The clean solution

M-iQ with steam and hot water heating

Operating Instructions

TRANSLATION OF THE ORIGINAL OPERATING INSTRUCTIONS

The original operating instructions can be downloaded from: https://partnernet.meiko.de

Belt conveyor - dishwashing machine

Basket conveyor-dishwashing machine

Contents

MEIKO Maschinenbau GmbH & Co. KG, Englerstraße 3, D-77652 Offenburg, Tel.: +49/781/203-0, Fax: +49/781/203-1121

1 Introduction and general instructions

Dear customer,
we are very pleased about your confidence in our products.
MEIKO, we are sure that they make your work a great deal easier and are of great service to you.

If you follow the instructions in this document carefully, your dishwashing machine will always give you total satisfaction and will have a long service life.

The dishwashing machine was installed in our factory and completely checked. This helps us make sure, and gives you the guarantee that you always receive a mature product.

For this reason, we ask you to carefully read the general operating instructions of the M-iQ dishwashing machine and these operating instructions. These operating instructions for M-iQ with steam and hot water heating provide additional information relevant to safety.

An M-iQ machine with steam and hot water heating is a machine with a hot water circuit that is indirectly connected to a district steam heating network.

These operating instructions describe installation, initial commissioning, operation and maintenance of the heating circuit.
You must comply with all listed safety instructions and instructions to safeguard the intended, safe operation and handling of the dishwashing machine's heating circuit.
Furthermore, the operating instructions of fitted parts apply, insofar as these have been enclosed.

These operating instructions are designed to familiarise the owner/operator of this plant with its installation, modes of operation, use, safety instructions and servicing.

In the event of any damage caused by non-observance of these operating instructions, any guarantee claims are invalid. We accept no liability for any additional damage caused as a result.

MEIKO operates a policy of continuous development on all its appliances.

As a result of this, please understand that we thus reserve the right to make changes to the scope of supply concerning the design, equipment and technical features at any time.

No claims may therefore be based on the details, the images or the descriptions contained in these operating instructions.

Should you require any further information, or in case any particular problems not dealt with in great detail in the operating instructions should arise, you may contact the relevant MEIKO branch to obtain the information you require.

Further, we draw your attention to the fact that the content of these instructions makes not part of a former or existing agreement, promise or legal relationship and does not modify such a point.

All obligations of MEIKO result out of the resp. sales contract, which also contains the complete and only valid warranty regulation. The contractual warranty regulations are neither extended nor limited through these instructions.

The operating instructions must exist in the local language for each EU country. If this is not the case, the dishwashing machine must not be commissioned.

The original operating instructions in Germany, and all operating instructions in all languages for EU countries can be downloaded from the following address:
https://partnernet.meiko.de
The complete technical documentation is issued to you free of charge. Additional copies will be charged at cost.

MEIKO wishes you much pleasure and success!

1.1 Safe keeping

Always store the operating instructions close to the system!
The operating instructions must always be at hand for installation, operating and maintenance personnel!

1.2 Name and address of manufacturer

In case of further questions, technical problems, etc. contact directly:

MEIKO Maschinenbau GmbH & Co. KG
Englerstraße 3
D - 77652 OFFENBURG
Phone +49 (0)781 / 203-0
http://www.meiko.de
info@meiko.de

or:

Name and address of the MEIKO branch, manufacturer's agent or from MEIKO authorised Service Partners

(Enter company's stamp or address)

1.3 Authorisations for Service Partners' Service technicians

MEIKO exclusively authorises authorised Service Partners for commissioning, inductions, repairs, maintenance, assembly and installation of the corresponding product groups within MEIKO devices.

1.4 Designation of machine type

Please provide the following information on any query and/or when ordering spare parts:

Type: .....

SN: .....

 .....

These information can be found on the plate in the electrical switch cabinet.

2 Explanation of the safety symbols used

The following safety symbols will appear throughout these operating instructions. These symbols are designed to draw the reader's attention to the text next to the safety instructions.

	This symbol means: danger for life and health of persons.
	This symbol means: danger for installation, material or environment.
	This symbol denotes information that helps you understand the installation's operation.
	Warning against dangerous electric voltage!
	Warning against hand injuries!
	**No splashing water:** prohibits the use of a pressure cleaner.
	**Danger of explosion:** indicates a potential explosion hazard.
	**Non-potable water:** The water is not for drinking. Health can be endangered by drinking.
	**Danger of burning:** indicates possible hazard due to hot surfaces or media.

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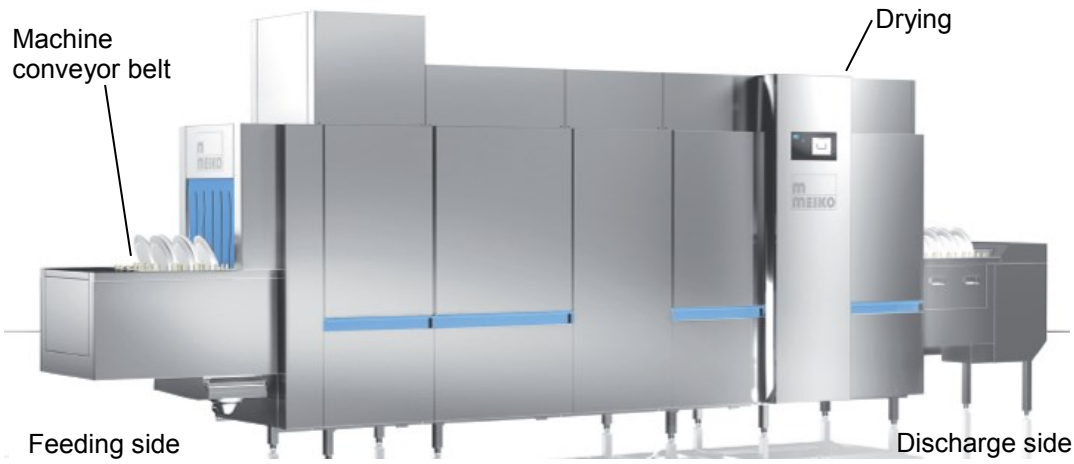
3 General description and use for the Purpose Intended

3.1 General description

This machines is a pass-through dishwashing machine with a conveyor belt.

On the feeding side the dishware is automatically or manually placed onto the conveyor belt and is independently transported through the machine on the moving conveyor belt. The dishware is cleaned and, if applicable, dried.

On the other side of the machine, the discharge side, the dishware is removed automatically or manually.



The dishwashing machine's heating circuit, intended for connection to a locally available district steam heating network, has been designed and produced according to valid, state-of-the-art technological standards and it can therefore be assumed that it meets all safety standards.

3.2 Intended use

The dishwashing machine must be used according to it’s purposes only.
This dish-washing machine is intended for washing cutlery, crockery and commonly used kitchen utensils.
Where applicable, other special dishware are described in the order confirmation.
The items to be washed must be suitable for industrial dishwashing.

In case of doubt, an agreement (size, version, basic suitability of dishwashers) can be made with Meiko concerning the suitability (info@meiko.de).

Kitchen utensils that are equipped with electric components must not be washed in the machine.

Any other use is not considered intended.

This dishwashing machine is intended solely for use in a commercial environment.
This heating water circuit is intended for indirect connection to a locally available district steam heating network.
Do not exceed the maximum, permissible primary steam temperature defined by the safety components fitted in the heating water circuit. The dishwashing machine's manufacturer’s plate specifies the maximum permitted primary steam temperature.
Intended use also means adherence to installation, operating, cleaning and maintenance instructions.
In addition to the safety information specified in the general M-iQ operating instructions, the following, additional safety information also applies to heating circuits that are indirectly connected to locally available district steam heating networks.-

4 EC Declaration of Conformity

See EC Declaration of Conformity of dishwasher.

5 General safety rules


CAUTION!

The following safety instructions are for your protection as well as the protection of others and the dishwasher. Compliance with them is therefore absolutely necessary.

5.1 Operator's duty of care

The dishwashing machine has been constructed based on a risk analysis and after careful selection of the applicable harmonized standards, as well as additional technical specifications.

It is therefore state of the art and guaranteed to provide maximum safety. Safety can only be guaranteed during operation if all necessary measures are taken.

The operator's duty of care comprises the planning of these measures and the supervision of their observance.

Measures to ensure the safe machine operation

The operator must especially make sure that...


CAUTION!

… the ambient temperature in the installation area of the dishwashing machine must not fall below 5°C to prevent frost damage to installation parts of the dishwashing machine heating that carry water.

... the dishwashing machine and the heating water circuit are used exclusively as intended. In case of other use or operation, damage or risks may arise for which we accept no liability (cf. chapter "Intended use").


CAUTION!

… the heating water circuit installation parts and primary circuit components are hot during operation. Removing cover panels from the machine may grant access to such hot installation parts. Avoid any contact with hot installation parts - risk of burns. Allow the installation parts to cool down before repairs or maintenance.


CAUTION!

. heating water is not drinking water. Dispose of any escaping water accordingly that is drained from the complete or parts of the heating circuit for repairs or maintenance purposes.


CAUTION!

The heating water circuit is pressurised using pneumatic components. As a result, the heating water circuit is pressurised at any point during operation. Open the bleed valve to depressurise the hot water circuit before working on the heating water circuit. Safely discharge any escaping water using suitable measures, such as a hose connected to the bleed valve. Take corresponding safety precautions when bleeding the heating water circuit when hot to prevent skin contact.


CAUTION!

… do not spray electronic heating water circuit or primary circuit components using a hose or high-pressure cleaners.


CAUTION!

… exclusively specialist personnel is permitted to work on and rectify faults in the heating circuit or the primary steam circuit.

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... heating water circuit and primary circuit components remain hot after having switched off the dishwashing machine and drained the dishwashing machine tank.This particularly applies to the heating elements fitted in the dishwashing machine tanks.As a result, there is a risk of burns or scalding when the machine is cleaned manually! Avoid direct skin contact.

CAUTION!

CAUTION!

… switch off the dishwashing machine using the main machine switch in hazardous situations or in the event of accidents involving the heating system. This will cut the power supply to the machine.

CAUTION!

… risk of scalding or suffocation when approaching large amounts of steam escaping from the machine. In this case, do not close the steam inlet on the machine's steam shut-off valve, close the locally available shut-off valve.

CAUTION!

Switch off the machine to shut it down and contact the authorised MEIKO service technician in the event that small amounts of steam or water escape from the machine.

6 Technical data

The machines' manufacturer’s plate must feature technical data of the heating system as well as other information. The manufacturer’s plate is located on the outside of the control cabinet.
The manufacturer’s plate features the following information regarding safe operation of the heating system.

