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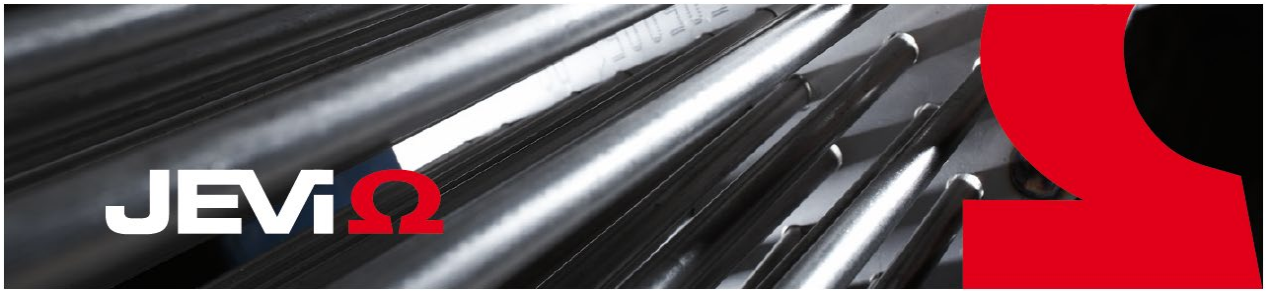

Installation, operation and maintenance manual for duct heaters
For installation in non-hazardous areas

PROCESS HEATER
Types EFF, EFI, EFFS, EFFL, EFIL, EFFLI, EFILI, EFR, EFRS, EFRSL

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ENGLISH

Safety information

To secure your personal safety, as well as prevent damages to property, this manual contains notices you have to observe. The notices referring to your personal safety:

 **DANGER**	Indicates that death or severe personal injury will result if proper precautions are not taken
 **WARNING**	With a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken
CAUTION	Without a safety alert symbol, indicates that property damage can result if proper precautions are not taken
NOTICE	Indicates that an unintended result or situation can occur if the corresponding information is not considered

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety symbol may also include a warning relating to property damage.

Qualified Personnel

Only personnel qualified for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions may operate the product described in this documentation. Qualified personnel are those who, based on their training and experience, can identify risks and avoiding potential hazards when working with these products/systems.

This adds up to following requirements to Operator:
Qualification - Certified electrician
Level of complexity – Basic action / preventive / corrective

Proper use of JEVI products

 **WARNING**	Proper transport, storage, installation, assembly, commissioning, operation, and maintenance is required to ensure that the product operates safely and without any problems. The permissible ambient conditions must be adhered to. Observe the information in the relevant documentation.

Disclaimer

JEVI A/S assumes no responsibility for any additions placed by the customer that can inflict our product. Additions or alterations implemented by the customer are not covered by our warranty.

IMPORTANT: These instructions should be read thoroughly before installation and operation. All warnings and precautions should be observed for both personal safety and for proper equipment performance and longevity. Failure to follow these instructions could result in equipment failure and/or serious injury to personnel.

NB! THIS IOM IS A STANDARD DOCUMENT AND IS NOT PROJECT SPECIFIC.

