Operating manual

Guidelines for transport, installation and maintenance

GIS voltage transformer

Type EGK 72s-3 … 170-3

History

Date	Modified
25/04/2019	Manual reissued
27/01/2019	Chapter 11 has been integrated
15/12/2020	Update chapter 7 and chapter 11
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07/03/2023	Digital remastered

Guide to symbols

	**Useful notes**
	**Hazard warning**
	**General prohibition sign**

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Content

1 Introduction

Transformers are devices that transfer high currents and/or voltages into standardized equivalent values for counters, measurement and protection devices. The transformers made by PFIFFNER Group AG are of very high quality and produced in accordance with ISO 9001 standards. These instructions apply to PFIFFNER GIS voltage transformers of the voltage ranges 72.5 – 170 kV.

National, regional or in-house regulations are not considered in this document. These must be observed in all cases.

2 Short design description

2.1 General design

The measurements of the transformer vary according to voltage level and design. The exact measurements can be seen in the dimension drawing specific to the order provided separately. The detailed technical data is displayed on the rating plate. The rating plate is located on the side panel of the terminal box.

Figure 1: EGK72sp-3

The EGK72sp-3 differs from EGK72s-3 by a special feature which makes it possible to mount the transformer onto the unit by plugging it in, or to dismount it without gas handling.

Figure 2: EGK145-3 with terminal box design above

The EGK170-3 differs from the EGK145-3 by the size of its housing and by the size of the flange.

2.2 Transformer housing

In GIS technology, all the function modules of the switchgear are encapsulated with insulating gas. The voltage transformer has a gas compartment separated from the unit by the barrier insulator. All housing parts are made from aluminum. The active parts, which consist of primary windings, secondary windings and laminated iron cores, are situated in the transformer housing. The connection materials are made from stainless steel. Easily corrodible material is not used so that a long service life can be achieved.

2.3 Earthing the transformer

A GIS transformer is earthed by securing the housing. The housing is secured with screws onto the unit by the barrier insulator and earthed.

2.4 Primary connections

The primary connections of the transformer are located on the barrier insulator. The exact location of the primary connections can be seen in the dimension drawing which comes with the transform- er. The earth connection (N/X) of the primary connections is situated in the terminal box. The terminal names are created in accordance with the standard specified on the rating plate. The primary

connections and the barrier insulator must be thoroughly cleaned with isopropyl before installation on the unit.

2.5 Terminal box and secondary connections

The terminal box for the transformer is situated on the cover above the grommet of the secondary outlets which come from the gas compartment. There are two designs; terminal box above and terminal box on the side. In the version with the terminal box above, the terminal box is located directly on the grommet, and in the version with the terminal box on the side, the terminal box is attached to the side of the transformer. In a side design version, the outlets of the grommet are additionally routed to the terminal box with a shaft. The connections of the secondary windings and the earth connection of the primary winding are located in the terminal box. The terminal types are determined by the customer. The connection for the end of the secondary winding is always earthed when supplied. The open delta winding for earth fault detection is interconnected and earthed on one side when supplied.

Figure 3: EGK145-3 with side terminal box design

It must be noted that the earth connection of the primary windings (N/X) must always earthed. Otherwise, life-threatening high voltage can arise in the terminal box.

It must be noted that short-circuited secondary windings are strictly prohibited. Furthermore, it must be noted that the secondary windings must not be loaded above the thermal limit.

Depending on the series terminal type, these earth connections can be partially realized directly on the terminals with nodes. Abrasion-resistant labels must be used to name the connection, which are created in accordance with the rating plate diagram and the specified standard.

2.6 Primary tapping

A GIS voltage transformer does not have a primary tap. Nevertheless, different primary voltage levels can be changed between with a secondary tap. The terminals for the tap are situated in the terminal box. The arrangement and designation of the terminals can be found in the diagram, which is also situated in the terminal box.

2.7 Secondary fuses (optional)

The secondary windings can be equipped with fuses to protect the voltage transformer from secondary short circuits due to faults in the secondary wiring of the switchgear. Depending on the requirement, the transformers are fitted with safety fuses or circuit breakers in the secondary terminal box. The circuit breakers optionally receive auxiliary contacts for status monitoring.

2.8 3-phase ferro resonance damping unit (optional)

Figure 4: EGK145-3 with a ferro resonance damping unit

An additional damping measure can be provided in the case of a possible 3-phase ferro resonance. This is implemented with the aid of a saturable reactor, which is connected in an open delta to the earth fault detection windings of a 3-phase voltage transformer. The saturable reactor will change to a state of saturation in the case of a 3-phase ferro resonance, and by doing so will temporarily heavily load the 3 secondary windings.
The damping unit is situated in an aluminum housing in accordance with IP54. The connection terminals in this housing are designed on a cross-section of 6mm^2.

It must be noted that the 3-phase ferro resonance damping unit must be removed during a one-phase energizing, otherwise undesired effects may occur.

