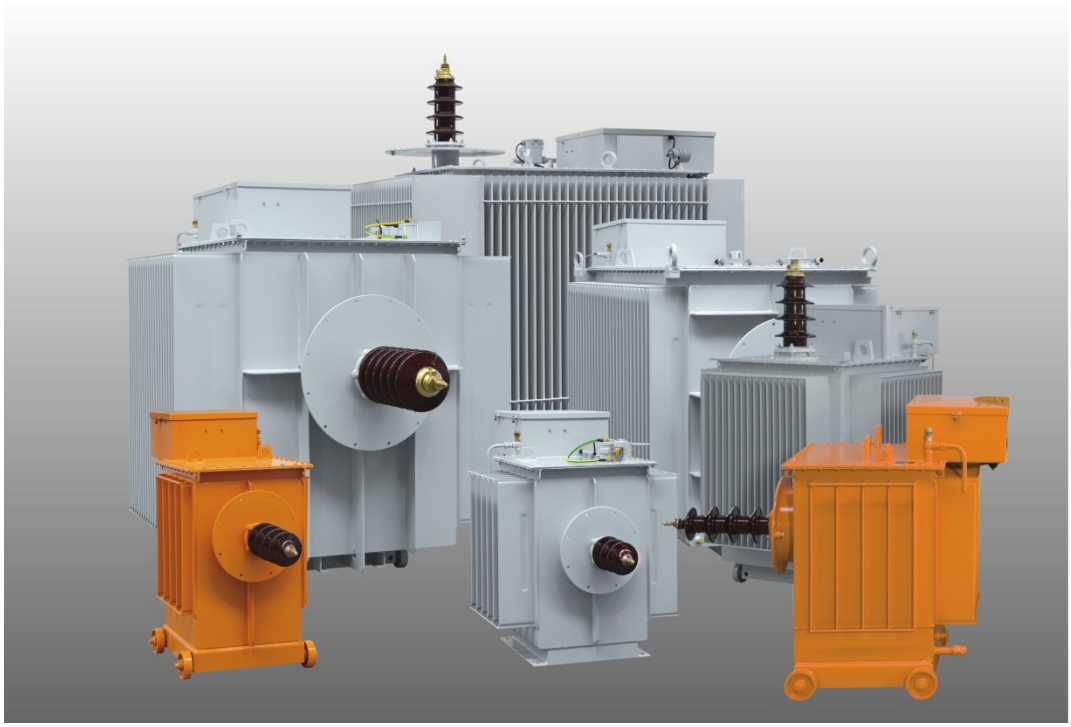
Rico-Werk

Manual
High Voltage Transformer/Rectifier Unit with Hermetic Tank

Rico-Werk

Eiserlo & Emmrich GmbH



CONTENT

1. GENERAL INFORMATIONS

1.1 DOCUMENTATION

This Manual describes the general properties of the high voltage transformer/rectifier unit with hermetic tank , hereinafter referred to as the (HV) Aggregate. In the interest of keeping the manual easy to navigate, it does not contain all detailed information for all types of this product.
Details on the dimensions, weights, anti-corrosive measures, protective switches, features, etc. can be found in the following documentation:

- Drawing key dimensions
- Interior circuit diagram
- Electrical circuit diagram
- System documentation of the filter supplier
- Order documents

This Manual is part of the Aggregate documentation and contains important information concerning the installation, operation and service of the product. The documentation is designed for the use by all individuals who perform assembly, installation, start-up, operation and service work on the product.

Operators of the Aggregate are required to make a legible version of this documentation available to such personnel. Please make sure that anyone responsible for the equipment and its operation, as well as individuals who are working on the high voltage equalizer autonomously read the documentation in full and do understand it. If anything should be unclear or if further information should be required, please contact the supplier *Rico-Werk*!

Moreover, we have to point out that the content of this Manual is not part of an earlier or existing agreement, commitment or legal relationship and that it is not designed to amend any such agreements.
Any and all obligations assumed by *Rico-Werk* are inherent in the respective purchasing agreement, which also contains the complete and solely applicable warranty policy. These contractual warranty provisions shall neither be expanded upon nor limited by the statements made in this instruction Manual.