Heating capacity …….. kW	Steam side	Heating water circuit
Max. permitted temperature	110°C	110°C
Max. permitted operating pressure	6 bar	3 bar
Test pressure	30 bar	10.5 bar

Sample manufacturer's plate, primary steam temperature <110°C

Heating capacity …….. kW	Steam side	Heating water circuit
Max. permitted temperature	133.5°C	110°C
Max. permitted operating pressure	6 bar	3 bar
Test pressure	30 bar	10.5 bar

Sample manufacturer's plate, primary steam temperature 110°C to 133.5°C

Heating capacity …….. kW	Steam side	Heating water circuit
Max. permitted temperature	165°C	110°C
Max. permitted operating pressure	6 bar	6 bar
Test pressure	30 bar	10.5 bar

Sample manufacturer's plate, primary steam temperature 133.5°C to 165°C

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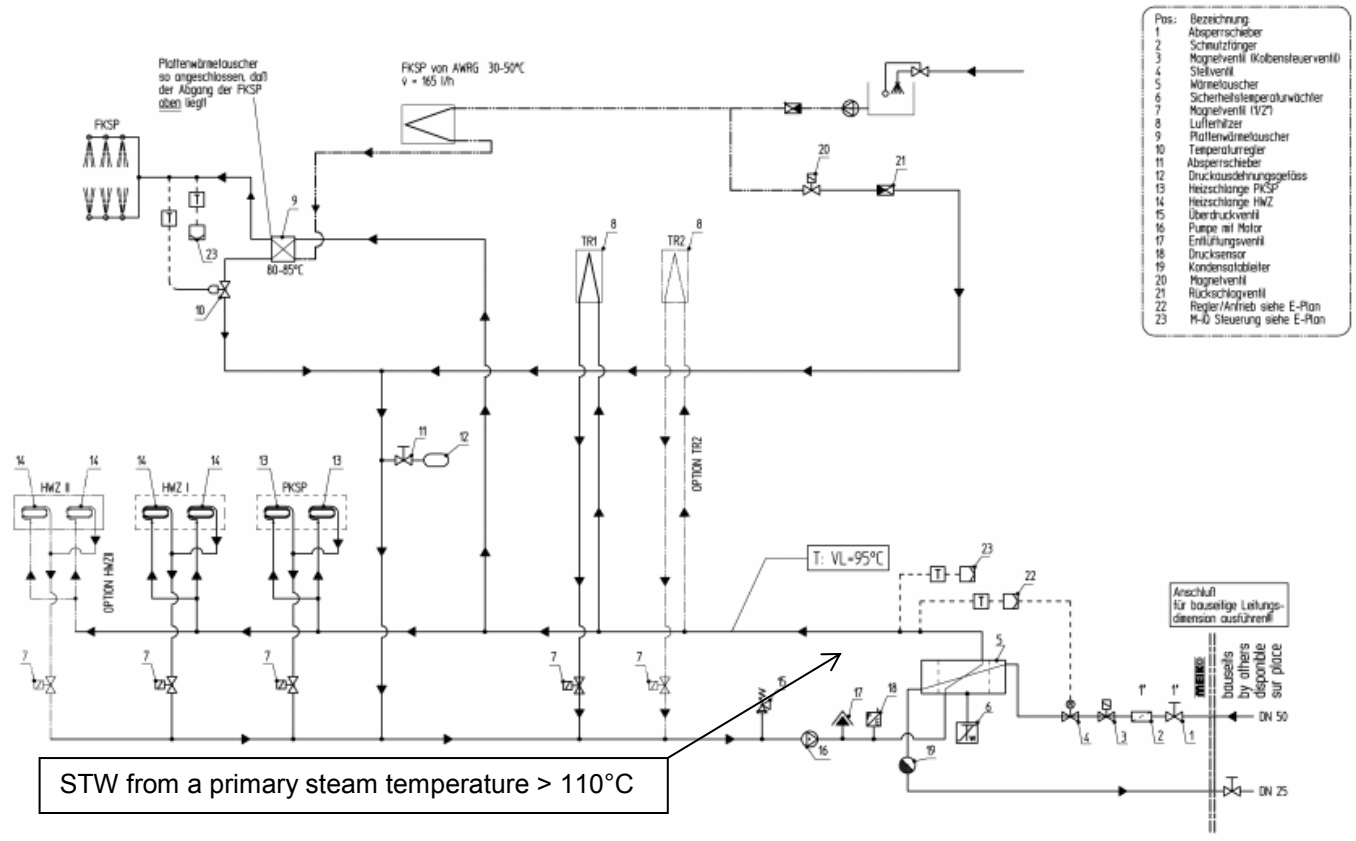
7 Function and assembly

Indirectly steam-operated heating water circuit as per AGFW worksheet FW 519



Installation drawing: MGM1-K821552

In this process, a central steam/water heat exchanger is used to transfer the heating energy of the locally available steam to the heating water circuit of the dishwashing machine. The heating water circuit supplies the individual consumers of the dishwashing machine, such as tank heating or drying. Individual consumers are controlled via temperature.
It is possible to activate/deactivate the tank heating and drying heat exchangers using valves. However, the energy supply to the fresh water heat exchanger is controlled using a control valve without auxiliary energy. The controlling characteristic is the fresh water temperature downstream of the fresh water heat exchanger.

A heating circuit pump continuously circulates the heating water between the central heat exchanger and individual consumers.
The heating circuit pump completes the following operating conditions: filling, filling/heating, heating, ready for operation and in operation.

Within the steam and primary circuit the energy supply to the central heat exchanger is activated upon switching on the machine using an open/closed steam valve and a control valve. The heating circuit pump is simultaneously switched on, providing the motor protecting switch of the heating pump has not triggered and the pressure in the heating water circuit is not above the *Start final rinse* pressure level.
The heating circuit pump remains on even after having detected a temperature in excess of the set temperature or any following, higher temperature limits to maintain the ability to control the heating water circuit.
The following temperature specifications or limit values apply to the heating water circuit temperature

7.1 Steam control valve set temperature

Temperature to which the heating water temperature is adjusted using the steam control valve.
Detected using a dedicated temperature probe. temperature probe is directly connected to the steam control valve controller. The specified temperature is set directly on the control valve.
The temperature probe to provide the control value for the steam control valve is fitted directly downstream of the central heat exchanger within the heating water circuit and connected directly to the steam control valve controller.

7.2 Maximum permitted heating circuit temperature

Temperature from which open/closed steam valve is closed via controls.

Report 51:
Over-temperature hot water circuit

This error must be acknowledged. Acknowledgement possible only if value has once again fallen below the maximum permitted heating water circuit.

The *maximum permitted heating water temperature* is recorded with the machine controls using a temperature probe.
The temperature probe is fitted directly downstream of the central heat exchanger in the heating water circuit.
The temperature specifications can be changed at manufacturer level only. The maximum permitted value is restricted to 110°.

7.3 STW safety temperature probe

According to AGFW worksheet FW 519, an STW may be required depending on the locally available steam temperature. It has been permanently set to ≤ 110°C, directly affects the steam control valve and also indirectly affects the open/closed steam valve via the machine controls.
Both valves are closed if the temperature exceeds 110°C at the STW.
If the STW triggers, it also sends a message to the controls.

Report 52:
Safety temperature overrun hot water circuit

Error must be acknowledged. Acknowledgement is possible only once the STW has autonomously switched back.

7.4 Heating water circuit pressure monitoring

A pressure sensor monitors the pressure in the heating water circuit. It is fitted between the heating circuit pump and the central heat exchanger.
An automatic bleed valve is also fitted between the heating circuit pump and the central heat exchanger.

If the **heating water pump is fitted vertically** the sensor exclusively records the static system pressure within the heating water circuit.
Resulting pressure limit values:

Threshold until message regarding pressure issues is output
If the pressure falls below this value, message 53 appears on the display: *Insufficient pressure in the hot water circuit*.

7.5 Start automatical re-fill

The system automatically refills if the pressure falls below this value when the circulation pump is switched off.
Set it to 1 bar to ensure that steam does not develop at the the maximum permitted temperature of 110°C within the heating water circuit.
Automatic re-filling is possible only once the booster pump of the separation in the fresh water pipes is running.
The heating circuit pump is switched off during automatic re-fill and consequently the OPEN/CLOSED steam valve and steam control valve are also closed.

7.6 Stop automatical re-fill

From this pressure value filling or automatic re-fill of the heating water circuit is stopped.

7.7 Interrupt automatical re-fill

If the specified pressure level for *Automatic re-fill complete* is not reached within a specified time, automatic re-fill is cancelled and message 58 *Automatic re-fill of hot water circuit interrupted* is output.
Upon initial filling or repairs entailing system pressures falling below 0.2 bar
the value for "*Interrupt automatic re-fill"* is multiplied by a factor of 10.

7.8 Automatic re-fill message appears too frequently

This message is output if automatic re-fills are run more than once within a specified period of time: Message 59 *Frequent pressure drops in hot water circuit (request service technician!)*

When **the heating circuit pump is running** the sensor measures the sum of the static system pressure and pump pressure.
Resulting pressure limit values:

7.9 Active ventilation

If the pressure falls below this value when the heating circuit pump is running, we can assume air has gathered within the pump and this may cause damage to the sliding seals. Switch off the pump to bleed it.
If the heating circuit pump is off, the *Start automatic re-fill* pressure is monitored and the aforementioned responses will occur upon falling below the specified value.

7.10 Minimum heating circuit running time

Adjustable period that the heating circuit pump remains on at minimum. If the pressure is not above the *Activate bleeding* threshold after the specified period of time, the heating circuit pump is once again deactivated.

7.11 Pipe vent time

Period of time for which the heating circuit pump is deactivated after having started *Activate bleeding*.

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7.12 Maximum number of "Activate bleeding"

Number of permitted *Activate bleeding* program sequences after
- the *Start automatic re-fill* program sequence has been run.
- having acknowledged display message 49 (see below)
- having switched on the machine.

Any of the three listed actions resets the *Maximum number of "Activate bleeding"* counter to zero.
Upon reaching the maximum number of bleeding attempts the machine display shows message 49 *Pump pressure in heating water circuit insufficient*.

This function is important for repairs or initial filling as in these cases it is required to remove large quantities of air from the system and a certain number of *Activate bleeding* cycles must be completed.
In this process, the air within the heating water circuit is separated using the circulation pump's centrifugal effects. This causes the pressure of the *Activate bleeding* to fall below the permitted value. This will deactivate the heating pump. The air within the pump them rises through the pump and the downstream pipes and is removed from the hot water circuit in a pipe elbow between heating water circuit pump and central heat exchanger via an automatic air separator.

7.13 Monitoring overpressure

If the air cushion in the expansion tank loses air, the pressure in the heating water circuit decreases regardless of whether or not the pump is running. This is compensated by the aforementioned pressure limits and using the corresponding automatic re-fill commands when the dishwashing machine is in operation.
If there is no air cushion in the expansion tank at all, the pressure in the heating water circuit significantly increases as a result of the expanding heat of the heating water.
If the pressure in the secondary circuit increases beyond the value specified using *Excess pressure monitoring* for a minimum of 10 seconds, this may be caused by a leak in the expansion tank, causing it to lose air.

Message 48 appears upon exceeding the specified limit value for a minimum of 10 seconds.
Overpressure in hot water circuit

Reasons: Leaking expansion tank – check integrity. Potentially re-fill air until reaching the initial pressure (specified on expansion tank)

7.14 Fresh water path, final rinse

The final rinse water is pre-heated in the fresh water path using the exhaust air heat exchanger. Temperatures of 40°C to 50°C are normal in this process, however, they fluctuate depending on the load in the dishwashing machine.
Subsequently, the pre-heated final rinse water is heated to the specified final rinse temperature using a fresh water heat exchanger. A plate shaped heat exchanger is used for this purpose; the final rinse water flows on one side and the heating circuit water on the other.
A control valve has been fitted in the return of the heating water from the fresh water heat exchanger to compensate for the different temperatures of the final rinse water downstream of the exhaust air heat exchanger, different supply temperatures within the heating water and different pressures caused by activating/deactivating various consumers within the heating water circuit. It adapts the energy supply to said components in the various conditions.

8 Commissioning the heating water circuit

8.1 Assembling and connecting the heating water circuit to a locally available steam and condensation network

Exclusively specialists must install and connect the locally available steam network to the system.
We decline any responsibility for damages caused by incompetent connections.

The steam connection point of the dishwashing machine depends on the design status (normally at a considerable distance from the locally available connection points).

The machine or heating system is ready for operation once the dishwashing machine has been assembled, i.e. you must only produce the cables and pipes for steam and condensate between the machine and the locally available connection point. For this purpose, use pipes and seals that are suitable for steam installations.

Any contamination and assembly residue must have been removed from the pipes prior to commissioning.

The machine's steam installation must be equipped with an un-pressurised sloping condensate return system on site.

Pipes into the condensate traps must not be insulated.

No further steam traps must be installed in the building's condensate pipes.
Information on nominal widths, cross sections etc relate to the appliance.
See the installation drawing for details.

Installations on site must be dimensioned to match local conditions (e.g. pipe, hose, cable routing, access lengths).

Locally available steam pressure and steam temperature must be maintained at a constant level during the entire operation process.

If the dishwashing machine is shipped to the destination in several individual parts due to shipment or urgent deliveries and the screw connections on the pipes of the heating water circuit are undone, use a PTFE seal with stainless steel insert when assembling the screw connections of the heating water circuit, e.g. Gylon HP 3560, made by Garlock.

8.2 Commissioning

After having installed fresh water, current, waste water, steam and condensate the dishwashing machine can automatically fill the heating circuit. For this purpose, open the locally available steam shut-off valve and subsequently switch on the dishwashing machine. The heating water circuit is automatically filled or re-filled in the "filling/heating" and "in operation" operating conditions, providing final rinse is simultaneously activated on the dishwashing machine and the filling pressure of the heating water circuit is below the set value.