2.9 Heating (optional)

An externally supplied heating unit can be integrated into the terminal box in order to prevent the formation of condensation. The input voltage and performance of the heating unit must be deter- mined by the customer.

2.10 Disconnector IID for EGK145-3 (optional)

In order to electrically disconnect the transformer from the unit without having to remove it from the unit, the transformer can optionally be provided with a disconnector. The IID (integrated isolating device) cannot be retrofitted. Therefore, this option must be ordered together with the transformer.

2.11 Electric arc monitoring (optional)

In order to detect an electric arc, the transformer can be optionally fitted with an electric arc sensor.

2.12 TVOLT function (optional)

By a corresponding design, the test voltage can be generated with a secondary feed-in of the transformer in the GIS field so that high voltage tests can be carried out. Depending on the requirement, an extra terminal box can be optionally ordered for this function.

3 Transport

3.1 General transport regulations

The following points must be observed when transporting the transformers:

- Only use vehicles with pneumatic suspension
- Transformers must only be transported in the appropriate transport facilities in an upright position (see 1HDG187000 transport instructions). If a transformer is transported in a horizontal position its guarantee becomes invalid.
- The insulator and the primary connections are always protected by a transport cover and the transformer is positioned standing on transportation feet.
- Transformers must be secured with straps for each trip
- If a transformer is sent back to the factory, the same transport regulations apply to it.
- The corresponding markers on the packaging must also be observed for the transport of the transformers.

3.2 Handling of shock indicators

Shock indicators are aids for transport monitoring and show the force of a sudden mechanical im- pact. Depending on the direction of the effective force, the horizontal and/or vertical indicator is triggered. Shock indicators work with values called "g" values. A "g" denotes the simple gravitational force. If it is activated, it is vital to make a note of this upon receipt of the goods on the transport company's receipt

Figure5

Non-triggered indicator

Figure6

Triggered indicator

Two shock indicators are installed on every transformer. An indicator is installed on the exterior on the cover of the transformer. The other is installed in the transformer terminal box. Both indicators must be checked directly upon the receipt of goods. If only one of two 20g shock indicators is triggered, an on-site check by a supervisor is required. If both indicators are triggered, the transformer must be sent back to the factory for inspection.

4 Inspection and storage

4.1 Inspection after arrival and evaluation of damage

The transformers and the packaging must be checked immediately for damage after they have been received by the carrier. Each instance of damage must be noted on the transport company's receipt. If this note is not made, PFIFFNER can reject all liability if a claim is made. The following components in particular must be checked during the inspection:

- Damage to the surface
- Terminal box
- Gas connections
- Rupture disc
- Transport cover
- The SF6 transport pressure
  (approx. 150kPa abs.)

The following points must be observed if damage occurs:
As a rule, Pfiffner must be contacted in each instance of damage.

Table 1: Inspection after arrival and evaluation of damage

Damage	Procedure
One of the two shock indicators has been triggered and there is no noticeable damage to the product.	An on-site check by the supervisor is required. After the check, the supervisor must decide whether or not the transformer can be continued to be used. The fact that one of the two shock indicators has been triggered must be noted on the transport company's receipt accordingly.
Both shock indicators have been triggered and/or there are visible traces of damage on the transformer.	As a rule, if both shock indicators have been triggered, the transformer is sent back to the factory. A corresponding note must be made for the transport company, the damage must be documented and PFIFFNER must be informed in order to mutually determine what should be done next. The goods remain blocked by PFIFFNER until they are released.
Slight scratching on the transformer / packaging, shock indicators not triggered.	The product can be used.
The transformer is damaged.	The transformer cannot be used in this state. A corresponding note must be made for the transport company, the damage must be documented and PFIFFNER must be informed in order to mutually determine what should be done next. The goods remain blocked by PFIFFNER until they are re- leased.

4.2 Unloading, unpacking and raising

The transformer can be unloaded with a crane or a stacker truck. If a crane is used, the transform- er must be unloaded with a suitable lifting device. When using a stacker truck, the markers and symbols on the packaging regarding the minimum length and maximum load must be observed. The transformer must be raised for installation, repair or inspection. There are 2 x M16 bore holes (EGK145-3) / M20 bore holes (EGK170-3) on the cover on which eye bolts are installed in order to raise the transformer with the aid of a crane and hoisting ropes. The total weight of the transformer is shown on the rating plate.

Figure 7: Raising the transformer by eye bolts

Depending on the packaging design, it must be carefully removed so that the transformer is not damaged. After the packaging has been removed, the shock indicators must be checked. The packaging materials must be disposed of while taking into account regional waste disposal regulations, or they can be sent back.

4.3 Storage

Pfiffner assigns the storage of the transformer to the GIS manufacturer.

5 Installation and commissioning

5.1 Staff

Installation and commissioning must only be carried out by specialist and trained staff. Incorrect operation by untrained staff invalidates manufacturer liability!