1.2 DEFINATION OF THE SAFETY ADVISORY SYMBOLS AND TERMS IN THE MANUAL

⚠ **DANGER!**	Imminent threat of danger	May lead to death or grave bodily harm
⚠ **WARNING!**	Potentially dangerous situation	May lead to death or grave bodily harm
⚠ **CAUTION!**	Potentially dangerous situation	May potentially cause minor injuries
SAFETY ALERT!	May cause property damage	May damage the Aggregate or its environment
IMPORTANT!	Helpful recommendation or tip: Faciliates the handling of the Aggregate.	

Please observe all of these instructions and share them with other qualified personnel*. Besides these instructions you will have to comply with all applicable

- Safety requirements
- Accident prevention policies
- Directives and the accredited state of the art

as well as all instructions set forth in this Installation and Operating Manual!
Rico-Werk reserves the right to make modifications to the product, the technical data or the Installation and Operating Manual at any time without prior notice.

1.3 INTENDED PURPOSE COMPLIANT USAGE

The *Rico-Werk* HV Aggregate is a factory completed and tested HV Aggregate. At the time of delivery, it is in compliance with all applicable laws, requirements and standards. If used as intended, it provides a high level of safety and usage efficiency when used as a supply device for electrical filters.

Perfect and safe usage is contingent upon the following:

- Proper transportation and storage
- Proper installation and start-up by qualified personnel *
- Diligent operation and maintenance by qualified personnel*
- Compliance with this Manual
- Compliance with the set-up, operating and safety requirements in effect at the place of installation
- Constant and consistent use of the proper PSE (personal safety equipment, e.g. protective goggles, gloves, safety footwear, etc.).

***Qualified personnel**

The term "qualified personnel" as defined in this Manual refers to individuals who are familiar with the set-up, installation/assembly, start-up, maintenance and operation of the Aggregate and who possess relevant qualifications for their work, such as:

- Completed apprenticeship and on-the-job training or authorization to turn on and off electrical power circuits and devices/systems in compliance with the safety technology standards and to ground as well as mark same.
- Completed apprenticeship or on-the-job training in compliance with the safety technology standards in the provision of services for and use of adequate safety equipment.
- Completed training and first aid course for actions to be taken in the event of potential accidents.

1.4 STANDARDS AND REQUIREMENTS

See equipment documentation "Standards and Requirements" and "CE Documentation"

1.5 LIABILITY ENTITLEMENTS IN THE EVENT OF DEFICIENCIES

Compliance with the provisions set for in the documentation is a prerequisite for the problem free operation of the product and the fulfillment of potential liability entitlements in the event of deficiencies. Hence, please read the documentation before you perform any work with or on the Aggregate.

We will assume unlimited liability only in the event of acts of intent or gross neglect at our end.
The liability provisions for all other cases are governed by the applicable purchase agreement.

1.6 LIMITATIONS OF LIABILITY

All of the technical information, data and recommendations concerning the installation, operation and maintenance of the HV Aggregate are in compliance with the applicable status at the time of printing and are provided taking into account all of our prior experience and insights to the best of our knowledge.

We shall assume liability for any errors or omissions subject to the exclusion of any further entitlements within the scope of the liability for deficiencies obligations we have committed to in the purchase agreement. Claims for damage compensation, regardless of the legal grounds on which such claims are based, shall be excluded provided they are not based on acts of intent or gross neglect at our end.

***Rico-Werk* shall deny any liability for any damages or injuries resulting from the non-compliance with the safety provisions described in this documentation or as a result of the failure to take standard precautionary measures and apply the necessary diligence when installing, operating, maintaining or repairing the Aggregate, even if such failures are not expressly listed herein. Non-compliance with this documentation does mean exposure to potentially life-threatening dangers/risks.**

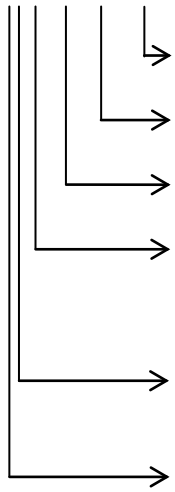
2. DESCRIPTION

2.1 USE

The high voltage equalizer is used to supply electric filters with unchangeable equal voltage in combination with a control cabinet.
Depending on the in-feed voltage one distinguishes between 1-phase and 3-phase aggregates.