The English IOM is JEVI's standard version

List of abbreviations

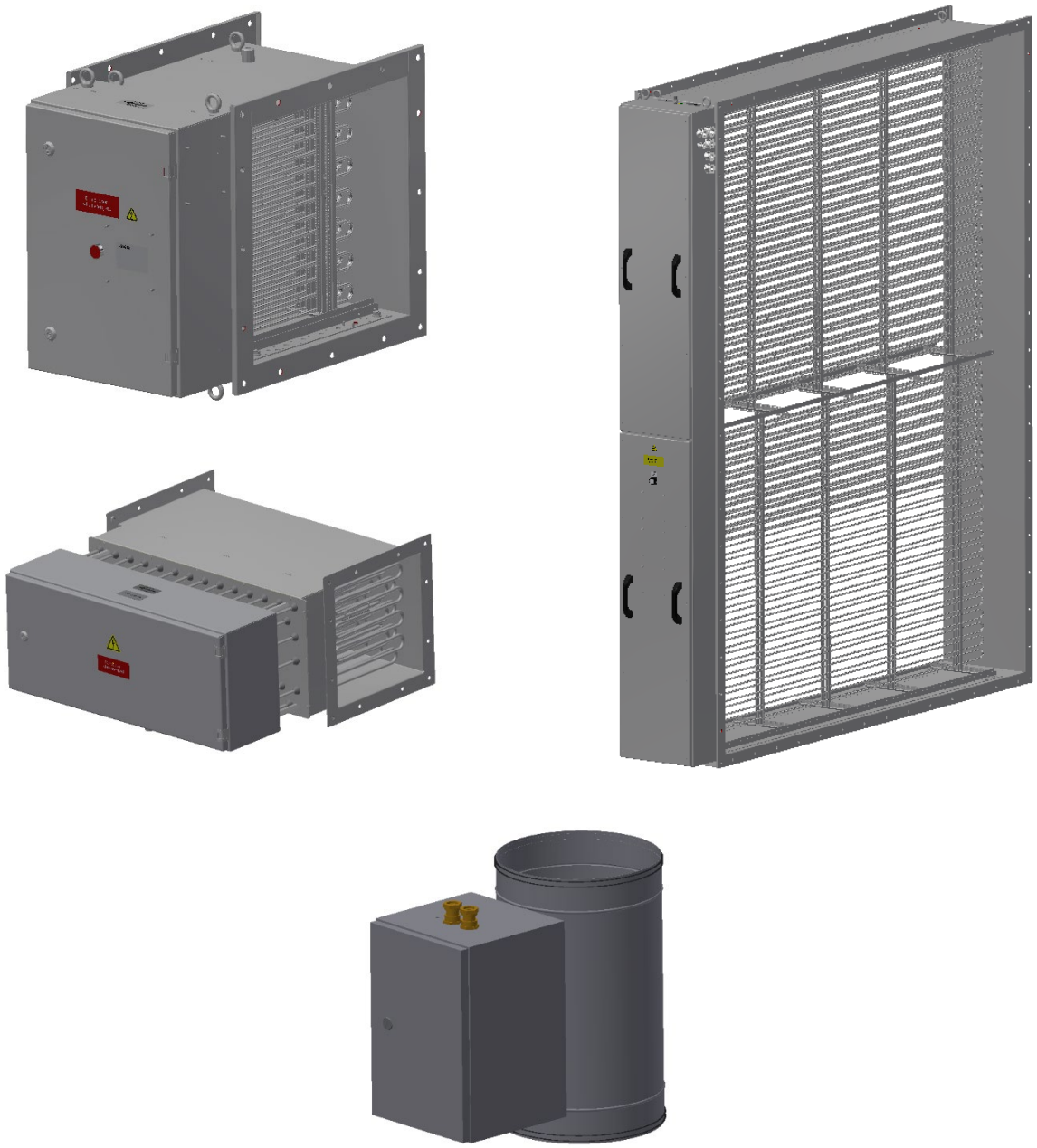
ACBR	Air Cooled Braking Resistor
CoG	Centre of Gravity
EF	Electrical Duct heater
GA	General Arrangement (Drawing)
HVAC	Heating, ventilation, Air Conditioning
IOM	Installation, Operating and Maintenance Manual
JB	Junction Box
VLE	Fan heater with integrated controls for temperature control
VLEx	Fan heater for hazardous areas
WCBR	Water Cooled Braking Resistor
TSH	Temperature Switch High
TSHH	Temperature Switch High High

1.0 Introduction

This manual is valid for variated models of process heaters.

The purpose of this document is to introduce a reader to the installation, operation, and maintenance procedure and most importantly to general safety precautions, which are not necessarily related to any specific part or procedure, and do not necessarily, appear elsewhere in the publication. These precautions must be thoroughly understood and applied to in all phases of operation and maintenance.

Descriptions in this manual are generic and are not project specific. Pictures may show other equipment and options than in the actual project.



2.0 Description of product

The duct heater is designed to heat air.
Reference is made to the general drawing of this item for the intended use:

Drawing no.:	Refer to equipment drawing GA
Electric supply:	See electrical diagram
Voltage:	See electrical diagram
Ref. number:	Same as order number and item number

The heater consists of an enclosure (IP rating according to GA and/or datasheet) containing:

- A protective device with manual reset (TSHH).
- Optional, protective device with auto reset (TSH).
- Alternative protective device, TSHH, thermocouple sensor type K connected to certified transmitter, Ga end user applies barrier, reset must be done by hand.
- Temperature sensors are placed at the highest temperature areas of the heating bundle.

In case of no airflow, the TSHH will cut off the heater.