5.2 Tools and material

To install the transformer on the GIS unit, standard tools and the following extra material is re- quired:

- Torque wrench with 6-edge plug inserts
- A suitable lifting device
- Screws, nuts, washers for securing onto the GIS unit

5.3 Inspection before use

Before installation on the GIS unit, the transformers must be checked. The transformers are individually checked and are provided with SF6 transport pressure approx. 150kPa (abs). Before in- stalling on the GIS unit, the following points must be ensured:

- The correct transformer is on site, the technical data on the rating plate corresponds to the trans- former to be installed. The general condition of the transformer is fault-free and undamaged
- There is no damage to metal parts, insulator, primary connections and terminal box

- The connection surface (flange) to the GIS unit must be clean

5.4 Installation and connections

5.4.1 Installation

It must be ensured that the installation surface is clean. The transformer can be mounted in an upright position and hanging (vertically.) If the transformer is horizontally mounted, it must be given extra mechanical support.
After mounting on the GIS unit, the following points must be ensured:

- On the voltage transformer, all the unused secondary windings are earthed, but never short-circuited
- All screws with the prescribed torque have been tightened
- The correct load is connected to every secondary winding

5.4.2 Earth connection

See chapter 2.3

5.4.3 Secondary connection

Every secondary connection must be earthed (exception: winding for earth fault detection, only **1 transformer** / winding **per three phase system** may be earthed here. The terminal names and the diagram or the documentation must be observed when connecting the earth connections.

See chapter 2.5

Voltage transformer secondary windings must never be operated in a short-circuited state. Unused voltage transformer secondary windings must be open and ideally earthed at the winding end (terminals)!

5.4.4 Primary connection

See chapter 2.4

5.4.5 TVOLT terminals (optional)

See chapter 2.12

5.4.6 Heating (optional)

The heating connections are usually labelled with XD80. The heating is operated by external energy. The input voltage and performance of the heating unit can be found in the transformer diagram.

6 Maintenance

6.1 Basic low maintenance

The transformer is designed so that it generally does not require any maintenance for a service life of approx. 40 years. Since different external influencing factors, which could negatively influence the transformer's performance parameters, cannot be strictly ruled out over such a long period of time, it is good practice to regularly check the device. Possible checking intervals are specified in Table 4 Inspection plan.

6.2 Possible checks

6.2.1 Visual inspection

The visual inspection of the transformer is the most straightforward method of inspection. The following points must be observed:

Table 2: Visual inspection

Check point	Target state	Measures to be taken if target state varies
Metal parts	No excessive corrosion	Clean, or contact Pfiffner
Secondary connections	Wiring according to the diagram Earthing of the earth connector N/X No excessive corrosion No traces of overloading No loose terminals, bolts and nuts.	Wire according to diagram, or contact Pfiffner
Insulator	No soiling No damage No cracks	Clean with isopropyl, or contact Pfiffner
The SF6 gas pressure	The operating pressure is noted on the rating plate of the transformer.	The operating pressure can be reproduced, a leak should be searched for and Pfiffner should be contacted
Sealing in the transition from the flange to the housing and barrier insulator	No leakage	Localize the leak with an SF6 detector and contact Pfiffner
Heating during operation	- The maximum heating of the housing during rating is 20K above the ambient temperature.	Contact the manufacturer

6.2.2 On-site electrical tests

There are several different possible on-site electrical tests. Regional or in-house regulations must be observed here. If there or questions or regarding types of possible checks, please contact Pfiffner.

6.3 Cleaning and care

6.3.1 Primary connections

The GIS manufacturer is to be referred to for the cleaning of the primary connections.

6.3.2 Terminal box

The terminal box can be checked for soiling and moisture (condensation). It must be cleaned if there is heavy soiling.

6.3.3 Secondary connections

The connections of the secondary wiring are securely screwed in by the factory. This state must be recreated after every use with a torque wrench and the corresponding torque in accordance with Table 3 Tightening torques.

7 On-site repairs

A repair or opening of a voltage transformer is only allowed to be carried out after consulting Pfiffner. As a precaution we would like to point out that the warranty will expire if the voltage transformer is opened on customers' own decision without Pfiffner explicit written confirmation.

8 Spare parts

Normally, no spare parts will be required during the expected service life of the transformer. How- ever, if parts become damaged or have to be replaced, only original spare parts from the manufacturer should be used. For this purpose, the manufacturer should be contacted sales@pfiffner-messwandler.de.

9 Malfunction

A voltage transformer is an electrical appliance. Electrical limit values have been defined for each transformer which it must be able to continuously tolerate during a set time period without becoming damaged. If these values are exceeded, the transformer could be destroyed. If you are unsure as to whether a transformer has been damaged, please contact Pfiffner at sales@pfiffner-messwandler.de.

In the case of malfunction, please proceed in accordance with the processes defined by the network operator and inform the manufacturer if necessary.