2.2 TYPE KEY (EXAMPEL)

ESO-40-35-140



140 =Output direct current (140 mA_{eff} DC)

35 =Output direct voltage (35000 V_{eff} DC)

40 =Connected voltage (400 V AC)

O =Mineral oil (standard)
E =Environmentally safe Pentaerithryte Ester
S =Silicone oil

S =Self-cooling (standard)
F =Forced refrigeration

E =Single phase aggregate
D =Three phase aggregate

Other data, please see type label.
Here you will find information on the total and insulation material weight of the Aggregate, the protection type, make and the manufacturer as well as the type designation of the insulation material used plus additional electrical data for the Aggregate.

2.3 HIGH VOLTAGE COMPONENTS

2.3.1 Contents

- One 1-phase or 3-phase high voltage transformer whose top voltage spool is made using the foil or wire winding process
- One current limiter switched in series with the primary winding of the high voltage transformer. It limits the current peaks as a result of overloads in the filter and is dimensioned in such a manner that the short circuit current is limited to a predefined current ($x*I_N$), which depends on the u_K (short circuit voltage in %) of the Aggregate
- A high voltage equalizer, which is bridge switched (B2 [1-phase aggregate] or B6 [3-phase aggregate]) on a silicone base
- A high voltage divider resistor
- A high frequency throttle (HF throttle) between the HV equalizer and the HV through-put
- An oil tank, in which the previously described elements are installed
- An HV through-put ***N*** (standard) or ***P***, to transport the equalized negative or positive high voltage out of the oil tank.

⚠DANGER!

2.3.2 The following components are located on the cover of the tank in a closed terminal box:

- Measuring resistor (shunt) for secondary electricity measurements (mA)
- Calibrating resistor for secondary voltage measurements (kV)
- Excess voltage diverter for the above measuring circuits
- Low voltage through-puts for:
  - LV-in-feed ***U***+***V*** (+***W*** when used on 3-phase aggregates)
  - Controlled voltage ***V1*** (nor if used on 3-phase aggregates)
  - HV output ***p****ositive* (standard) or ***n****egative* side of the equalizer (mA)
  - Measuring output for sec. voltage ***n*** (standard) or ***p*** (kV).

⚠DANGER!

The information on the components the Aggregate is equipped with can be found in the documentation listed in Section 1.1.

2.3.3 Monitoring elements for the protection of the high voltage equalizer

- Depending on the design of the Aggregate, different monitoring devices will have to be used.
  Among the options are display units and/or switch units that send alarm signals or that shut off the Aggregate for safety reasons. The parameters monitored are the temperature, the pressure and/or the level of the insulation liquid in the aggregate tank.
  Check the documentation listed in Section 1.1 to find out which protective devices the Aggregate is equipped with.
- Additionally, each Aggregate is equipped with a mechanically operating safety valve, which opens when an excess pressure level of >0.3bar is reached and which closes automatically once the pressure drops below the switch limit.
  The amount of insulation medium that is drained through the safety valve depends on the thermal and performance conditions of the Aggregate.

2.3.4 Explanation

The insulation liquid is added to the tank at a defined temperature and vacuum level. The tanks are completely filled; a defined air pocket is inserted into smooth tanks. The tanks are designed in such a manner that volume changes are compensated for by the flexible waves or air pockets if the system is working properly.
If excessive volume or pressure situations should arise in the tank as a result of problems or errors within the tank, the monitoring devices will recognize the problem and turn off the Aggregate electrically. As a result, the Aggregate's energy supply is suspended and the volume and/or pressure increases are stopped. If the electrical safety devices should fail or if energy should be delivered from the outside (e.g. by a fire) the mechanical safety valve will be activated to prevent the tank from bursting.

2.4 PROTECTION CATEGORIES

Active components IP 65
Terminal box IP 55
HV through-put IP 00*
*Keep the HV through-put clean and dry.

⚠DANGER!

Never apply voltage to the Aggregate if not all covers have been installed.