Optionally, the equipment mentioned below is mounted in the junction box:

- Temperature transmitter
- Anti-condensation heater

Optionally the heater can be supplied with:

- Thermostat
- Flow switch and
- external control system

see electrical diagram.

3.0 Packing

All packing is in accordance with the specific requirements of the individual purchase order or contract as well as with the regulations of the country of destination.

3.1 Choice of the Packing Type

The choice of the packing type and the requirement of particular protections depend on characteristics of the equipment and material to be packed, its handling requirements and kind of transport chosen.
The packing provides both mechanical and environmental protection.

3.2 Wood treatment

All solid wood, used for packing (including wooden pallets) is treated (heat treatment or fumigation) according to the international standard ISPM 15 (IPPC), latest revision.
As these rules are not the same for all countries, the procedure is to meet the demands of a country of final destination.

3.3 Pallets

Equipment is packed on pallets that provide adequate load support during transportation and storage. The pallets have a dynamic load capacity, enough to carry the mass loaded on the pallet.
Where feasible the top surface of the pallet must be flat.
The pallet must be tight on all sides with steel or synthetic straps on each side.
Bolts, clamps, supporting beams, etc. will properly fix all equipment and materials.
Fragile, easily damageable and loose parts will be pertaining to the equipment securely and properly packed in a separate case.

3.4 Handling

Under no circumstances may the equipment itself be used as a platform for gaining access to installation and construction areas above. If such access is required then suitable scaffolding must be established, the equipment may not be used as a support.

3.5 Centre of gravity

If required, large and heavy equipment are marked with Centre of Gravity (COG).

3.6 Labelling and tagging of equipment / Identification

If no specific identification is required, (see the Purchase Order for the technical specifications) the labelling is in accordance with JEVI standard.
On demand the identification label is in accordance with the final packing list/delivery note.

3.7 Shipping marks / labelling

All packages are marked or labelled in accordance with the data shown in the packing list/delivery note.

4.0 Transportation

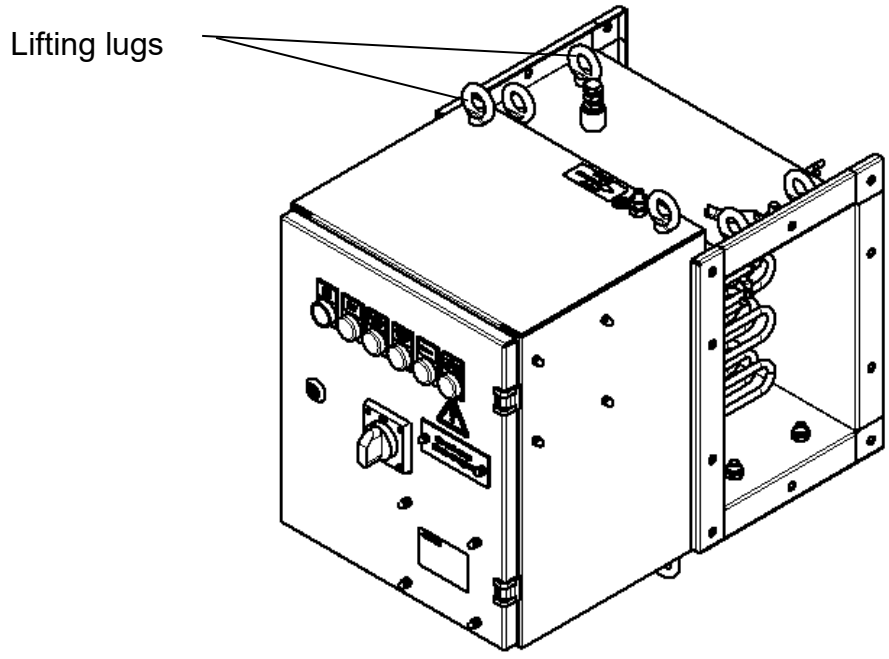
The product is packed according to agreement with indication of COG if required by customer.
The product is packed on pallets. The packing is easily moved either by forklift or by use of crane handled by authorised personnel.

- For lifting lugs, see GA
- For weight, see GA or rating plate
- For COG - if any, see GA

CAUTION	Heating elements must NOT be used for lifting, as this causes damage on the elements.

4.1 Duct heater

All heaters and inserts weighing > 25 kg are supplied with lifting devices.