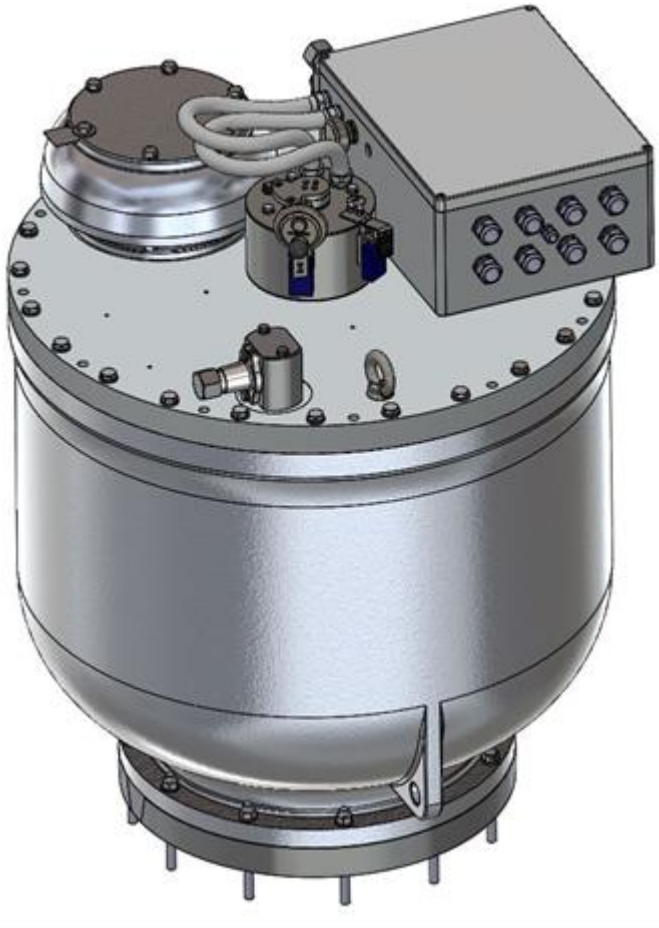
10 Disposal

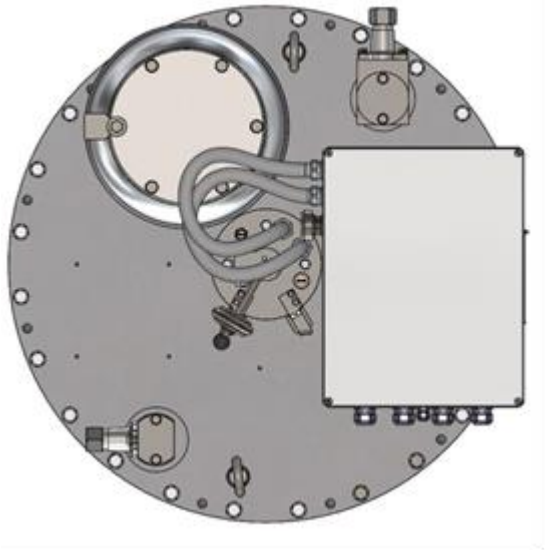
If the transformer is no longer needed, it must be sent back to the manufacturer (Pfiffner Deutschland GmbH). Disposing of the transformer independently is not permitted.

11 Manual for the IID (internal isolating device)

11.1 Introduction

This User Manual contains essential information how to use a three-phase internal isolating device (IID) of an EGK with IID. This isolating device is not a circuit breaker nor a disconnector switch according to the IEC, but rather ensures the disconnection of the VT from the substation by a lever to allow performing high voltage tests on the GIS bay. The electrical requirements are the same as in a voltage transformer**.**





Attention! Never operate under electrical load!

The isolating device is located in the middle of the VT cover near the junction box and rupture disc. A padlock, a blocking magnet, a lever, two position indicators and totally six position switches are the components of the IID. The position indicators are client-specific designed, four of the position switches are standard components and they are located inside the IID. Two of the position switches are optional and they are located for monitoring the padlock.