Water used for final rinse within the dishwashing machine is also used to automatically fill the heating water circuit. This safeguards an adequate water quality with regard to water hardness. As per VDI 2035, sheet 2 the water hardness for the filling water must not exceed 11°dH.

The filling pressure of the heating water circuit is controlled using the dishwashing machine. If required, the dishwashing machine automatically re-fills until it once again reaches the set pressure.

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Check all pipes and components on the primary side and the heating water circuit for leaks and damage upon initial commissioning. If required, reposition seals or replace them. Check their function if they are damaged and replace if necessary.

The parameters saved in the machine controls to control the heating water circuit must not be changed/must be changed only after having coordinated the measure with Meiko.

Parameters saved in the controller to control the steam control valve must not be changed/must be changed only after having coordinated the measure with Meiko.

The fins of the drying heat exchanger are sharp. Wear protective gloves if it is required to access the drying heat exchanger during assembly of the heating circuit.

9 Operation

The dishwashing machine controls automatically control the heating water circuit after having switched on the dishwashing machine.

Inform authorised MEIKO service technicians if errors requiring acknowledgement occur repeatedly.

10 Maintenance

The following maintenance manual describes the vital work required as part of maintenance. This compilation is not exhaustive. For more information please refer to the operating instructions concerning maintenance of individual components.

Switch off the dishwashing machine prior to maintenance or repair work on the heating installation and additionally close the manual steam input pipe shut-off valve and secure it against unintentional activation during the work, e.g. using a warning sign.

Existing safety systems must not be removed!

The fins of the air/heating water circuit within the drying heat exchanger are sharp. Risk of injuries. Wear protective gloves when cleaning the drying heat exchanger.

Check the external condition of the diaphragm expansion tank and the correct function of the equipment for the gas supply pressure of the diaphragm expansion tank as per the annual maintenance of the diaphragm expansion tank as per DIN 4807, part 2.
It is exclusively possible to check the gas supply pressure in the diaphragm expansion tank with a depressurised water side in the diaphragm expansion tank and for this reason, it is required to depressurise the diaphragm expansion tank during maintenance on the heating water circuit side. For this purpose, open the bleed valve of the heating circuit.
Water will escape at high pressure upon opening the bleed valve. Safely discharge any escaping water using suitable measures, such as a hose connected to the bleed valve. Take corresponding safety precautions when bleeding the heating water circuit when hot to prevent skin contact.
Close the bleed valve once water no longer escapes from the bleed valve.
You can now check the specified supply pressure and re-fill, if necessary. The supply pressure is stated on the diaphragm expansion tank.
Exclusively use nitrogen or any other inert gas to re-fill the gas cushion!
The heating water circuit system pressure is automatically established using a re-fill device via the dishwashing machine controls. This also applies in the event of large amounts of water escaping as part of repairs or system component replacements and upon initial filling of the heating water circuit.

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Drain the machine before descaling the plate heat exchanger.
Bridge the exhaust air heat recovery system to descale the plate heat exchanger. For this purpose, unscrew the supply and drain hoses from the exhaust air heat exchanger and directly connect them with each other using a ¾" threaded connector.
Subsequently add descaling solution to the air-gap tank. For this purpose, wear protective goggles and protective clothing. Switch on the machine after having added descaling solution to the air-gap tank. The machine then independently rinses the descaling solution through the plate heat exchanger using the air-gap pump.
Rinse for approximately 10 minutes. There must not be any descaling solution remaining in the air-gap tank by the end of this rinsing process.
Subsequently drain the machine, rinse using the shower head and re-connect the exhaust air heat exchanger to the supply and drain hoses.

Water escapes under high pressure as part of the functional check of the safety valve by briefly bleeding it. Take suitable safety precautions, such as connecting hoses to ensure that escaping water is drained safely. Take suitable safety precautions to prevent direct contact with the hot safety valve or escaping heating circuit water if the safety valve is checked when hot.

11 Maintenance manual

……
Customer

…… ……
Serial number of the machine: **current operating hours**

PLEASE NOTE: Maintenance work should only be conducted by authorised MEIKO personnel.
Whenever any electrical components are disconnected and reconnected, replaced or repaired, a safety test must be conducted, at least on these components!!!

Maintenance work	Note	Maintenance requirement
Visual check of all components and connections for leaks and damage	If applicable, re-tighten connections and/or replace seals. Check for correct function if components are damaged and replace, if applicable.	1 x yearly
Check the error memory of the dishwashing machine for errors in the heating water circuit	Can be viewed on the dishwashing machine display	1 x yearly
Functional check of the safety valve	Briefly bleed. See operating instructions safety valve.	1 x yearly
Clean the dirt trap on the steam side	See operating instructions dirt trap	1 x yearly
Visual check of the safety temperature probe	Check correct position on the heat exchanger	1 x yearly
Check the plate shaped heat exchanger for internal scaling	Rinse with a 10% descaling solution in the event of decreasing throughput on the fresh water side.	1 x yearly
Check the diaphragm expansion tank	Supply pressure	1 x yearly
Check the drying heat exchanger for contamination	If applicable, clean with hot water.	1 x yearly
Check the sliding seal of the heating circuit pump for leaks.	Potentially replace it. Replace the mechanical seal (seal kit: 9709386) every 5,000 hours	1 x yearly
Clean the fan intake hood of the heating circuit pump		1 x yearly

…… ……
Place, Date: authorized service technicians:

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12 Removal

Disassemble the dishwashing machine when cold only.

Disconnect the dishwashing machine from the mains and additionally close the locally available shut-off valve of the steam supply line and secure it against unintentional opening (e.g. using a warning sign) prior to starting to disassemble the dishwashing machine.
Exclusively authorised specialists must disconnect the system from the locally available steam, condensate and mains network.
We shall not be liable for any damage resulting from improper work.

The heating water circuit is pressurised using pneumatic components. Depressurise the heating water circuit by opening the bleed valve before starting disassembly on the heating water circuit. Safely drain any escaping water using suitable measures, such as connecting a hose to the bleed valve.

Heating circuit water is not drinking water, dispose of the escaping water accordingly.

The fins of the air/heating water circuit within the drying heat exchanger are sharp. Risk of injuries. Wear protective gloves upon disassembling the drying heat exchanger.

Press the air re-fill valve to depressurise the diaphragm expansion tank prior to removing the diaphragm expansion tank.

Individual system parts of the heating circuit may subsequently be disconnected from the steam network and disposed of.

13 Description of malfunctions

Section 4 "Functional description" lists the messages that appear as a result of malfunctions in the heating system.

Furthermore, monitor whether the specified primary steam temperature is maintained at a temperature that is permanently below 95°C in the heating water circuit. For this purpose, use the contact sensor or the optionally fitted pressure gauge in the primary circuit.

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14 Operating instructions JUMO Thermostat

JUMO heatTHERM-AT/ -DR

Aufbau-, Raum-, Abgas-, Hutschienen-Thermostat

Add-on, room, flue gas, top hat rail thermostat

Thermostats d'ambiance, pour gaz d'échappement, pour montage en saillie, sur rail

B 603070.0

Betriebsanleitung
Operating Instructions
Notice de mise en service

2013-01-02 / 00485240

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EG Konformitätserklärung
EC Declaration of Conformity / Declaration CE de conformité

Dokument-Nr. / Document No. / Document n°: CE 268
Hersteller / Manufacturer / Etabli par: JUMO GmbH & Co. KG
Anschrift / Address / Adresse: Moritz-Juchheim-Straße 1, 36039 Fulda
Produkt / Product / Produit: Beschreibung / Description: Aufbau-Thermostat, Raum-Thermostat, Hutschienen-Thermostat
Typ/ Serie / Type/série: JUMO heatTHERM-AT, JUMO heatTHERM-DR
Typenblatt-Nr. / Data Sheet No.: 60.3070

Wir erklären in alleiniger Verantwortung, dass das bezeichnete Produkt die Schutzanforderungen der Europäischen Richtlinien erfüllt.
We hereby declare in sole responsibility that the designated product fulfills the safety requirements of the European directives.
Nous déclarons sous notre seule responsabilité que le produit rempli les directives européennes.

Richtlinie / Directive / Directive — Datum der Erstanbringung des CE-Zeichens auf dem Produkt / Date of first application of the CE mark to the product / Date de 1ère application du sigle CE sur le produit

2004/108/EG	[EMV-Richtlinie]	07
2006/95/EG	[Niederspannungs-Richtlinie]	07
97/23/EG	[Druckgeräterichtlinie, Modul B+D] Kategorie IV	07

EG-Baumusterprüfbescheinigung
Type examination / Tests échantillon
IS-TAF-MUC 07 11 3377017

Angewendete Normen
Standards applied / Normes appliquées

DIN EN 61326-1	Ausgabe: 10.2006
DIN EN 60730-1	Ausgabe: 06.2009
DIN EN 60730-2-9	Ausgabe: 07.2011
DIN EN 14597	Ausgabe: 12.2005
AD 2000 Merkblätter	

Anerkannte Qualitätssicherungssysteme der Produktion
Recognized quality assurance systems used in production / Organisme notifié agréé

nach: Richtlinie 94/9/EG Modul D / Directive 94/9/EC Module D / Directive européenne 94/9/CE module D
TÜV NORD CERT GmbH, Am TÜV 1, D 30519 Hannover, Germany
Kennnummer 0044, Mitteilungsnummer TÜV 99 ATEX 1454 Q
Identification No. 0044, Notification No. TÜV 99 ATEX 1454 Q / N° d'identification 0044, N° de signification TÜV 99 Atex 1454 Q

nach: Richtlinie 97/23/EG Modul D / Directive 97/23/EC Module D / Directive européenne 97/23/CE module D
TÜV SÜD Industrie Service GmbH, Dudenstraße 28, 68167 Mannheim, Germany
Kennnummer 0036, Zertifikat-Nr. DGR-0036-QS-989-11
Identification No. 0036, Certificate No. DGR-0036-QS-989-11 / N° d'identification 0036 , N° de certificat DGR-0036-QS-989-11

Aussteller: Issued by / Etabli par: Firma / Company / Société: JUMO GmbH & Co. KG, Fulda
Ort, Datum: Place, date / Lieu, date: Fulda, 2012-10-10
Rechtsverbindliche Unterschrift: Legally binding signature / Signature juridiquement valable
Geschäftsbereichsleitung Verkauf und Produktion / Head of Division Sales and Production / Direction du département Ventes et Production
ppa. Günter Bott

Lesen Sie diese Betriebsanleitung, bevor Sie das Gerät in Betrieb nehmen.
Bitte unterstützen Sie uns, diese Betriebsanleitung zu verbessern. Für Ihre Anregungen sind wir dankbar.

Telefon +49 661 6003-716
Telefax +49 661 6003-504

Sollten bei der Inbetriebnahme trotzdem Schwierigkeiten auftreten, bitten wir Sie, keine unzulässigen Manipulationen am Gerät vorzunehmen. Sie gefährden dadurch Ihren Garantieanspruch! Bitte setzen Sie sich mit dem Lieferanten oder dem Stammhaus in Verbindung.

Read these operating instructions carefully before commissioning the device.
Please assist us in improving these operating instructions. Your feedback is appreciated.

Phone +49 661 6003-0
Fax +49 661 6003-607

If any difficulties should arise during commissioning, please do not perform any unauthorized manipulations on the device. Doing so will jeopardize your rights under the divice warranty! Please contact your supplier or the main factory.

Lisez cette notice avant de mettre en service l'appareil. Aidez-nous à améliorer cette notice en nous faisant part de vos suggestions. Nous vous en serons reconnaissants.

Téléphone : 03 87 37 53 00
Télécopieur : 03 87 37 89 00 e-mail : info.fr@jumo.net
Service de soutien à la vente : **0892 700 733** (0,337 € /min)

Toutefois si vous rencontrez des difficultés lors de la mise en service, ne procédez à aucune manipulation non autorisée sur l'appareil. Vous pourriez compromettre votre droit à la garantie ! Veuillez prendre contact avec nos services.