5.0 Storage and preservation

The purpose of this chapter is to specify how to handle and preserve a product from the day of shipment until the equipment is installed and commissioned.

The following conditions shall be observed for the installation/construction period.

CAUTION	During storage, prior to installation the unit must be stored dry with a relative humidity <60 %, temperature >15ºC.
CAUTION	Replace desiccant bag in junction boxes and enclosures (if any) every 6 months. Keep a log of the replacements as documentation.
CAUTION	The Anti condensation heater, if any, must be powered up and always connected.

5.1 Preservation during the transportation and pre-installation period

The packaging provides both mechanical and environmental protection. If the equipment is intended for service in an outdoor environment, to avoid any risk of harmful metallic dust during storage it is protected with enveloping plastic foil.
All openings such as cable entry holes are adequately sealed.

Packages must not be opened, or their integrity disturbed during the transport.
Packing may only be opened when the equipment has been taken from storage and has been transported to its intended location of installation, or to connect the anti-condensation heater, after which the packing must be resealed. Storage preservation measures are immediately invalidated as soon as the packaging is disturbed.

One shall inspect packages on receipt at the storage warehouse and at regular monthly intervals during the storage period regarding external damages. Any visible damage that may have a consequence to the condition of the contents or integrity of the preservation must be immediately documented and reported. In case of such an event, the supplier must be contacted immediately for advice.

5.2 Preservation during the installation/construction period

The product must be unpacked only when the equipment is to be installed, or to connect the anti-condensation heater. It is recommended to maintain the integrity of the packaging during transport from the storage warehouse to the installation site.
Inspect the equipment within each package for damage and condition as soon as the package is opened. Report and document any damage immediately. In case of such an event, the supplier must be contacted immediately for advice.

Installation and handling of the equipment once unpacked must be performed in accordance with the relevant elements of the documentation for the equipment delivered.

Damages caused by bad workmanship or failure to adhere to the installation instructions are not covered by the equipment warranty.

If the equipment is installed in an area where ongoing construction work of a nature that causes airborne pollution or other adverse conditions take place, the equipment must be suitably protected**.** Under no circumstances can the equipment be placed in the vicinity of any activity, which involves grinding, welding, painting, fireproofing, spraying, etc. without taking necessary precautions to protect it.

When cable termination is completed, a fresh desiccant bag must be placed in the enclosure. The desiccant bag must be replaced every 6 month or until commissioning, has been initiated.

All openings such as cable entry holes must be adequately sealed until the interfacing cables or pipes are installed.

During installation, always keep the equipment in a clean condition. Remove debris from cable installation activities at once. Take precautions to avoid any small pieces of a conductive nature from being left in the termination enclosures.

Under no circumstances may the equipment itself be used as a platform for gaining access to installation and construction areas above. If such access is required then suitable scaffolding must be established, the equipment may not be used as a support.

During installation the equipment must be thoroughly inspected at regular weekly intervals with regards to external damages, cleanliness and internal condition. Report and document immediately if any visible damage or adverse condition occurs. In case of such an event, the supplier must be contacted immediately for advice.

On completion of the installation work the condition of the equipment must be inspected. Report and document any damage immediately if any visible damage. In case of such an event, the supplier must be contacted immediately for advice.

CAUTION	It is extremely important that no debris enters the unit as this may lead to damage to the equipment**.**

5.3 Suggestion for preservation specification & record during storage:

PRESERVATION SPECIFICATION & RECORD								
Record No.:		Tag No.:	Description:				**Record page 1 of 1**	
Activity No.:	Intervals (Months)	Description of Preservation Activity	Recommended Preservative	Initial Preservation	Date/Sign Preserved (2)	Date/Sign Preserved (3)	Date/Sign Preserved (4)	Date/Sign Preserved (5)
1	1	Check that protection structure is undamaged.						
2	6	The desiccant bag inside the Junction boxes replaced.						
3	1	Check the storage conditions. Relative humidity < = 60 %, temp. > = 15˚C						
4	12	If stored for more than one year from packing date, the supplier must be contacted for advice regarding renewal of the desiccant bag.						
5	12	Check the paintwork.						
6	12	Check that there is no visual damage to the equipment.						
7	12	Verify that the general condition of the equipment is satisfactory.						
8	12	All openings such as cable entry holes are adequately sealed. Junction Boxes as well.						
9	12	All loose items/removed parts preserved, stored and marked.						
10	6	Verify no water leakages, condensation or moisture where applicable.						
11	6	The Anti-condensation heater in the equipment must be powered up and connected at all times.						
Comments:								
Performed by: Date/Sign:			Accepted by: Date/Sign:					

Note: *These procedures are considered normal maintenance and are performed at the owner's expense.*
* Depending on the environment, inspection frequency can vary.