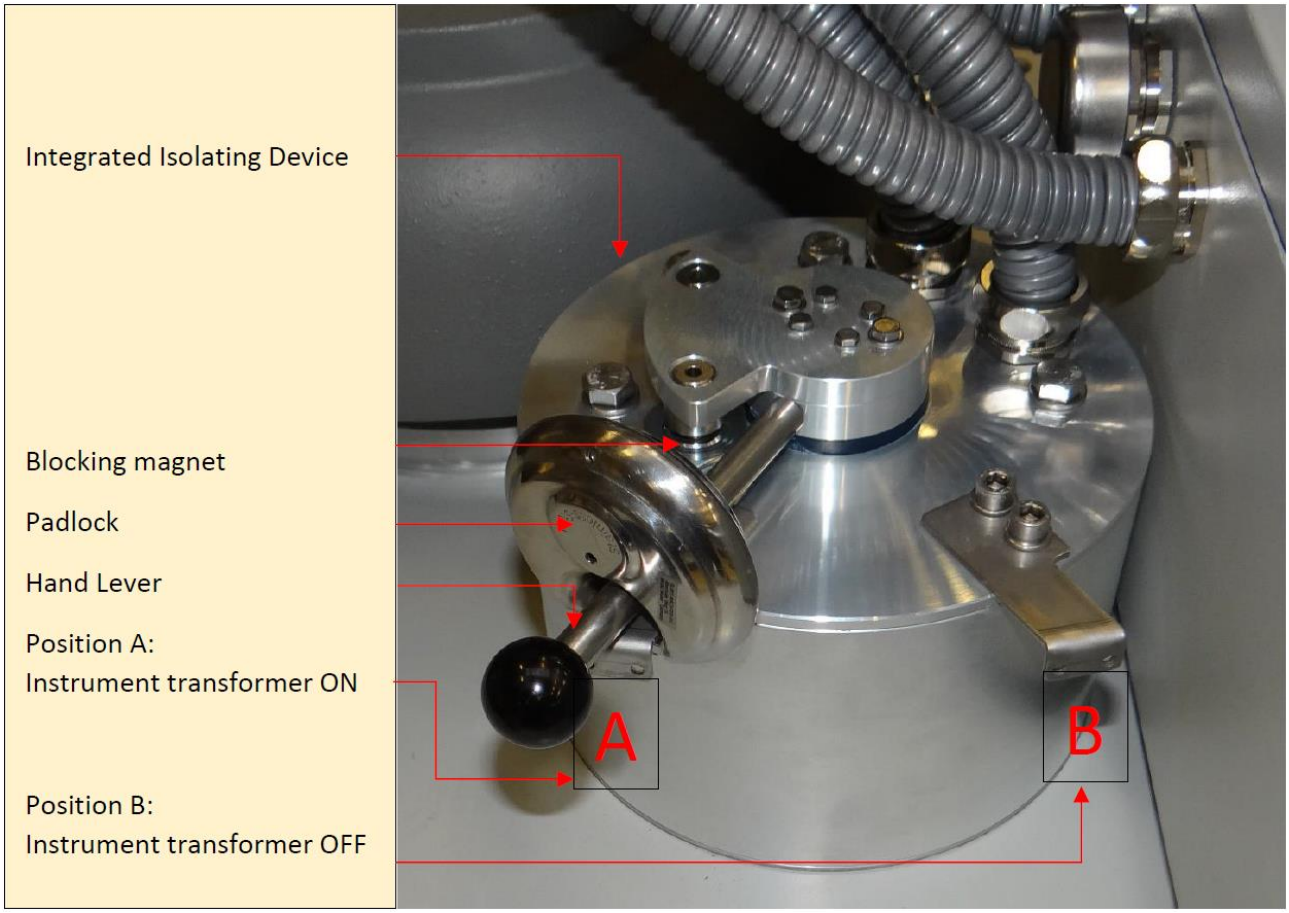


Figure 8: EGK with IID and the location of the isolating device

11.2 How to operate the IID

The position indicator of the lever is shown standard with ***A*** and ***B*** colors, except they are client-specific designed:

- *If the position indicator shows **A**, the VT is connected to the bay*
- *If the position indicator shows **B**, the VT is disconnected to the bay*

The VT will be delivered in position *A* by default.

1. ***Step:*** To operate the IID remove the discus-lock. The keys for the padlock are located in the terminal box.

Figure 9: IID without padlock

2. ***Step:*** Activate the blocking magnet. The activation is centrally managed. After the activation the blocking magnet releases the lever for rotation.

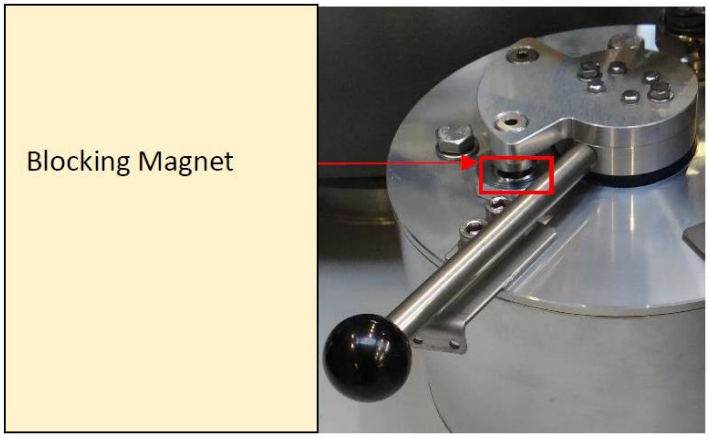


Figure 10: Position of the blocking magnet

3. ***Step:*** Turn the lever to the end position. After reaching the end position the blocking magnet should be activated once again to get the blocking magnet snapped into its end position.