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1. Einleitung

1.1 Verwendung

- Aufbau-Thermostate JUMO heatTHERM-AT überwachen oder regeln Temperaturen in Wärmeerzeugungsanlagen und Anwendungen in der Heizungs-, Lüftungs- und Klimatechnik.
- Raum-Thermostate JUMO heatTHERM-AT regeln Heizungen und Kühlungen (Klimatisierungen, Belüftung) in Gewerberäumen, Gärtnereien, Stallungen und Anwendungen in der Heizungs-, Lüftungs- und Klimatechnik.
- Rauchgas-Thermostate JUMO heatTHERM-AT verriegeln den Gas-/Ölkessel, der parallel mit einem Holzkessel an einem gemeinsamen Schornstein angeschlossen ist.

1.2 Kennzeichnung

- Ausführung nach DIN EN 14597 als:
  TR = Temperaturregler
  TW = Temperaturwächter
  STW = Sicherheits-Temperaturwächter
  STB = Sicherheits-Temperaturbegrenzer
  ATW = Abgastemperaturwächter
  ASTB = Abgassicherheitstemperaturbegrenzer
- Baumusterprüfung nach:
  - DIN EN 14597
  - Druckgeräterichtlinie (nur STW und STB)
  - UL 873
- Aufbau- und Raum-Thermostate JUMO heatTHERM-AT entsprechen der DIN EN 60730 (VDE 0631).

1.3 Sicherheitshinweise

- Knicken oder Durchtrennen der Fernleitung führt zum dauerhaften Ausfall des Gerätes.
- Beim Bruch des Messsystems kann Füllflüssigkeit austreten.

Physikalische und toxikologische Eigenschaften des Ausdehnungsmittels, welches im Falle eines Messsystembruchs austreten kann:

Regelbereich mit Skalenendwert °C	Gefährliche Reaktion	Zündtemperatur °C	wassergefährdend	Angaben zur Toxikologie: reizend	gesundheitsgefährdend	toxisch
< +200	nein	+375	Klasse 1, schwach gefährdend	nein	nein	nein
≥ 200 ≤ +350	nein	+490	ja	ja	2)	nein
280 1)	nein	nein	nein	nein	nein	nein

1) ATW = Abgastemperaturwächter
2) Über eine Gesundheitsgefährdung bei kurzzeitiger Einwirkung und geringer Konzentration, z.B. bei Messsystembruch, gibt es bis jetzt keine einschränkende gesundheitsbehördliche Stellungnahme.

Introduction

Use

- JUMO heatTHERM-AT surface-mounting thermostats monitor and control temperatures in heat-generating plant and HVAC applications.
- JUMO heatTHERM-AT room thermostats control heating and cooling installations (climate control, ventilation) in commercial premises, nurseries, stables and HVAC applications.
- These devices are not intended for plenum application.
- JUMO heatTHERM-AT flue gas thermostats seal the gas/oil vessel, which is connected in parallel with a wood firing vessel to a common chimney.

Marking

- Version in accordance with EN 14597 as:
  TR = Temperature controller
  TW = Temperature monitor
  STW = Safety temperature monitor
  STB = Safety temperature limiter
  ATW = Flue gas temperature monitor
  ASTB = Flue gas safety temperature limiter
- Type examination to:
  - EN 14597
  - Pressure Equipment Directive (only STW and STB)
  - UL 873
- JUMO heatTHERM-AT surface-mounting and room thermostats meet EN 60730 (VDE 0631).

Safety notes

- Cutting through or kinking the capillary will lead to permanent instrument failure.
- Liquid may escape in the event of a measuring system fracture.

Physical and toxicological properties of the expansion medium that may escape in the event of a measuring system fracture:

Control range with end of scale °C	Dangerous reaction	Ignition temp. °C	Water contamination	Toxicological data: irritant	danger to health	toxic
< +200	no	+375	Class 1, mildly contaminant	no	no	no
≥ 200 ≤ +350	no	+490	yes	yes	2)	no
280 1)	no	no	no	no	no	no

1) ATW = Flue gas temperature monitor
2) At present, there is no restrictive statement from the health authorities concerning any danger to health over short periods and at low concentrations, e.g. after a fracture of the measuring system.

Introduction

Utilisation

- Les thermostats pour montage en saillie JUMO heatTHERM-AT sont utilisés pour surveiller et réguler des températures dans des installation de production de chaleur ainsi que dans le domaine du chauffage, de la ventilation et de la climatisation.
- Les thermostats d'ambiance JUMO heatTHERM-AT régulent le chauffage et le refroidissement (climatisation, ventilation) dans des locaux professionnels, exploitations horticoles, étables et sont utilisés dans le domaine du chauffage, de la ventilation et de la climatisation.
- Les thermostats pour gaz de fumée JUMO heatTHERM-AT verrouillent la chaudière à gaz/fioul qui est parallèlement raccordée à une chaudière à bois sur une cheminée commune.

Caractéristique

- Exécution suivantTR = Régulateur de température.
  EN 14597 comme :TW = Contrôleur de température
  STW = Contrôleur de température de sécurité
  STB = Limiteur de température de sécurité
  ATW = Contrôleur de température de gaz d'échappement
  ASTB = Limiteur de température de sécurité pour gaz d'échappement
- Examen CE de type suivant :- EN 14597
  - Directive équipements sous pression (uniqu. STW et STB)
  - UL 873
- Les thermostats pour montage en saillie et d'ambiance JUMO heatTHERM-AT répondent aux normes EN 60730 (VDE 0631).

Sécurité

- Sectionnement et flambage du capillaire provoquent une panne durable.
- En cas de rupture du système de mesure, le liquide de remplissage peut s'échapper.

Caractéristiques physiques et toxicologiques des substances qui peuvent s'échapper en cas de rupture du système de mesure :

Plage de réglage avec val. fin d'échelle °C	Réaction dangereuse	Temp. d'inflammation °C	Risque pour l'eau	Indications toxicologiques: Irritant	Dangereux pour la santé	toxique
< +200	non	+375	Classe 1, risque faible	non	non	non
≥ 200 ≤ +350	non	+490	oui	oui	2)	non
280 1)	non	non	non	non	non	non

1) ATW = Contrôleur de température de gaz d'échappement
2) Actuellement il n'existe aucune disposition restrictive émise par les services sanitaires en cas d'émanation momentanée ou de faible concentration.

2. Gerät identifizieren

(1) Typenschlüssel / Bestellschlüssel
(2) Schaltleistung Öffnungskontakt / Schaltleistung Schließkontakt
(3) Regel-/Grenzwert-/Temperatur bei der dieser Thermostat kalibriert wurde (Option) / maximale Gerätetemperatur / Schutzart
(4) Verkaufsartikelnummer
(5) Fabrikationsnummer
(6) Fertigungsjahr
(7) Fertigungswoche
(8) Prüfzeichen

Musterbeispiel / example / exemple :

Identifying the instrument

(1) Type code / Order code
(2) Contact rating: break contact (SPST-NC) / Contact rating: make contact (SPST-NO)
(3) Control / limit temperature at which this thermostat has been calibrated (option) / maximum instrument temperature / enclosure rating
(4) Sales number
(5) Serial number
(6) Year of production
(7) Week of production
(8) Approval mark

Identification de l'appareil

(1) Code d'identification / Code de commande
(2) Pouvoir de coupure contact à ouverture/ Pouvoir de coupure contact à fermeture
(3) Température limite/de régulation à laquelle ce thermostat a été calibré (option) / température max. de l'appareil / indice de protection
(4) Numéro d'article
(5) Numéro de fabrication
(6) Année de fabrication
(7) Semaine de fabrication
(8) Marque de contrôle

3. Montage

3.1 Allgemeines

Einbaulage nach DIN 16257,
TR, TW, STW, STB: NL 0 ... NL 90
ATW, ASTB: NL 90

General

Mounting position to DIN 16257,
TR, TW, STW, STB: NL 0 ... NL 90
ATW, ASTB: NL 90

Généralité

Position d'utilisation suivant DIN 16257,
TR, TW, STW, STB: NL 0 ... NL 90
ATW, ASTB: NL 90

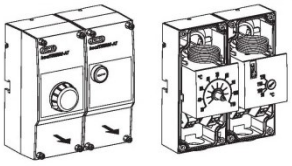
Mounting

Montage

3.2 Gehäuse öffnen

Opening the housing

Ouverture du boîtier



3.3 Schutzrohrmontage

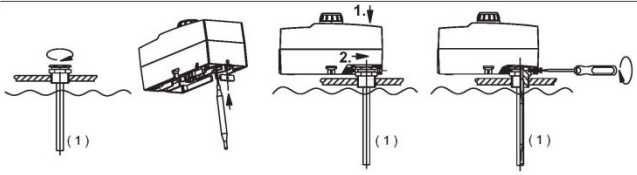
- Die Geräte dürfen nur mit passenden Schutzrohren betrieben werden.
- Im Betriebsmedium Luft, ohne Schutzrohr einsetzen.

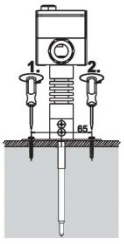
Mounting the protection tube

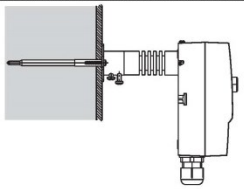
- The instruments must only be operated with the appropriate protection tubes.
- For operation in air, without protection tube.

Montage de la gaine de protection

- Les appareils ne peuvent être utilisés qu'avec des gaines de protection appropriées.
- A utiliser sans gaine de protection dans le milieu "air".







Fühler-Ø 6 mm	Probe-Ø 6 mm	Ø sonde 6 mm	Fühler-Ø 6 mm	Probe-Ø 6 mm	Ø sonde 6 mm
Schutzrohr-Ø 8 x 0,75 mm	Prot. tube-Ø 8 x 0,75 mm	Ø gaine protec 8 x 0,75 mm	Halterohr-Ø 7,2 mm	holding tube-Ø 7,2 mm	Ø tenir le tube 7,2 mm
Material Messing/Edelstahl	Material Brass/stainless steel	Matériau Laiton / Acier inox.	Material Edelstahl	Material stainless steel	Matériau Acier inox.

(1) Temperaturfühler muß vollständig in das Medium eintauchen.
(1) The temperature probe must be completely immersed in the medium being measured.
(1) La sonde de température doit être entièrement immergée dans le milieu.

3. Montage

3.4 Wandmontage

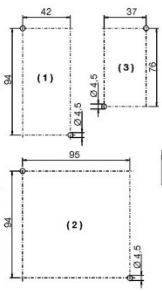
(1) Bohrschablone Einfachthermostat
(2) Bohrschablone Doppelthermostat
(3) Bohrschablone Hutschienen-Thermostat
(4) min. Biegeradius der Fernleitung 5 mm
(5) Fühler mit Formfeder gegen Herausgleiten sichern

Wall mounting

(1) Drilling jig, single thermostat
(2) Drilling jig, dual thermostat
(3) Drilling jig, top hat rail thermostat
(4) min. bending radius of the long-distance line 5 mm
(5) Shaped spring secures probe against sliding out

Montage mural

(1) Gabarit de perçage thermostat simple
(2) Gabarit de perçage thermostat double
(3) Gabarit de perçage Thermostat pour profilés chapeaux
(4) Rayon de courbure min. du capillaire 5 mm
(5) Sonde avec ressort de sécurité pour assurer le maintien dans la gaine



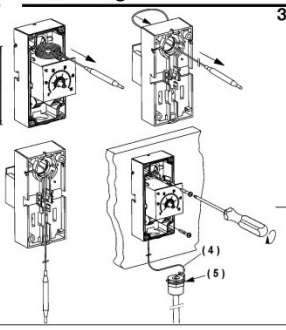
Mounting

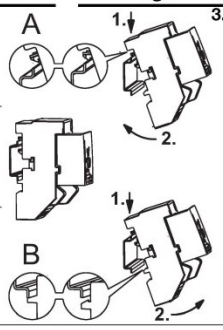
3.5 Hutschiene

Top hat rail
Rail

A
Montage
Installation
Montage

B
Demontage
Disassembly
Démontage





Montage

3.6 Rohrmontage

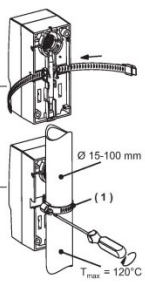
(1) Länge nach Bedarf kürzen.

Pipe mounting

(1) Shorten according to requirements.