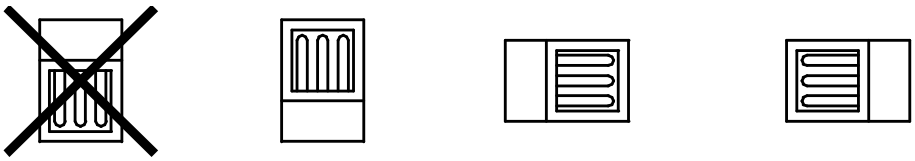
6.0 Installation instructions

6.1 General

The user must ensure that his employees are fully trained and supervised in the proper working procedures to ensure their safety. The plant must be maintained in a safe condition.
Ensure that the equipment is correctly installed in a suitable location by technically qualified personnel.
Installation must meet the requirements of the standards listed in the declaration of conformity.

6.2 Heater installation

Before unpacking the equipment ensure that all items are available and that all crates / or packages are in good condition and undamaged. Any damages must be reported to the site manager and subsequently to JEVI A/S.
After removing the packing material, check all items for damage. If any damages; report this to the site manager and subsequently to JEVI A/S.
For installation mounting and sealing materials must be used which are suitable for the medium to be heated and the prevailing temperatures that will occur. Please refer to the GA-drawing for precise data and indications of fitting positions.



1. Open the junction box.

2. Connect the electric power cables to the terminals or bus bar system as indicated on the electrical diagram and connect the earthing provisions on the mounting plate.

3. Connect the protective conductor to the earthing terminal.
   Follow the instructions provided by the supplier of the cable glands if these are present and/or applicable.

4. Close the cover.

WARNING	Do not open the junction box when energized.
NOTICE	• During non-operation the unit must be stored dry. Relative humidity <60%, temperature >15°C. • If applicable connect and switch on the space heater. • When dismantled it is advisable to place a desiccant bag inside the junction box.

6.3 Adjusting Thermal couple / RTD, TSH thermal switch with auto reset

The TSH is adjusted to 80% of maximum.
If an adjustment is needed, then load the heater with maximum power and the lowest air-flow according to specification.

1. Set the TSH on maximum temperature.
2. Wait until airflow and temperature is constant.
3. Adjust the temperature scale down on the TSH step by step with app 10°C at the time; wait to see if TSH switches off for 10 min. adjust again 10°C continue this procedure until TSH cuts off the heater.
4. Adjust the TSH scale up with10°C.
5. Test the heater with full load and switch off airflow. TSH must switch off before maximum allowed temperature for heater is reached.

The mechanical TSHH is nonadjustable.

6.4 Adjusting TSHH thermal cut-off (Thermal couple / RTD)

Adjusting TSHH thermal cut-off (Thermal couple / RTD) has been done by JEVI if the transmitter is mounted in the heater.
1. The max temperature must be set according to the wiring diagram, and the IOM for the transmitter.
2. This TSHH thermal cut-off (Thermal couple / RTD) must be with manual reset.

6.5 Test procedure TSH/TSHH thermal cut-off

TSH/TSHH are subject to factory test at JEVI.
In case an additional test of the TSH/TSHH thermal cut-off is required in connection with the commissioning process, the following procedure is recommended:

1. For control of temperature insert a temperature sensor close to the TSH/TSHH.
2. Warm up the sensors to the set temperature by using a heat gun.

7.0 Start-up instructions

Before the initial start-up of the heater, the following must be checked:

1. The desiccant bag is removed from the junction box.

2. The heater is correctly installed as described in the GA drawing and, if necessary, an air leakage test has been performed.

3. The protective conductor (PE) has been connected and, if necessary, the external connection between housing and ground has been effected, e.g. for avoiding electrostatic discharging.

4. The earthing connection is effected and properly secured.

5. The electrical connections are performed in accordance with the relevant regulations and wiring diagram.

6. The heater is properly installed, and all studs and nuts are properly tightened.

7. Electrical connections between control panel and heater are correctly installed e.g. power cable, temperature transmitter.