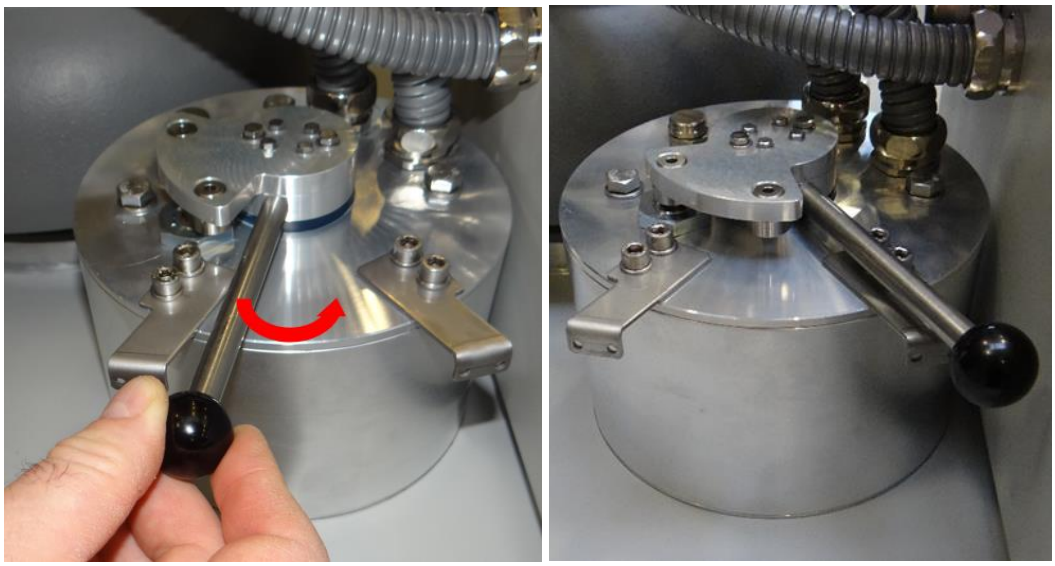


Figure 11: Switching the hand lever ON -> OFF

4. ***Step:*** Lock the lever at the end position. The VT is now disconnected from the bay.

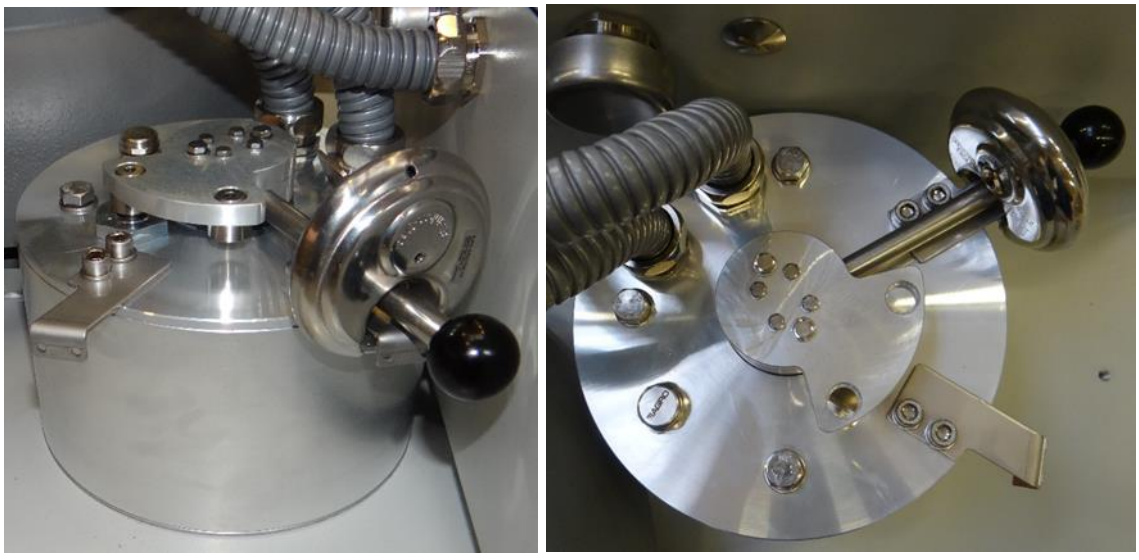


Figure 12: Locking the IID with the padlock

12 Sealings

In case of a certification through official sites following sealings are possibile

1) Burst disk
2) Terminal box
3) Base plate
4) Barrier insulator
5) Rating plate
6) Inside the terminal box