Montage tuyaterie

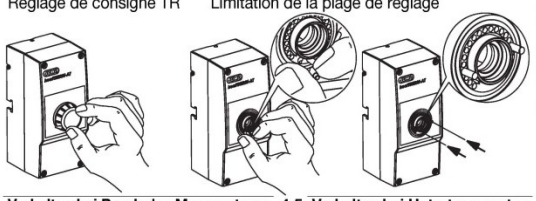
(1) Raccourcir longueur suivant besoin.



4. Einstellungen / Funktionen

4.1 Sollwerteinstellung TR / Begrenzung Regelbereich

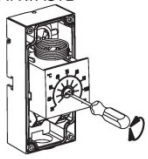
Setpoint adjustment TR / Control range limiting
Réglage de consigne TR / Limitation de la plage de réglage



Settings / functions

4.2 Sollwert- / Grenzwerteinstellung TW/STW/STB/ATW/ASTB

Setpoint / limit setting TW/STW/STB/ATW/ASTB
Réglage seuil/ consigne TW/STW/STB/ATW/ASTB



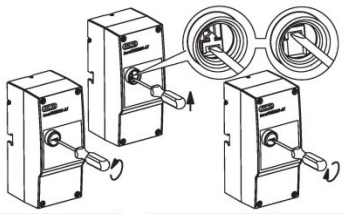
Réglages / Fonctions

4.3 Entriegeln STB/ASTB - STB/ASTB reset - Déverrouillage STB/ASTB

Nach Unterschreiten des eingestellten Grenzwertes (Gefahrentemperatur) - siehe Werte Tabelle, Typenblatt 603070 - kann der Sprungschalter entriegelt werden.

Once the temperature falls below the selected limit value (and the temperature is therefore dangerous) – see values table in data sheet 603070 – the snap-action switch can be unlocked.

Si la température passe sous la valeur limite réglée (température à risque) - voir Valeurs, tableau fiche technique 603070 - le contact à rupture brusque peut être déverrouillé.



4.4 Verhalten bei Bruch des Messsystems

Bei Zerstörung des Messsystems, d.h. wenn die Ausdehnungsflüssigkeit entweicht, fällt der Druck in der Membrane ab und öffnet beim STW/ATW und STB/ASTB bleibend den Stromkreis. Beim STB/ASTB ist ein Entriegeln nicht mehr möglich.

Response to measuring system fracture

If the measuring system is destroyed (i.e. the expansion liquid leaks) then the membrane pressure falls and the circuit will be permanently opened in the case of an STW/ATW or STB/ASTB. On an STB/ASTB, resetting is no longer possible.

Comportement en cas de rupture du système de mesure

En cas de destruction du système de mesure, c.-à-d. lorsque le liquide d'expansion s'échappe, la pression dans la membrane chute et le circuit électrique reste ouvert pour STW/ATW et STB/ASTB . Un déverrouillage n'est plus possible pour STB/ASTB .

4.5 Verhalten bei Untertemperatur

Wird der Fühler beim STW/ATW oder STB/ASTB auf eine Temperatur unter ca. -20°C abgekühlt öffnet sich der Stromkreis, schließt sich jedoch bei Temperaturanstieg wieder selbsttätig.

Response to low temperature

If the probe temperature on an STW/ATW or STB/ASTB falls below about -20°C, the circuit will open, but will automatically close again when the temperature rises.

Comportement si la température est trop basse

Lorsque la temperature passe sous -20°C pour STW/ATW ou STB/ASTB, le circuit électrique s'ouvre, mais se referme automatiquement lorsque la température remonte.

4.6 Schutzart IP 54

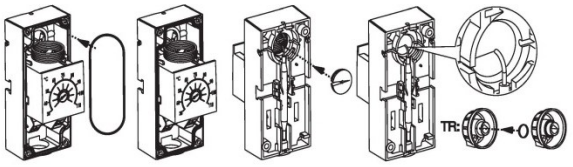
Zum Erreichen der Schutzart IP 54 müssen die Dichtungselemente wie dargestellt eingelegt sein.

IP54 protection

To achieve the enclosure protection rating IP54, the sealing elements must be inserted as shown in the diagram.

Protection IP 54

Pour atteindre l'indice de protection IP 54 les joints doivent être positionnés comme ci-dessous représentés.



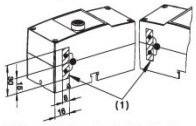
4.7 Plombierung

(Plombe nicht im Lieferumfang)

Lead sealing

(not included in delivery)

Plomb (Plombs non fournis)



(1) Bohrung beidseitig nur im schraffierten Bereich
(1) Drill only in the cross-hatched area on both sides
(1) Perçage latéral uniquement dans la zone hachurée

5. Installation

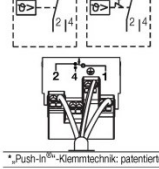
5.1 Vorschriften und Hinweise

- Der elektrische Anschluss darf nur von Fachpersonal durchgeführt werden.
- Bei der Wahl des Leitungsmaterials, bei der Installation und beim elektrischen Anschluss des Gerätes sind die Vorschriften der VDE 0100 "Bestimmungen über das Errichten von Starkstromanlagen mit Nennspannungen unter 1000 V" bzw. die jeweiligen Landesvorschriften zu beachten.
- Das Gerät völlig vom Netz trennen, wenn bei Arbeiten spannungsführende Teile berührt werden können.
- Gerät an der Klemme PE mit dem Schutzleiter erden. Diese Leitung sollte mindestens den gleichen Querschnitt wie die Versorgungsleitungen aufweisen.

5.2 Elektrischer Anschluss

- PUSH IN -Kontakt (Steckklemme) * geeignet für Anschlussquerschnitt 0,75...2,5mm² feindrähtig, feindrähtig mit Aderendhülse eindrahtig.
- Anschlussverbindung geeignet für fest verlegte Leitungen. Leitungseinführung mit Zugentlastung. Anbringungsart X bzw. M.
- Anschluss gemäß Anschlussbild durchführen.
- Schutzklasse I, einbezogen sind:
  - Schaltkopf inklusive 4000 mm Cu-Kapillare (einschließlich Fühlerlänge)
  - nur der Schaltkopf bei CrNi-Kapillare.

TR, TW, STW, ATW: **STB, ASTB:**



■ **Leitungen vorbereiten** / Prepare the cables / Préparation des câbles

(1) geeignetes Crimpwerkzeug verwenden
(1) Use a suitable crimpng tool
(1) Utiliser l'outil de sertissage adapté

*„Push-In®"-Klemmtechnik: patentierte Anschlusstechnik der Weidmüller GmbH & Co. KG, Detmold

Electrical connection

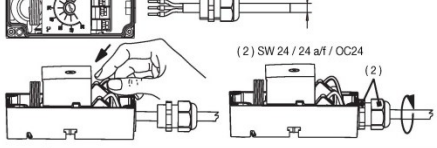
Regulations and notes

- The electrical connection must only be made by qualified personnel.
- The choice of cable, the installation and the electrical connection must conform to the requirements of VDE 0100 "Regulations for the installation of power circuits with nominal voltages below 1000 V", or to the appropriate local regulations.
- If contact with live parts is possible while working on the unit, it must be completely disconnected from the supply.
- Earth the instrument at the PE terminal to the protective conductor. This cable must have a cross-section that is at least as large as the supply cables.

Electrical connection

- PUSH IN contact (plug-in terminal) * suitable for conductor cross-section 0.75 — 2.5 mm². Use core-end ferrule with stranded conductor.
- Connection suitable for fixed cabling. Cable entry with strain relief. Attachment type X or M.
- Implement the connection according to the wiring diagram.
- These devices are for flexible conduit only.
- Protection class I includes:
  - switching head including 4000 mm Cu capillaries (including probe length)
  - only the switching heads with CrNi capillaries

■ **Anschluss herstellen** / Make the connection / Brancher



**Push-In®- terminal technology is patented by Weidmüller GmbH & Co. KG, Detmold

Raccordement électrique

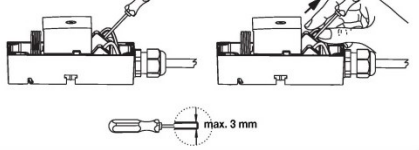
Prescriptions et remarques

- Le raccordement électrique doit être effectué exclusivement par du personnel qualifié.
- Aussi bien pour le choix du matériau des câbles, que pour l'installation ou bien le raccordement électrique de l'appareil, il faut respecter la réglementation en vigueur.
- Débrancher les deux conducteurs du réseau lorsque des pièces sous tension peuvent être touchées lors d'une intervention sur l'appareil.
- Raccorder l'appareil à la terre sur la borne PE, avec le conducteur de protection. Ce conducteur doit avoir la même section que les lignes d'alimentation.

Raccordement électrique

- Contact PUSH IN (borne à fiche) * adapté à une section de fil 0,75 à 2,5mm² de faible diamètre, faible diamètre avec embout unifilaire.
- Raccordement adapté à des câbles fixes. Entrée de câble avec décharge de traction. Type de fixation X ou M.
- Raccordement suivant schéma de raccordement.
- Classe de protection I, y compris :
  - Tête de commutation y compris capillaire Cu 4000 mm (y compris longueur du capteur)
  - uniquement la tête de commutation pour capillaire CrNi

■ **Anschluss lösen** / Disconnection / Débrancher



*Technologie „Push-In®" : connexion à insertion brevetée par Weidmüller GmbH & Co. KG, Detmold

6. Technische Daten

zulässige Umgebungstemperatur im Gebrauch	An Fernleitung und Schaltkopf: siehe Typenschildangabe	Am Temperaturfühler – max. Sollwert +25 K bzw. +15% – bei Flüssigkeitsfüllung max. 400 °C – ATW max. 600°C
zulässige Lagertemperatur	max. +50°C, min. -30°C	
maximale Schaltleistung	Am Öffnungskontakt (Kontaktbahn 1-2)	AC 230 V +10%, 16 (2,5) A, cos φ = 1 (0,6) DC 230 V +10%, 0,25 A
	Am Schließkontakt (Kontaktbahn 1-4) TR, TW, STW, ATW: STB, ASTB:	AC 230 V +10%, 6,3 (2,5) A, AC 230 V +10%, 2 (0,4) A, cos φ = 1(0,6) DC 230 V +10%, 0,25 A
minimale Schaltleistung	Zur Gewährleistung einer möglichst großen Schaltsicherheit (bei Silberkontakten) wird eine Mindestbelastung von: AC / DC = 24 V, 100 mA empfohlen	
	Bemessungsstoßspannung: 2500 V	
erforderliche Absicherung	siehe max. Schaltleistung	
Schaltpunktgenauigkeit	bezogen auf den Sollwert bei T_U +22°C = siehe Typenschildangaben am Gerät.	
mittlerer Umgebungstemperatureinfluss bezogen auf den Sollwert	Bei einer Abweichung der Umgebungstemperatur am Schaltkopf und der Fernleitung von der Justierumgebungstemperatur +22°C, entsteht eine Schaltpunktverschiebung. Höhere Umgebungstemperatur = niedriger Schaltpunkt; Niedrigere Umgebungstemperatur = höherer Schaltpunkt. Je nach Geräteausführung wird dieser Einfluss durch Einsatz einer Temperaturkompensation minimiert.	
Gewicht	ca. 0,2 kg	
Schutzart	EN 60 529 - IP 40 (IP 54). Verschmutzungsgrad 2	
Betriebsmedium	Wasser, Öl, Luft, Heissdampf, Abgas	
Zeitkonstante $t_{0,632}$	in Wasser ≤ 45 s in Öl ≤ 60 s in Luft / Heissdampf ≤ 120 s in Abgas ≤ 45 s	
Wirkungsweise	gemäß DIN EN 60 730-1, DIN EN 60 730-2-9 und DIN EN 14597 TR, TW : Typ 2BL STW, ATW : Typ 2BKLNP STB, ASTB: Typ 2BFHKLNPV	