2.5 STANDARD PAINT JOB

Base paint 60 µm
Intermediate coat 60 µm
Top coat 60 µm
2-component lacquer paint, acrylic resin based.
Hue RAL 7035

Other paint systems with regard to make, lacquer composition, layer thickness or hues as well as zinc coated tanks are available as options; the actually used paint system can be found in the documentation listed under Section 1.1.

2.6 INSULATION LIQUID

The standard filling liquid used in the HV Aggregates is mineral insulation oil according to VDE 0370-1 (DIN IEC 60296). The dielectric strength of a minimum of 250 kV/cm is tested and documented prior to filling any Aggregate in compliance with VDE 0370 (DIN IEC 60897).

The insulation oil does not contain any substances that contain PCB, PCT or TCDD.

The following types of oils are being used:

Manufacturer:	**Type:**
SHELL	**DIALA D, *Diala S2 ZU-I Dried**
	***successor type for Shell Diala D**

alternatively

Nynas	**Nytro Taurus**

Both of these types can only be blended with each other for emergency operations.

The following special compositions for the insulation liquid are possible:

- **Silicone oil:**
  - Dow Corning 561 Silicone Fluid
  - Baysilone Fluid M50 EL

- **Environmentally safe insulation liquid; Pentaerithryte ester based:**
  - Elantas: BecFluid 9902
  - Midel 7131
  - Cargill: FR3

Other insulation liquids may be possible; however, case-by-case clarification is required (see Section 1.1).

3. HANDLING

3.1 TRANSPORTATION AND HANDLING

⚠ **CAUTION!** ⚠ DANGER!

- The Aggregate must be transported in its horizontal (operating) position.
- The drainage of the insulation material to reduce the unit weight is prohibited.
- Setting the Aggregate at an angle or tipping is prohibited.
- The devices may be tied into place using the ring eyelets. Incidentally, the transportation and packaging instructions provided by *Rico-Werk* Eiserlo & Emmrich GmbH will have to be complied with.
- When tying the units into place, please make sure that the belts or tie-downs do not touch the wavy walls and the terminal box or any mounted on components, e.g. the corner safety valve, the fill-in shaft, the high voltage through-put, etc.
- When lifting the Aggregate with crane equipment, make certain that the chains are mounted in such a manner that mounted on devices, e.g. the corner safety valve, the high voltage through-put, etc. cannot be damaged or ripped off.
- If the Aggregate has ring eyelets that are welded to the corners of the wavy wall tank, the Aggregate must only be lifted by these ring eyelets.
- If the total mass is > 4000 kg, the Aggregate will have to be lifted up by the ring eyelets in such manner that only horizontal forces are applied to the ring eyelets.
- The lifting eyelets on the cover are generally intended for lifting the cover including the active components; the Aggregate must only be lifted up by the lifting eyelets on the cover if separate ring eyelets are not provided on the wavy wall tank cover.
- If the assembly is moved horizontally, the impact of the force must be only on the framework of the chassis.
- Generally-speaking, the Aggregate must be handled with adequate care; in particular thrust impact while cranes are in operation or during transports must be averted.

Non-compliance with these instructions may result in damages to or the destruction of the Aggregate and will void any warranty entitlements vis-à-vis *Rico-Werk*.

3.2 SET-UP

The Aggregates are designed exclusively for horizontal set-up, any set-up at an angle may result in the destruction of the Aggregate. Moreover, unless stated otherwise, the Aggregates are designed for the following conditions (deviating conditions can be found in the documentation listed in Section 1.1):

IMPORTANT!

- Interior room and outdoor set-up
- Ambient temperature (air temperature) min. –25 °C to max. 40 °C
- Set-up elevation < 1000m above sea level

If the ambient temperatures are higher, the nominal current will have to be reduced as shown in the table on the right:

Ambient temperature	Electrical load
(°C)	(%)
40	100
45	90
50	80
55	70

Optionally, the Aggregate may also be designed for temperatures not to exceed a max. of 55°C, which means that it can be operated under nominal current conditions. In the negative temperature range, Aggregates are available for max. of -40°C.