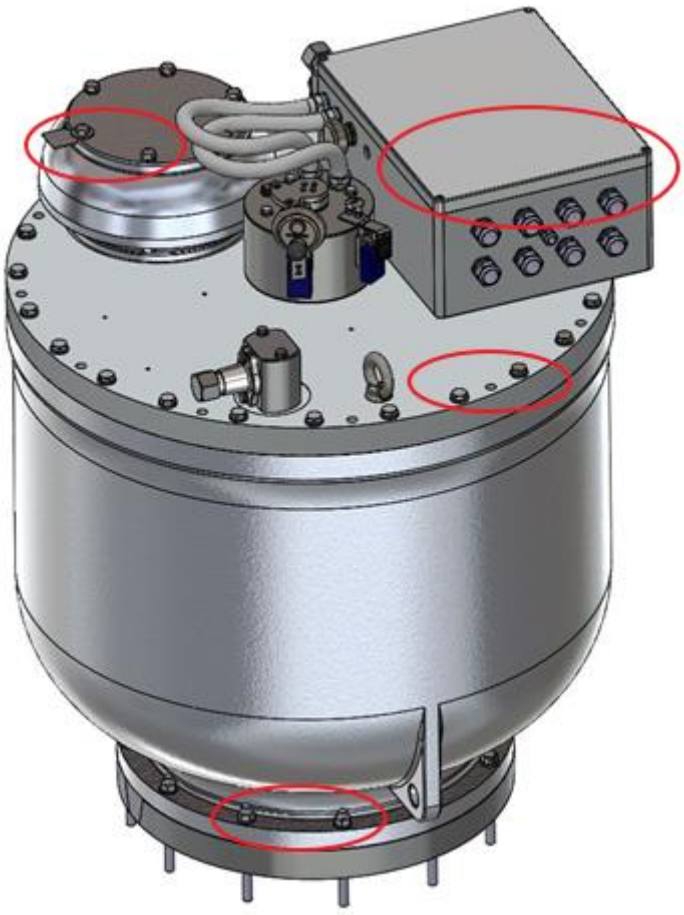


Figure 13: Sealings EGK 145-3

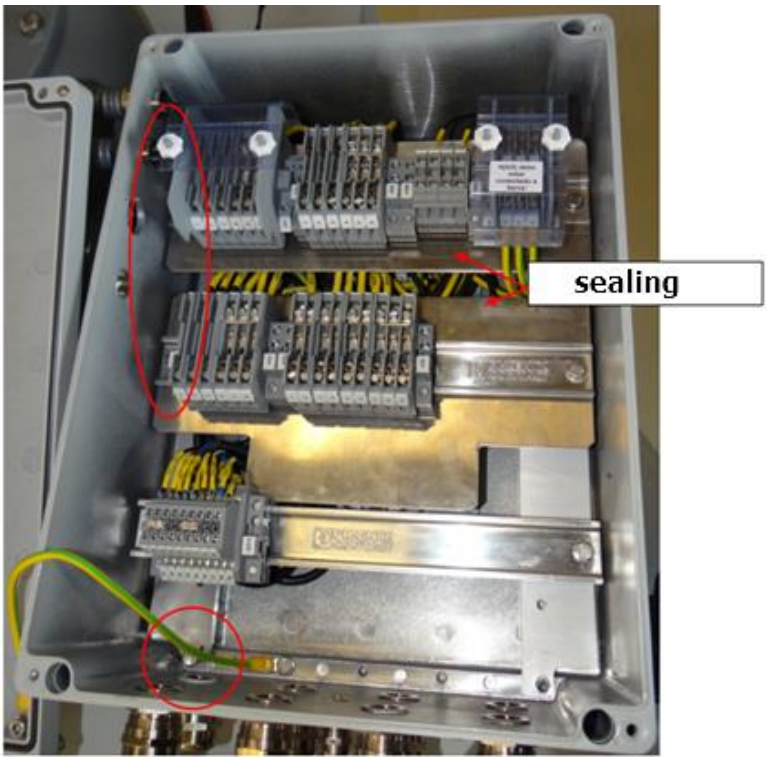


figure 14: sealings inside terminal box

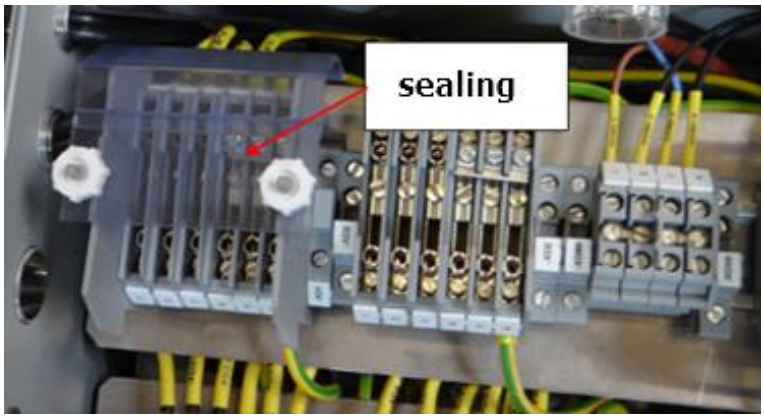


figure 15: sealings over terminal blocks

figure 16: sealing for rating plate

13 Appendix

13.1 Tightening torques

Proper use of screws is required for the connections to function correctly. To ensure operation without faults, the torques specified in the table below must be observed

Table 3 Tightening torques

Connection	**Required tightening torque**
Earth connection on the transformer housing M12	42 Nm
Terminal box cover	6 Nm
Primary connections on the barrier insulator M12	42 Nm
Barrier insulator on the housing with threaded rod M12 nut	70 Nm
Connection cover and housing M12 (EGK145-3)	42 Nm
Connection cover and housing M16 (EGK170-3)	90 Nm

13.2 Inspection plan

In general, the transformer does not require maintenance. However, it is good practice to inspect various points of the transformer. For this purpose, the following points are recommended.

