into the production process in question, have been used in compliance with applicable registration, authorization, and restriction provisions.
As of January 1, 2024, the tax on equipment containing fluorinated gases, approved by Law 14/2022 of July 8, amending Law 19/2013 of December 9, comes into effect. Specifically, this tax applies to equipment containing SF6 that is delivered and installed in Spain after that date.
In this offer, the tax has been calculated based on the scope and normal installation conditions of the project. If the scope and/or installation conditions change, the tax must be recalculated. This tax is transferable throughout the entire supply chain and is not exempt from VAT.
For equipment intended for export, inquiries can be made with the tax authorities on how to process the refund of the tax amount.
JURISDICTION In the event of disputes, the Judges and Courts of Toledo shall have jurisdiction, to which both parties expressly submit, waiving any other jurisdiction.



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