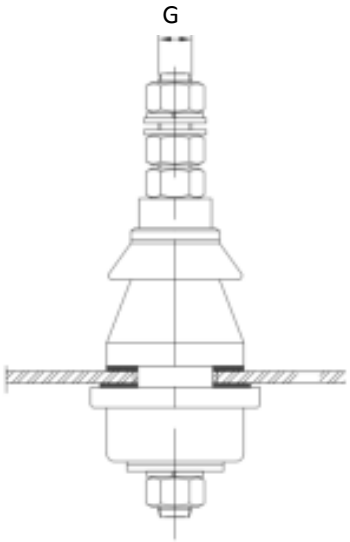
Mandatory checks with us are required if the system is to be set up at elevations of more than 1000m above sea level because of the flashover resistance of the high voltage through-put. Moreover, the device load has to be reduced in accordance with the table on the right.

m above sl	Electrical load
	(%)
1000	100
1500	97
2000	95
2500	92

Optionally, it is also possible to design the Aggregate for elevations >1000m above sea level, which makes it possible to operate it under nominal current.

3.3 CONNECTION

When setting up the Aggregate, make sure that it is not possible for large amounts of dust to settle on the devices. Adequate air circulation is required to make sure that the heat that comes off of the devices can be diverted effectively. No additional heat sources must be placed under the tank.
Prior to starting to connect the unit, make certain that the power cords are disconnected from mains.
If damages are detected on the Aggregate, contact *Rico-Werk* immediately prior to connecting the device.



The connection should principally be established in accordance with the type label and the circuit diagram. The cables will have to be inserted through the dedicated cable through-puts all the way into the terminal box and must be properly mounted so that no mechanical pressure is applied to the through-put. The terminal box has all required cable through-puts.
The connection to the NS-through-puts must be established as follows:
- Counter the middle nut with a matching screwdriver.
- Pull the top nut tight to the torque shown in the table below.

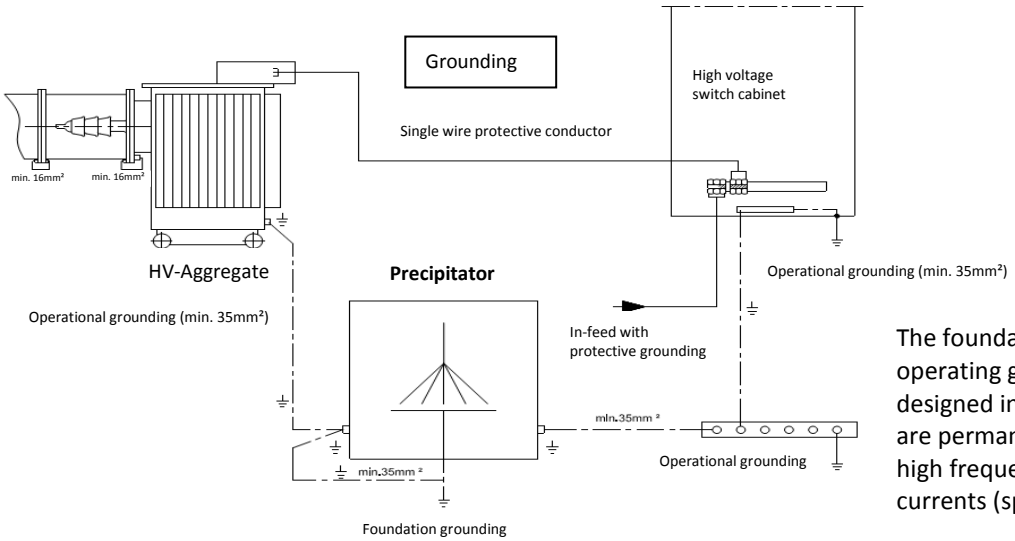
Safety alert!

Through-put	Screw driver size	Winding G	Torque
	mm		Nm
DT05/100	13	M8	6
DT1/250	19	M12	15,5
DT1/630	30	M20	52

The HV through-put must not be stiffly connected with the electric filter. The connection must be made as a flexible connection only to guarantee vibration and tension free operation.