Technical data

Permissible ambient temperature in operation	at capillary and switch head: see details on nameplate	At temperature probe – Max. setpoint value +25 °C or +15 % – For liquid filling max. 400 °C – ATW max. 600°C
Permissible storage temperature	maximum +50°C, minimum -30°C	
Max. contact rating	for break contact (SPST-NC) (contacts 1-2)	230 V AC +10%, 16 (2.5) A, p.f. = 1 (0.6) 230 V DC +10%, 0.25 A
	for make contact (SPST-NO) (contacts 1-4) TR, TW, STW, ATW: STB, ASTB:	230 V AC +10%, 6.3 (2.5) A, 230 V AC +10%, 2 (0.4) A, p.f. = 1(0.6) 230 V DC +10%, 0.25 A
Min. contact rating	To ensure a high switching reliability (for silver contacts) we recommend a minimum load of: AC / DC = 24 V, 100 mA.	
	rated surge voltage: 2500 V	
Required fusing	see max. contact rating	
Switching point accuracy	referred to the setpoint at T_A +22°C see nameplate data on the instrument	
Mean ambient temperature effect, referred to setpoint	A deviation of the ambient temperature around the switching head or the capillary from the calibration temperature of +22°C wil cause a shift of the switching point. Higher ambient temperature = lower switching point Lower ambient temperature = higher switching point This effect can be minimized by using a temperature compensation, depending on the instrument configuration.	
Weight	approx. 0.2 kg	
Enclosure protection	EN 60 529 - IP40 (IP54). Pollution level 2	
Operating medium	water, oil, air, superheated steam, flue gas	
Time constant $t_{0,632}$	in water ≤ 45 sec in oil ≤ 60 sec in air/superhtd. steam ≤ 120 sec in flue gas ≤ 45 sec	
Mode of operation	as per EN 60 730-1, EN 60 730-2-9 and EN 14597 TR, TW : Type 2BL STW, ATW : Type 2BKLNP STB, ASTB: Type 2BFHKLNPV	

Caractéristiques techniques

Température ambiante admissible en service	Sur le capillaire et le boîtier: voir indications de la plaque signalétique	Sur la sonde de température – Consigne max. +25 K bzw. +15% – lors du remplissage liquide 400°C max. – ATW 600°C max.
Température de stockage admissible	max. +50°C, min. -30°C	
Pouvoir de coupure max.	Sur le contact à ouverture (contacts principaux 1-2)	AC 230 V +10%, 16 (2,5) A, cos φ = 1 (0,6) DC 230 V +10%, 0,25 A
	Sur le contact à fermeture (contacts principaux 1-4) TR, TW, STW, ATW : STB, ASTB :	AC 230 V +10%, 6,3 (2,5) A, AC 230 V +10%, 2 (0,4) A, cos φ = 1(0,6) DC 230 V +10%, 0,25 A
Pouvoir de coupure min.	Pour garantir la plus grande sécurité de coupure possible, nous vous recommandons une charge minimale de : AC / DC = 24 V, 100 mA	
	Surtension transitoire de référence : 2500 V	
Fusible nécessaire	Voir pouvoir de coupure maximal	
Précision du point de contact	Par rapport à la consigne pour T_U +22°C = voir indication de la plaque signalétique	
Influence moyenne de la température ambiante	En cas de dérive de la température ambiante sur le boîtier et le capillaire +22°C, il en résulte un déplacement du point de contact. Température ambiante plus élevée = point de contact plus bas ; Température ambiante plus basse = point de contact plus haut. Suivant l'exécution, cette influence est minimisée au moyen d'une compensation de température.	
Poids	env. 0,2 kg	
Mode de protection	EN 60 529 - IP 40 (IP 54). Degré de pollution 2	
Milieu d'utilisation	eau, huile, air, vapeur, gaz d'échappement	
Constantes de temps $t_{0,632}$	dans l'eau ≤ 45 s dans l'huile ≤ 60 s dans l'air / vapeur ≤ 120 s dans gaz d'échappement ≤ 45 s	
Fonctionnement	suivant EN 60 730-1, EN 60 730-2-9 et EN 14597 TR, TW : type 2BL STW, ATW : type 2BKLNP STB, ASTB: type 2BFHKLNPV	

15 Installation and operating instructions for the SAMSON dirt trap

Strainers
Type 1 N
Type 1 NI
Type 1 FN
Type 1 FNI

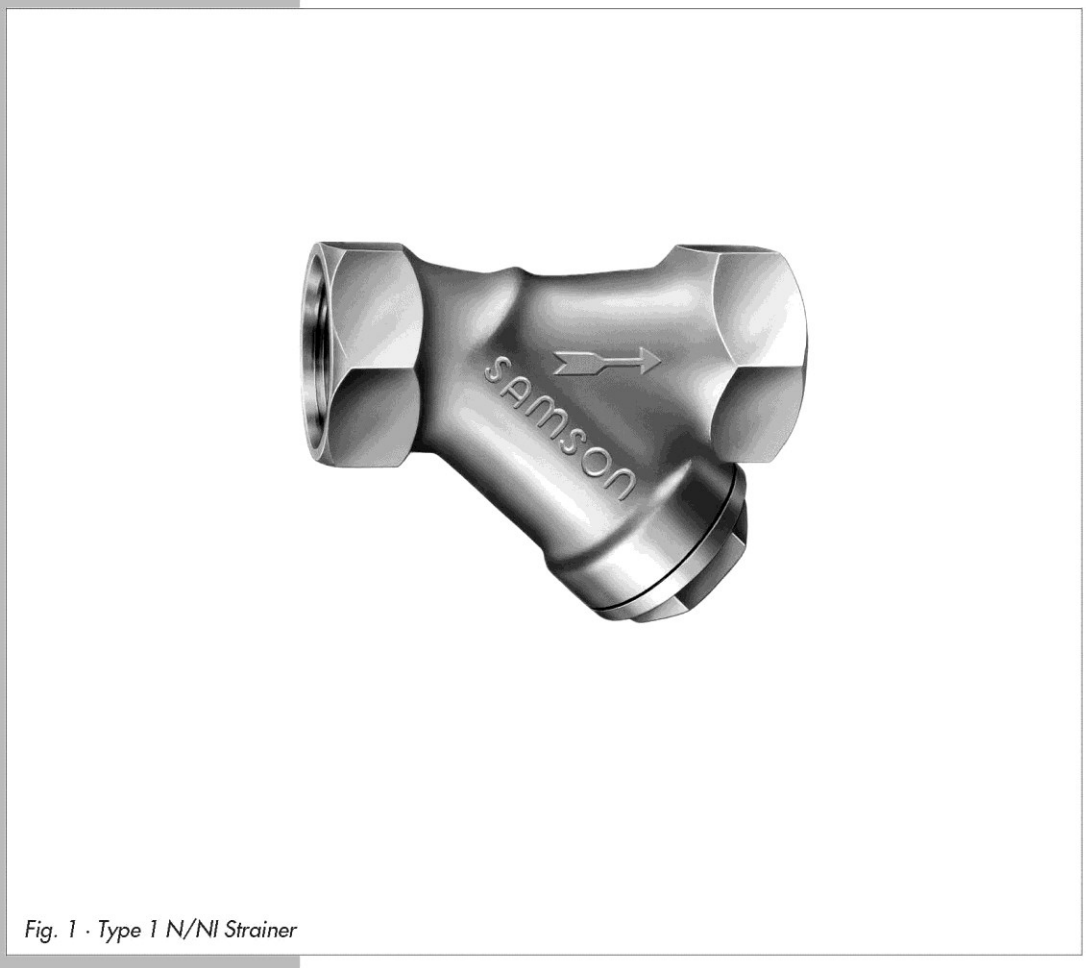


Fig. 1 · Type 1 N/NI Strainer

Mounting and Operating Instructions

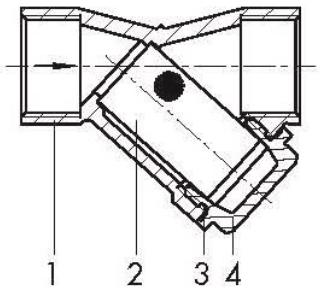
EB 1010 EN

Edition February 2007

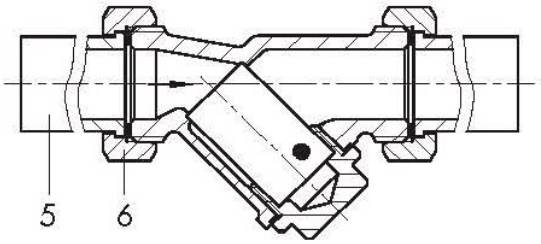
1 Design and principle of operation

Strainers protect downstream plants, assemblies as well as measuring and control equipment from becoming blocked up with dirt particles carried along by the process medium.
The strainers consist of a Y-shaped body with threaded ends, a strainer insert and a cap for the strainer.
Type 1 N is equipped with a single wide-meshed filter element. **Type 1 NI** has a single strainer insert plus an additional fine-meshed internal insert (dual insert).
Type 1 FN is intended for district heating systems. Its body has male threads for connection nuts and welding ends. The strainer is equipped with a single strainer insert.
Type 1 FNI is the same as Type 1 FN, except it has a dual strainer insert.

The process medium flows through the body in the direction indicated by the arrow on the body. Any dirt particles in the pipeline are retained and collected in the strainer insert.



Type 1 N/NI



Type 1 FN/FNI, district heating version

1	Body	4	Screw cap
2	Strainer insert	5	Welding ends
3	Gasket	6	Connection nut

Fig. 2 · Sectional drawings

- The strainer is to be assembled, started up or operated by trained and experienced personnel familiar with the product.
  According to these mounting and operating instructions, trained personnel is referred to as individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
- Any hazards that could be caused in the strainer by the process medium and the operating pressure are to be prevented by means of the appropriate measures.
- Proper shipping and appropriate storage are assumed.

2 Installation

- Make sure the direction of flow is consistent with the arrow on the body.
- Leave enough space to remove the strainer insert.
- **Standard installation**: Drain flange with the internal strainer insert **points down**. **Exception for steam pipes**: Drain flange points **to the side**.
- Strainers in vertical pipelines with the medium flowing upward are to be installed with the drain flange pointing up as indicated by the arrow. In this case, dirt particles are retained but not collected.

3 Maintenance

To prevent wear, regularly check whether dirt, which could block the flow through the strainer, has collected. Remove the strainer insert to do so.

Note!
Shut off and drain the plant section before starting any work on it.

- Unscrew the screw cap (4). Also remove the strainer insert(s) and clean them.
- Replace damaged strainer inserts (2). Always replace the gasket (3) after the strainer insert has been removed.

Refer to the table below for required spares.

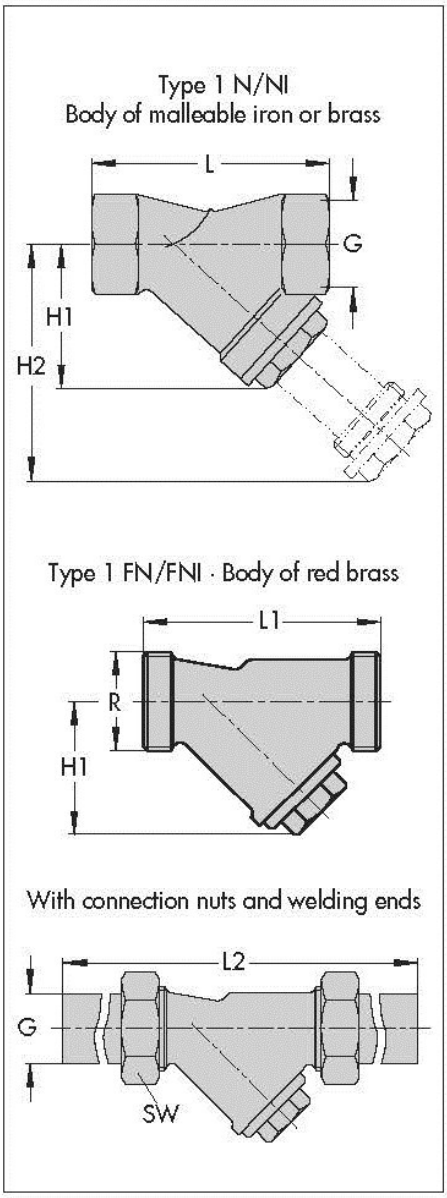
Table 1 · Order no. and tightening torques of screw cap