Table 4 Inspection plan

	Directly after transport	After unpacking	After installation	After commissioning	Annually or according to instructions	After 5 – 10 years	After a new connection	After a fault event	Comments
Packaging damage	x								If there is damage to the packaging, check if there is damage to the transformer
Mechanical damage to the product	x	x	x	x	x		x	x	In the case of damage to the transformer, inform the manufacturer
SF6 gas pressure		x	x	x	x		x	x	SF6 gas pressure must be in the permitted range
General condition		x	x	x	x		x	x	No excessive soiling or damage
Primary connections		x					x		No excessive soiling, damage or change of colour
Secondary connections			x				x	x	No loose connections
Secondary terminal box			x		x		x	x	Must not be soiled internally or contain water
Metal parts			x		x		x	x	No excessive corrosion.
Degree of cleanliness of SF6						x		x	Cleanliness of SF6 must be at least 98%
Shock indicators	x	x							see chapter 3.2

13.3 Rating plate

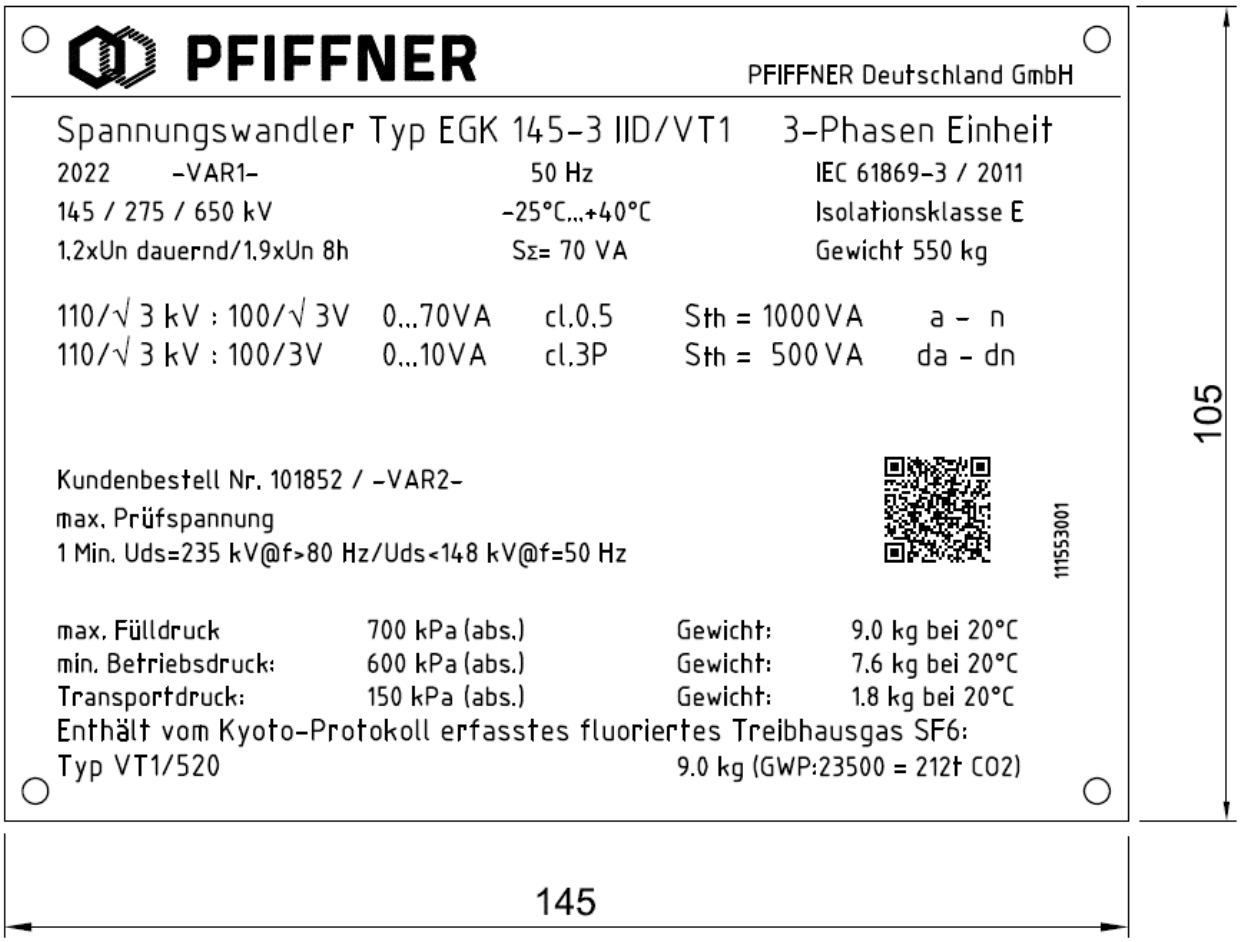


Figure 13: Example rating plate of a GIS voltage transformer