3.4 GROUNDING

When grounding the Aggregate, make sure that it is consistent and permanent. For this purpose, the Aggregate has connection options that are marked in yellow and/or with the grounding icon ⏚. These connection options are located on the interior of the terminal box, on the exterior below the terminal box and on the flange as well as on the chassis frame on the side of the terminal box.
All conductive transitions that are not welded will have to be bridged in the entire filter area, e.g. the transition aggregate-electrical protection pipe, transitions between the power protection pipes, etc.
The following overview shows the minimum grounding requirements.



The foundation grounding and the operating grounding must be designed in such a manner that there are permanently low-ohm, even for high frequency compensation currents (spark-overs).

3.5 START-UP

Prior to the start-up, the Aggregate must be visually inspected to ensure that it is leak proof (transportation damages). The connection voltage on the type label must be compared with the mains voltage available. The correct connection of the cables and dependable grounding must be verified.
The electrical protection devices (see interior circuit diagram and electrical circuit diagram) must be checked to ensure that they properly connected and function properly.
The VDI 3678 (electrical filters – process gas and exhaust gas purification) standard must be complied with when setting up electrical filter systems.

The equipment documentation and the control documentation have to be observed in the subsequent start-up steps (see documentation listed under Section 1.1).

4. MAINTENANCE

Principally, the Aggregate does not require any maintenance, however, we do recommend the following:

- Visual checks for damages to the paint job, leaks in the wavy tank → monthly
- Visual checks of the seals HV/LV through-puts → annually
  Important: After opening the terminal box, be aware of danger caused by parts conducting electrical voltage

⚠ WARNING!

5. GENERAL INFORMATION

5.1 HERMETIC TANK

Given that the Aggregate is a hermetically sealed device it must never be opened – not even to take a sample of the oil! If the lead seals on the input and outlet are damaged in any way, all warranty claims vis-à-vis *Rico-Werk* will be null and void. If damages are caused to or the protective devices on the Aggregate are triggered, contact the supplier or *Rico-Werk*.

The Aggregate is a sensitive electrical device, which is why the following activities are strictly prohibited:

- Loosening of individual cover screws, for instance to mount holders, cable sleeves and the like.
- Mounting of holders, supports, cable catching irons or the like on the expansion waves
- Application of mechanical loads to the flanges by current protection pipes, hoods, etc.
- Application of mechanical loads to the ceramic through-puts as this can lead to damages or leaks
- Any modifications to the Aggregate; removal of covers, etc.

5.2 WELDING WORK

- Direct welding work on the Aggregate is permitted only on the chassis frame for the installation of e.g. pulling eyelets. For this purpose, the Aggregate will have to be disconnected from the filter on the high voltage end. The mass pole of the welding tool must be terminal connected to the chassis frame in the immediate proximity of the welding location.
- Prior to performing any welding work on the filter in the proximity of the Aggregate and especially the spray system, the Aggregate will have to be disconnected from the filter (spray system) at the high voltage end.

Non-compliance with these instructions may cause damage to or destroy the Aggregate and will result in the forfeiture of any warranty entitlements vis-à-vis *Rico-Werk*.

6. DISPOSAL

If at all possible, the materials of the Aggregate should be recycled. It is possible to dispose of the Aggregate in an environmentally safe manner based on the existing legislation.

It is possible to return the Aggregate to *Rico-Werk* against payment of the disposal costs in effect at the time of the return.

The Aggregates contain primarily the following materials:

- Aggregate tank: clean and subsequently → dispose of as steel scrap
- Insulation material (see material data sheet and the documentation listed under Section 1.1) → dispose of in accordance with the material data sheet
- Electronics in the terminal box --> dispose of as scrap electronics
- Active component (contaminated insulation material) → dispose of in compliance with the material data sheet insulation material (see documentation listed under Section 1.1)

⚠ CAUTION!

You are required to dispose of the Aggregate in an environmentally safe manner in compliance with applicable legislation!

7. SERVICE

If you should need additional information or assistance, please contact:

Rico-Werk Eiserlo & Emmrich GmbH
Tempelsweg 12-14; D-47918 Tönisvorst
Phone: +49 (2151) 7099-0; Fax: +49 (2151) 7099-99
http://www.rico-werk.com
e-mail: vk@rico-werk.com

To prevent delays, please have the serial number (see type label) or commission number (E50.xxxxx, see equipment documentation or type label on the control box) of the Aggregate handy when contacting us.