Nominal size		DN 10 G ⅜	DN 15 G ½	DN 20 G ¾	DN 25 G 1	DN 32 G 1¼	DN 40 G 1½	DN 50 G 2
Spare parts for Type ...	**Order no.**							
Standard strainer insert **N**	**0550-**	0745		0746	0747	0748	0749	0750
Dual strainer insert **NI**	**0550-**	0751		0752	0753	0754	0755	0756
Screw cap **N/NI/FN/FNI**	**0070-**	0408		0164	0411	0412	0167	0168
Screw cap tightening torques		~25 Nm		~25 to 30 Nm		~30 to 40 Nm	~40 to 50 Nm	~50 to 60 Nm
Gasket **N/NI/FN/FNI**	**8413-**	1569		1570	1571	1572	1573	1574
Standard strainer insert **FN**	**0550-**	–	0767	0768	0769	0770	0771	0772
Dual strainer insert **FNI**	**0550-**	–	0773	0774	0775	0776	0777	0778

Table 2 · Dimensions in mm and weights

Body made of brass, malleable iron or red brass · PN 25							
Thread size G	3/8[1)]	½	¾	1	1¼	1½	2
Length L	65	65	75	90	110	120	150
Connection thread R	–	¾"	1"	1¼"	1¾"	2"	2½"
Width across flats SW	–	30	36	46	59	65	82
Length L1	–	80	85	100	125	135	160
Length L2	–	225	250	265	293	320	360
Height H1	40		45	56	73	84	108
Height H2 (insert extended)	61		75	90	115	134	158
Weight, approx. kg							
Type 1 N/NI (brass)	0.2		0.3	0.47	0.77	1.35	1.9
Type 1 N/NI (iron)	–	0.3	0.5	0.6	0.9	1.6	2.4
Type 1 FN/FNI (red brass)	–	0.55	0.65	0.8	1.1	1.85	2.6

1) Only Types 1 N/NI with brass body



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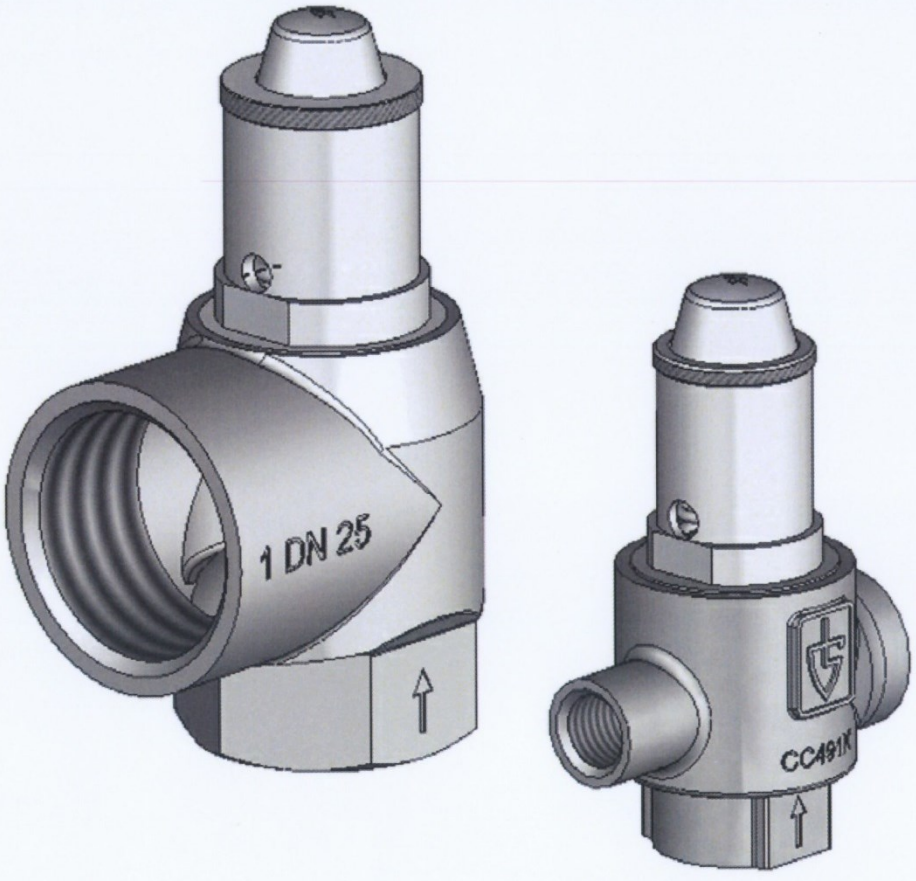
Internet: http://www.samson.de

16 Maintenance and installation instructions for the GOETZE diaphragm safety valve

ARMATUREN GOETZE

651 mHNK
651 mHIK
651 HNs
651 mSK



CE 0036

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Assembly and maintenance instructions

Diaphragm Safety Valve

GOETZE ARMATUREN

1 General Notes of Safety

en

- Only use the valve:
  - for the intended purpose
  - in satisfactory condition
  - with respect for safety and potential hazards.
- Always observe the installation instructions.
- Faults that may impair safety must be addressed immediately.
- The safety valve is exclusively designed for the range of application described in these installation instructions. Any other use, or a use exceeding the range of application shall be considered as improper use.
- The manufacturer's warranty for the setting of the valve shall be null and void if the sealed cover is removed.
- All assembly work is to be carried out by authorized specialist staff.

2 Range of Application

Series 651 mHNK/ mHIK/ HNs:

Solely for the protection of closed, thermostat protected heating systems with supply temperatures of up to 120 °C. Upon failure of the temperature regulation and limitation device the safety valves blow off the entire heating capacity of the heat generator in the form of hot water and steam.

Series 651 mSK:

Solely for the protection of closed, intrinsically safe solar heating systems with water or water mixtures serving as heat transfer medium with permissible supply temperatures of up to 120 °C.The valve is able to discharge the entire heating capacity of the solar heating system in the form of hot water and steam.

3 General Notes

Safety valves are high-quality fittings which require a particularly careful handling. The sealing surfaces are precision-machined at the seat and cone to attain the required tightness. Always avoid the penetration of foreign particles into the valve during assembly and during the operation. Rough handling of the finished valve during storage, transportation and assembly can also result in a safety valve leaking. If the safety valves are painted always ensure that the sliding parts do not come into contact with the paint.

4 Warranty

This valve was tested prior to leaving the factory. We grant a warranty for our products, which entails the cost-free repair of any parts that are returned and verified as being prematurely unsuitable for use due to defective material or manufacturing. We shall not assume any liability for any damage or other such obligations. If the factory seal is damaged, in the event of any incorrect handling or installation, non-observance of these operating and maintenance instructions, contamination or normal wear, warranty claims shall be null and void.

5 Installation and Assembly

To ensure a satisfactory operation of the safety valves they must be assembled in such a way that the safety valve is not exposed to any impermissible static, dynamic or thermal loads.

Supply:

The safety valves must be installed vertically in line with the direction of the arrow using a max. 1 meter long and straight connecting pipe of the same size as the safety valve inlet cross section. The installation of dirt traps or restrictions in the supply pipe to the safety valve is not permitted. Horizontal connecting pipes are to be avoided to prevent deposits.

Blowing off pipe:

The blowing off pipe must be of a design that corresponds at least to the size of the safety valve outlet cross section, it is to have no more than 2 bends and measure max. 2 meters in length. If more bends or a longer length are required, the entire blowing off pipe must be designed one diameter size larger. The blowing off pipe must always be routed sloping downward and designed in such a way that it cannot freeze and no water can accumulate in it. The opening must be arranged in such a way to ensure that steam flows out and discharging heating water can be observed and led off hazard free.

Series 651 mHNK/ mHIK/ HNs:

The safety valves are to be arranged in the boiler room at an easily accessible place at the highest point of the heat generator or in the immediate vicinity thereof, on the supply pipe.

Series 651 mSK:

The diaphragm safety valves must be installed open to the collectors in the cooler area of the solar heating system, at an easily accessible position.

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6 Testing / Identification

We test the safety valves, adjust the required set pressure and seal them.

Series 651 mHIK/ HNs:

The set pressure is marked on the upper part (spring bonnet). For blowing off capacities refer to technical data sheets of the manufacturer.

TÜV type-tested safety valves Series 651 mHNK:

With these valves the set pressure is marked on the upper part (spring bonnet) as the last figure of the type identification.

TÜV-SV-XX-516-H-P-2.5 or 3 bar

Valve size depends on the thermal output:

Connection G	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
Approved for Germany P in kW 2.5 and 3 bar	50	100	200	350	600	900
P in kcal/h 2.5 and 3 bar	45000	90000	175000	300000	500000	750000

TÜV type-tested safety valves Series 651 mSK:

With these valves the set pressure is marked on the upper part (spring bonnet) as the last figure of the type identification.

TÜV-SV-XX-2013-SOL-P-p (p = 2.0 to 10 bar)

Valve size depends on the thermal output:

Connection G	1/2"	3/4"	1"
P in kW	50	100	200
Collector entry area in m2 acc. DIN 4757	50	100	200

7 Operating mode / Maintenance

Flush the pipe well prior to assembly of the safety valve as welding sputter, hemp, metal chips etc. cause the valve to leak.
In the event of minor leaks caused by contamination between the sealing surfaces the valve can be made to blow off through lifting, for cleaning purposes.

If leaks continue:

1. Turn knurled nut in counterclockwise direction to lift the valve.
2. Use a flat wrench (not a pipe wrench) to unscrew the entire upper part including the diaphragm and seat sealing from the housing.
3. Clean seat and seat sealing with a rag and brush, do not use a scraping tool, file, screwdriver etc.
4. Screw the upper part back into the housing and tighten loosely.
5. Turn knurled nut in clockwise direction to the stop. The valve operates at the set pressure again.

In the case of safety valves with a lifting device it is recommended, and in certain plant-specific cases even stipulated that the valves from time to time must be made to blow-off by lifting the seal off the seat, in order to assure the correct functioning of the safety valve.
Safety valves are the ultimate safety device for the tank or system.
They must be able to prevent impermissible overpressure even when all other upstream control and monitoring equipment fails.
To ensure these functional characteristics safety valves require regular and recurring maintenance.

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Declaration of conformity

according to Annex VII of the Directive 97/23/EC

We, **Goetze KG Armaturen, D-71636 Ludwigsburg**
declare under sole responsibility that the delivered product:

Diaphragm safety valve

Series	TÜV component test number	Set pressure	EC type test
651 mHNK	516	2.5 and 3 bar	✓
651 mHIK	-	2.5 – 5 bar	✓
651 mSK	2013	2.0 – 10 bar	✓

has been manufactured in compliance with the Directive 97/23/EC and was subjected to the following conformity assessment procedure:

Module B+D

An EC type test certificate is available for the equipment part for pressure devices.

Diaphragm safety valve

Series	Nominal diameter
651 HNs	DN 15 - DN 50

has been manufactured in compliance with the Directive 97/23/EC and was subjected to the following conformity assessment procedure:

Module A

The monitoring of the production quality assurance is performed by the TÜV SÜD Industrie Service GmbH (0036).