8. At the cable entries temperatures exceeding 70°C are not admissible. The minimum temperature rating for all incoming cables is 70°C.

9. Monitoring systems have been actuated e.g., “Flow Monitoring” and “Overheat Protection”.

10. The medium to be heated, is in accordance with the heater design.

NOTICE	Before switching the heater on, check that the rated process flow is running. The construction materials used are chosen in accordance with the operating conditions specified. Should the heater be operated with other media or temperatures than those specified, warranty expires immediately.

7.1 Before energizing the heating elements:

1. Check the supply voltage.
   Check the control voltage.
   Voltages are specified on the wiring diagrams of this equipment.

2. Check whether the monitoring system has been actuated e.g. ‘Overheat Protection’. (PT100 or thermocouple sensor fixed to an element sheath).

7.2 Shutting down the heater:

De-energize the heater before shutting down the flow.

8.0 Operating instructions

Before start-up of the heater, it should be checked whether:

1. The heater is properly installed and, if necessary, a leakage test must be conducted.

2. The electrical connection is performed in accordance with the relevant rules and regulations.

3. The protective conductor (PE) has been connected and, if necessary, the external earth connection between housing and ground has been effected, e.g., for avoiding electrostatic discharge.

9.0 Maintenance instructions

The one-year service interval only applies if the heater is installed in a dry and clean environment. If installed in environment which does not meet these requirements, the service intervals might have to be reduced.
The responsible for the maintenance must ensure that his employees are fully trained and supervised in the proper working procedures to ensure their safety.

1. Check the ceramic insulators on the elements for damage.

2. Check the insulation resistance of the heating elements. Connect the Megger to an earth bolt and one of the phases U1, V1 or W1. If the measured value is less than 3 MΩ, each heating element will have to be checked separately. Minimum value is 3 MΩ at 1000 V.

3. Cleaning all surfaces.

4. Salt crystals, carbon or calcium layers must be removed from the sheath of the heating elements by means of a non-metal tool, e.g. wood.

5. Ensure terminations are securely connected to the terminals or bus bars. Heating element connections are to be tightened properly.

6. Check the functioning of the space heater in the junction box (if there is one incorporated). The space heater is fitted with an integrated thermostat situated inside the connection cable, which is factory set to frost guard temperatures. The space heater is maintenance free. If the heater does not function; it will have to be replaced.

NOTICE	If the insulation resistance has changed because of improper or prolonged storage, it is recommended: a) To open the junction box in a dry area and let the element-connections dry-out using a hot air blower. (Note: air < 80°C). b) Run the heater at a lower voltage until all moisture is evaporated and the insulation resistance has reached its desired value.
WARNING	Handling of the equipment must meet the requirements of DS/EN 50110-1:2013 (electrical safety).

9.1 Maintenance and service plan during operation

○ Check or clean
● Spare/replacements parts

System	Item	Periodic maintenance interval			
		Weekly (first 4 weeks)	Every 6 months	Every 12 months	Every 36 months
Whole	Inspect the exterior visually	○			
	Tighten all major bolts and nuts	○			
	Clean interior and exterior with compressed air		○		
Electrical system	Measure Ohm-values according to test record (max. deviation 10%)			○	
	Check wiring connections			○	
	Measure voltage on condense heater			○	
	Measure insulation resistance <3 m Ohm at 1000 VDC			○	

Note: *These procedures are considered normal maintenance and are performed at the owner's expense.*
* Depending on the environment, inspection frequency can vary.

10.0 Trouble shooting

Disconnect all power sources prior to any inspection, service, or cleaning. Hazard for electric shock exists while the equipment is connected.

For maintenance requiring repair or replacement of components, contact the factory immediately for further instruction. Only the failures within the scope of normal maintenance are listed below. If a problem is not listed or it is not eliminated by listed corrective measures, immediately contact JEVI A/S for assistance.

Problem	**Possible cause**	**Possible correction**
Heater/resistor failure	Loose bus bar Heater/resistor element burned out	Tighten failed unit Disconnect element and use spare
Temperature switch trip	Heater/resistor over temperature	Ensure air intake and exhaust are clear of foreign particles or blockage. Check fan operation
Flow guard trip	Loose connections Intake obstruction	Check all connections Remove and clean

11.0 Disposal instructions

Equipment containing electrical components shall not be disposed together with domestic waste. Collect separately with other electrical and electronic waste, according to local legislation.

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