Ludwigsburg, 05.10.2013
(Place and date of issue)

D. Weimann
Management

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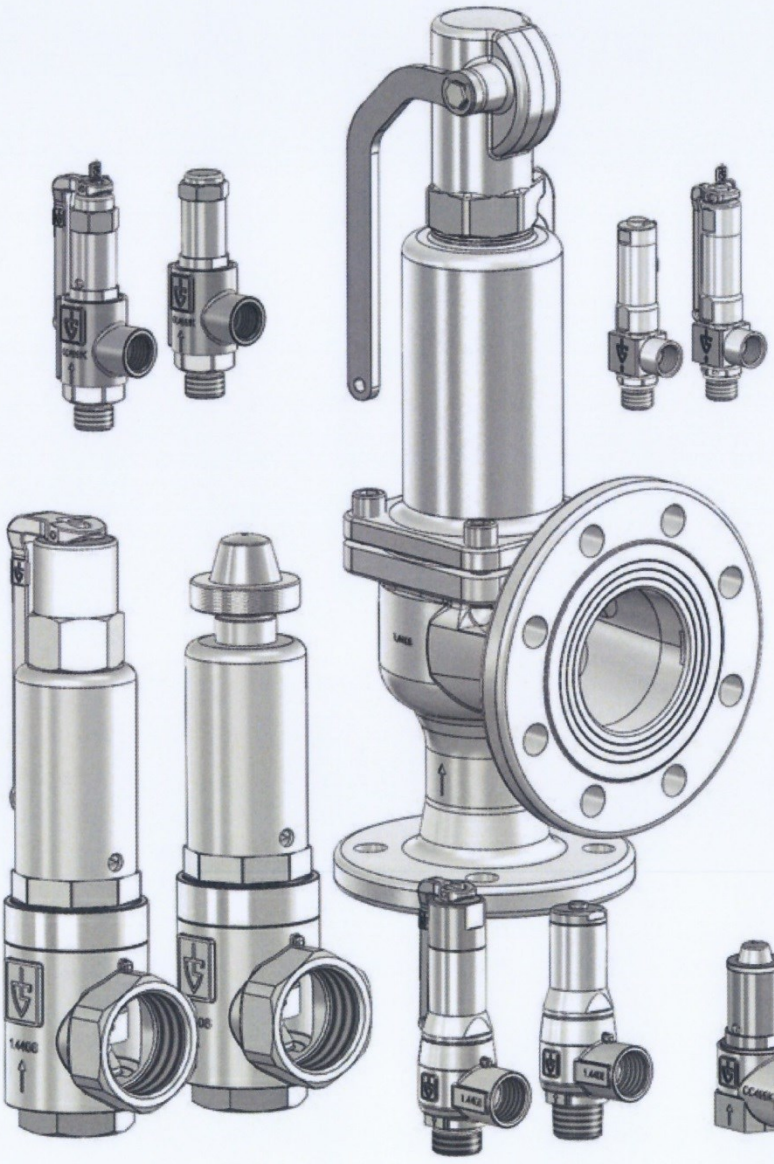
17 Maintenance and installation instructions for the GOETZE safety valve

ARMATUREN GOETZE

851 / 451, 852 / 452 / 352, 652 mFK, 652 sGK, 861 / 461, 420, 460



TÜV SÜD ISO 9001

CE 0036

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Assembly and maintenance instructions

Safety valve

GOETZE ARMATUREN

1 General Notes of Safety

en

- Only use the valve:
  - for the specified purpose
  - in satisfactory condition
  - with respect for safety and potential hazards
- Always observe the installation instructions.
- Faults that may impair safety must be addressed immediately.
- The valves are exclusively intended for the application area stated in these installation instructions. Any other or further use is not valid as the intended use.
- The manufacturer´s warranty shall be null and void if the sealed cover is removed.
- All assembly work is to be carried out by authorized specialist staff.

2 General Notes

Safety valves are high-quality fittings which require a particularly careful handling. The sealing surfaces are precision-machined at the seat and cone to attain the required tightness. Always avoid the penetration of foreign particles into the valve during assembly and during the operation. The tightness of a safety valve can be impaired when using hemp, Teflon tape, as well as through welding beads, among other things. Also rough handling of the finished valve during storage, transport and assembly can result in a safety valve leaking. If the safety valves are painted, make sure that the sliding parts do not come into contact withe the paint.

3 Range of Application

For details on the range of application of the individual versions please refer to the datasheets of the manufacturer.

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4 Installation and Assembly

Spring-loaded safety valves are to be installed with the spring bonnet pointing vertically upward. To ensure a satisfactory operation of the safety valves they must be installed in such a way that the safety valve is not exposed to any impermissible static, dynamic or thermal loads. Appropriate protection devices must be applied if the medium that discharges upon actuation of the valve can lead to direct or indirect hazards to people or the environment. Always pay attention to possible fumes discharging from the relief bores in the spring bonnet.

Supply

Supply connection pieces for safety valves are to be kept as short as possible and are to be designed in such a way that there can be no pressure loss greater than max. 3% of the response pressure.

Removal of condensate discharge

In the event of possible condensate formation the pipes or the valves themselves (in flanged version) must be fitted at their lowest point with a continuously operating condensate discharge device. Hazard-free removal of the condensate or medium discharge must be ensured. The body, pipes and silencers must be protected against freezing.

Blowing-off pipe / backpressure

The blow-off pipe of the safety valves must be designed to ensure that the required mass flow can be discharged pressure-free during the blowing-off process. In safety valves with metal bellows a backpressure of up to max. 4 bar has no impact on the response pressure of the safety valve.

5 Operation/maintenance

The operating pressure of the plant is to be least 5% lower than the closing pressure of the safety valve. In this way, the valve can satisfactorily close again after blowing off. In the event of minor leaks, which may be caused by contamination between the sealing surfaces, the valve can be made to blow off through lifting, for cleaining purposes. If this does not remove the leak, the sealing surface is probably damaged and this can only be repaired at our factory or by authorized specialists. Depending on the version, lifting is either carried out by means of a knurled nut above the spring bonnet (Fig. a) which is turned counterclockwise (afterwards the knurled nut has to be turned back to the stop) or by actuating the lifting lever on the upper part of the valve (Fig. b). For delivery purposes the lifting lever is blocked by means of strap which has to be removed for actuating the lifting device.

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Safety valves without bellows and without gastight cap (Fig. c)
In addition, in the case of safety valves without bellows and without gastight cap, the entire upper part can be unscrewed from the housing using appropriate tools and any residue removed from the seat and the seat sealing.

Prior to removal make sure that the safety valve is not under pressure.
The response pressure of the safety valve is not altered through the reassembly of the upper part in the housing.

Safety valve with metal bellows (Fig. d)
In the case safety valves with metal bellows the upper part is not to be separated from the housing, because otherwise tightness is no longer guaranteed in the event of backpressure occurring.

Safety valves with gas-tight cap (Fig. f) or gastight lifting (Fig. g)
On safety valves with gas-tight cap or gastight lifting lever, the top part may not be separated from the housing as this compromises gas tightness. However, if the top part does have to be unscrewed for a repair, it should be ensured that the tension on the spring is released before dismantling. You should also check before dismantling the valve whether there is any medium in the cap and if so, what it is. Potential risk of chemical burns or poisoning.

Lifting for maintenance purposes
In the case of safety valves with a lifting device it is recommended, and in certain plant-specific cases even stipulated that the valves from time to time must be made to blow-off by lifting the seal off the seat, in order to assure the correct functioning of the safety valve. This ist why they can be made to open at the latest as from an operating pressure of ≥ 85% of the response pressure. The lifting device is not to be operated when in a pressure-free state. In steam generating equipment, testing the ease of movement of safety valves must be carried at least every 4 weeks in compliance with TRD 601. Safety valves are the ultimate safety device for the tank or system. They must be able to prevent impermissible overpressure even when all other upstream control and monitoring equipment fail. To ensure these functional characteristics safety valves require regular and recurring maintenance. The maintenance intervals are determined be the operator in dependence of the operating conditions.

6 Dismantling the fitting

In addition to the general installation instructions it must be ensured that the system is made pressure free prior to disassembly of the safety valve.

7 Repairs

Repair work on safety valves is only to be carried out by Goetze KG Armaturen or by officially approved specialist workshops authorized by Goetze KG Armaturen using original spare parts only.

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8 Warranty

Every valve is tested prior to leaving the factory. We grant a warranty for our products which entails the repair, free of charge, of any parts that are returned and verified as being prematurely unsuitable for use due to defective material or manufacturing. We shall not assume any liability for any damage ar other such obligations. If the factory seal is damaged, in the event of any incorrect handling or installation, non-observance of there operating and maintenance instructions, contamination or normal wear, warranty claims shall be null and void.

Fig. a): Lifting by means of a knurled nut

Fig. b): Lifting by means of a lever

Fig. c): Safety valve without bellows and without diaphragm

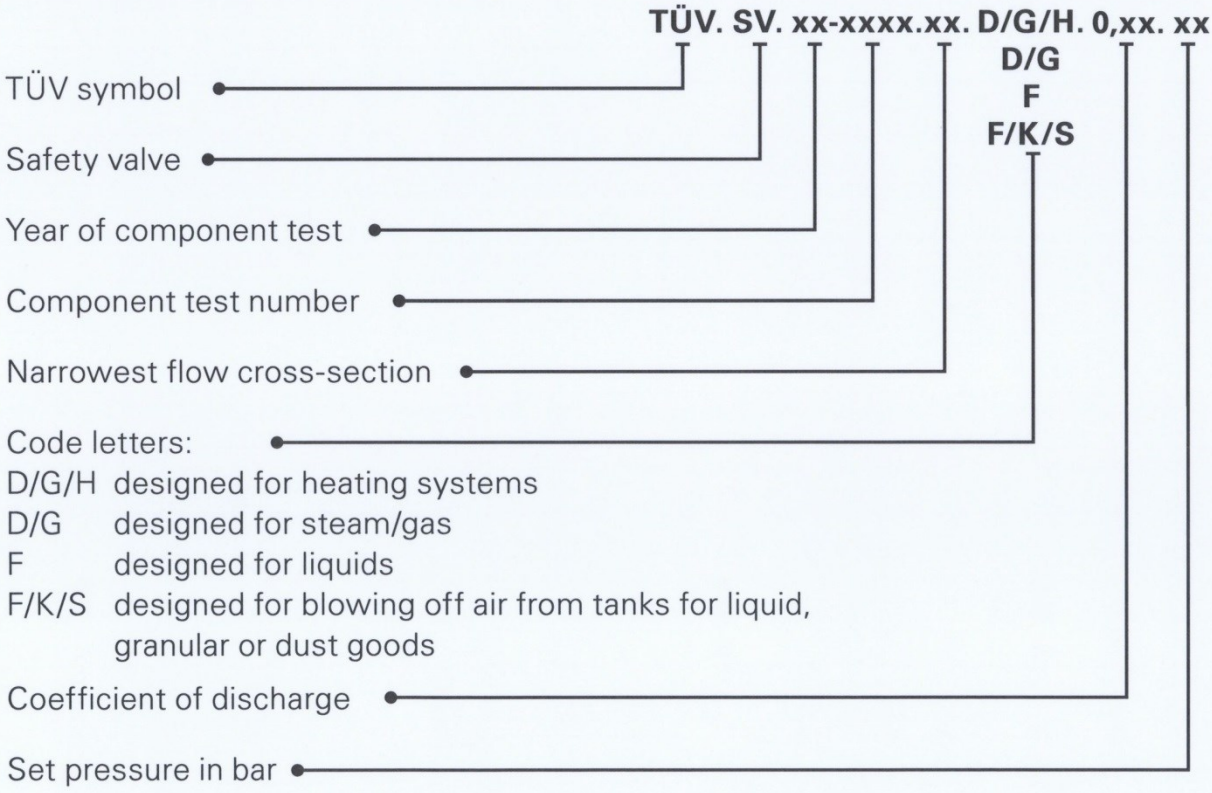
Fig. d): Safety valve with bellows

Fig. e): Safety valve with diaphragm

Fig. f): Safety valve with gastight cap

Fig. g): Safety valve with gastight lifting lever

9 Marking/testing



We check the safety valves for pressure resistance and tightness, adjust the requested set pressure and seal them. The identification on the type plate or on the spring bonnet of the valve is applied using a permanent marking system.
The type plate is additionally marked with identification codes and technical data in compliance with DIN EN ISO 4126-1.

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Declaration of conformity

according to Annex VII of the Directive 97/23/EC

We, **Goetze KG Armaturen, D-71636 Ludwigsburg**
declare under sole responsibility that the delivered product:

Safety valve

Series	TÜV component test number	EC type test
451 P/PL; T/TL 851 P/PL; T/TL	318	✓
451 bH; 851 bH	665	✓
451 G; 851 G	666	✓
451 E/EL; 851 E/El	268	✓
451 F; 851 F	684	✓
352, 452, 852	2007	✓
652 mFK	293	✓
652 sGK	312	✓
861/461	2061	✓
420	2069	✓

has been manufactured in compliance with the Directive 97/23/EC and DIN EN ISO 4126 as well as the national regulations AD 2000 A2/A4, TRD 421/721 and was subjected to the conformity assessment procedure:

Module B+D

An EC type test certificate is available for the equipment part for pressure devices.

The monitoring of the production quality assurance is performed bye TÜV SÜD Industrie GmbH (0036).

Ludwigsburg, 24.09.2013
(Place and date of issue)

D. Weimann
Management

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The clean solution

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